PROCEEDINGS

of the Second Conference of the

International Institute of Fisheries Economics & Trade

Volume 1: Economic Recovery, Fisheries Economics, and Seafood Trade

Christchurch, New Zealand
August 20-23, 1984

Proceedings of the Second Conference of the International Institute of Fisheries Economics and Trade

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Ordering Publications

Copies of this publication and its companion volume (Volume 2: A Compendium of Papers on Seafood Trade and Markets) are available at cost from the International Institute of Fisheries Economics and Trade, Department of Agricultural and Resource Economics, Oregon State University, Corvallis, Oregon 97331, USA.

December 1985

Preface

Approximately 100 individuals attended the 1984 biennial conference of the International Institute of Fisheries Economics and Trade. The program was varied and included discussions in the following general areas:

- Economic recovery and seafood markets for selected regions
- The new ocean regime: implications for international seafood trade
- Changing structure of fisheries and seafood markets
- Fisheries and seafood market development
- Seafood trade and fisheries management
- Market models
- Fisheries data
- Multinational arrangements
- Fisheries management: theory and practice

In addition, several excellent overview papers were given on the fisheries of New Zealand and of the South Pacific. There was also discussion of the FAO World Fisheries Conferences.

The proceedings of this conference are issued in two volumes. Volume 1 contains the bulk of the papers, which treat the issues listed above. Papers in Volume 2 report primarily on seafood trade and seafood market issues. This volume is issued as a cooperative report of the International Institute of Fisheries Economics and Trade and Oregon State University's Sea Grant College Program. Support for the conference was provided by the following: New Zealand Ministry of Agriculture, New Zealand Fishing Industry Board, Oregon State University's Department of Agricultural and Resource Economics, Oregon State University's Sea Grant College Program, the University of Canterbury Centre for Resource Management, Air New Zealand, and Ferons Seafood Limited. Their valuable contributions towards the success of the conference are gratefully acknowledged.

Thanks are also extended to the following individuals: Fred Smith (Oregon State University), who served as the conference chair; Susan Capalbo (Resources for the Future, USA), Parzival Copes (Simon Fraser University, (Canada), Brian T. Cunningham (New Zealand Ministry of Agriculture and Fisheries), Mark Hinchliff (New Zealand Fishing Industry Board), Robin Johnson (New Zealand Ministry of Agriculture and Fisheries), Basil Sharp (University of Canterbury, New Zealand), Joe Terry (National Marine Fisheries Service, USA), Trevor Young (University of Manchester, England), all of whom chaired conference sessions. Malcolm Cameron, Director General, Ministry of Agriculture and Fisheries, New Zealand, opened the conference and attendees were welcomed by Councillor Margaret Murray, chairperson, Waimairi District Council.

Following the conference, attendees were able to tour the fishing port and processing plants of Nelson, thanks to the generosity of SeaLords Products, Ltd. and Talley's Fisheries Ltd.

Ian Clark, with his colleagues, Doug Cosh and Murray Cameron, masterfully orchestrated the entire event. No one could leave the conference with a failure to understand why New Zealand has a global reputation as a cheerful host.

Richard S. Johnston, Chairman
International Institute of Fisheries Economics and Trade Executive Committee

Table of Contents

Page

Page

Overview Papers

The Fisheries of New Zealand

M. J. Belgrave
New Zealand Ministry of Agriculture and Fisheries
Wellington, New Zealand

Brief History

It is very gratifying to see such a good attendance and especially so many countries being represented. My talk is principally aimed at members of the conference who are not well acquainted with New Zealand and its fisheries. It is an attempt to briefly outline the development of our fishing industry and provide a profile of how it stands today.

New Zealand can only claim to have had a substantial commercial fishing industry over a comparatively short period of its history. Traditionally our shores, rivers and lakes were fished for hundreds of years by the Maori people, chiefly for subsistence although there was some trading. Many of the Maori fishing methods demonstrated great ingenuity and included flax seine nets, hooks and lines and basket traps.

Maori fishing was associated with many beliefs, ceremonies and superstitions. As we are in the South Island it might be appropriate to mention the Maori legend concerning the god Maaui who is said to have fished up the North Island by its eye, Lake Taupo, while fishing from the South Island. The North Island is known in Maori as Te Ika-a-Maaui, the fish of Maaui. I might add that the Maori people apart from depending on the sea were sailors and navigators of considerable renown.

The nineteenth century saw first the European exploitation of whales and seals and then subsistence fishing by European settlers.

Until the early 1960s the Government policy on New Zealand's fishing resources was one of caution in the light of limited knowledge of stocks. Before that a policy of conservation was reflected in the licensing of the catching, wholesaling and retailing sectors of the industry as far back as the 1930s. There was at that time concern that growing fish exports threatened any increase in domestic consumption. The availability of a cheap source of protein was seen of major importance in the difficult economic climate then prevailing. It is interesting to reflect that at this time the domestic market was seen as capable of absorbing the total catch!

In 1945 the earlier legislation was amended and only the catching sector remained licensed. Conservation was still of paramount concern. A major aspect of management at the time was that all licensed vessels were required to land at specified ports, usually one port (it would solve some of today's problems). This facilitated the assessment of license applications on the basis of fish stocks in the vicinity of a particular port. Most applications for vessel licenses were declined and various restrictions on fishing were implemented.

Vessel licensing as a basis for port rationing gradually became ineffective and was revoked in 1963 after 27 years. The catching power of vessels had improved in the 1950s with greater size, and horse power, improved fishing technology and refrigeration. Geographic boundaries between fishing ports had become blurred.

During this period, foreign fishing vessel catches around New Zealand indicated new and somewhat unexploited resources. There was concern at the time that restrictive licensing was retarding the development of the industry. There was also concern that only a quarter of the marketable fish species was being utilised by the domestic industry because of consumer preference. It was in this climate that in 1964 the Fishing Industry Board was established to promote the development of the New Zealand fishing industry. The following year saw a fisheries zone of nine miles in width established seawards of the territorial sea of three miles.

A period of rapid development then commenced with the export of rock lobster tails to the United States and the emergence of aquaculture in the form of first rock oyster and later mussel farming. Tunas and other pelagic fish began to be exploited, larger vessels began to be employed while processing plants increased in number and in size. Controlled fisheries were introduced in the late 1970s in two scallop fisheries and an eel fishery in an attempt to develop measures to match effort in particular fisheries to the ability of the resource to provide a sustained yield. The rock lobster fishery is currently the most notable fishery to be controlled and possibly one of the most successful.

Reverting to foreign involvement, first the Japanese in the 1960s followed by the Russians, Koreans and Taiwanese in the 1970s caught growing quantities of fish in waters around New Zealand. This was mostly made up of species unknown on the domestic market. April 1, 1978 saw the unilateral declaration of New Zealand's 200 mile Exclusive Economic Zone and a 12 mile Territorial Sea. In the preceding year the total catch from New Zealand waters was 477,000 tonnes of which domestic vessels accounted for 75,000 tonnes.

The declaration of the Zone gave rise to a buoyant period which saw increasing investment in processing and particularly in vessels to fish the deeper waters of New Zealand's economic zone. The Government encouraged this expansion in investment by concessionary and suspensory loan schemes, by making available grants for certain purposes and permitting certain types of new and second hand fishing vessels to be imported free of duty.

Under the terms of the draft Law of the Sea Agreement, New Zealand had an obligation to allocate fish which it could not catch inside the Zone to other countries. Bilateral fisheries agreements were concluded with Japan, the Republic of Korea and the Soviet Union which allow licensed fishing by those nations, encourage joint fisheries research and provide for a wide range of fisheries co-operation.

Research to define stock sizes of the various deepwater species and their biology was stepped up. To stimulate a more rapid involvement of domestic companies in exploiting the deeper waters of the EEZ in place of foreign licensed vessels, joint venture arrangements between New Zealand companies and foreign fishing interests were introduced.

These "joint" or "co-operative" ventures, I believe, served a very useful purpose. They enabled a more rapid expansion of the industry than would otherwise have occurred and considerable experience was gained in the catching, processing and marketing of deep water species some of which were previously unknown.

Looking back, some of the disadvantages of these arrangements stemmed from the attractiveness of chartering foreign vessels rather than purchasing vessels. Apart from having to pay charter fees, processors were vulnerable to foreign vessels not being available. There was also only limited success in the training of New Zealand crews on foreign vessels for a variety of reasons.

Table I shows estimates of finfish catch in New Zealand waters by foreign licensed, joint venture and domestic vessels from 1974 to 1983. The expansion that occurred in the industry is exemplified in Tables II and III which are statistics of the fishing fleet since 1974. In 1974 the total number of registered commercial vessels was 3,575 of which 2,496 were under 9 metres in overall length and only 39 exceeded 21 metres. By 1982 the total number of vessels had dropped to 4,818 after peaking at 5,405 in 1979, while the number of vessels exceeding 21 metres was 71. The total number of all registered commercial vessels has now fallen dramatically to some 2,700 with the exclusion of part-time fishermen as part of the inshore fisheries policy. I will return to the inshore fisheries shortly. These figures do not include chartered foreign vessels which are temporarily registered as New Zealand vessels. With little change in resource estimates and increased effort by co-operative fishing ventures and domestic operators, foreign licensed vessels were progressively excluded from access to the more desirable species. With the first priority in the allocation of resources being given by the Government to domestic interests, a number of companies expressed an interest in purchasing relatively large deep water vessels in order to secure a stake in the deepwater trawl fishery. Approval was given to one company to import two large vessels but the Government decided it was prudent to carry our a complete review of the deepwater trawl industry before any further approvals were granted.

Following the circulation of a discussion paper and considerable discussion with the industry, a development policy for the deepwater trawl fishery came into effect in April 1983. The main feature of this strategy was the allocation of transferable rights to catch prime species to individual companies who had a demonstrated commitment to and dependence on deep water species both in the catching and processing sectors.

It is apparent that this policy is achieving the majority of its objectives of placing controls of valuable deepwater species in New Zealand hands, of ensuring fish supplies to processing plants, of maximising economic returns to New Zealand, providing on and off shore employment opportunities and making allocation holders share in the management of the resource.

TABLE I

ESTIMATED FINFISH CATCH IN NEW ZEALAND WATERS 1974-83

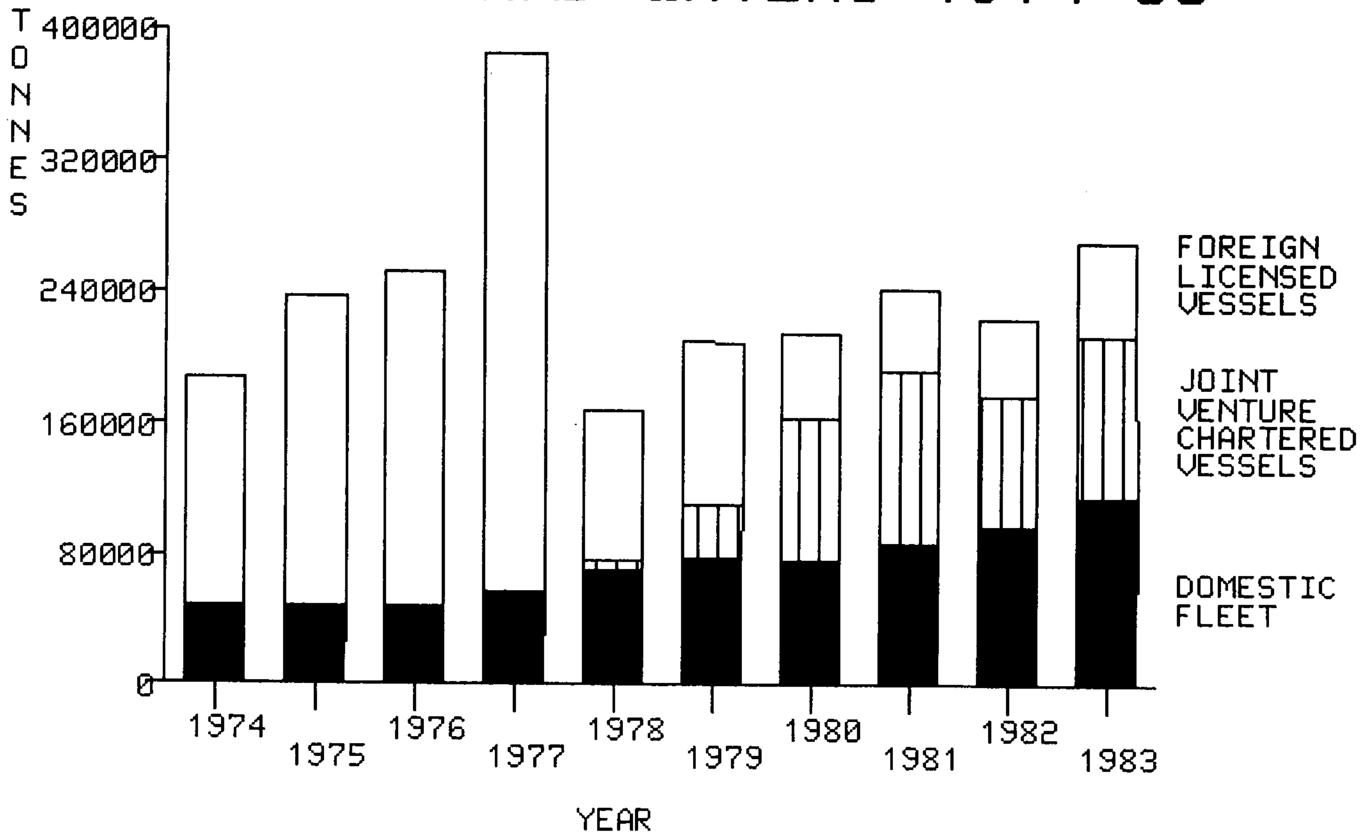


TABLE II
REGISTERED DOMESTIC COMMERCIAL FISHING VESSELS (TOTAL)

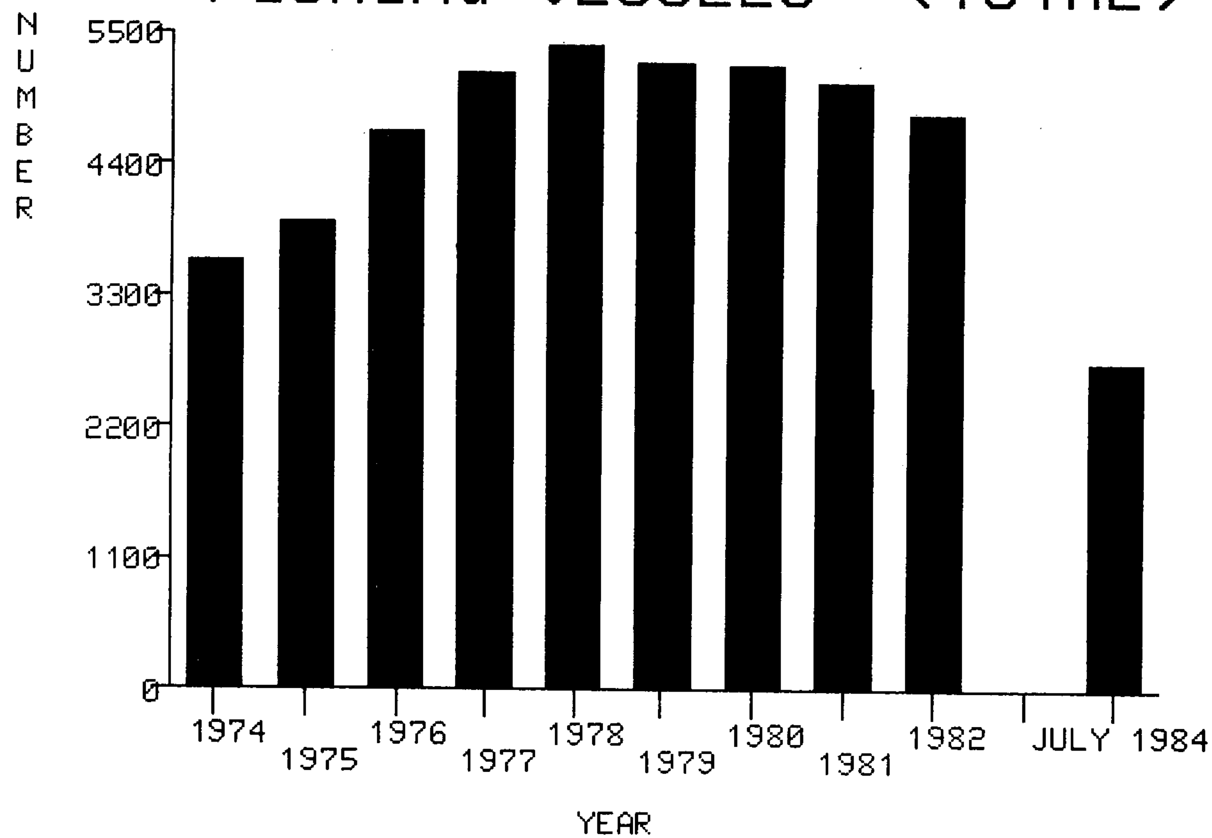
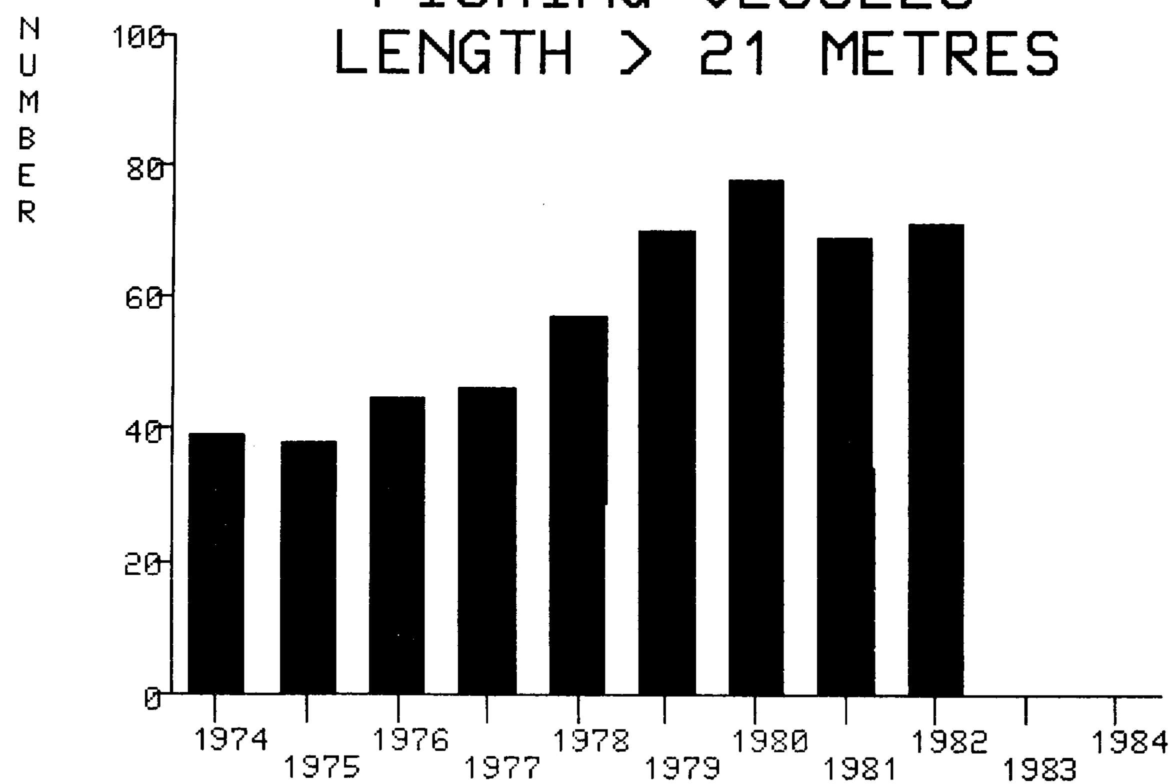


TABLE III

REGISTERED DOMESTIC COMMERCIAL FISHING VESSELS LENGTH > 21 METRES



Meanwhile, our inshore fisheries have been experiencing falling profitability over recent years stemming from:

(i) Rising costs, particularly fuel price increases; and

(ii) A general decline in catch per vessel, brought about by a rapidly expanding fishing fleet and declining stocks of many species in certain areas due to over-fishing.

In March 1982 a moratorium on the issue of further permits to fishermen was imposed as a short-term solution to stabilise the industry. This was followed by a joint Government industry study of the inshore fisheries during 1983 and the resulting report, in the form of a discussion paper, was published in August 1983. Following extensive consultation with the industry, consensus was reached among the industry concerning the need for a reduction of "fishing effort in these fisheries and the development of management strategies to ensure that biological and economic viability are maintained in the long term."

The first step was to more precisely define commercial fishermen and to reduce the impact of part-time fishermen on the resource from October 1, 1983. The Government has been given the formal report and recommendations of the National Fisheries Management Advisory Committee and this was released by the Government last week. MAF should be reporting to the Government on long term options for the fishery including the central issue of effort reduction, very shortly. It will be up to the Government to decide on the next move after that.

An associated problem is that a number of fish processors are suffering from an under-utilisation of productive capacity.

Profile of New Zealand's Fisheries

The rapid growth in the value and volume of exports of fish products is clearly indicated in Tables IV and V; in 1983 exports totalled 130,646 tonnes valued at $309.5 million. For the year ended June 1984 the value of exports has reached $370 million (Table VI). Table VII shows our main markets for fish products in 1983. An interesting development is the displacement of Australia in 1983 by the United States as our second most valuable market. This was mainly due to increased exports of orange roughy. New Zealand's fishing industry was traditionally based on inshore species such as snapper, rock lobsters, tarakihi and trevelly. Recent years however have seen the deep water species, orange roughy, displace snapper as our most valuable wetfish while squid has become a more valuable export than rock lobsters. Other non-traditional species which have become significant exports are hoki, warehou, ling, oreo dory and skipjack tuna.

Principal species exported by value in 1983 are shown in Table VIII.

The change in emphasis towards deepwater species has resulted in a marked shift in landings from North Island to South Island ports (refer to Table IX). Since 1979 the tonnage landed at Nelson has more than doubled while that of Port Chalmers has increased eight-fold. Other principal South Island ports also show increased landings while most North Island ports show a decline.

An important feature of the development of the fishing industry has been the increasing degree of processing. When the industry was largely based on the snapper catch, the degree of processing was often minimal because this was all that was required to achieve premium export prices. As snapper has diminished in importance relative to deep water species, processing has increased markedly, both in volume and complexity. This has added value to the product and increased employment in the industry. Under the deepwater trawl policy established by the Government in April 1983, all companies with fishing rights are obliged to process beyond the headed and gutted form a minimum of 35 percent of their catches onshore.

Combined with greater processing we have also witnessed greater attention to packaging and quality generally. A programme to ensure internationally recognised hygiene standards for the construction of fish packing houses and vessels licensed to process at sea and intending to export fish products was introduced by legislation in 1977. The programme was completed in 1981. All fish entering fish packing houses is now required to be in a chilled or frozen state. Routine supervision of premises and products is carried out and all fish exported is certified as complying with the appropriate standards.

The shift in landings from North to South Islands has, not surprisingly, also been witnessed in the processing sector. The Northland/Auckland/Bay of Plenty and East Coast areas of the North Island remain very significant but processing has greatly increased in the major South Island ports over recent years with the major processing area being Nelson/Marlborough.

Although trawling is the principal method of fishing, there has been a trend for many years in the inshore fisheries towards longlining, set netting and purse seining. This has been largely to achieve greater quality although the fact that these methods are less energy intensive has become increasingly important as fuel costs have soared over recent years (refer to Table X).

TABLE IV
NEW ZEALAND FISH EXPORTS
VALUE 1964 - 1983

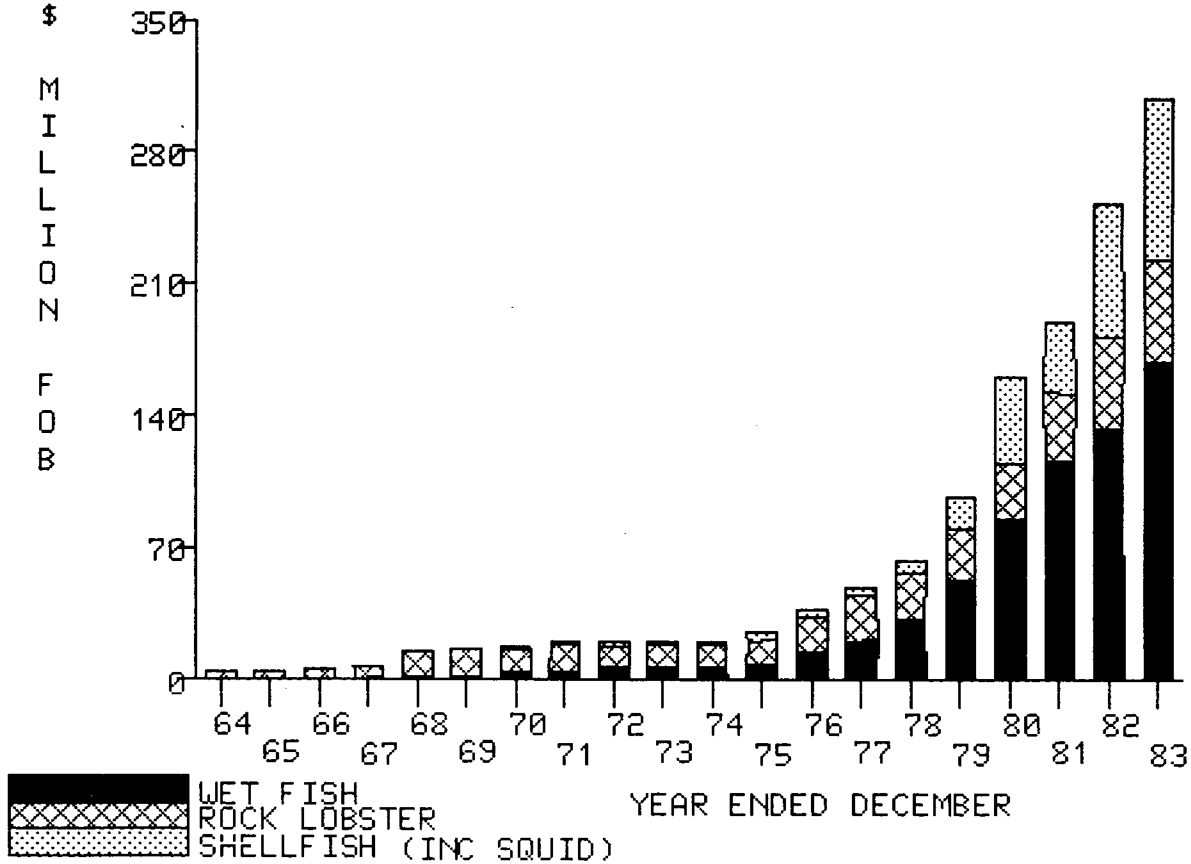


TABLE V
NEW ZEALAND FISH EXPORTS VOLUME 1964 - 1983

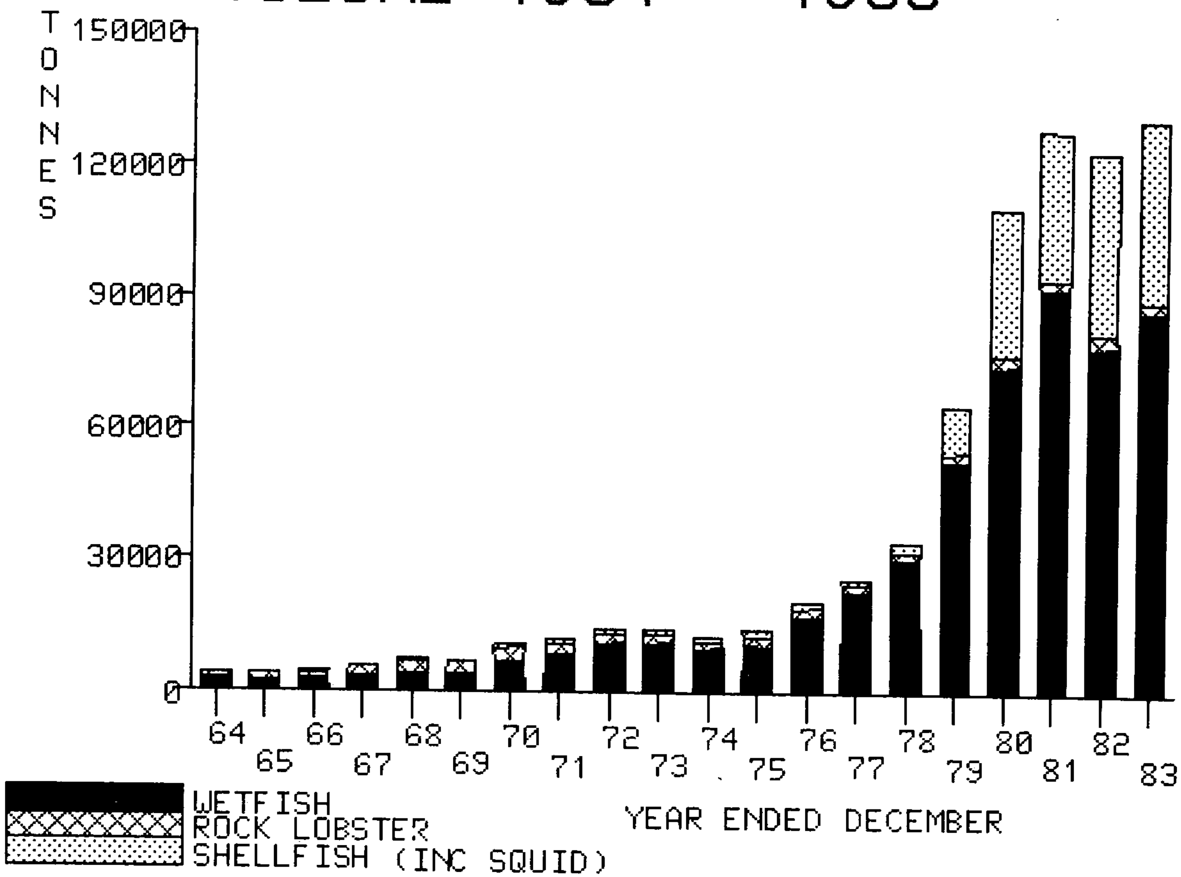


TABLE VI
1984 EXPORT STATISTICS

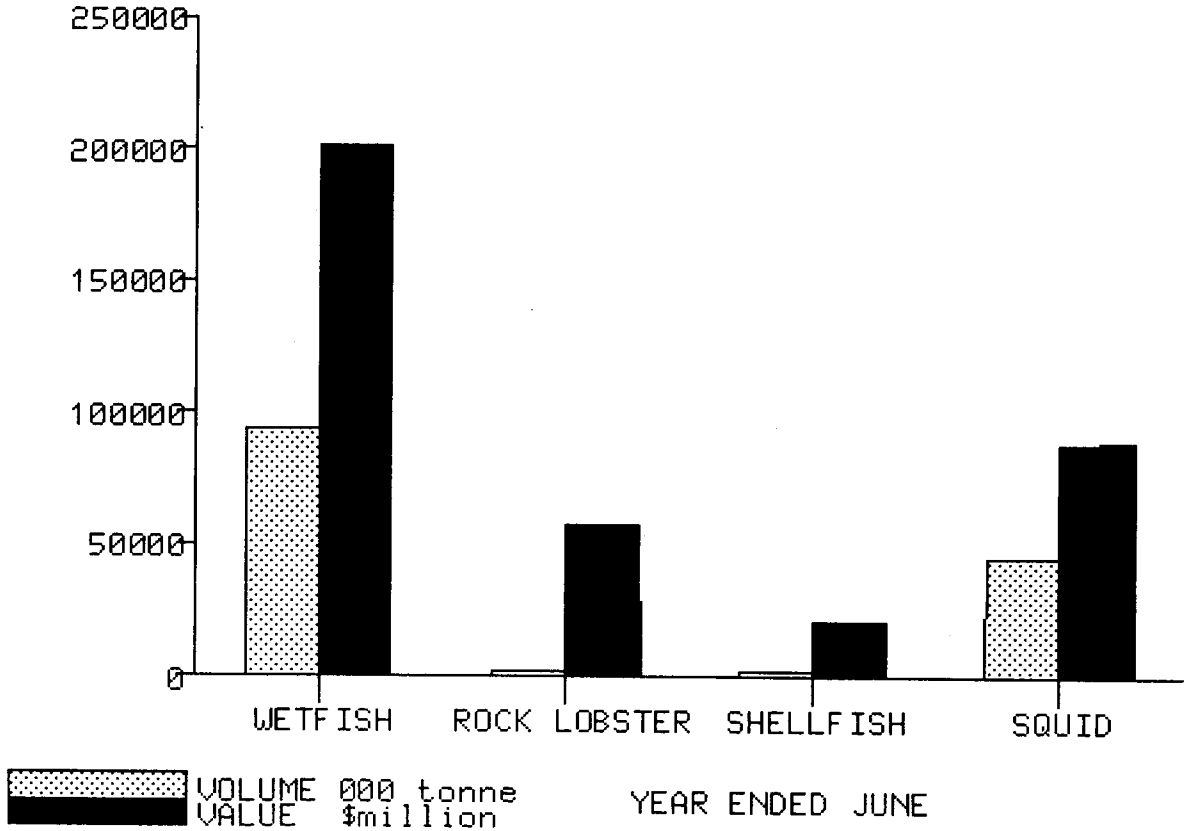


TABLE VII
MAIN EXPORT MARKETS 1984
by value

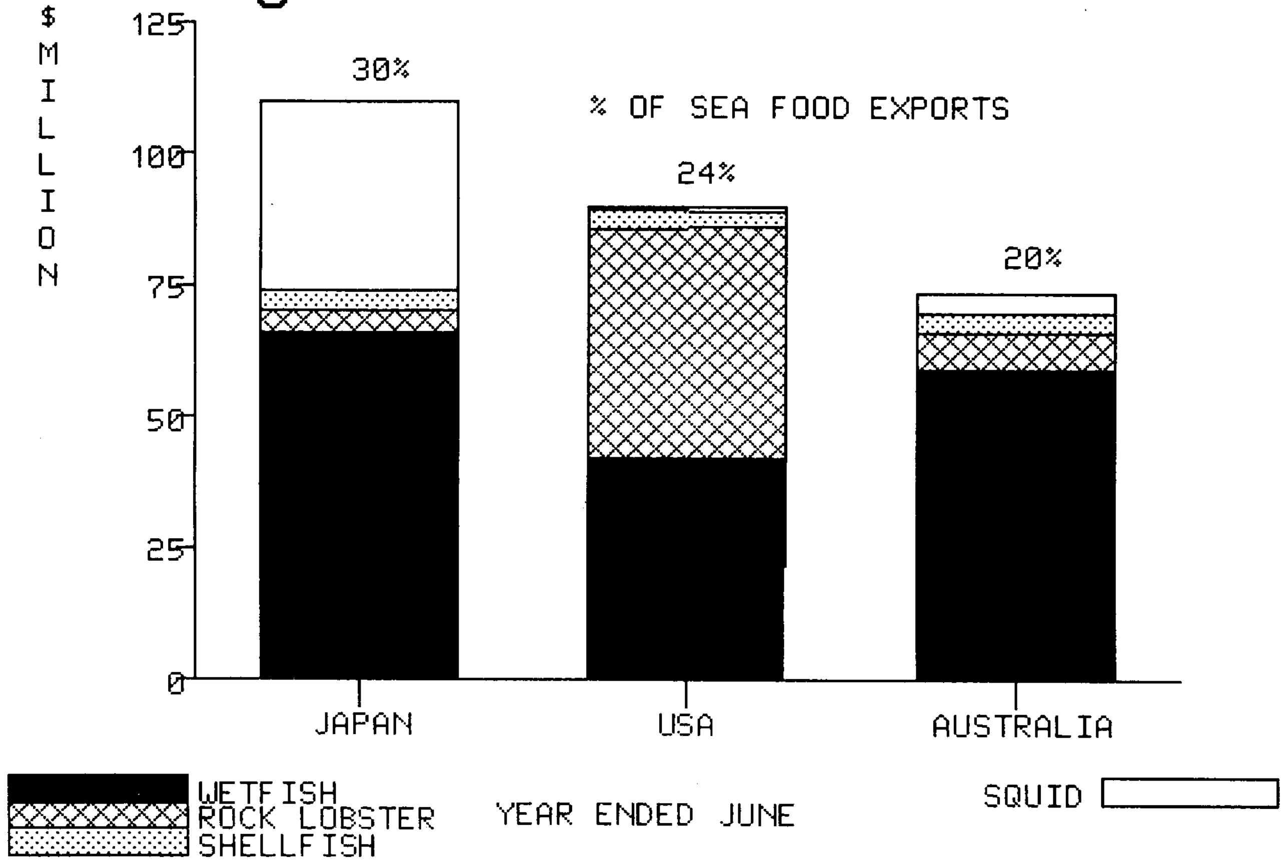


TABLE VIII
PRINCIPAL SPECIES EXPORTED by value 1984

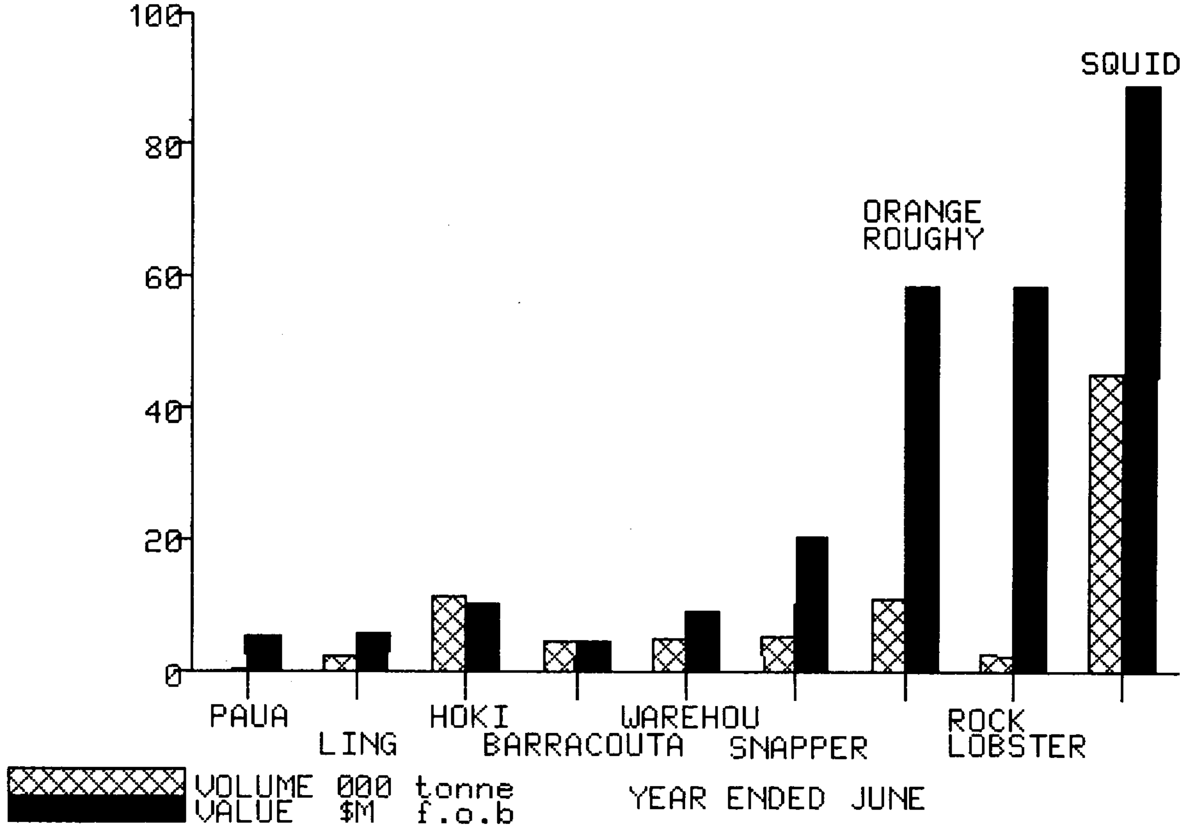


TABLE IX

MAIN METHODS OF FISHING BY DOMESTIC VESSELS IN 1983

FREQUENCY OF TYPE

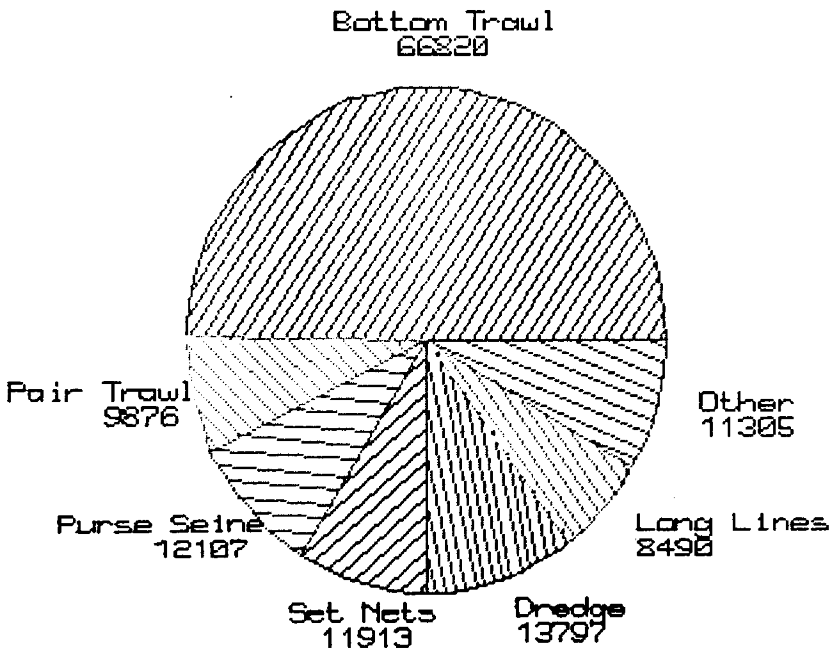
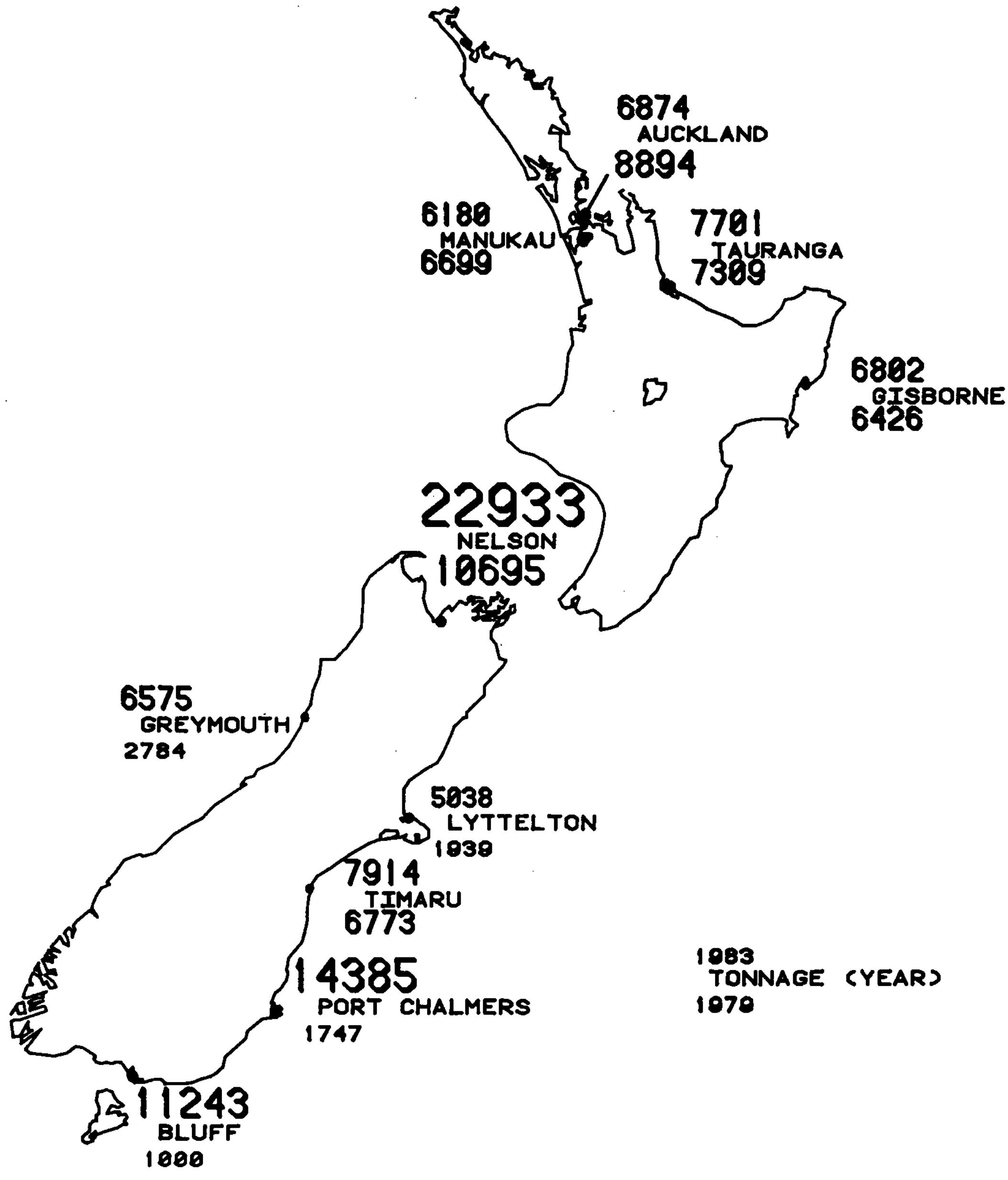


TABLE X MAIN FISHING PORTS



The main fishing grounds for some of our fish species are indicated in Tables XI, XII and XIII. Table XIV shows the extent of our EEZ and management areas.

Outlook for the Future

In spite of the problems besetting the inshore fisheries, there is still every reason to be optimistic about the future of the industry. Although we cannot expect to see any large increase in the finfish catch, the demand generally is high on the world market and is likely to increase in the future. Returns for exported finfish are increasing in step with improved quality and a greater degree of processing.

There is considerable scope for greater involvement by the domestic industry in the squid fishery which is our most valuable fish resource. A strategy for its future development is currently being developed. It is anticipated that draft strategy options will be discussed with the industry in the not too distant future.

There are promising developments in aquaculture, particularly mussels where there are indications that a break through has occurred in marketing. If this can be sustained, there is considerable potential for increased production.

Caged rearing and ocean ranching of salmon are also beginning to show results after a number of years of development.

I thank you for your attendance and I hope that all the countries represented will gain something from the papers presented and the discussions that will follow.

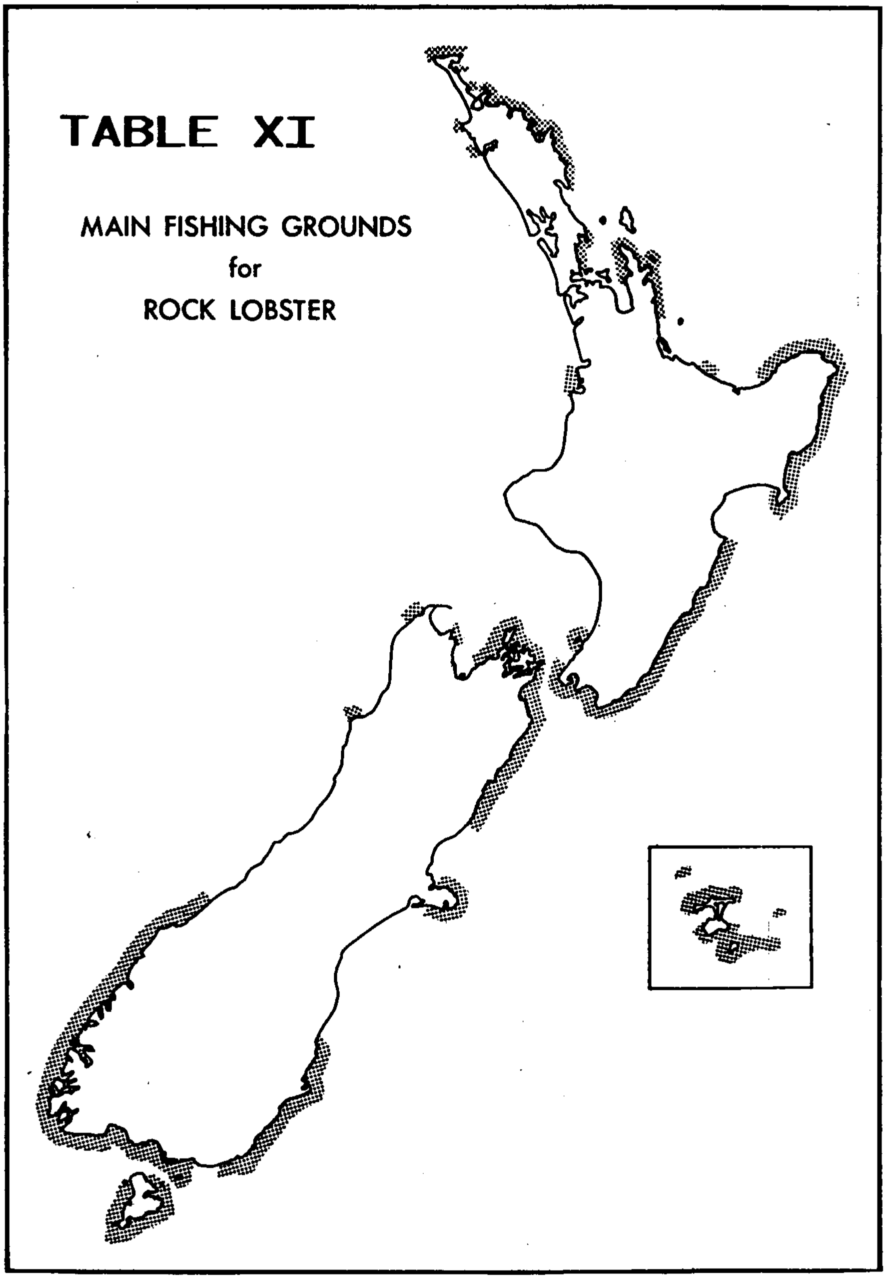


TABLE XI
MAIN FISHING GROUNDS
for
ROCK LOBSTER

TABLE XII. MAIN GROUNDS

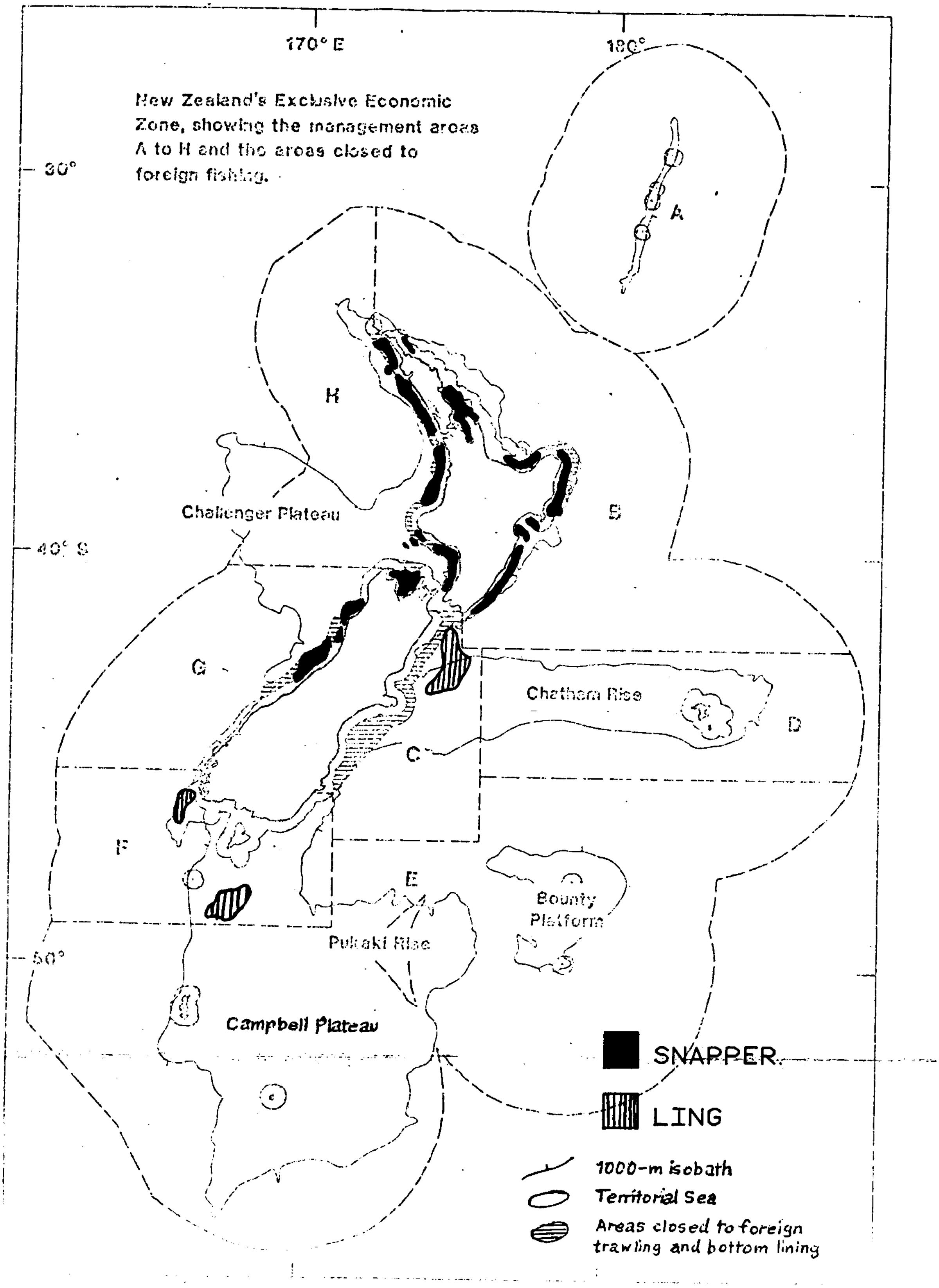


TABLE XIII MAIN GROUNDS

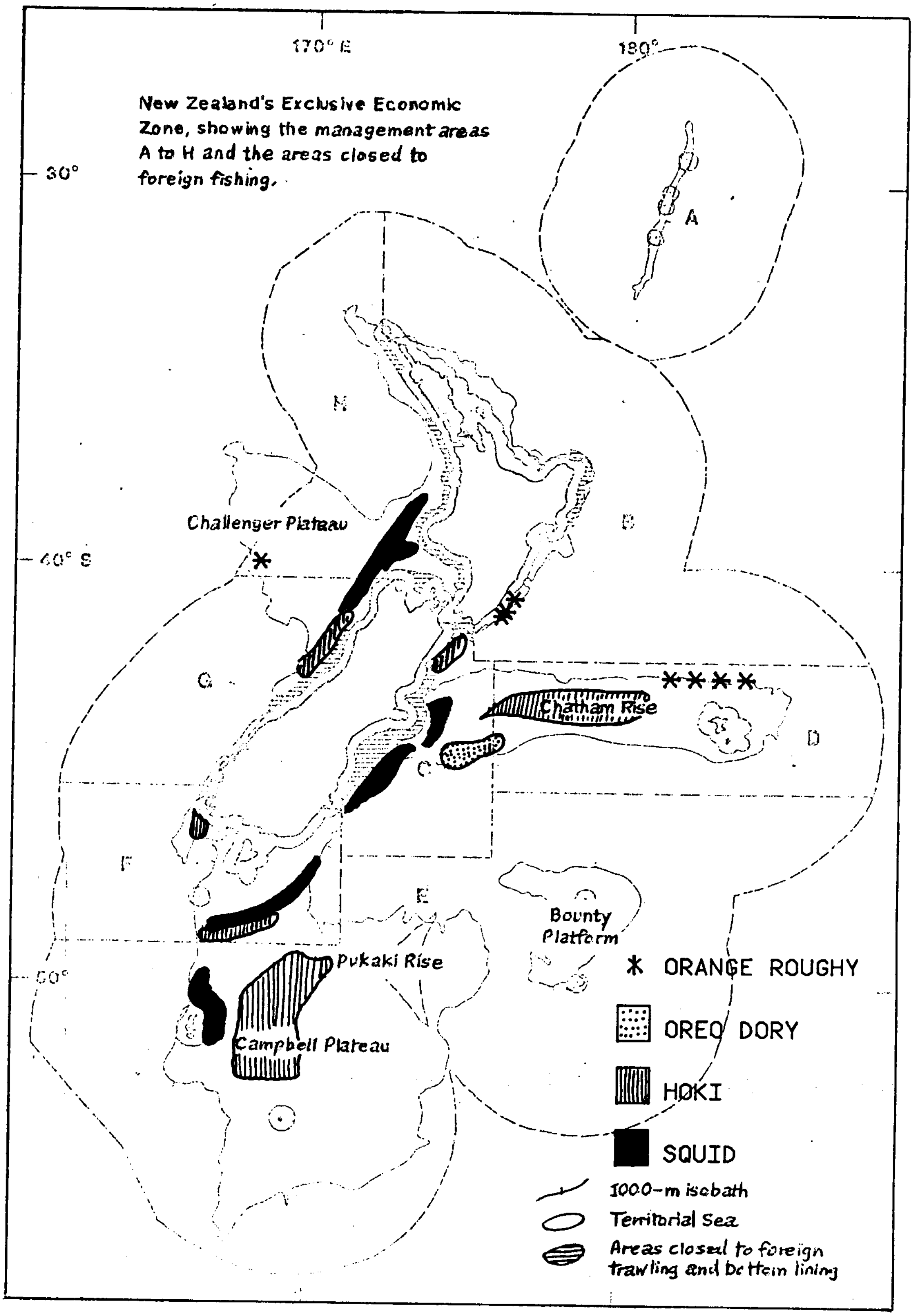
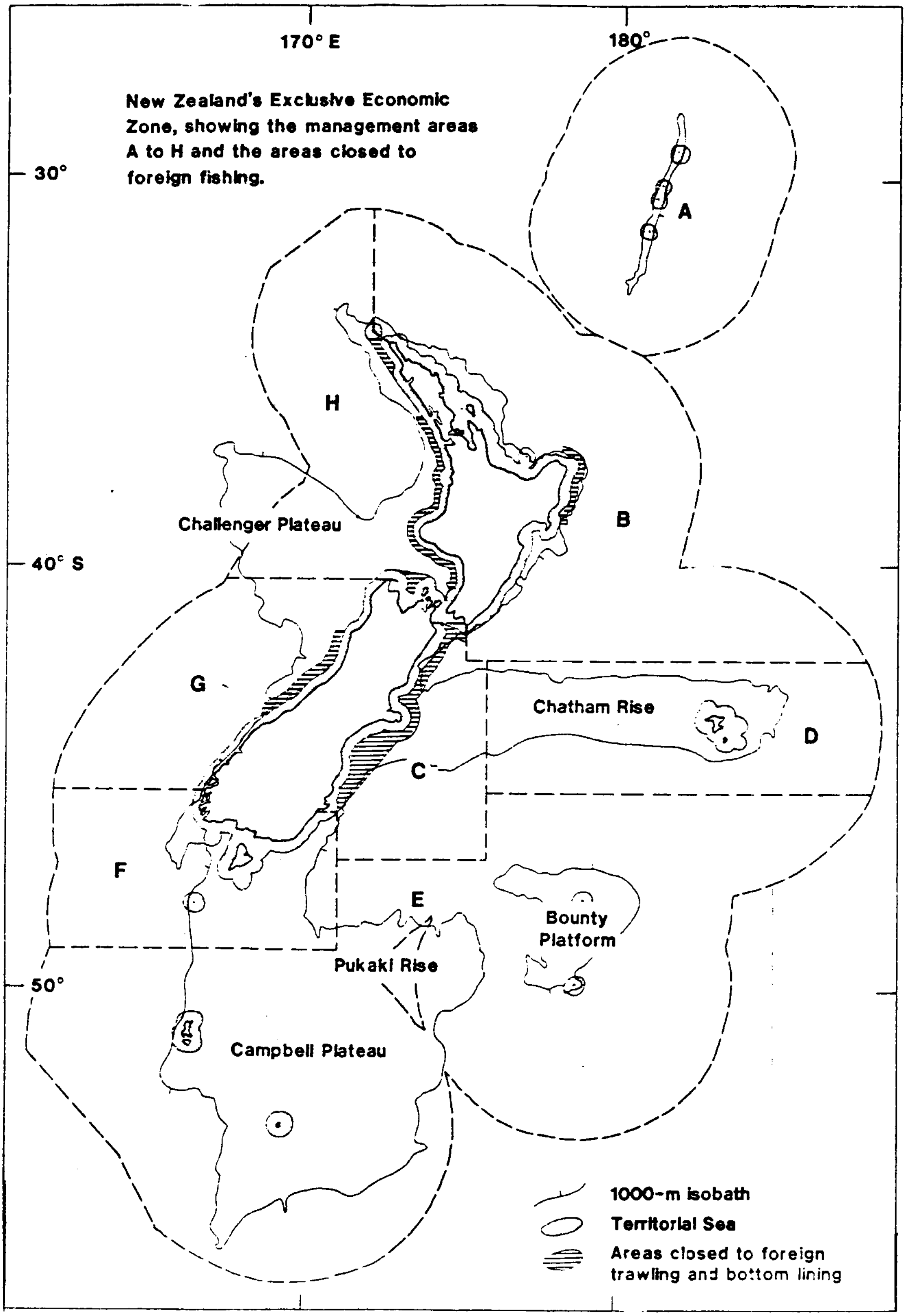


TABLE XIV


170° E
180°
30°
40° S
50°
New Zealand's Exclusive Economic Zone, showing the management areas A to H and the areas closed to foreign fishing.
A
B
C
D
E
F
G
H
Challenger Plateau
Chatham Rise
Bounty Platform
Pukaki Rise
Campbell Plateau
1000-m isobath
Territorial Sea
Areas closed to foreign trawling and bottom lining

Fisheries Issues in the Pacific Islands

Les Clark
South Pacific Forum Fisheries Agency
Honiara, Solomon Islands

Introduction

I always have some difficulty in responding to invitations to address topics as broad as that of 'Fisheries Issues in the Pacific Islands.' I'm sometimes troubled by the feeling that the institutions or people involved are expecting a heavy focus on the struggles of Pacific Island nations with distant water fishing interests for control of the tuna resources in the region. That area contains a whole set of important issues, and is, I guess, the best known area of work of the Forum Fisheries Agency and other regional institutions. And yet, too narrow a focus on these issues would ignore a range of other issues which are for me important, diverse and exciting, so that I propose at the risk of being excessively superficial in some areas and of not meeting your expectations in others to take a somewhat broader view of fisheries issues in the region.

I should begin then by making some apologies for the limits of the paper.

Firstly, it draws on my experience on the staff of the South Pacific Forum Fisheries Agency, and reflects my perception of experience in the states which are members of that agency, or observers to it. There are fourteen member states - Australia, Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Nauru, New Zealand, Niue, Papua New Guinea, Solomon Islands, Tonga, Tuvalu, Vanuatu and Western Samoa; and two observer states - Palau and the Marshall Islands. These states include generally all those in the region which are politically independent or, as in the case of the Micronesia entities, are apparently close to being independent. Significantly then the comments do not necessarily relate to the French territories (New Caledonia, Wallis and Futuna, French Polynesia or the U.S. territories of Guam, the Northern Marianas and American Samoa).

Secondly, as I noted in opening I have preferred to review a wide range of fisheries issues rather than to focus on a few major areas, and the treatment is necessarily therefore somewhat superficial. Even so, there has not been space to deal with inland fisheries or with aquaculture, in which there is a surprisingly diverse range of activity in Pacific Island States - a worthwhile topic in itself.

And thirdly, there are always dangers in drawing generalisations about fisheries issues as the paper does over such a range of countries, among which there are wide differences in the pattern of marine resources available; in historical attitudes towards fishing; in tastes; in the social and economic importance of fisheries and in levels of development, to name a few factors.

The kind of regional level viewpoint presented here then may be useful as an introduction or overview, and there are indeed some common and shared issues which can be identified, but it is important to recognise the diversity of conditions that apply in different places in the region.

Outline of the Paper

The paper begins with a brief note on inshore fishing. The focus then shifts offshore, initially to fishing of the outer reef slopes and to near-shore fishing or pelagics by small-scale fishermen and then to the offshore tuna fisheries.

A Demographic Note

Around 4.5 million people live in the Island States participating in the Forum Fisheries Agency. Over 3 million of these live in Papua New Guinea, and around another 1 million live in three other countries with relatively large land masses - Fiji, Solomon Islands and Vanuatu.

The main islands of these four states have relatively large land masses with areas of land suitable for farming and in these areas agriculture has provided most subsistence food needs. Indeed, the level of traditional fishing activity on the main islands of these countries is mostly still surprisingly low.

The number of people in these larger countries who live on small islands within the groups or in the coastal areas of the main islands, and who are likely to be largely dependent on fish for animal protein is probably 1.3 to 1.5 million.

The total population of the other 10 island states noted above is less than 0.5 million. On the small scattered islands of these groups soils are often poor, and the sea still provides subsistence food needs, and is a focus of cultural life.

Subsistence Fishing

The major types of subsistence fishing activity can still be seen along any shore of the Pacific Islands. Shellfish and crustaceans are gathered by hand in the shallows and on the reefs. Most fish is caught by fishermen and women standing or swimming in shallow water by spear, line or throw nets, or by drop-lining from small boats - typically dugout canoes. Other fish is trapped by cages or by the kind of arrow shaped structures of coral walls seen on the beach as you fly into Tarawa; the bamboo stick fence traps you see in the lagoon at Vila or the wire netting structures along the foreshore at Apia. Where there is more cash, there are outboard motors, fibreglass or plywood boats and sometimes gill nets.

Government approaches to the administration and development of subsistence fisheries are low-key, cautious and protective - based largely on the view that there is not much a young fisheries extension officer can offer to subsistence fishermen and on a concern about the impact of whizzbang programmes on established social and cultural arrangements. Existing programmes concentrate on making available a regular supply of fishing gear at reasonable prices and on the improvement of processing techniques to reduce waste and losses.

Small-Scale Commercial Fishing

There is a much more active government role in the management and development of small-scale commercial fisheries. These involve two main activities.

Firstly, there are a range of products, notably beche-de-mer, shell (especially trochus) and sharksfin which have for decades been harvested for export to specialist Asian markets. The trades are informally organised, usually through traders of Chinese origin, and often conducted as a part of generalised trading businesses.

Trade in these products is of special importance, because of its exceptional power in generating cash incomes in rural coastal areas and on outer islands. While there are real limits to the expansion of harvesting of these resources in specific areas, because they are relatively easily over-exploited, recent studies suggest potentially large gains could derive from:

- harvesting areas and species not now exploited;

- improving quality control; and

- increasing the degree of local processing

and programmes towards these ends are being expanded.

Rising populations, urbanisation and the development of cash economies have stimulated rapid growth in commercial market demand for fresh and frozen fish locally. Traditional forms of stewardship of resources have usually been successful in maintaining inshore resources sufficient to meet local subsistence needs, but the growing commercial demand threatens to break down these controls. There is already evidence of the effects of heavy fishing in some areas in terms of changes in species composition of catches, reductions in average sizes of fish, and the need for fishermen to travel further to fishing grounds in areas of dense populations. At the same time the growth of local commercial fish markets offers opportunities to develop small-scale commercial fishing operations which provide employment and cash incomes and opportunities to reduce imports.

Government responses have generally been to seek to direct this increased interest in fishing away from the more fragile and already heavily fished reef and lagoon resources and towards under exploited resources on the other reef slopes and the pelagic resources in deeper waters. There have been two successful programmes in this direction, both based on work by the Deep Sea Fisheries Programme of the South Pacific Commission and by the UNDP/FAO Regional Fisheries Programme. One programme has been aimed at catching deep bottom fish on outer reef slopes. This has required the development of deep-water drop-lining techniques, the training of fishermen in those technologies and the design and construction of larger boats - typically retaining the essentials of traditional craft in forms such as outrigger canoes and catamarans with sails as well as outboards. The second programme has involved the deployment of rafts - payaos or fish aggregating devices as they are variously known. The rafts, anchored in deep waters offshore, encourage collections of fish such as tuna, skipjack, mahi mahi and provide much higher catches - making trolling around the rafts an attractively lucrative occupation.

These programmes for introducing new small-scale fishing technologies have also required co-ordinated programmes involving improved supplies of fishing gear, establishing lines of credit for commercial fishing operations, subsidies or reduced duties and taxes on fuel and supplies; provision of landing sites with storage facilities, fish collection and distribution services and the development of marketing sites and arrangements in urban areas.

Overall, these programmes have been very successful - again largely because they have been developed at a measured pace on a scale which is appropriate to the capacities of administrations and communities to implement developmental changes. Supplies of fish have increased, prices to consumers have often fallen, incomes from fishing have risen, and in some cases imports of frozen and canned fish have fallen. There have been some failed outer island refrigeration projects which could have been done without, but there are relatively few of the expensive failures which have sometimes characterised small-scale fisheries development programmes in other regions.

Current problems arise largely in the marketing area. In several cases supply now exceeds local demand and there is a push to find export markets for higher valued species in points such as Honolulu, Guam, Australia, New Zealand and Japan; and to find markets for small volumes of tuna for processing. In some places, especially where the private sector is least developed, it has been difficult to find an appropriate blend of central government, local government, community or fishermen's co-operatives to run the marketing and collection operations commercially.

Despite the success of these programmes in diverting effort away from reef and lagoon resources, policy attention in inshore fisheries is likely to focus increasingly on managing the fisheries to reduce risks of over-fishing. Here, the effectiveness of direct government regulations can be only limited. There are in many cases regulations on the sizes of shells, lobsters, crabs, etc., which may be taken - these can be effective where the products are easily available for inspection at points of export - and fisheries inspection and information services have in some instances been successful in curbing the worst abuses of illegal fish poisoning and dynamiting. But there is little that governments with limited administrative resources can do to limit small-scale fishing through quotas, licenses, gear controls, etc., even if they had the information on which to base the establishment of regulations of these forms.

Rather, there is increased recognition of the need to have fishing regulation carried out by fishermen's groups, co-operatives and communities themselves. For now, this interest takes the form of study and discussion of methods to identify and formalise traditional forms of regulation of fishing activity, especially through the registration of ownership over inshore fish resources; and the devolution through legislation of fisheries regulation authority to provincial, community and fishermen's authorities.

The introduction of fishing around rafts creates its own institutional problems. The cost of materials and placement for each raft, anchored in from 800 m to 1500 m of water, is around U.S.$ 5000. Till now raft construction and placement has largely been funded by external development assistance. But in the future, funding for rafts will increasingly have to come from the fishermen themselves - and this raises the question of who pays, and how the structure of payments relates to use of the rafts. Again, this is an issue that will largely have to be settled within organisations of fishermen themselves.

<u>Tuna Bait Fishery</u>

Within the inshore fisheries, the fishing of bait for pole and line tuna boats is an important but often overlooked activity. Pole and line tuna boats need consistent supplies of small fish - sprats, scad, etc., - to operate. The story of a baitfish is perhaps the harshest in Pacific Island fisheries - dragged from inshore waters at night by scoop net, they are carried out to sea in tanks on board pole and line boats and cast down the throats of surface feeding skipjack to induce them into such a feeding of freezing that they are easy prey for the fishermen.

The existence of bait has been the major determinant of the pattern of development of the locally-based pole and line fishing operations which are described next. Baitfish are generally most plentiful in waters around larger land masses - underpinning the operations of pole and line fleets in Fiji, Papua New Guinea and the Solomon Islands. Freshwater run off into lagoons appears to be a major factor in providing natural conditions in which baitfish thrive. There is bait in the atoll lagoons, but the supply fluctuates so that Kiribati for instance farms bait to supplement the catch of lagoon fish.

Apart from their importance in supporting the local pole and line operations, three sets of issues attach to the baitfishing:

- the catches are relatively large - estimated at around 2500 tons for the Solomon Islands in 1983. These catches justify relatively rigorous programmes of research and control - many elements of which are already in place;

- the baitfishing is prominent since the lights of the boats can be seen off the reefs and from villages; and

- in Papua New Guinea and Solomon Islands at least much of their catches are taken from grounds which are still under traditional ownership and local government control - bait fee payments provide a source of cash to bait ground owners and to local governments, but negotiations are sometimes difficult and protracted, and not always successful.

At this stage the operations of the pole and line boats provide the most obvious interaction between the inshore fisheries and the industrial offshore fisheries - and involve perhaps the most rigorous national fisheries research programmes and require the most difficult management actions.

Offshore Fisheries

For now, the only established commercial offshore resources are the highly migratory species - skipjack, tunas and bill fish. Pacific Island Government concerns over the management and development of these resources fall into three major areas:

- they want to develop national tuna fishing and processing industries;

- they want to control and extract the maximum benefits from foreign fishing in their waters; and

- they are confronted by the need to co-ordinate their policies on the exploitation of these species with other states in the region and to develop a relationship with distant water fishing states over the management of the resources at a regional level.

Of these areas it is the first - their aspiration to gain employment, incomes, government revenues and foreign exchange earnings from industrial tuna fishing and processing which has highest priority in the medium term. In all the national development plans of states in the region, those aspirations figure highly.

Indeed, industrial tuna development seems for some to provide virtually the only opportunity for industrial and export development (leaving aside for now the important but at this stage longer term prospect of gains from seabed mining). Even for the countries with larger land masses such as Fiji, Papua New Guinea and Solomon Islands, tuna is already a major export commodity and occupies a major role in their economic development strategies.

Despite the priority attached to developing national tuna industries, and the apparent impetus to that development from the extension of jurisdiction of Pacific Island States over millions of square miles of tuna-rich waters, gains have been elusive.

Some historical background and some broad parameters are perhaps useful at this point. There were two earlier stages of development of national or locally-based tuna operations. The first began in the mid 1950s when bases were first opened for Japanese longliners fishing for albacore tuna for United States canners. The fish were landed at Tahiti, Pago Pago and Santo in Vanuatu. Later the Japanese were to leave this fishery for the more lucrative distant water sashimi fishery and their places were taken by Korean and Taiwanese fishermen - though often still under arrangements with large Japanese trading houses. These fleets are still there but economic conditions have become difficult for them. The sizes of the fleets are now falling - perhaps the biggest is the line of rusty vessels of bankrupted owners moored in Pago Pago harbour.

The second stage was associated with the overall expansion of the Japanese pole and line fleets to meet booming demand for skipjack for canning in the early 1970s. Large distant water pole and line vessels found good fishing conditions in Southern grounds and stimulated interest in ventures based in the South Pacific. Joint venture canneries were established in Fiji (with C. Itoh) and in the Solomon Islands (with Taiyo Fishing Co.). A major transshipping operation eventually controlled by Starkist and Mitsubishi operated in Papua New Guinea, and Van Camp operated a base in Palau. In every case, these operations were based on the use of skills and vessels from Japan, especially from Okinawa. However, the joint venture arrangements in Fiji and Solomon Islands also provided for the establishment of national fishing companies.

The success of these ventures which were by the late 1970s generating exports of frozen and processed fish worth around U.S.$ 70 million encouraged an expectation of further major gains, especially in the light of the establishment of 200 mile EEZs.

Experience has proved otherwise. At August 1984, the Papua New Guinea and Palau operations are largely closed though there are well-advanced proposals to reopen them on a smaller scale. Landings from the albacore longliners at Fiji and Vanuatu are down and there are signs of possible retrenchment for the Fiji pole and line fleet. The size of the Solomon Islands pole and line fleet seems likely to grow at a limited pace. There are also plans for a larger cannery to ensure more of the catch is processed before export. There has been no other cannery development in Forum Island States.

As it turned out, having an enlarged fisheries zone did not make tuna any easier to catch or market, and did not make it any easier for small island governments to obtain capital for investing in the risky business of tuna fishing. On the contrary the extension of EEZs encouraged other larger developing countries to make investments in tuna catching and processing. Indonesia, the Philippines and Mexico for example became major new competitors and suppliers of raw tuna expanded.

Currently, the prospects for developing national or locally based tuna industries are mixed. In the more established technologies of longlining and pole and line fishing there have been some small gains. Tuvalu operates 1 pole and line boat, the Kiribati national fishing company is now operating 4 pole and line boats. Tonga has an albacore longliner and the Solomon Islands national fishing company has 2 fairly new sashimi longliners - most of these vessels having been provided as technical assistance in association with the provision of access to Japanese distant water vessels. There may still be further opportunities for using these types of vessels.

But the major uncertainty attaches to the question of participation by Island interests in purse seining. The Western Pacific purse seine fishery has increased dramatically with recent improvements in technology. Till now the fishery has been the preserve of large vessels - notably the fleets of 500 gross tonne Japanese boats and the 1200-1500 gross ton U.S. boats. Favoured by their ability to stay on the fishing grounds for longer periods, to fish in rougher seas and to be able to search over larger areas of ocean, these vessels fish Western Pacific waters and land their catches in Japan and San Diego or at U.S. territories in the region - Guam and Tinian, American Samoa, and to a lesser degree, Honolulu. Now, several factors - on the demand side for frozen fish the shift of processing capacity both off the U.S. mainland because of production costs and even possibly out of U.S. territories because of taste changes which have reduced effective tariff barriers - and on the catching side better knowledge of fishing grounds, improved designs of smaller vessels, and greater use of FADs - contribute to the prospects of it becoming more competitive to catch tuna with smaller vessels and land them nearer more localised fishing grounds.

At this point, Island governments face a major dilemma. They have been pursuing strategies for tuna development based on the use of pole and line vessels and longliners which are relatively small, generate more jobs, are less complex and require less capital than purse seiners - in short: an appropriate technology. In the face of a drop in the tuna prices from over U.S.$ 1000 per ton to around U.S.$ 700 per ton those forms of fishing are more rarely competitive - but the alternative is purse seining - high-risk, high capital and few jobs. There are some major investment decisions to be made here.

While developing their own fishing and processing capacities is the major medium term goal of Island governments, establishing control over and deriving benefits from foreign fishing has certainly been the major focus of their immediate attention. But the story here is a happier one.

The size of the problems is no less. The declaration of EEZs by Pacific Island governments left them with rights and duties over resources in large areas of ocean which were fished by over 1000 vessels. At this point it may be useful to give a short description of the activities of these fleets.

The largest single fleet in terms of numbers of vessels and value of catch is the Japanese longline fleet of around 600 vessels. These vessels, all based in Japan, catch tuna and billfish exclusively for the Japanese sashimi or raw fish market. The product is carefully handled, of high quality and high value. These vessels fish throughout the Western Tropical Pacific from Micronesia down to Papua New Guinea and Solomons and across to Kiribati.

There are now around 100 Japanese distant water pole and line vessels, all based in Japan, delivering skipjack for high quality uses - fishing mostly in Micronesia across to Kiribati.

There are 40 Japanese purse seiners landing mostly in Japan and fishing almost exclusively in Papua New Guinea and the Federated States of Micronesia and in the high seas pocket between those two zones. There are around 60 U.S. seiners and some associated Korean and Taiwanese seiners working as noted above. Their fishing has been concentrated in Papua New Guinea, FSM and more recently Kiribati - but a new agreement with 5 other nations has provided the opportunity for fishing areas as far east as the Cook Islands.

Finally there is the fleet of around 100 Korean and Taiwanese vessels fishing more southerly and eastern waters targeting for albacore.

A major feature of this pattern of fishing is that it is still concentrated in western areas, though spreading.

These vessels carry the flags of large and powerful nations with whom Island governments have economic and political relationships. Initially, they were, with the important exception of the Japanese fleets, subject to little control by flag state governments. And until recently at least flag state authorities have, without putting too fine a point on it, been less than fully co-operative in their relationships with Island government fishing authorities and institutions.

The objective of FFA member governments in managing foreign fleets is quite clear - they have sought to maximise the net gains to their countries from the operations of foreign vessels. This approach has two sides to it. On the one hand they have adopted an attitude to foreign fishermen which is one of the most positive attitudes to non-reciprocal access rights for foreign fishing - in pursuit of the benefits of fees, technology transfer, development of new fishing grounds and techniques, fisheries development assistance, employment and information which well-managed foreign fishing operations can provide.

This side of the approach has resulted in the offer of stable, medium term access and flexible licensing arrangements for vessels whose flag governments are prepared to ensure that their fleets obey the laws of island states.

On the other hand, Pacific Island governments have adopted fairly tight controls on foreign fishing. There is a harmonised list of minimum access conditions with which all agreements in the region must comply, and those requirements are relatively rigorous by comparison with those applied by other developing coastal states, without being unreasonable. There is a regional register of fishing vessels - in effect a bank of information on all foreign vessels which fish in the region, and a regional blacklist against vessels which infringe seriously the laws of any single Forum state and do not submit to the legal processess of that state. No vessel may be licensed to fish in the region unless it is in good standing on the register. Governments may request the good standing of a vessel to be removed if it breaks their fisheries laws. The register is very recent but it has been invoked once with very satisfactory results. It is likely to be invoked again very shortly, and the evidence is that it has contributed substantially to ensuring that foreign vessels comply with Island governments fisheries laws.

There is a regular exchange of information. There are standard regional forms for information on vessels and on their catches and fishing activities. That information is brought together for processing at the South Pacific Commission in New Caledonia for scientific purposes and at FFA for regulation, surveillance and negotiation purposes. There are regular meetings between the FFA States involved in fisheries agreements with foreign fishing interests, and FFA staff now participate in almost all fisheries access negotiations as technical advisers to the governments involved. There are training programmes for national negotiators, data analysts, administrators and legal and enforcement officers.

In terms of the future role of foreign fishing, the shape of ownership of future fishing fleets should be quite clear. Island governments are committed to increasing their participation in fisheries operations through ownership of vessels, joint ventures, processing catches and servicing fleets working in the region. However, the abundance of the tuna resources is likely to far outstrip the fishing capacities of locally owned or based fleets in all but the fairly long term. There will therefore be a continuing role for foreign fishing. Which brings us to the question of the future management of the regions tropical tuna fisheries.

At present these fisheries are subject to a range of overlapping management regimes.

The most obvious of these is the set of access agreements which make arrangements for foreign fishing vessels to fish in the waters of states in the region. While these arrangements are mostly bilateral they are fairly closely co-ordinated in that:

- they have to meet a regional set of minimum conditions;
- they are the subject of regular strategy and review meetings by most of the Island governments;
- they are supported by regional programmes of research and policy advice at SPC and FFA; and
- some are indeed multilateral, providing fees for access to more than one zone by a single license.

The objectives of these agreements can largely be listed as including:

- generating economic returns (in cash, jobs, development assistance, etc.);
- protecting existing subsistence and small-scale fishing;
- securing improved data;
- improving the distribution of foreign fishing effort, especially in developing new fishing grounds; and
- encouraging new fleets to enter the fisheries.

In addition there are the management policies of the foreign fishing governments, including in particular:

- the Japanese government licensing system which defines the areas in which Japanese vessels of various classes may fish, regulates the sizes of Japanese fleets, and includes policies on technology transfer, landings overseas, transshipments, import controls and tariffs; and
- U.S. government policies including the developmental work of the Pacific Tuna (now Fisheries) Development Foundation, policies on import tariffs, and the limits to the unloading of fish from foreign vessels in U.S. ports; and all that other stuff in the U.S. fisheries stands.

These regimes have been largely developmental - aimed at expanding catches and fleet operations, and developing new fishing grounds and technologies (except that the Japanese government has limited entry to preserve stability in their domestic markets for fish and for fishing licenses).

Now the focus is changing, and there is a greater interest in a co-ordinated approach to limiting fishing activity. That interest has two origins. From the dismal science there is the observation that scarcity creates value and that fee receipts should be increased significantly when the amount of licensed access is limited. From the biological sciences there is theoretical and empirical support for the commonsense notion that when you start taking an extra 200,000 tons a year of tuna out of any area of sea, you ought to start being more concerned about the impacts on the stocks and more particularly on the catches taken by existing fishing operators.

The concerns over the impacts on stocks vary by species. The concern about skipjack relates mainly to local interaction on nearby fishing activity - both industrial and subsistence. The concern about yellowfin goes deeper, since these stocks are likely to be more vulnerable generally to over-fishing, while some billfish species may be particularly sensitive to increased fishing pressure.

For now, the impact of fishing levels on stocks is not seen as a matter for alarm. The first major impact would probably be for some U.S. seiners to put out of business some Japanese longliners which depend heavily on yellowfin catch rates and are already under financial pressure - not a prospect likely to bring tears to the eyes of an Island fisheries administrator.

But it is clearly foolish for all involved - for foreign fishermen and their governments, for national fishing managers and their governments, for the regional agencies and the fish processors - to depend on these resources as they do without seeking to improve research results and preparing to establish a more coherent mechanism to control fishing effort than the existing pattern of fishing agreements.

That is not easily done. The structure of institutional relationships between coastal states and fishing states generally is still in flux, especially in respect of highly migratory species fisheries. The previous types of arrangements for co-operative research and management of tuna resources such as IATTC (Inter American Tropical Tuna Commission) and ICCAT (International Commission for the Conservation of Atlantic Tuna) no longer seem appropriate, and there has been no new agreement anywhere on a form of arrangement which fully copes with the reality of extended coastal state sovereign rights. The shape of any likely new arrangements in the South Pacific is at the moment very unclear.

However, if there is to be any new arrangement I can offer some personal observations about factors which might affect their shape.

For one, there is likely to be a greater role for coastal states, and a lesser role for fishing states in any management structure in the Western Pacific than in arrangements such as ICCAT or the IATTC. Not only do those types of organisation not necessarily account for the extension of coastal state sovereign rights but in the Western Pacific the coastal states have a much greater leverage in terms of the importance of their EEZs within the fishery than is true of the Atlantic or Eastern Pacific tuna fisheries. In particular it is highly unlikely that very many vessels could operate sustainably fishing only in high seas pockets or in the EEZ of states other than those participating in the FFA.

Secondly, if a single management regime is established it is likely to be relatively simple. There will probably not be a need to set quotas by nationality of fleet or by zone. For nationalities of fleets, the local fleets are for now small and largely concentrate on local skipjack fishing grounds, so that schemes to give priorities and preferences for regional fleets should initially be easy to establish. As between foreign fleets, the FFA governments will probably be indifferent - such systematic differences as do occur - the U.S. boats for instance employ Pacific Islanders whereas the Japanese do not could be handled by establishing priorities relating to the benefits provided to FFA states, rather than by going through the task of allocating quotas to foreign national fleets.

More likely, and I stress this is a personal view, any mechanism for limiting catches is likely to involve either limiting the number or capacity of vessels operating by gear type (whether seasonally or by area) or by manipulating fees. If there are to be limits to the numbers of vessels, the allocation of licenses available could be either largely discretionary - that is, allocated according to an agreed set of criteria tied to the benefits the vessel would give the resource owing states through employment landings, etc. - or allocated by some market mechanism - by auction or by giving an initial number of licenses which become transferable.

The possibility of limiting effort by fee manipulation is also probably of sufficient interest to this audience to spend a minute on it.

If the FFA states do retain their present priority attached to extracting resource rents through fees, then there is clearly an option of simply seeking to manipulate fee levels to give the highest aggregate receipts. This strategy would likely be based on limiting effort to a point where the aggregate profits of the fleet were highest - and at that point catches are probably going to be below any measure of maximum longterm yield suggested by resource considerations, at least in aggregate. And if that isn't the case, and the pattern of fishing arrived at from manipulating fees to extract the maximum receipts did occasion concern about over-fishing in any way, the appropriate response would be to raise fees accordingly until sufficient vessels dropped out to remove the overfishing concerns. A fee-based system could also respond relatively flexibly to resource considerations - fees could vary for fishing on species with varying opportunity costs possibly being differentiated seasonally and/or by area.

Clearly, there is a lot more thought to be given in this area, and it will be a major focus of our work at FFA in the next six months leading up to a high level workshop in March next year at which these issues will be specifically considered.

Conclusion

I hope this covers in a useful if slightly rambling way, at least some of the major issues in fisheries in the Pacific Islands - which in summary I see as:

- maintaining the health of existing subsistence fishing activity;
- maintaining the existing impetus in small-scale commercial fisheries development programmes;
- but using the breathing space provided by the success of these programmes in diverting increased effort away from reef and lagoon resources and on to outer reef and pelagic resources to develop appropriate structures for managing small scale inshore fisheries;
- securing greater benefits from the relatively long standing trades in products such as shell, beche-de-mer and sharks fin;
- facing the difficult investment decisions that need to be taken in the development of national tuna fishing industries;
- continuing to strengthen the innovative pattern of control over foreign fishing that has been emerging, especially through even greater regional co-operation; and
- confronting the range of decisions that need to be taken to develop a management regime which limits fishing for tuna, especially the decisions involving the forms of co-operation with foreign fishing interests and the structure of supporting research programmes.

And yet this list probably leaves out the most important underlying issue - the need to develop effective fisheries administration.

Largely as a result of the substantial neglect by earlier administering authorities most Pacific Island states had completely inadequate fisheries administrations at independence. Where they existed at all, they were almost totally dependent on expatriate management. There has been a substantial commitment of resources by Pacific Island Governments to the need to develop skills in fisheries and related administrations, and as a result there is now a rapid transition towards more national administrations.

However the constraints in this area are severe. They include the relative scarcity of recurrent budget funds for employing staff, the difficulty in detaching staff from small administrations to participate in training programmes, the relative attractiveness of the emerging private sector as an employer, and in some cases the opportunities for migration for those with skills.

There is a place for the establishment of well-designed courses and the holding of workshops and meetings to enhance skills, and those projects deserve the highest priority for external assistance, but there is a limit to the extent that this type of programme can be absorbed.

The essential ingredient is probably time, and from my contacts with the officials in the region, I'm confident that with time they will be able to put together national administrations that can deal with the kinds of issues I've discussed above effectively and confidently.

Note: The views expressed in this paper are personal to the author and do not necessarily reflect the views of FFA.

A Review of International Marine Products Trade in the Pacific With Particular Emphasis on Export of Food and Non-Food Products From the Small Scale Industries in the Pacific

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Abstract

This overview paper is intended as an introduction to some of the principal trade development issues facing the traditional production and processing sectors of the Pacific. Emphasis is placed on export development on the basis that the present level of marine products' exports from the Pacific has yet to reflect the recognised resource wealth of the area and also, with the possible exception of Papua New Guinea, the small land mass and populations of the Pacific islands constitute strictly limited markets for imports from outside the region.

Information is given on the exports of a range of miscellaneous marine products, including button shell, mother of pearl, shark fin and beche-de-mer. Together these currently represent the largest proportion of non-industrial marine products exported from the Pacific, and are a major source of income to the isolated rural communities of the Pacific islands.

In addition to presenting descriptive information concerning current trade, this paper identifies weaknesses in the Pacific trade sector and suggests where development efforts might be best deployed.

Introduction

The island nations of the Pacific covered in this paper may generally be classified as those making up the Melanesian, Micronesian and Polynesian groups. Excluded are the metropolitan and industrial countries of the Pacific Rim (notably Japan, Taiwan, Hong Kong, Australia, New Zealand, and Hawaii). They are then:

Melanesia	Micronesia	Polynesia
Papua New Guinea	Federated States of Micronesia	Fiji
Solomon Islands	Marshall Islands	Tonga
Vanuatu	Kiribati	Tuvalu
(New Caledonia)	Balau	Western Samoa
	Caroline Islands	(American Samoa)
		(French Polynesia)
		Cook Islands

(Names in brackets are countries governed by a metropolitan power.)

In recent years fisheries interest in the Pacific area has been focused on tuna development, with heavy involvement by Japanese, American, Korea and Taiwanese interests, and considerable public and private sector support for domestic tuna catching and processing. In contrast, development of traditional indigenous marine products' industries has suffered from recent public and private sector neglect. Efforts at recovery are directed towards development of fresh fish handling and distribution systems which only mobilise a part of domestic and traditional production capabilities. Overlooked are a range of processed, long-life, food and non-food marine products - notably the button shell, *Trochus niloticus*, the mother of pearl shells, ornamental shells, shark's fin and other shark products, beche-de-mer (dried sea cucumber), coral products, marine aquarium fish and a range of processed fin fish products (dried, salted, smoked, pickled, etc.).

The commercial shells, shark fin and beche-de-mer have been traded from the Pacific to surrounding countries for a century or more and still constitute the largest export sources of the non industrial marine products sector. We will return to these a little later. Let us first describe the trade balance.

Trade Balance

For countries which possess such a wealth of marine resources, it is a continuing embarrassment that domestic production of edible seafoods still does not in general meet domestic demand. So in most countries there is a lucrative and expanding import trade in canned and frozen seafood products. Lack of productive capacity can be blamed for a part of this, characterised by a strong and relatively successful subsistence economy in rural areas and major sociological constraints to the development of professional (full-time) wage earning fishing industries in urban and peripheral communities. However, by far the larger blame must be shouldered by an unresponsive distribution and marketing sector. Urban and rural wholesale and retail distribution sectors still favour the import of standardised, price, quality and shelf stable products such as low value canned products, high value retail packed frozen products, and low value frozen fish. As the situation stands today, the risks associated with trade in such imported commodities are low and profit margins guaranteed; a marked contrast to domestic trade in indigenous seafood products. Unfortunately, until such time as the domestic distribution and marketing sectors change from essentially low population, rural systems to those capable of meeting the needs of the increasing urbanisation, imported foods will maintain a significant hold on domestic consumption. Programmes to counter this trend are hampered by the traditional conservatism of the Pacific peoples (embodied in the strong cohesiveness of Pacific society), the strong flow of private sector finance towards low risk trade in imported goods and the continued flow of international and domestic public finance to high profile industrial fisheries and programmes that fail to fully appreciate the sociological constraints to successful artisanal fisheries development.

Recent developments in the export of fresh fish by air and frozen goods by air and sea do, obtusely, show favourable changes to this state of affairs, but such developments require relatively high levels of investment in infrastructure, technology and organisational skills, and to date these have been largely provided by Government and through international aid programmes.

Imports to the Pacific, with the major exception of canned fish to Papua New Guinea, are small by comparison to trade elsewhere in the world, the principal suppliers being Japan, Australia, New Zealand and the U.S.A.

Exports of international fishery commodities from the region comprise spiny lobster and shrimp from Papua New Guinea, and increasing quantities of frozen and canned tuna from most countries of the region, but weighted towards the Western and Central Pacific.

Traditional Export Trade

The anomalies to the trading pattern are the aforementioned traditional miscellaneous marine products, and the potential for adding other, currently underdeveloped miscellaneous marine products to this list. Recognition of the potential benefits to the rural economies of the region has led the Australian Development Advisory Bureau (ADAB) and the Export Development Marketing Division of the Commonwealth Secretariat to sponsor, through the executing agency of the Forum Fisheries Agency of the South Pacific, a series of studies into marketing and market development of such trade. Benefits include the effect of trade on rural employment and income, improved foreign exchange earnings and the potential for development of relatively low capital and technology based secondary and tertiary industries. So there has been a comprehensive review of the past and current trends in the production and marketing of such products and preparation of a programme to further promote development of this trade.

To place such trade in context, and bearing in mind the general inadequacies of existing trade statistics, the following gross figures may be quoted (values are in U.S. dollars, first hand FOB value).

Trochus	- global	3,500 t/yr	US$ 7 M
	Pacific	2,000 t/yr	US$ 4 M
Shark's fin	- global	3,200 t/yr	US$ 50 M
	Pacific	140 t/yr	US$ 1.5 M
Mother of Pearl	- global	800 t/yr	US$ 3 M
	Pacific	130 t/yr	US$ 0.5 M
Beche-de-mer	- global	1,800 t/yr	US$ 15 M
	Pacific	60 t/yr	US$ 0.5 M

A crude statistic of the first hand value of export-directed trade in these products entering the domestic economies of the Pacific islands is thus U.S.$ 6.5 M/year; a significant figure when it is considered that a major part of this sum is distributed amongst essentially rural sector producers who have little alternative access to cash incomes. Nevertheless, it is more significant that these products are exported in relatively unprocessed form for onward processing and resale in entrepot markets, eventually realising retail values many times the raw material costs; factors of five to ten or more are common. This is not to say that considerable capital, skill and costs are not lavished on the processing and trading of such products, but rather that a greater proportion of the economic benefits could accrue to the primary, producing countries with relatively little capital investment and technological input. As matters stand at present the Pacific island countries perpetuate a traditional role as suppliers of raw material only.

Trade Examples

An indication of the diverse nature of the trade can be drawn from a few examples.

The button shell industry

The button or top shell, Trochus niloticus, can be found throughout the Central, Western and Southern Pacific and is the principal organism used in the production of pearl shell button. Once the mainstay of the world button industry, pearl shell buttons now have to be sold in competition with mass produced plastic buttons, yet they maintain a minor but stable position in the high value fashion clothing market.

Raw material has traditionally been imported by primary processing sectors in Japan (Osaka/Kobe) and a number of Western European countries. Prior to the entry of plastic buttons on to the world market, these industries produced finished buttons ready for shipment to predominantly Western industries. More recently, processing in Western Europe has slipped, Japan has become the main button processing centre, South Korea and Taiwan have become influential processors and the clothing industry is now Asian dominated.

The Japanese industry is highly segmented, relying on small cottage industry processors. The importer/ button wholesaler effectively sub-contracts the processing only. As international price competition has increased, Japanese wholesalers have found it advantageous to sub-contract to and finance organisations in countries such as South Korea and Taiwan where labour rates are lower. The bulk of by-product processing is now undertaken in these countries.

By contrast European processors have been hard put to compete on the same terms, since in general they have higher raw material shipping costs and higher labour rates. Economic factors have forced the Europeans to favour the development of automated, vertically integrated button factories operating in the lower wage level countries of Southern Europe.

In the type of processing sector described, investment levels, along the lines of the Asian model, are low and the technological inputs relatively simple. The critical factor is skill and degree of productivity. If these two factors can be successfully handled there is no reason why some, and eventually all, of button processing should not be moved to the countries where the raw materials are harvested.

Moves in this direction are already underway in Vanuatu, Fiji, New Caledonia and the Marshall Islands. With good management, development of these industries can offer new employment opportunities, increased foreign exchange earnings, and retention of the benefits of economies of scale, (in the areas of transportation and intermediate trader commission), within the countries of production.

The shark fin market

The market for shark fins is dominated by the Chinese, and centres on the areas of high concentrations of Chinese people - Hong Kong, Singapore, San Francisco, Vancouver and Taiwan. Although Chinese food has long been enjoyed by many non-Chinese people, the value of the non-nutritional shark fin is not readily understood by the non-Chinese.

The edible product of shark fin is the pure collagen fibres that are found in the very centre of the fin. They constitute as little as fifteen percent of the shark fin by weight or volume, and can be extracted in the form of regular shaped needles (the most expensive form) or as fin net - irregular strands of collagen. This product is to all intents and purposes tasteless, and retains a texture only in its purest form. It is eaten in flavoured soup - chicken, fish, etc. - and is perceived to have body strengthening value, a property also associated with consumption of animal skins and grissle, common Chinese food items.

A number of stable intermediate products can be identified in the processing of shark fins - untrimmed sun dried shark fin, trimmed fin, skinned and bleached fin, fin net and fin needles. At present the Pacific island countries export untrimmed sun dried shark fin principally to agents in Hong Kong and Singapore who sell on to processors. This, the most basic of the shark fin products, commands very low prices, the more so where the fins are poorly dried, sorted and graded, which is commonly the case. This situation is perpetuated by the Chinese traders themselves who see no trading advantage in paying higher prices for the same fins trimmed, sorted and graded, and by the scarcity of good sound market information available to Pacific island exporters and producers.

It should require very little effort to ensure exports from the Pacific are of trimmed fin at least, and although adamently denied by Chinese traders and processors, it is relatively easy to further process shark fin. Moves of this nature would secure higher product prices, better foreign exchange earnings, increased employment opportunities and savings in freight, etc.

Selling processed product to or in competition with the traditional Chinese traders and processors will prove difficult, but there are increasing numbers of not so traditional Chinese traders who would be more than happy to undertake such business.

Beche-de-mer (or dried sea cucumber)

This is another Chinese ethnic product, consumption of which is, however, more closely limited to the Chinese. Once again, the principal markets are Hong Kong, Singapore, Taiwan, Vancouver and San Francisco.

The product is made from a group of animals called sea cucumbers, or holothurians, which are harvested from the seabed, then boiled, gutted, reboiled and dried. The product is relatively time stable, and is rehydrated prior to being served cut up in soups and similar dishes. It too is considered a body strengthener, and of particular value to older people.

In this market information on preferred species and exact processing methods is poorly transmitted between importing traders and the exporting traders and producers of the Pacific. In consequence, processing is poor, sorting and grading incomplete, and a whole range of species are not harvested on the basis that they are not marketable. In many cases this is not true.

Considerable improvements in market intelligence, trader cooperation and price negotiating techniques could easily be achieved, yielding commensurate rewards to Pacific traders and producers alike.

Identification of Constraints

It is clear from these simple examples that there is much that can be improved in the production, processing and marketing of marine products from the Pacific islands. That changes are very slow or not occurring, is the understandable consequence of:

* a dispersed rural subsistence population;
* a part-time production/harvesting sector;
* an essentially non-existent value added sector;
* poor managerial and entrepreneurial resources.

This situation is further complicated by the fact that the Governments of the region pursue a number of objectives which in some areas are conflicting:

* to promote production;
* to meet domestic demand;
* to promote export to earn hard currency;
* to increase rural earnings.

Few countries to date have successfull managed to implement development plans to meet these objectives. An example of the lack of Government success is that virtually all the trade in non-industrial marine products exported from the Pacific islands occurs largely without Government support, without Government recognition, and in a number of cases subject to high Government export taxes.

A Programme for Development

All the products of this type currently exported can be characterised by:

* reliance on low technology in harvesting, handling and processing procedures;
* almost total dependence on being harvested and processed under rural conditions and on a part-time basis;
* all such products having a long stable shelf-life almost independent of storage conditions.

Firstly, then, these characteristics associated with successes to date should be identified, and in pursuing further development, this mix of characteristics maintained.

The next step is to seek an overall improvement in the marketing of such products. Efforts should be directed to:

* seeking better market intelligence;

* streamlining the export sales channels;

* paying considerably more attention to market requirements;

* paying more attention to quality and process control.

Once a system to implement these changes has been established with some concrete examples of improvement, a second tier policy should be effected with the intention of creating, or developing further, economies of scale related to:

* collection
* handling
* processing
* packaging
* shipping

The level of cooperation, development effort and improvements in efficiency needed to achieve even the smallest economies of scale will further support and develop the first tier efforts.

Once milestones in efficiency and turnover have been reached, as indicated by noticeable improvement in the quantity and value of product shipped and in the profits returned to traders and prices received by producers, a third tier development should incorporate planned investment in secondary and tertiary processing industries within the countries of primary production. Such development of added value industries will not be as difficult as it appears today, as long as the first and second tier developments precede it.

Finally, throughout this development series positive external steps, both government and trade supported, must be taken to:

* improve and channel the general entrepreneurial skills of Pacific island traders;

* further structure and organise the production sector;

* produce a cadre of full-time fishermen and processors.

Throughout this development strategy, change should be brought about in conformity with the traditional values and ways of life of the rural communities, and incorporating the developing strengths of the urban economies.

To unduly force the pace of development, and ignore the social context of such development, will only result in a repetition of past unsuccessful experiments.

In accordance and support of this strategy a programme has been tabled incorporating the establishment of a small trade development office in the Pacific, to coordinate and catalogue export development efforts in these fishery and related small scale marine industries, and the establishment and strengthening of national and regional trader and producer organisations.

Conclusion and Summary

Enormous potential exists in the Pacific region for the further development of high value exports of marine products. A strong base for such development already exists in a range of traditional, time stable marine products associated with the small-scale production sector. Further efforts must take full recognition of the cultural backgrounds of the Pacific peoples and must occur slowly and without the assistance of fly-by-night profit takers.

Current efforts to develop fin fish exports will increasingly tax the limited and valuable technical/ development manpower resources of government, and the entrepreneurial resources of the private sector. In contrast, a diversion of some of the valuable technical/development manpower resources of government, and the entrepreneurial resources of the private sector. In contrast, a diversion of some of the manpower and capital resources, already committed to the industrial sector, to the small scale sector will result in simple, widespread benefits to rural and urban communities amongst the Pacific islands.

A particular commitment to developing the entrepreneurial skills of the indigenous businessman will prove especially beneficial.

Achievements of the FAO World Conference on Fisheries Management and Development

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"You have created a Codex Piscatorius Mundi, a World Fisheries Charter, which provides a new orientation to the whole philosophy of fisheries development and an integrated framework for all the fisheries sectors of developing countries." These words were the central theme of the concluding statement of Mr. Edouard Saouma, Director-General of the UN Food and Agriculture Organization, to the World Conference on Fisheries Management and Development, which was held in Rome from 27 June to 6 July 1984.

The Conference was indeed a unique and historic occasion. It was unique in size and level of representation, being attended by 147 national delegations, many of them led by Ministers, and representatives of over 60 international inter-governmental and non-governmental organizations. It was historic in scope and outcome, being the first time that nearly all nations of the world, great and small, came together to reach agreement upon comprehensive action to confront the fundamental problems and utilize fully the potential of fisheries as a vital source of food, employment and income. It was honoured by the presence of His Majesty King Juan Carlos of Spain who addressed the Conference on its opening day.

The Heads of national delegations, in their statements to the Conference, expressed their high appreciation for the initiative taken by the Director-General of FAO in convening the World Fisheries Conference at such an opportune time. Reference was made to recent developments affecting world fisheries; for example, the levelling off in world fish catches during the past decade; the widening gap between the supply of and demand for food fish; the rapidly rising costs experienced in the fisheries sector since the middle of the 1970s; and the adoption in 1982 of the United Nations Convention on the Law of the Sea, in which the concept of exclusive economic zone was an essential element as regards fisheries.

There was strong support for the Conference objectives, namely: the optimum utilization of world fishery resources from the economic, social and nutritional points of view; a greater contribution of fish to national self-sufficiency in food production and toward food security; the promotion of self-reliance of developing countries in the management and development of fisheries; and the fostering of international collaboration in fisheries between developed and developing countries and also among the developing countries themselves.

Under the Chairmanship of Lic. Pedro Ojeda Paullada, Secretary of Fisheries of Mexico, the Conference endorsed a Strategy for Fisheries Management and Development and approved five associated Programmes of Action. It also adopted a number of Resolutions regarding the implementation of the Strategy and the Programmes of Action and specific aspects of fisheries management and development.

Strategy for Fisheries Management and Development

The Strategy represents a new global framework for fisheries, a coherent set of principles and guidelines for fisheries management and development. It covers a wide range of issues and includes eight elements under the following headings:

- the contribution of fisheries to national economic, social and nutritional goals;

- improved national self-reliance in fisheries management and development;

- principles and practices for the rational management and optimum use of fish resources;

- the special role and needs of small-scale fisheries and rural fishing and fish-farming communities;

- international trade in fish and fishery products;

- investment in fisheries;

- economic and technical cooperation in the fisheries sector;

- international cooperation in fisheries management and development.

In endorsing the Strategy, the Conference emphasized that the principles and guidelines contained therein were flexible, reflecting the special requirements and varying circumstances of different countries. They were not intended to re-open issues already settled at the Third United Nations Conference on the Law of the Sea and were without prejudice to the provisions of the 1982 United Nations Convention on the Law of the Sea.

The guidelines and principles are not binding upon governments or organizations; they do not impose impossible or unwelcome commitments. The Strategy does, however, embody a consensus on the best course for the management and development of the fisheries sector: the objectives which should be sought, the considerations which should be taken into account and the types of activity which might be promoted.

Programmes of Action

The Conference also approved an integrated package of five Programmes of Action designed to assist developing countries to increase fish production and improve their individual and collective self-reliance in fisheries. These Programmes constitute the first attempt to define a coherent and comprehensive plan to achieve rational management and development and to effect the necessary transfer of technology. The Programmes are based essentially on the needs and priorities of developing countries, as well as on the aid policies and priorities of potential multilateral and bilateral donor agencies. The Programmes cover the following separate but inter-linked areas:

Planning, management and development of fisheries. This Programme will provide developing countries with access to the range of skills required for the planning, management and development of fisheries, both marine and inland. A wide range of technical advisory services, in biology, economics, law and other subjects, will be offered by FAO, through short-term multi-disciplinary missions and, particularly, through the network of regional and sub-regional technical support units. Emphasis will be given to training courses in the collection and analysis of biological data, resource assessment, socio-economic analysis, management and development planning, and the monitoring, control and surveillance of fisheries.

Development of small-scale fisheries. This Programme is based on an integrated approach to the development of small-scale fisheries and the improvement of the socio-economic conditions of communities of artisanal fishermen and their families. It will promote the skills, capacities and potentials of fishing communities, through the active involvement and participation of the fishing villagers in the planning and implementation of management and development activities. Attention will be given not only to the technologies and skills involved in harvesting, handling, processing and distribution but also to economic and social considerations including education, health and infrastructure.

Aquaculture development. This Programme will strengthen and diversify the support services for increased aquaculture production already organized under the inter-regional UNDP/FAO Aquaculture Development and Coordination Programme (ADCP). The regional aquaculture centres established under the ADCP, which undertake applied research for technology development, senior-level training and the development of an aquaculture data base, will be linked to strengthened national centres for technology testing and adaptation, training of technicians and extension workers and information dissemination.

International trade in fish and fishery products. This Programme is designed to help developing countries to increase the benefits they obtain from international trade in fish and fishery products. It will maintain and extend the regional fish marketing information and technical advisory services already established by FAO. A new system will be created to provide continuous up-to-date information on major commodities entering trade in fish and fishery products; this system of international fish market indicators will coordinate and supplement the information provided by the regional services. The Programme also proposes action to develop a multilateral framework for consultation on trading conditions and fair-trade practices for fishery products.

Promotion of the role of fisheries in alleviating undernutrition. The objective of this Programme is to reduce wastage in fishing industry operations and ensure that fishery resources are utilized so as to make the greatest possible contribution to food supplies for the benefit of the poorest and weakest sections of the community. Action will be taken to increase the availability of suitable raw materials by improving handling and processing methods and thus reducing post-harvest losses, and to promote the reduction and market introduction of new low-cost products, particularly from underutilized species and from by-catch discards. Regional cooperative programmes in fish technology research will be encouraged and training provided in fish technology and processing.

The Conference recognized that to fulfill the intentions of the Programmes will require truly international efforts. Whilst the Programmes are designed mainly for execution by FAO, principally through its network of regional and sub-regional bodies and associated technical assistance units, the Conference emphasized that their effective implementation will depend entirely upon the provision of financial and other support from bilateral and multilateral donor agencies and financing institutions. In this respect, great encouragement was drawn from the generous comments and offers of collaboration made by a number of countries and international organizations in the course of the Conference itself.

The Conference also adopted several special Resolutions in which it urged a greater use of fishery products in international food aid programmes; asked greater priority for fishery investment projects and urged the World Bank and other funding agencies to accord special and favourable attention to projects for investment in fisheries; suggested that an International Year of the Fisherman be instituted; called for greater international solidarity for land-locked countries, particularly in the Sahel; urged greater technical and economic cooperation among developing countries in fisheries; and called for international action to combat pollution in the exclusive economic zones of developing countries.

Role of FAO

There was widespread recognition and approval of the key, catalytic role of FAO in worldwide fisheries development. Reference was made to the long experience and wide ranging expertise of FAO in the implementation of complex multidisciplinary projects and programmes and also the unique global information resources of the Organization. The Conference strongly supported the delivery of sub-regional, regional and inter-regional development programmes through a network of technical support units associated with FAO regional bodies. Many delegations expressed their appreciation for the work done by units of this type and for the assistance provided by FAO, notably through its special Programme of Assistance to Developing Coastal States in the Management and Development of Fishery Resources in Exclusive Economic Zones, which covers a wide variety of fields ranging from policy and planning missions, advice and technical and regional aspects of fisheries to resources assessment and training courses. Delegations welcomed the proposals, embodied in the five Programmes of Action, for the continuance and expansion of FAO's leading role in promoting the self-reliance in fisheries of developing countries, in close collaboration with other relevant UN agencies and concerned international and regional organizations.

The role of FAO will also be essential with regard to the implementation of the Strategy and the Programmes of Action. The Conference invited the Director-General to bring its results to the attention of the Council and Conference of FAO, of the Economic and Social Council and the General Assembly of the United Nations, as well as of all international bodies concerned. It further requested him to provide the FAO Committee on Fisheries and the governing bodies of the Organization with periodic reports on the progress achieved in implementing the Strategy and the Programmes of Action.

Assuring the Conference of FAO's determination to convert, with the collaboration of governments and sister organizations, the Conference's recommendations into a living reality for the fishermen and malnourished people of the world, Mr. Saouma complimented the delegates on their achievements. The Conference, he said, was truly worthy of celebration, far-reaching in its potential consequences and a source of encouragement and hope for all concerned with the future of fisheries.

Reference

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Economic Recovery and Seafood Markets for Selected Regions

Current State of Australian Fisheries—Impact of Domestic and Global Economic Conditions on Seafood Exports and Imports

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Introduction

Australia is surrounded by some of the world's largest oceans. Its 36,735 kilometre (22,775 mile) coastline is one of the longest in the world, suggesting that it should be a rich source of fish. But this is not the case. Australia produces only about half its domestic requirements of fish -- the balance is filled by imports.

This is because, except in the north and in the Great Australian Bight to the south, the continental shelf is narrow and gently-sloping, while the land mass is too far north of the path of the west winds and the 'Roaring Forties' that generate energy for upwellings that provide nutrients needed to support large fish populations. Also much of Australia lies in sub-tropical and tropical zones where there are big numbers of fish, but they are spread over a vast area and comprise hundreds of species.

(More than 2,000 species of fish have been identified in Australian waters, and this number is growing every year, but less than 10 percent are commercially acceptable.)

The annual fish catch is only 51,000 tonnes of which tuna (mostly southern bluefin) makes up 15,000 tonnes. After tuna, the big three in the fish catch are shark (school and gummy), Australian "salmon" (a sea perch) and mullet, followed by morwong (bream), flathead, gemfish and snapper.

Fish consumption consequently is low (less than 7 kg. per person per head of population annually), but there are signs that it is increasing as the population becomes aware of the nutritional value of fish.

Most Australian caught demersal fish is sold fresh to restaurants, hotels and retail fish shops. Some tuna is canned for the domestic market but most is now shipped frozen to Italy. Small quantities are shipped to Japan for the sashimi (raw fish) market.

Fast food outlets, supermarkets, institutions (hospitals, educational establishments) rely heavily on imports of frozen filleted fish (cod, hake and bream) for their requirements. These amount to more than 20,000 tonnes out of the 30,000 tonnes of fish imported annually.

However, Australia has substantial resources of crustaceans (prawns (shrimp) and rock lobster) and molluscs (abalone, scallops) that far exceed domestic requirements, and are exported to world markets where they sell for high prices.

There is also a considerable rock oyster farming industry on the eastern seaboard, which supplies local markets.

Prawning is the country's most valuable fishery, the annual catch of between 12,000 and 20,000 tonnes, earning between $A150 and $A200 million in export sales, mostly to Japan.

Rock lobster is our no. 2 fishery, the annual catch ranging between 12,000 and 16,000 tonnes, 80 percent of which comes from Western Australia. Most of the catch is exported to the United States as tails, some going to Japan live and whole frozen, earning in excess of $A100 million annually.

The importance of crustaceans and molluscs to the Australian fishing industry is high-lighted in 1982/83 statistics that show they contributed more than $A350 to the total value of the Australian fisheries production in that fiscal year worth $A439 million.

Australia is one of the world's largest producers of abalone (more than 6,000 tonnes shell weight annually) most of which is exported to Hong Kong and Japan canned and frozen, earning between $A40 and $A50 million.

History of Fishing in Australia

Fishing was a major pursuit of Australia's original inhabitants -- the Aboriginals -- who fashioned hooks from bones, spears and clubs from wood and erected barriers and traps in estuaries, rivers and lakes along the sea shores to catch fish.

They were hunters and gatherers who adapted well to the wide variety and harsh environmental conditions of this vast land.

Fish was the staple diet of many tribes and was also of legendary significance as demonstrated by ancient 'dreaming sites' that often feature rock paintings of barramundi (giant perch), and other popular food fish.

But the first European settlers who arrived in Australia in 1788, often faced starvation in a land frequently ravaged by drought, bush fires and floods. They were reluctant to turn to the sea for food. There were no fishing grounds comparable to those in the northern hemisphere, so attempts were made to introduce some species from Europe but with little success. Even rock lobster were shunned for a time because they did not have claws like the northern species. They did manage to acclimatize brown trout from England to Tasmania but efforts to introduce salmon and plaice failed.

During the first 125 years of white settlement in Australia, fishing was confined mostly to estuaries and inshore waters, to supply fish for local communities. Vessels were small (under 12 metres) and gear based mainly on that used in Europe.

The first attempt to break away from estuarine in-shore fishing was made early this century when the Australian Government built the fisheries research vessel Endeavour, which explored the possibilities of establishing deep sea fisheries.

This led to the introduction in the 1920s of large Castle-type steam trawlers from Great Britain that initially took big catches in eastern waters. But the era of big trawlers was short-lived, overfishing depleting stocks.

This was the first indication of the fragility of Australian fish resources and the need for them to be carefully managed.

Development during the next 50 years was slow, trawling operations being extended further offshore off the south-east. In 1975 otter trawling was attempted in the Great Australian Bight by three former British side trawlers that were later joined by larger Othello class block freezer stern trawlers operated by a joint British-Australian company. But catches were uneconomic and the venture folded after two years with heavy financial losses.

During the same period alternative fisheries were developed. These included tuna poling, rock lobster potting, prawn trawling, scallop dredging and abalone diving.

The most spectacular advances were made in the prawn fisheries, notably in northern Australia, where sophisticated, long-range freezer trawlers were introduced.

Fishing Limits

Fishing perhaps more than any other food producing industry, faces great uncertainties over supplies of raw material due to its common property nature and the mobility of the resource. Fish that may be plentiful one day may either have been fished out or moved on by the next.

Because of the general worldwide shortage of primary foodstuffs and abnormal price rises, many countries have recognised the value of fish as a competitive protein source. In addition, the rapid rise in real incomes which has taken place in many of the developed economies has led to increased demand for luxury seafoods such as lobster and shrimp, and quality white fish.

Big profits earned in some fisheries in the 1960s encouraged high levels of investment and fishing activity greatly increased. This resulted in increased competition between top world fishing nations on traditional grounds. To take the pressure off, a number of nations turned their attention to waters around Australia and New Zealand.

The possible consequences that foreign encroachment on resources could have on its fishermen was viewed with concern by the Australian Government, particularly in the light of effects of uncontrolled fishing elsewhere in the world. This led to the introduction by Australia, in 1967 of a 12-mile exclusive fishing zone. This was extended to 200 miles in 1979.

In establishing the 200 mile zone, Australian fishermen and enterprises were encouraged to develop the resources of the zone. Only where they were not in a position to exploit a resource were foreign nations allowed access. In retrospect this cautious approach has proved wise and Australia has escaped some of the problems other nations have experienced with foreign fishing.

Optimism among Australian and foreign fishing interests that declaration of an exclusive 200 mile would result in the discovery of extensive new fishery resources did not eventuate. There was an initial burst of interest in exploratory ventures involving foreign vessels but results achieved by the handful of projects that were approved were disappointing.

Introduction of the new zone also raised the expectations of Australian fishermen engaged in traditional fisheries and there was a rush to replace existing vessels with larger ones (more than 18 metres in length), with increased range and fishing capacity.

Ten years ago the number of vessels more than 18 metres in length numbered less than 20, out of a total of 7,000. Today the number is estimated to be in excess of 300. The trend towards larger vessels has been most marked in the northern prawn fishery, where all but 60 of the 293 licensed trawlers are more than 18 metres in length.

Co-inciding with the trend towards larger vessels was the introduction of modern electronic fish finding, navigation and refrigeration equipment and the development of more efficient catching methods.

Operating in the major prawn, trawl and tuna fisheries has become a highly competitive business where the strongest and most efficient survive. This requires top business management skills and marketing methods, tight financial control and access to considerable capital.

In some cases vertically integrated companies have been set up. They build and operate vessels and processing plants and do their own marketing. The most successful companies are those involving families or groups of owner-skippers. These companies have been most active in the prawn fisheries where most of the catch is exported.

Performances in the fishing industry of public companies, some of them subsidiaries of multi-nationals, others joint ventures with foreign firms, have been less than spectacular. This year two major northern prawning companies have withdrawn and a third has tied up its fleet, after heavy losses.

Management

License limitation has been the keystone of fisheries management in Australia since it was first introduced in Western Australia, 20 years ago, to protect prawn and rock lobster fisheries.

At that time this form of management control was virtually untried in the world. But events in the past two years have demonstrated that things can go wrong, even in a tightly-managed limited license fishery, and new measures may be required to contain and reduce fishing capacity to protect the resource and improve economic performance.

By the end of this year all major fisheries will be under new management regimes involving license limitation, boat replacement plans, buy-backs, quotas, and seasonal closures.

Australia has a Federal system of government that works for land based industries but has created problems for fisheries management where fish do not recognise boundaries.

Under the Australian Constitution the Federal Government has control over fish resources from three to 200 miles offshore. The six States and Northern Territory have jurisdiction out to three miles. This has led to conflicts between Federal and State fishery authorities and Governments and a tangle of regulations and licensing procedures. In some fisheries it is necessary to have as many as 40 State and Federal licenses.

In these circumstances it has been difficult to achieve uniform fisheries policies and regulations. The fishing industry has suffered as a result and is frustrated by a seeming inability to do much about the situation. However, industry has not been blameless -- it has until now been deeply divided in its views on management.

But there are clear signs that this state of affairs is improving and more effective industry/government consultative arrangements are emerging.

The first step was establishment by the Federal Government, of an Interim Fishing Industry Consultative Panel to develop a structure for industry/government discussions. As a flow on a National Fishing Industry Conference will be held in 1985. Its aim is to establish guidelines for long-term consultation and co-operation.

In 1984, significant progress has been made towards involving the fishing industry directly in fisheries management decisions that previously were the almost exclusive domain of the Federal and State Governments, through a network of committees and advisory bodies.

The break-through was the appointment of a Northern Prawn Fishery Management Committee composed of industry and government representatives. It has formulated a new management plan that features a unitised vessel replacement policy designed to contain fishing capacity and a voluntary license entitlement buy-back scheme, to reduce vessel numbers.

The overall aim is to improve the economy of the fishery which is suffering the effects of spiraling operating costs (largely the result of high fuel prices) fluctuating export returns and the downturn in the Australian economy.

A similar joint management organisation will soon be established to introduce a new regime for the southern bluefin tuna fishery that is threatened by overfishing. Features will be the introduction of a national catch quota and individual transferable quotas.

The south eastern trawl fishery is also likely to be managed by a joint organisation when a limited license regime is introduced this year.

No matter how you look at it, 1984 is going to be remembered as a landmark year by the Australian fishing industry.

Future Prospects

Looking ahead Australia probably will have a slimmer, more efficient and profitable industry; catch levels in major fisheries being maintained at present levels, with some fluctuations. There could be some opportunities for expanding demersal fishing off northern Australia if operations by foreign vessels (Taiwanese) are phased out. Also there are prospects for exploiting pelagic species (northern bluefin tuna, shark and mackerel), in the same area currently fished by Taiwanese gill-netters. Yellowfin and big-eye tunas in the Coral Sea, jack mackerel, pilchards and blue mackerel south of the Continent and orange roughie, blue granadier and squid in southern waters, are other possibilities.

As stated previously, Australia's fisheries resources are not limitless and must be protected. This is why the main thrust of new management regimes is to reduce vessel numbers and total fishing capacity. In the future, there will be an urgent requirement for greater utilisation of the available catch, improved handling, processing and marketing techniques.

There is still a strong consumer preference towards "fresh" seafood products. But it is difficult to consistently supply large quantities of fresh seafoods on a regular basis at competitive prices. There are also limitations to the shelf life of fresh seafoods. For these reasons, increasing quantities of seafoods are now sold in a frozen form which, if correctly processed, in many cases can be superior to the fresh product.

In recent years a number of advances in the presentation of the humble piece of fish have increased the consumption and value of seafoods. These include the introduction of fish fingers and portions.

One of the best prospects for the future is value-added seafood products. Value is added by coating seafoods with various combinations of flavours and sauces or preparing seafood as an ingredient in a recipe dish. Such products extend shelf life and generally reduce the price to the consumer. They are popular with consumers and are making inroads against meat, chicken and other "fast foods." They can also be an important outlet for less popular or unattractive looking fish species.

An example is the use in Japan of Alaskan pollock, for making "kamoboko." This is done by mincing, grinding, soaking and washing fillets, then adding salt, monosodium glutamate, sugar, starch and various flavourings and colouring agents. The mixture is cooked and shaped by extrusion into fish and crab sticks and other variations. When fish sticks were introduced to Australia, 1,200 tonnes were sold in a year. Breaded scallop and shrimp flavoured portions and crab claws followed.

Denmark developed fish recipe dishes using sauces, mornays and similar preparations and seafood pasta. These are soon to be produced in Western Australia for domestic and export markets.

Impact of Domestic and Global Economic Conditions on Exports and Imports

Despite its comparative isolation, Australia was unable to escape the effects of the global recession sparked by the blow out in oil prices.

A combination of rising inflation, high interest and fluctuating foreign currency rates, spiraling fuel costs and uncertain markets had a devastating impact on the Australian fishing industry.

Prices on export and domestic markets could not match increased operating costs in the prawn and trawl fisheries which are heavy consumers of diesel fuel. In the midst of the crisis in 1981/82 many trawlers were tied up. Owners were hard put to meet loan payments and pay for needed refits.

Least affected was the prosperous Western Australian rock lobster fishery where higher catches offset rising costs and prices on the United States market remained unexpectedly stable.

Although the Australian economy is recovering in sympathy with the United States, the economic situation in the fishing industry remains depressed. A number of innovative management measures designed to take the pressure off fishing operations are being implemented but are expected to take at least a year to bite.

Domestic Scene

There is no reason to expect any significant change in the total domestic trawl fish catch, which has tended to decrease in recent years, due to fluctuations in fish abundance. However, demand and wholesale prices for fresh and frozen fish could improve with the pick-up in the economy and rising import fish prices. Demand could be most pronounced in the eating-out sector. Imports of fresh and imported frozen fish, which increased in volume and value in the fiscal year to June 30, 1984, could slow as the result of reduced catches in some countries and the strength of the United States dollar against the Australian dollar.

The southern bluefin tuna fishery faces a difficult future as it grapples with new management measures and a reduced national quota of 14,500 tonnes, and falling export prices in Italy.

Introduction of individual transferable catch quotas is a bold attempt by the Federal Government to conserve the global southern bluefin stocks. Tuna fishermen who traditionally worked in the fishery and meet defined criteria will be eligible to receive a share of the national quota based on past catches and their investment in the fishery. They will be free to buy or sell quota units on the open market.

Low tuna prices on world and domestic markets, and high fuel costs have made tuna fishing a marginal full-time occupation. Those who are fortunate enough to diversify into prawning, trawl, scallop or shark or rock lobster fishing during the off-season have managed to maintain profitability. Entry to the high-priced Japanese sashimi market is also being looked on as a valuable addition to traditional sales to domestic canners and the European whole frozen market. However, only a small proportion of the total catch is expected to be suitable for sashimi and Australian fishermen will have to learn the techniques of butchering and handling fish for the highly-selective Japanese buyers.

Australian canners require about 15,000 tonnes of tuna annually to meet domestic requirements. This is more than the announced annual quota. In recent years canners have been unable to match prices paid in Europe for southern bluefin and competition from lower cost countries in south-east Asia. Except in Western Australia, canners have been relying increasingly on imports of whole frozen skipjack tuna from the Pacific. Previously this was imported in refrigerated containers shipped on merchant ships. However, the Australian Government is expected to soon allow direct unloading of tuna at Australian ports from foreign fishing vessels.

Exports

Nearly all contracts for Australian seafoods sold on export markets are written in American dollars. This is expected to benefit Australian export-based fisheries, particularly rock lobster, most of which is sold in the United States.

The prawn fisheries, in 1984 have experienced their worst seasonal downturn in five years, caused by reduced catches in northern waters and a slump in Japanese shrimp prices. There were indications of a recovery in July which will be assisted by the increased value of the American dollar. Introduction of a voluntary license entitlement buy-back scheme in 1985 and seasonal closures of main northern prawn grounds, could further assist prawners. A feature of the buy-back is that the 293 license entitlement holders have agreed to finance the scheme by a levy based on registered boat units.

They are also pressing for an extension of pre-season sampling, to determine the appropriate time the northern season should open. The aim is to maximise returns by reducing the number of small prawns in catches.

Because of the in-roads farmed prawns from Taiwan, south-east Asia and Ecuador are having on prices for small-count species (more than 20 to the pound), Australian ocean prawners are likely to concentrate in the future on catching large (under 20 count) prawns.

Fuel accounts for an incredibly high proportion (up to 40 percent) of the cost of operating a fishing vessel. Although the burden is spread across all sections of the industry, the prawning and fish trawling fisheries were hardest hit when diesel fuel prices started to escalate in the late 1970s.

Australia produces more than three-quarters of its own crude oil requirements but domestic fuel prices are based on world rates. This decision was aimed at cushioning Australia from excessive price increases when its domestic sources of supply ran out late in the century, when it would have to rely on foreign oil. However, with the discovery of new oil fields around Australia there is some doubt that this situation will arise.

Meanwhile, the Australian Government is reaping a windfall fuel tax that once in place is unlikely to be removed, so the fishing industry is unlikely to receive any relief from this cost burden in the foreseeable future. Realising this, naval architects and shipbuilders are designing energy-efficient trawlers and managers are streamlining fishing operations to save fuel.

In the northern prawn fishery trawlers are fueled and victualed at sea and only return to port every two or three months to discharge their catches. One company with a fleet of 30 trawlers, has introduced a computerised system for analysing catch data, trawler management, stock control, production and crew management. It is a fuel saving and cost cutting exercise.

Under the program each trawler, when at sea, reports daily to base giving location, activity and catch. From this information, daily fleet performance is compiled so that future operational strategies can be planned, catch predictions made and year and seasonal trends monitored.

The trawlers work efficiently and economically for extensive periods at sea, have boom and net systems designed to fish four nets simultaneously and deck handling equipment, including a grader that makes catch handling simple, convenient, fast and practical.

The prawns are packaged, snap-frozen on board ready for off-loading and dispatch to shore processing establishments or direct to world markets.

Despite these cost-cutting and efficiency measures and a recovery in the Australian economy, the northern prawning industry continues to experience an acute cost-price squeeze that is likely to continue until the Japanese shrimp market climbs out of its present slump.

The rock lobster fishery, especially in Western Australia, is in much better shape to benefit from the upturn in the domestic and global economic conditions.

However, steps are being taken to prevent over-exploitation of stocks by extending the closed season and rigidly enforcing pot and minimum size limits.

Production of scallops was a record 34,600 tonnes shell weight in 1982/83, most of which were exported, mostly to the United States, France and Hong Kong, where the demand was good and prices were stable. Like rock lobster, this fishery has been less affected by economic conditions than other export fisheries. Scallops are caught in Tasmania, Victoria, Queensland and Western Australia but catches fluctuate considerably from season to season.

The abalone fishery has been suffering a downturn since 1980, due to declining demand and prices in Japan and Hong Kong. Production in 1982/83 was 6,247 tonnes (in shell). Voluntary catch quotas have been imposed by divers until export prices improve.

Canadian Fish Production and Its Contribution to World Fish Trade

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Abstract

A favorable resource endowment, together with an up-to-date technology, has allowed Canada to become an important harvester of fish. The country is committed to purposeful management of the resources of the 200-mile zone it acquired in 1977. Depleted stocks are being restored through strong conservation measures. In allocating fish resources preference is given to the domestic fleet. This is particularly important for the economically depressed Atlantic coast region, which is in great need of additional employment opportunities. However, low productivity resulting from overcapitalization and excessive labor inputs has hindered expansion of operations. So far the domestic industry has not succeeded in utilizing some stocks of low-value species. These are being made available to foreign fishing fleets on reasonable terms, in accordance with Canada's acknowledged international obligations and its commitment to full economic utilization of available resources. The prospects are that current conservation measures will allow the Canadian zone to make greater contributions to world fish supplies in the future, but that an increasing share of the total catch will be taken by Canadian vessels. As Canada has a population of only 25 million and a modest level of fish consumption, the larger part of its fish harvest is surplus to domestic market requirements. This has allowed the country to become the world's premier exporter of fish products. Canada's exports consists primarily of moderately priced groundfish, as well as high value salmon, shellfish, and roe. Most of the exports are frozen, though significant amounts are shipped as fresh, canned, salted, and cured products. Over half of Canadian exports are destined for the United States, with most of the remainder going to Japan and western Europe.

Introduction

Canada has abundant stocks of commercially valuable fish species in its 200-mile zone. As an advanced industrialized country, it also has a full technical capacity to exploit these resources. This favorable combination of circumstances has allowed Canada to become a relatively important fishing nation. FAO statistics for 1981 ranked Canada 17th in fish production, accounting for 1.82 percent of world output (Table 1). By contrast, Canada's 1980 population of 23.9 million amounted to only 0.54 percent of world population. This high level of fish production in relation to population has allowed Canada to become a leading fish exporter. Indeed, the country has ranked first in value of fish exports since 1978.

It is worth noting that in value terms Canada's fish production is of even greater importance than it is in terms of quantity, as a high proportion of the country's catch consists of more valuable species. The Atlantic coast fishery is dominated by moderately valuable groundfish, of which cod is the largest component, and by luxury species of shellfish, in particular scallops and lobster. These three species together accounted for 46.2 percent of quantity and 62.9 percent of value of the Atlantic catch in 1981 (Table 2). On the Pacific coast, by far the greater part of the catch consists of highly valuable salmon and of herring utilized primarily for the lucrative Japanese roe market. Together these species accounted for 70.4 percent of quantity and 82.6 percent of value in 1981 (Table 2).

Though the commercial catch of freshwater fish in Canada is small in relation to that of marine fish, it is by no means insignificant (Table 2). Canada has the largest freshwater area of any country in the world, and particularly the larger lakes product substantial commercial catches.

Because of Canada's abundance of wild fish stocks and fish production levels that are far in excess of domestic consumption needs, the country has not pursued aquaculture with much vigor. However, conditions for some forms of aquaculture appear rather favorable. A number of successful ventures in fact have already been undertaken on a modest scale, e.g., in salmonid and oyster culture. The Norwegian success

Table 1. Nominal Fish Catches for Specified Countries and World Total, 1972-1981 (thousands of tonnes).

Country[1]	Rank	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
Japan	1	9,709	10,092	10,101	9,895	9,994	10,123	10,184	9,945	10,426	10,066
U.S.S.R.	2	7,752	8,614	9,256	9,970	10,132	9,351	8,915	9,050	9,476	9,546
China	3	3,680	3,793	4,134	4,247	4,320	4,463	4,394	4,054	4,235	4,605
United States	4	2,759	2,796	2,847	2,842	3,050	2,980	3,418	3,511	3,635	3,767
Chile	5	795	668	1,128	899	1,379	1,319	1,929	2,632	2,817	3,393
Peru	6	4,725	2,329	4,145	3,448	4,344	2,534	3,472	3,682	2,751	2,751
Norway	7	3,126	2,912	2,581	2,484	3,365	3,406	2,593	2,658	2,409	2,552
India	8	1,637	1,958	2,255	2,266	2,174	2,312	2,306	2,340	2,438	2,415
Rep. of Korea	9	1,213	1,460	1,688	1,887	2,118	2,085	2,092	2,162	2,091	2,366
Indonesia	10	1,267	1,262	1,331	1,382	1,479	1,568	1,642	1,742	1,841	1,863
Denmark	11	1,443	1,465	1,835	1,767	1,912	1,806	1,740	1,738	2,026	1,814[2]
Philippines	12	1,220	1,303	1,371	1,443	1,393	1,509	1,495	1,475	1,557	1,651
Thailand	13	1,678	1,679	1,516	1,553	1,659	2,188	2,099	1,946	1,793	1,650
Mexico	14	426	448	402	468	526	611	703	877	1,244	1,565
D.P.R. of Korea[2]	15	840	910	980	1,050	1,120	1,190	1,260	1,330	1,400	1,500
Iceland	16	727	902	945	945	986	1,374	1,567	1,645	1,515	1,441
Canada	17	1,132	1,121	974	993	1,102	1,235	1,366	1,411	1,334	1,362
Spain	18	1,592	1,569	1,498	1,512	1,469	1,389	1,373	1,205	1,265	1,264
Viet Nam[2]	19	978	1,014	1,014	1,014	1,014	1,014	1,014	1,014	1,014	1,014
Brazil	20	602	699	726	753	653	748	803	855	850	900
United Kingdom	21	1,074	1,128	1,077	970	1,027	998	1,031	906	826	859
Malaysia	22	359	445	526	474	517	619	685	696	736	796
France	23	774	797	790	784	778	744	768	742	793	768[2]
Bangladesh	24	818	820	822	640	641	643	645	646	650	687
Ecuador	25	108	154	174	222	298	434	617	608	671	686
Poland	26	544	580	679	801	750	655	571	601	640	630
Burma	27	453	463	434	485	502	519	541	565	585	625
South Africa	28	621	661	592	600	595	550	605	654	640	612
World Total		61,988	62,663	66,351	66,136	69,550	68,678	70,399	71,314	72,377	74,760

Notes: 1. Includes all countries with 1981 catches in excess of 500,000 tonnes.
2. FAO estimate.

Source: FAO, Yearbook of Fishery Statistics, 1981, Vol. 52, 1983.

Table 2. Major Components of Canada's Fisheries, in Quantity and Value Terms, 1981.

	Quantity			Value		
		Percent			Percent	
Component	Tonnes	Of Total	Of Region	Thousands of Dollars	Of Total	Of Region
Total	1,406,935	100.0		855,736	100.0	
Atlantic Coast	1,191,097	84.7	100.0	564,948	66.0	100.0
Groundfish	778,736	55.3	65.4	263,734	30.8	46.7
Cod	439,433	31.2	36.9	162,809	19.0	28.8
Shellfish	188,349	13.4	15.8	241,604	28.2	42.8
Scallops	89,896	6.4	7.5	99,60	11.6	17.6
Lobster	21,697	1.5	1.8	93,458	10.9	16.5
Pacific Coast	165,882	11.8	100.0	233,663	27.3	100.0
Salmon	78,840	5.6	47.2	157,920	18.5	67.6
Herring	37,960	2.7	22.9	35,060	4.1	15.0
Freshwater	49,956	3.5	100.0	57,125	6.7	100.0

Source: Canada, Department of Fisheries and Oceans, Annual Statistical Review of Fisheries, 1981, Vol. 14, 1983.

in salmon culture may soon be emulated in Canada. In the meantime, public enhancement of existing stocks of Pacific salmon is being pursued vigorously.

As indicated, conditions of resource availability and resource quality are generally quite favorable to the Canadian fishing industry. Nevertheless, the industry has long been beset by severe problems related both to Canada's domestic conditions and to external factors. The worst of the external problems have been resolved. The enforcement of a 200-mile fishing limit by Canada effective from January 1, 1977, has brought an end to severe overfishing of the stocks off Canada's coast by distant-water fleets and has guaranteed the Canadian industry a large and secure supply of fish.

The remaining external problems, while not insignificant, are of manageable proportions. They include disputes with the United States over mutual interception of migrating salmon on the Pacific coast and possession of the fish-rich Georges Bank on the Atlantic coast. The latter dispute has been submitted for binding settlement to the International Court of Justice, which is expected to render its decision shortly (in 1984). Another problem in the Atlantic concerns management of the stocks straddling the outer boundary of the Canadian 200-mile zone on the eastern ("nose") and southeastern ("tail") fringes of the Grand Bank (see Figure 1). Attempts are being made to resolve this question with other countries fishing in the area through the Northwest Atlantic Fisheries Organization (NAFO), of which Canada, because of its coastal state position, is the leading member.

In export trade the Canadian fishing industry continues to face some difficulties. As Canada is not a member of any trading bloc its fish exports are often at a disadvantage in gaining access to foreign markets. Canada's fish export trade also faces a perennial threat in its major market, the United States, from protectionist agitation by segments of the American fishing industry.

Another threat to Canadian fish exports has come from the well-financed activities of the International Fund for Animal Welfare (IFAW), which has selected Canada as the target of its campaign to end seal harvesting. The IFAW has mounted a far-reaching effort -- with some initial succes -- urging an international boycott of Canadian fish products until Canada bans the harvesting of seals from its massive herds of these animals. No other seal-harvesting countries have been similarly victimized. Under pressure Canada has suspended the harvesting of baby seals, which originally was the primary issue at stake, but has refused so far to bow to further demands that all seal harvesting cease. There are some signs that the IFAW campaign is now losing momentum.

The Canadian fishing industry does face chronically severe problems that are related largely to domestic factors. This is somewhat ironical. After all, the country enjoys a favorable fishery resource endowment, it has a skilled and highly experienced fishery labor force with access to modern technology, while its experts in fisheries biology and fisheries economics have a world reputation.

The economic causes and consequences of Canada's fisheries problems have been well researched and, on the whole, are well recognized by government. They have been the subject of numerous enquiries, most recently by the Pearse Commission on the Pacific coast (Canada, 1982a) and the Kirby Task Force on the Atlantic coast (Canada, 1982b). In simple terms, Canada represents one of the severest cases of the classical "common property" problem of the fisheries. After centuries of "open access," the Canadian fishing industry has accumulated a vastly excessive complement of manpower, vessels, and gear in the fishing industry. It is a case of too many men and too much capital sharing the total catch. In consequence, returns per man and per vessel are much lower than they might be, given the existing resource base and available technology.

The fisheries problem has been particularly severe on the Atlantic coast, where the regional economy has long been lagging and where unemployment has been chronically high (Copes, 1983). These conditions long deterred the Canadian government from any serious attempt to rationalize the fishery by reducing manpower, though it was often acknowledged that this was necessary (e.g., Canada, 1976). Instead, the government attempted to cope with low incomes in the fishery through subsidization. This, however, served only to attract additional surplus manpower and equipment from the depressed local economy, further reducing catches per fishing unit and requiring more financial assistant to support fishing incomes. The government did progressively limit entry to the fishery, sector by sector. In the province of Newfoundland, where the problem was the most severe, effective limited entry was not achieved until 1981, after labor force participation in the fishery had reached spectacular heights (Copes, 1983).

Though the current world recession has affected the economy of British Columbia on Canada's Pacific coast particularly severely, this region generally has been prosperous, so that there has not been the same pressure on the fishing industry to absorb unemployed workers from the surrounding economy. Nevertheless, the very richness of local fish resources helped to attract greatly excessive numbers of men and amounts of equipment, raising the aggregate cost of the fishery and dissipating the potential profits that the industry could yield (Canada, 1982a). The availability of vessel building subsidies and other forms of government assistance, largely induced by conditions on the Atlantic coast, helped to draw an additional excess of capacity to the Pacific fisheries as well. Weak markets and high fishing costs of late have also brought considerable distress to Canada's Pacific fishing industry.

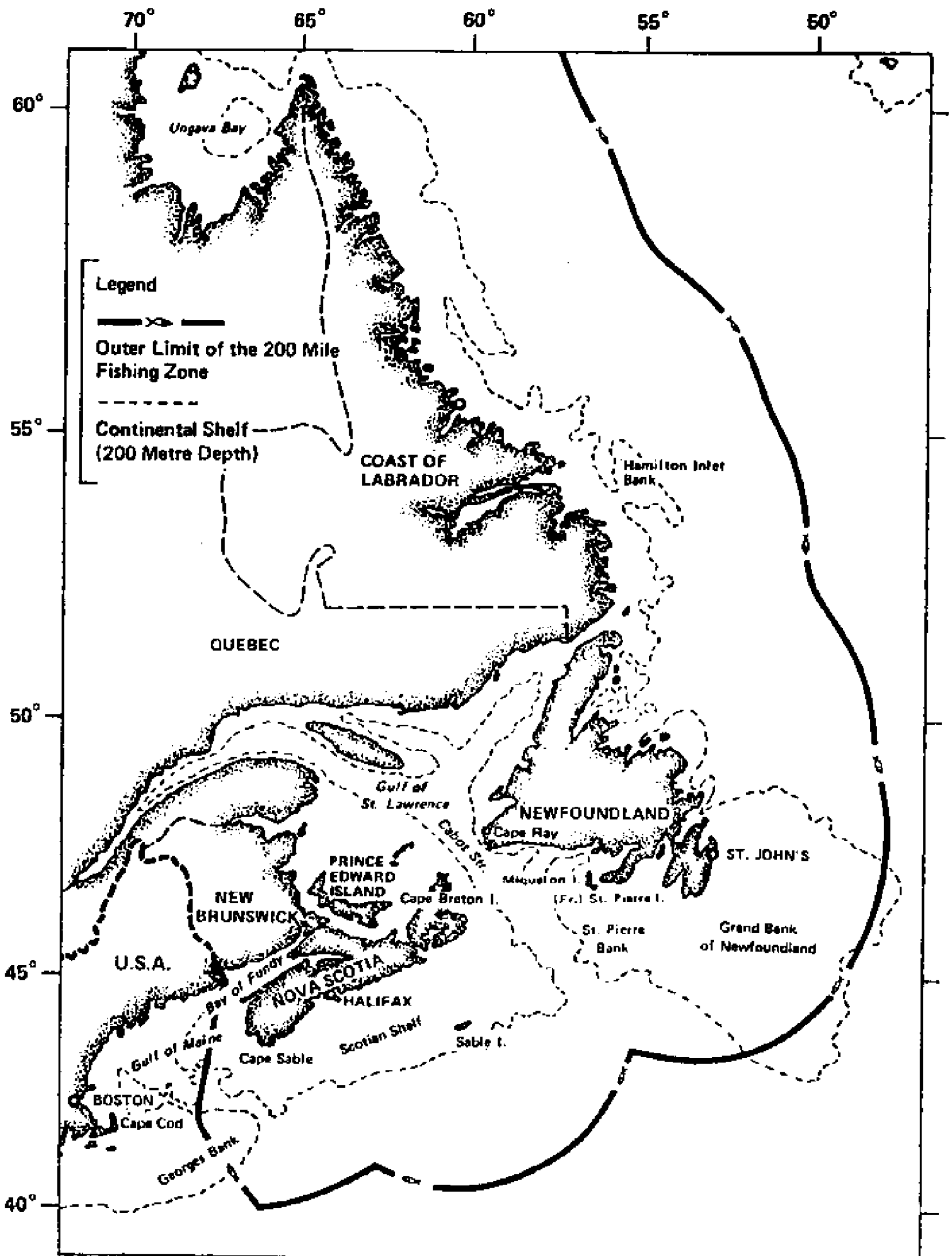

Figure 1. Canada's Atlantic Coast Fishing Zone

Fisheries Policy

Since the mid-1960s Canadian government policy generally has recognized the need for rationalization in the fishing industry, including particularly a reduction in the excess capacity of manpower and equipment (Copes, 1980). On the Atlantic coast the government has been deterred from implementing the policy because of severe regional unemployment. An ambitious attempt to rationalize the salmon fishery on the Pacific coast failed largely because of flaws in the management design (Copes, 1980).

The fisheries problem in the Atlantic region was greatly exacerbated during the late-1960s and into the 1970s by severe overfishing, caused largely by an enormously expanded fishing effort on the part of distant-water fleets. This encouraged Canada to become a leading advocate of extended jurisdiction for coastal states to protect their fisheries (Copes, 1980) and to be one of the first industrialized nations to proclaim a 200-mile fishing zone effective January 1, 1977.

Extended jurisdiction appeared to offer Canada new hope for the solution of its fisheries problems, specifically on the Atlantic coast. Increasing catches and incomes per man by reducing the labor force had proven impossible to achieve. But now the government might succeed in the same endeavor by keeping the labor force steady and increasing the Canadian catch from its 200-mile zone at the expense of other countries that had been fishing there. Indeed, this became the government strategy. Unfortunately, resolve weakened in the face of increased unemployment induced by the world recession. In anticipation of larger catches, the fishing labor force in Newfoundland was allowed to increase greatly, so that the catch per fishermen actually fell significantly, while the total catch increased (Copes, 1983). In the other provinces progress, where it occurred, was modest.

External Relations and the Fishery

Implementation of Canada's fisheries policy with respect to its 200-mile zone has revealed a number of underlying principles, which may be summarized as follows:

- All reasonable opportunities to increase the Canadian catch and Canadian processing should be pursued.
- While biological criteria should be observed for conservation purposes, overall management policy should pursue economic and social objectives.
- Opportunities to generate additional employment and income in the fisheries sector should be pursued with particular vigor.
- Canada should observe its international obligations to make fishery resources available to other countries, where they are surplus to Canada's own catch requirements.
- In allocating catch quotas from its 200-mile zone to foreign countries, Canada should seek to obtain "commensurate benefits" in return.

When Canada extended its fisheries jurisdiction in 1977, many of the more valuable stocks of its 200-mile zone had been seriously overfished. This was particularly so on the Atlantic coast and was most notably the case with the very large and important "northern cod" stock complex, stretching from northern Labrador to the northern Grand Bank. Figure 2 illustrates the course of fishing in terms of the size of

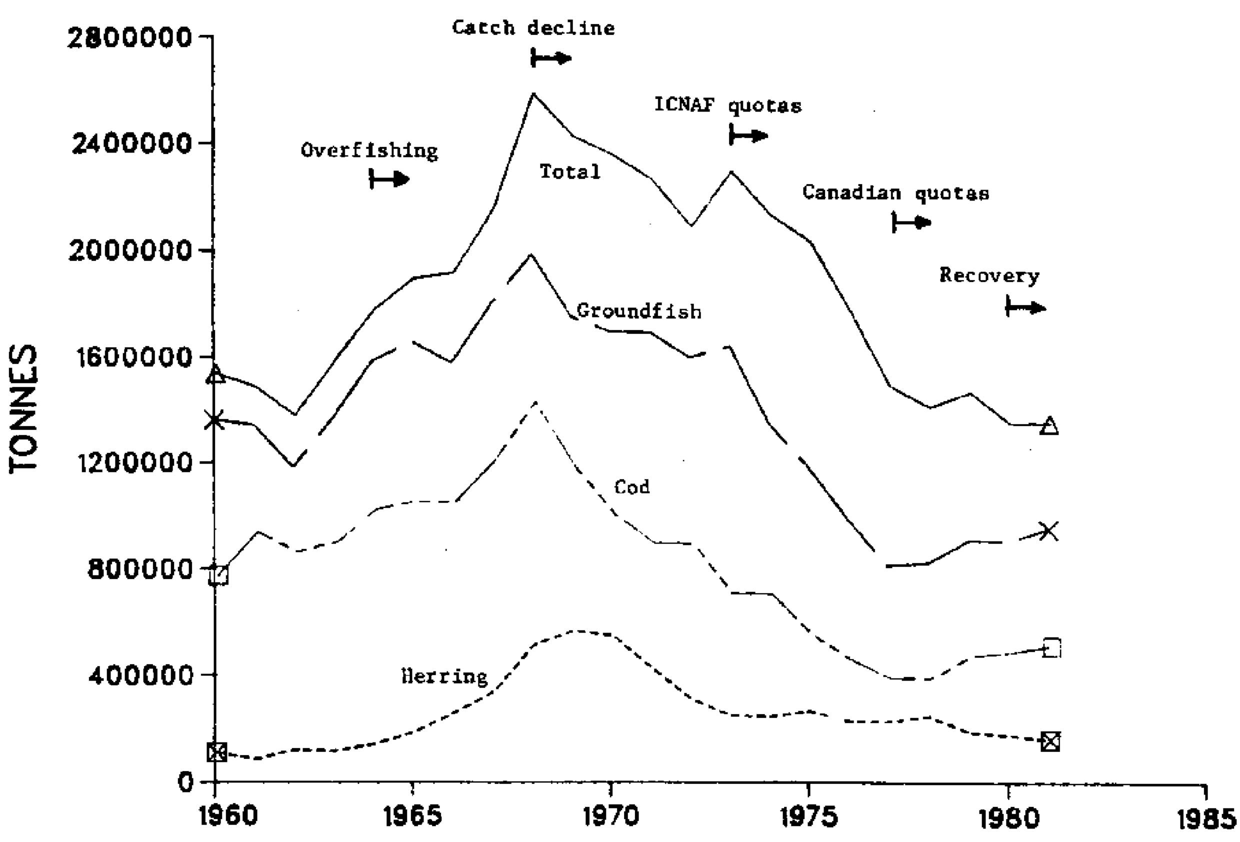

Figure 2. Total Fish Catch and Major Components for the Area Off Canada's Atlantic Coast, 1960-1981.

Note: Data pertain to ICNAF/NAFO subareas 0, 2, 3, and 4.
Source: ICNAF/NAFO, Statistical Bulletin.

the total catch and some of its major components in the waters off Canada's Atlantic coast during the period 1960-1981. The data pertain to NAFO subareas 0, 2, 3, and 4, which come close to coinciding with Canada's fisheries zone in the Atlantic. These NAFO subareas include three fishing areas outside the Canadian 200-mile limit, i.e., the Flemish Cap and the "nose" and "tail" of the Grand Bank, as well as the undefined French zone around the islands of St. Pierre and Miquelon. On the other hand, they exclude the Georges Bank area in dispute between Canada and the United States.

As is shown in Figure 2, the catch escalated during the 1960s, reaching unprecedented heights near the end of the decade. The high catches then taken proved not sustainable. The overfishing caused catches to drop despite further increases in fishing effort. Particularly as the result of Canadian pressure within the International Commission for the Northwest Atlantic Fisheries (ICNAF), the predecessor of NAFO, countries fishing in the convention area agreed with effect from 1973 to limit their harvests to country quotas set within a restrictive total allowable catch (TAC). The TAC and the quotas were negotiated within ICNAF in relation to previous catch performance, with a margin of advantage going to the coastal states (Canada, the U.S. and France on behalf of St. Pierre and Miquelon). Despite this, the Canadian fleet was especially hard hit by the quotas, as the TAC limitations applied with particular severity to heavily overfished groundfish species that were the mainstay of the Canadian catch. Canada's proportion of the catch dropped from 42 percent in 1972 to its lowest point ever, 36 percent, with the introduction of ICNAF quotas in 1973 (Figure 4).

The growing anticipation during the mid-seventies that coastal states would acquire exclusive 200-mile fishing zones, allowed Canada to pressure ICNAF into successive reductions of the TACs for overexploited stocks, most notably those of cod. When Canada proclaimed its 200-mile zone in 1977, it took over the setting of TACs and quotas in its zone and influenced the TACs and quotas set by NAFO (succeeding ICNAF) for the relatively small fishing areas in international waters outside the Canadian zone.

The Canadian management strategy evidently pursued two major goals. One was to rebuild depleted stocks quickly, to which end TACs were sharply reduced. The other was to provide as much fish as it could use to the Canadian fishing industry. For this reason quota allocations to foreign countries were greatly curtailed. In most cases, foreign quotas were given for stocks that the Canadian fleet could not utilize profitably because of lack of markets or fishing costs that were too high. Where quotas were given, Canada charged appropriate fees to help defray management and enforcement expenses, and also sought "commensurate benefits" of various kinds, including easier access for its own fish products to foreign markets (Copes, 1983). A particularly strong reduction in the TAC for northern cod was justified on the basis of serious stock depletion. However, it also gave the Canadian fleet time to prepare itself for a winter trawler fishery on spawning concentrations in ice-infested waters off Labrador. This was by far the most productive part of the northern cod fishery, which previously had been dominated by heavy ice-reinforced factory trawlers of distant-water fleets.

The results of the Canadian strategy may be traced in Figures 2-4. Declining overall quotas kept cod catches falling until 1978 and total catches until 1980 (Figure 2). The latter was caused in part by the continuing decline in the volatile herring stocks. However, Canadian catches were allowed to increase relatively quickly. Canadian cod catches and total catches started to rise again in 1976 (Figure 3). The result was that the proportion of the total catch going to Canada rose rapidly. Starting from a low of 36 percent in 1973 it reached 83 percent in 1981 (Figure 4). The Canadian proportion of the cod catch rose from 22 percent in 1974 to 84 percent in 1980.

During the period of serious stock decline in the 1970s the catch per unit of effort fell severely in most fishing sectors of the ICNAF Convention Area. This meant that fishing costs per unit of catch increased greatly. For some of the distant-water fleets that had privileged access to protected home markets, the higher costs could be passed on readily. But for the Canadian fishing industry, which had to sell most of its catch in competitive foreign markets, the results were disastrous. The Canadian government had to provide several infusions of subsidies to keep the industry operating.

In consequence, Canada became sensitive to the need to maintain adequately high levels of stock density. Specifically, Canada challenged the popular biological criterion that stocks should be fished down to the point where they provided a maximum sustainable yield (MSY), for this generally means that the last increments to the catch are obtained at very high cost to the fishery as a whole and that the resources in manpower and capital used for these increments could in fact produce more food at lower cost in alternative uses. Instead, Canada has advocated use of the "$F_{0.1}$" criterion in setting the level of stock exploitation (Gulland and Boerema, 1973; and Copes, 1982). This requires stock densities somewhat higher than those consistent with MSY and results in better economic returns to the fishery. Canada has used the $F_{0.1}$ criterion in many of its own TAC determinations and has persuaded ICNAF/NAFO to make some concessions to this criterion.

While Canada has increased its share of the catch in waters off its coasts greatly, it has not ignored the obligation in the new Convention on the Law of the Sea that requires coastal states to make fish available to other states if it is surplus to their own harvesting requirements. Tables 3-5 indicate that significant allocations are still being made to foreign countries. (While the data include NAFO authorized allocations in small fishing areas outside the Canadian 200-mile zone, a large part of the allocations shown has been made by Canada in its zone.) As is evident from Table 5, Canada is retaining

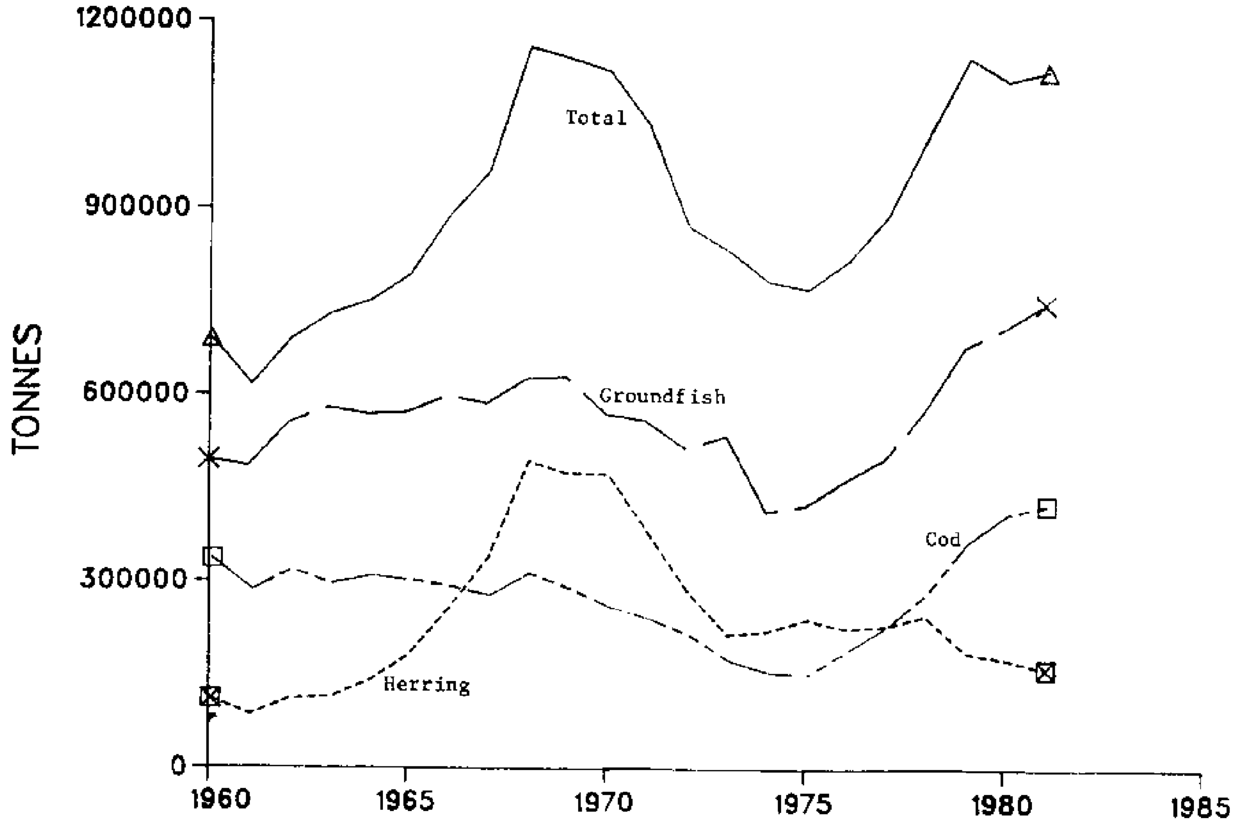

Figure 3. Canadian Total Catch and Major Components for the Area off Canada's Atlantic Coast, 1960-1981.

Note: Data pertain to ICNAF/NAFO subareas 0, 2, 3, and 4.
Source: ICNAF/NAFO, Statistical Bulletin.

Table 3. Allocations to Countries Fishing Off Canada's Atlantic Coast in NAFO Subareas 2, 3, and 4, by Country, 1977-1983 (tonnes).

Country	1977	1978	1979	1980	1981	1982	1983
European Economic Community					8,315	25,315	25,895
Denmark	5,740	15,750	7,350	4,800	5,600	6,600	-
France	20,340	42,010	41,825	34,520	33,610	31,970	31,180
F.R. Germany	21,930	9,510	3,700	1,320	-	-	-
Ireland	650	800	-	-	-	-	-
Italy	9,450	1,715	-	-	-	-	-
United Kingdom	3,280	3,610	3,145	450	-	-	-
EEC sub-total	61,390	73,395	56,020	41,090	47,525	63,885	57,075
Bulgaria	950	12,550	8,660	1,700	1,800	1,800	800
Cuba	19,145	30,975	26,610	22,876	22,030	24,630	22,780
Faroes (Denmark)	-	-	-	-	-	-	8,650
German D.R.	14,420	31,325	9,225	9,840	8,750	8,710	11,250
Iceland	7,000	-	-	-	-	-	-
Japan	20,050	9,030	20,800	20,100	20,500	6,250	28,500
Norway	59,710	55,960	3,000	2,530	2,500	2,800	3,000
Poland	24,055	34,850	30,140	10,363	13,210	7,710	7,930
Portugal	33,920	24,801	29,856	24,220	21,020	18,620	23,620
Romania	400	10,350	8,950	980	1,700	1,700	500
Spain	34,340	24,100	23,360	25,960	9,345	-	8,000
United States	9,470	4,225	-	-	-	-	-
U.S.S.R.	459,385	431,020	202,600	153,176	141,610	118,970	105,860
Others and reserves	36,840	5,010	9,500	20,820	20,920	64,070	33,185
Total	781,075	747,591	428,721	333,655	310,910	319,145	309,900

Source: Canada, Department of Fisheries and Oceans.

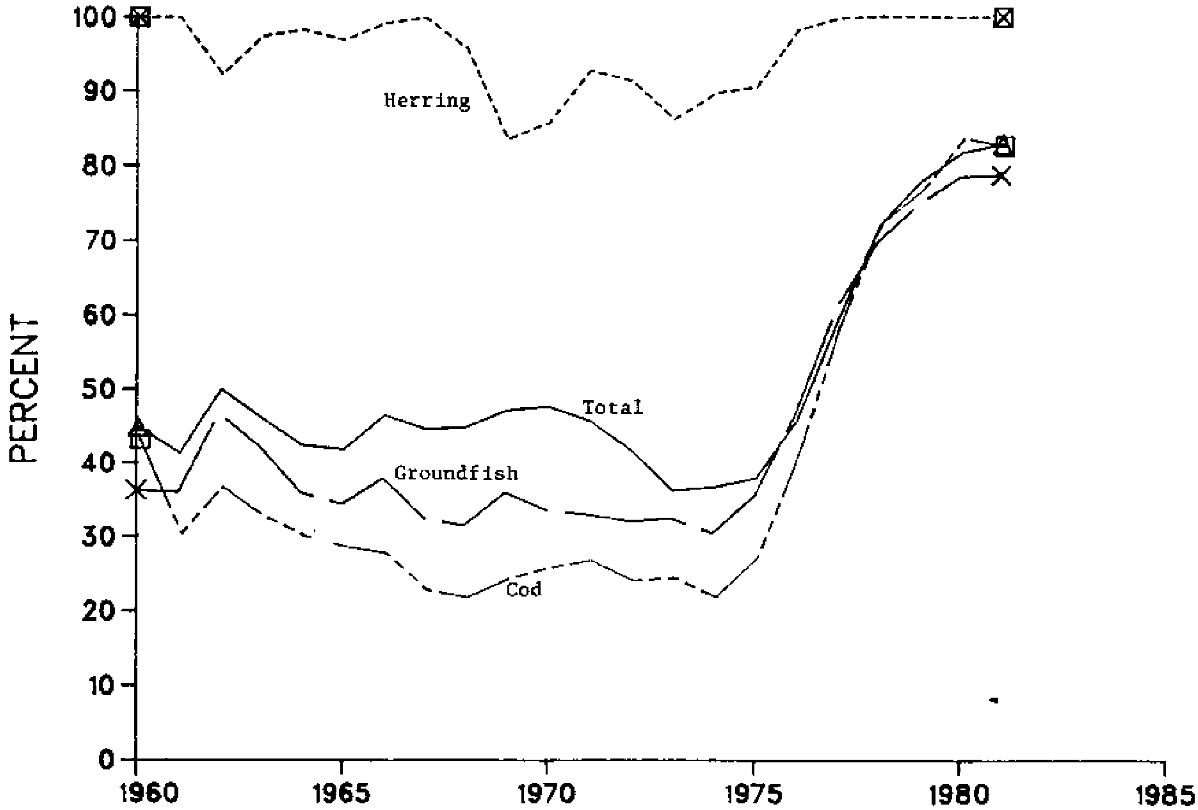

Figure 4. Canadian Total Catch and Major Components as a Percentage of Corresponding Catches of all Countries Combined for the Area Off Canada's Atlantic Coast, 1960-1981.

Note: Data pertain to ICNAF/NAFO subareas 0, 2, 3, and 4.
Source: ICNAF/NAFO, Statistical Bulletin.

Table 4. Allocations to Countries Fishing Off Canada's Atlantic Coast in NAFO Subareas 2, 3, and 4, by Species, 1977-1983 (tonnes).

Species	1977	1978	1979	1980	1981	1982	1983
Groundfish							
Cod	161,120	128,766	121,586	93,395	82,880	78,391	73,175
Redfish	53,375	37,200	47,580	59,650	54,600	56,600	56,100
Haddock	1,900	1,800	300	-	150	-	-
Greenland halibut	15,400	13,795	4,996	2,000	7,500	6,500	21,000
Yellowtail	800	800	900	500	500	530	465
Flounders	1,750	1,200	1,200	610	350	250	250
American plaice	6,600	6,170	4,370	3,150	3,200	2,700	3,100
Witch	11,500	11,710	11,870	13,810	7,710	6,720	6,710
Silver hake	56,170	66,130	59,820	66,870	59,100	81,250	79,000
Roundnose grenadier	34,800	32,200	34,000	29,000	26,000	26,500	14,000
Sub-total	343,415	299,771	286,620	268,985	241,910	258,545	253,800
Capelin	389,850	394,720	69,700	7,240	10,500	10,000	10,000
Argentine	19,000	18,000	19,000	14,320	19,000	3,100	3,100
Squid	28,810	35,100	53,400	44,110	39,500	46,250	44,250
All species	781,075	747,591	427,721	333,655	310,760	317,895	311,150

Source: Canada, Department of Fisheries and Oceans.

Table 5. Total Catch and Canadian Share of the Catch in NAFO Subareas 0, 2, 3, and 4, by Species, 1976-1981.

Species		1976	1977	1978	1979	1980	1981
Groundfish							
Cod	'000 tonnes	461.2	390.2	389.5	473.3	489.2	511.9
	Canadian %	41.3	58.6	72.4	76.8	83.8	82.7
Redfish	'000 tonnes	154.6	116.2	105.0	120.5	100.4	116.9
	Canadian %	57.8	57.3	69.6	67.4	48.7	61.4
Haddock	'000 tonnes	19.4	25.6	33.8	29.8	44.8	51.8
	Canadian %	93.4	92.8	95.1	97.8	98.1	98.2
Greenland halibut	'000 tonnes	31.7	40.6	50.9	45.1	42.2	34.5
	Canadian %	36.2	55.1	62.3	88.2	93.7	80.5
Yellowtail	'000 tonnes	11.4	13.5	18.3	21.4	15.5	18.0
	Canadian %	94.9	97.3	97.2	97.7	96.0	94.8
Flounder	'000 tonnes	4.2	2.9	2.7	2.9	3.3	3.6
	Canadian %	90.7	95.8	99.8	99.9	100.0	100.0
American plaice	'000 tonnes	90.5	78.5	83.2	75.6	77.1	78.6
	Canadian %	85.6	94.8	89.7	96.7	96.8	95.7
Witch	'000 tonnes	32.2	24.5	17.8	15.2	12.1	10.8
	Canadian %	50.1	71.4	61.9	69.7	71.8	66.0
Silver hake	'000 tonnes	97.2	37.2	48.6	51.8	44.6	41.1
	Canadian %	3.2	*	.1	*	.2	*
Roundnose grenadier	'000 tonnes	23.0	16.1	21.1	7.9	2.1	7.1
	Canadian %	.1	.1	*	.1	-	-
Pollock	'000 tonnes	25.4	23.2	23.7	29.7	32.8	37.4
	Canadian %	84.9	95.2	95.9	94.4	94.9	97.8
Other Groundfish	'000 tonnes	49.9	44.9	28.4	33.2	39.6	38.8
	Canadian %	72.6	58.1	25.2	91.2	89.3	91.4
Total Groundfish	'000 tonnes	990.0	813.4	823.2	906.5	903.7	950.5
	Canadian %	46.7	61.1	70.0	75.0	78.6	78.9
Herring	'000 tonnes	228.7	292.3	245.6	187.9	176.9	161.4
	Canadian %	98.3	99.8	100.0	100.0	100.0	100.0
Mackerel	'000 tonnes	33.1	22.8	25.9	30.6	22.3	19.4
	Canadian %	47.6	87.2	59.6	98.8	99.3	99.7
Capelin	'000 tonnes	360.9	228.9	94.6	22.6	27.0	39.0
	Canadian %	2.8	4.6	19.6	97.8	82.2	73.8
Argentine	'000 tonnes	7.2	2.5	1.9	2.6	2.1	.4
	Canadian %	-	.2	-	-	-	-
Squid (short finned)	'000 tonnes	41.8	83.6	94.1	162.1	69.6	32.2
	Canadian %	26.0	37.1	38.2	55.3	49.0	56.7
Others	'000 tonnes	119.1	113.6	126.1	155.7	150.7	150.5
	Canadian %	75.2	89.7	94.6	86.9	93.9	96.7
Total all species	'000 tonnes	1,780.7	1,494.0	1,411.2	1,468.0	1,352.3	1,353.3
	Canadian %	45.8	59.5	72.1	78.0	82.9	82.9

Note: - nil, * less than .05%.
Source: ICNAF/NAFO, Statistical Bulletin.

Table 6. Allocations to Foreign Countries Fishing in Canada's Pacific Coast 200-Mile Zone, by Country and Species, 1977-1983 (tonnes).

Country	Species	1977	1978	1979	1980	1981	1982	1983
Japan	Hake	5,000	5,000	6,000	6,000	5,000	2,500	-
	Rockfish	3,000	-	-	-	-	-	-
	Sablefish	3,000	2,200	1,000	200	-	-	-
Poland	Dogfish	20,000	-	-	-	-	-	-
	Hake	7,500	6,500	5,000	5,000	5,000	10,357[1]	12,555[1]
Republic of Korea	Sablefish	250	-	-	-	-	-	-
U.S.S.R.	Hake	-	6,500	-	-	-	-	-
Total		38,750	20,200	12,000	11,200	10,000	12,857	12,555

Note: 1. Flexible allocations, related to over-the-side purchases made by Poland.
Source: Canada, Department of Fisheries and Oceans, unpublished.

for its own use most of the catch of the species traditionally sought by its own fleet, even though not insignificant amounts of cod, redfish and Greenland halibut continue to be allocated to foreign fleets. The latter have obtained major allocations for such "non-traditional" species as silver hake, roundnose grenadier, squid and argentine. The very large quotas of capelin that were once given have been cut for reasons of conservation.

On the Pacific coast Canada has also continued to offer quotas to foreign fleets, be it on a very modest scale (Table 6). Salmon, herring, and halibut historically have been the principal components of Canada's Pacific catch. The available stocks of these species are fully exploited by the Canadian fleet, as are the small local stocks of shellfish. It is only in recent times that the Canadian fleet has brought the local stocks of groundfish under substantially full exploitation. Because of the relatively narrow continental shelf off Canada's Pacific coast, the groundfish stocks are not very large in any case. There are now stocks of only two commercial species surplus to Canadian requirements. One is hake, which Canadian fishermen find difficult to handle because of rapid spoilage and which in any event is not desired by local consumers. The other is the low-value dogfish, which neither Canadians nor foreigners appear to be able to catch at a break-even level at this time. Since 1981 Pacific coast quotas to foreign vessels have been confined to hake.

International Trade

On a world scale Canada is an important producer of fish (Table 1). But its population of 25 million is modest by comparison. Moreover, Canadians are not great fish-eaters. The recorded per capita consumption of fishery products in the country is only about 7 kg per year.[1] In consequence of all of this, Canada has a large surplus of fish products available for export. Indeed, since 1978 Canada has ranked first in the world in terms of the value of fish exports, accounting for about 8 percent of the total export trade volume. Table 7 compares the 1981 export and import positions of the most important participants in the international fish trade.

In terms of the weight of exported fish products Canada ranks only fifth in world trade. The country's higher ranking in terms of export value may be related to two factors. One is the relatively high value of the fish species exported by Canada. The other is the extent of weight reduction and value added in processing before export.

It is notable that most prominent fish exporting countries also have significant imports of fish products. Canada is no exception in this regard, though its balance runs strongly in favor of exports. By way of comparison it may be noted that the value of Canada's fish product imports in 1981 amounted to 1.9 percent of the world total, while the value of its exports amounted to 8.2 percent. In terms of net value of exports Canada still ranked first.

The United States is by far the largest purchaser of Canadian fish products, taking 53.7 percent of Canadian exports in 1981 (Table 8). Japan came next with 11.3 percent. Most of the remaining exports went to countries in western Europe. Central and South America -- particularly the Caribbean -- once were major buyers of Canadian fish, especially salt cod. A small amount of this trade persists.

As may be seen from Table 9, various categories of frozen seafish products together constitute the largest component of Canadian fish exports. A large part of this is frozen groundfish from the Atlantic coast exported to the United States, though frozen Pacific salmon exports to a variety of destinations are also significant. Next in importance is fresh and frozen shellfish, which is exported to many countries, though the United States purchases the largest amounts. Exports of salted or dried cod from the Atlantic coast and canned salmon from the Pacific coast have been of great historical importance to the Canadian fishing industry. Though the relative importance of these products among Canadian fish exports has been much reduced, significant amounts are still exported to diverse destinations.

Conclusion

As an important producer, and the world's leading exporter of fish products, Canada is making a significant contribution to world fish supplies. Canadian fish exports principally are destined for affluent trading partners, with well-established markets for the particular species and product forms that are most readily produced by the Canadian fishing industry.

Canada does not nearly utilize the full fisheries potential of its 200-mile zone. While the Canadian fishing industry operates effectively in terms of work force skill and appropriate technology, it is not economically efficient in overall terms. The problem clearly is one of a greatly excessive size of the fisheries labor force and the amount of capital invested -- a legacy of the previous era of open access. As a result costs of production are much higher than they need be. Incomes in the industry have been low and profit performance has been dismal. A further consequence has been Canada's inability to exploit the large stocks of lower value species available in its waters.

Canadian fisheries policy faces a serious dilemma. Because of severe unemployment in the Atlantic region, Canada is anxious to create jobs by exploiting a wider range of fish stocks in its 200-mile zone. But to fish the additional stocks profitably the Canadian fishing industry must be made more cost-

Table 7. Exports and Imports of Fish Products for Specified Countries, 1981.

Country	Export Value Rank	Value (millions of U.S. dollars) Exports	Value Imports	Value Net Exports (Imports)	Quantity (thousands of tonnes) Exports	Quantity Imports	Quantity Net Exports (Imports)
Canada	1	1,267	299	969	521	101	420
United States	2	1,142	2,988	(1,846)	454	1,044	(589)
Norway	3	1,002	59	943	727	74	652
Denmark	4	940	305	636	737	267	469
Japan	5	863	3,737	(2,874)	683	1,038	(355)
Republic of Korea	6	835	58	777	400	50	350
Iceland	7	713	1	712	489	-	489
Mexico	8	538	24	504	57	35	23
Netherlands	9	512	330	181	437	352	84
Spain	10	436	479	(43)	256	271	(15)
Thailand	11	358	23	335	269	44	225
Chile	12	337	2	335	594	2	592
China	13	325	-	325	101	-	101
United Kingdom	14	318	997	(697)	376	733	(357)
France	15	304	1,051	(747)	141	501	(360)
F.R. Germany	16	281	819	(538)	233	765	(532)
India	17	269	-	269	71	-	71
Australia	18	268	162	106	31	58	(27)
U.S.S.R.	19	243	76	166	419	57	362
Philippines	20	204	39	165	89	40	50
Indonesia	21	203	38	165	65	63	2
Morocco	22	190	-	190	133	-	133
Hong Kong	23	179	362	(183)	43	108	(64)
Peru	24	178	-	178	295	-	294
Ecuador	25	166	-	166	149	-	149
Other Countries		3,310	4,099	(789)	2,176	3,527	(1,352)
Total		15,382	15,958		9,946	9,129	

Note: 1. Includes top 25 countries in terms of export value ranking in 1981.
Source: FAO, Yearbook of Fishery Statistics, 1981, Vol. 52, 1983.

Table 8. Canadian Exports of Fish Products, by Country, 1981.

Country	Value (thousands of dollars)		Percentage Distribution	
United States	815,251		53.7	
Japan	172,324		11.3	
Europe	411,708		27.1	
United Kingdom		114,763		7.6
France		74,307		4.9
F.R. Germany		45,500		3.1
Portugal		44,053		2.9
Belgium-Luxembourg		27,167		1.8
Sweden		23,997		1.6
Italy		17,317		1.1
Netherlands		13,637		.9
Central and South America	62,305		4.1	
Puerto Rico		17,271		1.1
Dominican Republic		10,773		.7
Other	57,048		3.8	
Australia		29,197		1.9
Total	1,518,636		100.0	

Source: Canada, Department of Fisheries and Oceans, Annual Statistical Review of Fisheries, 1981, Vol. 14, 1983.

Table 9. Canadian Exports of Fish, by Main Product Groups, 1981.

Product Group	Value (thousands of dollars)	Percentage Distribution
Seafish, whole or dressed, fresh	32,251	2.1
Freshwater fish, whole or dressed, fresh	18,606	1.2
Seafish, whole or dressed, frozen	204,580	13.5
Freshwater fish, whole or dressed, frozen	21,877	1.4
Seafish fillets, fresh	23,916	1.6
Freshwater fish fillets, fresh	6,292	.4
Seafish fillets, frozen	273,762	18.0
Freshwater fish fillets, frozen	27,527	1.8
Seafish blocks, frozen	125,794	8.3
Freshwater fish blocks, frozen	3,462	.2
Smoked fish	11,464	.8
Salted or dried groundfish	140,004	9.2
Pickled and cured fish	28,018	1.8
Canned fish	139,864	9.2
Shellfish, fresh or frozen	302,777	19.9
Canned shellfish	25,248	1.7
Fish roe	93,851	6.2
Meal	17,582	1.2
Oil	4,353	.3
Miscellaneous fishery products	17,408	1.1
Total exports, all groups	1,518,636	100.0

Source: Canada, Department of Fisheries and Oceans, Annual Statistical Review of Fisheries, 1981, Vol. 14, 1983.

effective. This means reducing the existing fisheries labor force, which runs counter to the aim of increasing employment.

Canada's inability to utilize fully the fisheries potential of its Atlantic coast zone, contrasts sharply with the success countries such as Iceland and Norway have had in exploiting the full potential of their fisheries resources, which are much of the same kind as those of the Canadian Atlantic coast (Copes, 1984). On the favorable side, the Iceland and Norwegian examples suggest that it should be possible for Canada also to extract more from its fisheries resources.

Considering the severe social and political constraints Canada faces in attempting to rationalize its Atlantic fishing industry (Copes, 1983), it will probably require some beneficial external developments to bring about a significant improvement. The world recession eventually should end and world demand for fish may then increase under the influence of continued population growth and improved incomes, particularly in the Third World. With such a stimulus a significant expansion of Canadian fish production may prove feasible. If the Canadian government then manages to hold fisheries employment steady and curb excessive capital investment, the extra fish produced may be used to increase output and income per unit of labor and capital employed. The resulting improvement in cost-effectiveness should make it easier to expand fisheries production still further.

There is no doubt that extended jurisdiction has allowed Canada to implement a management regime that is safeguarding the stocks against the serious overfishing that previously took place. In cutting back TACs severely, Canada has opted for a policy of relatively rapid restoration of depleted stocks. The TAC restrictions do not mean that fish are being wasted. To the extent that Canada is unable to exploit stocks in its zone that are in healthy condition, it is making them available to other countries on reasonable terms, in accordance with international obligations. However, given the thrust of Canadian policy, it is likely that the foreign share in the harvest of its 200-mile zone will decrease over time and may eventually disappear. But there is ample evidence to suggest that Canada will manage the fisheries resources of its zone in a reasonable and effective fashion, so that in the future they will yield to the world a harvest conforming to their full economic potential.

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Note

1. See Canada, Department of Fisheries and Oceans, Annual Statistical Review of Canadian Fisheries, 1981, 1983.

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The Influence of Socio-Economic Factors on the Demand for Seafoods

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> "The challenge of market segmentation is to determine groups of people whose preferences are sufficiently similar to each other, yet different from other groups, to justify modification of a product to the preferences of that specific group."
>
> ENGEL, BLACKWELL AND KOLLAT

Management needs to understand behaviour of the consumer in terms of his being an individual, as a member of society, and as a purchaser of products. In order to accomplish this, marketing management utilises research from various interrelated disciplines which focus on human behaviour.

The classical Economics model portrays consumers as totally rational decision makers, as the possessors of complete knowledge of any given product's benefits and detriments. In reality, however, consumers are unable to avail themselves of complete information. Further, their emotional or psychological side would likely prohibit an absolutely logical buying decision. There are however, other comprehensive models which take both personal and environmental variables into consideration. These include models put forward by Nicosia (1966), Howard-Sheth (1969), Engle, Blackwell and Kollat (1973). Each of these have significant heuristic value, nonetheless are rather cumbersome and impractical.

The function of demographic, social and economic factors in determining market segments has often been discussed separately in the literature on consumer behaviour. Social differences in particular have been contrasted with psychological or individual variations which may influence consumer choice. These discussions however, have led to considerable debate (Yankelovich, 1964; Reynolds, 1965). Whilst a clear distinction between demographic and social variables is not possible, economic factors on the other hand cannot be considered in isolation. Several studies have illustrated that income cannot be considered on its own as an independent explanatory variable for aspects of consumer behaviour (Ferber, 1962).

Purchasing and consumer behaviour are affected by a multitude of factors. This paper, however, concentrates on the effect of socio-economic and related variables on the purchasing and consumption of seafood. In the context of the Howard-Sheth model the set of variables under discussion in this paper may aptly be described as 'exogenous variables.' That is, they are external to the consumer model but important in predicting behaviour. Or, in terms of the Engel, Blackwell and Kollat model, can be referred to as 'internalized environmental influences.'

Some researchers equate socio-economic status with social class. A broader definition is suggested in this paper in that certain related aspects of socio-economic characteristics such as dwelling type, residential location and social mobility are considered together with the more traditional variables of education, income, age, etc.

The data base for the research discussion are seafood consumption and marketing surveys conducted by the author in Australia between 1978 and 1983, mainly in Queensland and the Northern Territory. Information on seafood consumption was gathered for the 'household' as against the 'individual' since the acts of purchasing and consumption were viewed as decisions of the household rather than of an individual. A 'household' was defined as any group of individuals living together in the same dwelling. This implied that certain socio-economic variables had to be aggregated for the household -- such as 'household income' -- in order to utilize them as independent explanatory variables of consumer behaviour.[1]

The aim of this paper is to ascertain the adequacy of using socio-economic variables to measure the demand for seafood and also to determine the extent to which these variables reflect differences in household purchasing and consumption behaviour.

The socio-economic variables that were analysed in the research are as follows:

i) number of persons in household
ii) age and sex of all household members
iii) number of persons employed
iv) occupational categories (ABS classification)
v) household income
vi) education of household head(s)
vii) religion
viii) country of ethnic origin
ix) dwelling type
x) residential location

This paper will be first discussed in terms of traditional concepts of the Family, Social Class and Culture which incorporate socio-economic variables, and then with reference to the more recent concept of psychographics or life style patterns. Variables (i) and (ii) above, are mainly demographic and used to determine stage in the family life cycle. Whilst variables (iii), (iv), (v) and (vi) are mainly economic they are useful determinants of social class together with variables (ix) and (x). Variables (vii) and (viii) determine cultures and sub-cultures. In practise, all of the above variables interact in varying intensity to influence purchasing and consumption behaviour, and are some of the key factors determining life style patterns of psychographics (Plummer, 1974).

Purchasing and consumption characteristics of the household were looked at in terms of:

i) forms of seafood (fresh, frozen, smoked/dried, canned)
ii) frequency of consumption
iii) species consumed
iv) day of the week seafood consumed
v) meal of the day seafood consumed
vi) source(s) of purchase
vii) consumption outside the home

The more recent seafood consumption surveys conducted in Australia indicate that average per capita consumption in seafood has risen from 10.1 kg in the State capitals in 1976-77 (Department of Primary Industry, 1978) to 20.9 kg in Darwin, Northern Territory for 1982 (Bandaranaike, 1984) and 13.6 kg in the Moreton Region, Queensland for 1983 (Bandaranaike and Hundloe, in press). Even though these rates are relatively low when compared worldwide, it is encouraging to note that on an average 80 to 90 percent of the households in Australia are seafood consumers. Since Australian society is diverse in many respects, it is useful from a marketing point of view to measure the impact of select socio-economic variables on the demand for seafood.

In consumer literature there are limited studies conducted on the influence of socio-economic factors on customer buying and consumer behaviour of non-durables, and even fewer on seafood consumption. Ronald Frank (1967) conducted a series of studies in the purchase of grocery products to determine the extent to which households with different socio-economic and purchasing characteristics also exhibited differences in buying behaviour. Although Frank concludes that socio-economic characteristics contribute little to the understanding of household variation in the purchasing aspects that he examined (total consumption, private brand proneness, brand loyalty, packet size -- proneness and average price paid), research in other areas of purchase behaviour have indicated the effects of social stratification on consumer behaviour (Coleman, 1960).

Rich and Jain (1968) conducted a study on women's fashions in the Cleveland metropolitan area, United States, using social class and family life cycle as their independent variables. In their conclusion they questioned the usefulness of life cycle and social class concepts in understanding consumer behaviour. The reason given was that socio-economic changes in income, education, leisure time and movement to suburbia cut across traditional class lines and various stages in the life cycle. This study was replicated in a British city using the same independent variables but on food items and domestic applicances (Foxall, 1981). The latter study concluded that sociological variables "may be employed successfully as explicators of much consumer behaviour and, if operationalised, may form the basis of segmentation policies." In this context it should be noted that the effect of socio-economic variables will vary depending on the product analysed.

The family, or 'the household' as referred to in this paper, is one of the most important reference groups both in terms of an earning and a consumer unit. Therefore, it is justifiably the main focus for the study of consumer behaviour. It is important for the marketer to understand how purchasing decisions are made within the household structure together with the factors that result in such behaviour.

The traditional concept of 'The Family' and 'Family Life Cycle' need to be modified in the current context of modern living. Traditional societies still persist in maintaining either a nuclear family (the immediate group of parents and children living together) or an extended family (nuclear family plus grandparents and other relatives). However, in most non-traditional societies of the western world, groups of people live together in de-facto relationships or otherwise, pooling their resources and making common purchase decisions, particularly in relation to items of food. In compliance with the traditional nine fold classification of family life cycle stages (Wells and Gubar, 1966) the author has identified two other groups and refers to the different stages as 'Household Life Cycle.' Stages in the household life cycle were redefined as follows to suit the research being undertaken. For purposes of comparison Wells and Gubar's (1966) sub classes are given in parenthesis.

Group I - single adult (classes 1, 8, 9)
Group II - young couples with no children (class 2)
Group III - couples with one child (class 3)
Group IV - couples with two children (class 4)
Group V - couples with three or more children (class 5)
Group VI - adult groups (classes 6, 7)
Group VII - adult groups with young children (under the age of six)
Group VIII - adult groups with older children (age six and above)

It is still possible for individuals from the last two stages (the introduced sub-groups) to move into any of the other stages in the traditional family life cycle. This type of analysis is far more meaningful than the application of individual demographic factors such as age, sex or marital status.

Within these household units, it is also important to determine family roles since it indirectly affects consumption patterns. In a study done on marital roles in decision making (Davis and Rigaux, 1974) it was found that food was a 'wife-dominated decision.' In so far as the decision on the purchase of seafood was concerned in almost a quarter of the households sampled, it was a combined decision of the household. But this again varied widely depending on the stage in the household life cycle and the country of ethnic origin. In more than half the Asian and East European households seafood purchases were a 'husband-dominated' decision. In more than 60 percent of the households where there were either no children or very young children, the decision on the purchase of seafood was again made by the husband. As the family matured and moved through the stages in the life cycle, the role of the wife and children in the decision making process became more dominant. With reference to adult groups living together, often it was a combined decision, nonetheless on a few occasions (less than 5.0% of that sub-group) a dominant personality in that household was responsible for the purchase decision on seafood. These characteristics have important implications in marketing a product. For example it has been noted that the great advantage in television advertising is that it can be aimed at the household unit and thus can reach influencers, decision-makers, buyers and users simultaneously.

Associated closely with the concept of household life cycle is that of household size. However, since these two variables were found to be interrelated in the research findings, the influence of socio-economic factors on stages in the household life cycle only, are discussed below.

Whilst there were no statistically significant differences in the relationship between stage in the household life cycle and form of seafood consumed, minor variations were noted. In Darwin for example, among 'single adults' consumption of seafood at restaurants and takeaway outlets was the most popular form among 92.0 percent of this sub-group. Amongst all other sub-groups fresh seafood consumption at home preceded eating at restaurants and takeaway outlets. A characteristic feature of households with children was the popularity of fish fingers.

Some relationship was noted between monthly consumption frequencies and stage in the life cycle. Fresh shellfish had a particularly low monthly consumption frequency (< 1 per month) among households with three or more children -- probably a reflection of retail price. Canned seafood and frozen pre-packaged shellfish had relatively high monthly consumption frequencies amongst the sub-group 'single adults' either as a result of convenience in handling the product or due to a life style pattern.

Generally speaking the average serving of seafood at a meal (weight measured in grams) was found to be highest among 'single adults' followed by 'adult groups.' Weight of an average serving of seafood was lowest amongst those households with younger children -- namely sub-groups III, IV and VII.

These characteristics have far reaching implication on seafood purchasing behaviour and will be expressed in the demand for seafood in the market.

Social class is a method of stratifying society based on variables such as income, education, occupation, and family background. Whilst people within a social strata feel they 'belong together,' wide differences are recognised among members of different social strata. Depending on the rigidity of the enforcement of class structure within a society, they may be grouped into either a 'closed society' where there is no social mobility as in the case of the Sri Lankan caste hierarchy or an 'open society' such as in Australia where social mobility is possible through education or the acquisition of wealth or power. No attempt will be made here to define social classes in the areas of study. Instead, the effects of socio-economic variables comprising social class on seafood purchasing and consumption behaviour are discussed below.

The variables 'number employed' and 'occupational categories' of the household were mainly used as cross checks for 'household income.' In most research using social class analysis, income of the head of the household is used as an indicator of social status. During the past decade owing to the increased participation of women in the workforce, the prevalence of groups of adults living together and combining their resources in a household, it is more appropriate to use 'household income' as an indicator. In the consumer surveys carried out by the author household income was categorised into five groups as follows:

Group I - less than $ 8,000
Group II - $ 8,001 - $18,000
Group III - $18,001 - $35,000
Group IV - $35,001 - $75,000
Group V - more than $75,000

The analysis showed that there was a corresponding increase in the percentage of households consuming any form of seafood, up to the middle income level ($18,001 - $35,000) and then there was a tapering off. The highest income group (> $75,000) had the lowest percentage of households consuming seafood amongst all sub-groups. This feature was consistent among all the surveys conducted in Queensland and the Northern Territory.[2]

Analysing the relationship between income and forms of seafood (fresh, frozen pre-packaged, smoked/dried or canned) consumed, it was observed that this relationship varied depending on geographic aspect and life styles. In Darwin where amateur fishing is very popular owing to the predominance of fresh water bodies and the relative proximity to the Gulf of Carpentaria, fresh fish was consumed by 100 percent of the households in the lowest income group (< $8,000). This feature was a result of the relatively higher incidence of consuming fresh seafood caught (whereas in the higher income groups, a greater proportion of the fish caught was reported as being 'distributed to friends') and also the fact that friends and relatives contributed a considerable proportion free, towards consumption (Bandaranaike, 1984, p. 27). This same income group had a very low consumption of frozen pre-packaged (9.1%) and smoked/dried (9.1%) seafood. Compared with other sub-groups they also had a relatively low consumption of canned seafood (45.5%) together with a comparatively 'lower' incidence of eating outside the home -- i.e., at restaurants (63.6%).

There was no significant difference in the variation of form of seafood consumed among households with an income of more than $8,000. Among these groups, whilst fresh seafood was the most popular form, food eaten at restaurants and takeaway outlets was the next most popular. The high rate of consumption of frozen pre-packaged seafood among the middle income earners ($18,001 - $75,000) was purely a function of convenience among a group of white collar workers where often both husband and wife were employed. In the very high income group (> $75,000) as mentioned earlier, the consumption of all forms of seafood was relatively low. This could be indicative of the fact that as incomes rise a smaller proportion of the total income is used on the purchase of necessities, and consequently purchases of non-essentials rise. In addition, as incomes rise, consumers tend to buy more service and processing in their food products.

In a regional context each area had its favourite seafood species. For example in the Darwin region Prawns and Barramundi were the most popular species among all households. In the Moreton region it was Prawns and Whiting. However, the percentage of consumer households purchasing these same species varied according to income levels indicating a strong relationship between the higher income levels and the consumption of higher prices species. For example at Darwin, the highest income group (> $75,000) had 74.7 percent consuming Barramundi, the middle income group ($18,001 - $35,000) 71.8 percent, and the lowest income group (< $8,000) had 54.5 percent.

Not much variation was observed among the different income sub-groups and other purchasing and consumption characteristics.[3]

Total number of persons employed in a household was not an adequate measure of variation in consumer behaviour. Total household income was a more appropriate variable to assess purchasing power and consumer behaviour as may be seen from the above analysis.

Whilst the variables education and occupation are closely linked, in consumer research they have been used mainly as indicators of social class. For instance Hollingshead's 'index of social position' is a three-variable index utilising area of residence, occupation, and education (Myers and Roberts, 1959, pp. 24-25). Another study by Ellis, Lane and Olesen (1963) made use of 'father's occupation' to study the consumption patterns of college students in terms of the father's position in the class structure.

Education as a socio-economic variable to measure variations in seafood consumption behaviour was found to be totally inadequate. This partly results from a methodological problem where the level of education for the household was assessed via the 'highest level of education' achieved, in a particular household. This method obviously obscured the quality of education and the number of participating individuals within a household. However, it can be stated more generally that continuing increase in educational attainment levels will result in more knowledgeable, discriminating purchasing of seafood.

Occupation was used mainly as a cross check for income and as an independent variable did not relate to purchasing or consumption behaviour, unless the individual was a commercial fisherman.

Dwelling type and residential location are considered socio-economic variables in so far as they affect social class. Warner's Index of Status Characteristics uses these two variables (referred to as house type and dwelling area respectively) in his classification (Warner, 1960). Dwelling type affected seafood consumption mainly in the form of seafood purchased. Consumers living in small apartments and flats characteristically consumed larger proportions of frozen pre-packaged and canned seafoods in relatively smaller size packages or containers. It is felt however, that this feature together with residential location was more a result of life style influence on seafood consumption patterns rather than social class. Those consumers who preferred to live in flats in the inner city area or those that opted to live 20 km away from the city in five acre blocks did so because of changing life style patterns. Amongst other things this apparently influenced the form and frequency of seafood purchasing and consumption patterns.

Culture is an important determinant of consumer behaviour, but most unfortunately has varied definitions. In this paper culture is represented as a learned set of responses which is inculcated in each succeeding generation. It involves values, ideas and attitudes created by man to influence human behaviour. In any particular culture there are various sub-groups or sub-cultures, each with its own norms or values which create variations and result in a dominant pattern of life within the overall culture.

In seafood purchasing and consumption behaviour the author recognises four broad sub-cultures based on the following socio-economic variables -- ethnic origin, religion, geographic (residential) location, and 'fadonism' (adoption of a current craze).

In the seafood consumption surveys conducted in Australia, as an independent explanatory variable ethnicity showed the highest degree of correlation to purchasing and consumer characteristics followed by 'fadonism.' Whilst geographic location was relevant in some contexts showing a moderate correlation with consumer behaviour, religion had a very low correlation and the results were statistically not significant.

In Australia, it was found that country of ethnic origin was a more appropriate measure of variations in seafood consumption than nationality, owing to large numbers of naturalized Australians particularly in the urban areas, the results tended to be biased if nationality was taken as an attribute. Different religious groups are known to have varying consumption behaviour such as the Jews who do not eat shellfish or the traditional Catholics who do not eat meat on Fridays or the Hindu who do not consume meat. Geographic location is most relevant when considering large regional areas such as North and Central Queensland. Variations in seafood consumption result from poor physical communication between areas (Bandaranaike, 1981). The term 'fadonism' was introduced by the author to recognise the adoption of fads -- a pet notion or craze -- by a sub-group which may result in the physical or mental alteration of life styles such as eating habits or leisure patterns, or a change in attitudes. Some of these are transient situations and may fade away with time, nonetheless important to marketers while it lasts.

Ethnicity as a socio-economic variable affected many aspects of seafood consumer behaviour. In the analysis eight broad ethnic sub-groups were identified as follows -- Australian (white), Aboriginal, West European (excluding British), East European, British, Asian, American, and Mixed. In forms of seafood consumed among these sub-groups, the most conspicuous difference was in the consumption of smoked/dried seafood which was relegated to the Asian and East European sub-groups. A small proportion of the British and West European households consumed smoked fish particularly at breakfast. Yet, socially, smoked/dried seafood are not acceptable as yet among the majority, in the Australian society.

When analysing monthly consumption frequencies in different forms of seafood among ethnic sub-groups, it was observed that overall the Asian sub-group had some of the highest frequencies. The East European sub-group, mainly the Adriatics, had very high consumption frequencies in fresh shellfish. On the other hand the British had relatively high frequencies of consumption in frozen pre-packaged seafoods. Within the Australasian sub-group there was a marginally higher rate of consumption in fresh seafoods reflecting their greater participation in leisure fishing and outdoor life styles (Bandaranaike, 1984, pp. 47-50).

It was mentioned earlier that Barramundi and Prawns were the two most popular species consumed in Darwin. Among the different ethnic sub-groups, 92.0 percent of the Asian households and 83.3 percent of the Adriatic (East European) households consumed prawns. There were a few select species of seafood more favoured among some ethnic households than others. For example, Calamari (squid) and Octopus were consumed by approximately a third of the Adriatic households; Bream, Spanish Mackerel, Scallops and Squid were consumed among a third or more of the Asian households. There were also other species which were consumed exclusively by certain ethnic households. For example Halibut by West European and Red Salmon by Australasian households (ibid, pp. 67-69).

Methods of preparing seafood or cooking methods affected purchasing patterns indirectly. Most unfortunately very little ingenuity was shown in the average 'Australian household' in the cooking of seafood. Among the capital cities of Australia (excluding Darwin), on 40.0 percent of the occasions fish was served 'straight' (e.g., from a can) and on a third of the occasions it was fried (Department of Primary Industry, 1978). In Darwin, however, owing to the greater ethnic mix, there is a wider use of grilling, baking, boiling and other methods for cooking fish. Among the different ethnic groups in Darwin, the Adriatic households appear to have the greatest variety in methods of preparing seafood at home, followed by the British households. Thus, ethnicity as a socio-economic variable had quite distinct influences on aspects of seafood consumption.

Among the sub-groups of religion, no significant differences in seafood consumption were identified, except in 'the day of the week' seafood was consumed. Among the Catholics consumption of seafood on Fridays was marginally higher than other sub-groups, but not sufficiently different to be statistically significant.

The influence of geographic location is best illustrated with reference to per capita consumption figures in select inland and coastal towns of Queensland. For instance whilst the inland towns of Hughenden, Charters Towers and Mareeba had annual per capita consumption rates of 4.7 kg, 5.5 kg and 7.6 kg respectively, Townsville, Bowen and Brisbane located on the coast had rates of 8.2 kg, 10.4 kg and 10.4 kg respectively purely as an outcome of geographical aspect (Bandaranaike, 1981, p. 7).

'Fadonism' in seafood consumption is displayed with reference to the diet conscious sub-group who believe in low-cholesterol and low fat content in seafoods compared with most other food stuffs. In some cultures seafood consumption is associated with fertility and sex. Where these beliefs are upheld seafood becomes popular and considered a 'fashionable item' of consumption. In areas like Darwin, amateur fishing has become a way of life and almost a fad to engage in leisure fishing over weekends and holiday periods. Thus 'fadonism' has resulted in the increased consumption of mainly fresh seafood among various sub-groups in the population.

In summarising the above analysis it is evident that the concepts of family, social class and culture identified separately as explanatory variables of seafood consumption is somewhat inadequate. A much wider concept such as that of psychographics or the analysis of life style patterns would be more appropriate. The latter is a method of segmenting markets based not only on individual socio-economic characteristics of the household, but on related 'Activities,' 'Interests' and 'Opinions' and referred to as AIO analysis (Plummer, 1974).

It was noted that more recently significant changes had taken place in roles within the family, particularly in the traditional role of women. Education and changes in social values have made it possible for more women to participate in the workforce, resulting in greater affluence, increased household income and greater participation in the decision making process. This has also led to a tremendous impact on the eating habits of seafood. For instance it has meant increased consumption of frozen pre-packaged and canned seafoods, the increased incidence of dining at restaurants for the consumption of fresh seafood; and at home, seafood being relegated to a weekend meal. When compared with competing food products, it has also most unfortunately resulted in a decrease in consumption frequency of less than once a month for seafood and an increase in the consumption of meat to more than fifteen times per month among these households.

Life style patterns are also reflected in the counterpart household where the husband is the only person employed, the woman characteristically the housewife looking after several young children, and living on a five acre block away from the city. This sub-group engages in frequent leisure fishing and has a deep freezer full of freshly caught fish. The monthly consumption frequency of fresh fish in this sub-group is four or more times per month and much less in other forms of seafood. The frequency of dining at restaurants is minimal, entertaining is done mainly within the household and takes the form of barbeques where grilled fish is served frequently. The above examples illustrate two of the many psychographic profiles relevant in the marketing of seafood. Some researchers such as Bartos (1976) have given more general psychographic profiles of four types of women in the United States, with no specific reference to commodities purchased.

Life styles are never static, but changing all the time. Households are able to assimilate the life styles of others as a result of constant exposure. In Australia for example, owing to the influence of immigrants there is greater use of herbs and spices in seafood cooking. In turn, the immigrants tend to absorb the life style patterns of the host country.

Further evidence of the influence of psychographics can be seen in the choice of store in the purchase of seafood. In Australia, the main source of purchase of fresh seafood is the retail fish shop. For example in Darwin 49.4 percent of the transactions were made here. These fish shops varied in physical appearance, character and style. Irrespective of class status, ethnic background or stage in the household life cycle, it was found that the choice of individual fish shops was dicated by life style patterns. Among some households it was accepted that some shops were more prestigious, and irrespective of retail price it suited their life style to patronise these stores in preference to others. In some other households, where both husband and wife worked and limited time was available for shopping, seafood was purchased together with other groceries at one-stop shopping centres or at a fish shop located nearest to the workplace.

With frozen pre-packaged seafood life style segments did not appear to influence source of purchase very much. In canned seafood 0.8 percent of the Darwin consumers obtained their purchases from either overseas or inter-state. These householders having been exposed to a particular life style (that of eating a special brand or species of seafood not available locally), insisted on retaining it. A few others -- 0.9 percent of the consumers of smoked fish -- believed it was more healthy and prestigious to smoke one's own seafood, since this conformed to their life style. Another sub-group of households served canned seafood in sandwiches mainly as a lunch time meal. This characteristic while being totally unrelated to any one socio-economic variable, is a clear indication of a life style pattern.

The frequency of eating seafoods at restaurants whilst discussed under household life cycle, in reality is a way of life or a life style pattern. The fact that there was no significant difference between Catholics and others regarding the increased consumption of fish on Fridays as against other days, is once again attributable to life style patterns. Most households consider the end of the week -- Friday -- as a day of rest away from cooking chores. As a result a significant proportion of the households prefer to either eat at a restaurant or purchase fish and chips from a takeaway outlet, thus reflecting a way of life. These examples further illustrate the influence of psychographics on seafood purchasing and consumption behaviour.

Socio-economic variables on their own are inadequate to analyse consumer behaviour and define target markets. The use of these variables in psychographic analysis are of great value in assessing the demand for seafood. However, some concern has been expressed regarding the reliability of psychographic analysis. It is believed that the inclusion of unreliable items in AIO analysis can weaken its predictive power (Nunnally, 1967). There is also the fear of obtaining relationships between variables that may be due purely to chance (Wells, 1975). Feswick et al. (1983) reviews these problems and presents a method of assessing reliability. They conclude "life style analysis has promised much to marketing management, for the first time multivariate techniques were to be harnessed to provide a living portrayal of real consumers... This analysis allows marketing management to concentrate attention on reliable life style components, ensuring a firmer basis for segmentation and target market selection."

When analysing a national market or society in its entirety, we are not looking at a uniform entity but a body composed of various population sub-groups. These individuals within each sub-group have similar life styles, values, culture and attitudes and react in similar ways to environmental stimuli. It is this conformity of behaviour within the population groupings that provides the opportunity to segment markets and tailor products and promotions specifically for these segments. Thus when determining the demand for seafood products nationally or internationally, it is important to understand the processes that affect society in general, and the various market segments in particular. The relevance of socio-economic variables can best be analysed through the use of psychographics. The latter when successfully employed as explicators of consumer behaviour will form the basis of segmentation policies for the marketing of seafood.

Footnotes

1. In statistical literature there has been much debate on the use of continuous variables and the effect of grouped data on summary statistics such as the correlation coefficient. Correlations between two grouped variables play an important role in marketing research and are unavoidable. Morrison and Toy (1982) employ a method for assessing the effect of such groupings and also give some insights into better methods of grouping continuous variables.

2. The capital cities survey (Department of Primary Industry, 1978) did not analyse in detail the relationship between socio-economic variables and consumption characteristics.

3. Correlation coefficient values to illustrate the direct relationship between income and select dependent variables such as average weight of seafood consumed or monthly frequency of consumption yielded for the most part, values that were statistically not significant at the 5 percent level. Yet, it was noted that if other factors like geographic aspect of life styles are taken into consideration together with income, then it becomes an adequately powerful explanatory variable of seafood consumption.

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Fisheries Marketing Information Systems: Trade in Western Europe

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Abstract

A five year project to collect frozen fishery prices and market information on Western Europe is reviewed. U.S. fisheries exports to Western Europe range from $170 million to $290 million of total U.S. fisheries exports of $1 billion. The U.S. fishing industry has historically been characterized by many small and independent harvesters, processors and marketers who do not have the resources to collect information on foreign markets. The National Marine Fisheries Service, the project sponsor, distributes the information collected in weekly price reports and quarterly market analyses reports to the industry. Information collection methods, marketing information system uses and data limitations are discussed for two selected products; frozen salmon and squid. Project findings and plans for continuation are presented.

Introduction

DPRA Inc. (Development Planning and Research Associates, Inc.) a private research and consulting firm developed and operates a fisheries marketing information system in Western Europe. The project is financed by the National Marine Fisheries Service (NMFS), U.S. Department of Commerce. The purpose of the five-year old project is to collect information on prices and market conditions for frozen fishery products. The information is then distributed on a weekly basis to provide timely market intelligence to the U.S. fishing industry.

The Western European countries covered include:

Benelux (Belgium, Netherlands and Luxembourg)
France
Italy
Portugal
Spain
United Kingdom
West Germany

In 1983, U.S. exports of edible fishery products were 601.9 million pounds valued at $907.7 million. U.S. exports of edible fishery products to these nine countries was 101.3 million pounds valued at $140.8 million in 1983. In terms of value these Western European countries account for 16 percent of U.S. exports of edible fishery products. In comparison, U.S. exports of edible fishery products to Australia and Oceania were valued at $19.4 million in 1983 or 2 percent of U.S. exports in terms of value.

The project was started to fill the information gap for species not traditionally harvested in the U.S. and was later expanded to also include high value species. The species covered by the project are presented below.

Cod	Herring	Oysters
Dogfish	Lobster	Pollock
Eel	Mackerel	Salmon
Haddock	Monkfish	Skate
Hake (whiting)	Ocean Perch	Squid

When available, prices and market information have been collected for brill, cuttlefish, crayfish, octopus, orange roughy, shrimp, scallops and sole.

The structure of the U.S. fishing industry is characterized by many small and independent harvesters, processors and marketers. As a result, very few of the participants have the resources to gather foreign marketing information on this project's scale. Moreover the firms with the resources to support foreign market analysis consider the information gathered to be confidential and little information is made available to other members of the fishing industry.

The availability and quality of foreign market intelligence must be increased so that present or potential export markets for U.S. fishery products will be identified and exploited. Timely market intelligence is also necessary to facilitate penetration into foreign markets.

This report will discuss the types of marketing information on Western Europe fisheries trade collected and distributed through this project and will present specific data and data limitations for two of the subject species, salmon and squid. Then conclusions and plans to improve the project are discussed.

<u>Data Collection and Distribution</u>

The market and price information collected for this project are made available to the U.S. fishing industry in weekly reports. Prices for frozen fishery products are collected through contacts with importers, brokers, wholesalers and processors in each country. Only spot information is collected on canned products. Prices are the primary information gathered. When possible prices are collected at the import level which is generally C.I.F. (cost plus insurance and freight). Wholesale prices are used as a substitute for C.I.F. Along with the price quotes, contacts provide qualitative supply, demand and market condition information (for example, supply light, demand slow, and market weak). Prices for each specie are not collected in all countries. Table 1 shows the species and countries reported in 1983.

Table 1. Species and Countries Reported in Western Europe Frozen Fish Market Report, 1983

Species	Benelux	France	Italy	Portugal	Spain	U.K.	W. Germany
Cod	X	X	X	X	X	X	X
Dogfish	X	X	X	X			X
Eel	X		X		X		
Haddock						X	X
Hake (Whiting)	X	X	X	X	X	X	X
Herring	X					X	X
Lobster	X	X				X	X
Mackerel	X					X	X
Monkfish		X	X		X	X	
Ocean Perch		X					X
Oysters		X					
Pollock	X	X				X	X
Salmon	X	X	X		X	X	X
Skate	X	X	X				
Squid	X	X	X	X	X		X

Source: DPRA.

The price and market condition information is compiled and summarized in DPRA's Paris office and then transmitted weekly to NMFS, Northeast Region in Gloucester, Massachusetts. NMFS distributes the information as part of their Fishery Market News Reports. Approximately 5,000 subscribers then receive the information. Extracts of the report are also published in the following publications:

EUROFISH Report (U.K.)
INFOPESCA and INFOFISH (FAO)
British Columbia Fisheries Newsletter (Canada)
Pacific Fishing (USA)

Incidental to the projects' primary purpose, fisheries supply-demand variables or statistics are also gathered for analysis of markets. Supply data collected include:

landings
production
inventories or stocks

imports
exports

Demand related data collected include:

consumption
exchange rates

These data, which are generally not as timely as we would like, are compiled for each quarter and a Quarterly Review Report is prepared. These reports summarize prices and market developments for reported species and highlight developments in foreign markets which affect U.S. exports of fishery products. Specifically this report includes an analysis of exchange rates, regulatory actions in the European Economic Community, general developments in European countries, and a review of market conditions by species.

The Quarterly Review Report also contains a summary of U.S. exports to markets covered. A summary of U.S. exports for 1981 through 1983 is shown in Table 2. U.S. exports to Western Europe are shown to have declined each year for the frozen products specified. In terms of value U.S. exports of these products declined by 7 percent from 1981 to 1982 and by 24 percent from 1982 to 1983. The major reason for this decline is the strength of the U.S. dollar in the export market. Other factors include competition from Norwegian farmed salmon and possibly the 1982 salmon botulism incident.

Table 2. U.S. Exports of Specified Fresh and Frozen Fishery Products

	Quantity (millions of pounds)	Value (millions of U.S. dollars)	Percentage Change	
			lbs.	$
Total U.S. exports of specified fresh and frozen products to the European countries identified				
1981	51.7	77.0	--	--
1982	46.4	71.6	-10.3	- 7.0
1983	42.1	54.6	- 9.3	-23.7
Total U.S. exports of specified fresh and frozen products				
1981	355.7	473.7	--	--
1982	409.4	515.6	15.1	8.8
1983	374.4	462.8	- 8.5	-10.2

Source: National Marine Fisheries Service, U.S. Bureau of the Census.

The statistics for this table were made possible by the NMFS working with the U.S. Bureau of the Census. Prior to 1981, specific fisheries data were not available for most species in the U.S., as is the case with fisheries statistics in most other countries. Without this data prices cannot be matched to appropriate supply and demand variables, making the analysis of markets difficult. As I will show in an analysis of salmon and squid prices in the next two sections, this information is very valuable.

Salmon Market in France

The Western Europe fisheries marketing information system has various uses including analysis of markets. France is an important market for U.S. frozen salmon and was chosen for this brief review. U.S. exports of frozen salmon to France from 1981 to 1983 are shown in Table 3. U.S. exports to France in 1983 of frozen salmon were valued at $21.6 million. This was a decline of 38 percent from the 1982 value. France only accounts for 6 percent of the total value of U.S. frozen salmon exports but is the second largest U.S. export market. Japan accounts for about 80 percent of the U.S. frozen salmon market. The total U.S. market was valued at $356.8 million in 1983.

A substantial part of the French imports of salmon (estimated at 55 to 60 percent) is further processed into smoked salmon. France is almost totally dependent on imports for its supply of salmon. Presently king, coho and chum salmon are preferred but some substitution of reds and pinks has occurred due to increased prices based on the U.S. dollar's strength.

Price ranges for frozen salmon collected for the French market are presented below for 1983. These prices are compared to the average 1983 prices calculated from Bureau of Census information for U.S. exports to France.

Table 3. U.S. Fresh and Frozen Salmon Exports, 1981-1983.

	Quantity (millions of pounds)	Value (millions of U.S. dollars)	Percentage Change	
			lbs.	$
Total U.S. exports of fresh and frozen salmon to France, 1981-1983				
1981	17.6	39.7	--	--
1982	17.2	35.1	- 2.3	-11.6
1983	13.3	21.6	-22.7	-38.5
Total U.S. exports of fresh and frozen salmon				
1981	200.6	368.0	--	--
1982	250.9	405.3	25.1	10.1
1983	237.2	356.8	- 5.5	-12.0

Source: National Marine Fisheries Service, U.S. Bureau of the Census.

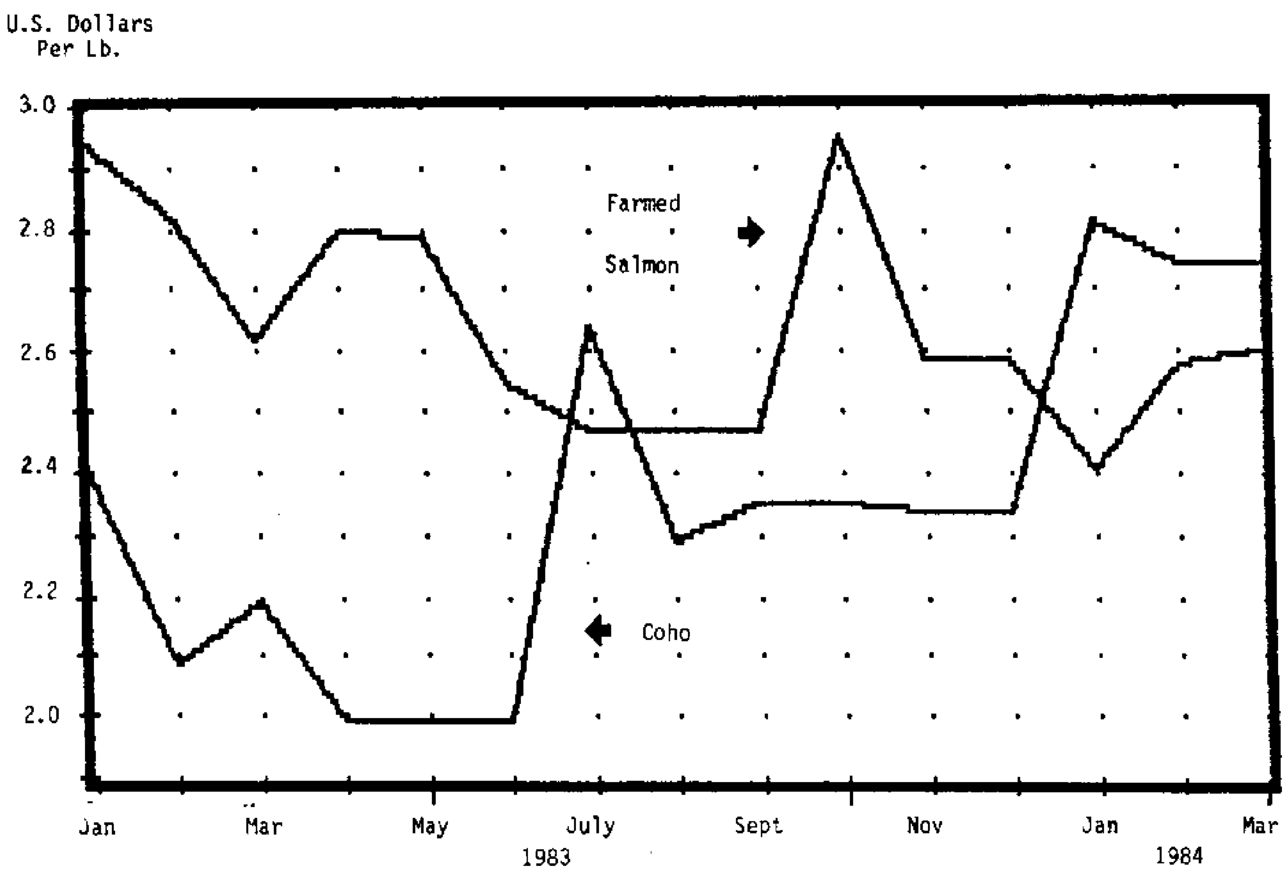

Figure 1. Import Prices on the French Market[1/]

[1/]Troll caught, 6 to 9 lb. coho salmon and 6 to 9 lb. Norwegian farmed salmon prices are used.

Source: DPRA European Weekly Report.

Specie	Collected Price Ranges[1/] $/lb	Average Price[2/] $/lb
King	1.90 - 3.35	2.66
Coho	2.00 - 2.82	NA
Chum	1.10 - 2.60	1.32
Pink	0.65 - 1.42	1.11
Red	2.00 - 2.25	2.18

[1/]DPRA price collected.

[2/]U.S. Bureau of Census estimate.

NA - Not available.

A comparison of prices of coho salmon with Norwegian farmed salmon is presented in Figure 1 for 1983 and the first three months of 1984. In 1983 France imported 2.3 million pounds of Norwegian farmed salmon versus 13.3 million pounds of U.S. salmon. Coho prices are generally lower than for the Norwegian product which is available year around. Only in July, which coincides with the beginning of the U.S. salmon fishing season, and the first three months of 1984 is coho more expensive than Norwegian farmed salmon. Though no specific trend can be determined from this graph it appears that coho prices are increasing while Norwegian farmed salmon prices are decreasing over the period. When prices are converted to French Francs both prices trend upward. A major factor in the market is the effect of exchange rates. Since DPRA started the project in 1979 the French Franc has declined by 50 percent from the U.S. dollar. This greatly influences the affordability of U.S. salmon in France.

Two major data limitations exist for analysis of the salmon market in France. First is the availability of information by specie. U.S. statistics need to be made available on coho salmon. European Economic Community statistics need to be available by species. Finally, inventory or stock data is needed for Western European countries. In working with NMFS on salmon they agreed to provide inventory data by specie. Previously, NMFS grouped pink and red salmon together. Marketing information systems and analysis could be enhanced by this additional information.

There are many other factors which should be introduced into an analysis of market conditions, such as salmon supplies from Canada which exported 13 million pounds of frozen salmon to France in 1983. But this review does present an application of the fisheries marketing information system which could be used by a small firm. DPRA in association with Frank Orth and Associates and Oregon State University produced a more comprehensive review of the salmon market in 1983.

Squid Market in Spain

Spain is a major potential market for U.S. squid exports. Table 4 shows the volume and value of U.S. exports of frozen squid to Spain and total U.S. exports of frozen squid from 1981 to 1983. U.S. exports of frozen squid to Spain have increased from 60 thousand pounds in 1981 to 4.2 million pounds in 1983. U.S. exports of frozen squid to Spain in 1983 accounted for almost 50 percent of the total value of $7.8 million of U.S. frozen squid exports.

Table 4. U.S. Frozen Squid Exports, 1981-1983

	Quantity (millions of pounds)	Value (millions of U.S. dollars)	Percentage Change	
			lbs.	$
Total U.S. exports of frozen squid to Spain				
1981	0.06	0.02	--	--
1982	1.36	1.10	2166.7	5400.0
1983	4.20	3.60	208.8	227.3
Total U.S. exports of frozen squid				
1981	11.24	7.26	--	--
1982	20.17	13.25	79.4	82.5
1983	8.87	7.85	-56.0	-40.8

Source: National Marine Fisheries Service, U.S. Bureau of the Census.

Also in 1983 U.S. landings of squid declined 29 percent in volume from 1982. The 1983 U.S. landings of squid was 37.9 million pounds valued at $10.9 million. During this same period Spanish vessels harvested about 30 million pounds of squid off the Northwest Atlantic Coast of the U.S.

Prices collected by DPRA on squid vary by specie, size and product form (whole or tubes). Squid (Loligo Pealei) harvested by Spanish vessels off the Northwest Atlantic Coast ranged in price from $0.52 to $1.54 per pound in Madrid in 1983. These prices compare to an average estimated 1983 price of $0.85 per pound (from U.S. Bureau of the Census data) for U.S. frozen squid exports to Spain.

The Spanish Peseta has experienced a decline in value similar to the decline of the French Franc over the past five years. A 20 percent decline in value of the Peseta has occurred over the past year.

Squid landings, production and imports in Spain are needed to follow this market on a timely basis. FAO publishes landings data but it is up to 2 years before it is available. The U.S. fishing industry needs marketing information on squid to make market decisions and to commit resources to penetrate this potential market.

Conclusions

Marketing information is required by the fishing industry to make informed decisions. A survey of the U.S. fishing industry in 1983 showed that the rate of use of the Western Europe weekly frozen fish report was 96 percent among U.S. exporters, 94 percent among brokers and 88 percent among exporters. Of the survey respondents over 80 percent considered the report to be usually accurate. Many respondents indicated that they did not have an alternative source of foreign market information.

Marketing information must be timely to be of use. Also there are a variety of supply-demand variables or statistics that are required for analysis of market data. The statistics collected need to be improved in timeliness. It would be very helpful as shown in the example applications for salmon and squid to have data by specie. Inventory or stocks data in importing countries are required to understand these markets. The data when collected needs to be made available to the industry.

Currently the U.S. is cutting back on funds to collect fisheries marketing information without which fisheries marketing information systems cannot be developed or maintained. The U.S. fishing industry being typified as consisting of small firms needs the information to become involved or to further penetrate export trade. The commitment of resources for this effort is required not only in the U.S. but in all other countries where these conditions exist.

DPRA plans to improve its Western Europe fisheries marketing information system by continuing to add species to the list of those currently studied. We will improve access to the system by use of a microcomputer to summarize and transmit information. We will also increase the types of supply-demand variables collected which will enable us to conduct more thorough market analyses. NMFS and the U.S. fishing industry also have ideas on improvements to the system which will be incorporated in the future. Input from other government agencies or members of the International Institute of Fisheries Economics and Trade are welcome.

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Economic Recovery and International Trade in Fish and Fishery Products

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Economists all over the world have been talking in terms of recovery from the grinding 1981-82 recession and they have been scanning the horizon for definite indications to prove this. Such analysis and forecast have normally been attempted in very broad terms of rise in GNP, consumer price index and business investment or in terms of reduction of rate of inflation or unemployment. When it comes to international trade in fish and fishery products, economic recovery does not appear to have had much impact. Apart from general economic factors, other imponderables related either to fishery output or marketing which vary from country to country and from one commodity to another, make the situation too complex for analysis. The purpose of this paper is to give a thumb-nail sketch of the 1983-84 situation with regard to international trade in fish and fishery products.[1/]

It is almost a truism to say that international trade in fish and fishery products depends on world production of fish. In recent years world catches of fish, shell-fish and other aquatic organisms have continued to increase only nominally, following the trend of the late 70's. Thus in 1981, world catch was estimated at about 75 million metric tonnes and in 1982 at about 76.4 million metric tonnes. Preliminary data indicate that the catch in 1983 was at the 1982 level.

The 1982-83 growth rate in the catch of developed countries as a group has only been about 2 percent and this has been offset by a decrease of about 2 percent in the catch from developing countries as a group. The performance of individual countries in both groups has also not been uniform. For example, the U.S.A. recorded an increase of 3 percent but Canada a decrease of 5 percent. All the countries under EEC, showed either a nil growth, or a decrease ranging from 3-7 percent. The growth of other fishing nations like the U.S.S.R., Norway, Japan, Australia, New Zealand, Iceland, and Poland, has ranged from 1 to 12 percent. Among developing countries, significant decrease in catch was shown by Latin American countries, for example Peru (57 percent) and Mexico (27 percent).

Among the reasons for the current slow-down in the rate of growth of fisheries output are no doubt the general decline in economic activity and the increased cost of fishing vessel operation. However, the main cause of this slow-down should still be traced to the actual rate of exploitation of most traditional fishery resources and of the various species of crustaceans and molluscs more recently exploited.

This state of world fishery resources, as you know, has led to the introduction in many fishing areas, of both national and international stock management measures such as total allowable catches (TAC), agreed catch quotas, mesh-size regulation, close reasons, partial or total banning of certain types of fishing, etc. Fishery management programmes are becoming more stringent in the light of the Exclusive Economic Zones (EEZ) declared by many countries. Only a small increase in the catches of coastal states has become apparent due to the implementation of such programmes, whereas a large decrease in the catches of traditionally distant-water fishing nations has resulted following such measures. For example, before 1977 the catch from the distant water fishing fleet of Japan comprised as much as 40 percent of total harvest but today it has declined to about 20 percent. According to OHKUCHI, President, Nippon Suisan Company, Tokyo, Japan, "the establishment of 200-mile zones also produced extensive after-effects even among nations not concerned with distant water fisheries. Excessive investment on fishing boats stemming from speculation on the new fishery regime, resultant overfishing, and resource depletion, inadequate marketing policy and slow development of the processing sector of the industry; coupled with the soaring prices of fuel oil and the general economic depression, led many coastal nations to situations much short of their original expectation".[2/]

Developing nations in turn have been going in for joint ventures, charter programmes and licensing methods for attracting developed nations in an attempt to exploit their own EEZ. Despite these exercises in collaboration, the situation continues to be still fluid in 1983-84 and it may take a much longer time to assess the full impact of these developments on the world fishery output.

Possibilities for any further major increase in world fisheries output appear to be linked to improved management of existing resources and to balanced and reciprocally satisfactory adaptation to new fishing regimes by both coastal and other states which could benefit from access to the surplus of allowable catches of coastal states. Some of the most promising areas for new fisheries development are to be found in the South West Atlantic, the Antarctic and the Indian Ocean. Though many of the developing countries adjoining these areas have programmes to extend their fisheries, the actual implementation of these may take time, since such exploitation will be capital intensive based on advanced technology. For augmenting future supplies of fish, three approaches seem possible. Firstly, post harvest losses especially in handling fresh and cured fish can be minimized. These losses result because of lack of proper chilling and storage, poor distribution and marketing infrastructure, insect infestation, and primitive drying methods. With available technology, this waste can be limited or prevented and about four million tonnes of fish can be recovered. Full utilization of small pelagic catches which are so highly seasonal, will also yield an extra twenty million tonnes of fish. At present these go to waste or get reduced to fish meal due to the inadequacy of infrastructure to cope with such peak loads for a short time. Proper use of by-catches from trawling especially for shrimp should also yield about 5-10 million tonnes of fish. At present these are thrown away into the sea, to conserve storage space or board the fishng vessels for shrimp which has about fifteen times greater value. The difficulties of collecting and utilization of this by-catch, however, are great.

Secondly, diversification of effort to the less conventional resources should also yield further quantities of fish. Oceanic cephalopods, mesopelagic species, and krill can be exploited on a massive scale, provided massive technological and financial inputs are forthcoming for this purpose. Thirdly, development in aqua-farming in fresh and coastal waters, of a number of varieties of fish, crustaceans and molluscs can also increase output. Though aquaculture activities are developing rapidly in many countries including a large number of developing countries, progress achieved so far has not been significant. The annual output from aquaculture is currently estimated at 6 to 7 million metric tonnes, i.e., about 9 to 10 percent of world catches. Though experts agree that aquaculture production can be increased four to five times, this may require concerted action in all countries.

The stagnation noted about in world fishery production is also reflected in the current volume of international trade in fish and fishery products. The total quantity of fishery products entering international trade in 1983 has declined though there has been a slight recovery in the prices of many products. However, there has been little or no change in the total value of international trade. The total import of fishery products has come down from 10.3 million metric tonnes to 9.65 million metric tonnes, recording a 6 percent decrease. The value has remained around 16.6 billion U.S. dollars. Similarly the value of exports has recorded only a nominal increase of 1 percent in 1983 from the 1982 level. The exports have increased from 15.26 billion U.S. dollars to 15.48 billion U.S. dollars. Trade in the developed countries during 1983 appears to be taking a much longer time to recover from the recession than in the developing countries. The developing countries have recorded an increase of 3 percent over the 1982 figure in the value of exports, i.e., from 6.49 billion U.S. dollars to 6.68 billion U.S. dollars.

The 1982-83 increase in growth of exports has been significant only in a very few developed countries like Norway (10 percent), France (8 percent), U.K. (9 percent), and Japan (12 percent). Other developed nations have shown either a negative or nil growth rate. Among developing countries, Mexico, Peru, Brazil, Korea, and Pakistan have shown a decrease in exports and others have shown only a nominal increase.

On the import side, Japan has shown an increase of 9 percent in quantity, though the value has gone down by 1 percent. The U.S.A. has recorded an increase of 20 percent by value and Canada 19 percent. In the EEC, France and the U.K. were the principal countries recording an increase and four other countries, Denmark, F.R.G., Italy, and the Netherlands have reduced imports. The most severe decrease has occurred in Spain (20 percent by quantity and 25 percent by value). Import data for developing countries show an overall fall of 15 percent in terms of quantity.

To illustrate further the complexities of international trade, two commodities can be studied as examples: (Viz.) shrimp, and tuna.

I. Shrimp

Shrimp landings in various countries showed improvement in 1983 and more shrimp was available in the international trade because of this increased production, and because of the fact, that shrimp is a major foreign exchange earner for developing countries. Cultured shrimp from Ecuador, and Asian-Pacific countries, gave rise to increased exports. Iceland and Norway had good cold water shrimp landings. Decline in U.S. domestic production, and the high U.S. dollar exchange rate attracted imports into the U.S.A. Import into Japan and Europe became more expensive. In the U.S. market, prices for frozen shrimp ruled high and consumer demand was good, and the U.S. market was stable during 1983. In the Japanese market, the year 1983 started with relatively high price levels for frozen shrimp, and poor demand. This resulted because of speculative over-buying by Japanese importers at very high prices during the last quarter of 1982. The resulting high prices were rejected by many final consumers and the demand fell and traders were forced to decrease their selling price, often losing money due to sales below the original purchase price. Unfavorable and unprofitable conditions prevailed throughout most of 1983. By early 1984 Japanese trading companies, because of this bad experience, began to quote prices, directly linked to prevailing domestic market prices, without speculating about the future.

Imports of frozen shrimp by most European countries increased though trading was dull and profitability low. The market followed generally its traditional periods of low and high demand during the course of the year. The European market was affected by the strength of the U.S. dollar against most European currencies, the domestic landings of cold water shrimp and the depressed market conditions in Japan during the first half of 1983.

In the case of canned shrimp, imports by the U.S.A., the world's largest market increased in 1983 by almost 150 percent, the largest supplier being Thailand. In the U.K., the largest import market in Europe, imports increased by just under 3 percent. The strong U.S. dollar tended to attract imports away from Europe. Prices of canned shrimp also changed very little.

On the relatively long-term prospects, a recent ADB/FAO (INFOFISH) study states:

"Growth in the period up to 1990 is expected to be slow in both the U.S. and Japanese market. Europe presents the likelihood of more rapid growth in usage of tropical species but from a much smaller base. Lack of growth in supplies has been seen to affect prices and to cause increased competition between buyers in the major markets. There is no reason to suppose that this situation will change in the short term. By 1990, cultured shrimp is expected to have a significant impact on world supplies.

In recent years, world markets have felt the impact of high inflation and the general economic slowdown. Unusually high interest rates have had a serious impact on costs and have tended to reduce speculation, since both producers and buyers have been unwilling to hold product in anticipation of higher prices owing to the high cost of maintaining unsold inventories. Fluctuations in exchange rates in the major markets have caused dislocations in trade and changes in the competitive position of buyers in relation to their suppliers. These factors are expected to continue to affect both the markets and the producers in the years to come."[3/]

According to this study, expansion of the three major markets is expected to come from imports, and the projected annual growth rate is very nominal -- Japan (1 percent), U.S.A. (1 percent) and Western Europe (5 percent).

Another recent study on the subject by the International Trade Centre, has the following generalization to make:

"The general view of the trade is that the world market for shrimps will continue to expand during the next decade, although at a much slower rate than in the previous decade. This rate will hinge on a rapid improvement in aquaculture technology, increased investment in aquaculture and a recovery from the current world recession.

Although ITC has not undertaken an econometric analysis of the various markets, their characteristics suggest that in most of them, i.e., the United States and Europe, demand is income rather than price elastic. In these markets, demand is therefore largely dependent on the level of real disposable incomes.

There are, however, significant differences between the two markets. First, whilst the United States market is largely homogeneous in terms of product form and presentation, the European market varies greatly from country to country and even within countries. Although the degree of uniformity is increasing, these differences are likely to persist in Europe in the foreseeable future. Second, whilst prices in the United States depend considerably on the size of domestic production, the European market is influenced to a greater extent by the behaviour of the Japanese market. Third, it appears that whereas per capita consumption in the United States has leveled off, this consumption is at a relatively low level in most European markets and is believed to have considerable potential for expansion.

In Japan, demand seems to be more price elastic, and the prospects for increased imports will largely depend on the attainment of more favourable real prices for shrimps in comparison with those of competitive food products. In the short term the value of the yen vis-a-vis other currencies, and the United States dollar in particular, will be a key factor. In the longer term increased availability of supply from aquaculture will be a major determinant of the size of imports.

In summary, the longer term outlook for the international trade in shrimps to 1990 is for continued growth, albeit at a notably lower rate than in the 1970's. The increases in real prices of shrimps that characterized the 1970's are unlikely in the later period; the sensitivity of Japanese demand to price rises and the developed countries' slow emergence from the recession and low real disposable incomes will exert a downward pressure on prices. However, as in the 1970's, the trade will probably fluctuate appreciably, with periods of high demand and increasing prices succeeded by periods of slackness.[4/]

II. Tuna

In general, the international tuna market remained depressed throughout 1983 due to continuing over-supply of most species especially skipjack and yellowfin. The sluggish demand and low prices which was a feature of the second half of 1982 continued in 1983 also.

The largest import market for tuna is the U.S.A. (about 249,000 tonnes in 1983) where demand is mainly for canned tuna. Stocks of canned tuna, which built up during 1982 due to consumer resistance to high price, had to be sold in 1983 at lesser prices. During the second half of 1983, consumers had to reduce production. Ex-vessel prices and import prices of tuna did not recover throughout the year.

The situation in Japan, which is the largest country market for fresh and frozen tuna, was much better. Total 1983 supplies were well above 1982 level. Imports in 1983 totalled 146,241 tonnes. The high grade sashimi meat enjoyed a strong market trend during most of the year, whereas lower grade sashimi meat was not in much demand. In 1983, Japan increased its exports of fresh and frozen tuna by 31 percent.

The European market, contracted in 1983 mainly as a result of consumer resistance to high prices. Spanish imports for example fell by about 49 percent and Italian tuna imports by about 10 percent.

According to a recent report by FAO/INFOFISH, prospects of the U.S. and Japanese economies, the two largest markets for tuna, look relatively bright for 1984. It is not immediately apparent, however, that an increase in purchasing power will result in an expansion of demand.

Demand for canned tuna in most markets appears to have become extremely price sensitive and packers appear to be pessimistic of pushing up both volume of sales and price in the short term. Many packers in the U.S.A. and Europe are working with narrow or nonexistent price margins. The trend to move canning operations to locations which are closer to major fishing grounds and which offer cheaper labour, is likely to continue. For similar reasons, packers in the Asian/Pacific region are likely to benefit.

Whether looked at from the point of total world fishery output, or the total volume of international trade, the immediate impact of economic recovery is not so dramatic especially in developing countries. Other non-economic parameters also appear to influence the situation. The current strength of the U.S. dollar, as explained earlier has had some effect in affecting the direction of trade, and also the developmental activities of some countries. With a strong U.S. dollar, nations which make their purchases in that currency have reduced imports, at the same time trying to develop their exports in terms of the U.S. dollar. The trade in and between developing countries is being mostly continued in U.S. dollar, and this has had a definite influence on the direction and volume of trade.

Even in a country like Japan, according to a recent report, "...the fishing industry is burdened by heavy debt and faces dull growth in fish consumption, factors that threaten to force a shake-out of as much as 20 percent of the industry in coming years -- Loans outstanding to the fishing industry as a whole exceed its annual sales. Many small and medium enterprises are struggling to avoid going deeper into debt but must borrow to cover operations and the government is encouraging a shrinkage of the number of enterprises in the industry so as to enable the survivors to make satisfactory profits."[5/]

In most developing countries, the industry is in the hands of small companies, and their size frustrates the introduction of new technology and management. International prices have not kept pace with the increased costs of production and ocean freight, and thus there is not much inducement to export.

Apart from these factors, the per-capita consumption of fish in many developed countries does not appear to rise considerably, due perhaps to competition from livestock products. According to Prof. Buzzell of Harvard Business School, U.S.A. per-capita consumption in the U.S.A. was 12.3 pounds in 1982 compared to 12.5, ten years ago, while poultry increased from 51.1 to 64.1 pounds.[6/] One explanation for this low level consumption is the amount of other meat products produced. Seafood is least often prepared at home in comparison with beef or poultry. The Institute for the Co-operative Study of International Seafood Markets, in its working paper No. 1 has stated, "Even though Americans do not cook fish at home as often as other meat items, they do tend to order it in restaurants. Therefore, it is reasonable to expect that consumption of seafood would rise and fall in response to real income levels, assuming that restaurant dining increases as personal income increases."[7/]

The Japanese fishing industry also faces the possibility of long-term stagnant domestic market due to competition from meat and poultry whose prices have remained fairly stable, in contrast to fish prices which have risen steadily. Since 1975 the consumer price index for fish (1975=100) has risen to 162, while the price of food in general has risen only to 135 and that of meat to only 110. As a source of protein, fish has come down from a level of 80% in 1955 to about 45%. Out of the total daily animal protein in-take of 39.7 gm by Japanese in 1981, only 18.1 gm came from marine products.[8/]

Static or declining consumption of seafood, calls for aggressive marketing, including in-depth consumer research. The industry has to educate the consumer in the value seafood has for them. One has to define the species, the geographic areas, consumer preferences, and demographic attitudes, to plan effective marketing strategy. The National Fishery Institute, U.S.A., has already taken up programmes for market promotion in the U.S.A. The Fisheries Council of Canada has plans to do consumer research in the U.S.A. and direct generic promotion in Canada. The Japanese industry is now attempting publicity campaigns to promote fish as a food low in cholesterol, rich in vitamins and low in calories in order to prevent further erosion of consumer preference.

Each country has its own tastes and requires meals based on its particular traditional dietary pattern. Unless a seafood product matches the requirements of the particular market, sometimes even segments of a local market, it will not stand any chance to be sold. What is most important is to produce the best possible product of a quality that is demanded by a particular market. Sound market promotion, depends again on sound quality of the products offered for sale. To maintain the quality of seafood which is so perishable from the moment the fish is caught at sea, to the moment it reaches the consumer in a far-off country, is a very difficult task indeed and unless proper infrastructure is built all along the way, especially in developing countries, this will well-nigh be impossible. International trade in fish and fishery products can be expanded only on the basis of quantity, quality and consistency of products and not on the basis of short-range speculative buying and selling. Here is the challenge for the future.

Unfortunately, the persons engaged in the seafood trade, are doing business on a day-to-day or even an hour-to-hour basis, and such macro-level analysis, in a global perspective, as I have indulged in now with your kind cooperation normally will not interest them.

It is in this context, that international conferences like this, become relevant, at least in the sense, that some awareness, trickles down the line about what is happening in the world as a whole, and what one can realistically expect in the future. Internationalization of fishery trade means that changes for good or bad, taking place in one part of the world rapidly spread and influence other parts of the world and they are often difficult to predict due to the increasing complexities of the market. Let us therefore hope that this conference will enhance mutual understanding through good communication among us and others concerned with international trade in fish and fishery products.

Footnotes

1. The analysis is based mainly on "Fishery Commodity Situation and Outlook 1983/84" - FAO's Fish Utilization and Marketing Service and INFOFISH, June 1984.

2. Quick Frozen Food International. January 1984, p. 63.

3. ADB/FAO INFOFISH. Market Report Vol. (3) Shrimp by Robin Rackowe. March 1983 - (Page VI).

4. Shrimp:- a survey of the world market. International trade centre. UNCTAD/GATT. GENEVA 1983 (Page - 4).

5. Far Eastern Economic Review. 2 August 1984, Page (36).

6. Quick Frozen Foods International. January 1984, Page 60.

7. Seafood Production, Markets and Policies. Institute for the Co-operative Study of International Seafood Markets. July 1982 (Page 121) (Oregon State University, U.S.A.).

8. Access to Japans import Market. Frozen fish Japanese. External trade organisation (JETRO), January 1984 (Page 13).

The New Ocean Regime: Implications for International Seafood Trade

Changes in Principal Factors Influencing International Trade in Fish and Fishery Products

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1. Introduction

In the paper the principal factors of influence since the mid 1970s will be discussed. Assuming that the new regime for fisheries following the general introduction in 1976 of the 200-mi EEZ in most parts of the world, has had a significant impact on the pattern of international trade flows. However, other factors of potential influence neither being equal, nor static, are considered as well.

A brief, introductory presentation of the trade as can be seen from Table 1, comparing annual average world trade in food fish for the six years 1971-76 with that of the six years 1977-82, there has been an increase in the world exports volume size of 45 percent. In the corresponding periods there has been a 17 percent increase in the world production of food fish, and a corresponding increase in total world catch of fish.

In value terms, there was in the same period an increase in the world exports of 161 percent. The higher growth in the value of the world trade can partly be explained by inflation and partly by above average growth in high value products. The rapid growth in trade around the world since the 1970s can be seen in shrimp, salmon, crab, tuna and hake, which have become thoroughly established international market commodities.

Table 1. World Trade of Food Fish by Product Groups, Annual Average 1971-76 and 1977-82.

	Volume, 1000 t			Value, million US$		
Product Groups	1971-76	1977-82	Change 1977-82 (%)	1971-76	1977-82	Change 1977-82 (%)
Total production	21,973	25,755	17	--	--	--
Total exports	4,602	6,650	45	4,671	12,221	161
- fresh/frozen fish	2,629	4,128	57	1,798	5,048	181
- cured fish	471	467	-1	515	1,104	114
- canned fish	743	890	20	869	1,803	107
- fresh/frozen/cured crustaceans and molluscs	671	1,038	55	1,256	3,719	196
- canned crustaceans and molluscs	88	127	44	233	547	135

Source: FAO, Yearbook of Fishery Statistics, Vols. 41, 47, and 55.

Statistics of the world trade in sea food products show that the main flows of exported fish and fish products have been and continue to be, irrespective of country of origin, toward more advanced nations. In fact, large importing countries are also substantial exporters and vice-versa. Comparing the annual averages for the years 1972-75 with 1979-82, developing countries increased their share of world exports volume of food fish from about 1/4 to about 1/3, and considering regional differences, mainly accounted for by Asian region, but also by Latin American region. Eastern European, including USSR and OECD countries as groups, had declining shares of world export, but within the OECD groups, the position of the EEC remained largely unchanged. Developing countries also increased their share of world import volumes to about 1/4, mainly accounted for by the African region, while imports to the OECD group declined and the position of EEC within this group remained unchanged. Developing countries increased their share of world catch of fish from 43 to 47 percent -- the increase accounted for by the Asian and the Latin American regions. The share of Eastern Europe including USSR remained stable around 15 percent, while the share of OECD declined from 40 to 37 percent within which the share of EEC remained stable around 8 percent. A comparison of the OECD countries' share of world catch and world trade shows that these countries, and especially the EEC countries, are the most active traders. Developing countries estimated share of world exports in value terms have increased gradually from 37 percent in 1977 to 43 percent in 1982.

2. Changes in Principal Factors Affecting International Trade in Fish and Fishery Products

2.1 Changes in the access of resources

The Exclusive Economic Zones (EEZ). The new regime for fisheries was expected to change the fish production patterns and the international trade in fishery products, e.g., one should have expected that nations which before the introductions of the EEZ were highly dependent on distant-water fleets for supplies, would have a higher than average fall in catches and/or export and/or a higher rise in imports, while fishing nations with long coastlines and no previous long distance fleet of significant importance would have a higher rise in catch and/or exports and/or a higher fall in imports than the average. Hence, a reduction of catches was to be foreseen for countries like China (Taiwan Province), Japan, Republic of Korea, Poland, Spain and USSR, in particular of the species traditionally caught by their distant-water fleets. A corresponding increase in imports was to be expected.

Between 1973 and 1982 landings by Japan's distant-water fleet were about halved to 2 million tons, due mainly to lost access. Japan harvested 44 percent of its marine fisheries catch within 200 mi from the coasts of foreign states in 1974, less than 30 percent in 1977 and less than 20 percent in 1980. Spain, the country that lost more, in absolute terms, under the redistribution of resources than any other OECD country with the exception of Japan had catches regularly exceeding 1.5 million tons in the early 1970s. By 1979 the Spanish catch had declined to less than 1.1 million tons. The distant-water catch of the Republic of Korea and China (Taiwan Province) were by the mid 1970s around 500,000 t and 300,000 t, respectively. The USSR's distant-water fleet which was the world's largest, was by the early 1970s taking almost 4 million tons from foreign waters in the Atlantic and another 1 million ton elsewhere. In 1975, Poland's distant-water catch was almost 600,000 t. That of the German Democratic Republic around 300,000 t, and Bulgarian and Rumanian about 150,000 t combined catch.

However, a change from distant-water catch to imports, has so far only partly taken place. Total imports of all fishery products to Japan increased by 90 percent when comparing the years 1970-76 with 1977-82 while imports of the two most important product groups, crustaceans and molluscs, and fresh and frozen fish increased by 76 percent and 122 percent, respectively. Japan's overall catch increased by 7 percent from 1976 to 1981. The reduction in the distant-water catch has been offset by an increase in the abundance in their own waters of sardines, mackerel, and other low-priced species. Although there was no substantial change in the total catch, imports increased because these species could not substitute the ones caught previously. In Spain total imports of all fish products increased on an average of 28 percent when comparing the years 1970-76 with 1977-82 (fresh/frozen fish 67 percent, cured fish 26 percent, and crustaceans and molluscs 31 percent). There has also been a growth in the imports of fish products to the USSR and other Eastern European countries. But the reduction in the catches of these countries have not been offset by increases in the volume of their imports. Despite significant reductions in the catches of demersal fish by the fleets of these countries, there has yet been no corresponding increase in the imports of such species.

Considering the countries with long distance fleets before the mid 1970s and comparing the annual average import volumes of 1972-75 with 1979-82, recorded imports to Republic of Korea, Japan, Poland, Spain and USSR, support the hypothesis of increased imports, while imports to other COMECON countries declined. Bulgaria, Cuba, Republic of Korea and USSR had moreover, substantial increases in exports.

The most favoured policy of nations that have lost the free access to traditional fishing waters, has been to increase participation in the exploitation of the resources within the EEZ of other countries or unexploited areas not under the jurisdiction of coastal States. Various methods with different impact on trade have been in operation:

- by establishing new bases abroad, what was the initial reaction of US tuna firms. New bases were established in Guam, Puerto Rico and Samoa, from which the fleets operated, and supplies were contracted from a few developing countries affiliates, particularly in West Africa;

- by establishing joint ventures between companies, private or public, in the countries with extended fisheries jurisdiction and foreign fishing companies whereby the vessels of the joint venture take the flag of the coastal State and land fish for transshipment. This is the most common practice in developing countries. Companies from Japan, Republic of Korea and Spain have been especially active in this area, particularly in Latin America. Imports of tuna to the USA have recently increased from countries which offer transshipment facilities to the increased international tuna-catching fleet in the Western Pacific, e.g., Kiribati and Singapore;

- by extending the latter option to include processing and exportation with the joint venture operating the processing plant and other shore facilities and the foreign partner controlling the marketing. Again companies from Japan, Republic of Korea and Spain are especially involved;

- by developing fishing abilities for deep-sea fishing outside the jurisdiction of coastal States like the Polish and Soviet distant-water fleets that have chosen to develop such operations in addition to operations within other nations coastal waters. Of total Polish catches of about 600,000 t, nearly two thirds come from factory trawlers operating in distant waters. In 1983 Soviet catches reached on a preliminary basis 10.10 million tons, which is at the level of the previous peak of 10.13 million tons obtained in 1976. There have been significant shifts in the geographical pattern of fishing by these countries, which has resulted in southward move, including the Antarctic region;

- by interpreting the new fisheries regime differently, e.g., whether or not highly migratory species like tuna which was traditionally caught by US vessels in Latin American waters should be excluded from the jurisdiction of the coastal States. Difficulties in reaching agreement between USA and countries like Congo, Costa Rica, Ecuador, Mexico, Peru and Senegal led to seizure of US tuna vessels fishing within their 200-mi EEZs. In retaliation the US authorities placed embargoes on tuna imports from these countries;

- by importing raw material for further processing in replacement for the fish previously caught by own fishing fleet.

Recorded trade figures for countries with long coastlines and no previous long-distance fleet of significant importance, support the hypothesis of falling imports and/or increasing exports in the case of Argentina, Brazil, Chile, India, Morocco and Peru among developing countries and Australia, Canada, Faeroe Islands, Iceland, Ireland, New Zealand, Norway, UK and USA among developed countries. Fishing nations with relatively short coastlines which have also increased their exports of food fish, such as Denmark, Federal Republic of Germany, Hong Kong, Ivory Coast, Republic of Korea, Netherlands, Panama, Sweden and Yugoslavia. A comparison of periods 1972-75 with 1979-82 shows that the island States in the South Pacific did not increase their exports.

Different policies to promote exports have been adopted by countries that have been in the position to utilize the catch within their EEZs:

- by seeking to take up as much as possible of the TACs within their EEZs and expand their fishery exports to levels they would otherwise not have reached, through over the side sales, a strategy followed by USA (mainly Alaskan waters), Iceland, Norway and UK (especially to the USSR);

- by linking concessions to fishing right, to admission to foreign markets in order to promote fishery exports and/or get assistance in fisheries development. Canada and Norway give access to EEC vessels in return for tariff concessions in the EEC market. Canada also has been given access to the Portuguese market for salted/dried fish. In USA legislation exists which links the access of foreign fleets to US fishing grounds to foreign concessions in trade policies and to the obligation to assist US fisheries development. Foreign vessels take about half of all commercial fish harvested in US 200-mi zone.

Limitations on fishery resources. Before the extension of the EEZs the stocks most heavily exploited among the traditional food fish species were herring and mackerel in the northeast Atlantic and Californian sardine among the pelagic species, and cod and haddock in the North Sea and Alaska pollock in the North Pacific among the demersal species. A FAO report concluded that by 1970 the stocks that were either fully exploited or depleted in the northeast and northwest Atlantic were cod, haddock, hake, saithe, redfish, herring and mackerel.

To date, many of the stocks have not recovered despite the adoption of control measures. The current state of exploitation of the main stocks shows improvements in only a few cases. Iceland has generally been more successful than others in rebuilding its stocks, e.g., cod, haddock and herring. For most other countries the problem of overfishing has not been resolved. Adjustment has been more gradual, i.e., fishing intensity has not decreased because of the problems associated with the allocation of shared stocks, partly intensified by various social considerations, and the lack of alternative deployment opportunities. The state of exploitation by 1982 indicates an excessive level of exploitation for about two-thirds of Northeast Atlantic stocks. In the Northwest Atlantic the management problems were less difficult as most stocks are located within the EEZ of Canada and the USA, i.e., only two nations. Here adjustment has been more rapid, and the effects of coastal State management have, generally, been positive.

Considering imports and the product groups where most of the scarce resources are utilized as raw material, i.e., fresh and frozen fish, imports have increased substantially to EEC countries, but whether this rise in imports is due to increased demand as replacements for reduced catches, or due to other factors, is difficult to evaluate.

Sudden fall in catches of other species with an obvious effect on trade and changes in sources of supplies are:

- the poor shrimp harvest in USA during the last three years with a following re-orientation of suppliers on the world market;

- the fall in the supplies of crab from US landings since 1980 was a most significant factor influencing the international market and sources of supplies;

- the near depletion of the South African pilchard sardine stocks and the substantial fall in the Peruvian catch of pilchard sardine caused a significant change in world trade of canned pelagic fish in 1978 and 1983, respectively;

- the near depletion of the herring stocks in the North Sea in the late 1960s had a substantial impact of the trade and consumption of herring in particular, but also various other small pelagic species utilized as substitutes, and with the recent recovery of the herring stocks, the replacement species have experienced and will continue to experience set-backs.

However, to what extent changes in supplies, like those mentioned above, have influenced total trade in fishery products in the period after the extension of the EEZ is difficult to estimate.

2.2 Changes in costs of production

Cost of labour. Labour costs of fishery products vary according to type of products and/or country of production in that similar products may be produced by more or less labour-intensive processes in different countries. An example is shrimp, which in some countries are peeled manually and in some countries by machines. Whether fisheries products are labour-intensive or not is a matter of type of product and what products they are to be compared with.

A common view is that producers in developing countries have a comparative advantage compared to competitors in the western world due to low labour costs. An example is the following argument: many tuna packers in the USA and Western Europe are working with very small margins on an extremely price-sensitive market. The Asian packers and particularly those in the developing countries, e.g., in Thailand and increasingly Indonesia, which have low labour costs and are relatively close to fishing areas, have thrived in this market situation. In the tuna production, wages in the tuna fleet in France as percentage of total operating cost from 1975 to 1981 increased from 27 percent to 35 percent.

Four countries with semi-industrialized economies in Asia, Hong Kong, Singapore, Republic of Korea, and China (Taiwan Province), have experienced rising labour costs (OCED, 1984).

A reliable impact of changes in the intensity of labour and changes in cost of labour on the total world trade in fisheries, is not within reach for this study but it is reasonable to believe that the trade of products supplying highly competitive markets and/or products with high price elasticity of demand, such as the trade in tuna at present, cost of labour probably have a decisive impact on the origin of supply.

Cost of energy. The effects of the two major oil crises in 1973 and 1978/79 on the fishing industry have been summarized by OECD as follows: not all countries were affected to the same extent because of the structure of their fishing fleets, national oil pricing policies or national currency fluctuations vis-a-vis the reserve currencies. Among the fisheries hardest hit were those deploying active technologies, e.g., groundfish trawling, purse seining, etc., and distant-water fishing in general. On the other hand, those fisheries utilizing passive technologies, e.g., longlining, gillnetting, setnets, etc., and coastal fisheries were less affected. National oil pricing policies are also divergent, as is indicated in the following summary of average domestic prices for light fuel oil, including tax, over the period 1978 to 1982. Taking 1978 as 100 the price per metric ton in national currency reached in Australia 272, Canada 234, France 278, Federal Republic of Germany 255, Japan 273, Norway 271, Spain 485, UK 242 and USA 254. Some governments provide financial support to promote improved fuel economy (EEC), while others give low interest or interest-free loans to enhance productivity within the fishing industry in general (USA and Japan).

Cost of credit. An effect of the disruption in the world economy during the 1970s was increasing interest rates from 1977 onwards. When the negative effects of the high interest rates become more powerful in the early 1980s as did the effects of the present recession, many developing countries were squeezed between stagnated foreign exchange earnings and soaring interest payments on their debt. Middle-income developing countries which in the 1970s had increasingly relied on the private credit markets for foreign capital, have during the last couple of years had to face declining supplies from this source thus making loans for the industry scarce and expensive. Some OECD countries give low interest, long term or interest-free loans to their fishing industries with the objective of promoting fish farming, innovation, improve productivity, construction and maintenance of vessels, equipment and buildings.

2.3 Technological innovation

Technological development also influences production and trade of fisheries products. In the 1970s introduction of new technology with partly substantial effect on the world trade has taken place in production methods and in product development. Examples are:

- cultured shrimp production has reached a significant impact on the world trade. Production increased in 1983, especially in Ecuador and in Asian countries. Counting Ecuador alone, aquaculture represented about 13 percent of US imports of shrimps;

- fish farming in general is undergoing a rapid development; examples are governmental programmes for financial support of aquaculture development in Japan, New Zealand, Sweden and the EEC. Exports of farmed salmon from Norway has reached levels of significant importance for this country;

- squid tubes processed and frozen on board Polish factory vessels using a new technology is another example;

- the technology for the manufacture of imitation or substitute seafood products has been developed in Japan. Industrial production for exports of crab substitute made from Alaskan pollock had in 1983 reached 18,800 t. Fish technologists in a number of countries are working on such products.

Other factors which may be relevant for changes in the international fish trade are the role of transnational corporations and their production and marketing strategies, the adaptation capability of developing exporting countries to changing market conditions and the related constraints with regard to technical and managerial skills. Furthermore, an analysis of investment projects in fisheries could determine whether the type of investments financed had a significant impact on international trade, e.g., by improving production systems, communications, financing, etc.

3. Consumer Demand

3.1 Food habits

The demand for food products in general and fish, in particular, is relatively stable because food habits change only slightly and slowly. However, the abundance and variety of food products available to the populations of the developed countries, permit substitutions which the modern corporations are quite ready to exploit. The resulting changes in demand are facilitated by greater availability of substitute raw material due to the increased international fish trade. Established fish species must then compete in the market with new fish species and products, as well as meat and meat base products, thus, facilitating replacement of the species of which supplies may have been lost due to exclusion from traditional fishing grounds or overexploitation of stocks.

While fish has often in the past, i.e., until some 30-40 years ago, been a relatively cheap food with dried/salted cod and salted herring dominant in international trade, today there is a whole series of what may be called luxury products in the trade. This trend toward a relatively higher consumption of luxury food is in accordance with theoretical explanations like Engel's law which is further elaborated by more recent theoretical and technological explanations of trade, such as Staffan Burenstam Linder's representative demand hypothesis (Linder, Staffan Burenstam, 1967) which draws a connection from income to tastes to technology to trade as follows: a rise in per caput income shifts a nation's representative demand pattern toward luxuries that the nation can now afford. This new demand causes producers to come up with improvements in the technology of supplying those goods in particular. Their gains in productivity actually outrun the rises in demand that caused them, leading the nations to export these very luxury goods and to lower prices. It would be worthwhile investigating whether or not this concept is valid for fish, in particular if a distinction is made between products originating from developed and developing countries.

However, there has been a rising demand for both conventional and luxury fish during the last quarter of a century, especially in developed countries. An example is the pattern of consumption in Japan where a growing preference for western-style food has led to a shift away from the traditional staples of rice and fish toward more bread and meat. The rise in demand for both conventional and luxury fish has attracted a number of food processing firms into the industry thus adding to increased consumption and trade in value added fish products. An example of the capacity of internationally operating firms in changing market demand is the recent changes in the international tuna trade. When Japanese firms lost ground in its traditional markets for canned tuna in the UK and USA, they made up for those losses by development of new markets, e.g., in Switzerland, the Near and Middle East and in South Africa. This implies also a change in the demand structure of these countries. Similarly, in some countries, e.g., in Africa and in the Caribbean the market for salted/dried demersal fish from Northern Europe was developed when prices were low. As prices have risen, imports by these countries have slowed down. These have partly been replaced by cheap canned fish.

3.2 Product quality

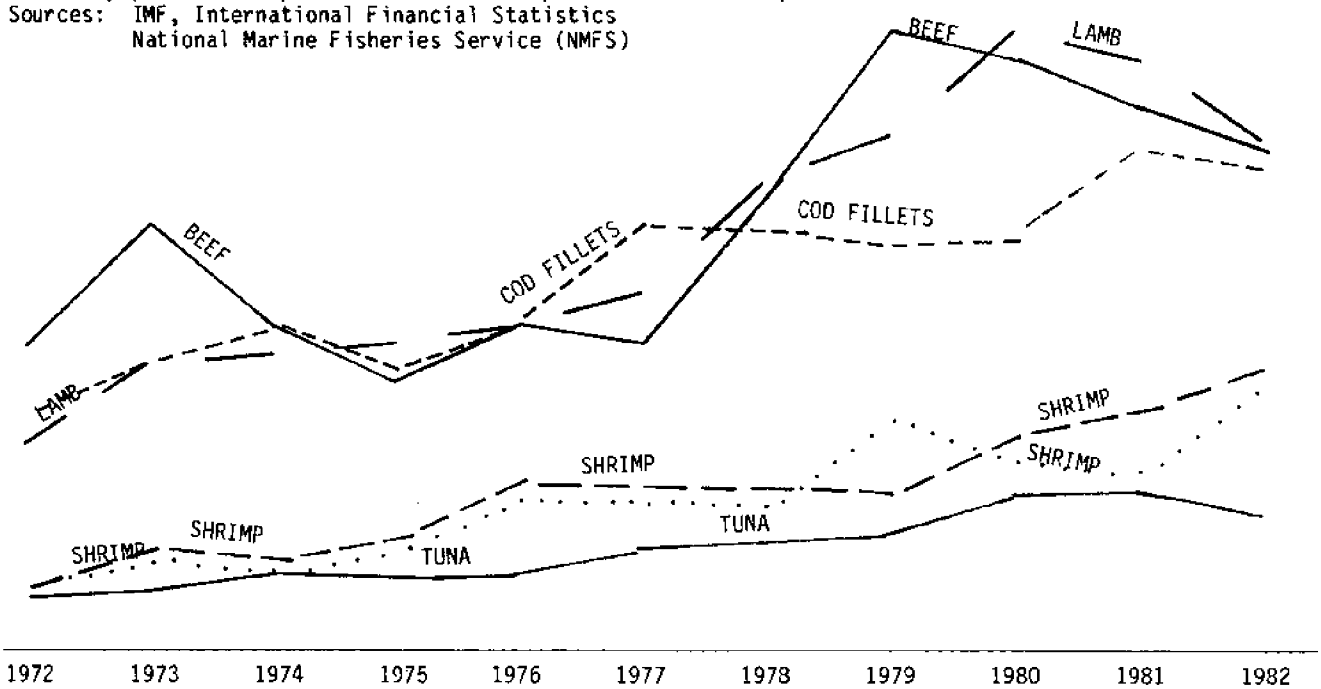
Consumers' perception of product quality is important for market success. This is valid for the high price shrimp products and also present in the attempts to actually replace the herring on the German market by other species where the product image (= quality) is of relatively high importance. An example of success for a non-traditional species on the market is the pollock on the US market. The frozen-at-sea skinless and boneless fillets has been recognized by buyers of its high quality. Of crucial importance to the product image is avoidance of food poisoning. It has been noted that in the years 1965 to 1975 only 29 outbreaks of foodborne infection and intoxication in the UK were attributed to fish, molluscs and crustaceans. Between 1976 and 1980, however, as marine products assumed a new importance there was an increase in the number of reported outbreaks with at least 126 separate incidents affecting more than 1,500 persons; 35 of these were associated with freshly-opened canned fish. In addition to canned fish, toxic substances discovered are often traced to shrimp and squid products from developing countries. This adds to the frequent perception among affluent consumers of developing countries as suppliers of low-quality products.

Constraints on trade caused by consumer preferences are sometimes reinforced by local industry's resistance to imports, as in the canned tuna market of Italy and Spain and in the reluctance to accept canned tuna products which would differ from those produced by the local industry.

3.3 Product price

A comparison of wholesale prices in main US ports from 1972 show that the development of the price of canned tuna, cod fillets and shrimp have been favourable as compared to beef and lamb, except for an unfavourable period in 1976-77 and in 1980-81 for cod fillets and 1981-82 for shrimp.

Commodity prices: Comparison of the development of wholesale prices
Sources: IMF, International Financial Statistics
National Marine Fisheries Service (NMFS)



IMF:

________ beef (all origins, US ports, 10 US cents/pound)

___ ____ lamb (New Zealand, London, 10 US cents/pound)

.... shrimp (US, New York Gulf, US$/pound)

NMFS:

________ canned, light tuna, 10 dollars per case

--------- cod fillets, cents/pound

__ __ __ fresh, frozen shrimp 27-25, New York, cents/pound

The largest importers of fish products, Japan and USA, have in many cases a decisive influence on the international price level. An example is the consumer resistance to high prices of canned tuna in USA which became evident in 1982. Sales slowed down and prices decreased.

International prices and consequently trade between countries are also influenced by the rates of exchange, especially the rate of exchange of the US dollar. It would be of interest to know to which extent changes of exchange rates have an influence on the competitive position of cod products and Latin American hake on the US market. Similarly, the US$/Yen relationship should have an impact on the flow of shrimp products.

The present recession has led to consumer resistance to price increases. Apart from the example of the US tuna market, this was also the experience in 1983 in the Japanese shrimp and cephalopod markets, as well as in some markets in Western Europe. However, the consumption of tropical shrimp in the USA increased in the early 1980s despite high prices and were not met by price resistance until 1983. In the canned salmon product range, the most highly valued salmon (reds) was in 1983 more successful on the international markets than the lower valued ones. In Japan there is a trend toward lower consumption of fish, but demand for the more expensive products continued to be good in 1983. On the other hand, exports of salted/dried demersal fish to traditional large markets in Portugal and Spain showed considerable falls in 1983, possibly due to lower buying ability.

These are illustrations of the fact that price/demand related factors need to be closely investigated and that there is a vast area comprising elasticities, demand functions, consumer buying behavior, etc., about which only partial knowledge exists. However, the following demand related factors have been identified, but no quantification of the impact could be given:

- the continued shift in eating habits toward more value added fish products in the OECD countries;
- continued increase in the interchangeability between various fish products, and fish and meat products in these countries;
- continued and possibly increased impact of the product quality, and especially related to products from developing countries;
- increased influence of prices on trade during the present recession in the world economy in an increasingly interdependent world market, reinforced by the development of rate of exchange of the main reserve currency;
- lower influence of price on demand for luxury product than on the demand for staple goods.

4. Free Market Deviations

Trade between countries as explained by the countries' different comparative advantages, is influenced by consumers' reaction as well as governments' policies and the market structure.

4.1 Governments' policies

Imports of fishery products into the major markets are restricted by quantifiable measures through tariffs and quotas and frequently by bilateral agreements. This is the case of Japan as well as of the EEC. The greatest volume of imports from the outside into the EEC area have been from the countries which have received special tariff concessions conceded under the GATT. In addition, almost 50 percent of total imports of fish products for human consumption is intra-EEC trade. In the USA most of the imports of fishery products in value terms are duty free or carry a tariff under the GATT's MFN (most favoured nation) clause. The MFN tariff reduction after the Kennedy Round agreements (1967) have favoured imports from other OECD countries to USA. Processed fish products, of which the US is a significant producer, are subject to high tariff rates for developed as well as most developing countries.

The Generalized System of Preferences (GSP), accepted as a GATT agreement in 1971, and adapted by the EEC in 1971 and USA in 1976, have turned out of limited value for developing countries. Reduced tariffs to developing countries may have contributed to increased imports into the EEC, in particular from the Maghreb states in Northern Africa and the ACP states covered by the Lome convention.

Among the non-tariff trade barriers is the price setting system in the EEC, the countervailing tariffs in the USA protecting domestic production from unfair competition by imported products, legislative and non-legislative action as precaution against health risks, embargoes on imports of tuna into USA in retaliation for the seizure of fishing vessels by exporting countries, licenses on fish imports in developing countries due to limited foreign currency, etc.

Other less visible non-tariff trade barriers comprise the financial support of production and/or marketing as well as health standards and other standards for packaging, marking, product information, customs classification, etc. Governmental measures in production and marketing have been of increasing importance in OECD countries as a result of the rise in unemployment and financial difficulties of companies that are no longer internationally competitive. Also, the fisheries' interests are usually well organized and fishermen and people within the fisheries' industries are as a group of importance to governments' policies in these countries.

An increase in tariffs and quotas would violate the GATT agreements.

4.2 National and transnational market structures

It has been reported that the world fisheries industry is substantially less concentrated overall than many other food industries, although most specialty products have only a few active processors. In some industries, however, there has been a trend toward firms extending their operations beyond national borders. A distinction may be drawn between the priorities of "surplus" food producers and those of "deficit" producers among the developed market economies in terms of their relations with foreign countries. The latter, of which Japan is the most prominent example, have been primarily interested in securing adequate supplies of basic food-stuffs from foreign sources including developing countries.

The supply arrangements of transnational corporation (TNCs) in fisheries, vary from fully integrated, to contract production, to open market procurements. Interests and current procurement strategies of the major Japanese, US and European based fisheries firms differ substantially.

Transnational companies have expanded their operations also to developing countries. By the mid 1970s there were more than 100 fisheries industry affiliates of 37 TNCs in 46 developing countries. With minor exceptions, these TNC investments are all export-oriented. Foreign direct investment has been seen as a superior source of much needed finance and of its provision of technology and know-how. Transnational companies have thus been regarded as major vehicles for the transfer of technology.

The result of the fisheries joint ventures with smaller developing countries have been mixed, as viewed from all sides. The strain on financial resources from the fishing companies has been great. There were quality problems, particularly connected with the need for rapid icing/freezing, and the assuring of local energy and water supplies for this purpose. The fisheries companies find that many of their collaborations do not sufficiently recognize the importance of their efforts and efficiency in meeting foreign demand and also that the local owners are reluctant to participate in important decisions that have financial consequences. From the developing nations point of view, the TNC have often fulfilled their bargain in terms of plant and facility construction, but they have fallen short of the mark in terms of training local managers, assuring local crew memberships, and aiding in the transfer of ownership. They have also been insensitive to the problems of fish imports faced by many developing countries, and less willing to work with local fishermen and utilize simple technologies to help provision this market at reasonable local cost. A less often mentioned problem is the combination of financial and cultural factors that limit utilization of capital intensive refrigeration technologies in developing countries.

However, some of the expansion of commercial bank lending in the 1970s has substituted direct investment by TNCs in developing countries. The relatively low interest rates during most of the 1970s encouraged this trend, as did restrictions placed by a number of host countries on direct investments.

Considering the differences between TNCs, their strategies differ according to where their headquarters are located and types of fish products. The TNCs in fisheries are mostly found in the tuna and the shrimp trade and production. Among the fisheries industries affiliates mentioned above, 1/3 operated in the shrimp and other crustacean industries, 1/5 in the tuna industry, and the rest had mixed supply bases, and include several which market locally in larger countries, such as Brazil and the Republic of Korea. Nearly 1/3 of the TNC affiliates are located in countries with very small domestic markets for processed foods, such as the lower-income countries of Africa and the Asia and Pacific regions.

Japanese-based fisheries companies not only have the largest volume and value of production, but are those that depend most fully on offshore supplies for their large domestic market.

Japanese companies appear to be exploiting all reasonable opportunities to ensure supplies, including acquisitions of and trade investments in established companies (particularly in North America), long-term supply contracts, direct purchases of open-market supplies from developing countries, e.g., Indian shrimp, the leasing-out of vessels and the extension of credit, supplies of technical assistance to local fleet operators, as well as setting-up of joint or minority ventures with developing country counterparts.

With the help of the State, joint ventures for fishery production are set up by Japanese partners with governments of smaller countries, such as Indonesia, in the mid-East in exchange for oil, and in the South Pacific.

Number of affilitates, joint ventures and contract purchase agreements by Japanese-based fisheries firms in developing countries has reportedly doubled since the early 1970s, but data on investments since 1976 are not generally available.

In the Japanese fishing industry the trading company strategy was to identify markets and then set up a vertical chain of integrated service and finance. In this manner the consortia were soon able to provide 15 percent of the shrimp to the Japanese market. The success in tuna was less striking since there are many alternative sources of supply.

The Japanese fleets are divided into two groups: first, the smaller, pole-line vessels owned by independent Japanese skippers, and more recently with crews from the Republic of Korea and Taiwan financed by the Japanese, and secondly, the larger mother ships, refrigerated vessels and factory ships owned by the Japanese fishing companies. The trading companies, however, do not as a rule own fishing vessels although they began to enter bulk ocean transport in the 1970s.

The larger US-based firms involved in shrimp and other fish rely to some degree on trade supplies, most of them also have affiliates in developing countries, particularly in the Caribbean and Central America, with mixed commercial success. None of the leading firms appears to be actively seeking new integrated supply affiliates in developing countries.

The integrated firms in the US tuna industry, Ralston Purina, H.J. Heinz and Castle and Cooke are now conglomerates whose production and wholesale distribution activities began in non-fish related products. All three entered the tuna business in the 1960s when they discovered that fish products could be complementary to their other processed food. Ralston purchased Van Camp with operations in Puerto Rico, Ecuador, Indonesia and Sierra Leone, and Heinz bought Columbia River Packers Association. Unlike the Japanese cases, the US firms entered the transnational tuna industry by acquiring seafood companies.

Examples of European companies which developed affiliate activities in developing countries are several French-based companies with affiliates in former colonies and the Spanish firm Pescanova, which has joint venture arrangements in Latin America.

In addition to TNCs operations in developing countries, such firms have expanded their operations also to other OECD countries, partly in order to secure supplies and partly to avoid trade barriers, or a combination thereof.

The question of whether developing countries have experienced worsened terms in their trade of fishery products can be neither supported, nor rejected according to available data.

5. Overall Economic Development and Other Factors

There are a number of factors which may be assumed to have had an influence on international fish trade. These include the recessions in the world economy, developments in the international credit market, in the monetary regime, in international institutions for transportation and communication, etc. Some, if not all, of these would be worth further study and analysis in order to obtain an idea about their relevance and impact in quantitative terms.

6. Conclusions

Because there are so many factors involved and many perspectives on the problems, an objective analysis of the changes in international trade is not easily obtainable, and simple conclusions not easily within reach. However, an attempt on conclusions follows.

The increase in world trade of food fish in the years after the general introduction of the Exclusive Economic Zones, and in particular of high value products, is thought to be mainly a result of the following factors:

a. large fishing nations, previously supplied to a large extent by their long distance fleet, have compensated the lost supplies partly by imports of mostly unprocessed fish, partly by joint ventures, and partly by fishing outside the jurisdiction of coastal waters, so that the large fishing nations which had long-distance fleets before the introduction of EEZs, with the exception of Spain, have rebuilt their supplies to the same or higher levels as before;

b. some, but not all nations with long coastlines, i.e., some developed and developing countries which had important fisheries before the introduction of EEZs, have significant rise in exports and/or fall in imports;

c. traditional fishing nations among the developed countries have increased trade with each other through over-the-side sales and by linking fishing rights to admission to foreign markets;

d. the restriction on catch due to stock conservation contributed to increased imports of fresh/frozen fish to other Western European countries, especially to the EEC;

e. the overexploitation or depletion of stocks like shrimp and crab in USA and South African pilchard has on the one hand led to increased trade in similar species or in species replacing the scarce ones, and other the other hand, to decreased trade in species having for some time replaced scarce species when the latter stocks were rebuilding, like the recent recover of the North Sea herring;

f. in the trade of products supplying highly competitive markets and/or of products with high price elasticity of demand, such as the trade in tuna at present, cost of labour has a decisive impact on the origin of supply;

g. the fishing industries hardest hit by the rise in energy costs were the technologically more advanced fishing industries in poorer regions, because competing industries in the richest OECD countries and Eastern European countries received governmental support and countries with fishing industries utilizing passive technologies were less affected;

h. the fishing industries in developing countries and developing areas of OECD countries have also been most hurt by disruption in supplies of credit, due to lack of governmental support;

i. the changes in consumer demand as caused by the continued shift toward more value added, branded products, increasing interchangeability of products, and increasing price resistance, especially for staple fish food;

j. reduced trade tariffs through the Generalized System of Preferences and the Lome Convention might have contributed to increased fishery exports from developing countries to the EEC, and the Most Favoured Nation tariff reductions might have increased imports from other OECD countries to USA;

k. the macro-economic factors, i.e., the overall economic development, monetary and financial factors, may have disfavoured developing countries and other factors such as communications and transportation, and possibly the international monetary and financial regimes may have particularly benefitted fish trade of industrial countries.

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Introduction

Canada lands some 1.5 million tons of fish with a value, at point of landing, of some C$900.0 million and a market value after processing, F.O.B. plant, exceeding C$2,000.0 million. Exports take nearly 80% of the production output by volume and 85% by value. Domestic consumption at close to 7.5 kg per person would need to multiply three and one-half times before it could absorb our present volume of fish products or conversely our population would have to multiply by three and one-half times. As neither of these two situations are anticipated in the near future, Canada will continue to depend upon export markets for the major part of its fish products output. Product development or changing technology may alter the conversion ratios from landed weight to product weight, or there may be new opportunity for changing the relative composition from low value to high value products by harvesting at various points along the food chain, but not to the extent to modify by much Canada's continued dependence on external markets for its fish products.

As a resource-rich industrialized country, Canada has a greater dependence upon trade than most countries and it has long been recognized that the viability of the Canadian economy is determined largely by its ability to compete in export markets and by the conditions of and development in those markets. In its first annual review in 1964, the Economic Council of Canada observed that Canada's export potential by 1970 would be determined essentially by four factors: the growth of foreign markets; access to those markets; the competitive capabilities of Canadian suppliers in terms of relative efficiency and their relative international cost and price position; and the marketing skills and aggressiveness of Canadian traders in exploiting opportunities for increased and diversified exports. This observation is believed as valid today as twenty years ago and in a fisheries context as well as in a general commodities trading context.

This dependence on international trade has influenced Canada to pursue two related routes -- pressing for greater access to international trade through reduction in tariff and non-tariff barriers and pressing for improvements in conditions and in economic growth in the less developed countries. Canada has participated in numerous multilateral tariff negotiations, is active in that respect within the Commonwealth, la Francophonie, OECD and UN agencies, and has used the bilateral approach to conduct and improve trade with Communist countries. Specifically in the fisheries, the extension of the economic zone to 200 miles and several types of foreign arrangements have contributed to opening new exporting opportunities. While Canada's contribution in aid to developing countries has not reached the target proposed by UN agencies, during the past four years it has exceeded C$1.5 billion annually and is scheduled to reach 1/2 of 1% of GNP by 1986.

The main instruments to implement the strategy to emphasize international trade and to put Canadian firms in an advantageous position include:

Canadian Commercial Corporation to provide free services related to commercial sales by Canadian firms or Canada to outside governments. These services include facilitating contacts at senior government levels, analysing risks, participating in negotiations, evaluating the technical and financial capability of Canadian suppliers and of the product, service or project; and following through on all aspects of a sale, including contract management, inspection and acceptance, shipping services, payment and collection.

Export Development Corporation to provide financial services to protect exporters and importers. These services include insurance for Canadian exporters against non-payment by foreign buyers, against wrongful calls on performance securities, and guarantees for banks providing securities related to performance or bids, guarantees to financial institutions against losses incurred in financing either the Canadian supplier or foreign buyer in an export transaction, long term loans to foreign buyers of Canadian capital equipment and services and guarantees against loss of Canadian investments abroad by reason of political actions.

External Affairs programs to help Canadian businessmen to expand markets abroad and become internationally competitive include Trade Commission Service to promote Canadian exports and to protect Canadian interests abroad, International Trade Data Bank to provide information on imports and exports of major trading countries, Promotional Projects Program to sponsor Canadian participation in trade fairs abroad, organize trade missions to foreign countries and arrange visits by foreign representatives to examine Canadian product and industrial capabilities, and Program for Export Market Development to help Canadian companies to enter and/or expand foreign markets through repayable financial contributions where there is a need to share the risk.

Canada's efforts toward improvement in the conditions and economic growth in the less developed countries are channelled through the Canadian International Development Agency (CIDA) which is responsible for administering most of the official assistance although funds may be provided from other sources. CIDA attempts to match the needs of the developing countries with appropriate Canadian supply through bilateral programs (80% of Canadian contribution), multilateral programs, and support of non-government organizations.

These general programs benefit all sectors of the Canadian economy including the fisheries sector but the fisheries are the object of specific attention on the part of the Canada Department of Fisheries and Oceans, such as, the Worldwide Marketing Exercise to evaluate the potential for exports of fish products in various areas, various countries.

The following figures may put in perspective fish exports as part of the total export picture. During the past five years Canadian exports have increased in value by 39% to a record C$90,964 million in 1983. During this period exports of fish products increased in value by 12% to C$1,518 million and comprised 1.6% of the value of all exports in 1983. This has established Canada as the major fish exporting country in the world during the past few years. While the value of all Canadian exports to developing countries increased by 45% during the period 1979/82, the value of export of fish products to these countries increased by 38% and comprised 1.2% of the value of all exports to those countries in 1982. Thus, Canadian exports to developing countries tend to reflect the composition of total Canadian exports. In the principal fish importing countries among the developing countries Canadian exports increased by 49% in value and fish products by 14% in value during that period. In 1982 fish products comprised 1/2 of 1% of the value of Canadian exports to these major importing countries.

In a regional context the industry is of much greater importance for the 130,000 fishermen and plant workers associated with it. For these provinces (Newfoundland, Nova Scotia, Prince Edward Island, New Brunswick and British Columbia), the fisheries industry comprises between 3% and 15% of the value added in all commodity producing industries. On the Atlantic side it provides from 5% to 25% of provincial employment and about 2% in British Columbia.

Canadian Export of Fish Products to Developing Countries

During the years 1960 to 1978, in terms of value of fish export, Canada ranked from 2 to 4 among the major fish exporting countries of the world and from 1979 to 1983 ranked first. However, the export of fish products accounts for about 1.6% of total Canadian export by value.

In absolute terms exports of fish products increased from 276,014 mt valued at C$138,130,000 F.O.B. plant, in 1960 to 369,647 mt valued at C$280,022,000 in 1970 to 531,886 mt valued at C$1,518,636,000 in 1981. The index of physical volume of production for those years (1960-62 = 100) is 92 in 1960, 116 in 1970, 132 in 1981. The consumer price index for fish (1971 = 100) for these years is 63.7 (1961), 95.9 (1970), and 363.8 (1981).

The product form composition of fish exports has changed little during those years as indicated below.

	Percentage Composition of Value		
	1960	1970	1981
Fresh and frozen	64.8	69.0	68.5
Smoked, salted, pickled	16.0	9.2	11.8
Canned	12.9	9.7	10.9
Oil	1.5	1.3	0.3
Meal	2.9	5.1	1.2
Miscellaneous	1.9	5.7	7.3

The United States, Europe and Japan receive most of the value of export of Canadian fish products -- 85% in 1960, 91% in 1970 and 95% in 1981. The relative importance of the developing countries' market for

Canadian export of fish and shellfish products has decreased from over 8% of value in 1960 to 5% in 1970 to 3% in 1981. This decrease parallels the decrease in the relative importance of smoked, salted and pickled and canned products from 28.9% of value in 1960 to 22% in 1981.

Fresh and frozen fish and shellfish products, which amount to nearly 70% of the total value of Canadian fish exports, comprise only 5% of the value of Canadian fish exports to developing countries. Over 90% of the value of fish exports to developing countries is currently made up of salted, dried or pickled fish and canned fish and shellfish and these only comprise less than 23% of the value of all Canadian export of fish products. In 1970 and 1971 these categories accounted for the total value of Canadian export of fish products to developing countries.

The products that have shown the greatest increase in value in recent years have been bloaters (round, smoked herring, increasing fivefold from 1970 to 1981), dried, salted hake (increasing sevenfold) and pickled alewife (increasing fifteenfold during the same period). These comprised 31% of the value of fish products exported to developing countries but only 1% of the value of all Canadian fish and shellfish exports.

The export prices of Canadian fish products necessarily reflect variation in the costs of the species and the types of processing, among other factors. In 1981, the products derived from herring accounted for 37% of the export value to developing countries; from groundfish (cod, hake, pollock) for 37%; from alewife and mackerel for 4% each; and from chum salmon for 2%. The price per ton to Canadian fishermen for those species ranged in Nova Scotia from C$165/mt for alewife, C$224/mt for mackerel, C$267/mt for pollock, C$272/mt for hake to C$420/mt for cod and to British Columbia fishermen C$1,594/mt for chum salmon. Similarly product prices (C$/mt) according to product form are given below for 1981 for Nova Scotia.

	Cod	Hake/Cusk	Pollock	Herring
Round or dressed, fresh	766.41	475.38	480.00	271.35
Round or dressed, frozen	1,314.19	--	1,547.17	675.66
Fillet, fresh	2,878.97	2,101.12	1,926.68	1,280.06
Fillet, frozen	2,816.61	1,884.89	1,931.10	768.85
Blocks, frozen	2,244.13	1,261.63	1,841.70	--
Wet, salted	2,281.95	1,400.35	1,388.38	--
Dried, salted	2,957.59	2,149.33	2,039.47	--
Boneless, salted	5,555.34	--	--	--
Pickled, cured, dressed	--	--	--	1,725.38
Pickled, cured, fillet	--	--	--	1,735.47
Canned	--	--	--	4,000.27

The average export price per product form for all species ranges during 1981 (excluding roe, meal, oil, and miscellaneous) from C$1,124/mt for seafish, fresh, whole or dressed to C$7,853/mt for canned shellfish. About 50% of the products identified as going to developing countries have an average price higher than the same products marketed in developed countries. Also the average price of all fish exports to developing countries show the same variations as those for developed countries. Products exported to developing countries appear to be mixed throughout the export price range and not to be clustered at either end of the price range.

In summary about two-thirds of Canadian export of fish products to developing countries comprise salted and dried salted groundfish (average 1981 export price from C$2,354/mt to C$2,639/mt), herring bloaters and pickled alewives (average 1981 export price of C$1,431/mt and C$738/mt respectively), and canned herring and sardine (average 1981 export price of C$2,625/mt and C$3,297/mt respectively). The costs of transportation, handling and insurance would add several hundreds of dollars per ton to these prices before the product could be delivered to developing countries.

External Indebtedness in Developing Countries

The problems of indebtedness on the part of some developing countries, the effects on their economies and their possible response to this as well as the anticipated impact on world trade have been receiving attention both within international and national agencies and have been reported in the press. The International Monetary Fund has pointed out that by 1987 (even under the most optimistic economic assumptions) Third World countries may have to allocate almost one-quarter of their export earnings for debt repayment. This compares with just over one-fifth of their export earnings in 1983.[1] Its World Economic outlook anticipated relatively satisfactory rate of growth of imports, exports and gross domestic products for developing countries.[2]

The term Third World or developing countries includes a wide group of countries that differ greatly as to natural resource endowment, international trade pattern, population growth, industrial structure, income distribution and market prospects and social and political structures. This diversity also extends to the end-use of the borrowed funds including consumer goods, industrial or social infrastructure or capital goods investments with various gestation periods before positive contributions to national income may be expected. These factors would undoubtedly be reflected in rating of credit-worthiness of debtor countries by international banks as reported by Institutional Investor, a U.S. business magazine.[3]

The burden of external indebtedness, the repayment of capital and the servicing of interest during the life of the loan, is largely determined by the terms and conditions of the loan, the level and composition of the gross national product of the debtor country, the level and character of its international trade, the rate of growth and diversity of its economy and by the growth of its population and labour force, among other things. Loans made government-to-government to these developing countries fall in a separate category as they may be later written off as foreign aid by the lending government. External conditions also impact upon this burden -- for instance the World Bank and the U.S. Federal and Reserve Board estimated that the latest rise in the U.S. prime rate to 13 percent is expected to add more than $1 billion (U.S.) to the Third World's debt of almost U.S. $800 billion or U.S. $3.5 billion additional total foreign debt in developing countries for each additional one percentage point in interest rates.[4]

Among other effects, the burden of external indebtedness impacts upon the availability of foreign exchange, the need for exchange controls, the need for import controls, and limits economic growth. The World Bank calculates that developing countries need an additional U.S. $100 billion in capital a year if adequate rates of growth are to be resumed.[5] Commercial sources for this investment are not available and developed countries have decreased their annual aid contributions to the Third World.

The level and burden of external indebtedness among developing countries may be indicated by the following:[6]

Developing Country	Total External Debt 1983	Debt Service % of Export Receipt 1983	Developing Country	Total External Debt 1982	Debt Service % of Export Receipt 1982
	(U.S. $ billion)	%		(U.S. $ billion)	%
Argentina	38.8	154	Columbia	10.2	95
Mexico	84.6	126	Philippines	20.7	79
Israel	28.0	126	Peru	11.2	79
Brazil	86.3	117	Ivory Coast	8.4	76
Chile	17.2	104	Morocco	10.8	65
Ecuador	6.6	102	Turkey	22.6	65
Venezuela	33.2	101	Thailand	11.1	50
South Korea	37.2	49	Nigeria	11.2	28
Egypt	21.8	46	Indonesia	21.9	28
Algeria	14.8	35	Malaysia	8.6	15

For five Latin American countries the cost of servicing the debt exceeds their annual earnings from export while the cost of servicing the debt in 1983 for four of the East Asian countries was under 50% of their annual earnings from export.

The burden of carrying this debt load has led to consideration of various solutions ranging from a moratorium on the payment of interest for some time, decrease in the rate of interest, fixed rate of interest, conversion of interest payment into longer term debt, greater market access for the exports of the debtor countries, counter trade or international barter and increased foreign aid from the developed countries. Some of these choices imply an austerity program imposed by the International Monetary Fund involving reduced domestic spending and money supply growth, reduced imports and reduced domestic wages. Other choices such as printing more money to pay the domestic bills with the attendant high rates of inflation may lead to default of the external debt, monetary and political collapse.

Twelve of the 20 developing countries with the more serious problems of external indebtedness are also among the 23 major fish importing countries among developing countries, importing fish produced valued at U.S. $920 million in 1982 or 42% of the total fish imports of all developing countries. Five of these 20 developing countries in 1981 imported Canadian fish products valued at C$8.8 million or 16% of all Canadian fish exports to developing countries but just over 1/2 of 1% of our total fish exports for that year. Thus while external indebtedness may impose severe constraints to our ability to expand our markets among developing countries, it impacts only to a smaller degree upon our existing trade in fish products.

Markets for Fish Products in Developing Countries

Comparisons between the costs of landing fish and the costs of raising various kinds of meat suggest that fish is a superior source of protein for poorer countries. And import figures tend to support this. If countries are ranked in descending order by reliance on animal protein derived from fish, 39 of the first 40 countries are developing countries.[7]

FAO statistics list 122 developing countries importing fish products valued at U.S. $2,165.2 million in 1981 and U.S. $2,209.3 million in 1982. In comparison to 1978 this represents an increase in value of about 40% and an increase in volume of about 50%. This comprised about 13% of world trade of fish in 1982.

Twenty-three countries importing over U.S. $20 million each in 1982 accounted for 85% of these imports in 1982. These twenty-three countries are: Hong Kong, Singapore, Malaysia, Korean Rep., Philippines, Indonesia and Thailand representing 48% of the value imported by these major importers; Nigeria, Ivory Coast, Zaire and Congo accounting for 23%; Saudi Arabia, Egypt, Iran, Libya and Kuwait representing 12%; Columbia, Brazil, Venezuela and French Guiana representing 11% and Cuba, Mexico and Jamaica accounting for the other 5%.

The average import price of fish products in four of these countries actually declined during the years 1979 to 1982, and increased by less than 30% in another 12 countries. The average import price of fish products in 1982 was less than U.S. $750/mt in 10 countries, less than U.S. $1,000/mt in 13 countries and under U.S. $2,000/mt in 19 countries.

The fish products imported may be classified into seven categories: fish, fresh, chilled, frozen representing 36% of the total value imported in developing countries in 1982; fish and shellfish products and preparations, whether or not in airtight containers, representing 23% of the import value; shellfish, fresh, frozen, dried or smoked representing 17%; fish, dried, salted or smoked accounting for 12%; meal for 9%; and oil for 12%.

Eighty-nine percent of the import of fish, fresh, chilled or frozen by the major fish importing countries among developing countries is accounted for by 14 countries where the average import price in 1982 was under U.S. $1,000/mt. The average Canadian export price for seafish in 1981 was: fresh, U.S. $899/mt; frozen, U.S. $1,939/mt; fresh fillet, U.S. $2,544/mt; frozen fillet, U.S. $2,084/mt; and frozen blocks, U.S. $1,898/mt.

Ninety-two percent of the import of fish and shellfish products and preparation (whether or not in air-tight containers) by the major fish importing countries among the developing countries is accounted for by 16 countries where the average import price in 1982 was under U.S. $2,500/mt. The average Canadian export price in 1982 for canned fish was U.S. $2,326/mt for herring; U.S. $2,754/mt for sardines; U.S. $3,409/mt for kippered herring; from U.S. $3,470/mt to U.S. $6,638/mt for various Pacific salmon; and U.S. $2,754 for canned fish and fish products, n.e.s.

Sixty-six percent of the import of shellfish, fresh, frozen, dried, salted by the major fish importing countries is accounted for by 11 countries where the average import price in 1982 was under U.S. $5,000/mt. The average Canadian export price in 1982 for shellfish, fresh or frozen, was U.S. $5,324/mt. About 20% of the value of export of shellfish fresh or frozen, comprised of clams in shell, lobster in shell and shrimp, were exported at an average price of under U.S. $5,000/mt.

Developing countries collectively are both importers and exporters of fish products. In 1982 the surplus value of exports of fish products, net of import, among the developing countries amounted to U.S. $1,849 million in Asia; to U.S. $1,091 million in South America; to U.S. $779 in North and Central America including the Caribbean area; to U.S. $149 million in Africa; to U.S. $180 million in the Near East; and to U.S. $22 million in Oceania.

Currently Canada imports about C$365 million of fish products a year of which 20% are from developing countries. The principal suppliers in 1981, by value, were Hong Kong (11%); Cuba (17%); Mexico (13%); Fiji (11%); Philippines (8%); Thailand (7%); Ecuador (5%). Another 11 countries supplied the remaining 22%. Canada's imports of fish products from developing countries amounts to C$78 million, of which 40% is from developing countries importing fish products from Canada with whom Canada had a trade deficit in fish products of C$13.8 million in 1981.

The International Monetary Fund[8] reports financial information on 21 of the 23 developing countries included among the principal fish importers. Fifty percent of these 21 countries had total exports valued at more than their imports in 1982 while for the remaining countries their exports exceeded in value their imports by less than 10% (four countries) and by as much as over 50% (four countries). The information available does not suggest a deteriorating balance of trade during the interval 1977 to 1982.

In 1980 and 1981 Canada Department of Fisheries & Oceans surveyed six of the largest "fish importers" among the developing countries (Hong Kong, Nigeria, Singapore, Ivory Coast, Brazil, Saudi Arabia) to evaluate prospects for increasing sales of fish products. Some of the observations include:

a) uncertainty from evolving import regulations, price sensitivity in distant markets, evolving development policies to promote greater self-sufficiency in food, from regulations on ceiling prices, etc.;

b) competitive disadvantage because of high reliance on imports from neighbouring countries, from distance, relative importance of fresh fish or low priced fish in domestic market, uncertain or inadequate infrastructure;

c) demand affected by inflation, by status of some countries as net exporter of fish products, by non-tariff barriers, etc.

Summary

Increasing external indebtedness may force some developing countries to reduce their import of fish products or change the species and product form composition of these imports or the source of such imports. However, this problem affects different developing countries to various extents. The remedial measures applied by the developing countries more seriously affected would have only limited impact upon Canadian exports of fish products. This is because of the relatively small portion of fish exported to developing countries, because exports to developing countries are limited to few species and product forms and because most of the developing countries to which Canada exports fish are less affected by the burden of increasing indebtedness.

Notes

1. "Rising rates spur study of world debt solution," The Globe and Mail, (May 10, 1984), p. B2.

2. Anatole Kaletsky, "Less developed nations' short-term prospects dim," The Globe and Mail, (June 11, 1984), p. B8.

3. "Asian debtor nations 'feel little pain'," The Chronicle-Herald, (July 5, 1984), p. 31.

4. James Rusk, "Bank warns of debt aid shortfall," The Globe and Mail, (June 26, 1984), p. B5.

5. Ibidem.

6. Douglas J. Tigert, "U.S. debt, not foreign, may be real threat," The Financial Post, (June 30, 1984), p. 15.

7. "Fishing fails to fulfill promise of feeling hungry," The Globe and Mail, (July 5, 1984), p. B12.

8. International Monetary Fund, International Financial Statistics, Vol. XXXVII, Washington, D.C. 20431.

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Canadian International Development Agency, Canada and Development Corporation, Annual Report, 1979-80, Minister of Supply and Services, Canada, 1980.

Department of Fisheries and Oceans, Canadian Fisheries Annual Statistical Review, Ottawa, Ontario, Canada, selected years.

Economic Council of Canada, Economic Goals for Canada to 1970, First Annual Review, Queen's Printer and Controller of Stationery, Ottawa, Canada, 1984.

Food and Agricultural Organization, Yearbook of Fishery Statistics, Vol. 55, Rome, 1984.

Statistics Canada, Exports by Commodities, Ottawa, December 1983.

Table 1. Canadian Exports 1979-1983, C$'000,000.

Export Area	Export Commodity	Years 1979	1980	1981	1982	1983
All Countries	All products	65,518	75,933	83,698	84,403	90,964
	Fish products	1,323	1,275	1,519	1,612	1,476
Developing Countries	All products	3,349	5,193	5,092	4,843	4,294
	Fish products	42	43	56	58	-
Developing Countries Major Fish Importers	All products	3,039	4,924	4,813	4,529	4,006
	Fish products	22	14	23	25	-

Statistics Canada, Export by Commodities, Ottawa, Various years.

Table 2. Export of Canadian Fish Products to Developing Countries and All Areas by Product Group, 1970/71 and 1980/81, C$'000.

Product Groups	1970 Dev Countries	1970 All Areas	1971 Dev Countries	1971 All Areas	1980 Dev Countries	1980 All Areas	1981 Dev Countries	1981 All Areas
Fresh or frozen, whole or dressed	-	101,352	-	108,324	1,321	517,072	2,979	580,091
Mackerel	-	392	-	163	69	2,803	2,205	3,207
Herring	-	-	-	-	619	14,908	189	27,440
Freshwater fish n.e.s.	-	330	-	175	-	2,957	516	2,498
Shellfish n.e.s.	-	99	-	402	633	1,915	65	1,368
Fresh or Frozen, filets & blocks	-	91,797	-	93,419	-	407,053	-	460,753
Dried, salted, smoked	5,461	19,145	5,453	20,817	12,172	109,180	16,735	151,468
Cod boneless	145	3,809	191	5,112	371	8,956	521	11,292
Hake	510	631	991	1,282	4,551	7,144	5,965	10,101
Pollock	394	1,035	283	797	3,184	9,429	2,875	11,062
Haddock, cusk	88	277	172	428	-	3,352	-	4,335
Herring bloaters	948	1,050	996	1,191	4,986	5,521	5,942	6,339
Fish n.e.s.	114	288	226	380	-	22,181	-	1,409
Cod heavy salted	3,506	5,926	3,205	6,246	4,066	17,905	7,374	22,209
Cod light salted	704	2,660	385	1,645	-	5,294	-	4,348
Pickled	1,218	6,614	1,702	9,643	6,958	29,794	8,037	28,018
Alewife	104	235	162	285	1,972	2,012	2,095	2,239
Mackerel whole or split	166	292	544	711	-	663	-	488
Canned	6,086	27,175	4,131	33,052	12,776	124,277	15,434	165,112
Salmon, chum	322	1,544	428	2,562	337	2,196	1,080	8,967
Salmon, pink	219	4,928	229	6,698	-	28,370	-	39,743
Sardine	3,507	5,766	1,711	2,960	8,595	18,636	8,114	18,807
Herring n.e.s.	1,912	2,781	1,763	3,481	538	4,242	2,639	6,692
Fish & fish products	126	558	-	327	-	1,430	-	2,745
Shellfish & products n.e.s.	-	20.	-	46	3,306	5,768	3,601	7,567
Roe, Meal, Oil, Misc.	2,427	33,939	2,523	29,476	10,106	87,554	13,145	133,194
Herring roe cured	-	-	-	-	-	38,122	1,952	76,836
Value of Products	15,192	280,022	13,809	294,731	43,333	1,274,930	56,250	1,518,636

Canada Department of Fisheries & Oceans, Canadian Fisheries Annual Statistical Review, Vol. 4 and 14, Tables 52 and 90.

Table 3. Canadian Export of Fish Products to Developing Countries and All Areas, 1970/71 and 1980/81, C$'000.

Country	Year			
	1970	1971	1980	1981
Africa				
Nigeria	122	805	1,372	2,212
Zaire	-	-	21	2,274
North/Central America Caribbean				
Bermuda	333	344	725	995
St. Pierre Miquelon	27	195	-	-
Panama	152	9	-	-
Bahamas	117	69	-	-
Barbados	753	529	1,202	2,364
Dominican Republic	1,286	1,235	11,903	10,773
Haiti	472	319	4,195	4,484
Jamaica	6,649	5,824	2,251	6,182
Leeward Windward	1,037	1,125	2,513	3,649
Netherland Antilles	255	178	634	599
Trinidad Tobago	1,585	1,601	7,281	9,469
South America				
Bolivia	149	-	-	-
Columbia	307	-	-	-
Guyana	699	481	-	-
Surinam	235	278	-	-
Venezuela	108	170	539	537
Brazil	120	-	2,178	3,408
Near East & Southern Asia				
Sudan	105	-	-	-
Iraq	-	-	-	536
Lebanon	-	-	606	183
East & South East Asia				
Hong Kong	393	431	5,350	4,517
Korea South	-	-	840	2,211
Malaysia	-	-	131	530
Singapore	180	166	1,592	1,327
Oceania				
Fiji	108	50	-	-
Developing Countries	15,192	13,809	43,333	56,250
All Areas	280,022	294,731	1,274,930	1,518,636

Canada Department of Fisheries and Oceans, Canadian Fisheries Annual Statistical Review, Vol. 4 and 14, Tables 53 and 91.

Table 4. Export Price of Canadian Fish Products, C$/mt, 1978-1981.

Product Groups	Year			
	1978	1979	1980	1981
Seafish, whole or dressed, fresh	683.28	792.81	1,204.80	1,123.57
Freshwater fish, whole or dressed, fresh	1,582.85	2,033.88	2,280.99	2,029.01
Seafish, whole or dressed, frozen	2,600.51	2,652.28	2,611.62	2,423.88
Freshwater fish, whole or dressed, frozen	1,409.52	1,550.15	1,373.61	1,511.78
Seafish, fillet, fresh	2,665.61	2,746.03	2,963.19	3,179.47
Freshwater fish, fillet, fresh	3,870.83	5,135.45	5,107.44	7,022.32
Seafish, fillet, frozen	2,071.44	2,304.22	2,393.77	2,605.05
Freshwater fish, fillet, frozen	3,879.03	5,751.57	5,958.84	7,286.13
Seafish, blocks, frozen	2,093.53	2,337.95	2,360.96	2,372.13
Freshwater fish, blocks, frozen	1,200.88	1,546.53	1,574.61	1,843.45
Smoked fish	1,678.75	2,132.62	2,241.80	1,956.31
Salted or dried groundfish	2,360.55	2,613.02	2,464.54	2,713.89
Pickled and cured fish	1,055.79	1,128.62	1,237.29	1,227.51
Canned fish	3,632.94	4,086.48	4,692.25	5,263.98
Shellfish fresh or frozen	3,340.30	3,665.20	4,391.84	6,654.59
Canned shellfish	7,685.91	9,388.79	8,684.85	7,853.19
Fish roe	12,035.90	22,557.32	10,816.38	12,313.17
Meal	464.64	477.72	484.77	539.82
Oil	493.03	385.23	534.02	480.99
Miscellaneous	638.18	687.85	682.59	959.28

Canada Department of Fisheries & Oceans, Canadian Fisheries Annual Statistical Review, Vol. 12, 13, 14, Tables 83, 88.

Table 5. Export Price of Canadian Fish Products Exported to Developing Countries and to All Areas, 1981, C$/mt.

	Developing Countries	All Areas
Fresh or frozen		
Herring roe cured	14,787	14,077
Shellfish, n.e.s.	4,062	4,701
Frozen, whole or dressed		
Mackerel	876	722
Herring	1,016	777
Freshwater fish, n.e.s.	655	1,187
Dried salted		
Cod boneless	5,788	3,761
Hake	2,354	2,428
Pollock	2,374	2,668
Herring bloaters	1,431	1,471
Salted 43% or less mc		
Cod heavy salted	2,639	2,679
Pickled		
Alewives	738	678
Canned		
Salmon, chum	4,779	4,276
Sardine	3,297	3,597
Herring, n.e.s.	2,625	3,415
Shellfish & products, n.e.s.	4,062	5,132

Canada Department of Fisheries & Oceans, Canadian Fisheries Annual Statistical Review, Vol. 14, Table 90.

Table 6. Value of Import of Fish Products, Developing Countries, 1978-1982.

Developing Area	Value of Imports US$'000				
	1978	1979	1980	1981	1982
Africa	416,594	452,511	460,573	463,761	535,524
North Western	7,812	8,811	9,864	9,828	12,002
Western	311,241	341,347	349,864	352,087	417,287
Central	55,924	63,312	62,392	67,580	70,374
Eastern	41,617	39,041	38,453	34,266	35,861
North/Central America					
Caribbean	168,056	184,924	233,355	234,003	167,308
Northern	4,573	4,796	5,420	6,098	5,961
Central	31,702	45,431	56,728	55,633	44,131
Caribbean	131,781	134,697	171,211	172,272	117,216
South America	154,476	230,606	219,568	218,060	240,881
Pacific	2,549	2,946	6,278	2,500	655
Other	151,927	227,660	213,290	215,560	240,206
Near East and Southern Asia	174,548	178,797	273,913	302,813	284,749
Near East Africa	71,641	43,312	69,391	102,869	84,565
Near East Asia	100,654	122,398	186,047	193,610	183,623
Southern Asia	2,853	13,087	18,475	6,334	16,561
East and South East Asia	514,013	627,201	704,458	773,150	928,182
Oceania	34,726	31,346	37,009	34,390	52,657

FAO, Yearbook of Fishery Statistics, Vol. 55, Rome, 1984.

Table 7. Imports of Fish Products, Major Fish Importing Countries Among Developing Countries, 1982, '000 MT

Item	Area					
	Africa	North/Central America	South America	Near East & Southern Asia	East & South East Asia	Total
Fish, fresh, chilled or frozen	590.0	36.3	51.1	99.6	275.9	1,052.9
Fish, dried, salted or smoked	15.7	8.5	18.6	4.3	20.2	67.3
Crustaceans & molluscs, fresh frozen, dried, salted, etc.	0.3	0.8	5.5	1.0	1,347.0	142.3
Fish products & preparations whether or not in airtight containers	85.5	22.2	40.1	45.6	81.0	274.4
Oils & Fat	0.0	1.5	33.2	0.0	3.1	37.8
Meals, solubles & animal feedings stuffs	6.6	39.0	54.3	72.0	237.0	408.9
TOTAL	698.1	108.9	203.2	223.6	769.0	2,002.8

FAO Yearbook of Fishery Statistics, Vol. 55, Tables B2, C2, D2, E2, F2, G2, H2, Rome, 1984.

Table 8. Major Fish Importing Countries Among Developing Countries, 1982, US$ million.

Developing Countries	Level of 1982 Imports		
	20.0 to 49.9	50.0 to 99.9	Over 100.0
Africa (81%)			
Nigeria			301.3
Ivory Coast		80.3	
Zaire	30.5		
Congo	22.1		
North/Central America & Caribbean (56%)			
Cuba	41.6		
Mexico	30.5		
Jamaica	21.6		
South America (90%)			
Columbia		84.	
Brazil		77.3	
Venezuela	34.5		
Fr. Guiana	20.0		
Near East & Southern Asia (81%)			
Saudi Arabia		92.1	
Egypt		53.4	
Iran	35.6		
Libya	30.6		
Kuwait	20.4		
East & South East Asia (98%)			
Hong Kong			469.4
Singapore			183.9
Malaysia		78.0	
Korea Rep		56.4	
Philippines		51.9	
Indonesia	45.2		
Thailand	27.7		

FAO, Yearbook of Fishery Statistics, Vol. 55, Table A1-5, Rome, 1984.

Table 9. Import Prices for Fishery Products in Major Importing Countries Among Developing Countries, 1979-1982, US$/mt.

Developing Countries	Average Import Prices			
	1979	1980	1981	1982
Nigeria	825.07	687.41	675.55	580.28
Ivory Coast	535.47	672.51	627.18	649.09
Zaire	1,081.69	1,042.07	1,111.78	918.67
Congo	936.66	1,167.28	1,119.07	1,084.25
Cuba	576.71	629.19	667.19	676.31
Mexico	536.02	861.30	983.77	987.90
Jamaica	923.48	1,154.91	1,294.36	1,312.12
Columbia	558.77	676.76	849.34	752.85
Brazil	1,122.61	1,268.55	1,289.85	1,183.23
Venezuela	1,655.76	1,233.59	1,115.38	1,247.34
Fr. Guiana	2,419.97	3,672.81	6,769.68	5,681.21
Saudi Arabia	1,590.26	1,864.66	1,894.60	1,888.78
Egypt	589.26	579.24	687.66	588.85
Iran	492.67	555.81	537.48	551.59
Libya	2,618.71	3,476.44	3,643.17	3,221.05
Kuwait	1,595.61	1,944.42	2,286.04	2,012.83
Hong Kong	3,068.68	3,328.75	3,359.01	3,203.76
Singapore	724.31	1,003.16	963.48	1,050.20
Malaysia	384.67	476.50	511.11	493.56
Korea Rep	768.54	753.06	1,153.05	696.16
Philippines	611.90	683.87	858.57	656.41
Indonesia	427.30	527.19	603.49	541.72
Thailand	262.69	537.03	467.81	606.13

FAO, Yearbook of Fisheries Statistics, Vol. 55, Table A1-5, Rome, 1984.

Table 10. Import Prices for Fishery Products in Major Importing Countries Among Developing Countries, by Product Group, 1982, US/mt.

Developing Countries	Fish Frozen Chilled Frozen	Fish Dried Salted, Smoked	Shellfish, Fresh Frozen, Dried	Fish Canned	Shellfish Canned	Oils	Meals	Average
Nigeria	402.71	4,701.03	-	1,238.10			345.45	580.28
Ivory Coast	625.93	2,566.04	3,095.62	1,324.76	3,900.00	-	-	649.09
Zaire	339.62	1,937.50	-	1,067.01	-	-	-	918.67
Congo	689.07	2,841.53	-	1,633.14	-	-	-	1,084.25
Cuba	596.97	1,092.20	-	1,650.19	-	-	350.00	676.31
Mexico	2,750.00	14,800.00	1,875.00	1,821.43	5,000.00	566.67	350.00	987.90
Jamaica	790.00	2,233.34	-	1,294.12	-	-	-	1,312.12
Columbia	1,291.74	-	2,305.56	1,303.39	968.09	797.81	472.69	752.85
Brazil	533.06	2,833.54	994.13	2,193.79	2,750.00	1,440.00	-	1,183.23
Venezuela	720.20	3,250.34	717.44	1,463.94	2,635.71	1,405.66	-	1,247.34
Fr. Guiana	1,416.67	3,344.44	6,094.45	2,412.37	3,294.12	-	500.00	5,681.21
Saudi Arabia	1,557.75	2,891.18	6,479.27	1,930.84	4,341.08	3,307.69	-	1,888.78
Egypt	400.00	1,965.46	-	1,365.66	-	-	353.75	588.85
Iran	791.67	-	-	2,037.04	-	-	480.77	551.59
Libya	2,700.00	3,200.00	-	3,293.33	-	-	-	3,221.05
Kuwait	1,837.50	3,461.54	4,700.00	2,388.89	-	-	-	2,012.83
Hong Kong	2,287.80	6,215.18	5,270.57	2,724.00	11,165.59	746.27	437.81	3,203.76
Singapore	842.27	4,266.33	1,774.87	1,432.71	6,542.48	840.00	430.26	1,050.20
Malaysia	281.25	854.17	601.25	1,050.85	1,739.13	-	249.20	493.56
Korea Rep	610.98	3,077.61	1,130.52	5,333.33	4,800.00	434.62	471.81	696.16
Philippines	-	-	-	987.09	1,100.00	-	350.00	656.41
Indonesia	277.99	1,571.43	2,267.67	1,485.68	3,950.00	789.14	537.44	541.72
Thailand	1,020.57	9,535.86	385.57	1,113.04	196.20	1,100.00	500.00	606.13

FAO Yearbook of Fishery Statistics, Vol. 55, Tables B2, C2, D2, E2, F2, G2, H2, Rome, 1984.

Table 11. International Transactions in Fishery Products by Developing Countries With Trade in Fish Products Valued at Over US $1 million, 1982.

Area	No. Countries	Trade in US$'000,000		
		Imports	Exports	Export Surplus
Africa	29	532,878	682,118	149,240
North America Caribbean	22	164,543	943,810	779,267
South America	12	240,881	1,331,749	1,090,868
Near East	12	267,598	87,850	179,748
Asia	16	944,739	2,793,889	1,849,150
Oceania	5	47,606	69,404	21,798

FAO Yearbook of Fishery Statistics, Vol. 55, Table A-1-5, Rome, 1984.

International Markets for Pacific Groundfish Since Extended Fisheries Jurisdiction

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The Magnuson Fishery Conservation and Management Act (MFCMA) (P.L. 94-265 of 1976) became law in the United States on March 1, 1977. Few projections of the impact of this "200-mile limit law" (we call it "322.58-km law") had been made. Fishermen generally saw the Act as a way to keep the foreign fishermen out. Processors believed less foreign fishing would mean greater opportunity for exports to major fishing nations. Management agencies envisioned greater fish protection, better controls and larger budgets.

Views of what occurred differ greatly among and within these groups of fishermen, processors and managers. On the West Coast of the United States -- California, Oregon and Washington (COW) -- the Pacific Fishery Management Council (PFMC) was established, and teams were set up to develop eight management plans, one for each of the following: salmon, squid, northern anchovy, jack mackerel, dungeness crab, pink shrimp, swordfish and pelagic sharks, and groundfish. Today, eight years after passage of the Act, only northern anchovy, salmon and groundfish have management plans in place, and only groundfish (which has been expanded to include northern jack mackerel) has and will have direct foreign participation and foreign market opportunities into the 21st century.

Foreign participation in the West Coast groundfish fishery is in the form of direct foreign fishing, foreign at-sea processing of domestic-caught fish, and importing. The majority of this participation has been and will be centered on Pacific whiting (Merluccius productus). Shortbelly rockfish (Sebastes jordani) has also been proposed for harvest by foreign fishermen, but only small amounts of this species have been taken. In the last fifteen years, 1970-1984, Pacific whiting has accounted for about ninety percent of the foreign participation in the COW groundfish fishery.

Foreign vessels started fishing Pacific whiting and rockfish (Sebastes spp.) heavily in 1966. By 1967 the Soviets, Japanese and Koreans were retaining 200,000 metric tons (mt) of Pacific whiting, 40,000 mt of rockfish and 5,000-10,000 mt of sablefish. Bilateral agreements between the U.S. and Japan, and the U.S. and the U.S.S.R. reduced the removals of non-whiting species to almost zero by 1976. The Japanese discontinued fishing off the West Coast after the passage of the MFCMA. The Republic of Korea did not receive fishing rights, and only the U.S.S.R., Bulgaria and Poland have applied for rights and actually fished in the Fishery Conservation Zone under the MFCMA.

The PFMC has established three priorities for dividing fish quotas among foreign nations and partitioning the Pacific whiting quota of 175,500 mt. The first priority is for U.S.-caught and processed fish, second priority is for joint ventures (JV) (currently U.S.-caught and foreign at-sea processing), and the third is for foreign fishing and foreign processing.

Although the PFMC sets and divides the quota by categories, it does not determine which foreign nation receives the JV and foreign share; this allocation is made by the U.S. State Department. Political -- not resource -- problems caused disruptions in the foreign allocation in 1979, 1980, 1981, and 1982. These disruptions in the foreign allocation have contributed to an increase in JV commitment by the U.S.S.R.

This shift from foreign fishing/processing to JV has significantly affected the COW groundfish industry. The most obvious effect is the ex-vessel value received by U.S. fishermen. This Pacific whiting ex-vessel value was $11 million U.S. ($22 million N.Z.) in 1983 and is projected to be $15 million U.S. in 1984 ($30 million N.Z.). When deflated to 1976 levels, the 1984 ex-vessel whiting value was half the total value of the pre-MFCMA COW groundfish fishery.

However, the effect of the JV fishery has been far greater than the domestic ex-vessel value. This greater effect has occurred because of the structural changes in the COW trawler fleet. The fleet has increased its number of larger and more powerful vessels capable of fishing midwater species. These new trawl vessels have sent economic shock waves throughout the COW groundfish industry since 1980.

Even though domestic landings have doubled since 1977 (from 49,000 mt to 100,000 mt in 1984), and domestic-sold harvests (JV transfers plus domestic landings) have tripled to 170,000 mt, the harvesting sector is experiencing financial turmoil.

Since 1976, over 200 new trawl vessels have been built. Many of these vessel owners received loan guarantees and other government assistance. However, as of July 1984, over sixty-five percent of those vessels financed through the Fishing Vessel Obligation Guarantee and the Production Credit Association have had major financial problems. Roughly 120 vessels have been foreclosed and resold since 1982. These sales have caused losses to the lending institutions, the fishermen and the industry. These vessels, while on the way to financial insolvency, have contributed to the increased landings, depressed ex-vessel, wholesale and retail fish prices, and decreased vessel values of 1981-1984. Even today, excess capacity and foreign imports contribute to smaller total revenues for domestic vessels. In 1979, one small 56-foot coastal trawler I know of grossed about $180,000. By 1982, the same vessel, same captain, same area with similar effort grossed $73,000. In 1984 this vessel's gross is projected to be about $130,000. When the 1984 $130,000 figure is deflated to 1979 values, it is roughly one-third higher than 1982 but still only half of 1979. The fishermen believe trip limits, too many vessels, and vessels which received financial assistance have contributed to most of the financial problems.

Financial turmoil in the domestic harvesting sector has contributed to a general instability in the West Coast groundfish fishery and has caused suppliers to seek long-run stable supplies elsewhere. Although fish has come from other U.S. states, some has also been imported. The new domestic and foreign suppliers who have increased exports of groundfish to the COW area are Canada (rockfish), New Zealand (orange roughy), Alaska (flatfish, cod and rockfish), and Massachusetts (flounder).

These international and domestic imports have retarded the production of domestic Pacific whiting, small flatfish and small rockfish (the category for shortbelly rockfish). However, the COW groundfish fishery still has latent export potential, excess harvesting capacity and underutilized edible species.

It is hoped that a stabilizing of the industry will lead to a more concentrated export effort by those companies which remain. The species these companies will be able to exploit will remain Pacific whiting (for blocks and fillets), shortbelly rockfish (in the round or butterflied), spiny dogfish (for fish and chips), and small flatfish (in the round). Total domestic production of these four categories of fish could be as high as 250,000 mt.

The MFCMA has increased the domestic and international market opportunities of the West Coast groundfish fishery, but to date, it has also been a factor in increasing the instability within the fishery. Eventually the international markets will need West Coast groundfish and the MFCMA will protect the fish stocks and the access of U.S. fishermen to valuable fishery resources of 250,000 mt. These resources used prudently could increase domestic stability and produce foreign exchange above $100,000,000 U.S. ($200,000,000 N.Z.).

The New Ocean Regime: Experiences of the Australia-New Zealand Fish Trade

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Introduction

The declaration of the Australian fishing zone in 1978 has had little effect on Australian landings of fish. While the declaration extended Australian jurisdiction to 200 nautical miles, no new fisheries have been developed. The limited expansion in catches which has occurred has been as a result of significantly greater increases in effort in the main established fisheries, resulting in overcapitalisation of those fisheries and the deteriorating economic performance of vessels.

One factor which has contributed to the Australian fishing industry's problems has been the greater competition for markets resulting from increased imports of fish from New Zealand, following the declaration of the exclusive economic zone. The development of the New Zealand deep sea fishery and the resultant increase in exports to Australia has changed the nature of import competition faced by the Australian fishing industry.

Those areas of the New Zealand industry where relative advantages have changed since declaration of the exclusive economic zone, the likely impact of the recent devaluation of the New Zealand dollar, and the implications for the marketing of the Australian raw fish catch are examined in this paper.

The Australian Market for Fish

Australian consumption of fresh and frozen fish (whole and filleted fish, fish fingers and similar products) in 1982-83 was estimated at around 7.9 kg liveweight per person, while total consumption of fisheries products was estimated to be around 16 kg liveweight equivalent. Demand for fresh and frozen fish is met from imports (4.4 kg per person), from the Australian fishing industry (3.0 kg per person), and from recreational fishing (0.5 kg per person).

The apparent quantity of fish consumed in Australia since 1972-73 has increased at an average rate of around 3 percent a year. The main increases occurred in 1976-77, when consumption increased by 11 percent, and in 1979-80, when the increase was 17 percent. While the 1976-77 increase resulted from both a rise in imports and a larger domestic catch, the higher consumption in 1979-80 was attributable almost entirely to higher imports (see Figure 1).

As a result of increased imports of fresh and frozen fish, the relative share of the market held by the Australian industry declined from nearly 48 percent in 1978-79 to 41 percent in 1982-83.

The share of the market held by imported fish fillets increased from 35 percent to 41 percent, and that held by imported whole fish nearly doubled, rising from 6 percent to almost 12 percent in 1980-81, before falling to 8 percent in 1982-83.

Recreational fishing is also a significant source of fish for household consumption and it could be expected to increase in importance over time as a result of increased leisure activity. In a 1976-77 study of household fish consumption in capital cities, it was found that leisure fishermen provided approximately a quarter of fish consumed (P.A. Consultants and Department of Primary Industry, 1978, p. 25). Consumption of privately caught fish varied considerably according to city (Hobart and Perth recorded the highest figures) and season (consumption was higher during summer).

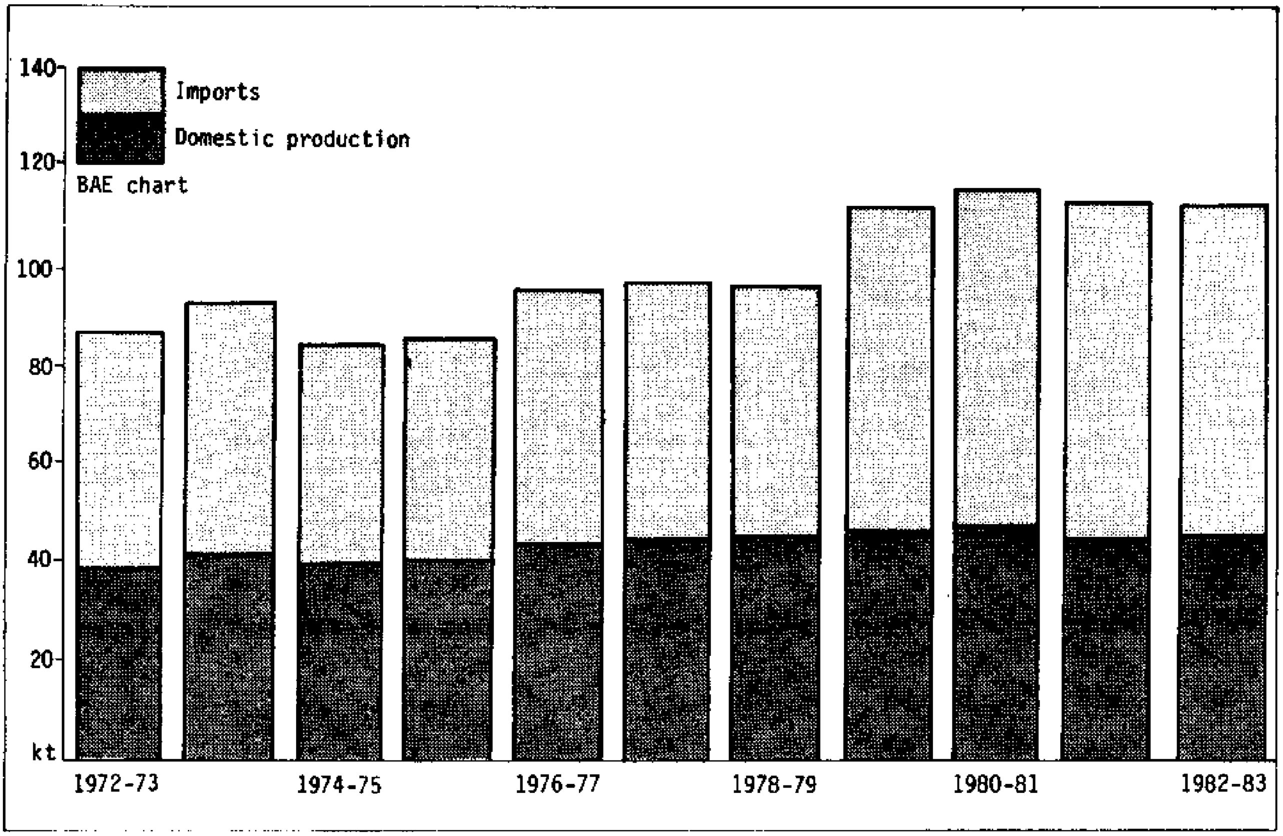

Figure 1. Australian Consumption of Fresh and Frozen Fish, Liveweight Equivalent

Source: BAE (1984a).

Impact of the Australian Fishing Zone on the Fishing Industry

The declaration of the 200-mile Australian fishing zone in 1978 and similar declarations by most countries around that time led to considerable optimism as to the potential for expansion of the fish sector of the Australian fishing industry.

Considerable scope was seen for replacement by domestic fish of an estimated 30 percent of imports, mainly in the form of frozen fish, smoked fish, some canned varieties and (in the longer term) fish fingers and fishmeal production. This process was expected to be assisted by a relatively rapid increase in prices for imported fish, given the already depleted resources of some important species prior to the introduction of exclusive economic zones, as well as the expected disruption to trade following their declaration (Australian Fisheries Council, 1977).

However, declaration of the Australian fishing zone has had, to date, a negligible impact on the Australian fish industry, and the extent of import substitution has generally been small. Of the areas identified as having potential for import replacement, only fish fingers are now manufactured locally -- but even that processing uses imported fish.

Development of new trawl fisheries in Australia has been constrained so far by many factors, including the uncertain extent of the resources, the high operating costs of fishing vessels and the high marketing costs associated with fishing in areas remote from the main areas of consumption in Australia (Senate Standing Committee on Trade and Commerce, 1982).

A more fundamental reason is that many of those species that are currently underexploited are not established on domestic markets, and there is thus little incentive for individual fishermen to exploit them. As a result, the main method of industry expansion has been to extend established fisheries further, rather than to fish new resources.

The rapidly expanded New Zealand production and exports, made possible by declaration of the exclusive economic zone, now supply many market areas in Australia where import replacement possibilities were previously identified. As a result, any future expansion of the Australian fishing industry will face increased competition for these markets.

The Australian finfish sector is the third largest in the Australian fishing industry (after the prawn and rock lobster industries), with total production in 1982-83 estimated at 54.1 kt, valued at $75.5m at the fishing level. Australian commercial production of fish (excluding tuna) has been increasing slowly, with a steady average increase of approximately 2.5 percent a year since 1972-73. The main growth has been in production from the south-eastern trawl fishery, which extends from north of Newcastle in New South Wales to Bass Strait and is the principal source of domestic supplies to Sydney and Melbourne.

The number of boats operating in the south-eastern trawl fishery has increased rapidly, from 108 in 1979 to 196 in 1981, and to 218 in 1982. The major factors behind this increase were optimism about the prospects for fish associated with declaration of the Australian fishing zone and rising prices received for fish, resulting in a significant increase in real terms in total vessel income.

A sharp turnaround in income per vessel occurred in 1980-81, with a fall in average vessel income of 18 percent in real terms between 1979-80 and 1980-81. This was due to three main factors: a reduction in total catch; a rapid rise in the costs of inputs (particularly of fuel, the unit cost of which rose by 50 percent between July 1979 and July 1981); and a reduction in prices received in real terms (BAE, 1982).

Most of the catch from the south-eastern trawl fishery is auctioned as whole fresh fish on the Sydney fish market. Prices there have fallen in real terms since 1979-80, with average unit prices in 1982-83 more than 13 percent below those of 1979-80. This has intensified the economic pressure on vessels in the fishery, as catches have remained relatively unchanged.

Development of the New Zealand Exclusive Economic Zone

In contrast to Australia's fisheries production, New Zealand's catch increased dramatically following declaration of the exclusive economic zone in 1978. Total output rose from 85 kt in 1977-78 to an estimated 233 kt in 1982-83, primarily as a result of increased fish catches by joint ventures using foreign boats and crews. Total joint venture catches rose from 6 kt in 1978 to 118 kt, while the fish catch by the New Zealand domestic industry rose by 11 percent a year, from 56 kt to 96 kt, between 1977 and 1982.

New Zealand developed joint ventures with foreign fishing nations as a means to expand the catch available to the processing industry, provide the necessary expertise for deep sea fishing, and promote greater involvement in fisheries in areas previously fished by foreign vessels.

Joint ventures enabled the utilisation of vessels of fishing nations which had been displaced by the introduction of exclusive economic zones. Because the vessel operation costs were met by the foreign partner, the cost to the New Zealand partner was low. The foreign partner received a percentage of the catch as a charter fee but was required to sell back a proportion of that share for subsequent processing and sale.

Joint ventures in New Zealand have covered a variety of arrangements, both in terms of the equity provided by the partners and the degree of risk sharing undertaken. In some instances, the arrangements did not give rise to any significant New Zealand input, as the foreign partner was required to bear most of the fishing risks, as well as the primary responsibility for marketing the product. In other instances, the New Zealand partner adopted a much more active marketing role (MAF, 1982b).

As a result of these increases in fish production, total exports of fish and fish preparations rose from $NZ60.5m in 1978 to $NZ169.7m in 1983, a growth rate of 25 percent a year in real terms (base 1980-81) -- see Figure 2. Most was marketed through traditional export markets for New Zealand fish, namely, Japan and Australia. The United States started to become a significant market for New Zealand fish only in 1981 and has since increased in importance.

A major factor in the growth of exports to Japan has been the Japanese involvement in joint ventures with New Zealand. The gross value of exports to Japan excludes the operating costs of Japanese vessels engaged in New Zealand joint ventures. In terms of the net trade balance, the increase has been much lower. Indeed, in net trade terms, sales to Australian markets made the greatest contribution to overseas revenue earned by the New Zealand fishing industry in calendar years 1981 and 1982 (Reserve Bank of New Zealand, 1982).

New Zealand exports of fish to Australia rose from $NZ9.3m in 1978 to $NZ50.7m in 1983, a rate of increase similar to that of the increase in total fish exports. The relative share of export sales to Australia has therefore remained reasonably stable, varying between 27 percent in 1979 and 33 percent in 1982.

Impact on the Australian Market

The rapid increase in New Zealand fish exports to Australia and the decline in exports of fish from some of the countries displaced by the introduction of the 200-mile limits has resulted in significant changes in the shares of the Australian market held by importing countries.

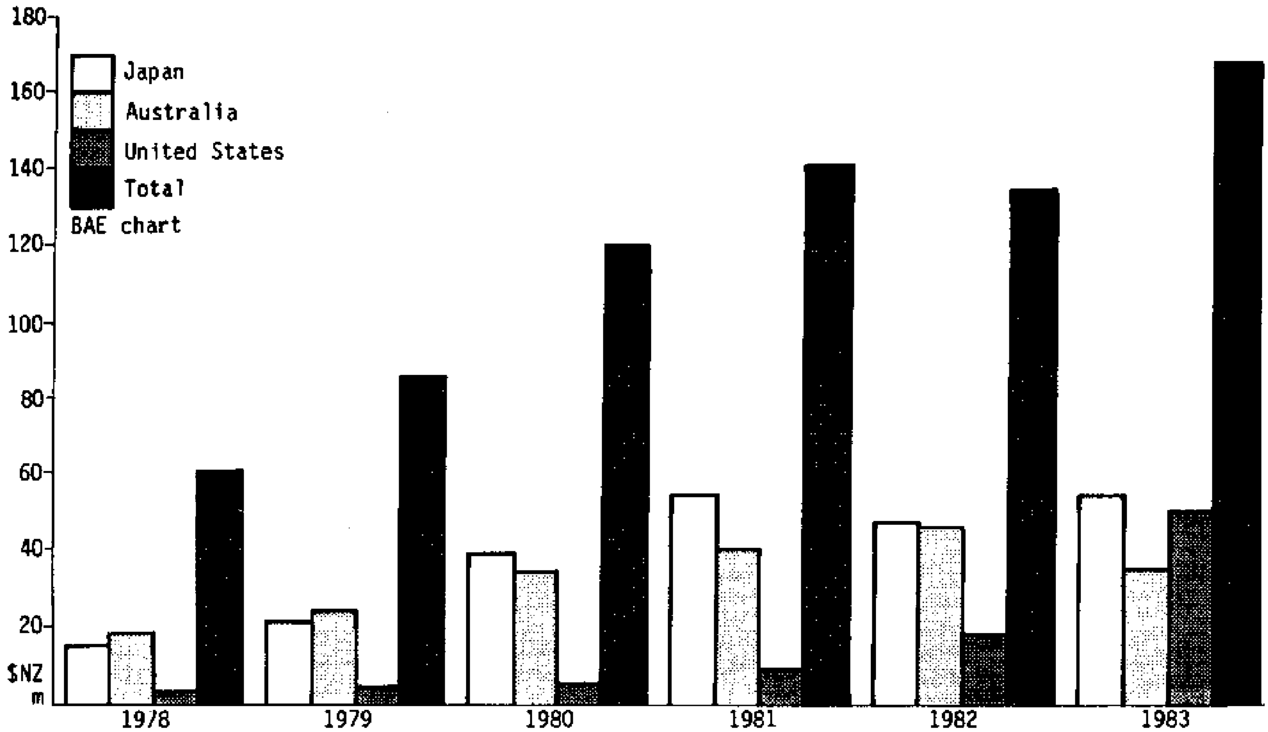

Figure 2. Value of New Zealand Fish Exports, by Country of Destination, in Real 1983 Dollars
Source: New Zealand Fishing Industry Board (1983).

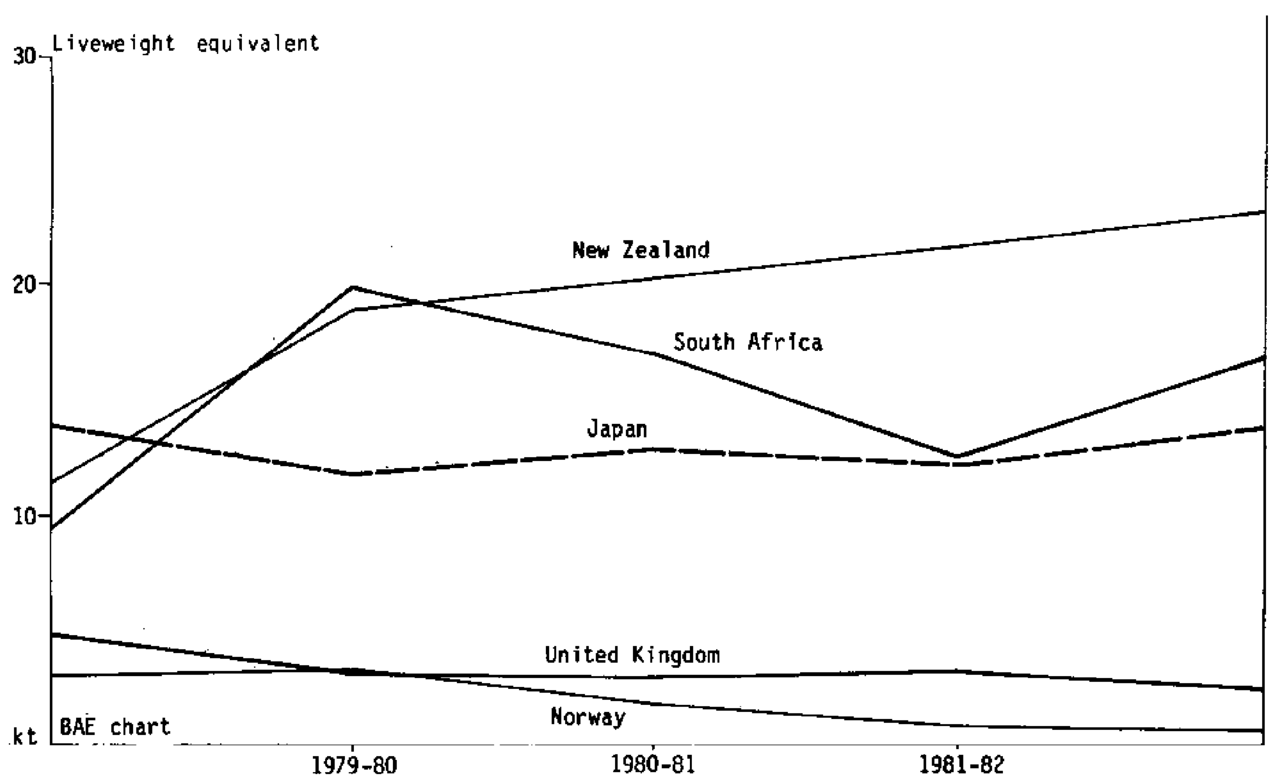

Figure 3. Australian Imports of Fresh and Frozen Fish, by Country of Origin
Source: BAE (1984b).

Comparison of relative market shares held in 1978-79 to 1982-83 (see Figure 3) shows that New Zealand, South Africa and South America improved in relative importance as suppliers of Australian fish requirements, while the domestic industry, Japan, the United Kingdom and Norway were displaced. New Zealand emerged as the major supplier of fish products to the Australian market in 1980-81, a position it consolidated in 1981-82, when it supplied over 21 percent of all fish consumed.

The increasing importance of New Zealand as a supplier of fish has had significant implications for the Australian fishing industry because both industries supply the table fish market. While exports of fish from the New Zealand domestic industry consisted largely of species also produced by the Australian industry, joint venture product was largely sold in new market segments, particularly those with less particular species requirements, such as the catering and supermarket sectors. The product specifications of orange roughy (a white fillet, bone-free, with a good shelf life) and its marketing in graded shatterpacks to enable better portion control enhanced the acceptance of joint venture product by these sectors.

The New Zealand industry was able to meet Australian demand for a product of this type, acceptable for catering use, because of the economies of size in catching and marketing enabled by introduction of joint ventures. Although a large Australian venture had previously attempted to supply the market, it was unsuccessful because of the relatively small size of the resource (Department of Primary Industry, 1981).

The Australian industry has found it difficult to meet the specifications of both the mass catering and supermarket segments because of the level and variability of fish landings in Australia, the marketing systems used and the difficulties in establishing a specialist fish processing sector. While New Zealand fish do not usually compete directly with Australian fish on fresh fish markets, they do exert a significant influence on those markets through competition at the retail level.

The increasing involvement of supermarkets in 'fresh' fish retailing has been made possible through improved access to imported frozen filleted product suitable for table use. This has increased the competitive pressure on specialist fish retailers, who depend more on domestic product.

There have been other, more direct, effects on segments of the Australian industry. The introduction of new species, particularly orange roughy, resulted in the displacement of other species from some markets. In particular, reef fish and some trawl species were displaced from some segments of the hotel and restaurant market. Some other imported species have been less well accepted and have been marketed under generic names or names related to established species to enhance public acceptance, possibly to the detriment in the longer term of the established species.

Competitive Advantage of the New Zealand Fishing Industry

Given the high and increasing importance of New Zealand as a supplier of table fish to the Australian market, it is necessary to assess the relative competitiveness of the Australian and New Zealand fishing industries and the factors likely to influence it.

The main aspects of competitiveness are the areas where the New Zealand industry has a probable relative cost advantage. If such advantages do exist, it should be established whether they are likely to be reflected in lower prices on the Australian market and lower prices to Australian operators.

In making this assessment, it is necessary to examine the New Zealand inshore fishery separately from the deep sea fishery because of their different structures. The inshore fishery is broadly comparable in structure and operation to the Australian finfish industry, while the economic structure of the deep sea fishery is quite different.

New Zealand inshore fishery

Australia was a relatively important market for the New Zealand fishing industry prior to declaration of the exclusive economic zone, with the New Zealand inshore fisheries supplementing the Australian production of fish for table use. In 1977, New Zealand sales of fish and fish preparations to Australia were valued at $NZ6.5m, or 30 percent of all New Zealand fish exports.

The New Zealand inshore fishery does not appear to hold any significant advantage over the Australian fish industry. Indeed, operators in the two industries face similar problems of cost-price squeeze and overcapitalisation.

Prices paid to New Zealand operators have been lower than those to Australian operators. After taking account of differences in freight costs to the Australian market, average prices paid to New Zealand operators were around 12 percent lower than those paid to the Australian industry in 1980-81. Export returns from the Australian market were higher than those from other markets for a large range of species exported.

While there is insufficient information for a full comparison of the competitiveness of the Australian and New Zealand domestic trawl fleets, the information available indicates that, while the New Zealand industry is advantaged by access to more productive fish resources, the Australian industry has advantages in direct operating costs. On the basis of a 1980-81 survey of the south-eastern trawl fishery, average boat cost (crew, fuel, vessel repairs, maintenance and gear costs) represented 56.1 percent of total vessel revenue. By comparison, a New Zealand Fishing Industry Board survey of all trawlers for the year ended March 1981 showed that while total sales were roughly equal to Australia's, the same costs represented 67 percent of total sales (BAE, 1982; MAF, 1982a).

Deep sea fishery

Under the early joint venture arrangements, the capacity of participants in the New Zealand deep sea fishery to compete on export markets was high. The ventures had access to fish at costs which did not reflect the true operating costs, as the New Zealand partner bore few of the costs associated with vessel operation. While the profitability of the catching fleet was marginal and in some cases substantial losses were made, they were met by the foreign partner, who was prepared to sustain short-term losses in anticipation of gaining long-term access to the resource.

The joint venture received a share of the catch as a condition of access, while the remainder went to the foreign owner of the vessel as a charter fee. The foreign owner was then required to sell back a proportion of that share to the joint venture at negotiated prices, for subsequent processing and sale. The joint venture company could buy back a further proportion of the catch from the foreign partner for processing and sale. As a result, the average fish cost to joint venturers was lower than the negotiated price.

Joint ventures paid no fees for access to the New Zealand exclusive economic zone but were required to land a minimum percentage of product for reprocessing onshore: 10 percent initially, progressively increased under the current policy to 35 percent of the deep water catch.

Subsequent management changes made to increase New Zealand participation in the deep sea fishery are likely to have significantly reduced the advantages held by this sector over the New Zealand inshore and Australian domestic industries.

The first steps in that direction were taken during the 1981-82 season, when total species quotas were introduced and preferential access was established for the domestic industry. These changes resulted in a number of inefficiencies in vessel operations, including an overinvestment in fishing effort; premiums were placed on being first in an area to maximise individual shares of the catch. There was also a reduction in catch levels because some species could not be caught without also taking a large catch of species already fished to quota limits. However, the main impact was on the efficiency of vessel operation, and fell largely on the foreign partner.

The introduction of a comprehensive deep sea fisheries policy in 1982 removed the incentive to overinvest in fishing capacity, by introducing transferable species quotas. While the policy continued to allow foreign vessels under charter, charter fees now had to be in cash rather than kind and fish sales had to be at 'realistic' prices. This could be expected to increase the cost of fish processed for export to more realistic levels than had been the case with joint ventures.

Greater New Zealand involvement in the fishery now depends entirely on the policies of the participating companies, which have complete freedom to choose the fleet configuration most suited to their operation. While this is likely to encourage high technical operating efficiency, it is also likely to lead to higher vessel costs over time, with a reduction in the number of surplus vessels overseas and an increase in charter fees.

The value of tradeable quota allocations is also likely to rise, reflecting the economic rent from access to the fishery. However, the allocations do prevent overcapitalisation of the fishery, providing an advantage over the New Zealand inshore and the Australian south-eastern trawl fisheries.

The fishery is also critically dependent on a limited volume of high-value species, and its longer term viability will therefore be dependent on resource considerations. Any changes in the yield of those species will have major implications for the long-term viability of the fishery.

Processing sector

The processing sector of the New Zealand fish industry is likely to have advantages over the Australian industry as a result of the probable economies of size associated with its higher throughput of product and lower wage cost structure, and the higher levels of assistance to the industry.

Fish from New Zealand's inshore fishery are sold largely to processors on the basis of an agreed port price negotiated between operators and processors. Together with the higher fish catch, this provides New Zealand processors with greater continuity of throughput from their inshore fishery.

The establishment of the deep sea fishery has proved a significant advantage to New Zealand processors. Because the product is frozen on board, it can be used to fill any gaps in inshore domestic production caused by poor catches. The deep sea fishery has also enabled the establishment of specialist processing because of the greater availability of individual products such as orange roughy and hoki.

The requirement that a percentage of the deep sea fishery catch be landed in New Zealand for further processing represents a further form of assistance to the New Zealand processing sector. The extent of that assistance will depend on the impact of the increased throughput on average costs and also on prices paid for that fish.

The New Zealand processing industry has also benefited from a range of assistance measures designed to encourage sufficient expansion in processing to handle the growth in throughput projected from increased New Zealand participation in the deep sea fishery.

Most direct assistance has been linked to the provision of capital both to the fishing and processing sectors. Suspensory loans to the New Zealand fishing industry have aided the establishment of a processing structure at lower private capital costs, an advantage with longer term implications than a product-based incentive would have. These assistance measures encourage overcapitalisation of both the fishing and the processing sector, resulting in increased social operating costs but lower private operating costs.

Assistance has also been provided to the processing sector through export incentives. However, these have been applied to less established species on the basis of domestic value added, thus advantaging deep water species over established inshore species on all export markets.

Implications for the Australian Fishing Industry

In the past, general price levels for table fish in Australia have reflected the relatively high domestic industry costs and the lack of direct substitutes for Australian-caught table fish. However, there are indications that this situation is changing and that New Zealand trade is becoming more important in establishing Australian prices.

Australian prices for New Zealand fish imports have remained relatively stable during the key period of expansion in exports in 1980-81, following the declaration of the exclusive economic zone -- despite higher sales volumes. This was made possible by the increasing competitiveness of the New Zealand industry, enhanced by the development of the deep sea fishery and by the devaluation of the New Zealand dollar against the Australian dollar.

Exchange rates have been a major factor influencing pricing of fish imports from New Zealand. In assessing their impact on the competitiveness of the industries in both countries, it is necessary to take account of movements in the relative rates of inflation, because of the close link between exchange rates and inflation. The New Zealand dollar has depreciated by nearly 16 percent in real terms against the Australian dollar since 1979 and has recently been further devalued by a further 20 percent. Figure 4 shows movements in the New Zealand-Australia real exchange rate.

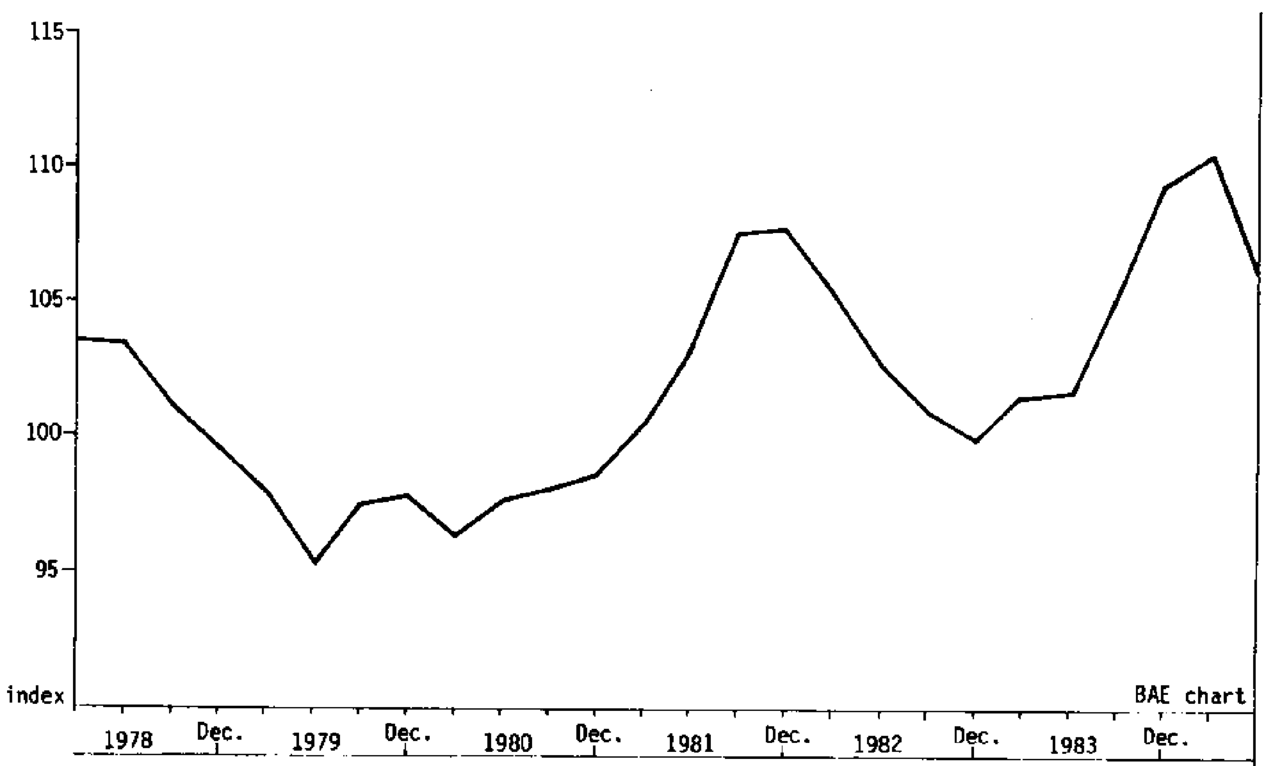

Figure 4. Real New Zealand - Australia Exchange Rate, Base 1980-81 = 100
Source: Reserve Bank of New Zealand (1982).

The latest depreciation is expected to make the New Zealand fishing industry more competitive on the Australian market, at least in the short term. However, in the longer term, the competitive gains are likely to be eroded because of the impact of inflation on costs.

These factors are likely to influence different segments of the fishing industry at different rates. The inshore fishery relies extensively on imported inputs (such as fuel), and its operating costs are likely to increase rapidly. The processing sector is relatively more labour-intensive, so that the extent of competitive advantage gained through devaluation will depend on the extent to which inflationary pressures can be contained. However, it seems likely that devaluation will further strengthen the position of the New Zealand processing sector through a decline in real wages.

Under joint venture arrangements, the impact of inflation (higher in New Zealand than in Australia) on the costs of fishing (met by the foreign owners of vessels) is likely to have conferred a greater competitive advantage on those exports than on exports from the inshore fishery, where the impact of higher inflation on cost of production would have reduced the advantages of a depreciating New Zealand-Australia exchange rate.

While this devaluation is unlikely to result in any significant increase in the total catch of the New Zealand fishing industry, because of resource constraints, it is likely to increase the proportion of fish landed in New Zealand for further processing. Under those circumstances, the level of exports to the main New Zealand markets -- Australia, the United States and Japan -- can be expected to rise.

New Zealand fish imports to Australia in the future can be expected to be more variable, as a result of the development of viable alternative markets -- the United States, for example.

Price levels on the Australian market will be determined more by overseas developments than they have been to date. Prior to the development of the New Zealand deep sea fishery, the Australian industry was relatively isolated from exchange rate developments because of the lack of direct substitutes for its products. However, with the changes that have taken place in New Zealand following the declaration of the exclusive economic zone, this is no longer the case.

Changes in relative currency exchange rates between Australia and the United States also significantly alter the distribution of fish exports from New Zealand, with consequent changes to prices on the Australian market.

The direct pressure of higher New Zealand fish imports on prices for Australian fish at major auction centres has been low, because different market channels are used; the majority of New Zealand imports is sold by importers and wholesalers to supermarkets and catering outlets. However, competition at the consumer level has restricted price increases on those markets, resulting in a decline in prices in real terms. This has intensified the cost-price squeeze on operators and demonstrates the need for industry adjustment.

Supermarkets are likely to increase in importance as retail outlets for fish in Australia, a development which is likely to increase the competition with traditional fresh fish outlets. The Australian industry is at a considerable disadvantage in supplying these outlets because of resource constraints, its dependence on centralised auctions and its limited processing capacity.

The Australian industry will also continue to face increasing non-price competition from the New Zealand deep sea fishery, through the better processing and marketing options arising from the latter's access to larger resources. A number of market innovations, such as grading of product to enhance portion control and new product variants, have been well accepted by Australian consumers of fish.

It will be necessary for the Australian fishing industry to look for ways of strengthening those areas of the supply market in which it has advantages, such as fresh fish. However, consumer preferences for fresh fish over frozen product have been eroded by improvements in fish freezing technology and by developments in marketing which make the distinction between fresh and frozen product less clear.

The Australian fish industry will need to adopt more positive marketing and production strategies, aimed at better meeting consumer demand for those fish types it can supply. If positive steps are not taken in this direction, the industry faces significantly greater adjustment pressures than those of overcapitalisation, as the pressures of the cost-price squeeze on vessel earnings will continue to intensify.

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Changing Structure of Fisheries and Seafood Markets

Change of Distribution Mechanism on Tuna in Japan

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Introduction

In Japan, since 1955, the level of food life has been heightened in accordance with the high growth of the industrial economy, and the consumption trend of the fishery product shows a switchover from "vulgar" fishes to "noble" fishes -- and in this situation the tuna fishes are forced to move into the domestic market for raw-eating (as "sashimi") due to decrease of export as canned tuna or tuna for material, and recently we can observe an apparent formation of tuna fish market (high priced tuna). On the other hand, for the tuna fishing boats of Japan, there is seen a keen decrease of productivity due to the 200-mile regulations of the fishing area that started in 1973, and the influence of the scissor gap high cost and low fish price which are results of the oil shocks in 1973 and 1978. And in spite of the trials for rebuilding of the fishery production by decreasing the number of boats supported both by the governments and the fishermen, the basis of management of the tuna fishing shows fragility and instability due to compiled loss.

The formation of the domestic market for the high class tuna fishes promoted the import of tuna fish by aircraft and ship, and the inactive domestic production of the tuna fish invited the rise of the capital of distributing commercials, and helped the distribution mechanism of the tuna fish change.

In this text, the author is going to grasp the current characteristics of the structure of the tuna fish market, by summing up the developments of the tuna fishery and the import, analyzing and considering the changes of the distribution mechanism.

Production Trend of Tuna Fisheries and Import Trend of Tuna Fishes in Japan

Tuna fishing in Japan was started in the middle of the Tokugawa Era (1603-1867) by set net fishing, and in the Meiji Era (1868-1912) long line fishing was introduced but the production at that time was only about 10,000 to 20,000 tons per year. Then the fishing boats came with engines and the fishing area was enlarged so that in the Taisho Era and the beginning of the Showa Era (1912-1940) production reached 20,000 to 90,000 tons.

It was after World War II (1945) that tuna fishing was positively started and the production was increased. It was encouraged by the national government to promote the deep sea fishing for overcoming of the lack of foodstuff. Regulations of the fishing areas were loosened and special permits for fishing were issued to abruptly push the production. It reached 223,000 tons in 1955, and more than 535,000 tons (which is a peak level) in 1963. The period of 1955-1965 is a golden age of the tuna fishing. The fishing areas were still enlarged, and the fishing boats were built in a rush, and the fishing tackles were fortified.

The fishing areas are in the Indian Ocean, surrounding seas of Australia, western longitudinal area of the Pacific Ocean, and the surrounding seas of South America, and they are widened to the off-shore of Cape Town and the Atlantic Ocean. The voyage continues more than 400 days.

Afterwards, however, the production has been reduced to 358,000 tons in 1970, and 361,000 tons in 1975 due to the decrease of the fish resources, reduction of the fishing areas and the lowering of the angling ratio.

The production trend of the tuna fish in 1970-1982 is shown in Table 1. And it stays at about 300,000 to 380,000 tons per year including marlin that means it goes without apparent yearly undulation. The slight

Table 1. Catches of Tuna and Marlin by Species and Year in Japan (1970 ~ 1982). (Unit : MT)

Year / Species	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Southern bluefin & bluefin	48,899	48,260	46,811	48,534	50,460	40,716	41,805	51,900	46,555	44,241	49,494	58,485	44,205
Albacore	68,626	88,140	92,104	95,118	97,168	68,861	107,071	54,027	87,675	66,822	69,677	64,082	70,048
Bigeye	92,842	89,489	98,257	104,974	101,755	118,445	114,775	128,388	127,666	180,466	128,168	110,518	181,772
Yellow fin	79,077	70,857	67,761	75,681	75,845	71,989	85,744	82,845	98,066	99,659	119,001	110,009	114,219
Others	12,078	11,219	15,657	17,516	28,727	15,655	18,398	19,425	24,712	21,729	17,156	17,190	11,908
Total	291,017	307,965	318,090	341,818	348,950	310,616	367,793	386,530	384,674	362,917	378,496	360,279	372,142
Marlin	66,798	52,506	48,857	46,693	48,712	50,561	45,155	41,548	46,627	48,357	44,120	47,455	44,479

Source : Ministry of Agriculture, Forestry and Fisheries, Annual report on the distribution of marine products (1971 ~ 1984).

Table 2. Number of Permission Vessel on Skipjack and Tuna Fisheries in Distant Waters (1970 ~ 1982). (Unit : Vessel)

Item / Year	80 ~ 210t			210 ~ 800t			800 ~ 500t			Grand total	
	Longline	Angling	Total	Longline	Angling	Total	Longline	Angling	Total	Vessel	Tonnage
1970	354	168	522	381	52	433	262	2	264	1,219	289,871
1971	323	153	476	387	61	448	287	2	289	1,213	299,884
1972	306	132	438	397	83	480	268	12	280	1,198	308,301
1973	296	102	398	428	125	553	242	58	300	1,251	313,198
1974	269	71	340	459	152	611	233	76	309	1,260	320,745
1975	267	48	315	462	160	622	220	98	318	1,250	323,147
1976	259	36	295	456	157	613	208	113	321	1,229	322,012
1977	264	26	290	446	151	597	200	115	315	1,202	331,129
1978	246	26	272	444	135	579	187	121	308	1,165	332,528
1979	237	36	273	456	116	572	207	110	317	1,162	332,263
1980	241	34	275	487	90	577	215	104	319	1,171	332,654
1981	213	38	251	499	71	570	222	89	311	1,138	322,710
1982	242	41	283	453	46	499	159	79	238	1,020	294,382

Source : Ministry of Agriculture, Forestry and Fishery, Fishery Agency, Number of permission vessel of skipjack and tuna fishery (1971 ~ 1983).

decrease in the years 1975 and 1977 are considered to be the influence of the oil shock in 1973 and the enforcement of the regulations of the fishery area.

When seen from the fish species, out of the four main species, the yellowfin and bigeye show an increasing trend while the bluefin and albacore show a stagnating trend, which means the stress on catches of multi-purpose species which can be used both for eating raw and processing. The marlin show a decrease.

We are looking at the outline of the tuna fishing boats (means of production) that correspond to the fluctuation of the catches.

Table 2 tells that during 1970-1982, the total number of deep sea tuna fishing boats is increasing until 1975 from 1,219 boats (289,871 tons) of 1970 and decrease afterwards to 1,020 boats (294,382 tons) in 1982.

Especially the large sized long line boats of 300-500 tons are decreasing 159 boats in 1982 though the numbers are different from year to year while the middle sized boats of 210-300 tons keep a level of about 450 to 500 boats.

The boat sizes show a trend of becoming bigger due to reinforcement of the means of production as represented by the manpower saving apparatus and the fortified quick freezing equipment, but the economical pressure in operation decreases the boats of 400 ton type and is moving into 299 ton type. It is considered that a trend for sound management through abbreviation plays a great role in the stagnation of production.

The export to the United States can be said to be one of the biggest reasons that tuna fishing has grown large after the War.

In Japan, the canning and export to the U.S. of tuna fish were restarted in 1946, and the export of canned tuna increased abruptly owing to the enactment of the Promotion Act of Export Fishery. Until about 1960, the export to the United States of canned tuna and material fish for canning was made smoothly, but afterwards, the recession in the canning industry and tuna fishing in the U.S. brought about reinforcement of the import limitation of canned and material fish which made both the canning of tuna and the fishing of tuna to be stagnated.

During that period, there was aroused banning of the use of the salt of cyclamine acid in 1969, and the problems of mercury and decomposition in the U.S.

On the other hand, after 1960, the high growth of the economy pushed up the income and life levels of the nation, and brought about desires for high class and selected marine products, especially demand for "sashimi" (eating raw) of the high class tuna.

According to Suisan Shinchosha (1983), the demand and supply of tuna and marlins for eating raw in 1982 reached 474,500 tons of supply (domestic production 349,000 tons, and import 125,500 tons), and with respect to the demand, the material for processing was 76,800 tons (62,600 tons for canning, 14,200 tons for export in frozen state), 397,700 tons for eating raw as "sashimi."

By considering the yearly stock, the consumption of "sashimi" is 385,800 tons in average, and 416,900 tons and 398,600 tons for 1980 and 1981 respectively -- the publisher says. Thus the inactive export of canned tuna and tuna as material, and the change in the dietary trend of the consumers especially the formation of the market of raw eating tuna are the great background factors for the import of tuna. And furthermore, the improvement in the freezing techniques in the long line tuna fishing boats in recent years, and the change in the form of merchandise from fresh tuna to frozen tuna have enlarged the value of tuna as merchandise and appropriate classification was set in the market transaction and the control of sales was promoted. The setting up of the cold chain and the supermarkets has served for the preparation of a new distribution system which is run from on board the tuna boats to the freezer and then to the shop front. These factors promoted import of tuna and at the same time reorganized the domestic market.

Now we are going to look at the import amount of tuna in recent years. Table 3 tells us that the import of tuna is about 100,000 tons per year recently, and we would call your attention to that until 1974 yellowfin and others (such as youngs of bigeye and yellowfin) were mainly imported, but from 1975 yellowfin and bigeye took the place, and when seen by the proportion, with respect to these two species of tuna, the latter had been increased by 1.65 times of the former.

The improvement in the on board freezing of the exporting countries and the imports by the commercial companies having tendency on the purchase of raw eating tuna explain this change.

The import of tuna is made, like the other first industry products, from a small number of specific countries by a small number of importers. In 1982, the import from Korea amounted to 54,784 tons (47.5% of the whole import) and import from Taiwan 29,467 tons (25.6%) which makes a total of 73.1%. The present import of tuna is maintained in the following manner.

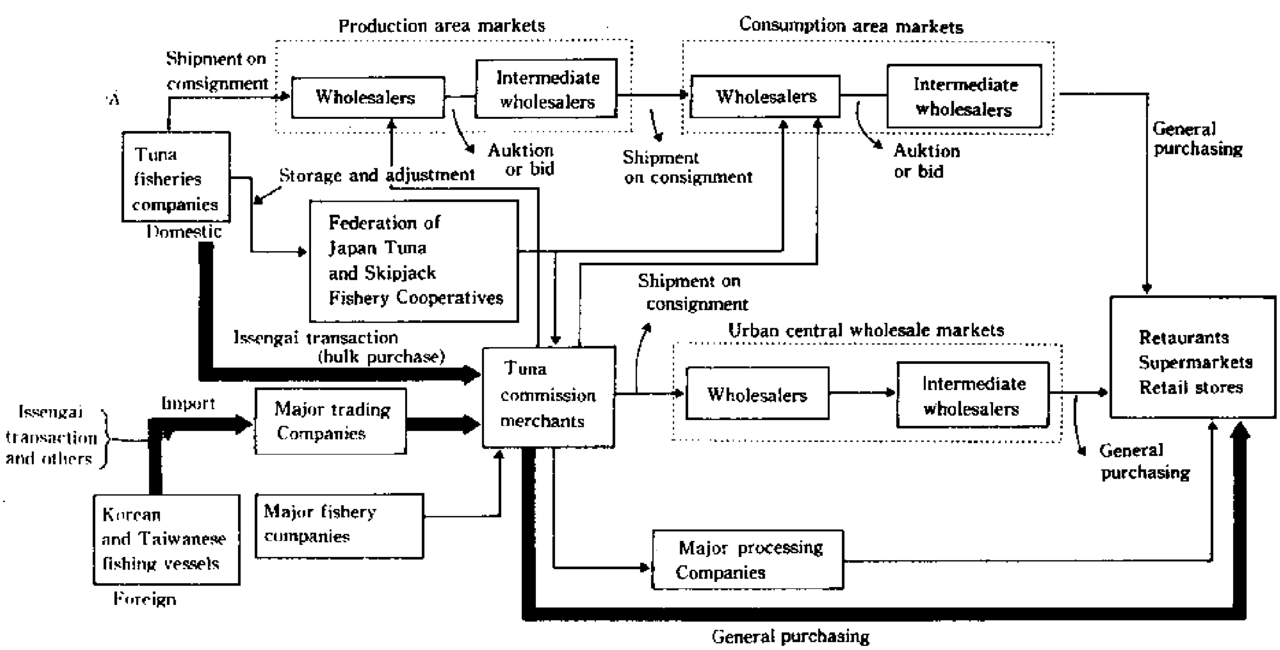
Table 8. Imports of Tuna by Species in Japan (1970 ~ 1982).

(Unit : MT)

Species \ Year	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Bluefin	852	451	1,001	1,869	1,725	1,868	101	1,209	1,410	1,866	1,042	1,162	1,049
Albacore	3,232	4,890	548	591	1,619	7,988	1,639	13,861	2,085	2,646	730	1,910	2,997
Bigeye	—	—	—	—	—	—	43,776	46,898	47,015	44,261	40,829	48,875	46,897
Yellowfin	7,180	7,008	8,480	13,089	15,088	23,042	31,164	43,525	39,274	43,428	35,511	39,667	48,192
Others	19,110	19,114	21,659	18,831	24,896	48,428	127	6	87	13	—	12	—
Marlin	16,285	15,888	15,251	17,182	17,616	19,117	21,586	19,996	21,486	21,049	16,065	15,683	16,640
Total	46,099	47,346	46,885	51,013	60,939	10,442	98,348	124,969	111,807	112,762	98,666	102,809	115,274

Source : Ministry of Finance, Monthly table of trade in Japan, 1971 ~ 1983.

Fig. 1 Distribution Channel of Frozen Tuna in Japan



(1) Frozen tuna discharged from the Korean or Taiwan tuna ships (bulk purchase).

(2) Fresh tuna from Taiwan in the Kyushu District (Taiwan fresh).

(3) Fresh tuna air freighted from the U.S., Canada and New Zealand (jumbo-N.Z.).

(4) Frozen tuna carried by the Japanese carrier boats after discharging at the foreign base caught by the Japanese fishing boats.

Almost all of these imports are based on the trading facilities of the commercial houses, but the Tokyo University of Fisheries (1981) say that "The Japanese importers of tunas are 18 in number by 1979, and are consisted of 8 general commercial houses and their affiliates, 5 big fishery and freezing companies, and 5 other commercial houses."

Four general commercial houses import more than 2/3 of the whole import. It is characteristic with the Japanese importers that they are organizing almost all of the foreign boats. The import of tunas is quite influenced by these small number of importers.

The commercial houses that have foreseen the increase of demand for fresh tuna in the domestic market, lend money, fishing boats and sold fishing boats to the foreign countries to set up the import route of the fresh tuna, and reorganized the market through their affiliate routes. The same system applies to the Japanese fishing boats.

On the other hand, the Japanese long line boats are, in order to absorb the rise of fuel and other costs, looking for the catches of the southern tuna and high class bigeye. But due to improvement in the on board freezing technique of the foreign boats, competition in the same market is becoming apparent. For example, in 1975 there was a movement against the discharging by the foreign boats caused by the Japanese tuna merchants, and in 1976 the MITI Minister applied a trade barrier on the import of tuna, and then the quarterly negotiation for the adjustment of import amount between Korea and Japan (import is limited to a maximum 60,000 tons per year as of 1982) -- it is so considered that the stagnation of the wholesale price in the domestic market is caused by the imported tunas.

It is sure that the import trend of tunas is influential on the domestic fishery production, and that there is formed a market led by the commercial houses and big fishery companies, and these are firmly connected with the distribution outside of the market maintained by the bulk purchase (a transaction that the shipowner sells whole of the catch by a ship the purchaser).

<u>Change of Tuna Distribution Mechanism and Price Formation</u>

It was after 1967 that the "sashimi" market (raw eating tuna) is formed firmly in Japan and it was the time of high growth of the social economy. Before that time, the purchase of tuna was made by bulk purchase by the two tuna buyers, but their purpose of such purchase was the export to the U.S. and Europe, and the basis for the domestic market was not formed amply.

In 1970, a big commercial house purchased a freezing company at Shimizu jointed with a local capitalist and newly established a tuna purchasing company. It built a 6,000 ton ultra low temperature freezer in 1971, and there was started import and purchase of frozen tuna from the foreign and domestic tuna boats to make the bulk purchase a routine manner of purchase, initiating the reorganization of the distribution mechanism.

After this, tuna is transacted by the bulk purchase by the big commercial houses and their affiliates, fish wholesalers at the producing and consuming places, big fishery companies and their affiliates to form transactions outside the market.

The conventional distribution route of tuna is explained in A of Figure 1. The tuna handed from the producer (shipowner) to the wholesaler (usually the fishery cooperative association) and purchased through auction and bid by the brokers in the market, then it is handed to the wholesalers in the market at the consuming point, and here again the auction or bid is held. Then the wholesaler at the consuming point sells to the retailers and sold to the consumers.

This kind of traditional transaction of multi-step mechanism requires complicated market facilities and addition of market commissions which becomes the cause of criticism from the consumers for the high fish price. And this aroused opinions for protecting the outside-the-market transactions for the rationalization by cutting the intermediate brokers, and this pushed up the bulk purchase. In the bulk purchase, transaction within the wholesale market is not done at all (nominal market transaction is recorded at Yaizu for the purpose of collecting the market commission) and the purchaser buys directly from the shipowner.

In this type of transaction, the shipowner confirms the conditions of merchandise reported from the fishing boats or the carriers by wireless before their arrival at the discharging ports about the species of fish, standards, sizes, places of catches, dates of catches, and negotiates with several purchasers.

The bulk purchase is characteristic in that a huge amount of catches is transacted speedily upon the information, instead of transaction one by one as in the case of the fresh fish. This is of course owed to the on board freezing apparatus that has standardized the marketability of the catches especially the freshness.

In the course of transferring from transaction on goods to transaction on information, there existed (and still partly exist the small sized tuna fishing boats) a transaction on sample that the sample is extracted from the boats at the discharging port, and inside-the-market transaction is done to enable further transaction based upon the market price. Currently the transaction on information is usually taken.

In the bulk purchase, there are roughly two types of transaction which are the direct purchase between the shipowner and the purchaser, and the intermediate purchase by the leased fund (Tsukiji and Yaizu Fish Wholesale Market). The direct purchase is mostly done at Shimizu. A commission of 2-3% is implied in the latter type of transaction.

We are looking into the present status of the bulk purchase of tuna.

Table 4 shows the breakdown according to the bulk purchasers at the Tokyo Tsukiji Wholesale Market during 1979-1982. The average amount of bulk purchase in those four years is 124,200 tons per year, and far surpasses 28,600 tons by bond, and 11,475 tons by other methods, or 72.2 to 80.9 in percentage.

It can be said that almost all tuna is supplied frozen and by bulk purchase.

There is no remarkable fluctuation in the handling amounts classified to the bulk purchasers from TR to MM, and this means that the purchase and distribution of tuna are being set up on the confidence and achievement of the seller and the purchaser.

Table 5 shows bulk purchase according to the species at Shimizu which is a discharging port of imported tuna and is a main port of the bulk purchase of tuna.

The average yearly transaction between 1975 and 1983 is 139,837 tons or 103,464 million yen. Seen by the year, the amount was reduced slightly in 1980-1982, but in 1983 it hit a peak of 158,000 tons. The amounts show remarkable increases year by year, and in 1983 it amounted to 2.1 times of 1975, and 5.5 times of 1970. The higher increase ratio as compared with the quantity show that purchase of high priced fish is being strengthened.

For example, excluding the southern tuna, we can point out that the bigeye keeps high levels of discharge, and that it has a share of 37.0% in 1983 while the albacore is only hardly increasing and the yellowfin is not so much increasing in quantity as the increase of multiple ratio.

The bonito is scarcely bulk purchased recently because it is not a fish for bulk purchase, but the fact that there was transactions of 5,000 to 17,000 tons until 1977 and is reduced rapidly means the selection of high priced fish for raw eating.

Tables 6 and 7 show the result of the whole discharge and the bulk purchases according to the fish species at the Yaizu port between 1975 and 1983. Yaizu is one of the outstanding discharge ports of tunas in Japan, and has results of 46,000 to 78,000 tons (36-60 billion yen) a year that succeeds Shimizu. From Table 6, we can see that, out of the important species to which the long line catching is applied, the discharging results of the bluefin and southern tuna show a decreasing trend while the bigeye is slightly increasing though with yearly undulations, and the yellowfin is increasing. The catching mind on the bluefin and southern tuna is stronger than it is on the yellowfin and bigeye because of the higher prices of the former two. It seems that regulations on the fishing area and the decrease of the resources make the yellowfin and bigeye increase.

Regarding the skipjack, in spite of the decrease of boats or bankruptcy due to worsening of management in the skipjack pole and line boats, the discharge is increasing from the purse seine net of fisher and the fish price is in the trend of decreasing.

Table 7 tells us that the average yearly results of the bulk purchase of tuna at Yaizu is 86.7 boats or 15,113 tons, 19.9 billion yen, and though the ratio of bulk purchase in the whole discharge is lower than Tokyo or Simizu, it is increasing year by year and is going to be a center of tuna transaction at the place of production. The reasons that the ratio of bulk purchase is low at Yaizu are explained like that at this port the yellowfin discharge by the purse seine net of the large and medium boats is included in the wholesale transaction, and the bulk purchasers are supplying their tuna to the wholesale market answering the request from the local brokers.

When seen by the species, the bulk purchase is increasing except for the southern tuna, and this is because of the demand as the material fish for canning and dried fish from the processors of Shimizu and the local processors.

Table 4. Quantity on the Transaction of Tuna Fishes at Tokyo Central Wholesale Market (1979 ~ 1982).

(Unit : MT)

Company \ Year	1979	1980	1981	1982
Issengai Total	130,700	123,300	125,200	117,600
TR	58,500	50,400	53,000	54,600
KY, HS	21,500	21,000	19,900	11,800
YM	15,400	16,200	16,300	14,000
AM	8,800	10,800	10,300	8,500
MK	2,400	5,100	8,400	11,200
NS	11,700	9,300	8,000	5,800
KT	7,000	5,700	4,300	8,900
MM	2,000	1,400	1,000	1,200
Others	3,400	3,400	4,100	6,600
Bid	23,700	30,100	32,800	27,800
Others (Warehousing, transportation)	7,100	15,000	6,400	27,400
Grand total	161,500	168,400	164,500	162,900

Source : Suisan Keizai Shinbunsya. 1983.
Note : TR ~ MM are Purchasing companies.

Table 5. Quantity and Value of Issengai Transaction of Tuna Fishes by Species at Simizu (1975 ~ 1983).

(Unit : MT, million yen)

Speies \ Year		1970	1975	1976	1977	1978	1979	1980	1981	1982	1983
Southern bluefin	Qua	1,251	18,048	13,631	20,434	18,229	15,972	19,295	18,166	12,203	11,784
	Val	628	15,824	22,077	29,861	32,620	32,498	39,338	42,378	37,444	39,486
Bigeye	Qua	14,825	34,283	41,366	46,601	54,287	58,720	45,942	43,822	51,106	58,267
	Val	4,762	21,034	27,951	33,695	37,272	47,089	33,344	37,015	43,276	48,382
Yellowfin	Qua	10,131	11,154	17,405	19,316	18,906	21,201	16,676	17,763	22,878	26,082
	Val	2,656	5,523	8,176	8,789	8,095	18,297	7,695	12,059	15,329	15,108
Albacore	Qua	4,544	5,649	8,420	4,407	2,708	3,180	1,961	3,886	4,763	4,071
	Val	1,225	1,488	3,328	2,166	908	1,135	889	2,114	2,292	1,594
Marlin	Qua	8,652	8,710	9,854	7,908	9,458	14,153	10,935	10,521	10,745	12,656
	Val	3,699	5,318	6,269	4,600	5,341	7,417	6,425	6,709	7,898	9,699
Others	Qua	9,045	7,025	7,745	6,556	5,606	6,200	4,980	4,554	4,916	4,825
	Val	2,290	2,911	3,734	2,488	1,964	2,111	1,609	1,588	2,140	1,438
Total	Qua	48,748	80,419	98,421	105,222	109,189	119,426	99,719	98,712	106,611	117,635
	Val	15,272	52,044	71,583	81,599	86,200	103,491	89,295	101,862	108,379	115,709
Skipjack	Qua	5,580	8,610	14,913	16,782	1,270	1,539	1,525	207	219	64
	Val	614	1,561	3,275	4,517	242	348	445	61	55	12
Grand total	Qua	88,396	112,080	183,161	136,614	143,186	151,112	133,412	136,963	144,436	157,619
	Val	23,729	61,792	84,723	93,337	97,394	117,197	105,450	118,033	123,288	129,963

Source : Simizu Fishing Port Promotion Association.

Table 6. Quantity and Value of All Landings of Tuna Fishes by Species at Yaizu (1975 ~ 1983).

(Unit : MT, million yen)

Species \ Year		1975	1976	1977	1978	1979	1980	1981	1982	1983
Bluefin	Qua	778	579	204	1,559	1,446	1,284	1,528	3,064	911
	Val	554	537	248	850	1,425	1,527	1,978	3,469	1,110
Southern bluefin	Qua	13,001	11,616	13,675	12,178	6,951	9,216	10,958	5,589	5,326
	Val	17,160	18,474	22,849	21,910	17,863	18,559	24,504	16,960	17,089
Bigeye	Qua	10,730	10,604	7,259	9,839	10,398	12,108	11,978	13,541	14,554
	Val	6,881	7,992	5,858	6,757	7,884	8,978	10,284	10,885	10,824
Yellow fin	Qua	6,460	7,068	8,287	11,068	18,566	22,872	29,819	39,411	34,832
	Val	3,364	3,679	4,469	4,568	8,112	11,622	13,929	16,018	13,896
Albacore	Qua	28,384	36,017	14,542	28,891	24,538	25,886	18,452	13,572	10,476
	Val	6,552	14,079	7,228	8,984	9,692	10,673	7,177	6,480	3,998
Swordfish	Qua	757	848	460	691	726	654	996	821	796
	Val	389	485	305	420	436	475	688	690	617
Striped marlin	Qua	624	636	298	592	657	402	677	470	564
	Val	464	585	296	432	566	310	547	406	534
Blue marlin	Qua	762	1,153	956	1,141	810	883	946	1,159	1,252
	Val	462	784	609	586	480	459	528	660	644
Black marlin	Qua	241	282	174	188	217	111	181	161	202
	Val	120	186	118	94	134	52	99	93	118
Total	Qua	61,727	68,808	45,855	56,147	64,309	73,411	70,580	77,788	68,918
	Val	35,951	46,751	41,470	44,601	46,592	52,549	59,729	55,161	48,780
Skipjack	Qua	81,811	83,464	93,967	103,796	84,287	106,929	100,247	119,895	160,758
	Val	14,928	18,105	25,808	18,606	19,769	32,726	28,593	27,806	30,471
Grand total	Qua	155,972	170,958	163,184	195,474	173,597	201,579	182,483	205,824	240,752
	Val	53,588	68,764	72,484	67,190	69,426	88,750	91,123	85,614	81,915

Source : Yaizu Fisheries Cooperative.

Table 7. Quantity and Value of Issengai Transaction of Tuna Fishes by Species at Yaizu.

(Unit : MT, million yen)

Item	Year	1975	1976	1977	1978	1979	1980	1981	1982	1983
Southern bluefin	Qua	8,115	7,769	9,713	8,247	4,840	4,997	7,020	3,852	8,844
	Val	10,892	12,580	16,510	15,798	13,045	10,780	16,529	12,499	13,404
Bigeye	Qua	3,051	4,749	1,969	4,859	3,440	3,702	4,099	5,778	5,688
	Val	2,552	4,040	1,720	3,462	3,367	3,582	4,156	5,699	5,607
Yellowfin	Qua	1,008	1,118	528	1,462	1,811	1,361	1,714	2,752	2,451
	Val	596	618	853	836	1,254	880	1,264	1,999	1,501
Albacore	Qua	455	568	450	341	268	210	563	452	639
	Val	124	207	191	91	83	84	279	173	226
Marlin	Qua	792	1,179	446	1,122	1,012	702	1,072	1,220	1,268
	Val	481	740	301	679	655	428	704	801	868
Others	Qua	684	920	694	768	585	1,090	1,887	391	4,354
	Val	170	280	207	169	126	301	371	128	752
Total	Qua	14,100	16,293	13,801	16,295	11,908	16,062	18,982	14,445	18,185
	Val	14,814	18,464	19,288	21,080	18,580	16,006	27,587	21,294	22,858
No. of vessel		88	94	76	82	66	74	108	95	97

Source : Yaizu Fisheries Cooperative.

Table 8 is the result bulk purchase at Yaizu between 1975 and 1983 according to the bulk purchasing companies. Seventeen companies have bulk purchase in these nine years, and they are composed of 4 commercial houses, 9 local wholesalers and brokers (including processors), 4 fishery companies (of large, medium and small capitals) and 1 fishery association. Especially the 5 companies from A to E has big results all through the years and occupy 70-90% in quantity and 80-93% in amount. The lineage of transaction is at random with the other companies than these 5, and their purpose of bulk purchase includes use of their processing and purchase from their own boats additional to the resale after bulk purchase.

The content of transaction by the purchasers in 1983 is 187.5 tons or 230 million yen per purchase in average, but the amount reaches 550 million yen when much bluefin is included. Similar contents are seen in the other years too.

The sales of the top 5 companies to the fishery companies in 1979-1983 are 39 companies (195 boats) with A, 16 companies (89 boats) with B, 12 companies (61 boats) with C, 7 companies (39 boats) with D and 4 companies (19 boats) with E, and in the whole 12 fishery companies bought more than 10 outputs. The bulk purchase of tuna is a huge amount transaction that far exceeds the yearly sales of an ordinary fishery or marine product processor, and requires rapid transaction in one contract, special knowledge and experience in transaction, having been fully informed about the market, and the purchaser must undergo huge risks in transaction, and mutual confidence between the seller and the purchaser is indispensable. For these reasons, the transactions are apt to be continuous once there is executed a transaction, and with respect to these 5 companies, we can easily find transactions that have continued 4 to 5 years.

At present, the distribution of tuna in Japan is said a company T has the share of 40%, and its sales result of 1983 is publicized to be 139.42 billion yen (pure profit 740 million yen). It is quite apparent that the purchases are maintained by about 15 purchasers.

We are referring to the price formation of the bulk purchase. As started before, the bulk purchase is, different from the auction or bid at the market by specific mass, the price determined by consent of the shipowner and the purchaser. The basis of determining of the price is the merchandise factors of the tuna as the object of transaction, and the market trend and speculation are taken into consideration.

Generally, in the bulk purchase, the purchasers are superior in the capital, and it is said that the purchaser beats down the price, buys up, and operates price by regulating the distribution, and for example the Culture Department of Nobunkyo (1979) says in its "Logics of Money Makers," and the discussion at the Metropolitan Congress concerning the private monopolization, but there is no substantial trouble concerning the bulk purchase with the background that the shipowners themselves requested the bulk purchase due to hardness in management from the high costs in the recent years. Or rather, after 20 years of introduction, the bulk purchase is getting its firm position.

The movement of the wholesale price of tuna at the production point is shown in Table 9, and as regards to Yaizu, the bulk purchase prices are higher than the wholesale prices of the market with all of the three species during 1979 to 1983. Seen from the species, the price of southern tuna keeps a high level and the prices of yellowfin and bigeye are lingering.

At Shimizu, the tuna prices are lower than at Yaizu, but this is due to the low quality tuna of the foreign boats and not signify that purchase price is unduly low.

According to Tayama's trial estimation (1981), the price of tuna is, when wholesale price at the point of production is 1,000 yen/kg, the price from the broker at the place of production is 1,149 yen/kg (broker's gross profit being 13%), and the price of the broker at the place of consumption is 1,321 yen/kg.

In the retail stage, with the edible part being 55%, the cost of boneless meat is 2,402 yen/kg, and with the gross profit of 35%, the retail price at the shop is 3,695 yen. Toro (fatty meat) will be 5,280 yen/kg, and red meat will be 3,063 yen/kg.

It is said that the profit rate of the tuna bulk purchaser is 3-5% of the sales amount, but this rate is lower than Tayama's estimation.

Conclusion

We have stated that the distribution mechanism of the tunas has transferred from the wholesale market transaction to the bulk purchase outside the wholesale market arising from the changes of conditions both in supply and demand. The most characteristic thing in the bulk purchase is that a large amount of purchase is executed by the purchaser from the domestic and foreign tuna fishing boats.

It is mostly believed that a principle of capital's priority by the commercial houses.

Conventionally, with the medium and small capitals in the tuna fishing are burdened with the payment of the building cost of the boat, postponement of the other costs, and other advanced investment fortified

Table 8. Quantity and Value of Issengai Transaction of Tuna at Yaizu (1975 ~ 1983).

(Unit : MT, million yen)

Company name \ Year	1975	1976	1977	1978	1979	1980	1981	1982	1983
A	1,363	3,827	3,460	6,709	5,947	5,734	8,368	6,283	4,585
	1,475	3,470	5,211	8,652	9,108	7,795	13,693	9,202	6,125
B	—	733	328	1,682	385	552	1,205	3,277	4,417
	—	921	559	2,872	789	1,254	2,108	4,779	6,339
C	1,166	1,328	1,910	2,422	2,481	3,576	4,906	2,235	3,136
	1,167	1,587	2,738	3,580	4,385	4,848	7,701	4,479	6,595
D	6,046	6,575	3,694	2,419	1,401	1,182	1,420	590	517
	6,329	7,105	5,306	2,977	1,813	1,616	1,848	596	906
E	2,589	2,245	1,736	1,204	781	542	476	485	288
	2,988	2,949	2,275	1,413	987	617	358	543	210
F	790		—	714	443	690	393	717	—
	558	—	—	456	577	282	445	647	—
G	—	—	—	158	151		111	—	318
	—	—		275	434	—	106	—	363
H	—	—	—	—	—	—	—	—	277
	—	—	—	—	—	—	—	—	311
I	769	295	217	—	—	—	—	58	78
	918	409	276	—	—	—	—	37	68
J	210	188	227	—	—	—	—	—	—
	193	247	290	—	—	—	—	—	—
K	755	1,377	1,586	410	—	—	—	—	—
	625	1,670	1,866	244	—	—	—	—	—
L	414	—	—	381	634	1,016	1,859	644	4,375
	540	—	—	284	662	945	819	611	805
M	—	—	—	—	—	—	—	—	96
	—	—	—	—	—	—	—	—	76
N	—	—	—	—		—	497	—	—
	—	—	—	—	—	—	138	—	—
O	—	188	—	—	—	—	—	—	—
	—	98	—	—	—	—	—	—	—
P	47	—	—	—	—	—	196	36	—
	27	—	—	—	—	—	378	100	—
Q	—	87	694	195	—	1,328	—	—	149
	—	58	762	278	—	1,781	—	—	555

Source : Yaizu Fisheries Cooperative.

Table 9. Unit Price of Tuna Fishes at Yaizu and Shimizu (1979～1983).

(Unit : yen／kg)

Item	Year	1979	1980	1981	1982	1983
Southern bluefin	All frozen Landings (Yaizu)	2,691	2,095	2,347	3,212	3,500
〃	Issengai (Yaizu)	2,695	2,142	2,366	3,245	3,486
〃	Issengai (Shimizu)	2,034	2,041	2,333	3,068	3,365
Bigeye	All frozen Landings (Yaizu)	759	739	862	770	743
〃	Issengai (Yaizu)	989	899	1,059	986	995
	Issengai (Shimizu)	801	726	845	847	830
Yellow fin	All frozen Landings (Yaizu)	407	443	434	385	372
〃	Issengai (Yaizu)	692	582	778	726	618
	Issengai (Shimizu)	627	461	679	670	579

Source : Yaizu Fisheries Cooperative, Shimizu Fishing Port Promotion Association.

by the lineage loans, and the regulations of 200-mile fishing area and the oil shocks still weakened the management of each fishing boat.

This drove the tuna fishers to the selection of bulk purchase in order to reflect their wishing advantageously in the transaction, and especially they fortified to secure the running money.

It means that the bulk purchase is not entered into by the selfish will of the purchaser, but the selection by the fishers plays a great role. It can be said that, consequently, the distribution of tuna has obtained a rationalization by shortening the multi-step distribution of the wholesale market to the direct transaction between their shipowner and the purchaser. Furthermore, we could see that the purchasers are buying at the wholesale market prices at the point of production.

But seeing that the consumer price of tuna is still high, and that the conventional fish wholesalers and the local brokers are being kicked out from the distribution route by the intervening of the commercial houses and their affiliates, there is need for reconsidering the bulk purchase of tuna which is now being set up.

International market is extending with tuna like salmons, shrimps, and eels, and there must be quick cultivation of a healthy market based on the viewpoint of international demand and supply. What most needs to be emphasized is that the purpose of the tuna distribution industry is the sound fostering of fishery and the protection of the consumers.

Tuna fishers, especially the bulk purchasers are demanded to pay attention on the formation of distribution mechanism and market for setting up of fair and correct prices, not only being diligent in the capital competition.

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Joint Venture Policy in the Gulf of Alaska/Bering Sea Aleutian Region— Implications for the Future Development of the Groundfish Resource

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Introduction

This discussion paper will briefly review the history of the development of joint venture policy and discuss the present joint venture allocation procedure in the North Pacific, New England, and Mid-Atlantic regions. The procedure will be examined for the implication of its effect on fisheries in the North Pacific. The purpose is to provide background material for the North Pacific Fishery Management Council as it develops a management policy for these fisheries. It is anticipated this policy will greatly influence the direction of fishery development.

Historical Development of Joint Venture Allocation Policies

A joint venture is a business enterprise entered into in this instance for the purpose of harvesting, processing and marketing fish. Although the structure of the enterprise varies from company to company, the general operating framework involves U.S. harvesting vessels supplying fish to foreign floating processors in the fishery conservation zone (FCZ) of the U.S. These joint venture operations require a permit annually to operate within the FCZ. The permit is issued by the U.S. Government.

The first "joint venture" (JV) fishing permits were issued on June 9 and August 16, 1978. The National Marine Fishery Service (NMFS) issued permits authorizing foreign vessels to receive fish harvested by the United States vessels in the fishery conservation zone.

The permits complied with the then-existing requirements of the Fishery Conservation and Management Act of 1976, as amended (16 U.S.C. 1801, et seq.) ("the Act").

On August 28, 1978, Pub. L. 95-354 further amended the Act to provide a preference for U.S. fish processors to process U.S. harvested fish. Specifically, as amended Pub. L. 95-354 provides that an application by a foreign vessel to receive fish from U.S. vessels at sea may be approved unless it is determined that U.S. fish processors have adequate capacity, and will utilize such capacity, to process all U.S. harvested fish from the fishery. The amendment further provided that the amount of U.S. harvested fish which may be received at sea during any year by foreign vessels may not exceed that portion of the optimum yield (OY), which will not be utilized by U.S. fish processors.

In 1979, it was found that although the approvals of joint venture applications were consistent with the Act, as amended by Pub. L. 95-354, the permit limitations on the amounts of fish which could be received at sea in 1978 were not consistent with Pub. L. 95-354.

Commenters felt foreign receipts of U.S. harvested fish were to be allowed only to the extent that U.S. processors were not expected to process the U.S. harvested fish (now referred to as DAH).

An example from 1979 shows the change from using optimum yield as the starting point in the calculation to the (then referred to as) U.S. harvested portion of optimum yield.

	Alaska Pollock
Change from:	
Optimum Yield	168,000 mt.
To be Utilized by U.S. Fish Processors	-500
Total Receivable by Foreign Vessels	168,300 mt.
to:	
U.S. Harvested Portion of Optimum Yield	32,700 mt.
To be Utilized by U.S. Fish Processors	-500
Total Receivable by Foreign Vessels	32,200 mt.

In 1980, following a settlement in the NEFCO vs. Kreps case, NMFS agreed to follow certain procedures for allowing public comment on joint venture applications, and to make available to the public (subject to confidentiality protections) the information used to estimate domestic harvesting, domestic processing and joint venture processing (DAH, DAP, and JVP, respectively). The settlement agreement stated the National Oceanic and Atmospheric Administration's (NOAA) view that the Act authorized the Secretary of Commerce, in appropriate cases, to impose permit conditions or restrictions on foreign joint venture permits that may aid development of the U.S. fishing industry. NOAA believed such conditions may be applied, but only in a manner which didn't eliminate the possibility of economically conducting a joint venture. Further, NOAA would not impose permit conditions with economic allocation as their sole purpose; any permit condition must have some resource conservation purpose. Nor would NOAA impose permit conditions that seriously adversely affect the interests of U.S. fishermen who wish to engage in joint ventures.

By this time the acronyms JVP (joint venture processing), DAH (domestic annual harvest) and DAP (domestic annual processing) were defined and the policy read as follows: Amounts of fish which can be received from U.S. vessels by foreign joint venture vessels are limited by statute to the "surplus" part of the U.S. harvest in excess of the amounts of fish U.S. processors will use (JVP = DAH - DAP).

Permit Application Procedure

To provide direction for future discussions of joint venture policy alternatives, it will be useful to begin with a detailed description of the current permit application procedure. Research into how the procedure functions has revealed it to be the source of a great deal of misconception and confusion. It is hoped this section will serve to clarify the process.

The joint venture allocation procedure begins with an application for a vessel permit to receive fish in the U.S. fishery conservation zone (FCZ) for a foreign flag vessel of a GIFA nation. A GIFA is a Governing International Fisheries Agreement negotiated between the government of a foreign country and the government of the United States. Only a foreign country with a GIFA may apply for a JV permit. Applications are made available by the U.S. Department of State through a U.S. embassy for EEC countries and for others through a foreign embassy in Washington, D.C. According to a document entitled "Basic Information on Fisheries Joint Ventures: The Transfer of U.S. Caught Fish to Foreign Flag Processing Vessels" prepared by the NMFS. The completed application is "signed and transmitted by the appropriate foreign official to the U.S. Department of State".

The State Department then transmits copies of the application to the NMFS, the regional fishery management Council(s) (by request), and the U.S. Coast Guard. Notice of receipt of the application is published in the Federal Register and a public comment period begins.

Subsequent comment by the Council is a matter of Council discretion [16 USC Section 1824(b)(5)]. "The Council may prepare and submit to the Secretary (of Commerce) such written comments on the application as it deems appropriate" and advisory in nature. The Secretary of Commerce may approve or disapprove such applications without concurrence by the Council [16 USC Section 1824(b)(6)].

Before permit issuance, an official foreign government representative must accept "general terms and conditions" ensuring "that the nation's fishing will be conducted in accordance with the law, including any additional restrictions attached to individual permits". The foreign government also appoints a foreign agent who "must respond to any legal issues applicable to these vessels fishing under the jurisdiction of the United States".

The NMFS then sends the permit plus any restrictions to the Department of State and notifies the agent that the permit has been issued. The Department of State then sends the permit to the foreign government.

New England and Mid-Atlantic Fishery Management Councils

The New England and Mid-Atlantic Fishery Management councils coordinate in managing the joint venture fisheries for squid and mackerel. Consequently, the policy discussion which follows applies in both regions.

The New England and Mid-Atlantic Fishery Management councils consider joint ventures as an interim means to achieve the objectives of the Act.

The councils' JV policy contains the following general provisions:

1. Those JVs are preferred which provide for the greatest involvement by the U.S. industry in the entire process of utilizing the fish, i.e., harvesting, processing, and marketing.

2. The council will give preference to those nations who provide full compliance with all commitments of the application and conditions of the permit and provide the most open access to their markets; and/or provide the most favorable trade agreements; and/or offer substantial technological transfers to the various phases of the U.S. fishing community.

3. In fisheries where there is a TALFF, JVs should be encouraged. To the extent that a JV allows U.S. fishermen to harvest fish which would otherwise be available for TALFF, the entire industry and the nation benefit.

4. In fisheries where DAH exceeds DAP, JVs should be allowed. However, if the council finds that specific domestic processing interests would be precluded from processing the species involved, the council may recommend that the permit be denied.

5. When it is considered to be in the best interest of the U.S., individual JVs ordinarily should be authorized for specific amounts of fish. Because of the relatively small total amounts of fish available for JVs on the East Coast, guaranteed quantities are necessary to make JVs attractive. Approving individual JVs for specific amounts of fish encourage development of the types of JVs which involve all segments of the U.S. industry. JVs without specified amounts might attract new, specialized vessels into the fisheries, rather than provide an alternative to existing vessels. In the northwest Atlantic, it would be counterproductive to encourage development of a separate "JV industry." Approving JVs for specific amounts of fish would also give NMFS greater ability to monitor an individual JV's operations to make sure it is in conformance with its permit and operating in the best interest of the U.S. industry.

The council has adopted the following items for considering JV applications:

1. The amount of projected increase in U.S. involvement in all phases of harvesting, processing, and marketing due to the JV.

2. Past performance and compliance with past JV commitments and permit conditions.

3. The benefits that the foreign nation offers the U.S. fishing industry (includes extent to which the flag nation of the foreign partner purchases U.S. processed products, competes with the U.S. fishing industry in the world market, presents trade barriers to U.S. processed fishery products, and provides overall assistance, including technology transfer to the U.S. fishing industry).

4. Long-term fishery commitments.

5. Compliance with the Act.

6. The extent to which the participants are identified and committed to the JV.

In addition to the general items, the specific criteria for Loligo JVs are:

1. The council goal over the three-year life of the Atlantic mackerel, squid, and butterfish fishery management plan (FMP) is to increase DAP to the point it equals DAH.

2. To receive a favorable recommendation from the council, Loligo JVs should contain the provision that they will provide an increased U.S. domestic market for U.S. processed Loligo or purchase domestic processed Loligo. In setting priorities between Loligo JVs, the JV with the largest percentage of domestic processed Loligo will receive the highest priority. JVs that purchase

domestic processed Illex or mackerel in addition to the higher amount of Loligo will receive additional preference.

The specific criteria for Illex JVs are:

1. The highest priority will be given to JVs that provide an increased U.S. domestic market for U.S. processed Loligo, Illex, or mackerel or purchase domestic processed Loligo, Illex, or mackerel.

2. JVs involving a directed foreign fishery will have the lowest priority unless they have a greater share of the tonnage purchased from U.S. processors than JVs that do not involve a directed foreign fishery.

3. In all cases, the greater the value of U.S. processed product purchased, the higher the priority ranking.

The provisions of the Magnuson Act which deal with the allocation of TALFF are important to the New England/Mid-Atlantic councils' JV policy. While these provisions deal with allocation of TALFF rather than setting TALFF, they are relevant to the TALFF setting process, particularly for the squid. These provisions are:

1. Whether, and to what extent, such nation imposes tariff barriers or nontariff barriers on the importation, or otherwise restricts the market access of U.S. fish or fishery products.

2. Whether, and to what extent, such nation is cooperating with the U.S. in the advancement of existing and new opportunities for fisheries trade, particularly through the purchase of fish or fishery products from U.S. processors or from U.S. fishermen.

3. Whether, and to what extent, such nation and the fishing fleets of such nation have cooperated with the U.S. in the enforcement of U.S. fishing regulations.

4. Whether, and to what extent, such nation requires the fish harvested from the fishery conservation zone for its domestic consumption.

5. Whether, and to what extent, such nation otherwise contributes to, or fosters the growth of, a sound and economic U.S. fishing industry, including minimizing gear conflicts with fishing operations of U.S. fishermen, and transferring harvesting or processing technology which will benefit the U.S. fishing industry.

6. Whether, and to what extent, the fishing vessels of such nation have traditionally engaged in fishing in such fishery.

7. Whether, and to what extent, such nation is cooperating with the U.S. in, and making substantial contributions to, fishery research and the identification of fishery resources.

8. Such other matters as the Secretary of State, in cooperation with the Secretary of Commerce, deems appropriate.

These provisions establish a general principal that the extent to which a particular nation assists with development of the U.S. fishery is a consideration relative to that nation's allocation. Since the squid TALFFs may be increased during the year if it can be demonstrated that such increase is in the interest of the U.S. industry, the FMP, the Act, and the JV policy are all consistent.

The joint venture allocation procedure derives directly from Amendment #1 to the FMP for the Atlantic mackerel, squid, and butterfish Fisheries. "The amendment changes the squid management regime to allow the Northeast Regional Director (RD), in consultation with the Mid-Atlantic Fishery Management Council (Council), to adjust OY at the beginning of the fishing year and throughout the year on the basis of specified guidance."

In order to understand the relationship between joint ventures and optimum yield, the Loligo optimum yield process is described. The same process is used for the determination of the Illex optimum yield. The mackerel optimum yield process is different and with respect to joint ventures, simpler; joint ventures for butterfish are not allowed since DAP approaches maximum OY.

The maximum OY for Loligo is 44,000 mt. The RD, in consultation with the council, determines annual specifications relating to IOY (initial optimum yield), DAH, DAP, JVP, and TALFF. The RD reviews yearly the most recent biological data pertaining to the stock. If the RD determines that the stock cannot support a level of harvest equal to the maximum OY, he establishes a lower allowable biological catch (ABC) for the fishing year. This level essentially represents the modification of the maximum sustainable yield (MSY) to reflect changed biological circumstances. If the stock is able to support a harvest level equivalent to the maximum OY, the ABC is set at that level.

From the ABC, the RD, in consultation with the council, determines the IOY for the fishing year. The IOY represents a modification of ABC, based on economic factors. It is intended to provide the greatest overall benefit to the nation by incorporating all relevant factors. The IOY is composed of an initial DAH and initial TALFF. The RD projects the DAH by reviewing the data concerning past domestic landings, projected amounts of Loligo necessary for domestic processing and for joint ventures during the fishing year, and other data pertinent for such a projection. The JVP component of DAH is the portion of DAH which domestic processors either cannot or will not use. In assessing the level of IOY, the RD must provide for a TALFF of at least a minimum bycatch of Loligo squid that would be harvested incidentally in other directed fisheries. This bycatch level must be 1 percent of the allocated portion of the Illex, mackerel (if a directed fishery is allowed), silver hake, and red hake TALFFs. In addition, this specification of IOY is based on the application of the following factors:

1. Total world export potential by squid-producing countries.

2. Total world import demand by squid-consuming countries.

3. U.S. export potential based on expected U.S. harvests, expected U.S. consumption, relative prices, exchange rates, and foreign trade barriers.

4. Increased/decreased revenues to the U.S. from foreign fees.

5. Increased/decreased revenues to U.S. harvesters (with/without joint ventures).

6. Increased/decreased revenues to U.S. processors and exporters.

7. Increases/decreases in U.S. harvesting productivity due to decreases/increases in foreign harvest.

8. Increases/decreases in U.S. processing productivity.

9. Potential impact of increased/decreased TALFF on foreign purchases of U.S. products and services and U.S. caught fish, changes in trade barriers, technology transfer, and other considerations.

The IOY may be adjusted by the RD, in consultation with the council, upward to the ABC at any time during the fishing year. An adjustment may be made to IOY to accommodate DAH needs, including when the application of the above factors warrant an adjustment in TALFF. However, TALFF may not be adjusted to a quantity less than that already allocated to and accepted by foreign nations, or less than that needed for bycatch.

Joint ventures enter into the OY setting process in two direct ways. First, as part of the IOY determination, the available joint venture applications are reviewed and perhaps amended if there are more joint venture requests than needed with respect to DAP and ABC, as well as their evaluation under the nine criteria. Second, joint ventures enter into the OY process if, after the IOY is determined, new joint venture features are offered or joint venture operators seek to modify existing arrangements. In these instances, the RD can increase DAH and thus OY if the cause of the increase, after review of the nine factors, will maximize the net benefits of the fishery to the nation.

Indirectly joint ventures enter into the optimum yield process. Note factors 3 to 9. Joint ventures can influence all of these factors in some way. As a development tool, the council will encourage joint ventures as long as they are in the best interest of the fishery and the nation.

Both the Mid-Atlantic and the New England Fishery Management councils have approved the use of a joint venture mechanism designed to streamline allocating additional over-the-side amounts to individual joint ventures. In the past, particularly under Amendment No. 3, no flexibility existed to respond quickly when a joint venture requested an additional amount of a particular species to the initial, approved amount. Amendment #1 provides the RD with the flexibility and ability to rapidly respond to a request. The JV mechanism strives to maintain first preference to the domestic fishery, maintain joint ventures based upon actual performance, help to achieve optimum yield, and promote further "fish and chips" agreements.

The JV mechanism operates as follows:

1. Upon receipt of a joint venture application, each council establishes an over-the-side "cap" amount (CJV). The CJV amount represents the total amount approved by the council for an entire season, unless a new application is received for increase above the CJV amount.

2. The council then determines an initial over-the-side amount (IJV) representing all or a portion of the joint venture processing cap. These amounts are published within the Federal Register. Council approval of the CJV amounts permits the Regional Director to increase a joint venture (above the initial amount) any time during the fishing year. There is no need to go back to the council.

3. Prior to the beginning of each joint venture, the "Additional Restrictions on Permits for Certain Vessels of the Government of N" section, within the Foreign Fishing Vessel Permit, shall specify the IJV and the CJV amounts per species. The vessel(s) are initially authorized to receive the IJV amount. At a later date, the vessel(s) may receive notification from the Regional Director which can permit the vessel(s) to receive up to a maximum amount per species, the CJV amount.

4. The NMFS generates a weekly over-the-side catch rate format for each individual joint venture. Based upon updated catch rates, i.e., a) average catch rate per joint venture fishing day, b) most recent catch rate per joint venture fishing day, and c) maximum processing capacity by vessel(s) per joint venture fishing day, predictions of the number of remaining fishing days to take the approved initial over-the-side amounts will be determined.

   This information is shared with each of the fishery management council staffs. A team approach between council staff and regional NMFS staff promotes communication and cooperation on all recommendations to the Regional Director.

5. At an agreed threshold amount, prior to exceeding the initial over-the-side amount, joint ventures which have demonstrated by actual fishing performance that their initial amount, may soon be taken, will be recommended to be increased. The Regional Director can increase the over-the-side amount up to the "cap" amount.

When an inseason adjustment to the JVP amount is necessary, a notice with a 15-day comment period is published. However, the notice becomes effective upon the date of filing with the Federal Register. Public comments received after the 15-day comment period may form the basis upon which to modify or rescind any inseason adjustment made by the Regional Director. An inseason adjustment to the joint venture processing amount increases the OY and DAH.

Besides approving and if necessary modifying the amounts requested by a joint venture, the council has also instituted a policy whereby one half of the approved amount is held in reserve. This reserve will be released to the joint venture if the joint venture is reasonably complying with its commitments (i.e. purchases of shoreside processed fish) or if it is even needed by the joint venture (i.e. in some instances after fishing has been initiated, the joint venture may not desire all of its requested amount). This policy increases the probability that the joint venture partners will not deviate significantly from what was indicated in their application as reviewed by the council. This policy also minimizes some of the problems associated with the evaluation of joint venture proposals that request amounts of fish that seem too high relative to their apparent capability to harvest and market the fish.

North Pacific Fishery Management Council

The North Pacific Fishery Management Council (NPFMC) joint venture policy is a generally worded document. "The council believes that it is in the greatest national interest for the resource to be both harvested and processed by U.S. industry (and) will use its ability to allocate harvest privileges to increase American participation in underutilized fisheries consonant with the wise use of the resource."

At the May 1984 NPFMC meeting, an industry workgroup introduced a draft policy on joint ventures. This policy categorizes joint ventures and lists them in order of preference. Within each category, a list of 16 criteria would direct the council in its allocation decision among joint ventures. In addition, a council workgroup meeting in June of 1984 drafted two different policies for the review of foreign fishing vessel permit applications, allocations and joint ventures. These recommendations will be presented to the full council in September 1984 for final action.

The actual allocation procedure begins with a determination of OY established by the FMP for the groundfish of the Bering Sea and Aleutian Islands area, implemented by final rule on December 31, 1981. And by the FMP for the groundfish of the Gulf of Alaska, implemented on April 21, 1978. The OYs are apportioned initially to domestic annual harvest (DAH), reserve, and TALFF. Thus, OY = DAH + RESERVE + TALFF. Further, DAH is divided among DAP, JVP, and domestic nonprocessed fish (DNP). Thus, DAH = DAP + JVP + DNP. JVP and DAP are determined by survey. These survey forms are sent out to industry twice, possibly three times a year. This joint venture survey form is similar to those sent to domestic processors for the determination of DAP.

Under 50 CFR Sections 611.92(c) and 672.20(c), the Secretary of Commerce (Secretary) may apportion to DAH any reserve amounts of the Gulf of Alaska groundfish that he determines to be needed to supplement DAH. Such apportionments shall be made as soon as practicable after the first day of April, June, and August, or any other date determined to be necessary. He shall allocate any resultant increases in DAH amounts among the three components of DAH. He also may apportion up to 40 percent of each initial Gulf of Alaska reserve to TALFF as soon as practicable after the first day of April and June, and up to 20 percent after the first day of August.

Under 50 CFR 611.93(b) and 675.20(b), the Secretary may apportion to DAH, or retain in reserve for later apportionment, the amount of Bering Sea and Aleutian Islands area groundfish anticipated to be harvested by vessels of the U.S. The Secretary shall allocate any increases in DAH amounts resulting from apportionments of reserve for the Bering Sea and Aleutian Islands area among the three components of DAH. As soon as practicable after February 2, April 2, June 2, and August 2, he shall apportion to TALFF up to one-fourth (1/4) of any reserve amounts for this area which will not be harvested by U.S. vessels. If, following any of the first three of these dates, the Secretary apportions less than 25 percent of any reserve amount to TALFF and DAH, the nonapportioned part of that 25 percent shall be added to the reserve amounts available for apportionment on the next specified date.

Also under 50 CFR 675.20(b), the Secretary may apportion from DAH to TALFF amounts of groundfish he determines will not be taken by U.S. fishermen. This will be done as soon as practicable after June 2 and August 2.

Unlike the New England/Mid-Atlantic regions, specific tonnage allocations are not made to individual joint venture companies when the permit is granted. Once total JVP is determined, the fishery is essentially open access until JVP is reached, then the fishery theoretically would be closed down. This situation, however, has not occurred as yet.

Further, the NPFMC until now has had ample slack in the TALFF category so that allocation among JVs of the total JVP has not been an issue. This situation is rapidly changing in the Gulf of Alaska, namely for two species: Pacific Ocean perch and sablefish. The NPFMC will need to establish a management policy which will encompass an allocation procedure for fisheries with no TALFF and for which DAH is still larger than DAP.

Joint Venture Policy Implications

The New England and Mid-Atlantic Fishery Management councils have developed species-specific policy for joint ventures based on the U.S. industry becoming involved in all phases of fish utilization: harvesting, processing and marketing. The policy establishes an interesting precedent related to allocation amounts. "When it is considered to be in the best interest of the United States, individual JV's ordinarily should be authorized for specific amounts of fish." It is felt that guaranteed quantities are necessary to make joint ventures attractive because of the relatively small total amounts of fish available for joint ventures. The rationale for this policy is that guaranteeing specific amounts will encourage development of the types of joint ventures which involve all segments of the U.S. industry. Concern was expressed that without specified amounts, new specialized vessels might be attracted into the fisheries rather than alternative uses for existing vessels being provided. There was no explanation in the text of how guaranteed allocations would provide the incentive for the latter type of joint venture development.

Joint venture allocation policy in the New England/Mid-Atlantic regions under Amendment #1 is a fundamentally different interpretation of sec. 204 (7)(E) of the Act than occurs in the North Pacific. Maximum tonnage in the North Pacific region is interpreted as the total JVP, whereas on the East Coast the interpretation was individual company maximum tonnages. The New England/Mid-Atlantic interpretation is in essence giving a property right to a specific amount every year to individual joint ventures. The two regional councils' awareness of this property right precedent is evidenced in a 1982 memo from David Fitch, legal counsel, to William Gordon, Assistant Administrator for Fisheries, NMFS.

The memo concerns itself with the New England Council's request "to include a new condition in the Atlantic joint venture permits, under which the RD (regional director) would review each operation's performance on a monthly basis and decide whether to allow it to continue as originally authorized, to reduce the levels of JVP allowed, or to terminate it." The advice to Gordon was that "the proposal could be accommodated, as a matter of law, by rewriting it to allow periodic assignments of JVP (rather than periodic retraction or revocation of existing rights). This change is necessary because, in the form proposed by F/NER, exercise of revocation authority would violate the Act and circumvent existing procedures required by the regulations. But doing so would require a policy decision that specific amounts of JVP be assigned to specific joint ventures, rather than allowing the total JVP to be taken by all comers of all nations on a first come, first served basis." (Specific joint venture allocations did subsequently become policy as explained earlier).

Of further interest in this memo are the reasons expressed for the legal concern over the New England Council's request:

> "These concerns are essentially that, when the government issues a permit, it establishes a property interest, an expectation of the ability to pursue economic operations without further interference. Altering this property right is a serious matter (underlining mine), and certain procedural safeguards must apply to give the property holder (permittee) the "due process of law" guaranteed by the U.S. Constitution whenever the government adversely affects a property interest. Without observance of proper procedural safeguards, the property-holder (permittee) has no protection against arbitrary or unlawful government action. Not only does the Constitution require such procedural protection against unwarranted governmental interference in private transactions as a general matter, but it also becomes particularly important under an Administration committed to reduction of governmental tinkering in business affairs. I think, therefore, that you (Gordon) must carefully consider whether the benefits that NMFS

would derive from this new in-season permit modification procedure would justify the uncertainty it creates for the joint venture operation, and whether expediency in this case outweighs the due process concerns that otherwise require procedures like those in 611.3 (i).

The original permit could state that it is only good for a fixed number of months, unless extended after review by the RD, or only authorizes a small amount of purchases initially, with amounts to be assigned by the RD after periodic review. This approach would of course require that specific portions of the total JVP available in a given fishery be "allocated" or "assigned" to each permittee. (This differs from procedures for the West Coast and Alaska. However, you have approved a Bulgarian JV permit authorizing purchase of only part of the full amount of mackerel JVP.) In addition, since the JV permit holder will need some idea of how much JVP he can reasonably expect to be assigned over the year, if performance is good, this anticipated total amount should be indicated in the initial permit.

Leaving the permit holder with the small amount of JVP initially assigned should do no harm, and avoids questions of whether NMFS has the authority to revoke or reduce rights granted by a permit once it has been issued. Allowing additional amounts to become available automatically, unless the RD determines to deny them, means that business operations will be prejudiced by agency inaction.

One important issue which the Region's request does not bring out is whether such joint venture termination or reductions would be appropriate or necessary in the absence of another applicant's competing to purchase the same fish. If there is a permitted joint venture underway, but not living up to expectations, it seems highly inappropriate for the government to intervene and terminate its operations, unless there is some reason for doing so."

Of further interest is that there appear to be indications that foreign industry is looking at the possibility that these property rights may be made for longer periods of time. The Anavar proposal is a good example of this. It is a proposed agreement between a Spanish industry group and the Mid-Atlantic and New England fishery management council whereby certain levels of TALFF would be guaranteed over a five-year period, pending resource availability, in exchange for guaranteed purchases of squid from the U.S. The proposal was eventually turned down but at the least a precedent has been set for negotiation between foreign industry and regional councils. In the North Pacific tonnage negotiations are carried out on an industry to industry basis.

It is also interesting to note that the short term property right (allocation) afforded to joint ventures on the East Coast is not afforded to domestic processors. If the property right is indeed viewed as an advantage in that companies can make financing and marketing arrangements based on a guaranteed supply, then this policy would appear at odds with the portion of the Act affording a preference to U.S. fish processors.

The North Pacific joint venture allocation procedure on the other hand implies essentially that the joint venture fishery is open access until JVP is reached whereupon the fishery would be closed.

This procedure may have caused some confusion in interpretation. First, although the JV fisheries are operated as open-access, the foreign industry partners have not perceived the fishing as open-access. For example, Japan sets tonnage targets for individual species in industry-to-industry negotiations (Atkinson 1984). These tonnages are then used as a basis for completing permit applications. Once the permit is granted the tonnages are allocated to the individual companies and hence vessels under the coordination of the Japan Deep Sea Trawlers Association. It is these tonnages that the council votes on at its meetings and upon which it bases its recommendation to the NMFS. While this council vote may be perceived by its members as an allocation vote, the fishery, by policy established by the NMFS, is open-access. Once the amount of resource becomes binding these tonnage targets will become meaningless. Also meaningless will be council recommendations for TALFF JVP ratios, as has been discussed recently at the May 1984 council meeting. Further it will be interesting to observe what happens to the interest on the part of foreign partners in participating in joint ventures when target tonnages can no longer necessarily be fulfilled.

The implication for future policy development for the North Pacific Fishery Management Council may be to design an allocation procedure whereby the property right is assigned to the all-U.S. segment of the industry rather than the foreign-U.S. partnerships.

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U. S. Seafood Exports and the Exchange Rate

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Abstract

This report examines how the appreciation of the dollar over the 1981-1983 period has affected U.S. exports to three of the nation's major trading partners in seafood products: France, Japan, and the United Kingdom. In 1982, these countries accounted for 70% of the value of U.S. edible seafood exports.

The findings of the report indicate that the U.S. seafood export sector has lost potential overseas sales because of the rise in the value of the dollar. For the 1981-1983 period, the average annual trade loss (in current dollars) ranges from $81 million assuming the dollar had appreciated by 5% against the currencies of France, Japan, and the United Kingdom to $417 million for a 25% appreciation. The cumulative impact of the potential trade loss (in current dollars) between the first quarter of 1981 through the first quarter of 1983 ranges from $169 million for a 5% appreciation of the dollar to $876 million for a 25% appreciation. Prospects for increasing exports will depend on several factors which include: a decline in the value of the dollar, the rate of income growth abroad, and the ability of some of the developing countries to resolve their debt problems and accumulate foreign exchange reserves.

Introduction

Exports of edible fishery products in 1983 continue to deviate from a long established rising trend that began in the 1970's. After reaching a record high of almost $1.1 billion in 1981, the current dollar value of edible seafood exports dropped below the $1 billion mark for two consecutive years. In 1982, the current dollar value was $998.7 million, while the 1983 value was $907.7 million, a drop of 15% below the 1981 peak.

For the 1980's, the U.S. fishing industry has embarked on an aggressive program to increase its export sales. However, there is growing concern that the program has been stalled temporarily because of the continued strength of the dollar in foreign exchange markets. Unfortunately, no estimates are currently available to assess the impacts of exchange rates on the fishery export sector. Everyone believes that exchange rates affect fishery exports, but no one can say by how much.

This report examines the relationship between exchange rates and imports of U.S. fishery products by three of our major trading partners: France, Japan, and the United Kingdom. The two questions of primary interest are: (1) How has the appreciation of the dollar affected the volume and value of foreign imports of U.S. fishery products; and (2) What is a "first approximation" of the potential trade losses due to the dollars' appreciation (which some analysts argue is overvalued against foreign currencies by as much as 25%).[1/]

This report takes the U.S. trade balance in fishery products as the starting point for determining the impact of exchange rates on U.S. fishery exports. The first section examines the changes in trade patterns over the past decade. The second section describes the impact of the appreciation of the dollar between 1981 and 1983 on exports.

Seafood Export Trends

Export Growth

The 1980's began with the prospect of significant gains in U.S. seafood sales abroad. Trends of the 1970's generated an expectation of a robust growth rate for exports and a narrowing of the U.S. fishery trade deficit. The value of edible fishery exports in current dollars grew from $93.9 million in 1970 to $1.1 billion in 1981 (Chart 1). Export volume of edible products jumped 375%, from 64,000 metric tons in 1970 to 304,000 metric tons in 1981.

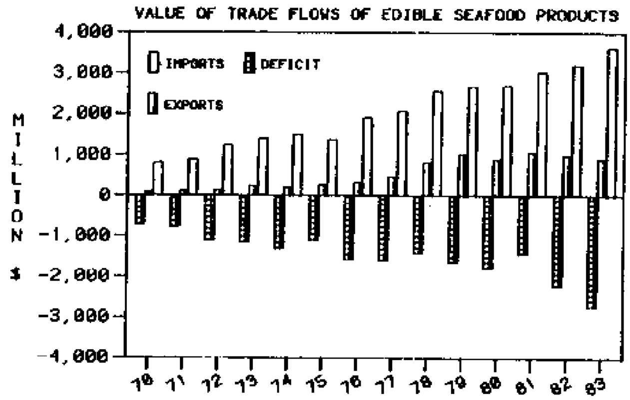

Chart 1

This expansion was stimulated by high economic growth rates abroad, availability of credit from commercial banks, and a relatively weak U.S. dollar in the mid-1970's. Another factor that affected U.S. - foreign trade flows was the implementation of the Magnuson Act and the American Fisheries Promotion Act. These statutes enable Regional Fishery Management Councils to determine the optimum yields in fishery management plans to enhance export opportunities by reducing or eliminating foreign allocations in the U.S. fishery conservation zone. Nonetheless, the U.S. trade deficit in edible seafood products rose from $719 million to $2.7 billion between 1970 and 1983.

Export growth has been accompanied by a marked shift in the relative importance of export markets (Chart 2). In 1970, European and North American markets accounted for more than 75% of the value of export shipments; by 1982 the market share was 31%. In contrast, seafood shipments to markets in Asia jumped from 21% to 66% of the total export value. For the most part, the shift mirrors the higher economic growth rates experienced by economies in the Far East.

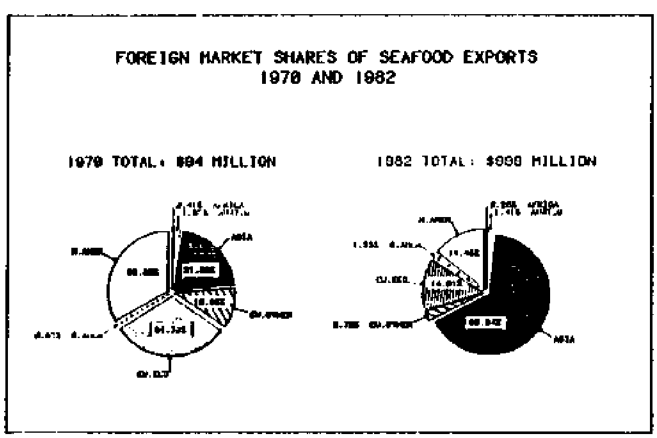

Chart 2

Factors Affecting Fishery Exports

As the U.S. fishing industry expands, it will become more closely linked with the rest of the U.S. economy. Cyclical changes in the level of economic activity both at home and abroad could have larger impacts on the economic condition of the industry than before. Interest rates, for example, already play a major role in the profitability of the industry. Exchange rates are becoming a more prominent factor as well as income growth abroad.

Recent reports by the Federal Government on the trade imbalance cite several factors that have affected the U.S. export sector.[2/] First, the pace of the economic recovery in foreign industrial countries is an important determinant of the export level. In 1983, the brisk expansion of the U.S. economy signaled an end to the recession at home. This is expected to be the catalyst that could spark a worldwide economic recovery and increase the overall volume of international trade.

Second, the difficulties caused by the heavy debt burden of the developing countries will have to be overcome. In 1982, U.S. exports to 13 of the most heavily debt burdened countries dropped by $8 billion. The developing countries have coped with their debt burden by rescheduling debt payments. In doing so, they have to make financial and economic adjustments which curtail their ability to import.

The third factor is the continued strength of the dollar. The exchange rate of the dollar, as measured against the currencies of major industrialized countries on a trade weighted basis, has risen almost 40% between 1980 and 1983 (Chart 3). The rising value of the dollar can be traced to such factors as lower inflation in the United States than in other countries, higher real interest rates in the United States, and the perception that the United States is a safe haven for investment funds.

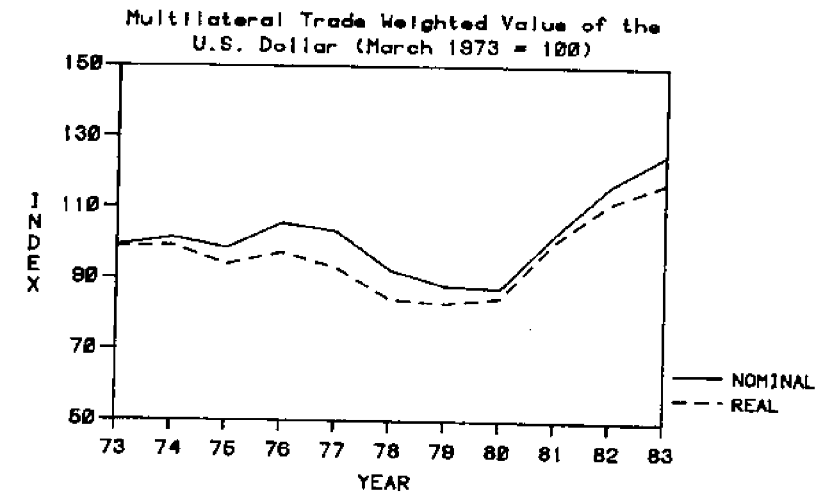

Chart 3

The real appreciation of the dollar -- the observed exchange rate adjusted for differences in nations' inflation rates -- has been 38% over the 1980:Q1-1983:Q1 period. This means that U.S. products are now being sold in world markets at prices that on the average have risen significantly relative to their competitors.

In the past three years, the principal drag on increasing overseas sales has been the explosive rise of the dollar. The markets hit the hardest, according to the Wall Street Journal, include those for agricultural products, where U.S. export sales were off $7.4 billion or 17% from 1981; civilian aircraft, down $3 billion or 26%; and other capital goods, off $10.5 billion or 14%.[3/] The General Accounting Office, citing estimates from the Ford Motor Company, indicates that changes in the yen-dollar rate gave its Japanese competitors a $900 per car price advantage.[4/] Moreover, the U.S. Department of Agriculture estimates that a 20% rise in the inflation-adjusted value of the dollar over 2 years will cut U.S. exports of wheat, corn, and soybeans by 16%.[5/] In terms of the overall U.S. trade performance, the Federal Reserve Board calculated that between mid-1980 and mid-1983, the appreciation of the dollar caused a $40 billion deterioration in U.S. trade balances (at an annual rate).[6/]

Fishery Balance of Trade

The direct effect of an appreciation of the dollar in both nominal and real terms is to raise the price of U.S. goods in foreign markets. This reduces the price competitiveness of the exports and results in a decline in exports from the level they would have otherwise attained. Foreign importers and consumers are more likely to buy their own country's products or close substitutes from other countries rather than the expensive U.S. exports.

Meanwhile, the strong dollar makes imports cheaper relative to some domestic products. In 1983, U.S. fishery imports of edible seafood products reached a record $3.6 billion, not only because of the strong dollar, but because of the recovery from the recession, which stimulated an increase in imports. Total imports of all fishery products was a record $5.1 billion.

The level of income at home and abroad affects imports and exports. Over the course of a business cycle, the U.S. trade balance historically tends to improve in recessions and worsens during an expansion as income rises. Growth of the U.S. economy is expected to continue well above that of its major trading partners in 1984. As a result, U.S. imports should rise faster than U.S. exports. Thus, the trade deficit in fishery products may not improve substantially in the near future.

Exchange Rate Impacts

In this part of the paper, we provide a "first approximation" of the estimated impact of exchange rate changes on the volume and value of fishery exports. The analysis focuses on the import patterns of three of our largest trading partners - France, Japan, and the United Kingdom. In 1982, these countries accounted for 70% of the total value of U.S. seafood exports.

This analysis involves two interrelated steps: estimating import demand functions for France, Japan, and the United Kingdom, and then forecasting how changes in exchange rates affect the quantity and value of imports. The estimates are for the first quarter of 1981 through the first quarter of 1983. This corresponds to the recent activity of the dollar in foreign exchange markets.

The analysis covers exchange rate impacts for the appreciation of the dollar against foreign currencies over the range of 5% to 25%. Although the dollar appreciated by more than 25% against the British pound and the French franc, we used 25% as the upper limit for exchange rate changes for two reasons: (1) the dollar rose about 25% annually relative to the pound and the franc (less against the yen); and (2) as previously noted, some analysts have argued that the dollar may be overvalued by as much as 25%.

France

Seafood Imports from the United States

The U.S. share of the French market for fishery products has not shown any appreciable gains in recent years (Chart 4). Although the total volume of fishery imports increased 13%, from 443 thousand metric tons (mt) to 501 thousand mt between 1977-1981, the U.S. share of the French market in terms of volume and value stayed around 2-3% and 5-6%, respectively.

Salmon products comprise the bulk of the imports from the United States (Chart 5). Between 1977-1982, salmon products accounted for 54 to 73% of the import volume and 65 to 83% of the import value. Fresh and frozen salmon was the primary import product from the United States.

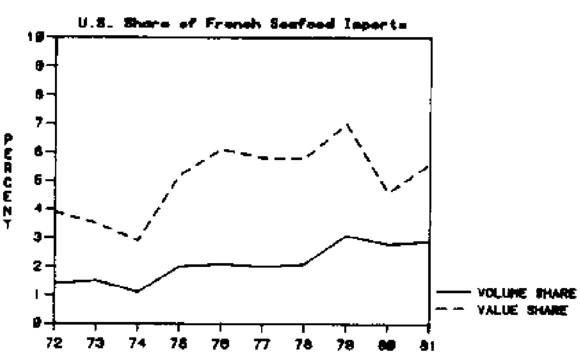

Chart 4

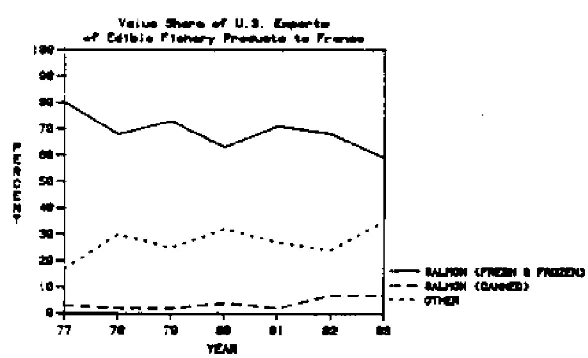

Chart 5

Because of the high percentage of salmon in the export picture, the flow of exports to France has a distinct seasonal pattern. Chart 6 shows the quarterly export patterns of total exports, fresh and frozen salmon, and canned salmon, which all reach seasonal highs in the fourth quarter. This reflects the peak periods of salmon landings in the United States which occur in the third and fourth quarters.

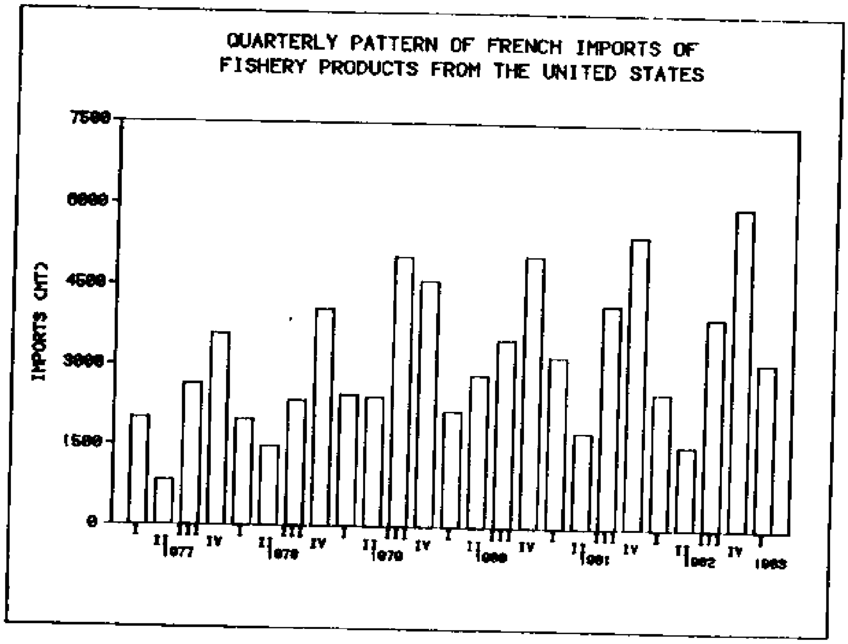

Chart 6

Dollar - Franc Exchange Rate

Since the first quarter of 1981, the dollar has appreciated 47% against the franc (Chart 7), or about 25% per year. However, the appreciation had a moderately negative effect on U.S. exports of edible seafood products to France.

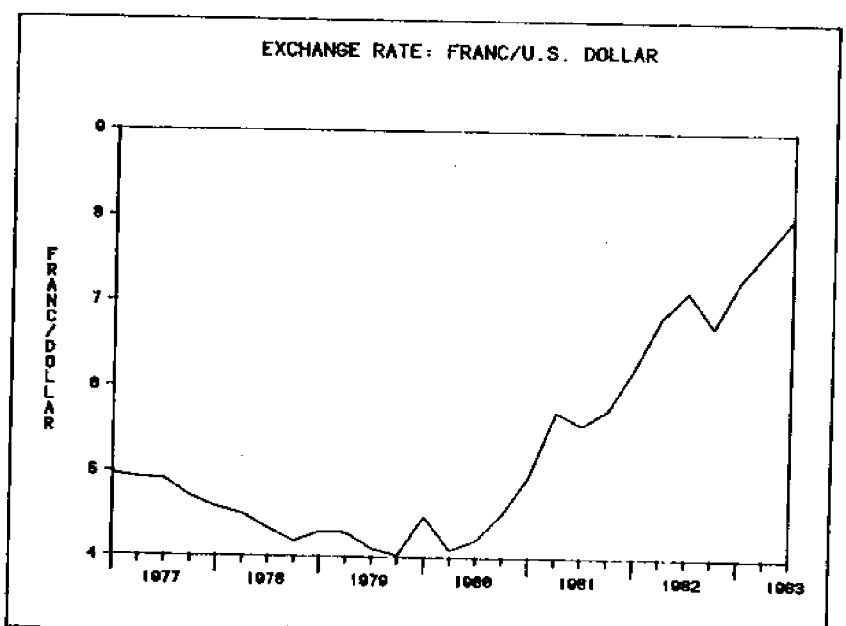

Chart 7

Exchange Rate Impacts

The results of the model in Appendix I indicate that the cumulative value of the trade losses between 1981:QI and 1983:QI range from $4.6 million for a 5% appreciation of the dollar to $28.5 million for a 25% appreciation. Table 1 shows the estimated potential trade losses in quantity and value for exchange rate changes. The figure in columns 2-6 indicate the estimated increase in U.S. exports, assuming the value of the dollar against the franc was 5 to 25% less over the 1981:QI - 1983:QI period.

The estimate of exchange rate elasticity of -0.29, as reported in Appendix I, indicates that for U.S. edible seafood products as a group, a 1% increase in the exchange rate of the dollar against the franc is expected to reduce imports by 0.29%. In other words, exchange rate changes will have a small effect on the level of imports of seafood products from the United States. The low value of the exchange rate elasticity suggests that U.S. imports play a minor role in the overall French import market. This conclusion is borne out by the figures in Chart 4.

Besides the exchange rate, the French import demand is strongly influenced by the level of income of French consumers. The elasticity of income measures the responsiveness of imports to changes in income. In general, those goods with income elasticities greater than 1 are considered luxury items, and increases in money income result in increases in the amount of the product consumed. The estimate of income elasticity from the model is 6.3. This suggests that seafood products imported from the United States are luxury items, especially since salmon is a principal export.

The estimate of income elasticity seems rather high. This may be due to the influence of other variables which change in the same manner as income but are omitted from the equation. This tends to overstate the responsiveness of imports to income changes if the omitted variables are positively related to income.

Table 1. Potential Trade Loss in Edible Seafood Products: France 1981:QI - 1983:QI.

	1981	1982	1983:QI	Total	Potential Loss (1981-1983:QI)
		Value ($ 000)			
Actual	58953	52667	10259	121879	
Estimated (Base)	58122	50789	9949	118860	
Appreciation:					
5%	60391	52772	10337	123500	4640
10%	62879	59946	10763	128588	7028
15%	65621	57342	11232	134195	15335
20%	68660	59998	11753	140411	21551
25%	72050	62960	12333	147343	28483
		Quantity (Metric Tons)			
Actual	14599	14017	3106	31722	
Estimated (Base)	13971	14590	2584	31145	
Appreciation:					
5%	14208	14837	2628	31673	528
10%	14462	15102	2675	32239	1094
15%	14735	15387	2725	32847	1702
20%	15030	15696	2780	33506	2361
25%	15352	16031	2839	34221	3076

Japan

Seafood Imports from the United States

Exports of fishery products from the United States are beginning to play a more dominant role in the overall Japanese import situation. While the total value of Japanese seafood imports increased 62% between 1977 and 1981, the quantity of U.S. exports to Japan increased 250%. As a result, the U.S. share of the import market more than doubled from 5.6% to 12.9%. In terms of value, the U.S. share jumped from 9.5% to 14.9% (Chart 8).

Salmon is the primary export to Japan, despite the inroads made by king crab and snow crab exports when crab stocks were relatively abundant. In 1982, fresh and frozen salmon products accounted for 53% of the volume and value of Japanese fishery imports from the United States (Chart 9). Imports of canned salmon are minimal. The United States reportedly accounts for 90% of Japanese salmon imports.[7/]

The fishery trade flow with Japan shows a strong seasonal peak in the third quarter of the calendar year (Chart 10). This corresponds to the bulk of the U.S. salmon catch which also occurs in the third quarter. The salmon fishery in Japan has two seasons: May-August in the North Pacific and September-December in coastal areas. U.S. exports of salmon peak between these two seasons. In some years, exports were strong in the second quarter as a result of large domestic snow crab catches which subsequently appeared on the Japanese market.

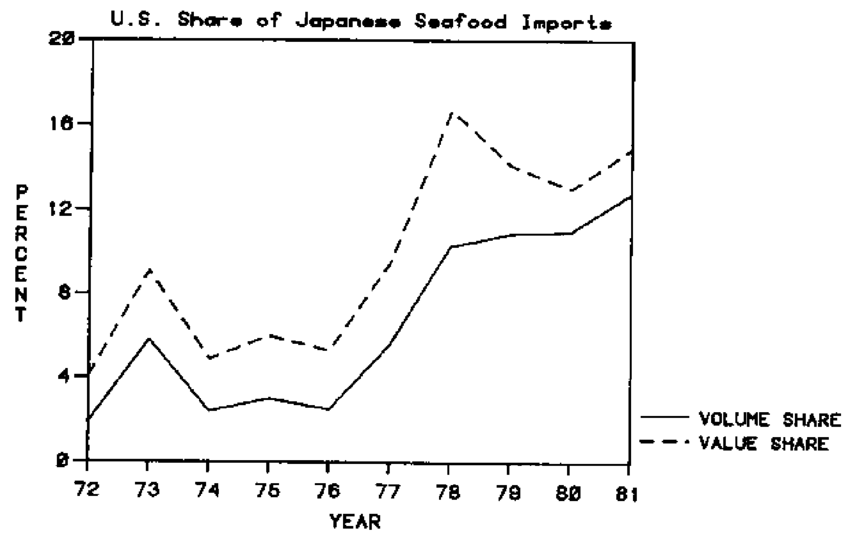

Chart 8

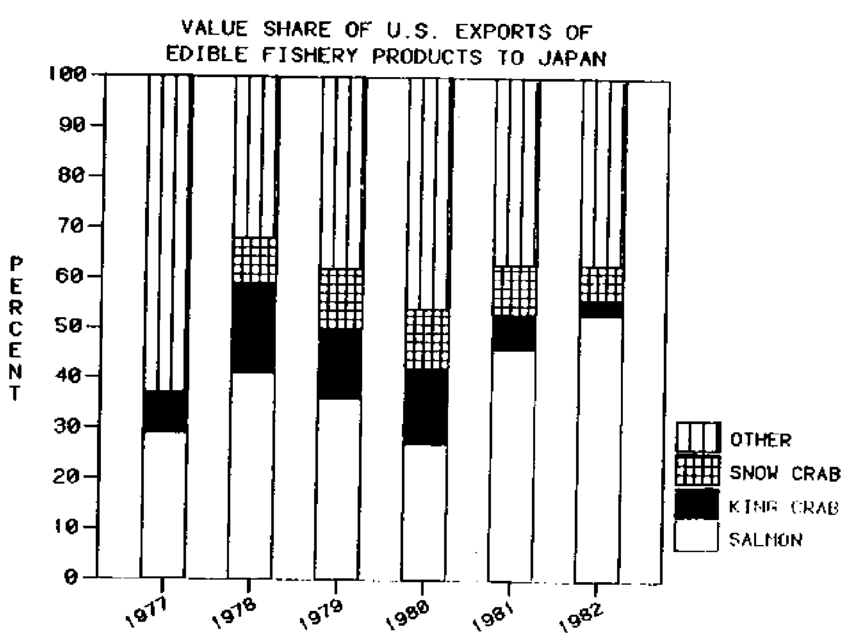

Chart 9

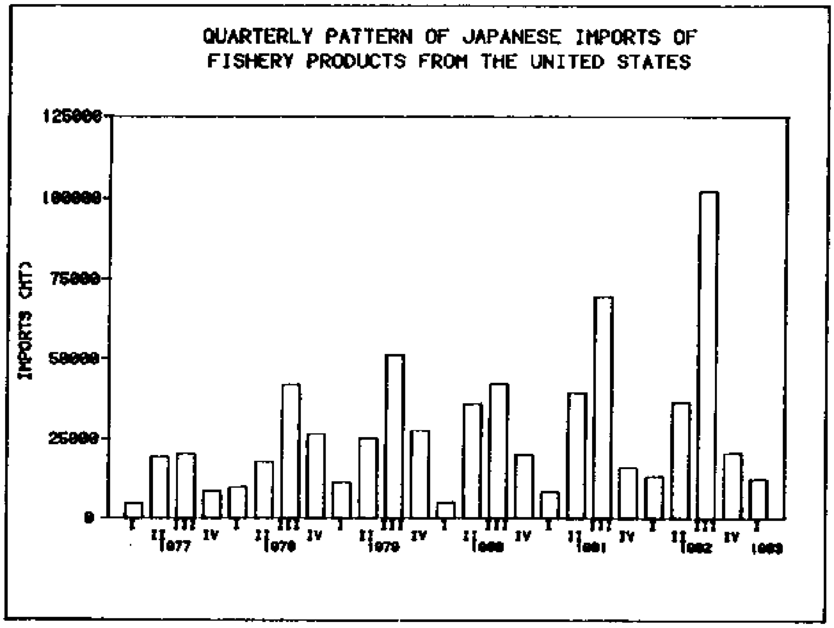

Chart 10

Yen-Dollar Exchange Rate

The yen-dollar exchange rate has followed a rollercoaster pattern since 1977 (Chart 11). In the 1981-1983 period, the exchange rate rose 28% from 1981:QI to 1982:Q3. Then it dropped by 11.2% from 1982:Q3 to 1983:QI. Over this entire period, the exchange rate increased 13.5%.

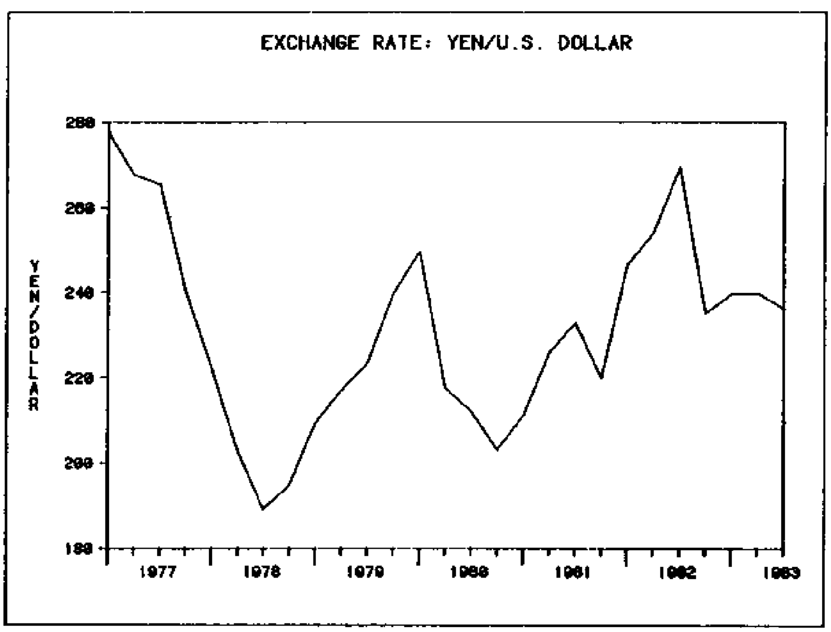

Chart 11

Exchange Rate Impacts

The import demand model in Appendix I indicates that the cumulative impact of potential trade losses between 1981:QI and 1983:QI ranges from $148 million for a 5% appreciation to $724 million for a 25% appreciation. Table 2 shows the cumulative impacts on import quantity and value based on the model.

Japanese imports are fairly responsive to exchange rate changes. The estimate of exchange rate elasticity in the model is close to -1. The greater responsiveness relative to France is probably due to the broader range of substitutes available on the Japanese market and the importance of salmon imports from the United States.

The level of income also is a major determinant of import demand in Japan. The estimate of income elasticity is 3.06 which suggests that U.S. seafood imports are luxury items. This estimate may overstate the responsiveness of imports to changes in income because of the possible omission of other explanatory variables.

Table 2. Potential Trade Loss in Edible Seafood Products: Japan 1981:QI - 1983:QI.

	1981	1982	1983:QI	Total	Potential Loss (1981-1983:QI)
		Value ($ 000)			
Actual	555313	613609	49543	1215465	
Estimated (Base)	586433	499465	47728	1133627	
Appreciation:					
5%	664478	564199	53259	1281936	148309
10%	723346	614183	57977	1395516	261879
15%	791260	671848	63421	1526528	392901
20%	870273	738937	69754	1678964	545337
25%	963076	817735	77192	1858003	724376
		Quantity (Metric Tons)			
Actual	133167	172026	12303	317496	
Estimated (Base)	142601	128154	12125	282880	
Appreciation:					
5%	152410	136970	12959	302339	19459
10%	163480	146919	13901	324300	41420
15%	176059	158223	14970	349252	66372
20%	190460	171165	16195	377820	94940
25%	207088	186109	17609	410806	127926

United Kingdom

Seafood Imports from the United States

The U.S. volume share of the British seafood market has remained relatively stable, ranging from 1.1% to 3.0% between 1977-1981 (Chart 12). Preliminary estimates indicate that the share of import volume may have shrunk to 1% - 1.5% in 1982. A key factor in the decline of the U.S. market share of imports in 1982 may be attributed to the botulism problem with canned salmon products that occurred in 1981.

The major fishery product imported from the United States is canned salmon, which accounted for more than 50% of the import value since 1977 (Chart 13). Together, canned and fresh and frozen salmon, comprise more than 80% of the value of U.S. fishery exports to the United Kingdom.

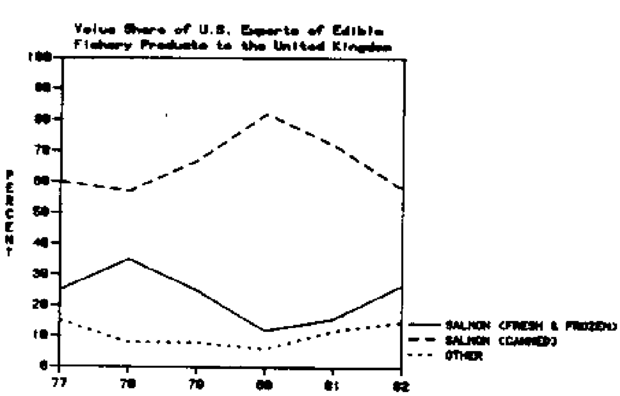

Chart 12

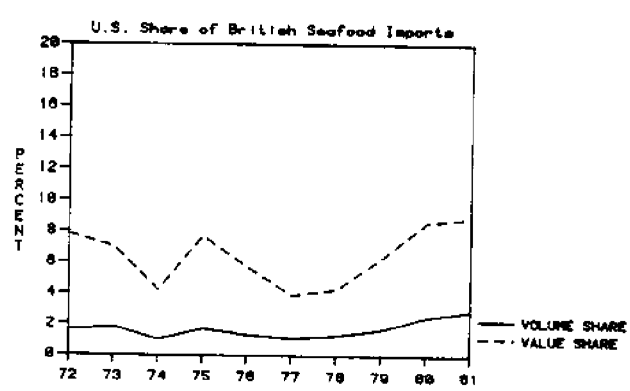

Chart 13

The seasonal pattern of imports in the United Kingdom is not as pronounced as compared to France and Japan (Chart 14). In some years, imports peak in the first quarter, which probably corresponds to the fourth quarter seasonality of canned salmon production. Seafood imports from the U.S. in 1980-1981 were much higher than historical levels. One explanation is that the bulk of the salmon products were exported elsewhere.

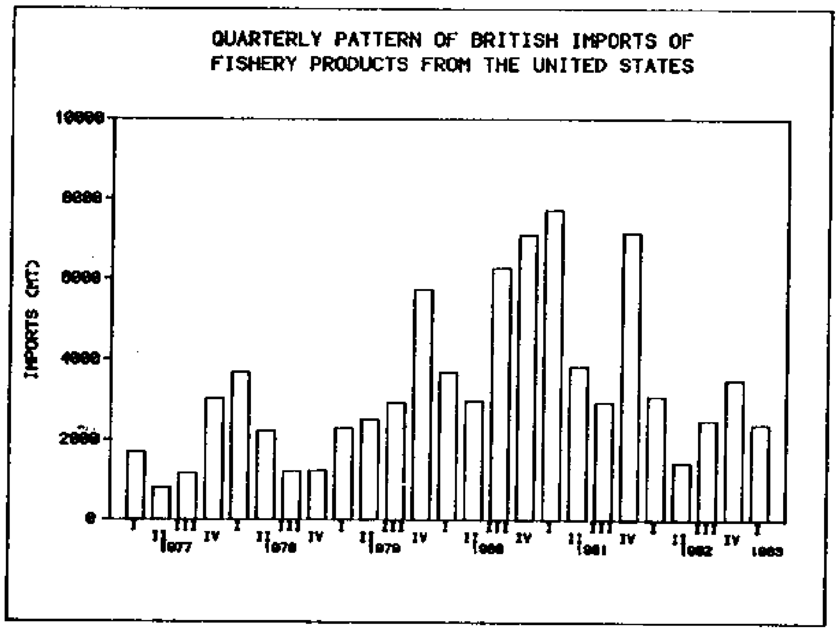

Chart 14

Dollar-Pound Exchange Rate

During the past two years, the dollar has climbed more than 50% against the British pound (Chart 15). The dollar rose 24% against the pound between 1981:QI to 1982:QI, and 21% in the 1982:QI and 1983:QI period.

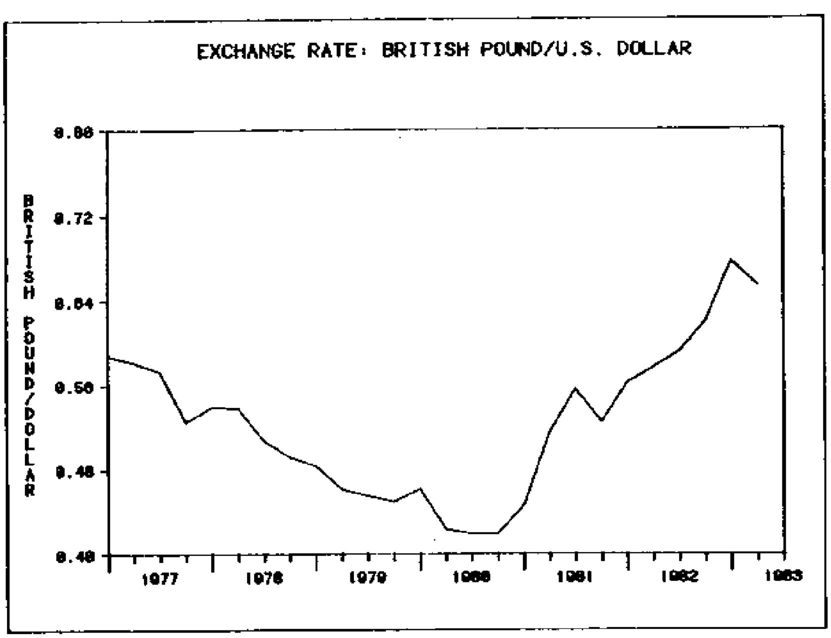

Chart 15

Exchange Rate Impacts

The results of the model in Appendix I suggest that the rise in the dollar has had a large impact on U.S. exports of edible seafood products to the United Kingdom. The estimate of the potential cumulative trade loss in fishery exports to the United Kingdom ranges from $16 million for a 5% appreciation to $123 million for a 25% appreciation of the dollar (Table 3). The corresponding quantities of potential export losses range from 2,000 mt to 13,000 mt.

Probably the most interesting result of the analysis is the sensitivity of British seafood imports to exchange rate changes. For example, the exchange rate elasticity with respect to value is 2.5%. This means that an appreciation of the dollar of 1% against the pound will result in a 2.5% decrease in the import value. The exchange rate elasticity with respect to quantity is 3.4%. Thus, an appreciation of the dollar by 1% will reduce the import quantity by 3.4%.

These estimates are much higher than those obtained for France and Japan. The reasons for the difference are not entirely clear. It is indeed possible, that the model lacks some important explanatory variables and does not take into account the interactions in the world salmon market. A more sophisticated framework to specify the seafood import demand of the United Kingdom would be a system of equations, including supplies from countries competing with the United States such as Canada and Norway. [Data was not available to estimate this model.]

Interestingly, an earlier study of the U.K. demand for Canada's frozen salmon showed the quantity of imports to be highly sensitive to price changes (that is, the estimated price elasticity was -4.3). Thus, the exchange rate variable might be a proxy for a price variable. Consequently, the exchange rate impacts could be overestimated.[8/]

Table 3. Potential Trade Loss in Edible Seafood Products: United Kingdom 1981:QI - 1983:QI.

	1981	1982	1983:QI	Total	Potential Loss (1981-1983:QI)
		Value ($ 000)			
Actual	88650	35706	9020	133376	
Estimated (Base)	64018	40948	8955	113921	
Appreciation:					
5%	72971	46674	10208	129853	15932
10%	83766	53579	11718	149062	35141
15%	96920	61993	13558	172471	58550
20%	113136	72365	15826	201327	87406
25%	133391	85321	18659	237371	123450
		Quantity (Metric Tons)			
Actual	21636	10507	2392	34535	
Estimated (Base)	15220	11392	2508	29120	
Appreciation:					
5%	16255	12167	2678	31000	1880
10%	17421	13040	2871	33332	4212
15%	18746	14032	3089	35687	6567
20%	20262	15166	3339	38766	9646
25%	22010	16475	3627	42112	12992

Conclusions

The 1980's may turn out to be a decade of only moderate growth of U.S. seafood exports. A sluggish world economy that is now recovering from the recent worldwide recession, a slow return of developing countries to financial strength, and a strong dollar, may dampen the growth in worldwide food demand in the next few years.

The appreciation of the dollar has had a substantial negative impact on exports of edible fishery products. The results of this analysis indicate that the cumulative loss in potential sales between 1981:QI and 1983:QI range from $169 million for a 5% appreciation to $876 million for a 25% appreciation. If the results of the estimated models are reasonable interpretations of the data, then current levels and forecast trends in exchange rates must be considered in export development programs. In particular, fiscal and monetary policies can have significant impacts on seafood exports via exchange rates.

Despite the appreciation of the dollar, the United States appears to have maintained its relative share of export markets in some countries. However, the dollars' rise may have offset any of the increase in market shares that occurred in the late 1970's.

Appendix I: Estimating the Response of Foreign Imports of U.S. Edible Seafood Products to Exchange Rate Changes

Import Demand Model

The import demand model applied in empirical studies of international trade flows follows from the theory of consumer demand: the quantity of imports of a country depends on domestic income, the price of imports, and the price of other commodities.[9/] These models have proved to be quite difficult to estimate because of the simultaneous equation bias.[10/] One solution to the problem is to assume that export and import supply elasticities are infinite.[11/] Thus, an increase in the demand for a country's exports can be satisfied without any increase in the price of its exports. Price is then treated as an exogenous variable and this allows the import demand function to be estimated as a single equation.

When applied to international trade in U.S. seafood products, this assumption may not be realistic. For commodities such as salmon, king crab, and tanner crab, the United States is a major supplier in worldwide markets. A change in the import demand for these products is certainly going to affect the export price. This problem can be overcome by estimating reduced form equations with imports (quantity and value) as the dependent variables, rather than supply and demand equations where the price and quantity variables interact.[12/] An equation can be specified in which variables regarded as "supply and demand" shifters (exchange rates, income, and population) are examined for their effect on the dependent variable.

Specification of Import Functions

The econometric model consists of reduced-form equations for quantity of imports and value of imports for France, Japan, and the United Kingdom. The general modelling approach follows the suggestion of Chambers and Just to include a separate exchange rate variable in the estimated equation.[13/]

The import quantity equations are of the form:

$$Q = a_0 + a_1\ EXCH + a_2\ Y + a_3\ Q_2 + a_4\ Q_3 + a_5\ Q_4$$

$$V = a_0 + a_1\ EXCH + a_2\ Y + a_3\ Q_2 + a_4\ Q_3 + a_5\ Q_4$$

where:

Q = Quantity of total imports of edible seafood products from the United States (metric tons)

V = Value of total imports of edible seafood products from the United States (U.S. dollars) deflated by the U.S. producer price index (1975 = 100).

EXCH = Exchange rate (nominal).

Y = Real gross national product (1975 = 100).

Q_2, Q_3, Q_4 = Dummy variables to account for the seasonal variation in imports.

Empirical Estimation

All equations were first estimated with all the independent variables. Then, depending on the results, different lags were tried for some variables or the equation was reestimated by omitting some insignificant variables. In addition, equations were estimated using U.S. salmon landings as an independent variable because of the dominance of salmon products in the overall import picture. The estimated equations were fitted by ordinary least squares using quarterly data covering 1977:QI - 1983:QI.

The resulting estimates for the reduced form quantity and value equations are presented in Tables A1 and A2, respectively. These tables provide, for each country, the "best" quantity and value equations. The left hand column indicates the importing country, and the succeeding columns give the estimated coefficients, the "t" ratios in parentheses, and the summary statistics for the equations.

Table A1. Reduced Form Import Value Equations, 1977:QI - 1983:QI Explanatory Variables*

COUNTRY	CONST	EXCH	EXCH(-1)	GNP	Q SAL	Q_2	Q_3	Q_4	R^2	DW	SER	RhO	F
France	-0.80 (-0.06)		-0.75 (-2.04)	0.84 (0.48)		-0.52 (-3.27)	0.36 (2.26)	0.73 (4.49)	0.78	2.19	0.29		13.1
Japan	9.29 (1.39)	-1.57 (-2.01)		0.41 (0.43)	0.37 (8.79)				0.81	2.09	0.39		29.2
United Kingdom	-6.06 (0.78)		-3.42 (-3.71)	3.10 (1.01)		-0.54 (-2.34)	0.37 (-1.82)		0.68	1.71	0.42	0.26	9.9

Note: Dependent Variables: Value of U.S. exports in U.S. dollars (deflated by the PPI, 1975 = 100); EXCH is the exchange rate (foreign currency/dollar); EXCH (-1) is the exchange rate lagged 1 quarter; GNP is real gross national product (1975 = 100); QSAL is total U.S. salmon landings (all species); and Q_2, Q_3, and Q_4 are quarterly dummy variables. All variables are in natural logarithms.

* t ratios in parentheses

Table A2. Reduced Form Import Quantity Equations, 1977:QI - 1983:QI Explanatory Variables*

COUNTRY	CONST	EXCH(-1)	GNP	Q_2	Q_3	Q_4	R^2	DW	SER	RhO	F
France	-44.86 (-4.42)	-0.29 (-1.21)	6.37 (5.28)	-0.32 (-2.45)	0.38 (3.19)	0.64 (4.95)	0.85	1.71	.21	-.15	20.6
Japan	-2.12 (-0.37)	-0.99 (-2.11)	3.06 (5.05)	1.22 (5.51)	1.73 (10.16)	0.74 (3.39)	0.86	1.94	0.31	-0.31	22.1
United Kingdom	-0.99 (0.21)	-2.54 (-2.20)	2.52 (0.91)	-0.43 (-2.17)	-0.36 (-2.04)		0.65	1.74	0.39	0.49	8.9

Note: Dependent Variables: Edible seafood imports from the United States (metric tons). Explanatory Variables: EXCH (-1) is the exchange rate (foreign currency/dollar) lagged 1 quarter; GNP is real gross national product (1975 = 100); and Q_2, Q_3, Q_4 are quarterly dummy variables. All variables are in natural logarithms.

* t ratios in parentheses

Data Sources

This section lists by variable the data sources used in the statistical analysis of this paper.

1. Exchange Rates and GNP: IMF, International Financial Statistics.

2. U.S. Export Data: Department of Commerce, National Marine Fisheries Service.

3. Import - Export Data of Fishery Products: FAO, Yearbook of Fishery Statistics.

4. Japanese Fishery Data: Ministry of Aquaculture, Forestry and Fisheries, Monthly Statistics of Agriculture, Forestry, and Fisheries.

5. U.S. Landing Statistics: Fisheries of the United States, National Marine Fisheries Service, Department of Commerce.

Footnotes

1. Washington Post, "Strong Dollar Paints Gloomy Picture for U.S. Trade in 1984," September 18, 1983. In determining whether a currency is overvalued, it is important to distinguish between short-term volatility and persistent misalignments. Short-term volatility is the amount of variability of the exchange in a specified period of time (daily, weekly, monthly). Misalignment is a persistent departure of the exchange rate from its long-term equilibrium level based on changes in its current account. This equilibrium exchange rate is influenced by underlying capital flows or changes in the supply of demand for traded goods. A more detailed discussion of misalignments is "The Exchange Rate System," John Williamson, Institute for International Economics, Washington, D.C., September, 1983.

2. Economic Report of the President, February 1984; The Economic Outlook, Congressional Budget Office, February 1984, and Business America, U.S. Department of Commerce, August 22, 1983.

3. Wall Street Journal, January 18, 1984, "Strong U.S. Currency Gives Companies Here Competitive Problems."

4. U.S. General Accounting Office, Testimony of Alan Mendelowitz before the Subcommittee on International Trade, Investment, and Monetary Policy, November 1, 1983.

5. U.S. Department of Agriculture, Draft Report, "Strong Dollar Dampens Demand for U.S. Farm Exports," November, 1983.

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An Overview of the French Seafood Market Regulation Scheme: A Case Study of Price Effects

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The primary focus of this paper is the impact of the price support scheme in France on ex-vessel prices. The price support scheme was initiated by the French government quite recently (1975). This research, which attempts to quantify effects on average prices, is the first step towards determining the impact of the price support scheme on producers' returns and/or consumers' interests.

Unfortunately, severe data limitations prevented the formulation of a model analyzing the impact over the entire seafood sector; thus it was only possible to model the impact on ex-vessel price for a single case, notably live Norway lobster (Nephrops norvegicus). Aside from this research, a more complete study has been conducted on the entire regulation process of the French government concerning the national seafood market, in order to discuss the expected vs actual effects on the different types of enterprises: producers, processors, wholesalers, etc. (Gilly, Lent, L'Hostis, 1984).

There has been a long tradition of government intervention in the French national economy: King Louis the 11th created in 1467 the first national enterprise, a state-owned porcelain factory (Morvan, 1983). As for fisheries, it should be noted that a great deal of the laws on French fisheries were adopted in 1681 (Ordonnance generale sur la marine, 1681) by Colbert, a famous government minister of King Louis the 14th, and are still in general valid.

These processes are not specific to the French government as most nations interfere -- directly or indirectly, officially or not -- in the economic environment or in the sector itself.

The French seafood market can be seen, in the way it operates, as an autonomous part of the national food system. The characteristics of seafood production, processing, marketing and consumption diverge considerably from other food products.

The supply of seafood, which fluctuates considerably, originates in a number of scattered points along the French coast. The variability of production is very high in the short and medium run, and no satisfactory explanations for this can be found. As a corollary to this diversity and atomicity of production, one may find very heterogenous economic structures, very different behaviour of enterprises and various types of activity.

Given product perishability, technical rigidity, uncertainty of supply and the common property nature of the resource, one can consider that ex-vessel supply is inelastic. This assumption is often made in fisheries economics (Anderson, 1977) and is particularly relevant in the short run (as the level of fishing effort responds with a lag to changing prices).

In contrast, French demand for individual seafood products appears to be relatively elastic in general, with evidence of substitution (and/or complement) effects between seafood products and/or with other protein foods such as meat, poultry, etc. These phenomena have yet to be completely substantiated in France, primarily due to a lack of data over a sufficient period for analysis.

A wide variety of domestically landed seafood products is consumed in France. This diversity is reflected in the distribution sector, composed of marketing chains of different lengths and various types of enterprises.

Such characteristics of the seafood market tend to result in disequilibrium (or unstable equilibrium) in the market in terms of supply and demand. The lower the ex-vessel price, the higher the effort exerted by the fleet (in the medium to long run) as fishermen attempt to attain an acceptable income level. In contrast, when prices rise, substitution phenomena tend to reduce demand. In the absence of regulation policy (of any nature), disequilibrium may be self-generated.

Confronted with a strongly competitive international market, the French seafood system is poorly adapted to changing patterns of production and consumption. While French production of fresh seafood products is sufficient for domestic demand (imports of fresh products totalling less than 7% of the seafood product deficit), adaptation to new products (frozen, prepared meats, etc.) which have a high added value, is slow and difficult.

Given national and international constraints, endogenous "self-regulating" mechanisms did not permit smooth and timely supply - demand adjustment, nor an acceptable level of industrial development and expansion. The 1975 market crisis provided sufficient evidence of the disequilibrium in the seafood sector, and resulted in the establishment of specific organizations and policies for regulation of the seafood market. This exogenous regulatory structure is overseen by industry participants as well as the administration, the latter responsible for administering the policies adopted.

Price Support Scheme

It should be noted that the French price support scheme is required in theory (Gilly, Lent, L'Hostis, 1984) to be coherent with the EEC scheme. Actually, one should make the distinction between "common species" of the EEC and "national species" that are covered by French regulation.

There are three levels of organization in France:

- At the local level (e.g. on the coast) producers' organizations (P.O.) unite, on a voluntary basis, those fishermen who wish to create their own marketing organization. Once in the P.O., they are required to respect the rules established by the government agency as well as their own. Producers are required to pay a certain tax on their landings in order to permit the P.O. to participate in the support price program. In the beginning of 1984, there were twenty-one P.O.'s in France, marketing nearly 95% of the domestic landings. The positive aspect of the organizations are evidenced by the fact that there were only three of them in 1975 and none in 1971. All the P.O.'s (except for one) are grouped in a national "structure," the National Association of Producers' Organizations (NAPO).

- At the national level, the NAPO is responsible for grouping and synthesizing the proposals of all the P.O.'s for submission to the national agency. This agency, called FIOM (French Seafood Market Regulatory Agency) is administered by a mix of staff (regular personnel) as well as by producers and processors. The role of the FIOM is to elaborate guidelines for seafood market regulation policies and to help the P.O.'s finance their interventions. The FIOM conducts several types of programs: ex-vessel price support scheme, production support scheme (assisting producers in locating new fishing grounds), and activities influencing seafood demand, such as promotion and advertising. The annual budget of the FIOM is approximately FF 150 million, of which 70 to 75% originates from government subsidies.

- At the European level, seafood market regulation is a part of the Common Agricultural Policy. There is an EEC agency (FEOGA) responsible for providing subsidies to the P.O.'s; at the French level, the FIOM relays FEOGA funds for all species regulated by European policy (SEYTRE, 1983).

Given this overview of the structure of the market regulation system, we may now focus on the price support scheme. The total amount of financial support is relatively low, representing only 3% of the total value of landings. However, this program is of particular importance for those specific regions in which fishing is the main source of income and employment (and where resources may be imperfectly mobile). The price support program attempts to stabilize fishermen's incomes at an acceptable level, insuring an active fleet as well as employment.

The price support scheme is based on interventions at the ex-vessel market level, specifically at the auction where fish merchants purchase landings from fishermen.

i) The withdrawal price is fixed each year, for each species (in FF/kg) according to a percentage of the previous year's average market price, and varies according to the freshness, size or weight and presentation. Seafood landings may not be sold for human consumption below their specific minimum price, and must be destroyed if there is no buyer at or below this price. Thus a floor price is established to effectively prevent price falls during periods of relatively high production and/or weak demand. In such cases, the fisherman receives 40% of the withdrawal price from the FIOM and the remaining 60% from his P.O. Approximately 3% by volume of French annual landings are withdrawn (less than 1% by value).

ii) Producers, as well as others, soon found that the withdrawal system was wasteful and it was suggested that another type of intervention be established. This resulted in a program allowing "surplus" to be withdrawn without being discarded. Two types of outlets for withdrawn products were established:

a) supply contracts; particularly for large-scale production species. A contract is negotiated between P.O.'s and processors for a given quantity of a certain species at a given price (contract price). In addition, the FIOM and the P.O. agree to provide subsidies to the processors which cover the difference between the contract and withdrawal prices. Thus this program may be considered as a processing subsidy.

b) subsidization of purchases for later sale (transformed); this measure allows processors to purchase a part or all of the "surplus" at a price above the withdrawal price, the difference being covered by a subsidy.

In both cases, the FIOM provides 60% and the P.O.'s 40% of the subsidization outlays. Processors are required to process the seafood landings in some manner (frozen, cooked, canned, etc.) as they decide. It is expected that they will place these processed products on the market when supply of fresh products (landings) of the same species is low. This assumption is particularly relevant for cases where processed (e.g. frozen) product is a close substitute for the fresh product.

Methodology

Suppose that, in a free market system, government intervention occurs in the form of a withdrawal price. For the case of the ex-vessel market for seafood products, this appears as a floor price at the auction market. There are two possibilities:

1) The floor or withdrawal price (P_w) is less than or equal to the market price (P_m) as determined by the intersection of demand and supply (see figure 1). A market equilibrium is established at P_m, Q_m, and the withdrawal price has no effect on the market.

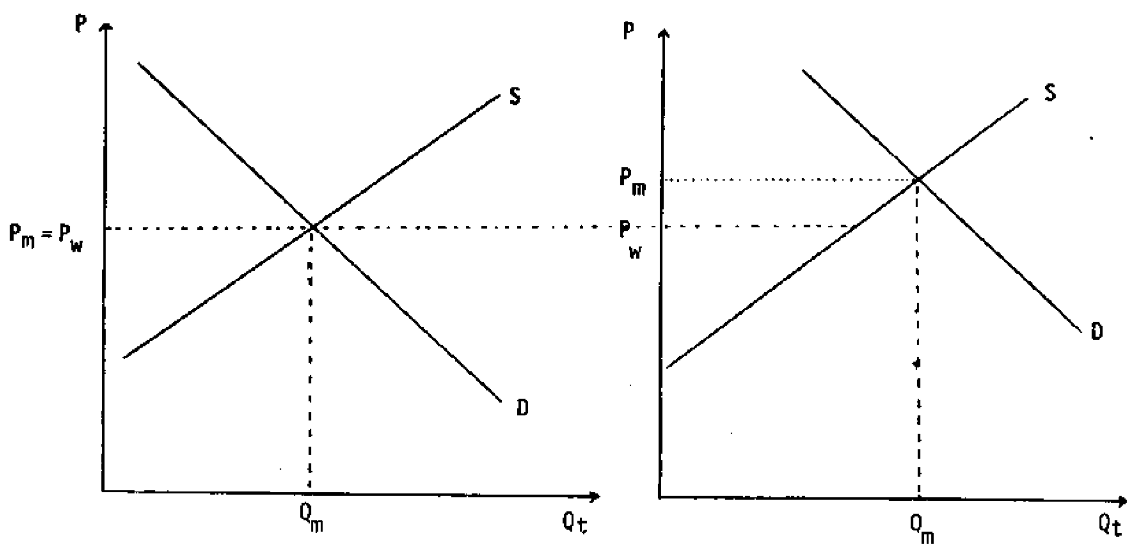


Figure I

2) The withdrawal price is above the market price: in this case, equilibrium is modified as a certain amount of the landings must be withdrawn (the "surplus" created by the price floor). Obviously, P_m will not be observed when it is below the floor price, however it is not unreasonable to assume it "would" exist (see figure 2).

The quantity withdrawn is $Q_w = Q_s - Q_o$ (at P_w).

Income to producers, then, varies given the market situation. In the first case, revenues are $R_m = P_m \cdot Q_m$, while in the second case they are $R_w = P_w \cdot Q_w + P_w \cdot Q_o = P_w Q_s$. On the buyer's side, quantities exchanged are lower with the withdrawal system in cases where the program is effective (i.e. $P_w > P_m$) while average prices are higher. The relative value of purchases (P x Q) with and without the program depend upon the elasticity of demand.

As discussed earlier, ex-vessel supply of seafood products is often assumed to be price inelastic. Given this framework, then, it is possible to consider the floor price program as a system of reducing supply up to the point where demand = supply at P_w (figure 3).

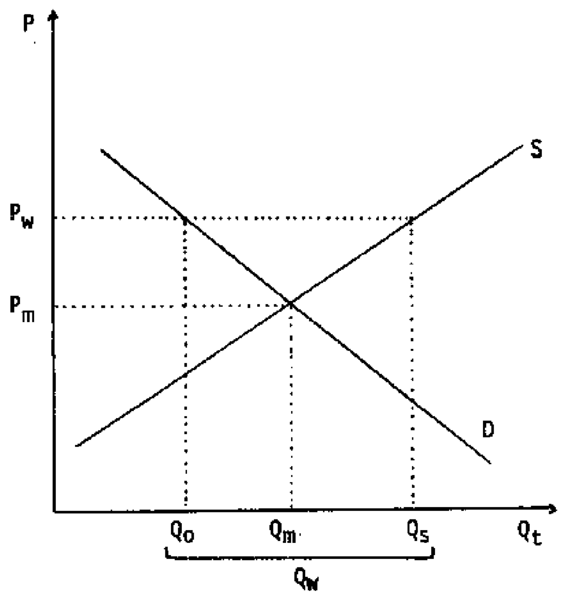


Figure 2

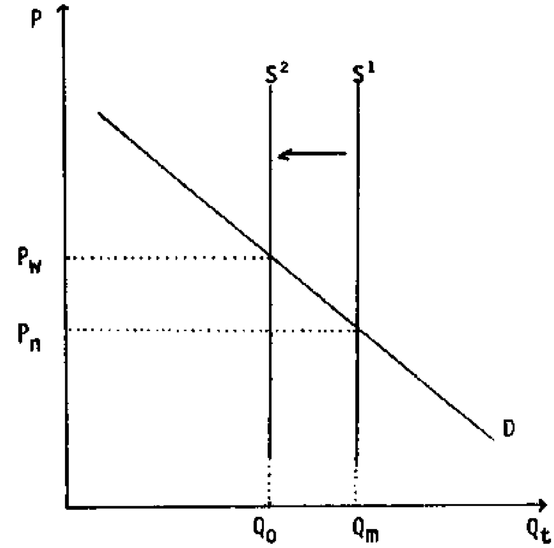


Figure 3

A Case Study: Norway Lobster

Given the previous discussion of the French minimum ex-vessel pricing scheme, it should prove useful to attempt to examine the economic effects of the program, particularly the impact on average prices of landings. The example chosen for such analysis in this study is the Norway lobster species (Nephrops norvegicus), more specifically the fishery in the Gulf of Biscay. This species appears to be the most useful as a first step in analyzing the economic effects of the program, for several reasons, which will be discussed in the following sections.

Overview of the Norway lobster fishery

There are two Norway lobster fisheries in France, for which the fishing grounds and the "product" differ:

- the fishery in the Gulf of Biscay, whose product is landed live;
- the fishery in the North Atlantic, whose product is landed iced.

The analysis which follows concerns the first fishery, whose fleet is composed of relatively smaller vessels, and is characterized by shorter fishing trips. While live Norway lobsters are landed year round, the peak of the season occurs between the months of April and August.

The bulk of the production of live Norway lobsters is landed in the following ports (all in Brittany):

- Le Guilvinec,
- Loctudy,
- Lesconil,
- Saint Guenole,
- Lorient.

Annual landings and average prices for these five ports are presented in Table 1 for the period 1979-83. Landings have been relatively stable over this period, ranging between three and four thousand metric tons. Average price varies somewhat across ports, reflecting primarily differences in quality or short run information. While average prices for both the small and large sizes have increased steadily over the past several years, it is evident that variations in landings have an impact on average prices.

The marketing of Norway lobster

Nearly all landings of live Norway lobsters are sold at the ex-vessel level through the auction system (90%). The marketing channels for this product are relatively short compared to other seafood products, with two or three agents between the fisherman and the consumer.

In contrast with the iced Norway lobsters, the live product is consumed primarily in the western region of France (approximately 80% of the production). Consumption in regions close to the ports of production

Table 1. Landings of Live Norway Lobsters, Quantity and Monthly Average Prices by Size and Port (tons and francs).*

	Large		Small		
	Q (T)	Ave Price	Q(T)	Ave Price	Q Total (T)
1979					
St. Guenole	73	27.36	73	13.60	146
Guilvinec	298	24.71	481	13.94	779
Loctudy	286	23.93	481	11.81	767
Lesconil	290	26.35	401	13.17	691
Lorient			771	14.95	771
Total					3154
1980					
St. Guenole	126	26.40	192	14.65	318
Guilvinec	343	25.52	573	13.89	916
Loctudy	362	25.07	636	12.78	998
Lesconil	380	26.75	507	13.63	887
Lorient			908	15.52	908
Total					4027
1981					
St. Guenole	116	31.14	157	15.76	273
Guilvinec	311	29.90	572	15.14	883
Loctudy	348	28.45	603	15.21	951
Lesconil	364	29.25	441	15.91	805
Lorient			1011	17.88	1011
Total					3923
1982					
St. Guenole	86	37.55	120	19.30	206
Guilvinec	240	36.21	435	17.91	675
Loctudy	309	34.71	512	17.71	821
Lesconil	300	35.78	401	18.12	701
Lorient			815	20.65	815
Total					3218
1983					
St. Guenole	106	37.97	138	21.43	244
Guilvinec	268	37.23	486	20.04	754
Loctudy	357	34.78	526	19.23	883
Lesconil	342	36.66	394	20.16	736
Lorient			1042	21.72	1042
Total					3659

*Figures for Lorient represent mixed sizes.

stems from the necessity to cook the shellfish while they are still alive as well as from both traditional and touristic demand.

Previous studies have examined the marketing of live Norway lobsters (e.g. Comite Local des Peches, Le Guilvinec, 1979) with several interesting conclusions which are essential to the present analysis:

- The price of small and large sizes are practically independent, the markets for the two being essentially separate;
- Similarly, the market for iced Norway lobsters is independent of that for the live variety. This characteristic permits the hypothesis (useful in the demand analysis) that the prices of both iced French-produced Norway lobsters and imports (primarily from Denmark) do not have a significant impact on the market for live Norway lobsters;
- Retail prices generally fluctuate with ex-vessel prices, while some of the variation may be absorbed in the marketing chain.

Price formation in the live Norway lobsters fishery

A useful point of departure is to examine how prices are formed at the ex-vessel level, and to attempt an assessment of how this process is affected with the introduction of a minimum price.

Previous studies of the formation of landings prices for seafood have utilized the assumption that supply at the ex-vessel level is inelastic, at least in the short run. Thus supply determines the quantity marketed, and demand "determines" the price at which this quantity is sold. Such conditions permit the specification of a demand curve which is price dependent, and avoids the need to specify supply, and thus a simultaneous equation system for representing price determination.

Several assumptions need to be advanced prior to specifying the model:

1) The behavior of the fishermen, particularly decisions as to the level of effort applied to the Norway lobster fishery, is assumed to be unaffected by the minimum price scheme, i.e. the landings are the same with or without the interventions. In fact, it is difficult to find and example of a period during which low ex-vessel prices (even before the minimum price program) resulted in a decrease in effort;

2) Product removed from the market and frozen for later sales does not affect the ex-vessel price of live Norway lobsters when put back on the market at a later date. This assumption does not seem unreasonable given the observations of previous studies as well as industry participants that the markets for live and frozen Norway lobsters are virtually independent;

3) Supply is price inelastic, at least in the short run;

4) Tastes and preferences have remained relatively stable over the period of analysis.

Note that the first two hypotheses state in effect that the minimum pricing program has no effect on the ex-vessel price unless the current market price is below the minimum price as discussed in the previous section. Thus it is assumed that the effects of the program are only evident during periods of heavy landings and/or low demand.

Several variables are assumed to affect the demand for Norway lobsters, as in the following specification:

$$P_t = f\,(Q_t/POP_t,\ DY_t/POP_t,\ P_t^{s/c},\ DV_{jt})$$

where: P_t = average ex-vessel price of live Norway lobsters

Q_t = quantity of live Norway lobsters

POP_t = population

DY_t = disposable income

$P_t^{s/c}$ = prices of substitute/complementary products

DV_t = seasonal dummy variables

t = time period (t = 1, 2, ... T)

The form of Q (quantity) in this equation will be specified as the net quantity (NQ), that is the quantity actually sold in the auction. Thus NQ = (quantity landed) - (quantity removed). Thus average price determination is a function only of that quantity marketed, or that sold to the buyers at the auction. Given such an approach, it should be possible to obtain an estimate of what the price would have been without intervention by substituting total quantity landed for net quantity once the parameters have been estimated.

Data/empirical analysis

The data used in the estimation of the model were collected from a number of sources. The difficulty in obtaining information concerning the quantities removed from the market placed severe restrictions on the analysis: it was only possible to have such information for three years (1981-83), in monthly figures (from P.O.'s). Thus all other data were obtained over the same period. Landing and average prices were collected from the CCPM,[1] while the demographic data and price series for related products were obtained at the INSEE.[2] INSEE sources also provided a price index (for food products) which is utilized to deflate all prices and income. Because demand at the retail level is being estimated with ex-vessel prices, it is necessary to include in the equation some factor which accounts for the margin between the two marketing levels (Foote, 1958). As live Norway lobsters require little handling in contrast with other seafood products (only sorting and boxing) it is assumed that the major factor in the marketing margins is the cost of transportation. Thus an average price for diesel fuel, also available from INSEE sources, is added to the equation. Dummy variables to represent seasonality in both production and consumption are included, three for the first three trimesters. Given these refinements to the model, the equation to be estimated takes the following form:

$$\frac{P_t}{PI} = f\left(\frac{Q_{net_t}}{POP}, \frac{DY_t}{POP \cdot PI}, \frac{P^{s/c}}{PI}, \frac{P^D}{PI}, DV_1, DV_2, DV_3\right) \quad \text{where PI = price index}$$

The equations were estimated in three groups, corresponding to the groups stipulated by the data provided concerning quantities removed from the market: small and large sizes for the Bigouden region[3] and mixed sizes for the port of Lorient. The need to conduct a separate analysis of data from Lorient was disappointing, however most industry participants state that, similar to the independence of the live and iced markets and the small and large size markets, the Lorient dealers supply a different market, and prices are to a certain extent independent of those in the Bigouden region. In fact, results for the Lorient equations were inferior to those of the other ports combined, perhaps due in part to the imprecision of working with data on mixed sizes.

The demand curves were estimated using Ordinary Least Squares; results for the Bigouden region are presented in Table 2. Given some uncertainty on the part of both industry participants and researchers on the nature of substitute or complement products, several possibilities were examined. As Norway lobsters are often consumed as the first course in a main meal, products of a similar nature were suggested (pate, cold cuts, other shellfish consumed cold, etc.). However Norway lobsters may also be consumed on a platter of a variety of shellfish (also as a first course) and thus may exhibit a complementary relation with products such as sea snails, oysters, spider crabs, pink and gray shrimps; this is particularly ture for the larger size (Norway lobsters). Thus for each of the two sizes, two equations with different substitute/complement products are presented.

All four equations exhibit the expected signs on both quantity (negative) and income (positive), quantity playing a significant role in price determination. The price of diesel fuel was expected to be negatively related to the ex-vessel price; this relation expectation is supported in the case of the small sizes, but not for the large, perhaps due to a relatively strong correlation problem between the price of diesel fuel and disposable income. It is encouraging to note that the signs (and relative significance) of the seasonal dummy variables are consistent across all four equations. The negative sign of DV_1 may be indicative of a "slump" season in demand in the beginning of the calendar year, while a positive sign for DV_3 lends evidence of increased demand during the tourist season.

The price of pate exhibits a substitute relationship with the small size Norway lobsters; this result is interesting as it supports the notion that small-sized (and less expensive) Norway lobsters are more apt to be served in an averaged-priced restaurant, as is pate. In contrast, the large sized Norway lobsters demonstrate a complementary relationship with pink shrimp, perhaps evidence of both being served on a platter of shellfish. Gray shrimps exhibit a substitute relationship with Norway lobsters, with a significant coefficient in the case of the larger-sized product.

The percentage of variation in ex-vessel price which is explained by the equation ranges from 68.70% to 87.80%. There is no conclusion possible concerning autocorrelation in the four equations.

Estimating prices without interventions

For the four equations discussed above, prices were estimated using the total quantity landed instead of the net quantity. For all the periods in which product was withdrawn, estimated average monthly prices are higher with the minimum price scheme than without interventions (see Table 3). Estimated variances are higher under the withdrawal scheme. Given the negative relationship between price and quantity, these results are not surprising. Price without a limitation on quantity landed is able to fall

Table 2. Estimated Coefficients for Live Norway Lobster (By Size and Production Area).[@] (d.f. = 25)

No	Region/Size	R^2, D-W	Sub/Compl.	Q^{net}	DY	P^D	DV_1	DV_2	DV_3	$P^{S/C}$	Constant
1a)	Pays Bigouden (small)	0.687	Pate	-1.029	6.859	-0.053	-0.415	0.365	0.805	1.737	-13.523
		2.402		(-6.725)*	(0.698)	(-1.178)	(-1.153)	(0.922)	(2.075)	(0.914)	(-0.612)
1b)		0.690	Grey	-1.015	5.889	-0.026	-0.483	0.310	0.568	0.134	1.247
		2.015	Shrimp	(-6.591)	(0.593)	(-0.481)	(-1.274)	(0.781)	(1.543)	(1.031)	(0.097)
2a)	Pays Bigouden (large)	0.878	Grey	-2.223	1.318	0.144	-1.681	0.557	1.414	0.390	-7.143
		2.128	Shrimp	(-8.264)	(0.123)	(2.441)	(-4.080)	(1.132)	(3.682)	(2.786)	(-0.514)
2b)		0.846	Pink	-2.217	8.038	0.058	-1.071	0.581	1.531	-0.115	1.428
		2.328	Shrimp	(-7.317)	(0.682)	(1.036)	(-2.508)	(1.053)	(3.520)	(-0.975)	(0.092)
3a)	Lorient (mixed)	0.614	Sausage	-0.972	6.779	-0.089	0.028§	0.936§	0.297§	-0.330	14.986
		2.263		(-3.066)	(0.537)	(-1.618)	(0.074)	(2.652)	(0.814)	(-1.231)	(1.045)
3b)		0.600	Grey	-1.229	1.674	-0.010	-0.591	-0.115	0.554	0.152	4.879
		2.170	Shrimp	(-4.138)	(0.150)	(-0.170)	(-1.428)	(-0.243)	(1.331)	(1.070)	(0.343)

@ Quantity and income per capita; all prices and income deflated
* Numbers in parentheses are t-values
§ For these equations, the dummy variables are lagged by one month

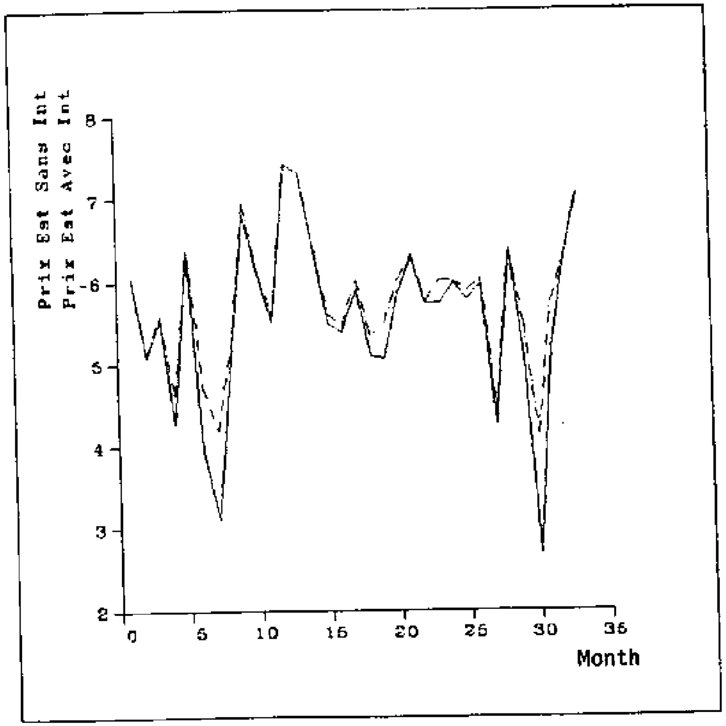
Table 3. Comparison of Estimated Price Series With ($\hat{p}$) and Without ($\hat{\hat{p}}$) Intervention.

Region/Size	$\hat{p}$, $\hat{\hat{p}}$	Average	Variance	Tendency ($P = a + bT$)		
				$\hat{a}$	$\hat{b}$	R^2
Pays Bigouden (small)	$\hat{p}$	5.788 1/	0.661	5.633	0.009	.012
	$\hat{\hat{p}}$	5.576	1.133	5.480	0.006	.003
Pays Bigouden (large)	$\hat{p}$	10.934	2.549	10.318	0.036	.048
	$\hat{\hat{p}}$	10.857	2.925	10.322	0.031	.032
Lorient (mixed)	$\hat{p}$	6.624	0.550	6.639	-0.001	-- 2/
	$\hat{\hat{p}}$	6.330	1.221	6.432	-0.006	.003

1/ To be coherent with the preceding analyses, prices have been deflated.

2/ R square is nearly zero.

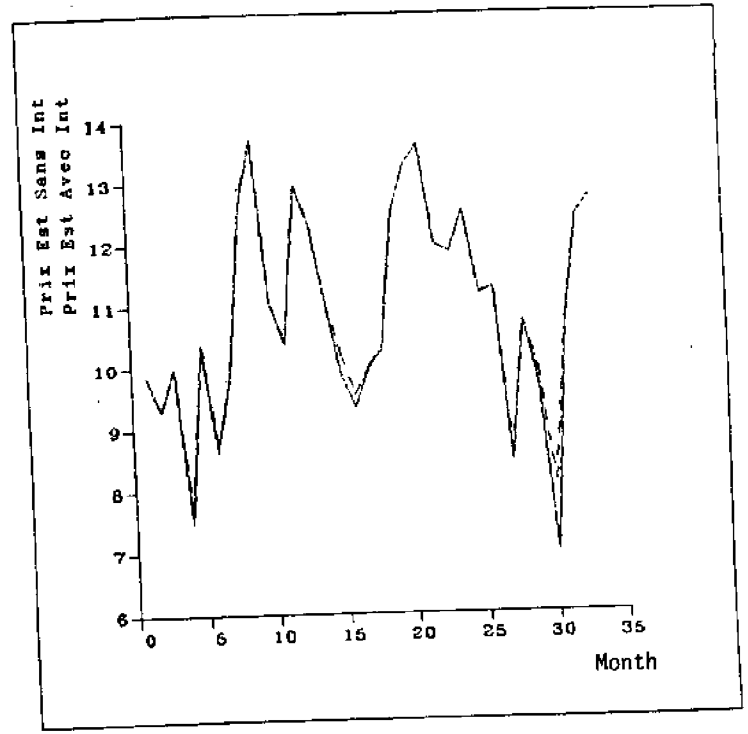
(01/1981 -12/1983)



-.- with intervention
--- without intervention

4a - Live Norway Lobster: Small Size

(01/1981 - 12/1983)



-.- with intervention
--- without intervention

Figure 4b - Live Norway Lobster: Large Size

Figure 4. Comparison Between Estimated Prices With and Without Intervention.

significantly during periods of heavy landings and/or weak demand, and thus also exhibits higher variation.

It should be noted that the restrictions imposed on the preceding analysis, primarily due to data limitations, imply that the results should be interpreted with caution. However, it is encouraging to note that the results support the theoretical hypothesis that:

1) Minimum price legislation may result in higher average prices in the long run;

2) A minimum price is only effective when landings are heavy and/or demand is weak. This conclusion is demonstrated by plotting estimated prices with and without interventions; peaks look identical while troughs are lower without withdrawals (see figure 4).

In addition, this study represents a first attempt to actually quantify these phenomena, a first step towards finer assessment of the impact of fishery market regulation.

Conclusions, Recommendations

An example of the work which would represent the continuation of this research is found in the saithe species. Indeed, an attempt was made to conduct similar analysis on saithe, however certain peculiarities of this product (as opposed to live Norway lobsters) imposed insurmountable difficulties in quantifying minimum price effects. The simplifying assumptions in the Norway lobster case, notably the independence of the fresh and frozen markets, were not possible in the saithe example. A detailed presentation of this analysis conducted for saithe is beyond the scope of this paper, however a conceptual presentation of the complexities encountered may serve as a framework for future research.

For the case of saithe, as with many so called "large scale production species," the interdependence of the fresh and frozen markets affects the impact of the minimum pricing program. If a floor price prevents a price falling, a policy of putting frozen product back on the market when prices are high may play a role of a "ceiling price." Frozen product put back on the market implies an increase in supply and thus a dampening effect on prices.

There are, at least, two possibilities:

1) Fresh and frozen products are perfect substitutes; thus when a P.O. places previously withdrawn supplies on today's market, this is equivalent to an "increase in landings," and ex-vessel price falls (see figure 5).

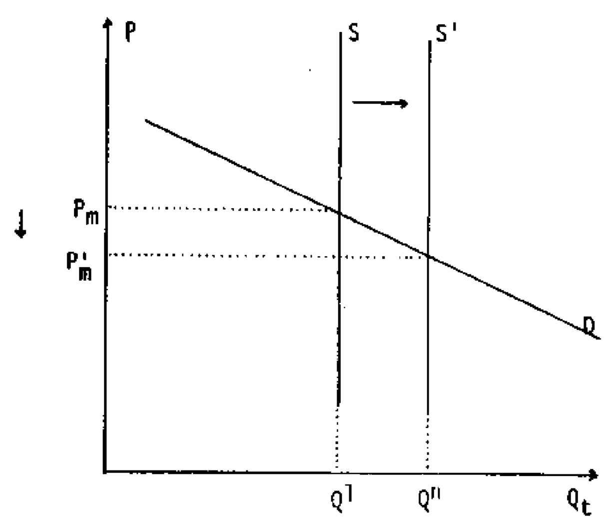


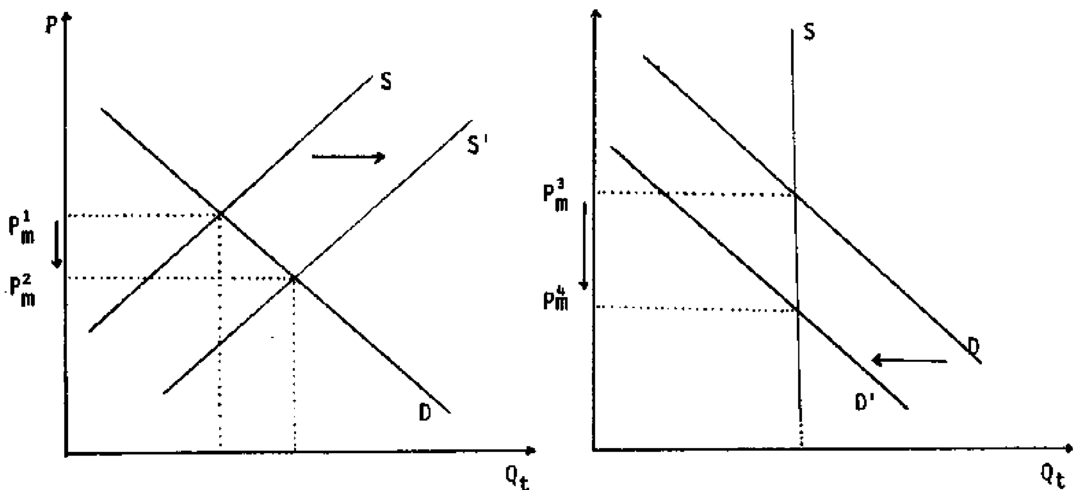
Figure 5

Note that in this case, it would be necessary to know the period in which product was placed back in the market. The "net quantity" to be used in estimating demand (hence prices) would be:[4]

$$Q_{net}(t) = Q_s(t) - Q_w(t) + Q_{replaced}(t)$$

$Q_{replaced}(t) = Q_w(t-i)$ where i is the average storage time

2) Fresh and frozen products are substitute products; in this case, product placed on the frozen market has the effect of decreasing demand for the fresh product. The net effect is similar to the first case, i.e. ex-vessel prices tend to fall, ceteris paribus (see figure 6).



6a - Frozen market   6b - Fresh market

Figure 6

Future studies of the French minimum ex-vessel price program thus will require considerably more complicated analysis. Such work, data permitting, should prove to be not only the object of important economic research, but also a useful tool in policy formation for the regulation of the French seafood market.

Footnotes

1. Central Committee for Sea Fisheries (Comite Central des Peches Maritimes).

2. National Institute for Economic Statistics and Studies (Institut National des Statistiques et Etudes Economiques).

3. The Bigouden region includes all ports previously listed, except Lorient.

4. A further complication may arise in such a case since, in fact $Q_{replaced}$ is not entirely exogenous; it is, to a certain extent, a function of current period market price.

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Fisheries and Seafood Market Development

Pondfishes, Underutilized Freshwater Fisheries and Hunger in the United States

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Synopsis

Food shortages have been predicted in the United States since the Dustbowl period of the Great Depression. For a variety of reasons it appears these shortages may occur and persist during the coming decade. Factors which contribute to the likelihood of food shortages exist in both primary food systems, agriculture and fisheries, and are compounded by diminishing non-renewable resources and increasing reliance on imports for agricultural fertilizers and food fish.

Food shortages in the United States would probably cause unstable social responses. Poor neighborhoods and racial ghettos in large cities are likely to suffer food shortages most frequently and most severely. In these areas food riots may occur, with violence transcending the boundaries of disprivileged neighborhoods.

Economically viable, environmentally sound programs can be implemented to mitigate food shortages and decrease reliance on imported agricultural fertilizers. Programs to utilize fresh water fishes, particularly Cyprinus carpio, can generate employment, food, agricultural fertilizer, and substitute domestic products for certain major imports -- particularly frozen minced fish in institutional food markets.

This paper does not discuss aquacultured species such as catfish, of which much is written elsewhere, but rather recommends exploitation of feral freshwater fish which flourish without human assistance across the length and breadth of the continental United States. Harvest equipment lies fallow in many regions where Pondfishes are abundant, and skilled fishermen are looking for work.

Contents

Section One: An overview of trends in agriculture, fisheries is surveyed in the context of transitional demographics and emerging dependencies.

Section Two: Examines the availability and commercial potential of feral Pondfishes, and sets forth the reproduction dynamics of a selected species, Cyprinus carpio, the most abundant underutilized species in American waterways. This resource is all but incomprehensible without a basic understanding of extraordinary reproduction, durability and physical range of these prolific fish.

Section Three: American Microcosm: economically devastated Harney County, Oregon, with one of the largest standing stocks of Cyprinus in the United States. This fragile wetland ecosystem is dominated by a waterfowl sanctuary, threatened by an exploding carp infestation, and presents a composite of the physical, economic and environmental challenges and benefits inherent in the harvest of Pondfishes.[1]

Section Four: Products and markets for products from Pondfishes: agricultural, industrial and institutional. This section looks also at harvest constraints. Oregon is fairly typical in terms of laws and regulations which limit or render uneconomical the commercial utilization of Pondfishes. Legislation, though generally aimed at protecting the sport fisheries and wetlands, often has the effect of allowing unlimited proliferation of the destructive carp.

Section One: The Escalating Crisis in American Food Production

Agriculture

On Tuesday, February 12, 1985 the state of South Dakota appropriated $95,000.00 to send its governor and entire legislature to Washington, D.C. to petition Congress for economic relief. Twenty-five percent of South Dakota's farmers face bankruptcy. That same week respected TIME magazine columnist Hugh Sidey noted "The U.S. is exhausting its topsoil and a few decades down the road could suffer from food shortages, not surplus." Both events are remarkable, the first because it is unprecedented, the second because it was commonplace; printed amid a myriad of indicators that have led most observers to expect food shortages for decades.[2] A grim prediction penetrated reality and the public consciousness like a thief in the night, with little to indicate awareness of harm.

In the past several weeks we have conducted a manifestly unscientific survey, inquiring of business associates, shop clerks, cab drivers and others regarding their awareness of, and belief in the prediction of impending food shortages. The result was uniform -- all knew and all believed that periodic food shortages would occur in the United States during the next decade, though none had considered how these shortages would affect their lives. It is past time to consider this problem and to look earnestly for solutions.

American farmers now owe more money than Brazil and Mexico combined; farm debt has risen from under $50 billion in 1970 to more than $190 billion. Some 20,000 American farms have been auctioned since 1981.[3] This situation arises in part from interest rates and the boom and bust of U.S. agricultural land prices between 1968 and 1983, which is exacerbated by a world-wide agricultural surplus which in 1984 made America the supplier of last resort.[4] Although 83% of the total farm debt is owed by only 29% of farmers, fully two-thirds have debts equal to 40% of their farm's value -- which means they pay out more in interest than is earned from crops. Prices, particularly in export market, are falling.[5] The transitional crisis of farm debt tends to obscure a much larger, permanent problem: fertilizer dependency.

Total Fertilizer Consumed in the United States by Nutrient Type (tons).

Fertilizer Type	1970	1980	Percent Change
Nitrogen			
Anhydrous Ammonia	3,468,363	5,483,349	58.1
Ammonium Nitrate	2,844,360	2,627,660	- 7.6
Ammonium Sulfate	781,874	870,722	11.4
Nitrogen Solutions	3,242,892	6,669,503	105.7
Urea	533,535	2,144,628	302.0
All Nitrogen	11,898,188	19,052,771	60.1
Phosphates			
Ammoniated Phosphates	644,120	657,881	2.1
Normal Superphosphate	294,979	83,587	-71.7
Triple Superphosphate	1,159,355	782,247	-32.5
All Phosphates	2,521,905	2,320,124	- 8.0
Potash			
Potassium Chloride	2,172,572	5,065,855	133.2
Potassium Sulfate	37,943	38,913	2.6
All Potash	2,140,042	5,541,608	158.9

[6]Source: An Econometric Analysis of the U.S. Fertilizer Industry.

The Fertilizer Problem

Increases in the productive capacity of the U.S. fertilizer industry outpaced domestic fertilizer demand during the 1950's and 1960's, creating a fertilizer glut which depressed prices. Rising energy and capital costs, attributable in part to the Arab Oil Embargo of 1973 and massive debt-financed development of Third World agricultural programs, caused this situation to reverse between 1971 and 1975. During the same period domestic acreage planted increased from 332.4 million acres to 356.5 million acres, and U.S. fertilizer imports increased by 32.5%. U.S. fertilizer exports increased 43%.[7]

During 1983-84 U.S. imports of plant nutrients increased 27% in volume to 9.4 million tons, and 22% in cost to roughly $1.6 billion. In the "Fertilizer Year" ended July 1, 1984 fertilizer consumption in the United States rose 21% to nearly 22,000,000 tons, and will increase another 2% during 1984-85.[8]

Ammonia

Ammonia is the most important nitrogen fertilizer used in domestic agriculture.[9] Approximately 37,600 cubic feet of natural gas is required to produce a ton of nitrogen.[10] The price of natural gas to U.S. fertilizer producers rose from $0.28 per thousand cubic feet in 1970 to $2.33 per 1000 cubic feet in 1981.[11] This trend will not improve with time. Deregulation of natural gas prices will be complete during 1985, and as the long-term natural gas contracts which stabilized price growth during the early phases of deregulation expire, successor contracts will reflect the higher rates.

Fluctuations in the price of natural gas have caused as much as 20 percent of agricultural ammonia to be imported during recent years. A shift toward import can be expected whenever domestic natural gas prices and/or currency valuations shift in favor of foreign sources. While ammonium fertilizers will become increasingly costly, it is unlikely that domestic agriculture will be without this substance; the most critical component, natural gas, is available domestically.

Potash

Potassium is a metallic element found in nature in large quantities. It ranks seventh in order of abundance among the elements in the crust of the earth, and is found with various minerals such as carnallite, feldspar, saltpeter, greensand and sylvite. Potassium is a constituent of all plant and animal tissue as well as a necessary constituent of fertile soil.[12]

At present 85% of the potash used for domestic crops is imported, primarily from Canada. U.S. production of potash declined 10% during 1984, a year which saw a 17% increase in potash imports. By the year 2000 it is expected that 90% of potash used by American farmers will be imported.

Phosphates

In its most common form, phosphorous is a white wax-like element which ignites spontaneously in air. It is non-metallic, and occurs in the same group of the periodic table as nitrogen, arsenic, antimony and bismuth. The most common phosphorous mineral is flurapatite, found in the United States, Morocco, Tunisia, Nauru and the U.S.S.R. Most of the phosphate rock mined world-wide is used to make agricultural fertilizers.[13]

World demand for phosphate fertilizers increased 14% in 1983-84, as U.S. phosphate producers extracted an additional 1.3 million tons from the ground to meet demand. Domestic consumption and expanded foreign agricultural systems divided the production increase about equally. As recently as 1980 it was thought that the U.S. had approximately 30-40 years domestic reserves of high grade phosphate in the ground. Those estimates pre-date the massive growth of agricultural systems in India, China, Mexico, Brazil, Argentina, and do not include their massive present and future demand.

Sic fugit phosphate, lynchpin of a vicious cycle that rides the winds and rain of topsoil erosion. Today phosphates are an export, boosting productivity in competitive agricultural systems, depressing prices and assisting U.S. farmers toward bankruptcy. When the U.S. dollar next drops in value against foreign currencies phosphates exports will increase as the infant agricultural behemoths of the Third World scramble for massive harvests to pay development debts. Many of the loans are from U.S. banks, which adds irony to the dilemma of the American farmer.

When domestic reserves are exhausted,[14] the United States will import phosphates. Grain export negotiations with the U.S.S.R. may assume some interesting configurations. Phosphates, indeed all fertilizers, have become a fundamental necessity in agriculture. Our emerging dependence on imports has been described as roughly analogous to U.S. dependence on foreign oil,[15] about which some hard lessons were learned in the 1970's. Like oil, these fertilizers come from non-renewable resources. Oil is essential to manufacturing and transportation. The analogy is apt, though understated in terms of socio-biological impact.

Belaboring the Obvious

Agribusiness in the United States cannot properly be called farming. That term describes careful management of resources, husbandry, a state of grace forfeit decades ago. It is time to define the use of nitrogen, phosphate, potassium, topsoil and ground water to produce crops, as "extraction;" the mining of non-renewable resources to produce food crops.

In Iowa, where a million acres of maise and soybean can be planted in a single day,[16] an estimated two bushels of topsoil per bushel of corn are lost where farming is done on sloping soil.[17] "Sometimes the progress of man is so rapid that the desert reappears behind him."[18]

> "In our area of Nebraska you see hilltops eroded -- completely naked...Yet farmers are still getting 90 to 95 bushels of corn an acre. Farmers don't believe they are losing productivity."[19]

One-third of the topsoil in prime farming states has been lost since we began tilling the soil. Rain-related erosion carries away 4 billion tons of topsoil from cropland, range, pasture and forest land; wind erosion may remove as much as 3 billion additional tons per year. Seven billion tons equals 3.5 inches of topsoil on all cropland in Pennsylvania, New York, and New Jersey -- per year.[20]

Federal price subsidies and "target" prices for domestic crops, high land, credit and production costs have converged with a strong U.S. dollar and yielded inflated prices for many U.S. commodities -- effectively pricing them out of world markets. Farmers from Brazil and Argentina to India and the European Economic Community have expanded production, secure in their ability to undersell U.S. producers.[21]

Foreign Exchange Famine

Staggering debt and interest payments diminish these nations' purchasing power, while forcing the harvests into export. In addition to threatening the marketability of American commodities exports, this combination can produce Foreign Exchange Famine, a horror lately abundant across the deserts of Ethiopia.

Foreign exchange famine exists wherever people starve in the face of bountiful harvests. In Central America and the Philippines peasants starve beside flourishing banana plantations. In the United States cereal crops fatten beef and pork. We decline to explore the policy arguments surrounding this pattern of resource allocation, but note in passing that the time for such luxuries may already have passed.

U.S. government programs to alleviate the farm crisis will be accompanied by demands for fundamental concessions in U.S. farm price support and subsidy programs.[22] Termination of federally sponsored farm subsidies and price supports will transform a half-century of economic expectations and agricultural practices. The quiet threat of agri-chemical and fertilizer dependence, lost amid a roar of bankruptcies and foreclosures, will be further muted in the din of adjustment to a new economic order. Ultimately, it will be heard -- and felt deeply.

Fisheries

The United States fishing industry produced in 1982 $4.5 billion in edible and non-edible products, employing 72,777 in fishing, processing and wholesale distribution.[23] That figure is all but insignificant when compared to the 20,000,000 involved at all levels of agriculture-related employment.

Fisheries employment, like farm labor, is the visible tip of a vast interdependent system. Families, communities, suppliers, bankers, tax collectors, boat builders, mechanics and retailers' fortunes rise and fall with the economic health of local and regional fisheries. The worst decline is in the freshwaters of the interior, where fishing, once a significant source of employment in the Midwest has declined steadily for 25 years. As transportation systems became more sophisticated, Mid-West consumers substituted seafood for local lake and river fish -- a substitution accelerated by pollution.[24] The number of processors and wholesalers in America's inland states declined from 621 in 1957, to 237 in 1982.[25] Miles of nets hang unused as inland fisheries continue to decline.[26]

Obituary by Omission

An index of the status of commercial fisheries on the Great Lakes is found in THE FISHERMAN's cover story about a sophisticated new self-propelled manned submersible research vessel. The economic value of the Great Lakes, as calculated by the Center for the Great Lakes produced the following statistics:[27]

1) Hydroelectric power which produced more than 43 billion kilowatt hours in 1983

2) Drinking water for 75% of the 35 million residents of the Great Lakes watershed

3) An annual $3 billion boost to the region's economy from international shipping

4) Water-based recreation and tourism valued at more than $8 million per year

5) A $1.5 billion income each year from sport fishing.

The compendium of benefits contained no mention of a economic activity attributable to Great Lakes Commercial Fishing.

Coastal and Maritime Fisheries

During May, 1984 after many protests, Oregon fishermen burned a fishing boat on the beach to dramatize their economic plight. The winters since 1981 have seen some twenty commercial fishermen lost in storms off the Columbia Bar; storms that wouldn't have been risked short of desperation. Boats, homes, cars have gone and families have shattered in foreclosure and bankruptcy. Auction of fish processing facilities along the Oregon coast is commonplace. There seems no end of boats for sale.

In April of 1984 a West Coast Sea Grant conference on Underutilized Species of the Columbia River System, held in Astoria, Oregon, drew participants from every segment of Oregon's maritime fishery. The abundant species, Shad and Carp, had scant market, but a Portland restaurant was reported to be purchasing crawfish of a certain quality.

The conference concluded with a slide presentation featuring gaunt children from Third World famines with huge eyes and bloated bellies. The adults had arms and legs like sticks hung limp over ribs and hollows that fairly screamed despair. The agony in that auditorium was terrible to behold. Many of the paid attendees were fishermen facing bankruptcy.

The crisis in fisheries is most dramatically illustrated in equipment, new and used, for sale. Miles on miles of nets hang unused. Tuna seiners which cost $9,000,000 to construct cannot be sold for half the price. Coastal banks own vast fleets which cannot put to sea.[28] Labor costs caused major packers to terminate operations on the West Coast and relocate in developing nations, processing equipment is auctioned at rock-bottom. Eighty-five percent of the classified advertisements in the January, 1985 issue of THE FISHERMAN, offered boats and nets for sale; none sought boats to buy.

Unemployment and bankruptcies in American fisheries occur in wry juxtaposition with rising domestic fish consumption, increasingly imported.[29] "Our sales have increased about 20% every year over the past four years," says Bill Demond, Vice President-Purchasing, Insland Seafood Corporation, Atlanta. A Des Moines restaurant reports 75% of dinners served are seafood, and receives three air freight shipments of fish a week, totaling 400-500 pounds.[30]

Foreign competition, frequently subsidized, is chipping away at U.S. and international fisheries prices. Aquacultured Salmon from Scandinavia and Scotland flourishes as U.S. states and Canadian provinces compete for anadromous salmonids decimated by hydroelectric dams, logging roads, and other forms of development. Attempts to replenish Salmon through state and private fish hatcheries on the Columbia are reported as "The Dream That Got Away."[31] Private hatcheries, sport, commercial and Native American Treaty fishermen battle in legislature and court over the returning fish. Cynics might describe this situation as an amendment to the Lawyers and Judges Full Employment Act.

The dams which electrified the Northwest and eliminated floods along the Columbia-Snake River System, also halted the ancient cyclic innundation of tidal fisheries.[32] Chemical runoff, fertilizers and biocides from 279,000 square miles[33] of intensive agriculture washes across estuaries and tidal basins.[34] There is nothing to indicate a spontaneous renewal of the once-bountiful and profitable inshore fisheries of the Pacific Northwest; the predominate characteristic is steady decline.

Absent a fundamental shift in the structure of this nation's food production, America will have more, not fewer, homeless and unemployed; these will be fishermen and farmers, processors, packers, builders of boats, tractors, and harvest technologies.

To what occupation does one retrain a middle-aged farmer, fisherman or cannery worker with an eighth grade to high school education? Who pays for training? What businesses will arise to replace industries lost? Whence capital? Where will those who lost farms, boats, homes and equipment live? On what?

Hunger in Abundance

The irony of America's abundance is hunger. Across the nation school lunch programs, meals on wheels and senior center food programs, soup kitchens, food stamps, prenatal nutrition programs, and surplus cheese distribution programs provide essential nutrition to Americans who, even in good times, cannot afford food.

Early in the administration of President Ronald Reagan an outcry erupted over the suggestion that catsup be listed as the "vegetable" in Federally-financed school lunch programs for economically disadvantaged children. The catsup controversy was symptomatic of broad-spectrum efforts to control non-military government spending.

A microcosm of food shortage can easily be studied in the United States, even in the much-favored city of Portland, Oregon, a busy port at the confluence of the Columbia and Willamette rivers in northwest Oregon. In addition to abundant water and fisheries resources, Portland lies at the northern end of the rich Willamette Valley where topsoil sometimes runs 40 feet deep. Portland is not the sort of place one expects to find hunger and people dying on public streets. Roughly two million people inhabit Portland's bi-state metropolitan area, which has a mild and moist marine climate.[35] The Oregonian newspaper of February 12, 1985 reports 2,000 men, women and children homeless. Leo M. Crider, 59, was the third person known to have frozen to death on the streets of Portland in the winter of 1985.[36]

Approximately 2.2 million people live on the streets of urban America. Estimates run as high as 50,000 in New York City, where court-ordered round-ups collect human detritus in police paddywagons. Homeless Americans in Portland and elsewhere sleep in flop-houses, public shelters, doorways, under bridges and elevated freeways, in abandoned cars -- wherever. Which is why, even in Portland's fairly mild winter climate, people freeze in the night.

In 1984, U.S. Attorney General Edwin Meese created a storm of controversy by suggesting that people eat in breadlines for reasons unrelated to dire necessity or basic survival. In fairness it should be noted that Mr. Meese may have observed a deceptive phenomenon. Many breadline standees actually do appear well fed, even fat, particularly in winter when lines are long and cold. Their bulk comes from layer on layer of filthy, salvaged garments and grimy bedrolls worn to blunt winter's bitter wind. Some few are fat, bloat bilious from starchy diets; the obesity of malnutrition.

The visible homeless are mostly male. They are the alcoholic, the deformed, and the mentally ill. They are three generations of combat fatigue from foreign wars. They are also battered wives, displaced homemakers, children. In Portland a particularly wretched shelter, the West Women's Hotel, echos sorrow that makes despair seem a state of grace. From time to time newborn infants are brought "home" to this castle of gloom.

Many of these vagrants once were mill and factory workers with homes and families. Progress has left them "structurally unemployed," with little regard for merit or thrift. Native and imported Americans, the Red men and the Black, share cheap wine to forget what they never found. They are joined by immigrants, legal and otherwise, who are likewise "unassimilated." For various reasons, each of these individuals has flunked free enterprise. Some, just down on their luck, will make the transition back. Many will not. These are the people who can teach us what it is like to live without things we take for granted -- things like food.

Poverty Plunge

These human casualties insult our senses and we resist them, fearing perhaps that their fate is contagious. They pass out on public sidewalks and we swerve from the sweat-alcohol-urine stench. The bus station, mecca for poor travelers, is relocated to Skid Row. A service group cruises the area in cage-protected vans to pick up the unconscious and the violent to remove them promptly from the public's street and view. It offers a weekend "Poverty Plunge," elective penury for the socially inquisitive. Few accept, so few learn that it is possible for perfectly decent hardworking people to end up in an alleyway, grateful for the company and protection of a stray dog, even if it means another mouth to feed.

Portland's homeless illustrate a best-case response to the problem of food shortages: passive deterioration. There are no food riots on Portland's Skid Row. We measure their hardships and privations, in part by the attendant mortality; but the tape must be recalibrated if it is to comprehend the reaction of more ordinary people to a life suddenly bereft of food. What will Americans do if the supermarkets run out of food for a week? What if it happened twice? Or for a month? As we contemplate the possibility of periodic food shortage these questions loom large. Food shortage probably includes price increases. It is time to consider these matters in some detail.

Economists Threatened

Nutrition dependents, "Breadeaters," are people whose daily caloric intake is purchased, contributed, or otherwise provided by Breadwinners. Homemakers, children and household pets are Breadeaters, as are military personnel, prison inmates, college students and millions of others in various parts of the "knowledge" economy -- many of us produce services and intangibles and exchange these for food and lodging. Some very upstanding individuals will become unemployed "Breadeaters" if food prices alter the basic parameters of social economics. Dancing masters, housekeepers, artists, musicians, economists and chauffeurs would be among the first to go. Police patrols, fire fighters and public school teachers would go, although their bureaucracies and administrators would doubtless remain intact. If the situation gets sufficiently out of hand many will lose their homes.

Breadwinner is a temporary status enjoyed by those who earn. It can be interrupted or terminated by injury, illness, progress, foreign exchange rates, social preferences, even legislation. At best Breadwinner status is bracketed by youth and retirement. While it is by no means certain that domestic phosphate reserves will nourish American agriculture for an additional 30-40 years, it is abundantly clear that ten million Breadwinners will retire during that interval -- and most will live longer.

Post-War Baby Boomers are pushing forty. Hallmark Cards is selling "Over the Hill" birthday party supplies, the "Very Best" in matching paper cups, plates, napkins and tablecloths to celebrate the aging of the Pepsi Generation. In 25 years, when this group begins to retire, 25% of the American population will already consist of retirees. Twenty-seven million Americans are already aged 65 and over. By the year 2000 almost 35 million elderly will depend on pensions, investments and social security. But for sex discrimination, the elderly as a group would dominate structural poverty and comprise the single largest nutrition-dependent population in America. As it is, women threaten to achieve that distinction. As individuals, retirees and heads of households with dependent children, women face a circumstance described frequently as the "Feminization of Poverty."[37]

The economic plight of American women transcends racial and generational categories. Increasingly it threatens children of both sexes and all races. America has moved beyond the school lunch Catsup Controversy. On April 11, 1985 CBS Evening News films showed school-aged children in breadlines of major cities in the United States. The reported cause: redefinition of eligibility guidelines for federally subsidized school lunch programs. Hungry children were seeking food among the homeless because their families were deemed "too affluent" for subsidized school lunch.

One can argue that these juvenile harbingers of hunger are anomolous. Certainly few children turn up in Portland breadlines (most are in the West Women's Hotel, out of sight) but that misses the point: It is highly likely that the price of personal and contributed food will become burdensome to the average American. Our food production systems exist largely on mythology. Their economic and natural resource base is eroded.

> "All over the mid-west, signs proudly proclaim that 'one farmer feeds 75 people.' The sign is a myth. Farmers do not live in a self-sufficient world...They buy tractors and seeds from farm supply companies. What they sell, and how much they sell it for, is determined by how much other countries produce. Above all, they depend on other people's money to keep themselves in business...one farmer plus one banker plus one tractor-maker plus one fertilizer chemist feed 75 people."[38]

American agriculture remains the richest and most efficient in the world, and until recently produced abundance to feed the world. Agronomists now work feverishly on new agricultural products and technologies to maintain profitability in changed circumstances. One "modern innovation" is to stop ploughing the land, an ironic back-to-nature movement at the cutting edge of science.[39]

Beyond the fertilizer problem lies a food system amazingly fragile and interdependent. Who could have guessed, for example, that in 1972 schools of anchovies normally abundant off the Peruvian coast, would suddenly disappear. These fish supplied millions of tons of high-grade protein for meat-raisers, and were a major component of America's "indirect" diet. They fattened the beef. The sudden reduction of livestock protein supplements was reflected in domestic soybean prices, which rose from $3.35 to $12.00 per bushel during the next eight months. The price of wheat rose from $1.73 per bushel in September 1972 to $2.06 in March 1973, and to $4.78 later that year. Bread went from 27 cents per loaf to 60 cents per loaf.[40]

The anchovie phenomenon preceded and was smothered by the 1973 Arab Oil Embargo, which escalated fuel costs and sent food prices and interest rates soaring. The fisheries component should not be overlooked -- it was part of the meat price escalation which followed. The combination of fuel and fisheries shortages in 1973 impacted prices throughout the economy. The 1979 Oil Embargo brought double digit inflation and a world-wide recession which persists under the label "Third World Debt."

Food Riots

Food shortages are likely to be most frequent and disruptive in large cities, especially in racial ghettos. These communities experience food availability, price and quality problems in good times. There is no reason to expect food supplies in these areas to improve during periods of shortage.[41]

Social response to food shortages in impoverished urban and ghetto communities may resemble the Urban Ghetto Riots which struck 58 American cities between 1965-68, killing 141 and recorded injuries to 5,441. Because of the high anxiety component of food shortage (as opposed to housing, gasoline or heating oil shortages), it is not unreasonable to expect food seeking activities and social reaction to spread beyond the borders of the ghettos.

Racial ghettos in the United States are frequently bordered by transitional (buffer) communities comprised of the poor and working poor of many races. The relatively low rents of ghetto and buffer communities attract multi-child and single-parent families who cannot afford suburbia. The elderly are a significant population in ghettos and buffers because their residency often pre-dates the "deterioration" of the neighborhood. This residential pattern is ominous. Disproportionate numbers of helpless and vulnerable individuals live in or near areas with the greatest potential for civil disorder and violence.

The most recent shortage events in the United States occurred after the Ghetto Riot era, caused by the Arab Oil Embargos of 1973 and 1979. The first embargo was greeted with a kind of stunned acceptance; viewed perhaps as a transitory aberration. Lethal violence did not erupt until the second embargo.

In the second Gas Crunch two men were murdered in separate incidents on New York City gas lines within ten days; one shot, the other stabbed to death.[42] In Ohio, 25 shooting incidents involving truckers and motorists occurred within a single week. These incidents, though fragmentary, suggest that social response to food shortages is potentially explosive, and that violence associated with food shortages may escalate with repetition; a species of social panic setting in when the previously unthinkable recurs.[43]

In estimating the social risk of food shortages from historical data such as the Gas Crisis it is important to distinguish between the degree of anxiety and the shortage duration. The shortages of 1973 and 1979 were artificial products of political tension, commenced and concluded with the stroke of a pen -- mere memory a month later. Structural shortages cannot be resolved with ink. There is a certain inexorability to the Farmer's Almanac.

It is time to re-examine our policies and resources, starting with the wealth of inland waters. These are used presently for electrical generation, recreation, residential and industrial toilets, and highways, but could produce substantial direct and indirect food. Much as we cast a blind eye on the homeless and ignore ominous trends in import dependencies, we ignore abundant resources; especially the freshwater fisheries.

No nation on earth is so blessed with inland fisheries resources. Most of the world's nations would trade their whole treasure for a river like the Mississippi or the Columbia. For perspective consider the Danube, enshrined in splendid waltz; the Illinois at Peoria is larger, but lacks a song. We hardly notice that river unless it invades the basements of local citizens during spring floods.

Smaller than the Danube, the historic River Jordan, would be lost among the Mississippi's 54 steamboat-navigable subordinate rivers, and rate scant notice among the Columbia's secondary tributaries.[44] The Jordan, scene of two thousand years of bloody conflict, is about the size of the Clackamas River just south of Portland, Oregon. Most nations in history would have eagerly gone to war to obtain the wealth of the Columbia or Willamette Rivers. Portland celebrates these as avenues of trade and recreation. The Chamber of Commerce found the idea of a commercial fishery quite novel. The near-by Clackamas, save for sport fishing and a handful of drownings each summer, is largely ignored, It would be hard to locate on a map of the United States.

Environmental Considerations

As fertilizer dependency and rising prices converge with the inexorable march of demographics and topsoil erosion it is appropriate to re-examine these resources. It is not simply a matter of hunger. Some agri-chemicals are quite hazardous, as demonstrated at Bhopal,[45] where the pesticide methyl isocyanate leaked, leaving 2,000 dead and an estimated 200,000 injured. Two months after that disaster an average of five people per week were reported dying from aftereffects.[46] Unreported leaks at Union Carbide's Institute, West Virginia plant, manufacturing the same deadly substance, have been belatedly revealed. Union Carbide has no monopoly on lethal agri-chemicals. And exotic bio-cides are not the only hazard. A common agricultural fertilizer routinely transported on public roads, can produce greater devastation than Bhopal in a single instant.

On August 7, 1959 a tanker truck carrying 4 tons of ammonium nitrate fertilizer, and 2 tons of other explosives, was ignited by a trash fire which burned an adjacent warehouse. The fertilizer blast touched off a series of explosions and fires in rapid succession. The center of Roseburg, Oregon was leveled for eight blocks by the blast, which created a disaster zone covering 30 city blocks. The crater was 15 feet deep. Eighteen people were killed, 350 businesses closed, 178 homes damaged. Hospitals, apartment buildings and schools sustained structural damage. The only identifiable part of the truck, a badly twisted rear axle, was found a quarter-mile away. The blast occurred at 1:30 a.m. During business hours it would have killed hundreds; in a larger city, thousands. American farmers used 11,200,000 tons of nitrogen fertilizers in 1984.[47]

Stable organic fertilizers manufactured from Pondfish (and a number of other underutilized organic wastes including treated sewage sludge and livestock waste)[48] are capable of nourishing many domestically cultivated crops. As the following sections will demonstrate, there is more than sufficient Pondfish biomass, often most plentiful in agricultural regions -- each depends on water.

Section Two: Biodynamics of Carp, Surplus for Export?

Among the Pondfishes the Carp stands as the Queen of the Waters, with all the characteristics of its cousins writ large: more fecund, bigger, more vigorous, more adaptable, more destructive, more mobile and more useful than the balance combined. For this reason Carp is the prototypical Pondfish, focus of this inquiry.

Cyprinus carpio, known to most of us as Carp, is not native to the Western Hemisphere. The species is thought to have originated in Central Asia, possibly the waters of the Tigris and Euphrates; Syria, Iraq and Iran. Because these fish are enormously durable, they were transported throughout Asia, Europe and Africa for centuries. The Latin scientific name refers to the Island of Cyprus, from which Carp were brought to Europe.

Carp were first introduced in the United States during the American Revolution as food for Hessian mercenaries. These professional soldiers, though willing to kill and perhaps to die for money, required fresh Carp.

Congress subsequently authorized the importation of Carp to the United States for distribution as an abundant protein resource for a growing nation. Live Carp were transported on wagons and by rail throughout the United States, and purposely introduced in ponds and lakes across the nation. Occasionally they were accidentally dumped, as with a train wreck which released an entire box-car load into the Mississippi River system in the mid-nineteenth century.

Through interconnected waterways and by flood Carp migrated throughout the Mississippi and Missouri River systems and into the Great Lakes. Natives of the Midwest frequently state that the Carp are thick enough to walk across in places, and in Garfield, Minnesota during July of 1984 we observed that that was almost literally true, and a stunning sight. Accurate estimates of the standing biomass are virtually impossible to obtain. Oregon, which produces some of the nation's premier food Carp, has no official statistics on stock or migration patterns.

North Dakota Game and Fish Department reported that 5-6 million pounds per year of Carp could be taken from North Dakota alone. In Wisconsin 1,200,672 pounds were harvested by a single three-person crew in 63 days of fishing five rivers[49] and Wisconsin reports 4,458,608 pounds of Pondfish in 1982, 2,500,401 were Carp.[50]

Arkansas fishermen harvested 4,444,330 pounds of Pondfishes in the 1982/83 season. Carp, which fetch only 5¢ per pound, accounted for 288,777 pounds ($14,438 value). Tommie Crawford, who evaluated commercial fisheries in Arkansas, estimates a sustained yield of 5-6 million pounds per year from Carp alone if markets existed.[51]

Tennessee produced similar ballpark estimates upon inquiry in 1984, but cautioned that huge areas of the state are too polluted to harvest. Mercury and radioactive chemical contaminants have rendered water for five counties bordering the Oak Ridge Reservation hazardous and/or unfit for consumption, fishing and recreation. Most states, including Oregon and Tennesses lack reliable estimates of Carp, even when other Pondfishes are surveyed. Almost all states know exactly how much money was spent on poisons and "trash fish" removal programs, and approximately the number of tons extracted each cycle from various sport fishing lakes. They generally know the intervals at which poisoning must be repeated to control Pondfish infestation.

Without systematic human harvest most Pondfishes will proliferate to the limits of the aquatic environment and its food web. Carp have no effective natural predators in the waters of the United States. Rumors that they can be "exterminated" are greatly exaggerated, as any game manager will attest.

It is impossible to comprehend the Pondfish resource without understanding reproductive dynamics. These fish are beyond prolific, as their history in the Columbia River demonstrates.

Five Carp at Troutdale

Carp did not reach the Pacific Northwest until 1880, when five Carp were brought from California and placed in a pond near the Columbia River at Troutdale, Oregon.[52] Settlers had tired of the then-abundant salmonids, Trout, Steelhead, and Salmon, and there was a market for Pondfishes. Carp were thought to be the best investment, possibly worth $5.00 each after two years growth. The five adults produced approximately 7,000 fry in their first spawning. These were left with the adults in the pond to winter over, fattening like hogs.

The following spring the Columbia River flooded to the margin of the pond and some 3,000 juvenile Carp escaped. A decade later the Oregonian newspaper carried advertisements for Carp as fertilizer -- at $5.00 a TON. In the century which has passed these fish have proliferated unbelievably.

In Oregon and elsewhere attention to Pondfish, especially Carp, is normally delivered in the form of Rotenone, a substance which kills fish by causing their gills to become congested. Commonly a lake will be poisoned with Rotenone, cleared of debris, and restocked with game fish some years later when the environment has recovered. This "solution," though expensive and repulsive (it produces a lake full of rotting fish and dramatic proliferation of aquatic vegetation) provides approximately 3 years of partial relief from Cyprinus infestation.

Draining lakes to exterminate Pondfish and aquatic vegetation is another common practice. It is not 100% effective because Carp survive lengthy periods in mud, and are able to utilize atmospheric oxygen.[53] Carp are the last to die, the most likely to escape and survive; 100% wouldn't work if it could be achieved. Migration, floods, or accidental re-introduction (by birds, animals, people) will ultimately occur if the fish are in the region. One fish can lurk for decades, growing bigger and more potentially prolific while waiting for a mate. A single successful spawning from one pair of Cyprinus will re-establish the population.

Reproductive Dynamics

It is no accident that ancient Chinese medicine prescribed Carp for all manner of infertility and sexual disorders. These fish are beyond fecund. A five-pound female produces approximately 500,000 eggs. A twenty-pound female produces about 2,000,000 eggs; about half spawn.[54] Twenty pound Carp are not unusual.

As early as 1929 studies conducted by New York authorities confirmed rapid growth and survival, even in areas with exceptionally cold winters.[55] Fry and fingerling survive at high rates because of rapid growth (one inch by 18 days), and especially in agricultural regions, dense shelter provided by nitrate-enhanced aquatic vegetation. The young do not emerge from marginal grasses until approximately 4 inches in length -- too big to be eaten by most competitors.

Growth rates determined by temperature, length of summer season and food supply. The fish flourish in warm, eutrophic waters.[56] Six inches is an easy first season's growth across the United States.

Three-year Cyprinus recovery cycle is assisted by differentials in sexual maturity: males become sexually mature at two years of age. Females mature at age three. This biological quirk insures a perpetual surplus of males to fertilize the millions of eggs produced by females. It is not uncommon for a single female to lay five quarts of eggs at a time -- 2,000,000 or more. To insure complete fertilization she should be attended by 6-10 males.[57]

Carp in the wild live an average of 13 years, but can live for fifty years and more. One Japanese Koi (Cyprinus carpio) selectively bred over centuries to obtain vivid color) is reported in Japanese Koi literature to have lived 200 years. "Hanako" was passed from generation to generation within the same family for two centuries. It is not uncommon, even among Koi fanciers in the United States, for exceptional specimens to pass by Will. Nor is it particularly uncommon for people to pay $10,000-$100,000 for a single fish or a breeding pair. But it is astonishing.

The largest carp on record, caught in South Africa, weighed 82 pounds. The North American record is 59.5 pounds, and one is reported unofficially from Oregon waters at 63 pounds in 1984. Females in these size ranges produce 4,000,000 to 8,000,000 eggs per season.[58] In waterways throughout the United States, from balmy Florida to frigid Wisconsin, Carp flourish unto billions.

Carp migrate through ponds, rivers, streams; into agricultural drainage ditches and livestock watering holes. A 4-mile gridlock of migrating Carp was observed and photographed by this writer on a small stream near Garfield, Minnesota in July, 1984. The fish were attempting to enter a 10-acre lake where a barrier had been erected. Half-submerged in the shallow water, they had spent two full days jammed so close they could be netted at will. Maynard Olson, veteran "carpologist," dipped them out two at a time with a circular 18 inch net on a five-foot pole. He could have continued for hours -- the fish had no room to escape. He estimated their age at two to three years. The fish were all over 18 inches long and weighed 5-6 pounds each.

It is a measure of abundance that the fishermen who discovered the gridlock stopped tracking it after 4 miles. It was unabated, but the men had more important things to do. It is doubtful that the fish would have received a second look except that a curious lawyer wanted to photograph and confirm the tale. One doubts anyone returned to see what became of the fish. The barrier worked, that was what mattered. The marginal lake, so shallow that it froze solid each winter, would have no Carp in a year or two -- maybe.

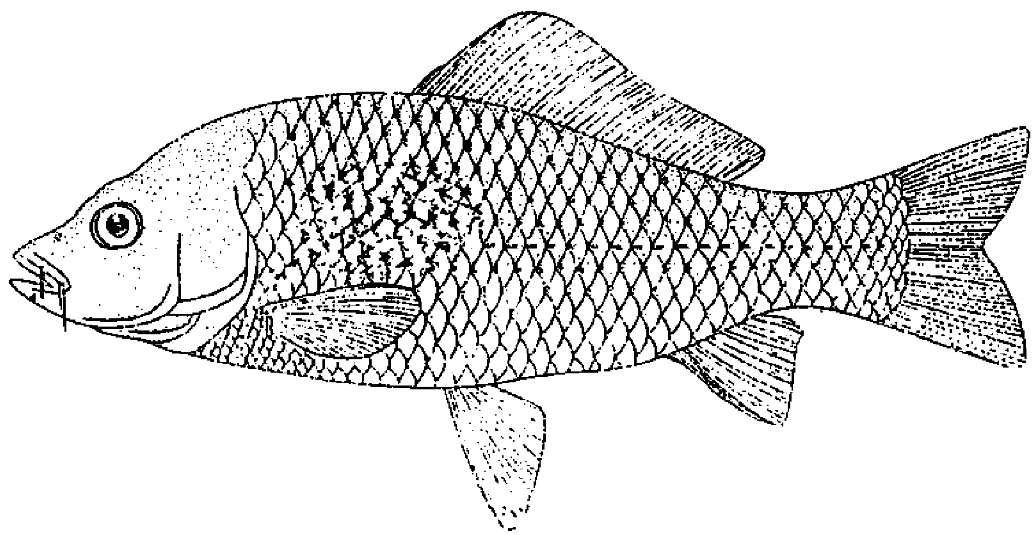
Migration and Range. A carp tagged in Missouri in 1955 was recaptured 28 months later in South Dakota having traveled at least 674 miles. Some transport of fertilized Cyprinus eggs is attributed to migratory waterfowl. The sticky eggs can adhere to feathers and occasionally survive as the birds fly from place to place during spring and summer spawning seasons. Carp destroy sago pond weed, an important element in the ecosystems of waterfowl nesting areas. Carp flourish in warm, vegetation congested water. Twenty-four hours at 98°F is the upper tolerance for heat. Carp become inactive at 37°F, have been known to survive freezing, and winter-over quite well in cold climates.

Largest Underutilized Protein Biomass in the United States of America

Pondfishes are the largest underutilized edible biomass in the United States. They are an expensive environmental nuisance and a valuable, viable resource for local employment and regional production of high quality agricultural fertilizer and food products.

Impact on Sport and Commercial Species

In sterile or clear waters with mature populations of sight-feeding species such as Trout and Walleye, Carp infestation is controlled to a limited degree by predation -- the little ones get eaten. In vegetative environments, however, Cyprinus compete effectively with game fish. Over time the balance will normally shift in favor of the Carp because they tend to deteriorate water clarity. Striped Bass, Roccus saxatilus, Largemouth Bass, Micropterus salmonides, and catfish of various sorts are species which provide limited controls on population growth through predation. Fisheries biologist Vern Hacker states that in managing Wisconsin lakes it has been found that turbidity is the critical factor in the balance between Cyprinus infestation and game fish predation. As the water clarity deteriorates carp proliferate and drive game fish out.[59] Agricultural fertilizers enhance aquatic vegetation and virtually seal the fate of adjacent sport fisheries. Without systematic commercial harvest, Carp proliferate to the limit of the aquatic ecosystem -- then migrate when their numbers become too great.



Cockroaches of the Water

Pondfishes, especially Carp, are the ultimate aquatic survivors. Even without the spectre of food shortages it would be economically and environmentally necessary to design programs to harvest and use this resource, as the damage they inflict in recreational waters and wetlands is costly and all but impossible to restore.

Section Three: Harney County, Oregon

Ecological Economic Development

Harney County, Oregon provides a unique laboratory illustration of environmental problems and economic development potential of Pondfish utilization.

Harney County is a 10,000 square mile swath of the "Old Wild West" in transition, a classic sagebrush desert bordered by mountains, reverting to an ancient inland sea. If each human resident of Harney County were given an entire square mile of land, 2,750 square miles of Harney County would remain uninhabited; there are more cattle than people.

Severe climate extremes make Harney County one of the coldest areas in the United States in winter; one of the hottest in summer. Timber and ranching, the primary economic activities, are in decline. Twenty-eight ranches, two schools, several roads and the region's only railway for timber shipment are under water -- the Harney County Basin has been reclaimed by a prehistoric inland sea.

Several years of exceptionally heavy snow fall and uncharacteristic cool summers between 1979-84 caused the problem. Malheur, Harney and Mud Lakes caught and evaporated each years' spring run-off in a pattern pre-dating Indian legend. These lakes have merged into a single body of water over 30 miles long covering 200,000 square acres.

The vast impoundment may now be creating its own weather, generating additional precipitation. The lake gained one full inch of depth during six weeks in September-October 1984; sufficient by itself to make a 5,000 acre lake 24 feet deep. Flooding, according to County Judge Dale White, caused $36,000,000.00 damage during 1984.

At sunset a century of development is mirrored against the mountains; homes, barns, fences and old frontier corrals reflect on the water. State Highway 205, built up like a jetty at a cost of over $3,000,000.00, vanishes into the still water. Wild horses stranded on high ground graze amid herons, geese, egrets and ducks.

Within the rising waters lies the Malheur Wildlife Refuge, jewel of the U.S. Fish and Wildlife Service. Carp were first observed in numbers there in 1945. Many attempts have been made to eliminate them with Rotenone. None succeeded. The rise and fall of waterfowl production in the refuge tracks the three-year recovery cycle of *Cyprinus carpio* with dramatic precision.

Carp flourish in newly impounded waters. Detritus, freshly inundated vegetation and organic debris, are rich nutritional resources for these scavengers. Flooding of flat range has produced hundreds of square miles of shallow water, the favored breeding and summer habitat of Carp, which are reproducing at exceptionally high levels. Even drainage canals on dry land have dense Carp populations. The 1984 Harney County "Carp Derby," a wry tribute to disaster, produced a father-son team that won the "Weekend Harvest" event. In two days' fishing 830 Carp were caught. They weighed almost 7,000 pounds.

Spring 1985 run-off will contribute as much as a million acre feet of water. Spawning will produce billions of fry as juveniles from 1981-1983 expansion-enhanced spawnings join 30 years of parent stock. By October, when the margins begin to freeze, surviving young-of-the-year will be 5-8 inches long. Next spring yet another year-class of each sex will mature and there will be billions more.

Harney County is a micro/macrocosm of America's Pondfish resource: both problem and potential. Like the lakes and streams of the Mississippi Delta, most of the bottom is filled with submerged objects which snag and destroy nets and lines. The deep, clear bottom where purse seining could yield 10,000 pounds of fish per haul is within the Malheur Wildlife Refuge. Carp do serious damage, but boat motors and human activity destroy the tranquility required for nesting and breeding. There is no "lesser" among these evils. The Refuge waters can only be fished during waterfowl non-breeding months, and then only with care.

Bifurcated Fishery

What emerges is a bifurcated fishery creating maximum economic impact in a manner synchronized to waterfowl nesting seasons and the requirement of a steady supply for manufacturing.

During non-nesting winter months, when Carp and other fishes take refuge in the deepest waters, commercial fishing with power boats and large nets can occur if carefully conducted in cooperation with refuge policies. This fishery would probably employ one or two crews, only 6-8 people, and produce greater volume per unit of effort, as compared to artisanal fisheries. Factory administrative, marketing and production personnel would remain employed throughout the year.

In spring and summer an artisanal fishery using non-motor vessels, traps, and set nets of various types, can take place on non-Refuge waters at the margins of the lake. This could employ as many as 60 people in harvest. The artisanal fishery could provide modest incomes for large numbers of casual fishermen, including former range hands, loggers, Native Americans and elderly retirees.

There are no demographic barriers to this employment; the factory requires fish. The price is not high, but 7,000 pounds at 8¢ a pound is a good weekend's work. At that rate the Carp Derby father-and-son team would have earned $560 for their efforts. Such a fishery would necessarily posit a price differential between week-day and weekend rates in order to encourage steady volume.

Trapping and Drainage

Harvest in Harney County may be facilitated by the existence of an alarming hazard. The 1984 lake surface, 4,102.42 feet above sea level, is rising with every rain and snow toward the first natural drainage outlet at 4,112 feet. A devastating flash flood, similar to the collapse of a major dam, could occur if the water reaches, breaches and surges downstream.

"The people in Vale and Ontario (Oregon, down land from the drainage outlet at 4,112 feet) are no longer going to be worrying about the parts-per-million, the undissolved solids in that water, the salinity and the boron or anything else...They're going to want life preservers. Somebody is going to have to do something. For God's sake, do something."[59]

A drainage canal, estimated at $18-20 million, must be constructed to prevent this catastrophy. Canal trapping data from Minnesota demonstrates that such a canal provides multiple benefits. Flash flood prevention, refuge ecology, and economic development objectives can be advanced simultaneously if the canal is designed to include trapping access. Economic activity from food and agricultural products from the fishery will help offset the high cost of disaster prevention over time.

In Minnesota, canal-type traps yield an average 63,000 pounds of Carp and assorted Pondfish per day during migration. The record harvest from a single Minnesota canal trap is 183,000 pounds in one day. That trap, observed by the author, is a 25 yard canal segment, some 20 feet wide at the inlet of a 35 acre lake. In summer, 1984 that small trap filled as quickly as it was seined, from dawn to dusk as a crew of six toiled. Most of these fish were buried -- the fishermen couldn't even give them away.[60] In Minnesota a single coordinated fishing effort landed 1,000,000 pounds of Carp from beneath the solid ice in the depth of winter. These fish can be caught year-round. The technology for ice harvest is quite adequate to the deeper parts of Harney Lake.

Every day of every summer thousands of pounds of usable Pondfish are removed from sport, recreational, conservation and agricultural waters. It gets expensive. In central Minnesota Backhoe operators charge $50.00 per hole to bury Carp. Those not hauled away by hog farmers or buried in $50.00 holes are left to rot. The ones that get away simply proliferate.

In California's San Luis Obispo County a Rotenone program costing $2,000,000 is proposed by state officials in order to remove unwanted Pondfish from 200,000 acres of flooded farm land and the adjacent surface water systems. If released into the Sacramento Delta these fish would do major damage to salmonids of commercial and recreational value. If the Rotenone project is implemented it will be one of the largest and most wasteful in history.

A daily average of fifteen to twenty thousand pounds per day are needed to economically operate a factory producing approximately 100,000 gallons of concentrated agricultural fertilizer per month. A plant processing 15,000 pounds of fish per 8-hour day would require 8-10 manufacturing and administrative personnel, and fishermen in numbers appropriate to the harvest season. When harvest is abundant, as it frequently is during spring and summer, a second shift could be added. Food production could add 30 more to the payroll. Sales representatives and government procurement contract specialists would be required to develop commercial and institutional markets.

Section Four: Product Forms, Direct and Indirect Food

Fertilizer

Experimental production of Pondfish agricultural fertilizer in Minnesota from 1973-1983 demonstrated that once farmers had tried the product they purchased more because of excellent growth results. Unfortunately the manufacturer lacked the working capital necessary to support field sales and advertising. Field research from carefully supervised controlled studies were not performed under scientifically controlled conditions.

Anecdotal evidence, the testimonials of farmer-users, provide an indication of the performance of Pondfish fertilizer when used in conjunction with pre-treatment of seeds and/or foiliar feeding of growing plants with irrigation, tanker, or airborne spray programs. The following table represents testimonials received by Pondfish fertilizer manufacturer Maynard Olson of Garfield, Minnesota. The "Control" column represents the fertilizer commonly employed by these individuals on their crops. No single (or identified) fertilizer is involved. The farmers presumably compared the Pondfish/seaweed fertilizer with the product they normally used. We emphasize that these data are anonymous farmer testimonials, not scientifically validated.

Location	Crop	Application Method/Acre	Control	Fish/ Seaweed	Difference Bushel/Acre
Gibbon, MN	Corn	1 qt/acre sprayed before tasseling	110.00	177.00	+67.00
Springfield, IL	Corn	1 qt/acre sprayed before tasseling	202.00	239.00	+37.00
Gibbon, MN	Wheat	1 qt on plants 6-8" high	41.7	50.67	+ 9.5

Location	Crop	Application Method/Acre	Control	Fish/ Seaweed	Difference Bushel/Acre
Buffalo, MN	Soybean	1 qt/acre sprayed at blossom stage	30.17	34.67	+ 4.5
Iowa	Soybean	1 qt/acre w/surfactant	47.42	56.10	+ 8.68
Sleepy Eye, MN	Soybean	1 qt/acre when beans start to pod	72.91	85.93	+13.02
Morgan, MN	Corn	1 qt/acre just before tassel	201.00	214.00	+13.00
Nobel, OK	Cotton	1 qt/acre w/surfactant 1 week after squaring	345 lbs. lint	485 lbs. lint	+120 lbs. lint
W. Texas	Cotton	1 qt/acre w/surfactant 1 week after squaring	345 lbs. lint	375 lbs. lint	+120 lbs. lint
Minnesota	Alfalfa	1 qt/acre w/surfactant	15.2% protein	17.9% protein	+2.7% protein
Kansas	Tomato	1 qt/acre for 4 weeks	31 lbs.	55 lbs.	+24 lbs.
Isabel, SD	Potato	1 qt/acre at blossom seed treated also	300 sacks per acre	400 sacks per acre	+100 sacks per acre

Substantial formal testing is needed, however, it is not unreasonable to expect adequate performance from this product, at least equal to results from similar strength synthetics. In light of the probable rising cost of imported fertilizers it is appropriate to investigate this abundant resource.

In addition to supplying domestic agricultural needs and enhancing rural economic development, utilization of the Pondfish resource can achieve meaningful reductions in state and federal expenditures for "rough fish" extermination and removal. Improved surface water conditions would support higher survival of game fish.

Home Grown Technology
Kiwi Practicality in Action

The New Zealand Ministry of Agriculture and Fisheries arranged a tour of the Talley Fish Processing Plant in Nelson, New Zealand, at the conclusion of the IIFET gathering. Talley is the source of many fish-stick and frozen minced fish products imported into the United States for sale through major supermarket and fast food chains. Disposal of fisheries waste at Talley produces valuable fuel and products. Maintenance personnel routinely render processing waste into fish meal and fertilizer concentrate. The boilers are powered by fish oil -- from waste fish. Conversion of the Talley boilers from diesel to fish-oil cost $150.00 per unit, and was accomplished by the plant's equipment maintenance personnel.

In Minnesota, sport fishermen and conservationists harvest Carp and other non-sport Pondfishes to sell for fertilizer, then use the money to restock depleted populations of their treasured Walleye. "Operation Walleye," a non-profit consortium of sport fishermen and resort operators, harvest Carp from state-constructed traps. As in New Zealand, the fertilizer plant runs on fish oil.

State of Wisconsin fisheries managers harvest Pondfish for commercial sale. They use the revenues to augment state conservation budgets. Twenty-two contract fishing crews and two state crews remove Pondfish from local lakes at regular intervals. Income from bid contracts and state removal totaled $90,000 in 1982, 44.6% from bid income, $50,334 from sales. Mink ranchers purchased 333,500 pounds, while 651,360 pounds were used for human food in regional urban markets. This program, which barely scratches the surface, has proven cost-effective.

Wisconsin's program encourages utilization of Pondfish for food. In only two years a 4.4% increase was realized in the quantity of Pondfishes processed for human consumption. The Wisconsin program appears to have escaped conflict with sport fishing constituencies, however, it has occasioned resentment from commercial fishermen in Minnesota because Wisconsin's abundant harvest depresses wholesale prices in the regional fishery.[61]

Eat Carp?

More attention should be focused on direct nutritional markets for Cyprinus and other species. For decades the primary food markets for Carp have been in ethnic enclaves, principally Jewish communities in and around New York City and Los Angeles. "Smoked Whitefish" in Brooklyn delicatessens is frequently Carp -- sometimes from the exceptionally clean waters of Oregon and the Pacific Northwest. Gefilte fish is generally made from Carp. These products are served to affluent and very discriminating customers, often in cafeteria-style restaurants where each dish is visually inspected prior to selection. It has to be perfect or it won't sell. It sells by the ton, and one need not possess an ethnic heritage to enjoy the excellent flavor.

Asian immigrants, particularly in California, constitute a growing consumer market for Carp. Again, this fish is served as a gourmet dish in quality restaurants catering to discriminating customers of many races and heritages. The Chinese have aquacultured Carp for at least three thousand years.

The balance of Carp caught and sold for human consumption in the United States is consumed by the urban poor in the Midwest. As many American cities are located on waterways, some of the poor and unemployed ply their lines to catch these fish themselves. For the rural poor of all races Carp is "free" food. In Portland people talk of the Great Depression and how the houses along the slack and turbid Columbia River Slough had old bathtubs and barrels behind the house to "purge" Carp. Because the fish came from muddy water they were held in fresh water several days to flush out river silt, then they were a fine meal in hard times or in good. Anymore only the poor partake of this harvest.

Carp is a gourmet dish in much of Eastern and Western Europe. West Germans aquaculture Carp on over 4,000 farms, and import $10,000,000 per year from aquaculture operations in Eastern Europe. The French serve Carp at Christmas in preference to turkey, and purchase the fish live from tanks at the fish market -- much as we obtain live lobster in some restaurants and supermarkets. Live Carp in the fish markets of France and Austria fetches a price comparable to that of fresh Salmon in U.S. supermarkets. The gourmet tradition of Carp accounts for its introduction into North American waters in the first place, and it is an irony of affluence that we hold this fish in such contempt.

> "Captain John Harlow stood in his front yard at Troutdale and made up his mind...he would send a letter to San Francisco and place his order. By all report this new wonder-fish, the German Carp, which the Californians were rapturously rearing, could be introduced profitably into Oregon and as a public service. Yonder was a fish, sir, fit for every superlative, the most toothsome table fish of them all -- the favorite of European gourmets and gourmands since the Middle Ages -- yet it could be grown in one's backyard as handily as pigs or poultry, and even more so."[62]

If Carp were rare, costly and imported we couldn't satisfy the demand. Fresh Carp fetches 6-10¢ per pound at dockside across the United States, a price range that hasn't varied since World War II. Fish markets in Europe get upwards of $5.00 per pound for live Carp, and generally sell all they can obtain.

Among Americans, only Nebraskans and Arkansans seem openly to admit an appreciation of Carp. In 1958 a Utah Agricultural publication reported that the Nebraska Fish and Game Department was transporting Cyprinus carpio from western to eastern Nebraska to meet sport fishing demand. There is a flourishing carp restaurant in Omaha. Carp has a cartilaginous skeletal frame. These soft "bones" are fractured by compression prior to cooking. The small cartilage fragments dissolve when the breaded patties are deep fried. In Little Rock an enterprising fish processor, one Virgil Young, opened his second Carp restaurant in early 1985. There are pockets of commercial activity, and where they exist they enjoy profitable trade and plenty of eager customers.

Don't Carp Taste Muddy?

Trout from muddy waters taste muddy. Any fish taken from turbid water will have a residue of silt unless and until it has been in clear water long enough to purge its system. Clams and Oysters are frequently are frequently left in clear water for several days prior to market; Sturgeon as well. Cyprinus carpio is not a garbage eating "scavenger." The primary food sources for this fish are filamentatious green algae and higher plants, although they also eat benthic invertebrates (snails), mollusks (freshwater clams), and crustaceans (small crawfish). Unless faced with starvation, Carp are picky eaters, well able to travel in search of better food. Powerful fish, their rooting and digging creates muddy water as they search out the choicest plant roots. As Carp grow quite large, it doesn't take many to stir things up. In most U.S. water ways there generally are -- or soon will be -- quite a lot of them in any event. On the Columbia River Carp essentially destroyed a species of yam known as the Wapato, which nourished Native Americans for centuries. Uncontrolled proliferation of Cyprinus carpio does a lot of environmental damage, a built-in penalty for poor resource management.

Extraordinary turbidity occurs at spawning, when the Carp thrash violently in shallow water, often for hours and days on end. This may actually suffocate the incubating eggs of some sport fish. Large populations of Carp can create turbidity in confined waters by engaging in normal feeding activity. Unpurged, they will taste muddy. Their activities can drive away sight-feeding species such as Trout and Walleye, which rely on clear water to locate insects and other food.

Impact of Pollution

It is impossible to ignore the impact of water pollution on freshwater fisheries. Although meaningful steps have been taken in recent years, many waterways still carry carcinogenic contaminants. Moreover, mature fish, particularly Carp, pose health risks even after clean-up. Toxic PCB's and heavy metals, particularly mercury, are not excreted by the body. They accumulate in fish the same way they accumulate in humans; permanently. They lodge in various organs, including skin, and in fatty tissue. Carp is a long-lived, fatty fish. A 30 year-old Carp from waters that have been clean for the last ten years still has 20 years worth of poison in its body. That poison will remain until the fish dies. Young fish from such waters are fine for eating. Larger, older fish are not. Carp can live 50 years. In many parts of the Midwest the classic fish story runs in reverse: the "big ones" must be allowed to "get away."

Food Products

Institutional and Consumer

There are excellent casserole and sausage-type products which can be mass-produced for consumer or institutional markets from deboned Pondfishes. Minnesota is the home of two premier Carp processors. Bud Ramer has produced Taco Filling, Chow Mein, Spaghetti and Carpballs and Chili Con Carpe by substituting deboned minced Carp for beef and pork in traditional recipes. He has enjoyed a steadily growing trade in Pickled Carp and Smoked Carp. Maynard Olson has produced and marketed Carp bologna, pepperoni, breakfast sausage and ham loaf. Demand occupied the full-time efforts of a German sausage maker and 6 assistants. At 6-10¢ per pound for raw material, these carp-based casseroles and sausages have interesting potential for alleviating state institutional food budgets. Food scientists at several U.S. universities have developed a number of excellent products from Carp, many of which have been "taste tested" with excellent results. European recipes for Carp date back hundreds of years, and freqently are the pride of country restaurants in France and Germany. There is nothing mysterious about making good food from these fish. The mystery is why it isn't done more often. Bud Ramer and Maynard Olson could save the taxpayers of America a very substantial amount of money.

Oregon can develop institutional food production utilizing local Carp. Our waters are clear and the fish require minimal purging prior to processing. Oregon Carp are presently "exported" at 10¢ a pound or less, to California and Eastern U.S. fish markets. Local manufacturing of institutional or commercial food products would generate jobs and profits that would remain in the state. While official statistics on Carp populations and migration are not available, commercial fishermen have harvested the Columbia and other state waters regularly. The dean of Northwest Carp fishermen is Nephi Grastite, who, with his brothers and sons, has fished Northwest Carp for 20 years and more. A newcomer to the group is Larry Hollingshead of Vail, Oregon, a fisheries biologist. He has constructed a pair of commercial Carp seiners with holding tanks to keep the fish swimming in their own waters until they are transferred to tanker trucks. His boats, the Desert Rose and the Silver Sage, can bring up 10,000 pounds at a time, up to 40,000 pounds per day -- with virtually no incidental catch. His fish arrive alive at the factory door. Hollinghead and his colleagues are a valuable resource: he is capable of designing and implementing harvest programs to the highest environmental standards, an important skill in the sensitive environment of anadromous fisheries.

Protein Extenders

One of the least expensive Carp processing techniques yields the largest volume of merchantable food with minimal equipment. Deboned, minced frozen carp is a viable 50% protein extender with ground beef in institutional markets. It can be produced without "fish odor" or taste, and is used for fish loaf dishes or as an "extender" for ground beef or pork. Market and product tests conducted for the Santee Indian Tribe and Maynard Olson in 1978 demonstrated excellent product acceptance among nursing home patients. At 51¢ per pound, a 60-bed nursing home estimated that it could use 80-100 pounds per month. The cost basis for the Minnesota tests was 6-8¢ per pound, dockside. Oregon Carp would run cost 10¢ per pound dockside (April 1985 quote. Note: we are competing with New York and California markets for Oregon Carp) and it is unlikely that frozen product could be delivered at under 65¢ per pound...which isn't bad considering the price of ground beef and pork.

The institutional food market for minced fish is among the most cost-effective and near-term markets for Oregon Pondfish products. Such a program would generate employment in harvest and processing, and generate savings in state-supported institutional food budgets. School programs, day care centers, college food services, nursing homes, senior centers, hospitals, military installations, and prisons constitute a vast market where minced fish enjoys a price advantage over all other forms of animal protein.[63]

Gourmet Products

It takes less equipment and imagination to produce marketable gourmet products for the consumer market. Ramer has produced and sold thousands of pounds of smoked carp to Minnesota supermarkets, delicatessens and restaurants. Like Salmon, Carp is a fatty fish. At the risk of blasphemy, smoked Carp compares quite well to smoked Salmon -- and it is considerably less expensive.

In recent years Ramer has developed a restaurant and commercial market for Pickled Carp. The product compares favorably to Pickled Herring, but costs 75¢ per pound less to produce. Side-by-side comparisons using unmarked dishes of Pickled Carp and Herring demonstrated consumer taste preference for the Carp product by a ratio of three-to-one.

Export Markets

West Germany, in 1972, had 4,295 commercial Carp aquaculture operations ranging from less than one hectare to over 50, totaling 16,364 hectares. These produced 3,368 metric tons of food fish for market. An additional 715 metric tons of Carp and other cyprinids was caught wild, 53% from rivers, 47% from lakes. In 1975 an additional 3,763 metric tons of Carp were imported, and the level between 1970 and 1975 increased by 50%. Imports were obtained primarily from Yugoslavia, Hungary, Poland, and the USSR. Lesser amounts were exported by France, Belgium, Holland, and Switzerland.

Inquiries among fish processors and fisheries economists in the Mississippi Delta region indicate that a price of 6-10¢ per pound dockside price along the Arkansas River would multiply to US$ 1.00 or more per pound when headed, gutted and shipped IQF to Europe. A plant processing Carp in this fashion would require a minimum of 200,000 pounds per month, and in the muddy waters of the Arkansas and Mississippi Delta, fresh-water holding ponds to allow the fish to purge river mud.[64]

There is no indication of Carp exports from the United States to any nation in the world. Present economic factors do not encourage the export of frozen Carp, in the round or as fillets. Transportation costs drive the price too high to compete with locally caught or aquacultured Carp in commercial or wholesale markets in Europe. Processing Carp as salt fish or stock fish may be viable, although one suspects the primary use of this food form would be in famine relief. Tasteless, odorless fish protein concentrate, which resembles cornstarch when processed for human consumption, is a promising product form with potential in domestic and export markets. Like cornstarch, FPC can be added to soups and stews to boost nutritional content. It can be baked in bread. Commercial processing technology to utilize this resource is developing steadily, will probably become market-ready and commercially viable within 2-3 years.

Barriers to Implementation

Oregon is typical of the balance of the United States in the presence and abundance of Carp, and a legislative framework that discourages systematic harvest. Almost every state has laws or regulations designed to protect sports and commercial fisheries. Frequently these regulations preclude systematic harvest of pondfish such as Carp. Discouraging commercial Carp harvest does nothing to improve sport fisheries. In most regions the opposite is the case. Moreover, state removal of "trash fish" tends to be expensive and environmentally devastating.

Oregon levies a 1/3¢ per pound excise tax on commercial harvest of Carp. The tax should be made a bounty to encourage the removal and utilization of these destructive fish. Licensing of commercial fishing boats, predicated on the economic and regulatory realities of offshore fisheries, is a prohibitive barrier to artisanal and commercial harvest of Carp and other Pondfishes in inland waters. The father-son-rowboat team at the Harney County Carp Derby would spend nearly $500.00 on licenses before catching their first commercial Carp. An unemployed ranch hand or logger can't front that cost.

Like most states, Oregon has winced at environmental damage and ignored the potential of Pondfishes. There are no state funds to study Carp -- none even to estimate the extent and locations of the biomass. Yet Carp compete with valuable salmonids and sport species. Carp course up and down the fishladders of the Columbia-Snake River system with impunity while stocks of valuable salmonids dwindle and fisheries employment declines. Abundance in Oregon fisheries runs to bankruptcies and foreclosures, auctioned boats and processing plants, grim faces, broken families, empty nets.

Ants at the Picnic

The level of belief in impending food shortages is approximately equal to the level of indifference surrounding the consequences. It is as if the nation believes life will go on as usual except that from time to time there will not be food; like ants at a picnic, it happens that way.

It won't be like that -- for several reasons. Start with communication. Previous 20th Century domestic food shortage episodes, the Great Depression and World War II, pre-date television. America's privileged inhabit America's fantasies and her living rooms. The Carrington's of "Dynasty" can be observed and consumed. Perfume and beverage bear their likeness, a fashion line is contemplated. Those willing to pay will shortly drift off to sleep in soap opera pajamas. Actor Paul Newman's face adorns Spaghetti Sauce and Salad Dressing bottles, the lifestyle is in the kitchen -- we can watch, eat, drink and smell their world. While there is yet illiteracy, there is no ignorance. The "innocence" of poverty, if it ever existed, is gone.

The last honorable war ended forty years ago. The almost religious patriotism which supported World War II food rationing programs is as quaint and naive as War Bond posters and Kate Smith records. Museum stuff. It won't sell in the ghetto, and it won't be too popular at suburban supermarkets.

Americans who experienced and can recall the Great Depression are now sixty to ninety-plus years old. Their children, grand- and great-grandchildren were born after World War II. The American population is a product of affluence and modern convenience, accustomed to a lifestyle and level of comfort unprecedented in human history. Expectations are higher now, and so are the odds. There will be no patriotic support, no ignorance of privilege to forestall violence. There will be the very old, the very young and the very angry to reap a bitter harvest.

Acknowledgements

Three remarkable men have contributed products from Carp and other Pondfishes. Maynard "Ole" Olson, Bud Ramer and Vern Hacker. One encounters resolute integrity in each of them. Their work has been quiet. They are only occasionally credited with accomplishment and innovation. Mass markets have ignored and eluded them, and yet they persevered through decades. They have shared their skills and understanding generously. These are excellent men whose work will become increasingly apparent and important. Another major contributor is Claude Ver Duin, publisher of The Fisherman. The Ver Duins have weathered the hard times and provided consistently excellent coverage of the inland fisheries over several generations.

The author is also indebted to Fishery Marketing Specialist James W. Ayers, U.S. Department of Commerce National Oceanic & Atmospheric Administration; Earl Evans, Ph.D. and Gary J. Burtle, of the University of Arkansas at Pine Bluff; Virgil Young, owner of Young's Fish -- Seafoods & Institutional Foods of Little Rock, Arkansas; and Willeen M. Hough, Economic Development Representative, Economic Development Administration, Austin Region, United States Department of Commerce. These people gave generously of their time in interviews and field studies conducted by the author in Arkansas during May, 1984, and helped establish the basic analytical framework upon which development of Pond fish economic programs rests.

Special thanks are due to Carl E. Bond, Ph.D., of Oregon State University, upon whom fell the difficult task of educating a lawyer to the biology of a fish. He is a man of great patience and goodwill, a superb teacher.

None of this would have been done except that a grand gentleman, Harvey L. Moore, Executive Director of the Consortium for International Fisheries and Aquaculture Development (CIFAD), persisted three decades with a singular notion: Inland Fisheries are Valuable. He has logged and updated the people, resources and processes which have gradually accumulated a viable technology to utilize the Pondfish resource -- then he convinced a lawyer to study fish. People just don't come any better than Harvey Moore.

Endnotes

1. Species such as carp, buffalo, suckers, smelt, sheephead, etc. are classified as "trash," "rough," "coarse" or "underutilized," "noxious" and "exotic" fish in various English-speaking countries. Many of these fish are valuable aquaculture resources which have been commercially cultivated in other nations for thousands of years. Nomenclature ought not be libel. We call them Pond Fishes.

2. Sidey, Hugh; "The Power of the Prairie," TIME, February 18, 1985 at 31.

3. "American Farming; Old MacDonald Sold His Farm," THE ECONOMIST, December 1, 1984; Vol. 293 Number 7370, at 34. "To achieve productivity gains, farmers are expected to turn even further to other sectors of the economy to purchase production inputs and finance land purchases -- increasing their dependence on areas where interest rates and inflation levels are beyond their control." Agriculture in the Future: An Outlook for the 1980's and Beyond, USDA/Agriculture Information Bulletin 484 at ii, (hereinafter OUTLOOK).

4. ibid, at 34, 37. Brazil encourages exports with free land and subsidized credit.

5. ibid, at 34. Interest rates have risen since November, 1983, when this season's crops were financed. Prices have dropped -- soybeans from \$8 to \$6 a bushel; maise from \$3.25 to \$2.80.

6. CHART, Total Fertilizer Consumed in the United States by Nutrient Type, An Econometric Analysis of the U.S. Fertilizer Industry, (hereinafter ECONOMETRICS) Emanual A. Gyawu, Larry D. Jones, David L. Debertin, and A. Pagoulatos; Agricultural Economics Research Report 39, November, 1984, University of Kentucky, College of Agriculture. An analytical structure to predict future price increases is a valuable part of this publication.

7. INPUTS, Outlook and Situation Report, USDA, Economic Research Service, 11/84; IOS-6 (Hereinafter, INPUTS) at 33-34. It should be noted that 1983/84 fertilizer consumption increase is attributable in part to PIK (Payment In Kind) lands being returned to cultivation. 1983/84 figures most closely describe domestic agriculture at full production levels, thus, although the percentage increase is exaggerated, the levels of consumption and prices are fair and represent the system's requirements. See also Medard Gable, Cornucopia Project, Preliminary Report, Rodale, Inc., Emmaus, PA, at 33; U.S. Department of Agriculture, Fertilizer Situation, 1980, at 14; also Wolfbauer, "Mineral Resources for Agricultural Use" Agriculture and Energy, W. Lockeretz, ed. (New York: Academic Press, 1977) pp. 301-14; General Accounting Office, Phosphates: A Case Study of a Valuable Depleting Mineral in

America, Report to the Congress by the Comptroller General of the United States, EMD-80-21, November 30, 1979, p. 1; cited in Lappe, Diet for a Small Planet, Balentine, 1982.

9. ECONOMETRICS, op cit, citing Paul and Kilmer, "The Manufacturing and Marketing of Nitrogen Fertilizers in the U.S.," USDA/ERS, Agricultural Economics Report, No. 390, 1977, a comprehensive update on the fundamental predictors of price and usage of agricultural fertilizers in the U.S. is arrayed in the context of several classic fertilizer cost studies.

10. ECONOMETRICS, Table I at p. 2.

11. See also Lappe, 80-81, op cit, collecting authorities. Lappe is very political and fundamentally opposed to utilization of agricultural resources for production of red meats, particularly beef, a matter not within the scope of this paper. Her analysis of agricultural cost structures and resource utilization is thorough and scholarly in areas related to soil depletion, erosion and agri-chemical impacts and economics, and represents a useful collection of data, authorities and resources.

12. Funk & Wagnalls New Encyclopedia, 1981, volume 19 at 310 and 311. (hereinafter F&W).

13. HOW IT WORKS, the Illustrated Science and Invention Encyclopedia, International Edition, Vol. 13, p. 1725 et seq. Stuttman Inc., Westport, Connecticut (previously published in the United Kingdom under the title "How it Works").

14. HOW IT WORKS, op cit, at 1725.

15. Lappe, op cit, 80-81, see also U.S. Department of Agriculture, Fertilizer Situation, 1980, at 14. We approach this analogy with caution. The emerging food problem will be structural, not political, and thus more difficult to resolve. The emergence of a multi-national (governmental) cartel controlling cereal grains in the manner of OPEC is far-fetched. One wonders, however, whether international grain conglomerates would mimic the OPEC effect.

16. Lappe, op cit, at 80.

17. The loss of topsoil by wind and water erosion is a well-documented problem. Dustbowl levels erosion have ceased to be a historical phenomenon. Pressure to place ever more land into production has resulted in demolition of shelter rows planted decades ago to preserve the soil, as land is farmed fence to fence. In his treatis on America, INSIDE U.S.A. published nearly 40 years ago John Gunther describes deterioration of topsoil in language nearly identical to contemporary descriptions.

18. deTocqueville, Alexis, Democracy in America, Phillips Bradley translation, Volume I, p. 295, Knopf, 1945.

19. Marty Strange of the Center for Rural Affairs; the economic impact of water erosion was estimated by the Department of Agriculture at $540 million in 1980. Soil and Water Conservation Act -- Summary and Appraisal, USDA Review Draft, 1980; Lappe states that wind erosion accounts for an additional 30 percent, citing the continuous cultivation of corn as the crop responsible for almost 25% of erosion; op cit, 80-81.

20. ibid.

21. Church, George J., "Real Trouble on the Farm: As Losses Mount, A Bitter Debate Begins Over The Government's Role," TIME Cover Story, February 18, 1985, at 24-28. "...farmers are likely to depend increasingly on markets abroad for prosperity -- markets that may become smaller for U.S. farmers as policies of other countries encourage their farmers to expand production while restricting imports from the U.S. OUTLOOK at pp. ii-2, et seq.

22. TIME, op cit, at 28-31; OUTLOOK at p. ii et seq for breakdown of various crops and livestock.

23. Fisheries of the United States, 1983, April 1984, Current Fishery Statistics No. 8320, National Marine Fisheries Service, at 87. (hereinafter FISHERIES/83). Agriculture is the nation's largest and most important industry, accounting for one-fifth of the GNP and 23,000,000 jobs. It adds $19 billion to the balance of payments, the largest positive contributor to our trade balance. OUTLOOK, p. 1. Oddly, our long neglected fisheries may help salvage our behemouth agriculture.

24. "Abnormalities Noted in Children of Mothers Who Ate PCB Tainted Trout and Salmon," THE FISHERMAN, The News Journal of the Freshwater Fisheries, Marine Publishing Company, Grand Haven, Michigan; Vol. 37, No. 1, January, 1985 at page 10 (hereinafter, THE FISHERMAN): "The infants of mothers who ate Lake Michigan Fish contaminated with toxic PCB's have poor muscle control and slowed emotional responses, according to a team of psychologists...Michigan health officials currently recommend that people eat no more than half a pound per week of fish from polluted Lake Michigan and that children, pregnant women, and women of child-bearing age eat none."

25. FISHERIES/83 at page 86.

26. The pollution-related decline of inland fisheries transcends PCB and the Great Lakes region. Waterways across the nation sustain continuing impacts, often from commercial and industrial activity, and occasionally in the name of national defense. Waters surrounding the federal reservation at Oak Ridge cannot be fished for food due to mercury and other contaminants produced in pursuit of national security.

Agriculture generates its own forms of pollution of ground and surface waters. Phosphate pollution has been recognized as a source of water pollution for well over a decade. Waste water from phosphate in laundry detergents is a primary nutrient of certain algae which, growing in excess, can choke a lake or river and draw off oxygen needed by other aquatic life forms.

Canada banned production of all detergents containing over 20% phosphates effective August 1, 1970. A 1970 report by the U.S. Department of the Interior reported that the phosphate content of 48 popular detergents were as high as 73.9%, and several communities including Detroit, Akron and Suffolk County, N.Y. banned the sale of such detergents. F&W, Vol. 19 at 64-65.

Radio talk shows across the agricultural heartland, monitored by this writer during April-June, 1984 in the course of driving 8,000 miles in fisheries research, evidenced substantial awareness of agri-chemical ground and surface water pollution, often from individuals who identified themselves on the air as farmers. The radio interviews were punctuated by commercials for agri-chemicals. The singing jingles for pesticides were simply incredible.

27. THE FISHERMAN, op cit, at 3.

28. Winter 1984 prices for 1200 ton tuna seiners equipped with heliports and $300,000.00 electronics systems averages $4,000,000.00 in San Diego. These boats cost $9,000,000.00 or when built, $10,000,000.00 to replace in U.S. shipyards. Used seiners in excellent condition are readily available at $3,500,000.00 -- probably less to a cash buyer. Many "Floating Palaces" of the tuna trade are owned by reluctant bankers.

Research and interviews conducted by author and Harvey L. Moore, Executive Director, Consortium for International Fisheries and Aquaculture Development (CIFAD). The price of some boats dropped <u>one to five million dollars</u> each between September 1984 and February 1985.

29. Edible fishery products imported to the U.S. weighed 2.4 billion pounds in 1983, valued at a record $3.6 billion, up 161.7 million pounds over the previous year. That 7% increase in quantity added up to a 13% increase in value; $424.3 million dollars over 1982. Domestic landings decreased 1% and imports increased 11% in 1983. <u>FISHERIES/83</u>, at v.

30. Sheraton, M., "Just Name Your Poisson," TIME Magazine, February 18, 1985, at 92, noting that "to keep supplies steady and <u>free of pollutants</u>, several kinds of seafoods are successfully being farmed." (emphasis added). New Zealand whitefish, orange roughy, John Dory, hoki, halibut and swordfish are popular imports.

TIME sources, restauranteurs and wholesalers, describe more market growth than FISHERIES, op cit. The truth probably lies in the middle -- between data timeliness and the desire of businessmen to perpetuate and encourage a trend.

31. Smurthwaite, D., N. Armantrout, "Salmon Ranching," The Dream That Got Away; THE OREGONIAN, Northwest Magazine, cover story, June 24, 1984, pp. 4-5. "If it weren't for the hatchery programs, there wouldn't be a salmon run. Period," says Salmon Rancher Bill McNeil. Overfishing and habitat destruction are causes cited for the decimation of the fishery.

32. The impact of hydroelectric development on estuarial and tidal lands at Aswan High Dam is a well documented phenomenon, not limited to Egypt. Periodic flooding of the Nile Estuary and low lands attracts greater attention due to its dramatic role in Egyptian agriculture. The same impact occurs on the Columbia, but is not generally mentioned as a factor in the decline of estuarial fisheries. We take our massive dams for granted, grateful to be free of devastating floods. There is a price.

33. American farmers spent $4,282,900,000.00 for pesticides in 1982; $211,700,000.00 in the Columbia-Snake River drainage alone. Farmers in Minnesota purchased $224,000,000; California, $468,000,000.00. From less than 225,000,000 pounds active ingredient (a.i.) in 1971, herbicide use grew steadily until 1984 and may have leveled off; 500,000,000 to 545,000,000 pounds a.i. are expected to be applied to croplands during 1985. Discontinuing these chemicals could yield as much as a 21% decrease in corn production, 33% for soybeans. This would raise both prices and water quality. Only minor yield losses would occur if biologically efficient and cost effective alternatives are available. Source: INPUTS - Outlook and Situation Report USDA Economic Research Service, November 1984, IOS-6.

34. Gunther, J., INSIDE USA, Harper & Brothers, New York and London, 1947, at 272. "...Lake Erie...the greatest industrial waterway in the world...almost as big as Palestine with a cordon of railways drawn tight around it like a noose."

35. Bella, Rick, "Shelter for the Homeless, How Does Portland Stack Up; The Oregonian, Tuesday, February 12, 1985; Page 1, Section C. Another thousand homeless are expected to arrive with warm weather. Almost none of this population is attributable to the highly controversial and much-publicized transport of street people to an Oregon ranch maintained by Indian Guru Bhagwan Shree Rajneesh.

36. ibid.

37. It is not new news that women average only 62% of male wages. Consider the downstream impact. The problem escalates at retirement. Pensions and social security supplements reflect earnings during an individual's years of employment and, bluntly stated, have the potential of creating legions of bag ladies.

    Corporate pension programs, particularly in small and closely held corporations, encourage pension and profit-sharing programs which cluster contributions within upper management. In practice this kind of "corporate financial planning" denies meaningful pension accumulations to non-union hourly workers. Such workers are service and clerical, occupations overwhelmingly occupied by women of all races and men of color.

    If you desire such a pension plan, call the local agency of any major U.S. insurance firm, listed in the Yellow Pages. This will connect you with a "Corporate Financial Planning Consultant" (insurance agent) who, without charge in most instances, will design a program to maximize executive benefits and tax preferences while minimizing outlays other than Social Security on behalf of non-management employees. There are limits, but it is fair to say that the governing structure invites and rewards abuse. (Do inquire about consultation fees before scheduling this educational experience.) The printouts and actuarials are quite remarkable, and provide solid indication of the long-term prospects of most female workers, and their ability to provide their own budget for food. The situation will become very serious if the predicted food shortages occur, as food prices will soar dramatically unless regulated by government price and rationing programs.

38. The Economist, op cit, 31.

39. "How One Man Survived," THE ECONOMIST, 1-7 December, 1984, at page 38. Twenty-first century back-to-nature agriculture may shortly mimic ancient practices of Native Americans whose women planted fish under maise to make it grow better.

40. White, T.H., BREACH OF FAITH, The Fall of Richard Nixon, Athenum, 1975.

41. As a college student in New York City, and as a law student in Newark, New Jersey, this writer learned first-hand of the quality, supply and price problems afflicting poor urban neighborhoods. More than once the supermarket shelves emptied within hours; hints of a possible Teamster strike would send people scurrying to purchase and hoard food. In 1970, when the water turned briefly brown in affluent Fort Lee, New Jersey, I observed bottled water vanish from area supermarkets within 90 minutes. Sold out.

    No New Yorker who lived through the gas crisis will forget weeks of quarter-mile and longer gas lines. Some might still recall the "teaser" to the evening news of May 31, 1979: "Brooklyn Man Murdered in Gas Line, Pregnant Wife Watches in Horror, (Film at Eleven). The murder was two-column front page news in the June 1 edition of the New York Times. That paper reported the city's second gas-line slaying ten days later -- on page 30. The unthinkable becomes commonplace at amazing speed in America.

42. In 1981 the Center for Research on Aggression at Syracuse, N.Y. logged 11,500 killings by bullet in the United States, as compared with eight in Great Britain, 42 in West Germany, 49 in Japan and 52 in Canada. American adults are not the only violent segment of the population; that same year there were 110,000 assaults on teachers, 9,000 rapes, 20,000,000 thefts and 400,000 acts of vandalism amounting to $600,000,000 in property damage in American public schools.

43. Threat of interruptions of food supply systems were observed by this writer from 1970-1979 in New York and New Jersey did not yield any indication that repetition evoked diminished anxiety. Under normal conditions people in this largest and most congested of American metropolitan communities expect to wait an hour in a supermarket check-out line at suburban shopping centers. Supermarket aisles are all but impassable, as they are piled high with additional inventory because the shelves cannot hold a supply sufficient for a single day of normal shopping activity. The mere suggestion of shortage or disruption of supplies occasions hoarding.

    These people know how quickly shelves can empty, and take no chances. They can be quite rough, and their aggressive behavior is not limited to food. Recall the Christmas 1984 Cabbage Patch Doll shortage. News footage from department stores did not suggest peaceful patience -- even where the item in short supply had no demonstrable utility. One nationally televised interview showed a mother with her nearly hysterical five-year-old daughter -- another woman had overpowered the little girl and wrenched the Cabbage Patch Doll away.

44. The 1982 National Geographic Map of the U.S. shows the Clackamas as a thin, unnamed blue line below Oregon City. It is a minor tributary to the barely visible Willamette, a tributary of the Columbia River. There hasn't been a war or a waltz about the Clackamas or Willamette in -- well, years.

45. Rosenblatt, R., "THE WORLD GASPED, A Tragic Gas Leak Offers a Parable of Industrial Life," TIME, op cit, at page 20: "In Specimen Days Walt Whitman created a terrible picture of proximity of human progress and human frailty by describing the U.S. Patent Office when it was used as a hospital during the Civil War. There the dead and dying soldiers lay on cots surrounded by the latest inventions of the day, high shelves packed with gleaming instruments devised to ensure the world's safety and advancement."

46. Stoler, P., "Frightening Findings at Bhopal; Union Carbide and India Begin to Uncover What Happened;" at 78.

47. Both the Oregon Journal and the Oregonian Newspapers reported the Roseburg blast from August 7 to 14, 1959. This account is a composite of the major stories. Nitrogen consumption figures: INPUTS, op cit, at 32. Nitrate consumption in 1983/84 reached 11.1 million tons and fertilizer use climbed 21% over 1982/83 levels.

48. See, e.g., EPA 430/9-81-012, UTILIZATION OF MUNICIPAL WASTE WATER AND SLUDGE FOR LAND RECLAMATION AND BIOMASS PRODUCTION, Symposium Proceedings and Engineering Assessment, Robert K. Bastian, Project Officer, U.S. Environmental Protection Agency, Office of Water Program Operations, Municipal Construction Division, Washington, D.C. 20460, September, 1980. There are numerous alternatives to synthetic and imported fertilizers, and some can generate fisheries-related employment. See EPA 430/9-80-0006, AQUACULTURE SYSTEMS FOR WASTEWATER TREATMENT: Seminar Proceedings and Engineering Assessment; same author and address. These options and resources are beyond the scope of this paper, but are noted because they have become increasingly important as agricultural fertilizers.

48. The lack of data is related both to the power of sport fishing constituencies in the allocation of funds for inland fisheries research and to the lack of meaningful commercial markets for Pondfishes in most areas of the United States. The price of carp has not fluctuated over two cents since World War II. Then and now it is possible to purchase these fish by the ton for 6-8¢ per pound. A cash-on-delivery price of 10¢ per pound would generate unmanageable harvests in many regions in the United States.

49. Hacker, V., "1982 Annual Report of the Removal of Rough and Detrimental Fish From Wisconsin Inland Waters by State and Contract Fishermen," Wisconsin Department of Natural Resources, Bureau of Fish Management, Box 7921, Madison, Wisconsin. The five waters fished by Hagensick were the Bark River, Lake Kegonsa, Lake Koshkonong, Rock River and Lake Waubesa. None were marked on the 1982 National Geographic Map of the United States; like the Clackamas in Oregon, Wisconsin's fruitful waters lack waltzes and wars. The 1982 Report included Freshwater Drum, 1,045,460; Buffalo, 523,041; Sucker, 323,296; Quillback, 27,312; Garfish, 2,355; Dogfish, 1,182, Burbot, 850; Redhorse, 200; Turtle, 40. Wisconsin has a unique and singularly practical method of harvesting "Rough" and "Detrimental" fish. One full-time State crew, a short-term Northwest District Crew and 22 contract operators harvested 4.5 million pounds. Lake Winnebago, approximately 15 miles long, yielded 1,021,165 pounds in two months.

Wisconsin is unique, and one suspects that has a lot to do with the indefatigable Hacker. Wisconsin is not blessed with an abnormal supply of these fish, they're abundant throughout the region. Wisconsin is blessed with good sense.

50. Ben Hur Lapham's classic, The Coming of the Pond Fishes tells this tale with considerable charm and detail.

51. MacKay, H.H., Fishes of Ontario; Bryant Press, Ltd., 1963.

52. LaRivers, Ira, Fishes and Fisheries of Nevada; Nevada Fish and Game Commission, 1962.

Average weights of Carp from a wide range of Utah lakes is as follows: YEAR ONE, 5 inches; YEAR TWO, 10.4 inches; YEAR THREE, 15 inches; YEAR FOUR, 19 inches; YEAR FIVE, 21.4 inches; YEAR SIX, 23 inches; YEAR SEVEN, 24 inches. Sigler, W.F., The Ecology and Use of Carp in Utah; Utah Agriculture Experiment Station Bulletin 405, 1958, page 63.

We have averaged Sigler's growth figures for lakes ranging from cold/sterile to seasonal/fertile to yield a usable figure for average conditions. There is a huge disparity of growth rates (e.g., a three year Carp in Bear Lake is 8.3 inches, while one in Ogden Bay reaches 20.4 inches).

California Carp commonly weigh about a pound at 12 inches, 2.5 pounds by 18 inches. Wohlschlag, D.E., and C.A. Woodhul, The Fish Populations of Salt Springs Valley Reservoir, Calaveras County, California, California Fish and Game, Vol. 39, No. 1, pp. 5-44; 1953.

53. Trautman, Milton B., The Fishes of Ohio, Ohio State University Press, 1957. Maynard Olson, Garfield, Minnesota conservationist and Carp observer reports that Carp spawned in midsummer in central Minnesota Lakes normally reach 8 inches before the October freeze. (Interviews and field surveys with Olson, Operation Walleye Executive Committee Members and local fishermen, conducted by author, July, 1984, in and around Garfield, Minnesota.)

54. The author observed numerous Carp spawning during 1984 Minnesota field studies. Even in canal traps they continued, females surrounded by males thrashing violently against the sides of the impoundments. Olson and Operation Walleye personnel report draining marginal lakes for Carp control purposes and finding a thick, tapioca like border of sticky Carp eggs around the entire circumference an inch deep and two feet wide. The eggs adhere to grasses, birds, anything, and hatch within 96 hours of fertilization.

55. Interviews conducted by author in September, 1984, at Oregon State University with Carl E. Bond, Ph.D., who wryly noted that such a fish constitutes a potential Carp nation.

56. Interviews, May, 1984, Oshkosh, Wisconsin, with Vern Hacker; Garfield, Minnesota with Olson.

57. Olson reports that in 1958 he seined 35,000 pounds of Carp from a small Minnesota lake in order to save the sport fishing resort which he operated with his wife. He buried the fish, and pondered the irony of his act -- people elsewhere starved as he destroyed food to save his livelihood. At his invitation this writer made yet another trip to the Midwest in July, 1984, to observe and photograph the trap-harvest process. Rotting in the sun behind a slough were 20,000 pounds of huge decaying Carp, the remains of a single day's harvest at a single trap. Operation Walleye fishermen produced photographs of that day's work, which harvested 43,000 pounds of large (10-30 pound) healthy fish. Local hog farmers are said to have hauled away 23,000 pounds; the remainder was left to rot behind a hill because nobody wanted to pay $50.00 per hole to bury them.

58. The Oregonian, January 10, 1985, Page D-6, reported by correspondent Pauline Brayman.

59. The fishermen were resort owners and sport fishing enthusiasts seeking to control the ever-burgeoning Carp population. Construction of the traps from which these Minnesota fish were harvested is an artform. The Carp are powerful fish, and will root and dig seeking escape. Olson reports having retrieved Carp "with no nose left" after hours of escape efforts, and displayed one stream-trap site where the frantic escape efforts of the trapped carp had undercut and collapsed thirty feet of adjacent road. Steel embankments, gravel and cement were required to repair the damage.

Reports of Carp undermining banks and dropping timber along river and stream banks are suspect. The reader is admonished to beware of shaggy Carp stories. Minnesota woodsmen refer to Carp as "Iowa Walleye," and tell hilarious tales of luring unsuspecting tourists to watch "Iowa Walleye Making Fire Wood." No event of this type has been confirmed.

60. Lampham, B.H., op cit, at 11.

61. Graham, Don, A Report on the Joint Venture Between Carpole's and the Santee Indian Tribe, June 27, 1979, prepared under Contract #9A00-0101667, for CARPOLE's, Garfield, Minnesota and the Santee Indian Tribe. As we have researched the Carp situation across the United States we have observed that this fishery could provide employment and economic development in Native American communities. Carp is perhaps the only commercially valuable fishery not exploited by sport and commercial interests. In the Pacific Northwest, where tribal access to treaty fisheries involving salmonids is the subject of extensive litigation, Cyprinus could be a profitable activity for treaty fishermen, and a worthwhile development project for some tribes. Mr. Graham is a full-blooded Sioux.

62. Hacker, op cit, augmented by personal interviews in May, 1984, with Hacker and with Minnesota processor Bud Raymer of Winona. Discussions 4/15/85 with publisher Claude Ver Duin, who had just returned studying Carp export potential in Europe, confirm the general sense that regional domestic markets may be the only viable avenue for selling fresh or frozen Carp. The fish are so prolific that local aquaculture and feral harvests easily satisfy demand in most areas of the United States and Europe.

Economic Costs of Conflicts Between Competing Users of the Snapper *Chrysophrys auratus* Stocks in the Marlborough Sounds, New Zealand

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The Resource Organism. Chrysophys auratus (Forster 1801)

The fish Chrysophys auratus known as the New Zealand snapper, resembles in appearance the true snappers of the Family Lutjanidae but is actually a member of the Family Sparidae or Sea Breams, known in some part of the world as Porgies. Although the Sea Breams are numerous and widely distributed Chrysophrys auratus is the only representative found in the New Zealand Exclusive Economic Zone. It has two relatives in Australia, Chrysophys unicolor (Quoy and Gaimard 1824) and Chysophrys guttulatus (Valenciennes 1830), which are very similar in appearance. The generic name of some sea breams is given as Pagrus. Pagrus major (Temminck and Schlegel 1842), the Japanese red sea bream is sometimes called red snapper and the high value placed on this fish in Japan led to the ready acceptance of the New Zealand golden snapper as a market substitute.

Chrysophrys auratus has a perch-like form, i.e. moderately laterally compressed giving it a deep oval shape. It has a large bony head and powerful jaws. The teeth towards the front and centre of the mouth are conically pointed and capable of biting; those on the outer sides are blunt and more adapted to crushing. The dorsal fin has 12 spines and 10 rays, the anal 3 spines and 8 rays, and the pectoral has 15 or 16 rays. The colour varies according to the wide range of habitats which it can occupy varying in reddish gold in clear water over rocky bottoms to silver in more turbid waters over mud. The scales are large and around the well marked lateral lines are scattered an array of turquoise spots.

The Biology of Chrysophrys auratus has been well described by New Zealand authors. Cassie (1956,a,b) described its spawning, early development and growth. Longhurst (1958) recognised racial differences in size and growth of East and West Coast stocks. Godfriaux (1969) and Colman (1972) reported on the feeding habits of snapper in the Hauraki Gulf. Paul (1967) (1976) (1977) evaluated the results of tagging experiments over the period 1952 to 1963, described studies on age, growth and population structure in the Hauraki Gulf and reviewed the commercial fishery for snapper in the Auckland region from 1900 to 1971. Paul and Elder (1979) updated this review to 1978. Vooren and Coombs (1977) discussed variations in growth, mortality and population density of snapper in the Hauraki Gulf. Crossland (1981) gave an updated review of the biology of the New Zealand snapper and Paul (1980a) (1980b) compiled two notes in the Fishdex series of informational papers issued by the Media Services of the New Zealand Ministry of Agriculture and Fisheries.

Growth Rate. Longhurst (1958) concluded that the East and West Coast stocks are separate with those on the West Coast growing at a considerably faster rate and reaching a greater final size. He reported that there was an increase in growth rate from North to South with the maximum growth rate being found in the Tasman Bay population. His curves comparing the growth rates of the Tasman Bay and Hauraki Gulf stocks are shown in Figure 2. This figure shows that whilst Tasman Bay stocks reach a greater length at each successive year of age, the percentage annual increment is the same in both stocks. Electrophoretic studies by Smith et al. (1978) confirmed that the stocks are racially distinct. Paul (1980a) shows the average length of 4 year old fish as about 22 cm. for East Coast and 29 cm. for West Coast fish. The annual increment becomes much slower after age 5. By age 10 the East Coast fish have reached about 31 cm. and by age 40 46 cm.; the corresponding figures for West Coast fish at these ages are 39 cm. and 60 cm. respectively. The relationship of weight with length seems to be the same for both stocks regardless of age; Paul (1980a) shows the length weight relationship as follows. See Table 1.

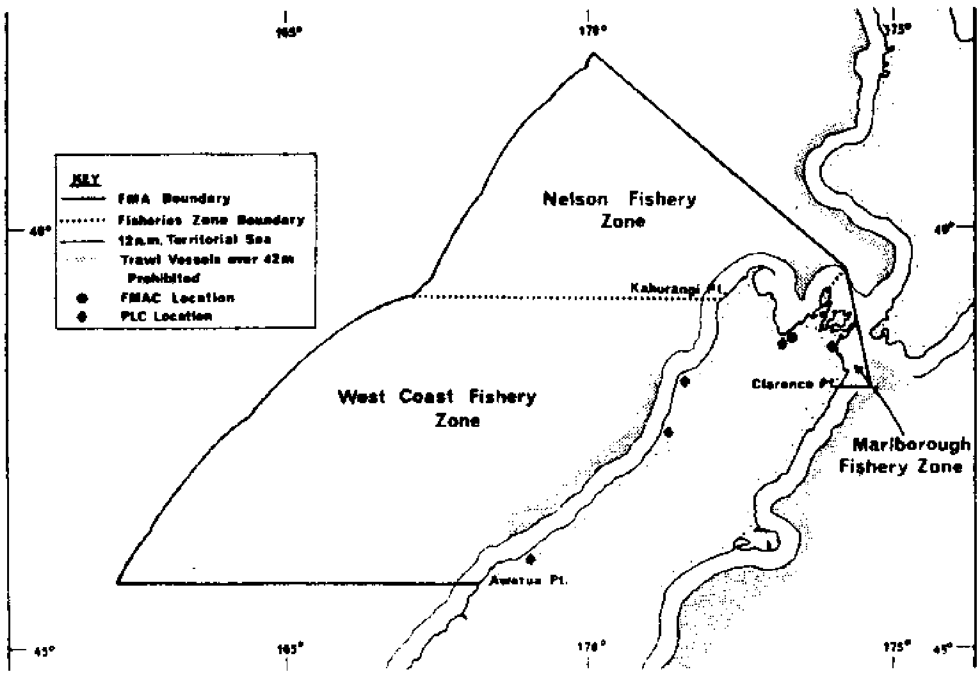

Figure 1. The Challenger Fisheries Management Area

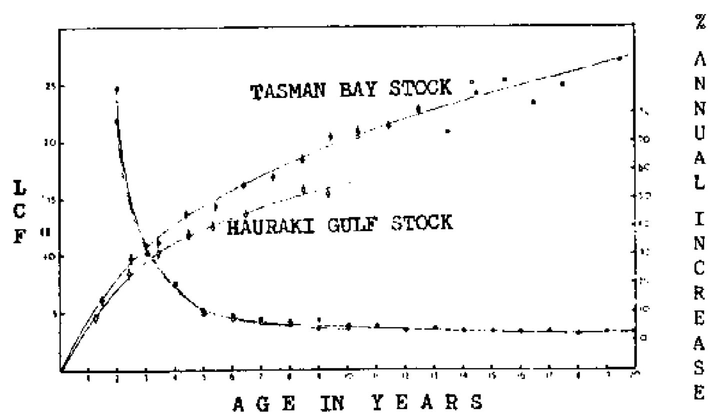

Figure 2. Growth Rates of New Zealand Snapper Stocks

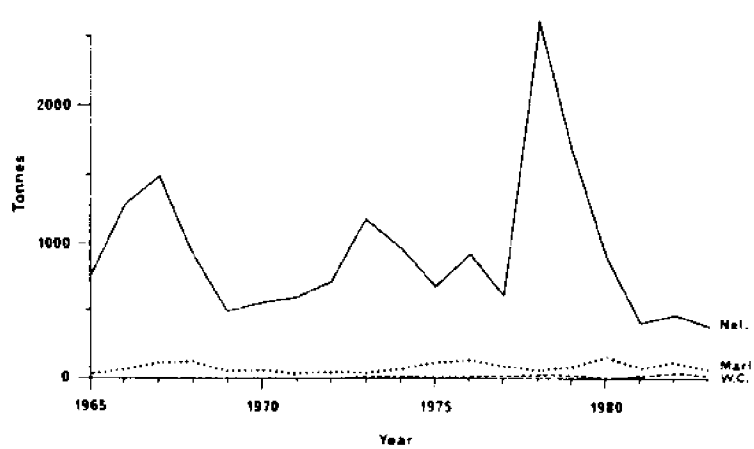

Figure 3. Trends in Landings, 1965-1983, Nelson, Marlborough and West Coast

Table 1. Relationship Between Average Body Weight and Length of the New Zealand Snapper

Length Cm.	Weight Kg.
10	0.03
20	0.20
30	0.60
40	1.33
50	2.49
60	4.13
70	6.36
80	9.23

There is a change in body shape with increasing age. The body becomes elongated and the head enlarged with a prominent bump on the forehead. Though such fish are known as "old men" snapper the bump develops in both sexes. The bump is not related to attainment of sexual maturity which is reached in 3 to 4 year old fish at a length of 25 cm. which is the minimum legal size.

Spawning behaviour. Summarising published information on spawning behaviour Crossland (1981) states that most spawning takes place in depths of 20 to 70 m in large bays with some spawning along the open coast. He includes Tasman Bay in a list of known spawning grounds but does not include the Marlborough Sounds. Typical conditions within the inner sounds would be at variance with conditions reported as suitable for spawning elsewhere. He states that there is no spawning where the water is very turbid or in estuarine (low salinity) areas. For instance only occasional eggs have been found in the Tamaki Strait or the inner Firth of Thames although these are only a short distance away from dense spawning areas in clear waters of the Hauraki Gulf. Statements that the Inner Marlborough Sounds are a significant spawning and nursery area for snapper are not supported by any published evidence which would justify taking such claims into account in the formulation of any management plans for this area.

Feeding habits and food. Studies on the feeding habits of snapper by Godfriaux (1969) and Colman (1972) show the fish can feed on a wide variety of food organisms. Small snapper have a preference for softer bodied organisms such as worms or small crustaceans. Larger snapper extend their diet to include small fish, crabs, sea eggs, brittle stars and shell fishes. They have powerful crushing jaws to which the relatively thin shelled green lipped mussels, Perna canaliculus produced by rope culture in the Sounds are particularly vulnerable.

Damage to mussel farms. The predation by snapper on mussel crops on culture ropes goes far beyond the taking of their food requirements. The snapper approach the long lines in schools which the author has observed to attack the mussels in what is reminiscent of the feeding frenzy of sharks and tuna. The emergence of a beach seine fishery in the Inner Pelorus from 1980 onwards can readily be related to the discovery by the snapper of this readily available food supply. In many instances the beach seine fishermen have been called in by the mussel farmers after the snapper have moved in on the farms, and catches of up to 100 large fish have been made by seines pulled underneath the long lines. Other relatively large catches up to one tonne of snapper per haul have been made on beaches in close proximity to the mussel farms. Any management policy for the snapper in the Inner Sounds should recognise that the economic viability of the mussel farms is threatened by the presence of the snapper.

The Fishery for Snapper in the Challenger Management Area

The snapper which are seasonally found in the Marlborough Sounds are part of a unit stock which occupies the Marlborough, Nelson and West Coast Zones of the Challenger Management Area (Figure 1). Until evidence is published to convince otherwise the Challenger stock should be managed as a unit fishery. Prior to 1963 the Challenger area stock was relatively lightly exploited by New Zealand vessels due to a system of restrictive licensing imposed by the Fisheries Amendment Act 1945 which froze the fleet at that date in respect both of number of vessels and methods in use. During the 1960s catches were made by Japanese, Russian and on one occasion by a Rumanian factory stern trawler, which are not included in the available statistics of catches and landings. With the end of restrictive licensing in 1963 and fleet expansion from 1964 the snapper catch from the Challenger area increased until 1967, declined sharply over the next two years, and then trended slightly upwards from 1970 probably due to the introduction of pair trawling, which has been shown elsewhere to be more efficient than single boat trawling. Figure 3 shows the trends in landings for the three zones of the Challenger area between 1965 and 1983. The rise of purse seining in Nelson from the mid 1970s had an unexpected impact on the snapper fishery arising from the use of spotter aircraft by the purse seiners. In 1977 the fish spotter pilots reported large schools of snapper at the surface and these were immediately exploited both by purse seine and by pair trawlers towing nets at the surface. In the 1977/78 season the snapper catch from Tasman Bay exceeded 2,000 tonnes for the first time, but extremely poor economic use was made of the large catches, which were frequently too large to be taken on board by the catching vessels. The major part of one large catch was towed back to Nelson in the trawl net, where it was condemned by the Health Inspectorate and taken to the Nelson tip. The unloading capabilities of the factories was also exceeded so that more fish was condemned by the time it could be taken off the boats. Much of the catch was in any case in very poor physiological condition and fit only for the lower end of the market.

In 1978/79 a quota was declared for the snapper fishery with a seasonal closure to be applied once it had been reached. In three out of the first four seasons the catch overshot the quota before the season could be closed. In the last three seasons the closure was not enforced due to delay in passage of the empowering regulations. See Table 2.

Table 2. Snapper Quotas Declared and Actual Catches Taken in Tasman Bay for the Seasons 1979/80-1983/84

Season	Quota Declared (tonnes)	Catch (tonnes)	Date Season Closed
1979/80	1,000	1,135	25/12/79
1980/81	650	740	30/12/80
1981/82	600	474	-
1982/83	400	503	-
1983/84	400	225	-

More significant than the failure to enforce the quotas in the earlier seasons is the collapse of the fishery, to yield only about half of the recommended quota in the 1983/84 season, in spite of a closure not being applied. The decline of the fishery is also apparent from the mean daily catch rate of pair trawlers of less than 18 m length which fell from 1.69 tonnes per day in 1978/79 to 0.88 tonnes per day in 1982/83. The catch rate for 1981/82 was even lower at 0.75 tonnes per day.

Snapper Fishery in the Marlborough Zone

Snapper in quantities sufficient to sustain a commercial fishery are found in the outer Sounds and in Pelorus Sound. They penetrate well into the Inner Sounds, including Kenepuru Sound, where they have historically supported both recreational and commercial fisheries. They are found much less abundantly in Queen Charlotte Sound where there is no commercial fishery and where the snapper catch contributes only a minor part of the recreational fishery. Prior to 1980 the commercial catch was by trawling, set net and long line. Beach seining was introduced in 1981 and in 1982 contributed more than half the catch. The landings for 1982 at Havelock from the Pelorus are shown in Table 3.

Table 3. Total (All Species) Landings, and Snapper Landings, by Each Fishing Method in Pelorus in 1982

Method	Total Landings (tonnes)	% Snapper in Catch	Snapper Landings (tonnes)
Trawl	215.2	15	31.9
Set net	44.8	24	10.8
Longline	65.9	9	6.8
Beach seine	72.3	96	69.3

The landings up to the end of October 1983 showed that the beach seiners had taken 57 tonnes of snapper; the line caught catch had increased to 12.1 and the set net catch had dropped to 6.0 tonnes. Thus the combined line and set net catch had not greatly changed. The trawl caught catch, however, had fallen to 14.0 tonnes. There was an obvious conflict of interest between the trawlermen and the beach seine fishermen. Since the beach seine catch was made in the inner Sounds and during the summer season, their operations were readily observed by occupiers of holiday homes and boating enthusiasts and there was an outcry from these interests against the beach seining operation. This operation could not be transferred to the outer sounds or even the middle reaches since the beaches become too steep and rocky and have too many seaweed beds for beach seines to be worked.

Management of the Fishery. The Fishery Management Plan

Part I of the Fisheries Act of 1983 calls for the development of fisheries management plans to conserve, enhance, protect, allocate and manage the resources within New Zealand fisheries waters having regard to (a) planning, managing, controlling, and implementing such measures as may be necessary to achieve those purposes; (b) promoting and developing commercial and recreational fishing; (c) providing for optimum yields from any fishery and maintaining the quality of the yield without detrimentally affecting the fishery habitat and environment. Section 5 of the Act calls for the management plans to be developed for distinct management areas as declared by the Minister of Fisheries. On 26th April 1984 the Minister

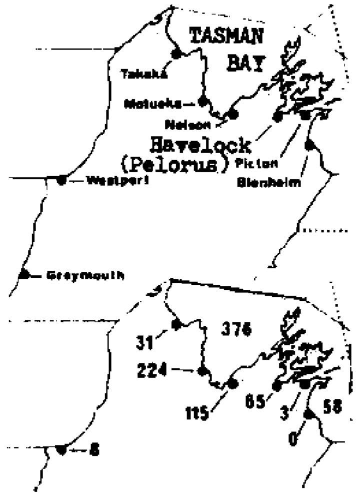

Figure 4. Catches by Area, Landings at Ports (tonnes), 1982/1983

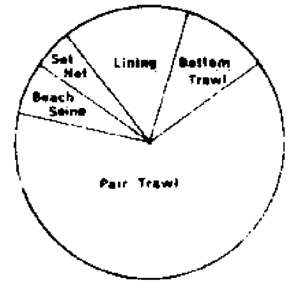

Figure 5. Catch by Method

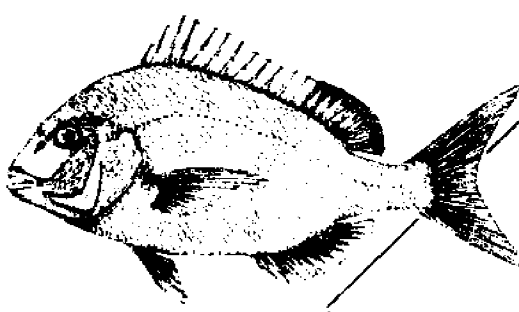

Figure 6. N.Z. Snapper Chrysophrys auratus About 30 cm Long From Paul 1980a

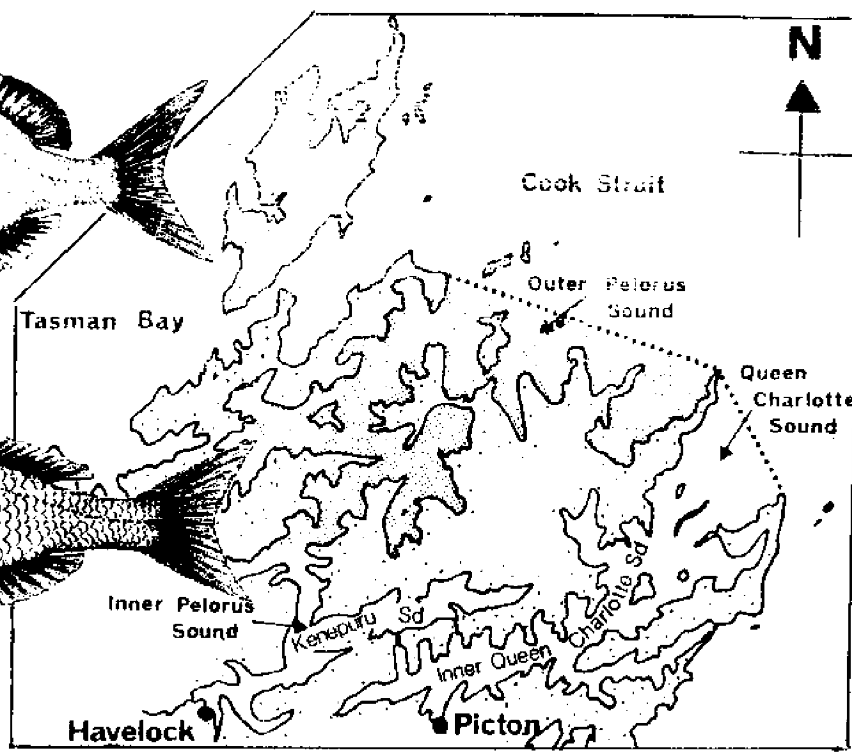

Figure 8. Map of Marlborough Sounds, New Zealand

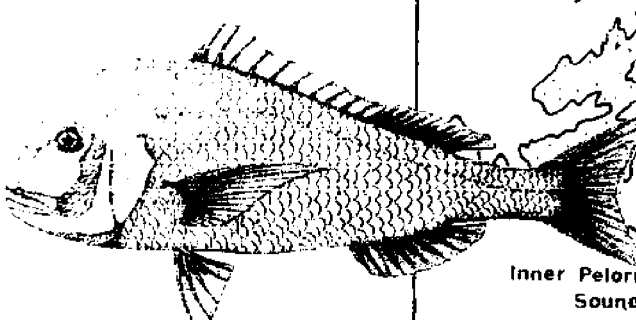

Figure 7. N.Z. "Old Man" Snapper About 75 cm Long From Paul, Ibid

gazetted an area to be called the Challenger Fishery Management Area embracing those parts of New Zealand fishery waters shown in Figure 1. The Challenger area is subdivided into three zones, namely the Marlborough, Nelson and West Coast Zones.

Section 6 of the Fisheries Act requires the Director-General of the Ministry of Agriculture and Fisheries to develop a management plan for the Challenger Area within a structure which will allow fair consultation and consideration of the views and responsibilities of appropriate public authorities, acclimatisation societies, the Fishing Industry Board, and such organisations and persons representing commercial, recreational, Maori, traditional, and other interests in fisheries as he considers appropriate.

For the purposes of preparing proposed plans and giving advice in relation to operative plans Section 7 of the Fisheries Act empowers the Minister to appoint advisory committees for each management area or part thereof. The Challenger Fishery Management Advisory Committee was appointed by the Minister in July 1984. According to a Draft Proposed Challenger Fishery Management Plan, issued by the Director-General (1984), the role of the Advisory Committee will be to provide a forum for the discussion of issues and management measures that are regional in nature.

Port Liaison Committees. As part of the management structure so called Port Liaison Committees have been appointed, each to provide a forum for the development of management packages that should suit the special circumstances of each fishery zone. The Draft Challenger Proposed Fishery Management Plan envisages that members of the Fishery Management Advisory Committee will ensure that the different viewpoints of users in each Fishery zone are fairly represented in the fishery management planning development process, by developing strong ties with the Port Liaison Committees. There is obviously an assumption that fair representation of different user groups will be provided in the Port Liaison Committees.

This situation did not apply to the Marlborough Port Liaison Committee during 1983 which gave extremely unbalanced representation of the different groups. Thus in a committee of ten members, three were directly representatives of the recreational interest, and two others were indirectly identifiable within the recreational use lobby through interest in the tourist accommodation industry, and as charter boat operators. The commercial fishing interest was represented by trawl and line fishermen. The beach seine fishermen were denied representation altogether. There was one representative of the multi million dollar marine farming industry.

At a meeting in October 1983, a Senior Fisheries Office of the Ministry of Agriculture and Fisheries, chairing a meeting of the Marlborough Port Liaison Committee, allowed the presentation of a motion by the representative of the Marlborough Boating Club, seconded by the representative of the Sea Anglers' Club, which called for the banning of commercial fishing within the Inner Sounds. In effect this called for the banning of beach seining which could not for technical reasons be conducted elsewhere, as distinct from line fishing and trawling which could be continued on the same stocks when they migrated seasonally from the Inner Sounds. The motion was carried by nine votes to one with only the Marine Farmer's representative voting against it.

In announcing this result the Chairman informed the meeting that the Ministry would implement the call for banning of beach seining without delay. The following week the beach seine fishermen were served notices revoking their permits to fish within the Inner Sounds. Effectively this deprived them of their livelihoods, and the value of their investments in boats and gear, and, in the absence of alternative employment opportunities for several of them, confronted them with the prospect of having to abandon their homesteads and leave the district.

Economic Consequences of the Management Decision

According to the Fisheries Research Division Statistics Unit fourteen beach seine fishing permits to fish within the Inner Marlborough Sounds were effectively revoked by this managerial action. Since, as mechanical hauling of beach seine nets is not permitted, each permit gives employment to two fishermen, twenty eight employment opportunities were removed. The seafood processing industry in Havelock lost landings of about 65 tonnes of snapper and the added value derived from its processing and marketing, and onshore employment opportunities were correspondingly reduced.

Since no provision was concurrently made to spare the 65 tonnes of snapper from capture by trawling in other parts of its migrational range, the net effect of the management measure was to change the method of capture from beach seining to trawling. Trawling is a biotechnologically inferior method of catching snapper in two respects. Firstly the fuel oil cost per kilogram of snapper caught is much higher. Slack (1979) collected figures from operators of Nelson based trawlers which showed average catches of 2.99 kg of fish per litre for single trawlers, and 3.22 kg per litre for pair trawlers operating in Tasman and Golden Bays. Since then, as reported above, the catch rate of pair trawlers has fallen to less than half that for 1979 and the catch rate must be down to about 1.5 kg of snapper per litre of fuel oil consumed. By comparison the beach seiners operate much smaller boats, with very little travelling time between their homes and fishing grounds, and are prohibited from using power to haul their nets. Average catches of snapper by beach seining would be in the order of 20 to 30 kg per litre.

Secondly all the beach seined snapper is taken alive and in undamaged condition, whereas the general condition of trawl caught fish is low, fitting it for only the lower end of the market, or sometimes for condemnation as unfit for human consumption as reported above. Since the beach seine snapper are taken alive, however, the opportunity presents itself of holding these fish in sea pens and feeding them until they reach peak physiological condition. A readily available food supply exists in the form of blue mussels which are at present an unutilised by crop of the farmed green mussel production. The snapper can then be airfreighted to the sensitive "sashimi" market in Japan in quantities just sufficient to maintain the maximum premium price, having regard to the fact that the market is depressed by offerings exceeding two tonnes at any one time.

Interaction Between Mussel Farming, Beach Seining and Recreational Fishing

The damaging effect of predation by snapper on mussel crops in the Marlborough Sounds was reported by Jenkins (1978) in the early days of establishing the mussel farms in the Inner Sounds. Since then the existence of this readily available food supply appears to have been discovered by more snapper to the extent that predation by snapper on the mussel crops can cause a substantial loss. Even if methods of reducing predation are developed, they have a labour and materials cost which affect the profitability of mussel farming.

The most effective protection of the mussel farmers against snapper predation of their crops is assured by the existence of an operational group of beach seine fishermen living in close proximity to the mussel farms. The prime sites of operation of these fishermen are adjacent to the mussel farms and if an individual farmer observes his crop to be under attack he can call in the fishermen at short notice specifically to take the fish which are molesting his farm. This interest of mussel farmers showed in their vote against prohibiting beach seining in the Inner Sounds.

Recreational interest safeguarded. In opposition to the continued beach seining of snapper, whether or not it is beneficial to the mussel farmers, is the recreational fishing lobby. The recreational fishermen argue that a snapper taken by beach seining is a fish lost to the man with a rod and line. This stance is in itself questionable. Snapper with appetites more than satiated on tender live young mussels are unlikely to be very interested in the traditional recreationalist bait of dead squid. I would like to make a suggestion which offers a reconciliation of the recreational interest with that of mussel farmers and beach seiners.

Transplant the snapper alive. One of the Inner Sounds of Pelorus Sound, Kenepuru Sound is separated from Queen Charlotte Sound by a narrow range of hills. Queen Charlotte Sound contains the terminal for the arrival from North Island of the interisland road/rail ferries; it is located in the town of Picton, the major tourist centre of the Marlborough Sounds region. It contains many more hotels, motels, motorcamps, marinas, boating and sailing clubs and operators of charter recreational fishing boats than any other area of the Sounds. Sited within it there is only one mussel farm as compared to over two hundred in Pelorus Sound. There are two saddles between the hills separating Queen Charlotte from Kenepuru Sound transversed by reasonably good roads of only a kilometre or so in length. I conclude with a suggestion that the best solution of the problem of conflicting user interests which I have described above would be to allow the beach seine fishermen to continue operating and thereby protecting the numerous mussel farms in the Inner Pelorus and Kenepuru Sound from predation by snapper, with provision being made for their catch to be bought from them alive and held temporarily in sea pens or cages. These snapper could then be transplanted alive, either by helicopter and monsoon bucket, or by tank truck over one of the short routes into Queen Charlotte Sound. It is envisaged that the transplanted snapper would distribute themselves throughout Queen Charlotte Sound becoming available to recreational fishermen. Even the trawlermen might participate in the benefit as in the normal course of seasonal migrations, those fish which escaped the recreationalists would be likely to move out into the trawling grounds.

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Seafood Trade and Fisheries Management: Macro vs. Micro Models

Research in International Fisheries Trade: Methodologies and Techniques

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Introduction

Researchers today face numerous economic and methodological problems in specifying, estimating and simulating commodity trade models (Labys, 1975b). A primary source of these problems stem from the gap between the simplistic nature of models and the complexities of international models.

The major objective of this paper is to analyze the 'state of the art' of international fisheries trade models. In order to accomplish this objective, this paper is developed in several sections or subobjectives. First, trends in seafood trade are reviewed. Second, modeling methodologies often used in international trade are discussed. Third, past and current fisheries trade modeling research is reviewed. Fourth, recommendations are made for future seafood trade modeling.

Trends in Seafood Trade

Tables 1, 2, and 3 consist of data on world imports and exports of fishery products. The data source is the Yearbook of Fishery Statistics published by the Food and Agricultural Organization (FAO) of the United Nations.

Table 1 illustrates the trends in fisheries trade since 1960. The data indicate a sizeable increase in nominal and real import and export values in the 1980's. Real import and export trade values increased by 86% and 79%, respectively, from 1960 to 1970 and 150% and 169% respectively, from 1970 to 1980.

For the seven categories of seafood trade reported by FAO, fish (fresh, chilled or frozen) and crustaceans and molluscs have the largest import and export values (Table 2). In 1982, these two categories combined accounted for 68% and 67%, respectively, of nominal import and export trade value. Together, these two categories' share of imports and exports has increased from approximately 38% in 1960 to 50% in 1970.

Table 3 shows the four major seafood importers and exporters in 1980-1982. Japan and the United States are by far the major importers based on nominal import value. For seafood exports, unlike imports, there are no dominant exporting countries.

International Commodity Trade Models: An Overview

The intent of this overview is to examine different methodologies used to model international trade. I was fortunate to find other studies that had surveyed the international trade literature. Of particular assistance in this overview are separate works by Thompson (1981); Ryan (1979); Labys (1975a); and Taplin (1967). I have used these reviews as a basis and supplemented them with more current studies on international trade models.

International trade models are very diverse. As a starting point, I will define an international commodity model as a formal representation of a domestic commodity market with one or more foreign sectors. The behavioral relationships underlying these models reflect existing economic, political and social characteristics of the country or economy.

Trade models are generally simultaneous systems of equations characterizing behavior of a number of trading countries and/or regions and their interrelationships through the world market. Thompson describes three classes of trade models:

Table 1. World Exports and Imports of Fishery Products[1]

	1960	1965	1970	1975	1980	1982
EXPORTS						
Quantity (1000 MT)	4,054	6,290	7,328	7,677	10,080	10,597
Nominal Value (Million U.S.$)	1,212	1,943	2,894	6,361	15,098	15,299
Real Value[2] (Million U.S.$)	1,764	2,615	3,166	5,032	8,513	7,395
IMPORTS						
Quantity (1000 MT)	4,187	6,178	7,381	7,648	9,835	10,225
Nominal Value (Million U.S.$)	1,324	2,181	3,274	6,956	15,908	16,519
Real Value (Million U.S.$)	1,927	2,935	3,582	5,503	8,969	7,985

1. Fishery products include the following categories: fresh, chilled or frozen fish; dried, salted or smoked fish; fresh, frozen, dried, salted, etc. crustaceans and molluscs; fish products and preparations, whether or not in airtight containers; crustaceans and mollusc products and preparations, whether or not in airtight containers; oils and fats, crude or refined, of aquatic animal origins; and, meals, solubles and similar animal feedingstuffs, of aquatic animal origin.

   Number of reporting countries have varied between 150-170 countries over time period.

   Unit of measure: 1000 MT = thousand metric tons; and, value in million U.S. dollars.

   Source: Food and Agriculture Organization of the United Nations. Yearbook of Fishery Statistics. (various years).

2. Real values of exports and imports are calculated by dividing nominal values by the U.S. Gross National Product (GNP) deflator (1972 = 1.00).

   Source: U.S. Department of Commerce, Survey of Current Business. Bureau of Economic Analysis, (various issues).

Table 2. World Fisheries Trade by Major Categories

	1960	1965	1970	1975	1980	1982
FISH-FRESH						
IMPORTS						
Quantity (1000 MT)	1,189	1,611	1,979	2,669	4,166	4,306
Nominal Value (Million U.S.$)	350	608	978	2,310	5,846	6,274
EXPORTS						
Quantity (1000 MT)	1,128	1,724	2,046	2,904	4,319	4,392
Nominal Value (Million U.S.$)	324	567	870	2,214	5,502	5,630
FISH-DRIED						
IMPORTS						
Quantity (1000 MT)	584	483	494	402	423	384
Nominal Value (Million U.S.$)	204	219	286	598	1,217	1,142
EXPORTS						
Quantity (1000 MT)	554	503	519	428	485	461
Nominal Value (Million U.S.$)	182	215	270	595	1,292	1,161
CRUSTACEANS						
IMPORTS						
Quantity (1000 MT)	226	346	492	804	1,109	1,228
Nominal Value (Million U.S.$)	154	332	666	1,800	4,381	4,977
EXPORTS						
Quantity (1000 MT)	210	293	439	732	1,045	1,189
Nominal Value (Million U.S.$)	143	266	537	1,588	4,039	4,675
FISH-CONTAINER						
IMPORTS						
Quantity (1000 MT)	516	514	605	714	970	907
Nominal Value (Million U.S.$)	324	383	481	988	2,152	1,940
EXPORTS						
Quantity (1000 MT)	505	522	606	741	983	893
Nominal Value (Million U.S.$)	314	367	474	969	2,167	1,929
CRUSTACEANS-CONTAINER						
IMPORTS						
Quantity (1000 MT)	52	78	102	127	170	193
Nominal Value (Million U.S.$)	54	104	164	367	803	867
EXPORTS						
Quantity (1000 MT)	45	60	73	80	128	162
Nominal Value (Million U.S.$)	48	80	124	260	641	682

Table 2. World Fisheries Trade by Major Categories (continued)

	1960	1965	1970	1975	1980	1982
OILS						
IMPORTS						
Quantity (1000 MT)	648	763	690	628	751	794
Nominal Value (Million U.S.$)	127	165	155	241	367	318
EXPORTS						
Quantity (1000 MT)	593	723	638	598	740	727
Nominal Value (Million U.S.$)	107	139	128	202	322	246
MEAL						
IMPORTS						
Quantity (1000 MT)	972	2,383	3,019	2,304	2,246	2,413
Nominal Value (Million U.S.$)	111	370	544	652	1,142	1,001
EXPORTS						
Quantity (1000 MT)	1,019	2,465	3,007	2,193	2,380	2,773
Nominal Value (Million U.S.$)	94	309	491	533	1,135	967

Source: Food and Agriculture Organization of the United Nations. Yearbook of Fishery Statistics. (various years).

Table 3. Major Fishery Exporting and Importing Countries in the 1980's

	1980	1981 (million U.S. dollars)	1982
Importing Countries:			
Japan	3,115	3,737	3,974
United States	2,633	2,988	3,175
France	1,131	1,043	1,036
United Kingdom	1,034	995	886
Exporting Countries:			
Canada	1,089	1,267	1,300
United States	993	1,142	1,034
Denmark	1,000	940	901
Japan	905	863	801

Source: Food and Agriculture Organization of the United Nations. 1982 Yearbook of Fishery Statistics. Vol. 55, 1984.

(i) nonspatial price equilibrium models,
(ii) spatial equilibrium models, and
(iii) trade flows or market share models.

These models are generally partial equilibrium models treating a single commodity or several commodities simultaneously. These three categories of international trade models differ in two aspects:

(i) nature of price linkages between trading countries and
(ii) the mathematical-statistical procedure (algorithm) used to solve the model.

Nonspatial price equilibrium models

Nonspatial price equilibrium models are generally comprised of simultaneous demand and supply relationships including export and import equations linked by a world market price. If the system of equations are linear then, the model is solved by matrix inversion. For non-linear systems of equations, iterative procedures such as the Gauss-Seidel technique (see Heien, Mathews and Womack, 1973) can be used.

A few examples of studies in this category are Reutlinger (1981, wheat); Abbott (1979, grains), and Fischer and Froberg (1980, 19 commodities IIASA model). The limitation of these models is the difficulty in estimating export and import equations involving source-destination trade flows for several trade partners.

Spatial equilibrium models

Geographical price relationships can be analyzed by using spatial equilibrium models. These models permit estimation of prices in each country and the quantity of each commodity produced and sold in each country.

Assuming competitive markets, spatial price relationships are dependent on transfer costs between countries. These transfer costs are transportation and handling charges. Price differences between regions cannot exceed transfer costs due to the competitive nature of the market (see Tomek and Robinson, 1981).

Spatial equilibrium models are very useful in evaluating interregional price relationships and trade patterns in the case of numerous producing and consuming countries. Spatial temporal models have incorporated linear programming (LP), quadratic programming (QP) and modified LP and QP algorithms. One of the first spatial equilibrium models developed in a mathematical programming format was formulated by Samuelson (1952). He essentially adapted the interspatial market problem to a standard problem in linear programming. Judge and Wallace (1958) extended this analysis and showed that regional price differences can also be calculated from the dual solution of the LP problem.

In the Samuelson partial equilibrium (one commodity) model, the problem of descriptive price behavior is artificially converted into a problem of maximizing net social welfare. For any region, net social welfare is derived by determining the value of the area under the excess demand curve. Takayama and Judge (1964) converted the Samuelson formulation into a quadratic programming (QP) problem. This technique allows for the representation of spatially distinct regions separated by transportation costs and having continuous supply and demand functions.

A major drawback of the Takayama-Judge spatial/temporal equilibrium model is the requirement of a symmetric Q matrix for creation of the consumer and producer welfare function. Bartilson, Zepp and Takayama (1978) have developed a linear complementary programming (LCP) model which permits determination of market equilibrium prices and quantities with an asymmetric Q matrix. In the LCP framework, the objective function is no longer necessary. Briefly, LCP modeling represents a market oriented approach that:

(i) allows prices and quantities to be endogenous,
(ii) allows inclusion of technical and political constraints,
(iii) satisfies conditions for a Marshallian market equilibrium,
(iv) allows constraints to be placed directly on prices and quantities, and
(v) has an efficient solution procedure.

Spatial price equilibrium models are probably the most common type of agricultural trade models dealing with comparative statics analysis. Examples of research done utilizing spatial equilibrium commodities are Hashimoto (1977, multi-commodity, two region model), Shei and Thompson (1977, wheat), Hammig et al. (1981, sugar) and Pieri, Meilke and MacAulay (1977, pork). This approach has the advantage over other modeling methods in terms of generating information on trade flows and market shares and its relative ease in introducing trade barriers for policy analyses.

The shortcomings of spatial price equilibrium models are two-fold. First, data deficiencies may be severe, especially in terms of difficulty in obtaining reliable data on transportation costs. Second, specification error may arise since these models capture only a portion of the commodity's market. For instance, often times cross price effects, weather and price expectations are excluded from the supply and demand equations.

Market share or trade flow models

This third classification of trade models has utilized two basic approaches. The first technique assumes that the market shares are either constant or stochastic. If the market share is assumed to be constant, then historical trade flows can be analyzed. The probabilistic trade flow approach calculates the probability of any particular shipment originating in a particular country A and terminating in another country B. Markov models and transition probability models have been used for this stochastic estimation technique (see Dent, 1967).

The second type of market share model estimates total import demand for each country or region and separate market share equations for the U.S. and other exporting countries. Tsujii (1973, world rice) and Fisher (1977, Australian wheat) have employed this approach.

A Review of Fisheries Trade Modeling Research[1]

Modeling of international fisheries trade can be classified broadly in two categories: aggregate fish and/or shellfish models and specie specific models. The majority of studies found were in the latter area. Primary advantages of specie specific models are reduction of aggregation data bias and ability to evaluate specie trade flows and trade policy analyses.

There have been only a few studies utilizing an aggregate fish and shellfish modeling framework. Hassan (1977) formulated a monthly U.S. econometric model of edible fish and shellfish. Several versions of a simultaneous equations model were used to evaluate equilibrating forces in this market.

Hassan's model is outlined in Figure 1. The trade component is exogenized through a market equilibrium identity condition.

Hassan indicates that data availability and aggregation problems were shortcomings of the model. In particular, a representative price series for aggregate fish and shellfish was lacking and data were not available for tonnage of fishing vessels separated into landings for human consumption and landings for industrial use.

Yanagida (1983) proposes use of an alternative nonspatial price equilibrium model. This aggregate fish and shellfish model has five parts: (i) production, (ii) supply, (iii) domestic landings and wholesale demands, (iv) retail demand and (v) trade. Unlike the Hassan model, imports and exports are solved endogenously. The modeling technique proposed is three stage least squares. The data problems found in Hassan's model would also be shortcoming in the Yanagida study.

Specie specific models have been estimated for many fish and shellfish, in particular, numerous studies exist for salmon, shrimp and groundfish. However, these models often exclude a trade component (Prochaska, 1978; Tsoa et al., 1982; and Yanagida and Tyson, 1984).

There seems to be two general features of specie specific trade models. First, these models fall into the category of nonspatial price equilibrium models. Second, a popular specie studied is shrimp.

Perhaps the pioneer study in this area was done by Doll (1972). Utilizing a five equation U.S. shrimp model, imports were incorporated as an exogenous variable. Shrimp imports were found to reduce ex-vessel prices but did not contribute substantially to price variability.

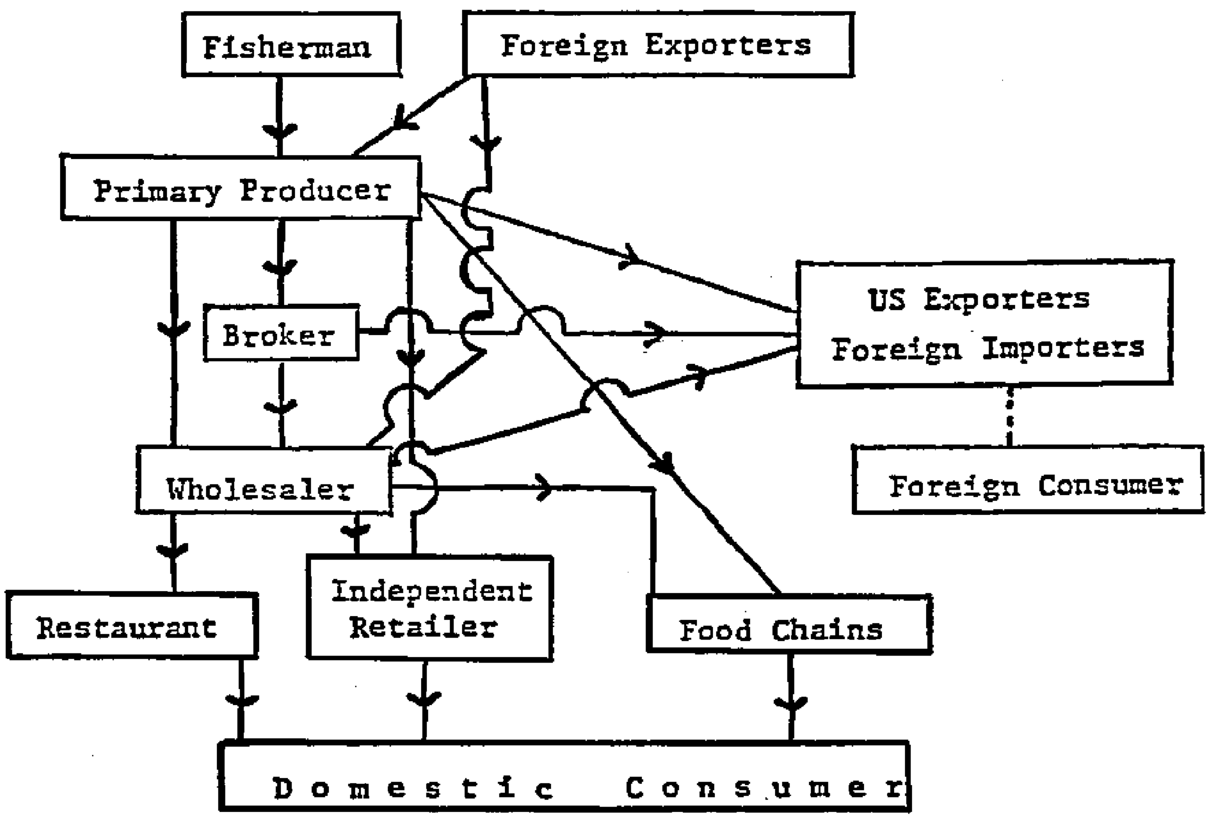
Research in the 1980's has produced several studies on shrimp (Prochaska and Cato, 1981; Blomo et al., 1982; Hopkins et al., 1983; and Prochaska and Keithly, 1984). Blomo et al. estimated a system of equations with two-stage least squares. In this study, imports of all shrimp are solved endogenously with imports affecting U.S. landings and prices by different size groups. Hopkins et al. employed a similar annual modeling framework. Imports are treated endogenously and formulated as a function of lagged ex-vessel price and lagged U.S. shrimp imports. Prochaska and Keithly analyzed U.S. shrimp import demand and world shrimp supply to the U.S. with a simultaneous equations model to determine import price, import quantity and tax revenues generated from proposed quotas and/or tariffs.

Summary of Fisheries Trade Models

There has not been much modeling of seafood trade in comparison to other commodity groups such as grains or livestock. International trade modeling activity for fish and shellfish has generally been specie specific and primarily involving estimation of nonspatial price equilibrium models.

Fisheries trade research has concentrated on models incorporating an endogenous or exogenous trade component for either trade between the domestic country and the rest-of-the-world or trade between two countries or regions. For this type of research, econometric models are appropriate. However, to analyze multi-country or multi-region trade flows, nonspatial price equilibrium modeling may be cumbersome. Spatial equilibrium models can more easily handle these situations.

Figure 1: Hassan's Model



The Distribution of Fish and Shellfish.

There are two other trade modeling issues that deserve discussion. First, do transactions in the seafood market take place in equilibrium or disequilibrium? Second, should fisheries trade research consider product differentiation models for individual species?

For the former question, Bockstael (1983) discussed disequilibrium in seafood trade modeling at the 1982 Alaska International Seafood Trade Conference. She cited several reasons why a disequilibrium model may be more appropriate.[2] Notably, disequilibrium economics is likely when the market mechanism adjusts slowly. In the seafood market, inventories cannot exist for fresh seafood products negating possible inventory adjustments. Also, institutional constraints such as quotas and tariffs prevent the market mechanism from operating efficiently. Furthermore, seafood trade prices often are agreed upon earlier or may be sticky due to transportation costs precluding adjustments to desired demand and supply quantities. Simultaneous equations models are still appropriate for seafood trade modeling under market disequilibrium. However, the actual quantity transacted is no longer an identity with desired levels of quantity demanded and quantity supplied. Also, price stickiness can be incorporated with a partial adjustment model.

The latter question explores the possibility of incorporating product differentiation in seafood trade modeling.[3] Heterogeneity among seafood species is recognized and accounted for in limited fashion by specie size differences (e.g., shrimp).

Pagoulatos and Lopez (1983) propose an agricultural trade model for the case of differentiated products. They indicate that two-way trade (i.e., a country both importing and exporting certain products) suggests the possibility that products are differentiated internationally. Their model incorporates Lancaster's characteristics approach to product differentiation as a theoretical basis for analysis.

By relaxing the assumption of perfect substitutability between traded commodities, Pagoulatos and Lopez use Hanoch's constant ratio of elasticity of substitution homothethic (CRESH) function to estimate product-demand. Here, it is assumed that consumers differentiate among varieties of the same good on the basis of their country of origin. Once formulated, this modeling framework can evaluate policy implications from export subsidies and exchange rate changes.

Notes

1. This summary of fisheries trade modeling is based primarily on studies done in the U.S.

2. Other references for disequilibrium modeling include Ferguson, 1983; Ziemer and White, 1982; and Baumes and Womack, 1979.

3. See Johnson, Greenes and Thursby, 1979; and Sarris, 1981; for further research on product differentiation in agricultural trade.

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Seafood Trade and Fisheries Management: Macro vs. Micro Models

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New Regimes

During the last two decades most research within fisheries economics has been addressed to management problems related to exploitation of fish resources. Issues related to trade in fishery products have been of minor importance to fisheries economists, although trade problems especially have been of great importance to the fishing industry.

I think, the majority of managers within the fishing industry have been reluctant to realize that overfishing and declining stocks of certain species were problems they had to face. Although the amount of raw materials of fish was less abundant than previously, production was dependent on several other parameters. It was possible to substitute one species for another, to develop new products and markets, to rationalize and, to some extent, also to control wages and raise product prices. These parameters were in control of the managers, while managing the exploitation of fish resources called for political decisions due to the common property nature of the stocks.

After several countries extended their fishing limits in the late 70's, it has been obvious that the fishing industry has great interest in the conduction of exploitation of stocks. I think, therefore, that the industry will come to play a more important role in the future attempting to influence management and thereby the allocation of raw materials. Furthermore, changes in trade patterns have appeared in the late 70's because some major countries within fisheries have been expelled from traditional fishing grounds.

These changes mean that fishery stock management and trade in fishery products have been linked together more closely, and proper solutions call for closer cooperation between managers within the industry, civil servants and politicians.

Macro- vs. Microeconomic Models

Under the new regime it might be relevant to ask how can economists contribute? Is it reasonable to continue to apply microeconomic models, which normally are related to the individual firm and consumer, or do we have to apply macroeconomic models, which deal with aggregate figures?

These questions are difficult to answer, because it is very hard to decide what is microeconomics, and what is macroeconomics. Textbooks give no clear definitions. They state that macroeconomics deals with aggregations on variables: i.e. how incomes are determined and why and how they fluctuate; how job opportunities and price levels fluctuate; how money and banking fit in, and how fiscal and monetary policies can keep the aggregate system working.

Microeconomics is said to be dealing with determination of relative prices of particular goods and factors of production, and with quantitative breakdown of the national income aggregates into goods and services.

From the fishing industry's point of view microeconomic modelling seems to be applicable, as it comprises the behaviour of the individual consumer, firm or market. From the point of view of society macroeconomic modelling seems to be attractive, as it is not the behaviour of the individual consumer or firm, but how and why aggregate figures of income, employment, foreign trade, etc. change, which is of interest.

Textbooks on economics also state that macro- and microeconomics are so closely related that one of them cannot be fully understood without knowledge of the other. As mentioned above the new regime has implied that managers of the fishing industry have been more or less forced to worry about aggregate figures. It implies that macroeconomic analyses play an increasing role in their decision making. Society, on the other hand, has increasingly to be concerned with income distribution and regional problems, which demand microeconomic analyses.

Although it can be very useful to understand the differences between macro- and microeconomic analyses it is hardly appropriate to carry the distinction far, when issues within fisheries economics and trade are investigated. It is more fruitful to analyse problems by application of a proper model for each specific case. A proper model might consist of both macro- and microeconomic elements, and it can be formulated in prose, geometry, mathematics or in computer language, depending on the complexity of the model and the taste of the scientist. But no matter what form of model is chosen, it must be obligate to present results in an understandable mode to ensure communication between various groups of people working within and in relation to the fishing industry.

Construction of Models

How do we work out a proper model? It is in no way an easy matter. In economics the goal of model construction is usually to make predictions. What will happen to stock sizes of particular species if fishing effort is increased or decreased? Or, what quantity of commodities can be exported in the future? etc.

Very often managers of the fishing industry are able to predict future developments precisely, because of long experience. But they are usually not able to explain the prediction, i.e. the parameters or the assumptions which make them predict the way they do.

Scientists seldom have great practical experience within technics or business administration, but they have experience in model construction, which means they are experienced in finding explanations to a phenomenon. In fact these explanations are only assumptions, but the explanatory power is strong, if these assumptions logically lead to the phenomenon. If we are able to explain a phenomenon, we are able to make predictions, and we are also in a good position to predict what will happen if some of the assumptions are changed.

It is well known to the scientist that model construction includes several steps:[1] a) identification of the problem, b) preliminary model formulation, c) data collection, d) parameter estimation and e) model tests.

To others not familiar with this process, let me give an example. Imagine that our phenomenon is that people are complaining about the seats in an aircraft. Then our problem may be the design of the seats, but not necessarily. Then we construct a model of the seat. We do not have to build the whole aircraft, we just have to know that the shape of the aircraft imposes certain constraints on the volume of the seat. If various persons are placed on the seat, and the reactions of the seat are observed, we are able to explain why people are complaining. Corrections of the seat can be made and from our model we can predict the result. We may not be able to explain why people complain by just building and testing seats. The reason may be that nothing is wrong with the seat, as the cause of the complaints is to be found elsewhere inside or outside the aircraft. We must reject the model and build a new one.

Similar to that we do not need perfect knowledge of the entire environment of the sea and society to make qualified treatments of particular problems related to that environment. It is almost certain that we never get to a position of full knowledge. But it is crucial to evaluate to which extent imperfect or missing information is influencing the explanatory power of the model. In that way biological information has been ascribed major explanatory power, when constructing economic management models, while information about trade or fluctuations in demand for fish have not.

Fisheries Management and Trade

Most models constructed previously are constructed in order to explain phenomena within either management of fish stocks or trade in fish.

As one of the most distinguished goals in model construction ought to be simplicity without losing explanatory power, models within fisheries management normally are confined to fisheries activities and biological characteristics of the resources. These models are aiming to explain why and how sizes of fishery stocks fluctuated because of fishing, and what could be done in order to create equilibrium, subject to particular goals.

Similar to that, phenomena within trade in fish are normally explained without explicit inclusion of activities within fisheries. According to the aircraft example, this distinction seems to be convincing.

Topics within management of fisheries resources have often been analysed by application of price theory and neoclassical capital theory, while topics within international trade have been analysed by application of theory of comparative advantages, which is connected also with neoclassical theory. This theory tries to explain why trade occurs, which commodities will be traded, and what will be the impact on income, employment and prices, but it cannot explain the volume of trade. Other theories, i.e. the theory of gravitation, have successfully explained the volume, but not which commodities will be traded.

The theory of international trade have been formulated due to the questions asked: why trade occurs, what are the obstacles of trade and what are the impacts of trade. The general theory can provide good answers to many questions within trade in fish. But more specific answers demand more specific analysis.

If we look at the trade pattern for major im- and exporters of fish,[2] it reveals that trade mainly occurs between countries located near each other. About 90% of Japan's imports from developed countries is supplied from the USA and Canada. Among developing countries the Republic of Korea and Taiwan are major exporters to Japan. About 50% of the USA's imports from developed countries is supplied from Canada, and Mexico is supplying 20-25% of the USA's imports from developing countries. A similar trade pattern can be demonstrated for the European countries.

This trade pattern could previously be explained by the theories of comparative advantages and gravitation, without explicit inclusion of changes in supply caused by overfishing. With extension of the fishing limits, with several species being restored after breakdowns and with new regulatory schemes new and more specific questions arise. Some questions that have been asked, are how will reallocation of fishing effort due to extensions of fishing limits affect international trade? And how will quotas affect trade?

Micro- and Macroeconomic Model Approaches

A topic, I have been working with occasionally during the last year, is the reopening of the herring fishery in the North East Atlantic, particularly the problems related to the North Sea opening. This fishery has been abandoned since 1977. Several countries have interest in herring fishery in the North Sea, and herring commodities are traded widely. So, the topic has to be regarded by inclusion of both bioeconomic issues and trade issues.

The goal function I have applied has been maximization of gross economic yield in the long run, as very little is known about cost in the herring fishery. To solve this problem investment theory has been applied and a dynamic bioeconomic Beverton-Holt based model has been constructed, in order to calculate the optimal starting point in time for the fishery on a year class. The optimal starting point in time is dependent on the values of several variables, i.e. recruitment, natural mortality, fishing mortality, growth of the year class, the price of fish, and whether catches are meant for human consumption or for fishmeal. Influences of trade are not regarded in this version of the model, although it is clear that trade has impact on prices and utilization of catches. Clearly, the model will gain in explanatory power if trade is modelled explicitly.

Although, dealing with aggregate figures this model approach, in my opinion, is based on microeconomics, as assumptions of behaviour of individuals form basis of the aggregates.

It seems to be exaggerated to construct a macroeconomic model aiming to evaluate the impact of the reopening of the herring fishery on macroeconomic variables, i.e. balance of payments, employment and income. But, I think, it is most pertinent to apply macroeconomic models when exploring social economic influences of regulatory schemes. I have previously been working with that topic by application of input-output models, attempting to evaluate the impact of fluctuating, but exogenously determined total allowable catches (TAC's) and quota allocations on various macroeconomic variables.

At our institute in Denmark we are now extending this approach. As quota regulation is widely adopted, we feel it may be reasonable to attach greater importance to social economic issues rather than to bioeconomic issues. It does not mean that bioeconomics are no longer important, only that TAC's and quotas exogenously fixed call for another type of analysis, in which greater emphasis is devoted to evaluations of regulatory schemes influence on certain macroeconomic variables. If such models were already accessible, they could most likely be applied on the herring subject.

However, not much work has been done internationally within construction of macroeconomic fisheries models. Therefore, let me finally express that we are very interested in exchange of experience and information with individuals or departments working with or just interested in similar approaches.

Notes

1. See Cohen and Cyert (1965): Theory of the Firm, Prentice-Hall, Inc., United Kingdom, Ch. 2.

2. Infofish Marketing Digest No. 5/83.

Market Models

The Use of Japanese Market Statistics for the Prediction of the Ex-Vessel Price for Bristol Bay Sockeye (Red) Salmon

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Introduction

In 1884, just 100 years ago, the first salmon cannery was established on the Nushagak River flowing into Bristol Bay (Alaska). The resource was abundant, the market good and the industry grew rapidly, reaching an initial peak of nearly 25 million sockeye salmon (62,500 mt) in 1917, a second peak in 1938 and a third peak in 1965, all of about the same size. Until the mid-1970's, almost all of the catch was canned and over the years, the processors and fishermen had grown up with the system, understood the cannery operations and limitations, and had developed familiar marketing channels, and pricing and negotiating patterns. In 1977, the picture began to change. The Japanese high-seas salmon fishery, which was the main source of their supply of sockeye salmon, was sharply curtailed by the enactment of the 200-mile fishery/economic zones of the United States, Canada and the USSR. Japanese buyers turned to Bristol Bay and other areas in Alaska for their supply of sockeye salmon, and to satisfy that demand, the salmon industry rapidly converted from a canning to a freezing operation. The production of frozen sockeye salmon for export to Japan grew rapidly and by 1982, had exceeded that of canned salmon.

Although at first, the sale of frozen salmon to Japan was by contract between the larger U.S. companies and their Japanese counterparts, beginning about 1982, there was an influx of buyers from the medium and smaller Japanese companies plus a number of independent "cash buyers." This was a new experience for the Bristol Bay fishermen, their marketing associations and coops; they had little concept of foreign market conditions and prices, and they were "lost" in negotiating with the foreign buyers. Over these past several years, there have been a flood of letters, mini-reports, news articles, workshops and seminars aimed at the general problems of how to sell salmon and other fish to Japan. There are two questions most frequently asked by the Bristol Bay salmon processors and fishermen: (1) What are the costs of marketing salmon in Japan, and (2) what will the ex-vessel price be for the coming year -- information needed by the fishermen and the companies in their annual ex-vessel price negotiations and in the sale of their fish to the Japanese buyers. Whatever the method, the fishermen and smaller companies want it to be simple, easily understood and requiring a minimum of data, and of course, to be reasonably accurate.

This study reviews the development of several methods that are quite applicable in answering the questions posed by the Bristol Bay fishermen and processors. Certainly, the costs of handling and marketing are fixed and quite stable. Prediction is more difficult and it is recognized that the several methods proposed here for prediction of market, ex-vessel and other costs are far from perfect but they are easy to understand and use and the results, if market conditions are somewhat normal, can be surprisingly accurate. Perhaps these methods will be of some help in answering similar questions in other fisheries and other countries.

Source of Market Statistics

Over the years, a number of Japanese sources of statistical information have been examined for marketing detail on fish and shellfish and various seafood products in order to establish a consistent base price for the study of market conditions and trends. Although there are some exceptions for specialized products, the best sources of statistical information applicable to the marketing of United States and Canadian fishery products, especially salmon, are summarized below:

(1) The volume and wholesale prices for fish and product landed at 67 of the most important Japanese ports (i.e., "production wholesale markets") are given in the annual statistical yearbook, Suisan butsu ryutsu tokei nenpo, published by the Japan Ministry of Agriculture, Forestry and Fisheries in Japanese only. A summary of these statistics, though not as complete, are given in the Monthly

Statistics of Agriculture, Forestry and Fisheries and in Fishery Statistics of Japan, both published in Japanese/English and English respectively by the Ministry of Agriculture, Forestry and Fisheries.

These statistics, as we find in many of the Japanese statistical sources, divide salmon into two categories: Sake which combines chum, sockeye, silver and chinook salmon together, and masu, commonly referred to as "sea trout" or just "trout," which includes pink and cherry (or Japanese) salmon. At the present time, the landings at these ports are almost entirely chum salmon from the Japanese coastal/river and land-based fisheries, mainly from Japanese hatchery production, with a lesser amount of pink salmon and a negligible amount of sockeye, silver, chinook and cherry salmon.

(2) The "consumer wholesale market" prices are the key to any marketing study and are available in some detail in the publications by the Japan Ministry of Agriculture, Forestry and Fisheries noted in (1) above. Generally, however, the available data are combined into groups of fish and fishery products, too large for many marketing studies. For example, salmon is again divided into the familiar sake and masu. As far as we have been able to determine, the best source of consumer wholesale market prices is found in the statistical yearbooks of the Tokyo Central Wholesale Market (Tokyo-to chuo oroshiuri ichiba nenpo: Suisan butsu), published by the Tokyo Municipal Government.

The Tokyo Central Wholesale Market (Tsukiji) is the largest consumer wholesale fish market in Japan and probably in the world. The market proper covers an area of about 22.5 hectares, located between 1 and 2 kilometers from the Ginza (the center of Tokyo), and in 1983, the market handled 818,000 mt total of fresh and processed seafood products, or nearly equal to one third of the total U.S. catch. About 50 percent of the sales are by auction and the remainder by written bid or tender, or at a fixed price. The commission that the seven government-licensed brokers may charge is fixed by law at 5.5 percent for fishery products. The operation of the market is by the Tokyo Municipal Government, overseeing the entire operation, compiling the statistics, inspecting the products and regularly auditing the brokers for any indication of dishonest sales or reporting.

The Tokyo Central Wholesale Market statistical yearbooks are published in Japanese only, every March after the end of the preceding reporting year. The main series of tables give the annual amount sold (in kg) and the value (in yen) for nearly 400 kinds of fish, shellfish, crustacea, seaweed and the various seafood products, by month and yearly total for the most recent five years. A second table provides the average wholesale prices for all items in the main table and avoids calculation of those values.

Not only do the statistical yearbooks of the Tokyo Central Wholesale Market provide wholesale prices of frozen sockeye salmon (benizake) but also handles about 10 percent of all frozen salmon entering Japan, either from the domestic fisheries or from imports.

(3) Export/import statistics and the source of C&F prices are available in the comprehensive trade statistics (Nihon boeki geppo) published by the Japan Ministry of Finance/Japan Customs Association. These statistics are reproduced monthly for fishery products in Imports of Marine Products by country and commodity from the Japan Marine Products Import Association and in the Foreign Fisheries Information Releases by the U.S. Department of Commerce, National Marine Fisheries Service (Terminal Island, California). All three sources are in Japanese/English or English.

(4) Since 1981, the United States exports by commodity and country by area of export and a valuable source of U.S. FOB prices, have been published by the Resource Statistics Division of the U.S. Department of Commerce, National Marine Fisheries Service. Similar data have also been published by Canada Fisheries and Oceans, Pacific Region since 1981 (viz., Fish Product Exports of British Columbia). Both sources of statistics provide detail by salmon species and product form.

(5) Ex-vessel prices for salmon, by area and species, are generally available from the Alaska Department of Fish and Game, Juneau and similar state agencies of Washington, Oregon and California, and from Canada Fisheries and Oceans, Pacific Region (Vancouver). This information is reproduced from time to time in the Fishery Market News of the U.S. Department of Commerce, National Marine Fisheries Service, Seattle.

The above references are considered to be the standard sources of information for U.S./Japan marketing studies. There are, of course, a number of other sources of information found in the six or more fishery economic newspapers published in Japan and providing daily market prices for a number of products. These same newspapers also contain on occasion special news articles on market conditions for specific products, with tables and other material not generally available in other references and can provide valuable supplemental information for a study. Bill Atkinson's News Report, published by an Associate, provides summary translations of the more important articles and current market prices from these newspapers each week.

Costs of Marketing Bristol Bay Sockeye (Red) Salmon in Japan

One of the most frequent questions asked by the fishermen and processing companies in Alaska relate to the costs of marketing seafood products in Japan. Although the level of wholesale market prices for various fish/shellfish and seafood products in Tokyo and Japan is not too difficult to obtain by the fishermen and the processors, there is little information available to them itemizing the internal costs of marketing their product in Japan and most of all, they want to know why the big spread between the price they are paid and the wholesale market price in Japan. These costs for marketing sockeye salmon are itemized in Table 1 and explained in some detail below:

(1) Tokyo wholesale market prices are taken directly from the statistical yearbooks published by the Tokyo Central Wholesale Market (Tsukiji). The monthly and annual amounts sold and the prices obtained for frozen sockeye salmon (benizake) are available from about 1971 to the present, for all grades, sizes, domestic landings and imports combined. Nearly all of the sockeye salmon handled in the market, however, are top grade with the lower grades being sold directly by the importers/brokers to the processors outside of the market.

(2) Tokyo wholesale market commission is established by the government at 5.5 percent of the auctioned price and is included in the base statistics referred to above.

(3) Domestic shipping costs are for the transfer of product from the port of landing to Tokyo. The average distance shipped would be from, say, Osaka or Sendai to Tokyo and would cost about 10 yen/kg. Local shipping costs are about 1 yen/kg.

(4) Cold storage costs consist of a 12 yen/kg "in and out" charge and a 6.6 yen/kg charge per four of cold storage. The average time that salmon are kep in cold storage before marketing is about four months, or 26.4 yen/kg, or a total cost of 38.4 yen/kg.

(5) Forwarding agent's charges are 6.6 yen/kg and include dockside handling, inspection, etc.

(6) Company's commission is highly variable but estimated at about 3 percent of the C&F value.

(7) Ussance charge is based upon an annual bank rate of 8.5 percent, or 0.7 percent per month. A five month period is used, consisting of one month in transit plus four months in storage, or a total of 3.5 percent of the C&F value.

(8) Insurance is 1 percent of the C&F value.

(9) Import duty is now fixed at a rate of 5.5 percent of the C&F value for frozen salmon.

(10) C&F price should approximate the Tokyo wholesale market price less all of the above handling and marketing costs. Unfortunately, the Japanese import statistics lump all chilled/frozen salmon together into one category with no separation by species. Bristol Bay salmon, however, dominate the imports of salmon from the United States and the statistics do provide a very approximate check at this point between the actual declared C&F price and the estimated price. As shown in Table 1, the deviations of the estimated from the actual C&F price range from minus 4.8 percent (1983) to plus 19.0 percent (1980).

(11) Ocean freight rates also vary widely, depending upon whether the shipment is in bulk or container, from an Alaskan port or from Seattle, or by a Japanese or Korean tramper or a commercial shipping line. Most of the Bristol Bay sockeye salmon are shipped to Japan by tramper at a cost of 75 to 85 yen/kg, or an average cost of 80 yen/kg.

(12) Conversion to U.S. measure, that is from yen/kg to US$/lb, is calculated at this point, the normal break between U.S. and Japanese charges. The rate of foreign exchange is usually associated with the time of arrival in Japan: For Bristol Bay salmon and allowing one month for transit, the average rate of foreign exchange for August, September and October would probably provide the best estimate.

(13) U.S. shipping agent's charge ranges between 3 and 5 cents/lb, or an average of 4 cents/lb.

(14) FOB price is estimated from the C&F price less the ocean freight and the shipping agent's charge. Again as a check, the estimated FOB price is compared with the declared FOB price obtained from the National Marine Fisheries Service statistical reports. The deviations of the estimated from the declared FOB value range from zero (1981) to minus 10.8 percent (1983), or an average of minus 6.5 percent.

Although the available Japanese import and United States export statistics lack sufficient detail to determine the declared C&F and FOB prices for Bristol Bay sockeye salmon alone, they do follow the expected deviations from the estimated values. For example, the declared C&F prices are for all salmon imported from the United States and although Bristol Bay sockeye salmon dominate the imports, there are still significant quantities of other lower priced salmon (i.e., pink, chum and coho salmon) being imported into Japan to depress the declared C&F prices for 1980, 1981 and 1982; the higher 1983 price is due to the effort to reduce an accumulation of inventory at a lower than the expected price. Similarly the general higher declared FOB prices are due to the higher-priced sockeye salmon from the other areas being combined with exports from Bristol Bay.

Table 1. Costs of Shipping, Handling and Marketing Bristol Bay Sockeye Salmon in the Tokyo Wholesale Market

Price or Cost Item	Units	Year			
		1980	1981	1982	1983
Tokyo wholesale market price	yen/kg	1,206	1,415	1,360	1,066
Tokyo market commission	yen/kg	63	74	71	56
Tokyo wholesale auction price	yen/kg	1,143	1,341	1,289	1,010
Domestic shipping costs	yen/kg	11	11	11	11
Cold storage costs	yen/kg	38	38	38	38
Forwarding agent's charge	yen/kg	7	7	7	7
Broker's commission (5% C&F)	yen/kg	29	34	33	25
Ussance charge (3.5% C&F)	yen/kg	34	40	38	30
Insurance (1% C&F)	yen/kg	10	11	11	8
Import duty (5.3% C&F)	yen/kg	51	60	58	45
C&F price Japan (Bristol Bay sockeye)	yen/kg	963	1,140	1,093	846
C&F price (all salmon)*	yen/kg	(809)	(1,094)	(993)	(889)
Ocean freight (tramper)	yen/kg	80	80	80	80
Total (yen/kg for conversion)	yen/kg	883	1,060	1,013	766
Foreign exchange rate	yen/US$	214	231	262	242
Total (US$/lb converted value)	US$/lb	1.87	2.08	1.75	1.44
US shipping agent charge	US$/lb	.04	.04	.04	.04
FOB price Bristol Bay	US$/lb	1.83	2.04	1.71	1.40
FOB price (US export reports)	US$/lb		(2.04)	(1.85)	(1.57)

*This statistic is for all species of salmon imported by Japan from the United States (Minato Shinbun, 1984).

Effect of Inventory on Tokyo Wholesale Market Price for Sockeye Salmon

Between 1970 and 1977, the inventories of frozen salmon in Japan fluctuated at a relatively low level, from about 5,900 mt to 13,100 mt, and imports from 2,200 mt to 15,100 mt. With the enactment of the 200-mile fishery/economic zones by the United States, Canada and the USSR, Japan's high-seas fisheries for salmon were basically eliminated from the eastern North Pacific and substantially reduced in the western North Pacific. In order to satisfy the Japanese demand for salmon, imports of frozen salmon rapidly increased from some 19,300 mt in 1977 to 49,800 mt in 1978, and to 107,700 mt in 1982 -- an "over-heated" market condition resulting from consumer "panic-buying" and the growing competition between Japanese companies and entrepreneurs for a source of frozen salmon. As a result, the inventories of frozen salmon (all species) at the end of March each year increased from 18,900 mt in 1978 to 22,700 mt in 1979 and to 34,800 mt in 1983. The shift between supply of sockeye salmon and imports of frozen salmon is shown in Figure 1.

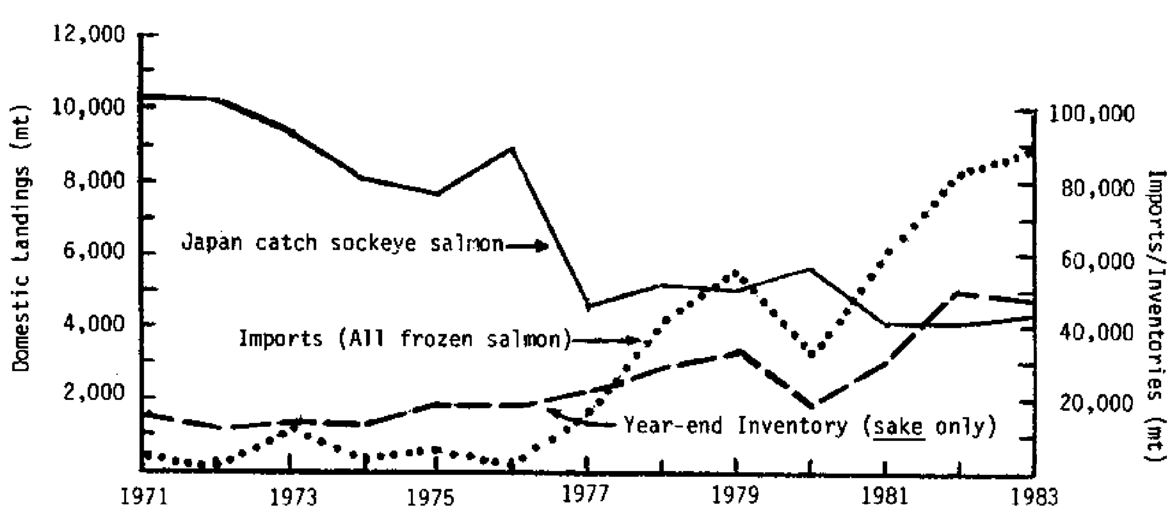

Figure 1. Trends in Japanese Landings of Sockeye Salmon, Imports of all Frozen Salmon and Year-End Inventories of Frozen Sake Salmon.

Any attempt to predict prices of Bristol Bay sockeye salmon over these past five years is clouded by the effect of the interrelated high levels of imports and inventories upon the expected wholesale market prices.

Perhaps the simplest way to determine the effect of inventory on price is to compare, in a time series, the changes in price and inventory for one year with that of the previous year (i.e., inventories for 1971/1970 vs. prices for 1971/1970, inventories for 1972/1971 vs. prices for 1972/1971, etc.), and determine the slope and error by standard methods of regression. This has been done for a series of values from 1971/1970 to 1983/1982 and the results plotted in Figure 2.

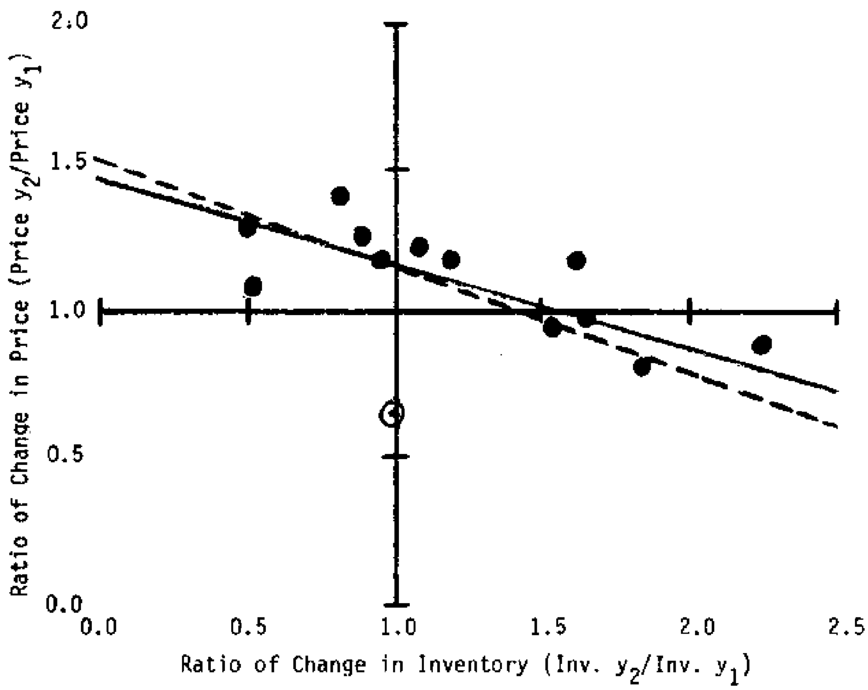

Figure 2. A Measure of the Effect of Year to Year Changes in Inventory on Price.

The broken line shown in the figure is the regression for all years (1971/1970 through 1983/1982), but you will note the abherrent value indicated by a circled dot. This value is for 1980/1979 -- a year of marked change in the composition of the supply of salmon sold in the Tokyo wholesale market (i.e., a shift from the predominantly domestic landed salmon to the lower-priced imported salmon). Although the value obtained for the following year (1981/1980), while adjustment was still taking place, is still a little low, the deviation is not large.

For reference, the following values were obtained in this analysis:

Regression for all years --

$$EY = 1.5195 - 0.3670X \quad (s(y \cdot x) = 0.2342)$$

Regression for all years except 1980/1979 --

$$EY = 1.4697 - 0.2928X \quad (s(y \cdot x) = 0.0313)$$

where

X = the change in inventory

EY = the estimated change in price

$s(y \cdot x)$ = standard error of estimate

Japanese statistics are not available for cold storage holdings by month for frozen sockeye salmon only and the figure reflects the relation between inventory for sake (i.e., sockeye, chum, coho and chinook salmon) and the Tokyo wholesale market price for frozen sockeye salmon. There is some competition between the various kinds of salmon in the consumer market and although no study has been made of this interspecies competition, the results here certainly show the general relation between inventory and price but lack the precision to be of practical use in predicting price. The average deviation between estimated and actual price is 263.5 yen/kg, with a range of minus 474 to plus 427 yen/kg.

Prediction of Tokyo Wholesale Market Price for Sockeye Salmon

In earlier studies (Atkinson, 1980, 1981), it was shown that the basic wholesale prices for most fish, shellfish, etc. and seafood products handled in the Japanese consumer wholesale markets increase from year-to-year in a geometric progression, primarily linked the annual rate of inflation in Japan. When transformed into semi-logarithmic form, the data lend themselves to simple linear analysis, providing a good average rate of increase for the series of wholesale prices and a basis for prediction of future prices. An example of this geometric progression of prices for all products handled in the Tokyo Wholesale Market is shown in Figure 3.

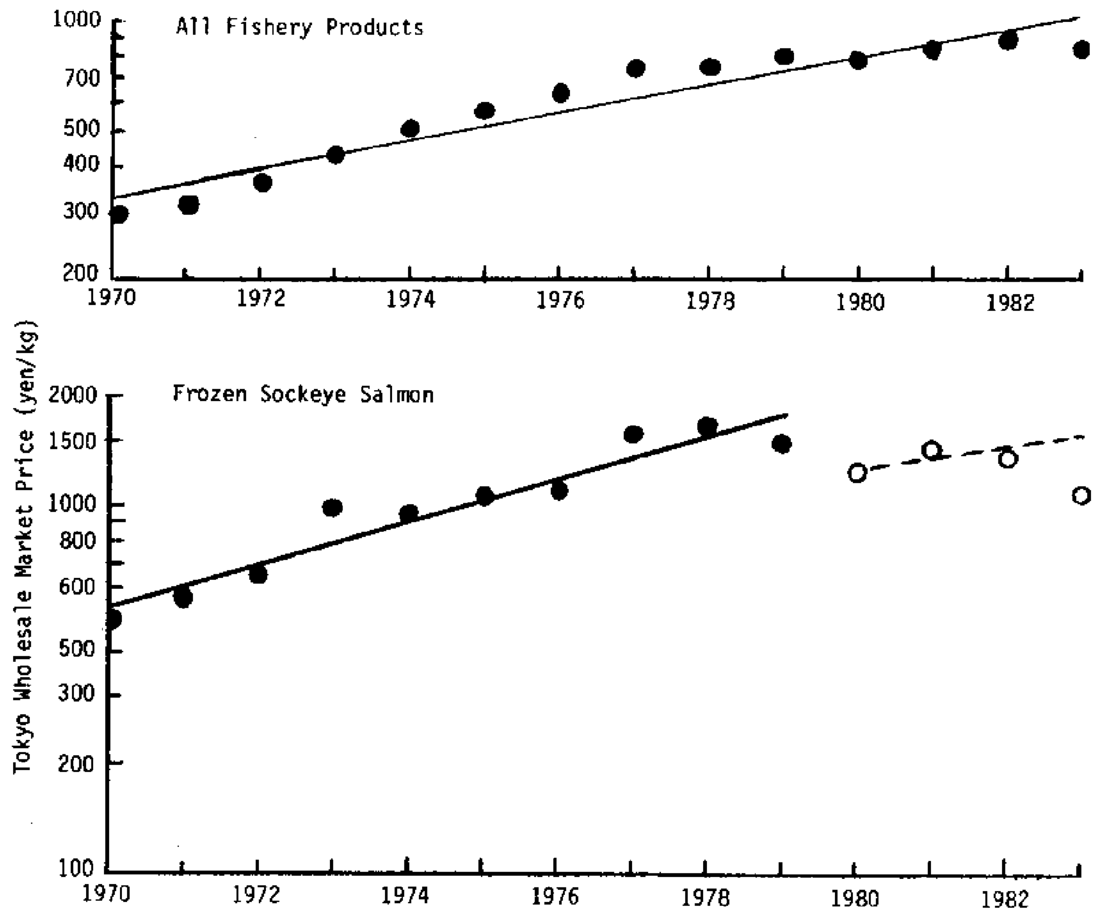

Figure 3. The Annual Average Prices at the Tokyo Wholesale Market for all Fishery Products and for Frozen Sockeye Salmon Plotted on a Logarithmic Scale.

As would be expected, there are major deviations from the trend lines. Most easily detected are the one year or short term "blips" caused by "over-heated" market conditions (e.g., extreme competition between Japanese buyers for control of the supply of product, consumer "panic-buying," etc.). More difficult to detect are the long term shifts in price trends associated with a change in the availability of resource (or supply), the development of new products or fisheries, a shift in the eating habits (or consumer preference), etc. Accordingly, although a valuable tool in studying and predicting market conditions for fishery products, this method also requires a continual monitoring of general market and economic conditions in Japan in order to detect any significant shift in the price trend.

Using this method, we have plotted in semi-log form the wholesale prices for frozen sockeye salmon sold in the Tokyo consumer wholesale market (Figure 3), and relatively good agreement is obtained between the calculated and actual prices between 1970 and 1979. Beginning in 1977, however, the composition of the supply of sockeye salmon available in Japan began to change from the domestically caught product to the lower priced imports (Figure 1). There was no immediate effect upon the wholesale price until 1979 when the actual price fell 15 percent below the predicted value. Even so, it was not until 1980, 1981 and 1982 that there was sufficient data to establish a new tentative trend line at the lower price level. To add to the difficulty, 1983 was an abherrent year, strongly influenced by the disposal of a heavy inventory of over-aged salmon at a sub-normal price. It is still too early to obtain an average wholesale price for 1984 from the Tokyo wholesale market statistical unit, particularly important at this time since it will allow confirmation or adjustment of the present tentative trend line.

If we accept the trend line established by the three points, 1980, 1981 and 1982, the predicted value for 1983 would have been 1,493 yen/kg (a deviation of some 427 yen/kg from the actual price), and the predicted value for 1984 (ignoring the 1983 value) would be 1,585 yen/kg.

Two base lines were tested during the course of this study in order to determine the best fit for predictive purposes. One set of data is based on the calendar year, the other upon a "salmon year" (i.e., from July 1 to June 30 of the following year, significant landings and imports of "new" salmon do not appear in the Japanese market until after the beginning of July). Surprising, calculations based on the calendar year data gave the best linear fit, possibly due to some carry-over of salmon and salmon prices into the new year. This relation needs further study and definition. A comparison of the two sets of data are given in the following table.

Table 2. The Comparison of Actual and Calculated Wholesale Prices Based Upon Calendar Year and "Salmon Year" Data

Calendar Year				Salmon Year			
Year	Wholesale Price (yen/kg)			Year	Wholesale Price (yen/kg)		
	Actual	Predicted	Difference		Actual	Predicted	Difference
1970	485	529	- 44	1970/71	496	553	- 57
1971	561	607	- 46	1971/72	565	635	- 70
1972	659	697	- 38	1972/73	760	728	+ 32
1973	993	801	+ 192	1973/74	925	836	+ 89
1974	945	919	+ 26	1974/75	929	959	- 30
1975	1,121	1,056	+ 65	1975/76	1,317	1,100	+ 217
1976	1,198	1,212	- 14	1976/77	1,432	1,261	+ 171
1977	1,503	1,393	+ 110	1977/78	1,489	1,447	+ 42
1978	1,614	1,598	+ 16	1978/79	1,667	1,600	+ 67
1979	1,568	1,835	- 267	1979/80	1,517	1,905	- 388
Average Difference: 81.8 yen/kg; US$ 0.154/lb				Average Difference: 116.3 yen/kg; US$ 0.220/lb			

During the last several years, alternate methods of analysis have been tried in an effort to find a more accurate method to predict wholesale prices for sockeye salmon in the Japanese markets. These have included the use of the annual rates of inflation, wholesale and consumer price indices, foreign exchange rates, etc., all of which are historically available and the predicted values made each year by the various government agencies and industry associations. Although it is expected that someday composite models will be developed that will combine these and other factors together to give a more precise predicted value, at the present time none of the above, treated separately, have provided the degree of accuracy found in the semi-log method described here. The real advantage for the fisherman, processor or broker is the simplicity of the method itself and a primary purpose of the study.

Determination of the Ex-Vessel Price of Sockeye Salmon by Formula

Some Japanese companies, in order to satisfy the American fishermen's often repeated desire to "sell their salmon directly in the Tokyo Market," have developed a mathematical approach for determining a fair ex-vessel price, based upon the actual selling price obtained for the fish in the Tokyo Market. In practice, this should really be considered, however, as a method of post-season price adjustment. In other words, the contracts will call for a base price to be paid at the time of delivery of the salmon to the buyer and the balance will be paid after sale of the fish in the market, perhaps two to four months later.

Following is the formula used by one of the Japanese buyers to determine the cost of the purchase of the fish from the fishermen, processing, shipping and marketing the salmon in the Tokyo wholesale market. The difference between the buyer's costs and the actual auction price in the market is profit and shared equally between the buyer and the fishermen.

The formula used was:

$$\frac{(Ev)(1.05) + (Pr) + (Te)}{0.75} + (Sh) \times (Jc) \times (Co) = (Bc)(1.055)$$

where

Ev = ex-vessel price
(1.05) = Alaska State raw fish tax (5%)
Pr = processing cost
Te = tender cost (transport of salmon from fishing vessels to plant)
(0.75) = recovery rate (weight of processed product/weight of raw fish)
Sh = shipping cost (ocean freight)
Jc = handling costs in Japan
Co = conversion from yen/kg to US$/lb (2.2046 x FX)
Bc = Japanese buyer's cost
(1.055) = Tokyo wholesale market commission (5.5%)

Assuming careful handling and processing to produce good quality salmon, the success of this method of price adjustment is primarily dependent upon the expertise of the buyer/broker in placing the salmon in the market at just the right time, even on the proper day, in order to obtain the highest price (and the greatest profit). Although the "offer" or "list" price in the market usually remains rather constant with slow incremental change, the actual daily auction price may vary something like 20 cents/lb from day to day. Thus, improper marketing can easily wipe out any profit due the fishermen from this type of price adjustment.

Prediction of Ex-Vessel Price for Bristol Bay Sockeye Salmon

The prediction of the ex-vessel price for Bristol Bay sockeye salmon is based upon the predicted Tokyo wholesale price, determined by the semi-log method described previously, and working backwards to the ex-vessel price. There are three methods that may be used: (1) Subtract the various processing, handling costs directly from the predicted market price, (2) calculate the ex-vessel price by formula given in the preceding section, or (3) use a simple multiplier to convert the wholesale price to the ex-vessel price. The latter method is the simplest to use and again, requires little additional data.

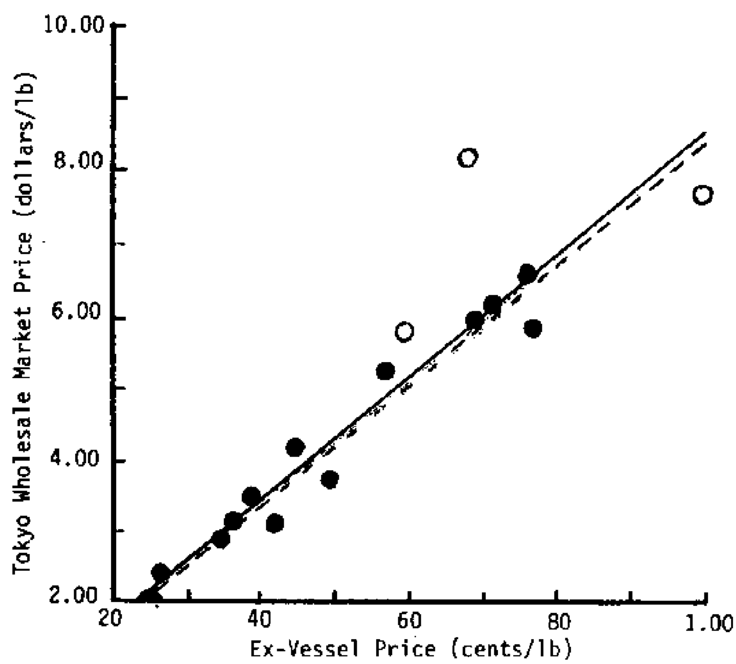

Figure 4. Relation Between the Ex-Vessel and the Tokyo Wholesale Market Prices for Bristol Bay Sockeye salmon. (Open circles are for the years 1977, 1978 and 1979 and the solid line is the trend.)

The relation between the predicted Tokyo consumer wholesale market price and the actual ex-vessel price for the years 1971 through 1984 is shown in Figure 4. To plot the data, the Tokyo wholesale market prices were converted to US$/lb, using the average rate of foreign exchange for that year. The ex-vessel prices are from the Alaska Department of Fish and Game, uncorrected for any post-season price adjustment that might have been paid the fishermen.

The ratios for ex-vessel price/Tokyo wholesale market price was determined for the series of years, 1971 through 1984, and the average of these values used to establish the predicted value. Using all years, the average ratio (or multiplier) was determined to 0.257 (stand. dev. of 0.0945), while if we delete the three years, 1977, 1978 and 1979, the years of "panic-buying" and market adjustment, then the average ratio would be 0.267 (stand. dev. of 0.052) and the variability reduced by almost half. In simple terms, the ex-vessel price for sockeye salmon in Bristol Bay is about 26 percent of the Tokyo wholesale market price.

Summary and Conclusions

Since the enactment of the United States 200-mile economic zone in 1976, the export of sockeye salmon, mainly from Bristol Bay (Alaska), has increased rapidly along with an increase in Japanese buyers and competition for product. This has been a new experience for many of the American companies and fishermen. Two questions are repeatedly asked: (1) Is the price being offered by the Japanese buyers a fair price, and (2) what will the wholesale price be in Japan and the ex-vessel price be in Bristol Bay or other areas in Alaska for the coming year (a base for negotiation)? The companies and the fishermen also want a simple method, one that they can understand and one requiring a minimum of data. This study explores several methods that may be used to answer these questions, briefly reviewed as follows:

(1) There are only three sources of reliable statistical information for sockeye salmon per se: The statistical yearbooks published by the Tokyo Central Wholesale Market (Tokyo Municipal Government), the statistical information compiled by the Alaska Department of Fish and Game for ex-vessel prices, and export/import statistics published by the United States Department of Commerce, National Marine Fisheries Service and Canada's Department of Fisheries and Oceans (Pacific Region). There are a number of other sources of market information published by the Japan Ministry of Agriculture, Forestry and Fisheries, the Ministry of Finance, and the Japan Marine Products Importers Association: The statistics are official and reliable but unfortunately, the species are lumped together, making analysis by species difficult and the results imprecise.

(2) The costs associated with the marketing of sockeye salmon in Japan (i.e., from a U.S. port through the Tokyo consumer wholesale market) are itemized and briefly discussed. The average costs of handling and marketing sockeye salmon in Japan (1984) are estimated to be 56 yen/kg plus 12.8 percent of the C&F value. Most of the sockeye salmon are shipped to Japan by Japanese tramper at an average cost of 80 yen/kg. The average cost for the U.S. shipping agent is about 4 cents per pound.

(3) The relation between Japanese inventory of salmon and the Tokyo wholesale market price for sockeye salmon may be expressed as a linear regression, and as would be expected, the larger the inventory, the lower the price. This method may also be used to estimate the predicted price but the variability is too great to be of practical value.

(4) The best method to predict the Tokyo wholesale market price for sockeye salmon is to convert the price information to logarithmic values and analyze as a linear time series. Two series of data were examined: One using wholesale prices for the calendar year and the other using wholesale prices for a "salmon year" (i.e., from July 1, when the new product arrives in the market, to the following June 30). At least for the period of years examined (1970 to 1979), the calendar year series of data provided the best fit.

Because of the change in the composition of frozen salmon handled in the Tokyo wholesale market beginning in 1977, the trend line broke in 1979, and a new trend line established at a lower price level in 1980. Further difficulty is apparent in the wholesale price for 1983 when the market price was affected by a reduction in inventory and an associated reduction in price. The three useable years, 1980, 1981 and 1982, can only provide a very tenuous trend line at this time. The availability of the 1984 average price information for sockeye salmon should go far in adjusting and increasing the reliability of the new trend line.

(5) There are actually three methods that can be used to predict ex-vessel price of sockeye salmon to the fishermen. All make use of the Tokyo wholesale market price as the starting point and working backwards to the ex-vessel price. The first method simply subtracts the various costs from the predicted Tokyo wholesale price: No attempt has been made here to carry the cost analysis beyond the U.S. FOB price but the method is still applicable to individual companies who have knowledge of their internal costs for tendering, processing, recovery rates, etc. The second method again uses the Tokyo wholesale market price as the base and determines the ex-vessel price by formula. The third method uses the average ratio of ex-vessel price to Tokyo wholesale market price as a multiplier, the value for which was 0.257 for the years 1971 through 1984, and with 60 percent of the predicted values falling within 3 cents of the actual average ex-vessel price.

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Partial Adjustment Price Models: A Study of the Impact of Fish Imports on Ex-Vessel Prices on New England Groundfish

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Abstract

A partial adjustment model is adopted to analyze the impact of fish imports on New England ex-vessel prices on a species basis for cod, cusk, haddock, hakes, pollock, yellowtail flounder and other flounders. Monthly data from January 1974 to December 1982 are used in analyses with Zellner's seemingly unrelated regression procedures. Fresh fish imports have an adverse effect on the New England ex-vessel prices and price-import flexibility is less than one for these species in both the short run and the long run. The 1982 ex-vessel prices of these species would have been raised by 0.8% - 4% if the 1982 fresh fish imports were reduced by 10%. Price-landing flexibility at the ex-vessel level is inflexible, ranging from 0.20 to 0.50 in the short run and from 0.21 to 0.56 in the long run. The mean lag of species ex-vessel price adjustment varies from 0 to 0.67 with shorter lags for cod, haddock and yellowtail flounder.

Introduction

Impact of fish imports has been an issue to the New England groundfish industry because fish imports affect this major industry in New England and some imported fish are under foreign government's financial subsidies. The subsidies constitute an unfair competition and may have created damages to the New England industry. In this study, impact of fresh fish imports on ex-vessel prices of New England groundfish products is investigated with partial price adjustment models. As background information, characteristics of the New England industry and the natures of competition between imported and domestic groundfish as well as foreign subsidies are presented in this section.

The New England groundfish industry of the United States harvested 349 million pounds of groundfish and employed 3,833 fishermen and about 20,000 processing workers in 1977. The industry processes and markets its domestic catches primarily for the U.S. fresh fish market: the 1982 production value of fresh fish fillet is approximately $500 million. As fresh fish command a higher price than frozen fish in the U.S. market, domestic landings are seldom marketed as frozen fish. Domestic production of frozen fish occurs when landings fail to meet quality requirements for processing fresh fish products and/or the fresh fish market is severely glutted, and the production is mostly from ocean perch and whiting.[1]

Domestic fresh groundfish fillets predominate the U.S. fresh groundfish market and enjoy a market share varying from 77% to 90% of the total during 1970-81 (Georgianna and Dirlam, 1983, pp. 36-37). The market channels for fresh fish products are distinct from other fish products (Crutchfield and Gates, 1982), and U.S. wholesalers are convinced that fresh fish markets are insulated from frozen fish markets in the U.S. (Dirlam and Wang, 1978). These suggest that fresh fish products produced from domestic landings, while rarely competing directly with frozen fish, vigorously compete with fresh fish imports of various origins.

Fresh fish imports, including whole fish and fillets, have increased substantially in recent years and are primarily from Canada (Georgianna and Dirlam, 1983).[2] For example, whole fish imports of cod from Canada rose to 3,378 thousand dollars in 1982 from 504 thousand dollars in 1974, a 670% increase. Canadian imports predominate U.S. imports of fresh whole groundfish as well as fresh fish fillets. U.S. landings are, however, far in excess of imports of fresh whole cod and flounders, while imports from Canada are about one-third of fresh whole haddock landings.

Canada is a major competitor not only in the U.S. fresh fish markets, but also in the exploitation of groundfish resources on Georges Bank, one of the richest fishing grounds on the earth. The competition between these two countries has been intensified since both nations under extended jurisdiction have claimed fishing rights over the northeastern section of Georges Bank. (The dispute over the fishing rights will be settled by the World Court.) The U.S.-Canada competition, however, has triggered U.S. concern about Canadian fishery policies and Canadian subsidies to its fishing industries in particular. The U.S. fishing industry has tried to connect its poor financial performance with high volumes of Canadian fish imports, partially resulting from Canadian subsidies, and has several times requested trade protection via tariffs, i.e., imposition of countervailing duties equivalent to foreign subsidies.[3] Several studies have been conducted to identify the extent to which Canadian eastern groundfish fisheries have been subsidized (Capalbo et al., 1977; Cole and Dirlam 1981; Corey and Dirlam 1982; and Crutchfield and Gates 1982). The most recent study estimates the subsidies to be 19% of the 1981 price received by Canadian fishermen.[4]

While the documentation of the subsidies is necessary for countervailing duties under trade agreements, the impact of fish imports on fish prices in the U.S. markets has to be further investigated to show damages to the U.S. fishing industries. In this investigation, literatures on the impact of groundfish imports on the U.S. fish markets are reviewed in Section II. Section III deals with model specification and estimation. The models adopted in this study are the partial adjustment models originally developed by Koych (1954) and Nerlove (1958). Model specification and selection of estimation methods are also justified in this section. Empirical results are discussed in Section IV. Evaluation of impact of fish imports is included in this section. The summary and conclusion of this study is lastly presented in Section V.

Literature Review

Literature review is limited to studies of the relationship between U.S. groundfish markets and groundfish imports. Literature under review includes Nash and Bell (1969), Houtsma (1970), Gates and Norton (1974), Bockstael (1977), and Crutchfield and Gates (1982).[5]

In 1969, forty economists attended a demand workshop sponsored by the U.S. Bureau of Commercial Fisheries. Most of the studies reported in the workshop investigated factors affecting ex-vessel price (Nash and Bell, 1969). Among the economists, Bell attempted to relate ex-vessel prices of New England groundfish with imports and other variables, e.g. landings, income, Lent, etc., for haddock, cod, yellowtail flounder and whiting. The import variable failed to show significance in determining ex-vessel prices of these species, except for whiting. Price-import flexibility was reported to be 0.152 for whiting at the ex-vessel level. However, the findings indicate that Lenten demand is an important price determinant for some of these species. It should be noted that import data may have included fresh and frozen imports since separation of fresh imports from frozen imports was not possible at that time.

Houtsma (1970) studied the effect of increases in groundfish imports on U.S. groundfish prices. A single equation model was used to analyze U.S. wholesale demand for fish fillets, sticks and portions in aggregation. The author concluded that increases in imports plus a drop in meat and poultry prices caused the decline of U.S. groundfish prices in the 1950's. The increase in imports during the 1950's led to a drop in the groundfish prices of less than 8.1%. He further commented that the effect of imports had been grossly overestimated in a study by the U.S. Bureau of Commercial Fisheries. However, it must be pointed out that (1) Houtsma's research was directed toward a specified end which was to challenge the findings of the Bureau study, and (2) in the Houtsma study, aggregation over diversified product types and groundfish species may have created an aggregation bias and has constrained the usefulness of its findings.

Gates and Norton (1974), in their study of alternative management for the New England yellowtail flounder fishery, estimated a demand function of yellowtail flounder. The authors specified quarterly average ex-vessel price at New Bedford as a function of the ratio of per capita imports of flatfish fillets in the current quarter to per capita imports for the past quarter, per capita quarterly landings of yellowtail flounder in New England, per capita quarterly income in the northeastern states, and quarterly mean processing yield of yellowtail flounder landed in New England. They found that the import ratio was significant in determination of the ex-vessel price of yellowtail flounder in New Bedford.

In an attempt to establish a market model for the New England groundfish industry, Bockstael (1977) included a trade component and emphasized price determination at producer and consumer levels in her study. Groundfish species included were an aggregate species consisting of cod, haddock, flounders and ocean perch while product types were individual product forms, e.g. fillets, blocks, sticks and portions. A recursive model composed of various simultaneous blocks was estimated with a combination of OLS and 2LS procedures. Among many useful findings, the author reported that a one percent increase (decrease) in frozen groundfish fillets imports would lead to a 0.10% decrease (increase) in ex-vessel prices of the aggregate species in New England. Unfortunately, due to data limitation at that time, fresh groundfish imports were omitted in the analysis. Also, the species aggregation prevented the author from deriving price impact on a species basis.

Later in 1982, Crutchfield and Gates, in their study of tariff quotas and U.S. groundfish imports, adopted Bockstael's New England model for the U.S. groundfish market, and expanded to include more groundfish species. Three stage least square procedures were used in estimation. The authors not only estimated price impact of imports, but also derived changes in consumer and producer surpluses. They concluded that the impact on ex-vessel price would be insignificant if the U.S. imported a countervailing duty equal to 19% of the price received by Canadian fishermen. Their findings also indicated that the ex-vessel price of groundfish would drop by 0.019% as a result of a 1% increase in fish imports. It must be noted, however, that the problems related to import data and species aggregation in the Bockstael study remain in the Crutchfield and Gates study.

Finally, it must be noted that all of the studies reviewed above implicitly assume market equilibrium in each period and thus specify a static model for econometric analyses. Their assumptions and specifications may not be adequate, and a further discussion on assumptions and model specification is warranted and is presented in the next section.

Model Specification and Estimation

For model development, three assumptions are made. First assumption is that markets are separate for fresh and frozen fish. This assumption of market separation is reasonable since most domestic landings are produced as fresh fish fillets for institutional and home consumption in Atlantic coastal areas where the purchase of frozen fish is generally very insignificant. On the other hand, frozen fish primarily from import sources are marketed for inland areas where fresh fish are historically not available. The assumption is reinforced with findings of the 1978 fish wholesaler survey conducted by Dirlam and Wang: "Fish wholesalers interviewed were convinced that the market for fresh fish was wholly insulated from the market not only for sticks and portions, but for frozen fillets as well." Purchasers of fresh fish fillets are not influenced by relative prices between fresh and frozen products, at least within the range at which the fresh fish is being sold. Second assumption is that the fish supply at the landing level is exogenously determined since catches are mainly a function of biological and environmental factors, e.g., stock abundance, weather, etc. This assumption is consistent with those made traditionally for econometric modelling of fish markets (Bell, 1968, Waugh and Norton, 1969, Gates and Norton, 1974, Bockstael, 1977, Wang et al., 1977, Tsoa et al., 1982, Crutchfield and Gates, 1982). Third assumption is that there is no inventory holding in fresh fish market sectors due to high perishability of fresh fish products.

With these assumptions, a complete fresh fish market model can be conceptually specified for econometric estimation. However, in this study, only ex-vessel prices of groundfish products are specified since our primary interest is to evaluate the impact of fresh fish imports on U.S. ex-vessel prices. Therefore, ex-vessel price functions, as reduced form equations conceptually derived from the unspecified complete fresh fish model, are established as

$$P_i = f(L_i, L_j, I_i, I_j, MPF, DPI, RI, D's) \qquad (1)$$

This specification generally states that the ex-vessel price of species i (P_i) is determined by landings of the species (L_i), landings of related species (L_j), fresh fish imports of the species (I_i), fresh fish imports of related species (I_j), the price of meat, poultry and general fish products (MPF), consumer income (DPI), quality of imports (RI), and seasonal factors (D's).

Either static equilibrium models or dynamic disequilibrium models can be postulated for the specification. However, a dynamic disquilibrium model is postulated in this study for several reasons as discussed in a Bockstael study (1983): (a) High fluctuation of fresh fish supply prevents markets from achieving equilibrium, (b) The absence of inventory holdings remains a source of adjustment to an equilibrium price level, (c) Different tariff schedules for imports prevent quick price adjustment, (d) The nature of institutional market structures impair market performance. Fresh fish supply, from either domestic landings or imports, is highly variable depending upon biological abundance, weather, etc. This variation tends to cause unstable market conditions which prevent markets from achieving equilibrium. The unstable markets can be stabilized sufficiently to approximate equilibrium market conditions if inventories exist. Unfortunately, inventories cannot be economically and technically established for fresh fish products. Consequently, the adjustment of price to supply variation cannot be readily achieved in the U.S. fresh fish markets.

Market disequilibrium due to a high variability of supply is further aggravated with trade barriers since a quarterly quota system is implemented for U.S. fish imports.[6] The quarterly quota system, in which a higher tariff is imposed on imports exceeding quotas, tends to create a higher seasonal variation of import supply. Importers, in order to avoid a higher tariff, rush their imports before a quarterly quota is filled (Georgianna and Dirlam, 1983). As a result, higher imports are created for the first month of each quarter and thus prevent market mechanisms from achieving equilibrium conditions within a short period, e.g., a month.

Institutional structures of the New England fresh fish market, which include reciprocal agreement and some forms of bilateral arrangements, tend to impair market performance, particularly when fish supply is low. "The need to honor reciprocal agreements (between buyers and sellers) tends to create situations in which the determination of prices can be highly problematical. One of the effects...is to minimize price bidding, and therefore the frequency at which price information enters the market" (Wilson, 1980, p. 500). This indicates that price determination is generally not instantaneous and adoptive processes for price determination exist in these agreements over time.

In this study, a partial adjustment process in price determination is postulated for ex-vessel prices of New England groundfish products for the above reasons, and a fairly simple model for partial adjustment originally developed by Nerlove (1958) is adopted. With the model, short-run and long-run parameters as well as mean lags of adjustment processes, can be derived. In model formulation, it is presumed that in any period a desired price level is not observable because the desired level can not be achieved due to market disequilibrium. Nevertheless, the model assumes that a fixed percentage of the adjustment to the desired level is achieved each period. For the purpose of elaboration, let us explicitly specify the ex-vessel prices equation as

$$P^d_{igt} = a_0 + a_1 L_{igt} + a_2 \sum_j L_{jgt} + a_3 \sum_k L_{kst} + a_4 IRF_t + a_5 IFF_t + a_6 MPF_t + a_7 DPI_t + a_8 RI_t \qquad (2)$$

Where: P^d_{igt} = desired ex-vessel price of species i in species category g (roundfish or flatfish) in period t

L_{igt} = landing of species i in species category g in period t

$\sum_j L_{jgt}$ = landing of other species j's in species category g in period t

$\sum_k L_{kst}$ = landing of all species k's in substitute species category s in period t

IRF_t = total fresh fish import of roundfish in period t

IFF_t = total fresh fish import of flatfish in period t

MPF_t = consumer price index of meat, poultry and fish in period t (1967 = 100)

DPI_t = disposable personal income in period t

RI_t = quality of imports; fresh fish import of groundfish species from Iceland, Norway, and Denmark as precent to the Atlantic fresh fish imports of the species in period t

Since P^d_{igt} is not observable in a given period, the equation (2) cannot be directly estimated without an assumption of adjustment processes. The actual adjustment between the current and the immediate past (t and t-1) periods is assumed to be a fixed percentage of a desired adjustment (λ) and the assumption is shown as

$$P_{igt} - P_{igt-1} = \lambda(P^d_{igt} - P_{igt-1}) \qquad (3)$$

Where λ is adjustment coefficient ($0 < \lambda \leq 1$) and P_{igt} and P_{igt-1} are actual prices for t and t-1 respectively.

The adjustment coefficient (λ) is positive and less than or equal to one. Larger values of λ imply more rapid adjustment of the dependent variable to changes in independent variables. When λ is equal to one, partial adjustment becomes instantaneous adjustment, indicating a static equilibrium model.

To apply Koych transformation (Koych, 1954, Nerlove, 1958, Kimenta, 1971, Labys, 1973), we obtain a partial adjustment model in dynamic specification as

$$P_{igt} = \lambda a_0 + \lambda a_1 L_{igt} + \lambda a_2 \sum_j L_{jgt} + \lambda a_3 \sum_k L_{kst} + \lambda a_4 IRF_t + \lambda a_5 IFF_t + \lambda a_6 MPF_t + \lambda a_7 DPI_t + \lambda a_8 RI_t + (1 - \lambda) P_{igt-1} \qquad (4)$$

Finally, seasonal variables (D_{mt}) indicating monthly seasonality in demand and thus in prices, are added to Equation (4) to complete the specifications as

$$P_{igt} = b_0 + b_1 L_{igt} + b_2 \sum_j L_{jgt} + b_3 \sum_k L_{kst} + b_4 IRF_t + b_5 IFF_t + b_6 MPF_t + b_7 DPI_t + b_8 RI_t + b_9 P_{iget} + \sum_{m=2}^{12} b_{10m} D_{mt} \qquad (5)$$

Where $b_0 = \lambda a_0$, $b_1 = \lambda a_1$, - - - , $b_9 = (1 - \lambda)$

A priori, it is expected that the relationship between changes in the dependent variable and in each independent variable is as follows:

$$(\partial P_{igt}/\partial L_{igt}) < 0, \ (\partial P_{igt}/\partial \Sigma L_{jgt}) < 0$$

$$(\partial P_{igt}/\partial \Sigma L_{kst}) < 0, \ (\partial P_{igt}/\partial IRF) < 0, \ (\partial P_{igt}/\partial IFF) < 0,$$

$$(\partial P_{igt}/\partial MPF) > 0, \ (\partial P_{igt}/\partial DPI) > 0, \ (\partial P_{igt}/\partial RI) < 0, \text{ and}$$

$$0 \leq (\partial P_{igt}/\partial P_{igt-1}) < 1$$

Short-run price responses to changes in independent variables are equal to $b_i = \lambda a_i$, while long-run price responses are equal to a_i. Thus price flexibilities in both the short run and long run can be calculated with these coefficients, b_i's and a_i's, and sample means of dependent and independent variables. The lag coefficient (λ) has a characteristic of a steady decline geometric distribution with mean lag $(1 - \lambda)/\lambda$, which measures the average lag of the price adjustment process.

For estimation, groundfish are divided into two categories: roundfish and flatfish. Roundfish include cod, cusk, haddock, hakes and pollock, while flatfish consist of yellowtail flounder and other flounders. Monthly data from January 1974 to December 1982, are used in analyses with Zellner's seemingly unrelated regression procedures. Undeflated prices and income series are analyzed.

Empirical Results

The empirical counterparts of the equation (5) for each New England groundfish species are presented in Table 1. As indicated by the R^2-values, the specification explains 85% - 90% of ex-vessel price variations depending on species.[7] Nevertheless, the results reported in Table 1 are from Zellner's seemingly unrelated regression procedures and are more efficient than those from OLS procedures.

In general, the coefficients are statistically different from zero and have correct signs consistent with a priori expectations. For example, fresh fish imports show an inverse impact on New England ex-vessel prices of these species, as revealed by the signs of b_4 and b_5, which are negative. The price-import flexibility at sample means, which indicates responsiveness of ex-vessel prices to changes in fresh fish imports, is presented in Table 2. For each species, the price-import flexibility is inflexible, i.e., less than one, implying that ex-vessel prices are not very responsive to changes in fresh fish imports. For example, a 1% increase in fresh roundfish imports would only lead to a 0.082% decrease in the ex-vessel price of cod (Table 2.A). It must be noted that the price-import inflexibility holds true in the short run as well as the long run: the magnitudes of the price-import flexibility at the ex-vessel level range from 0.039 to 0.129 for the short run and from 0.056 to 0.142 for the long run. These estimates are consistent with those reported in other studies which are also less than one: Bockstael (1977) reports price-import flexibility at 0.10 while Crutchfield and Gates (1982) report it at 0.02. However, it must be noted that these estimates are substantially larger than that reported in the Crutchfield and Gates study and on average are approximately equal to the Bockstael estimate.

Price-landing flexibility at the ex-vessel level is inflexible ranging from 0.20 to 0.50 for the short run and from 0.21 to 0.56 for the long run (Table 3). Again these magnitudes are qualitatively comparable to those reported by Bockstael, and Crutchfield and Gates at 0.30 and 0.67 respectively. However, these findings are inconsistent with the Tsoa study (1982) in which price elasticity is reported to be smaller than one (i.e., price flexibility larger than one) for both the short run and the long lag. This inconsistency in price-landing flexibility leads to opposite policy implications. It must be pointed out, however, that Tsoa et al. failed to report the market level of their analysis. Analyses of different markets might result in this kind of discrepancy between estimates.

The mean lag of the ex-vessel price adjustment process varies from species to species and ranges between 0 and 0.67 with shorter lags for cod, haddock and yellowtail flounder (Table 4). The zero mean lags for cod and haddock indicates that a static model is sufficient for modelling the ex-vessel prices of these two species. The low values for cod, haddock and yellowtail flounder models may indicate that markets for these important groundfish species are more competitive than those for other species. Relatively significant market shares of these three species and high market preference toward these species may lead to general awareness of and close attention to the market supply and demand conditions of these species. This promotes competition on these species and tends to shorten the mean lag. However, the extent to which mean lags are different among species is hard to interpret without further studies.

Finally, the empirical models are used to simulate the impact of fresh fish imports on ex-vessel prices of these species for 1982. The question addressed is what the impact on ex-vessel prices and revenues would have been if some restriction on fresh fish imports had been imposed in 1982. For the purpose of demonstration, a 10% reduction of Canadian fresh fish imports from the 1982 level is assumed. Under this

Table 1. Ex-Vessel Price Model for New England Groundfish by Species, January 1974 - December 1982

Species	Constant b0	(L_{igt}) b1	$(\Sigma_j L_{jgt})$ b2	$(\Sigma_k L_{kst})$ b3	(IRF_t) b4	(IFF_t) b5	(MPF_t) b6
Cod	3.674	- 2.078 (-10.70)*	-0.607 (-3.01)*	-0.595 (-2.38)*	-0.740 (-2.68)*	-0.388 (-0.39)	0.097 (3.38)*
Haddock	-3.512	- 7.577 (-16.73)*	-0.260 (-1.11)	-0.309 (-0.92)	-0.792 (-2.11)*	-0.449 (-0.33)	0.166 (4.19)*
Hake	5.020	- 4.293 (- 3.84)*	-0.246 (-1.38)**	-0.723 (-2.21)*	-0.654 (-1.87)*	-3.180 (-2.21)*	0.011 (0.29)
Pollock	0.883	- 1.138 (-4.12)*	-0.154 (-1.44)**	-0.871 (-4.78)*	-0.355 (-1.76)*	-0.367 (-0.50)	0.050 (2.32)*
Cusk	5.233	-20.48 (- 5.30)*	-0.732 (-4.76)*	-0.474 (-1.75)*	-0.848 (-2.70)*	-0.089 (-0.07)	0.074 (2.22)*
Yellowtail Flounder	32.69	- 6.122 (-9.69)*	-3.418 (-4.11)*	-0.344 (-1.10)	-0.064 (-0.11)	-10.35 (-4.57)*	-0.076 (-1.22)
Other Flounders	13.81	- 3.540 (-6.07)*	-3.039 (-7.28)*	-0.417 (-1.91)*	-0.487 (-1.17)	-3.718 (-2.41)*	0.010 (0.23)

Species	(DPI_t) b7	(RI_t) b8	(P_{igt-1}) b9	(D_{2t}) b10.2	(D_{3t}) b10.3	(D_{4t}) b10.4	(D_{5t}) b10.5
Cod	0.021 (6.60)*	0.005 (0.06)	0.015 (0.32)	-1.941 (-1.42)**	3.261 (2.02)*	-0.503 (-0.33)	-2.679 (-1.46)**
Haddock	0.025 (5.90)*	-0.043 (-0.36)	0.032 (0.68)	0.044 (0.02)	5.583 (2.44)*	4.909 (2.37)*	-0.329 (-0.13)
Hake	0.016 (3.87)*	0.056 (0.51)	0.402 (5.45)*	2.285 (1.27)**	4.501 (1.99)*	-2.514 (-1.17)	-8.435 (-3.52)*
Pollock	0.010 (4.22)*	-0.090 (-1.42)**	0.246 (3.70)*	2.642 (2.49)*	7.038 (5.25)*	1.600 (1.12)	-0.464 (-0.31)
Cusk	0.016 (4.58)*	-0.111 (-1.12)	0.092 (1.62)**	-1.994 (-1.24)	0.704 (0.37)	-1.888 (-1.07)	-5.856 (-2.76)*
Yellowtail Flounder	0.042 (6.08)*	0.135 (0.72)	0.224 (4.19)*	2.448 (0.82)	7.494 (2.00)*	0.805 (0.21)	1.585 (0.33)
Other Flounders	0.030 (6.28)*	0.189 (1.45)**	0.298 (5.84)*	-0.723 (-0.35)	4.839 (1.87)*	-1.446 (-0.53)	1.845 (0.54)

The figures in parentheses are t-statistics.
*Significance at the 5% level (one - tail t).
**Significance at the 10% level (one - tail t).

Table 1. Ex-Vessel Price Model for New England Groundfish by Species, January 1974 - December 1982 (continued)

Species	(D_{6t}) b10.6	(D_{7t}) b10.7	(D_{8t}) b10.8	(D_{9t}) b10.9	(D_{10t}) b10.10	(D_{11t}) b10.11	(D_{12t}) b10.12
Cod	-2.572 (-1.48)**	-3.965 (-2.42)*	-3.041 (-1.85)*	-3.722 (-2.46)*	-2.772 (-1.89)*	-4.641 (-3.28)*	-3.753 (-2.81)*
Haddock	-0.658 (-0.28)	-3.737 (-1.64)*	-3.287 (-1.46)**	-4.427 (-2.12)*	-2.466 (-1.19)	-4.969 (-2.54)*	-2.610 (-1.35)**
Hake	-6.138 (-2.78)*	-4.626 (-1.97)*	-1.878 (-0.72)	-3.493 (-1.60)**	-3.031 (-1.48)**	-5.395 (-2.86)*	-5.485 (-3.15)*
Pollock	-0.409 (-0.32)	-2.054 (-1.73)*	-0.739 (-0.63)	-1.192 (-1.08)	-1.079 (-0.98)	-2.975 (-2.72)*	-3.864 (-3.68)*
Cusk	-7.743 (-3.91)*	-9.638 (-5.15)*	-8.161 (-4.32)*	-8.248 (-4.65)*	-6.795 (-3.95)*	-7.152 (-4.42)*	-5.212 (-3.35)*
Yellowtail Flounder	4.822 (1.23)	4.599 (1.32)**	5.303 (1.53)**	3.238 (1.00)	4.562 (1.41)**	-5.994 (-1.96)*	-10.090 (-3.51)*
Other Flounders	7.190 (2.60)*	10.48 (4.34)*	9.582 (3.90)*	3.729 (1.62)**	4.149 (1.83)*	-3.894 (-1.83)*	-5.129 (-2.56)*

Species	R^2 1/
Cod	0.90
Haddock	0.88
Hake	0.89
Pollock	0.88
Cusk	0.85
Yellowtail Flounder	0.85
Other Flounders	0.86

The figures in parentheses are t-statistics.
*Significance at the 5% level (one - tail t)
**Significance at the 10% level (one - tail t)
1/ R^2 values are derived from OLS procedures for approximation.

Table 2. Price-Import Flexibility, Monthly (1974-82)

A. Short-Run Price Flexibility

Species	With Respect To Fresh Roundfish Import	Fresh Flatfish Import
Cod	0.082	a
Haddock	0.060	a
Hakes	0.101	0.070
Pollock	0.065	a
Cusk	0.129	a
Yellowtail Flounders	a	0.096
Other Flounders	a	0.039

B. Long-Run Price Flexibility

Species	With Respect To Fresh Roundfish Import	Fresh Flatfish Import
Cod	0.082	a
Haddock	0.060	a
Hakes	0.169	0.117
Pollock	0.086	a
Cusk	0.142	a
Yellowtail Flounders	a	0.124
Other Flounders	a	0.056

a - Nonsignificant

Table 3. Price-Landing Flexibility, Monthly 1974-1984

Species	Price-Landing Flexibility[1/]	
	Short-Run	Long-Run
Cod	0.50	0.50
Haddock	0.50	0.50
Hakes	0.20	0.33
Pollock	0.16	0.21
Cusk	0.26	0.29
Yellowtail Flounder	0.42	0.54
Other Flounders[2/]	0.40	0.56

[1/]Measured at sample means.

[2/]All flounders except yellowtail flounders.

Table 4. Mean Lag of Price Adjustment: $(1-\lambda)/\lambda$

Species	Mean Lag
Cod	0
Haddock	0
Hakes	0.67
Pollock	0.33
Cusk	0.10
Yellowtail Flounder	0.29
Other Flounders[1/]	0.42

[1/]All flounders except yellowtail flounder.

assumed reduction, the 1982 ex-vessel prices would have been raised by 0.2¢ - 0.8¢ per pound, i.e., 0.8% - 4%, depending on species (Table 5). The corresponding increases in species revenues again depending on species, would have been between $20 thousand and $468 thousand, an increase between 0.8% and 4%. The total increase in gross revenues of these species would have been $1.7 million, a 1.25% increase from the 1982 level.

Summary and Conclusions

New England groundfish industries primarily harvest and process the New England landings for the fresh fish markets. In the market, the industries with a predominate market share compete with foreign fresh fish imports, mainly from Canada. The competition between New England and Canadian groundfish industries exists not only in the market area but also in the utilization of groundfish resources on Georges Bank. Consequently, the rigorous competition and the existence of Canadian governmental groundfish subsidies have prompted the U.S. industries, including the New England industries to request trade protection. This is based on the argument that Canadian exports, partially assisted by Canadian subsidies to its groundfish industries, have damaged the U.S. industries. While Canadian subsidies have been well documented, this study deals with the impact of fresh fish imports on New England groundfish industries.

Our literature review indicates that authors of previous studies adopted static model, and aggregated across species as well as across fresh and frozen fish imports. Unlike the previous studies, we specify a partial adjustment model and analyze the impact of fresh fish imports on ex-vessel prices on a species basis for cod, cusk, haddock, hakes, pollock, yellowtail flounder and other flounders.

Our findings indicate that fresh fish imports have an adverse effect on the New England ex-vessel prices of groundfish and price-import flexibility is less than one for these species in the short run and the long run. The magnitudes of the price import flexibility at the ex-vessel level range from 0.039 to 0.129 for the short run and from 0.056 to 0.142 for the long run. These magnitudes are much higher than those found in the Crutchfield and Gates study. The 1982 ex-vessel prices of these species would have been raised by 0.8% - 4% if fresh fish imports in 1982 had been reduced by 10%. Price-landing flexibility at the ex-vessel level is inflexible, ranging from 0.20 to 0.50 in the short run and from 0.21 to 0.56 in the long run. The mean lag of species ex-vessel price adjustment varies from 0 to 0.67 with shorter lags for cod, haddock and yellowtail flounder. Nevertheless, disequilibrium models for the entire fresh market, e.g., partial adjustment specification, may be deserved. Also, analysis of relations between fresh and frozen products at both the ex-vessel market and other market levels is warranted.

Footnotes

1. Market shares of domestic frozen groundfish fillets are rather small, varying from 2.7% to 9% during 1970-81 (Georgianna and Dirlam, 1983, p. 36).

2. The information in this paragraph is derived from a study by Georgianna and Dirlam (1983).

3. The U.S. Trade Act and the General Agreement on Tariffs and Trade provide relief to a domestic industry in the form of countervailing import duties when import production is subsidized and the domestic industry has suffered material injuries from the import. Under these, countervailing duties may be imposed up to an amount equal to subsidies only if the ITC finds the domestic industry has suffered material injury resulting from subsidized imports regardless of the imports being dutied or not. (Hasselback et al., 1981, and Crutchfield and Gates, 1982.)

4. There have been several studies relating to Canadian subsidies to the eastern groundfish fisheries: Capalbo et al. (1978), Cole and Dirlam (1981), Corey and Dirlam (1982), and Crutchfield and Gates (1982). Capalbo et al. estimated that the magnitude of Canadian subsidies to harvesting sectors varied from 3.3 to 6.9 cents per pound of landings, depending on landings per vessel. Combining the subsidies with additional subsidies to the processing sectors, total subsidies were estimated in a range between 24.9 and 34.8 Canadian cents per pound on frozen fillets and blocks. Corey and Dirlam described various Canadian subsidy programs and proceeded to update the above study in 1981. New estimates were about 4.4 - 5.2 cents per pound of landings for a representative 54 foot dragger. The new estimates did not include gear acquisition, price supports, sales tax exemption on fuel and assorted other sources of aid. Crutchfield and Gates, using data collected by Corey and Dirlam, reassessed the subsidies to be 19% of the 1981 price received.

5. Studies dealing with fish trade issues of the other species include Wang and Norton (1976), Hasselback et al. (1981) and Bockstael (1982).

6. Quarterly quota for fresh and frozen fillets of cod, cusk, haddock, hake, pollock and ocean perch is 3,750,000 pounds or one quarter of 15% of the average apparent annual consumption of these species during the previous three years, whichever is larger (Georgianna and Dirlam, 1983).

7. The R^2- values are derived from OLS.

Table 5. Impact of Import Reduction

A. Estimated Increases in Ex-Vessel Prices Resulting From a 10% Reduction of Fresh Fish Import, 1982

Species	Range of Increase in Monthly Ex-Vessel Price (Percent)	1982 Annual Price		
		Increase		New Price
		Percent	¢/lb	(¢/lb
Cod	.67 - 2.21	1.23	.4	33.75
Cusk	.52 - 3.78	2.07	.5	23.65
Haddock	.38 - 1.36	.84	.4	51.83
Hake	.86 - 6.53	4.10	.6	16.29
Pollock	.48 - 1.44	.96	.2	20.74
Yellowtail Flounders	.17 - 3.28	1.60	.8	52.10
Flounders[1/]	.41 - 1.50	1.10	.5	50.07

B. Estimated Increase in Ex-Vessel Gross Revenue Resulting From a 10% Reduction of Fresh Fish Import, 1982

Species	Range of Increases in Monthly Gross Revenue (Percent)	1982 Annual Gross Revenue		
		Increase		New Gross Revenue
		Percent	1000$	1000$
Cod	.43 - 2.22	1.24	468	38,340
Cusk	.52 - 3.78	2.10	20	974
Haddock	.38 - 1.36	.84	180	21,720
Hake	.86 - 6.53	4.06	107	2,740
Pollock	.41 - 1.41	.97	60	6,241
Yellowtail Flounders	.16 - 2.98	1.60	444	28,248
Flounders[1/]	.41 - 1.50	1.10	444	40,776
Total		1.25	1,723	139,039

[1/] All flounders except Yellowtail Flounders.

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A Market Analysis on "Ika" in Japan

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Introduction

Japan consumes over one half of the world catch of "ika" (general term for squid and cuttle fish in Japanese). Today ika is one of the most important seafood items consumed in Japan, and this is due to the wide range of utilizations of ika such as sashimi, family cooking use, institutional and restaurant use, and many kinds of processed food. In the past, the supply was mainly composed of Surume ika (Japanese common squid, Todarodes pacificus), but with the decreasing catch of Surume ika and the extension of utilizations, Japan is now consuming many kinds of ika in addition to Surume ika, such as Aka ika (Ommastrephes bartrami), Kensaki ika (Doryteuthis kensaki), Yari ika (Doryteuthis bleekeri), New Zealand ika (New Zealand common squid, Notodarus sloani sloani), Canada matsu ika (Canada illex, Illex illecebrosus), Argentin ika (Argentin illex, Illex argentinus), Kou ika (Sepia esculenta), Mongou ika (European cuttle fish, Sepia officinalis) and others. Some of them are caught in foreign waters by domestic vessels and/or are imported from foreign countries. So, in this paper ika includes all kinds of ika utilized in Japan, though it is focused on the main species.

Firstly this paper analyzes briefly supply and demand situations, utilizations, and household consumptions of ika, and then the author discusses distributions and factors of price determinations at Hachinohe, the world's largest ika landing port.

Supply Situations

The supply of ika (domestic production + import) in Japan fluctuated from 500 to 700 thousand tons during 1967 to 1982 as shown in Table 1, except rich catch years in 1968 and 1980. In the past, the supply of ika was mainly composed of Surume ika by species, but in recent years many kinds of ika have been supplied to Japan such as Aka ika, N.Z. ika and etc. by the problem on resources of Surume ika and other factors.

The production structure of Japanese ika fisheries has also changed. Until the early 1960s, Japanese ika fisheries were mainly hand hook and line fisheries at coastal waters, but from the late 1960s hook and line machines were introduced to this fishery and this introduction of machines caused the change of the working conditions of ika fisheries, from works mainly composed of harvest to works mainly composed of treatment.

In addition, by the increasing demand of Surume ika and the rising price, hook and line ika fishing vessels began off shore fisheries. For this purpose, larger size fishing vessels equipped with modern riggings were introduced into this fishery. At present hook and line ika fisheries are roughly divided into coastal part time fisheries using small or medium size vessels, off shore full time fisheries which operate in the Japan Sea and North Pacific with high performance freezing equipment using 30 to 100 tons medium size vessels, and fisheries which operate in the North Pacific using over 100 tons large size vessels. About half of the last itemed large size vessels operate off New Zealand at off-season of the North Pacific fisheries. In addition to the above mentioned hook and line fisheries, ika fisheries include fixed net fisheries, trawl fisheries, drift net fisheries and others. Trawl fisheries operate in off shore Japan and some foreign countries including New Zealand. Drift net fisheries for Aka ika were introduced in 1978 and the catch is now showing an increase. The catch recorded 135 thousand tons in 1982. Thus Japanese ika fisheries have shown diversification in species, fishing gears, and size of vessels, and this leads the change of the structure.

Table 1. Supply Trend of Ika in Japan (Volume: 1,000 ton)

Year	Domestic Production				Import	Total
	Surume ika	Kou ika	Aka ika & Others	Sub-total		
1967	477.0	15.7	104.1	596.8	5.2	602.0
1968	668.4	15.3	90.1	773.8	8.5	782.3
1969	478.2	16.5	95.2	589.8	8.5	598.3
1970	412.2	14.7	91.9	518.9	15.2	534.1
1971	364.3	15.4	102.8	482.5	21.3	503.8
1972	464.4	15.1	120.0	599.5	27.8	627.3
1973	347.6	12.2	126.5	486.3	29.0	515.3
1974	335.0	17.2	117.8	469.9	44.8	514.7
1975	385.3	15.5	137.1	537.8	58.6	596.4
1976	312.1	19.8	170.0	501.9	68.5	570.4
1977	264.3	20.4	227.9	512.6	74.7	587.3
1978	198.5	18.8	302.5	519.7	118.1	637.9
1979	212.8	14.1	301.9	528.8	155.9	684.7
1980	331.2	10.4	345.0	686.6	94.4	781.0
1981	196.8	7.1	312.6	516.5	68.8	585.3
1982	181.7	7.7	361.1	550.4	96.3	646.8

Note: 1967-1977 N.Z. ika is included in Surume ika and 1978-1982 N.Z. ika is included in Aka ika & Others.

Source: Annual Statistics of Fisheries and Aquaculture, Ministry of Agriculture, Forestry and Fishery (MAFF), Japan; Monthly Statistics on International Trade, Ministry of Finance (MOF), Japan.

Table 2. Import Trend of Ika in Japan by Country (Volume: 1,000 ton)

	1977	1978	1979	1980	1981	1982	1983
Total	74	118	156	94	69	96	102
R. Korea	20	27	32	18	16	17	19
Spain	8	14	15	10	12	12	5
Thailand	8	10	11	8	9	10	9
Canada	7	27	15	18	4	0	0
Argentina	0	10	22	5	0	1	10
Poland	-	-	8	3	0	11	25
Morocco	0	3	4	4	7	9	7
Others	31	27	49	28	21	36	27

Source: Monthly Statistics on International Trade, MOF, Japan.

Table 3. Demand Estimation of Ika in Japan (Volume: 1,000 ton)

		1978	1979	1980	1981	1982
Inventories Jan. 1	A	105	110	145	190	110
Supply	B	638	685	781	585	647
Demand	C	633	650	736	665	617
Inventories Dec. 31	D	110	145	190	110	140

Note: Demand Estimation (C) = A + B - D

Source: Supply, Annual Statistics of Fisheries and Aquaculture, MAFF, Japan; Monthly Statistics on International Trade, MOF, Japan;
Inventories, Calculated based on Annual Statistics of Distributions on Fisheries Products, MAFF, Japan.

Import of ika is divided to two by the Japanese import system. Import of cuttle fishes is liberalized, but there is an import quota reviewed yearly to ika except cuttle fishes. Import of cuttle fishes has been stable between 40 to 60 thousand tons in recent years because of poor catch in Japan. Main exporters include Spain, Thailand, Morocco and Mauritania. On the other hand, import of ika except cuttle fishes has shown large fluctuations affected by the relation between domestic catch and demand. Main species and exporters are Canada matsu ika, Argentin ika and New Zealand ika. The author thinks that this large fluctuation will be weakened through the improvement of quality and stabilization of resources in exporting countries.

Demand

Demand of ika in Japan in the recent five years ranged between 610 to 670 thousand tons except the rich catch year in 1980 as estimated in Table 3. Almost all of them were consumed in Japan and the export was negligible. Here the author describes briefly the situation of domestic demand through analysis on the utilizations and the household consumption.

Utilizations of ika

As mentioned before, ika has a wide range of utilizations in Japan. Especially Surume ika has the widest utilizations because of its superior characteristics for sashimi, many kinds of cooking and processing use. But the domestic supply of Surume ika has shown the shortage through the resource problem and the increasing demand. In these shortage situations of Surume ika mainly for processing, some substitutions were developed such as New Zealand ika in the early 1970s, and Aka ika and Matsu ika (including Canada matsu ika and Argentin ika) in the late 1970s. In recent years, these substitutional species have come to be utilized for sashimi and cooking use, not only for processing.

The utilization of ika, at present, seems to be fixed by species, difference between fresh and frozen, and size. This tendency is, however, largely affected by the domestic catch of Surume ika. For instance, in 1980 a rich catch year of Surume ika, Surume ika was destined to all kinds of use. As a result, inventories of Aka ika, New Zealand ika and Matsu ika showed a large increase and the prices declined heavily. Table 4 shows the usual utilization of ika by main species and by the difference between fresh and frozen.

Surume ika. Fresh Surume ika is mainly consumed as sashimi, and frozen Surume ika is mainly used for sashimi and cooking, but is also used for processing. The utilization of frozen Surume ika is expected as follows:

less than 30 in number per one case (about 8.4 kg)	sashimi and cooking
31 - 40	cooking and sashimi
41 - 50	processing (saki ika) and bait
over 51	processing (yaki ika, salted and canned)

Aka ika. Fresh Aka ika is mainly used for cooking and the utilization of frozen Aka ika differs from fishing gears. Frozen Aka ika fished by hook and line is mainly used for saki ika and frozen Aka ika fished by net is mainly destined for cooking and smoked products. In addition to the above frozen Aka ika is utilized for many processed products such as salted, canned, yaki ika and others, and for bait.

New Zealand ika. The utilization of New Zealand ika fished by hook and line is similar to frozen Surume ika, so that it is affected by the domestic production of Surume ika. In addition New Zealand ika competes with Aka ika in the fields of some kinds of processing. The utilization by size is expected as follows:

less than 30 in number per one case	sashimi and processing (dried, dried and salted)
31 - 40	cooking and processing (dried, dried and salted)
41 - 50	processing (dried, dried and salted) and bait
over 51	processing (yaki ika, salted)

Matsu ika (incl. trawled N.Z. ika). Matsu ika is mainly used for processing but some are used for sashimi and cooking. Matsu ika also competes with Surume ika and Aka ika.

The author estimates that the distribution of utilizations of ika is 30% for sashimi, 15% for cooking use, 50% for processing and 5% for bait, in the recent five years as a whole.

Household consumption

Here the author describes household consumption based on the Annual Report on the Family Income and Expenditure Survey to make clear the consumption characteristics of fresh and frozen ika. Table 5 and Figure 1 show the trend of index of quantities and unit price of fresh and frozen ika per household. Unit price is deflated by CPI. Thus fresh and frozen ika has strong price elasticity, and this means that fresh and frozen ika compete with other medium price level seafoods and that at the same time, fresh and frozen ika also compete with meats as a medium price level seafood. Based on Food Supply and Demand

Table 4. Utilization of Ika in Japan (xx Main use, x Common use)

	Surume ika		Aka ika			N.Z. ika	Matsu ika (1)	Argentin ika
	Fresh	Frozen	Fresh	Frozen Hook	Frozen Net	Hook		
For Sashimi	xx	xx				x	x	x
For Cooking		x	xx		xx	x	xx	
Saki ika (2)		x		xx			x	
Smoked					xx			
Dried	x	x				x	x	
Dried & Salted						x		
Salted		x		x	x	x	x	x
Canned				x	x	x	x	
Boiled & Seasoned							xx	
Yaki ika (3)		x		x	x	x	x	
Others		x		x	x	x	x	
For Bait		x		x	x	x	x	

Note: (1) Canada Illex and N.Z. ika caught by net
(2) Dried, seasoned, baked and flaked
(3) Boiled, seasoned, dried and baked

Source: Economic Structure of Hook and Line Fisheries of Ika, Japan Fisheries Ass.

Table 5. Index of Quantities and Unit Price of Purchased Fresh and Frozen Ika Per Household (Quantities: 1 g, Unit Price: Yen/100g; Deflator = Consumer Price Index (1980=100)

	Quantities		Unit Price		
	Quantities	Index	Unit Price	Deflator	Real Index
1974	6,378	100	73.50	65.2	100
1975	7,318	114.7	79.75	72.9	97.0
1976	7,077	111.0	88.30	79.7	98.3
1977	6,666	104.5	102.25	86.1	105.3
1978	6,507	102.0	105.91	89.4	105.1
1979	6,638	104.1	107.09	92.6	102.6
1980	7,940	124.4	95.44	100.0	84.7

Calculated from Annual Report on the Family Income and Expenditure Survey, Statistics Bureau, Prime Minister's Office, Japan.

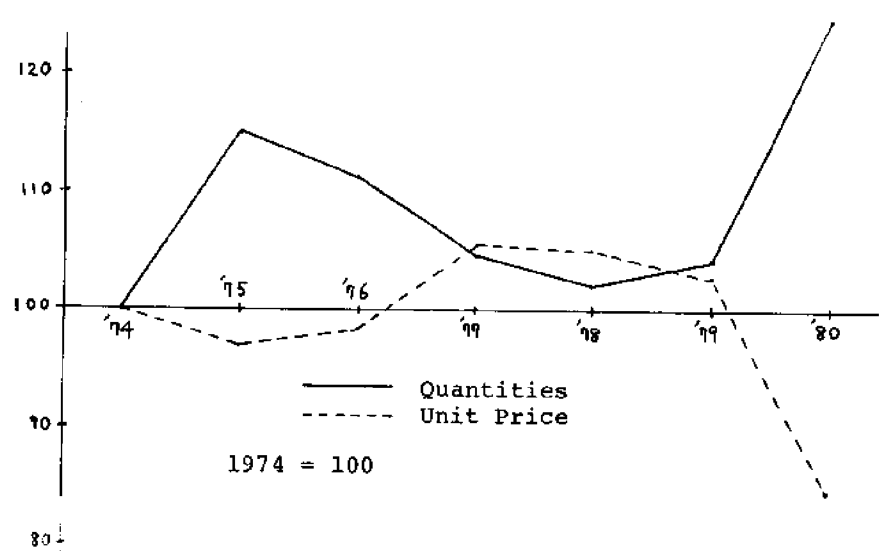

Figure 1. Index of Quantities and Unit Price of Purchased Fresh and Frozen Ika Per Household.

Analysis, cross elasticity of medium price level seafoods (horse mackerel, skipjack, flatfish, salmon, ika and octopus) to meats (beef, pork anc chicken) is 0.43 during 1970 to 1979.

On the other hand, it is said that fresh and frozen ika does not have a strong income elasticity. Table 6 presents the index of expenditure per person by yearly income quantile group in 1980. Thus differences of expenditure of fresh and frozen ika between income groups is smaller than that of all fishery products. This means that income elasticity of fresh and frozen ika is smaller than that of all fishery products, and this is more clear when compared with fresh and frozen tuna, one of the high price level seafoods.

Table 7 shows characteristics of fresh and frozen ika consumption. Fresh and frozen ika has small differences on the index of expenditure per person by age group of household head, and shows a clear decline from 50-54 age group, though all fisheries products reach a plateau at 55-59 age group and do not show a decline in following age groups. Consumption of fresh and frozen tuna shows an increasing trend with the growth of age group. There is a clear difference between fresh and frozen ika and tuna about expenditures per person by age group of household head. The author supposes this means that fresh and frozen ika is a favorite seafood for younger people because of the wide variety of cookings.

Distributions and Price Determinations of Frozen Ika at Hachinohe

Fresh ika caught by small size vessels at coastal waters is landed nation wide. On the other hand, there seems a tendency that landings of frozen ika centralize upon some specific ports, such as Hachinohe, Ogi and Hakodate. This concentration is mainly due to the fact that these ports have: wholesale function which can deal a large volume of landings; large scale cold warehouses; processing function around the port. For instance, Hachinohe and Ogi take about 65% of Japanese landings of frozen Surume ika, and Hachinohe and Hakodate have over 70% of national landings of frozen Aka ika. In the case of New Zealand ika, Hachinohe takes over 70%.

Here the author discusses distributions and price determinations at Hachinohe based on the results of interviews.

Distributions

Hachinohe is the world's largest ika landing port. In 1982, ika landings at Hachinohe fishing port reached about 114 thousand tons. The author points out the characteristics of ika landings and distributions of Hachinohe, as follows:

* Ika is the most important species for Hachinohe. It took about 52% in value of total landings.

* Over 95% of ika landed to Hachinohe is frozen.

* By species composition, Surume ika, New Zealand ika and Aka ika took 34%, 10% and 55% of ika landings respectively in 1982. So, landings to Hachinohe are mainly composed of substitutional species for Surume ika.

* Landings by other mother port's vessels take large share. (It took 31% in volume in 1982.)

* All ika landed at Hachinohe is well divided by size.

* Hachinohe is one of the largest ika processing areas in Japan.

* There are two wholesale markets in Hachinohe. Each market is operated by the Federation of Hachinohe Fisheries Cooperatives and the Hachinohe Fish Market Cooperation. So there is a competitive relation between the two markets.

* There are about 120 fish buyers at Hachinohe and about 80 buyers in them deal ika. But large scale buyers have an overwhelming market share. About 30 large scale buyers purchase about 80% of ika landings. They are mainly local subsidiaries of large fisheries companies such as Taiyo, Nihon Suisan, or large fisheries processing firms, local subsidiaries of large buyers in Tokyo Tsukiji Market, and many of them operate composite management at Hachinohe, such as shipping, cold warehousing and processing.

Figure 2 shows distributions of frozen ika at Hachinohe by species. Frozen Surume ika and New Zealand ika have about the same distribution routes. In them sashimi and cooking use is transported by freezing truck at no-processing or after low level processing, to consuming cities, mainly to Tokyo. Surume ika and New Zealand ika for processing are mainly processed at Hachinohe and then transported to consuming cities.

Distribution of frozen Aka ika differs somewhat from Surume and New Zealand ika. Frozen Aka ika treated at Hachinohe is not only Aka ika landed at Hachinohe but includes Aka ika transported from other fishing ports near Hachinohe. This shipping into Hachinohe is due to the strong demand by processors. The distributions of Aka ika for cooking use are the same as Surume ika and New Zealand ika, but that for processing is not only processed at Hachinohe but also transported to other cities by kind of processings.

Table 6. Index of Expenditure Per Person by Yearly Income Quantile Group in 1980 (Expenditure: 1 yen)

Group	Persons Per Household	Fresh & Frozen Ika		Fresh & Frozen Tuna		All Fishery Products	
		Expenditure Per Household	Index Per Person	Expenditure Per Household	Index Per Person	Expenditure Per Household	Index Per Person
Ave.	3.82	7,577	100	8,573	100	121,513	100
1	3.30	5,983	91.4	6,227	84.1	93,308	88.9
2	3.71	7,045	95.7	7,035	84.5	105,884	89.7
3	3.91	7,591	97.9	8,086	92.1	117,107	94.2
4	4.03	8,126	101.6	9,853	108.9	132,389	103.3
5	4.16	9,192	110.8	11,663	124.9	158,886	120.1

Note: Yearly Income Quintile Group 1. -2,530,000 yen
2. 2,530,000-3,340,000
3. 3,340,000-4,220,000
4. 4,220,000-5,570,000
5. 5,570,000-

Calculated from Annual Report on the Family Income and Expenditure Survey, Statistics Bureau, Prime Minister's Office, Japan.

Table 7. Index of Expenditure Per Person by Age Group of Household Head in 1980 (Expenditure: 1 yen)

Age Group	Persons Per Household	Fresh & Frozen Ika		Fresh & Frozen Tuna		All Fishery Products	
		Expenditure Per Household	Index Per Person	Expenditure Per Household	Index Per Person	Expenditure Per Household	Index Per Person
Ave.	3.82	7,577	100	8,573	100	121,513	100
-24	2.89	3,387	59.1	2,628	40.5	57,580	62.6
25-29	3.37	5,501	82.3	4,552	60.2	78,888	73.6
30-34	3.93	6,469	83.0	5,879	66.7	95,929	76.7
35-39	4.24	7,933	94.3	7,502	83.1	116,559	86.4
40-44	4.26	8,719	103.2	9,599	100.4	128,791	95.0
45-49	4.04	8,565	106.7	10,277	113.4	137,724	107.2
50-54	3.63	8,575	119.1	10,012	122.9	141,162	122.3
55-59	3.37	7,733	116.3	9,760	129.0	136,833	127.6
60-64	3.21	6,712	105.4	9,538	132.4	129,369	126.7
65-	3.16	5,966	95.2	10,461	147.5	125,895	125.2

Calculated from Annual Report on the Family Income and Expenditure Survey, Statistics Bureau, Prime Minister's Office, Japan.

Table 8. Quantities and Unit Price of Frozen Ika Landed at Hachinohe Fishing Port by Species (Quantity: 1 ton, Unit Price: Yen/kg)

		Surume ika	N.Z. ika	Aka ika	
				Net	Hook
1981	Quantities	22,342	15,745	21,314	27,269
	Unit Price	410.8	178.1	365.3	306.0
1982	Quantities	26,382	23,427	38,594	20,961
	Unit Price	511.7	391.9	427.6	334.6
1983	Quantities	25,570	29,303	46,415	13,981
	Unit Price	435.6	355.5	317.1	231.3

Source: Federation of Hachiohe Fisheries Cooperatives.

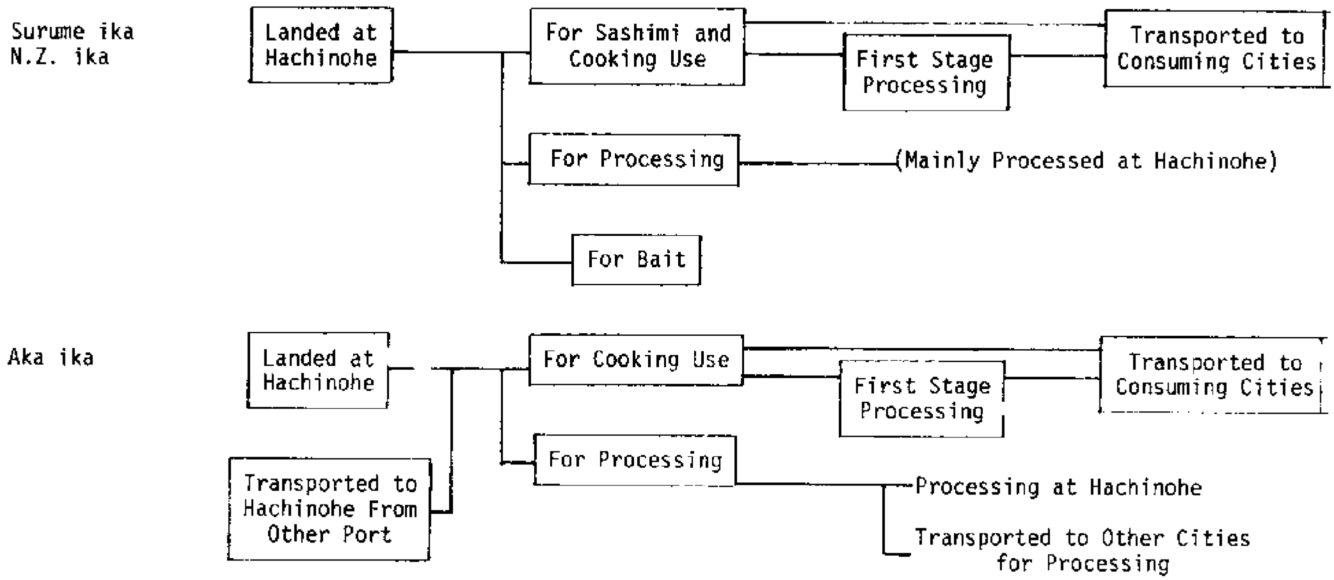

Figure 2. Distributions of Frozen Ika at Hachinohe by Species

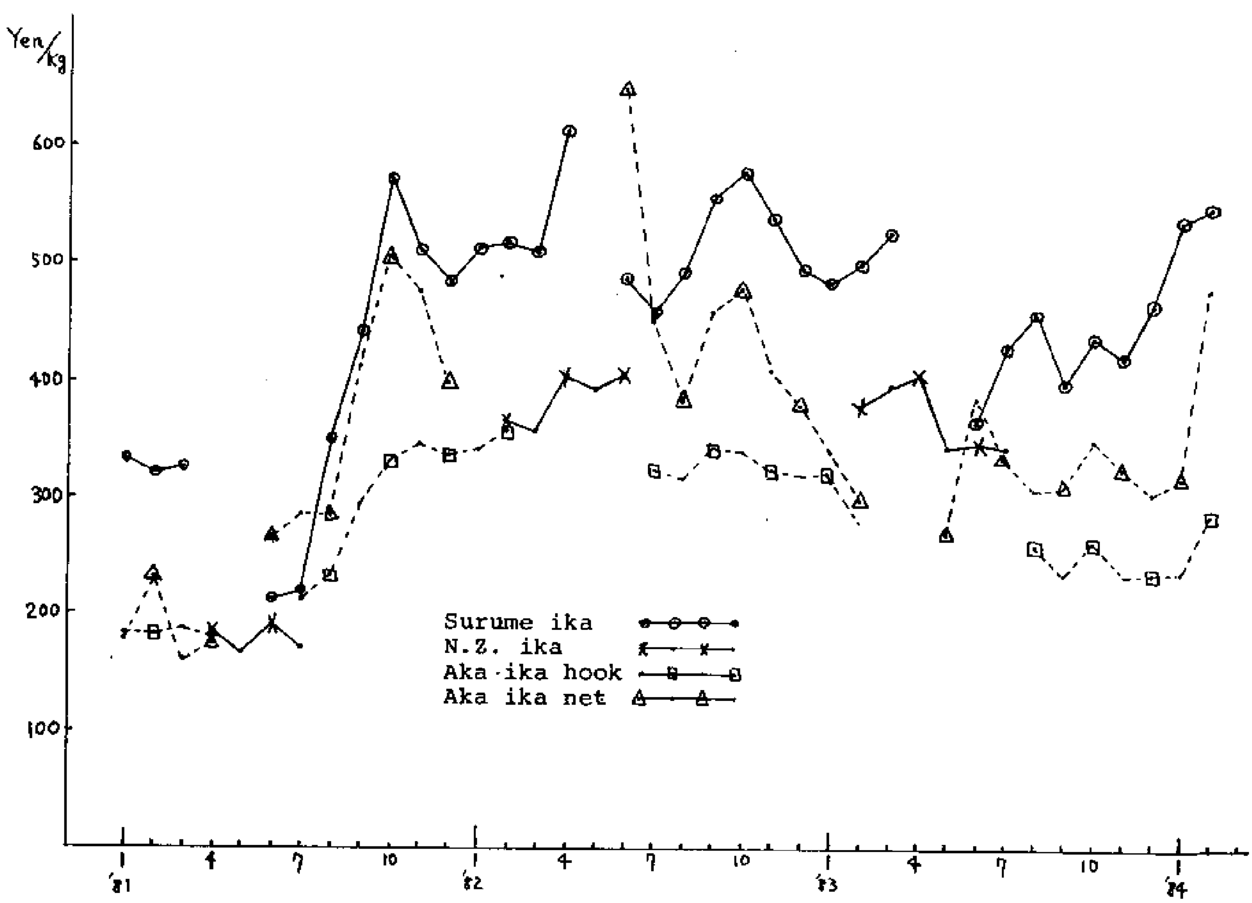

Figure 3. Monthly Wholesale Unit Price of Frozen Ika at Hachinohe by Species

Source: Federation of Hachinohe Fisheries Cooperatives

Hachinohe treats about one third of total Japanese landings of frozen surume ika, New Zealand ika and Aka ika, and fulfills the roles as shipping base of ika for sashimi and cooking use and processing base of ika for processing use. The author thinks that this strong position of Hachinohe comes from, in addition to the before mentioned functions for concentrations, fine division of ika by size and treatability of all kind and all size of ika, because the utilization of frozen ika mainly differs by species and by size.

Price Determinations

The author thinks that price determinations of ika at the place of landings are roughly divided into two systems. One is the system for sashimi and cooking use centered by Surume ika and another is that for processing use represented by Aka ika. The price of Surume ika for sashimi and cooking use at the place of landings is mainly determined by market price at the place of consumption affected by supply-demand situations. The price of Aka ika at the place of landings is determined by the cost of each processing. In these situations, the price of New Zealand ika which has substitutional character for Surume ika and Aka ika is mainly determined by supply-demand situations of Surume ika and Aka ika, and shows large price fluctuations. Table 8 indicates landing volume and the unit price of ika landed at Hachinohe in the recent three years. Unit price of New Zealand ika in 1981 shows a heavy slump by the increased inventories caused by rich catch in 1980, but shows rapid recovery in the following year, compared with other species. In this table, Aka ika caught by net indicates a higher price than Aka ika fished by hook and line. This reversal phase is due to the fact that net caught Aka ika is usually low level processed on board. In general, the price of New Zealand ika is set up lower than Surume ika and somewhat higher than Aka ika, though it differs by size. Figure 3 shows this situation more clearly.

Conclusion

The author points out the following about price determination of frozen ika by species at Hachinohe through interviews.

Surume ika. Surume ika has the widest utilization and the utilization is mainly determined by size. Large size Surume ika (less than 40 per case) is destined for sashimi and cooking use. So the price at Hachinohe of this size is basically determined by market price at the place of consumption, especially the price of Tokyo Tsukiji Market. In other words, the price is led by the price at Tokyo market.

Medium and small size Surume ika is mainly used for processing and for bait. The destinations by size are roughly fixed by the kind of processing. So the market price of Surume ika for processing by size at Hachinohe is basically calculated by each market price of processed products which Surume ika is used by size.

Some quantities of 41-50 per case Surume ika is used for bait for tuna fishing. The price for this use is determined by the market price, and the market price is affected by the supply situations of other fishes used for this purpose.

Aka ika. Aka ika is mainly used for processing. The market price by size at Hachinohe is determined by each market price of processed products which Aka ika is determined by size.

New Zealand ika. The market price of New Zealand ika at Hachinohe is mainly determined by the market price of Surume ika and Aka ika by size, and inventories and catch expectations of these ika by size. Because New Zealand ika is landed at the off-season of Surume ika and Aka ika fisheries.

The utilization of ika in Japan has multiple structures by species, by the difference between fresh and frozen, by size and by fishing gear, and the price determination mechanism is very complex. The author can not analyze econometrically in this paper. The author is now preparing an econometric analysis on this issue.

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Fisheries Data and Information Exchange Working Group

Recent Change in World Fishery Production by Major Species Groups and by Major Fishing Areas in Relation to the New Regime of the Oceans

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0. Introduction

Analyses were made based on catches and landings data released by FAO Yearbook of Fishery Statistics to see recent change in world fishery production by major species groups and by FAO major fishing areas. The ideas behind this were (i) to forecast briefly the future supply of fish and fishery products by referring to the past trend of fishery production and (ii) to know change in fishery production by FAO major fishing areas in relation to the new regime of the oceans that has emerged from the Third UN Conference on the Law of the Sea.

1. Change in World Fishery Production by Species Group

1.1 Analytical Method Followed

For the compilation of catch by species in the FAO Yearbook of Fishery Statistics "International Standard Statistical Classification of Aquatic Animals and Plants" (ISSCAAP) is in use. In the ISSCAAP all aquatic animals and plants are at first classified into nine divisions such as Freshwater Fishes, Diadroumous Fishes, Marine Fishes, Crustaceans, Molluscs, etc., each of which are further subclassified into several groups of species. For the macro-analysis of the fishery, however, these divisions and groups of species are often grouped into some ten species groups as seen in the columns of Table 1.1 Therefore, change in world fishery production was analyzed herein by such species groups for the period from 1974 to 1982.

In the present analyses catch which was reported to FAO as either miscellaneous fish or trash fish was treated as a part of demersal fish, as such cases often occur for the catch of demersal fish. This may be argued by some, as there are some countries which are unable to report their catch by species. As a result, catches of all marine fishes in such countries are reported to FAO as miscellaneous fish.

1.2 Findings (See Table 1.1 and Figure 1)

i) World Fishery Production

For the period from 1974 to 1982 world fishery production increased from 66.5 million tons to 76.5 million tons at an annual increasing rate of 1.8 percent, which well corresponds to the annual growth rate of world population towards 2,000 which were forecasted by the United Nations.

ii) Oceanic Pelagic Fish Like Skipjacks and Tunas

For the same period the production of this species group well increased from 2.2 to 2.6 million tons at an annual increasing rate of 1.8 percent due mainly to a recent remarkable increase in skipjack catch.

As a matter of fact, since 1979 catch of skipjack in the world has increased at an annual rate of 4 percent, implying its further increase in the future.

iii) Coastal Pelagic Fish Like Mackerels, Pilchards, etc.

For the same period the production of this species group tremendously increased from 23.9 to 29.7 million tons at an annual increasing rate of 2.8 percent. As this species occupies the highest proportion of world fishery production, the production has well offset a recent declining trend of demersal fish catch.

iv) Demeral Fish (See Table 1.2 as well as Figure 1)

In the capture of demersal fish high quality fish are normally sorted out by species, while low quality fish are treated as others, i.e. miscellaneous or trash fish. As seen in Table 1.2, during the period under review catch of high quality fish declined considerably, whereas that of low quality fish increased markedly. As a result, species composition of demersal fish catch in terms of high and low quality fish is becoming worse. Moreoever, catch of demersal fish as a whole showed a declining trend. These facts may well imply that demersal fishery resources are generally under a heavy pressure of fishing effort, and hence adequate fishery management is urgently required for this species group.

v) Shrimps

For the period from 1974 to 1978 the production of shrimps increased from 1.4 to 1.7 million tons. However, after 1978 the production becomes stagnant, implying that it has already reached its maximum production level. Such a trend well corresponds to a deteriorating tendency in demersal fish catch, as shrimps are often caught together with bottom fish by trawlers.

vi) Cephalopod, i.e. Squid and Octopus

For the period under analysis a marked upward trend in the production was noted at an annual increasing rate of 4.9 percent. This clearly indicates that there still remains the resources of cephalopods which could be further exploited. Recent development of the squid fishery for the entire area of the Gulf of Thailand and on high seas of the north Pacific Ocean may well prove such a possibility.

vii) Other Marine Animals Such as Shellfish (See Table 1.3)

The production of other marine animals as shown in Table 1.3 is composed of mainly shellfish. For the past eight years until 1982, as seen in Table 1.3, the production of oysters, mussels, scallops, clams, cockles, etc. increased to a great extent due to the development of mariculture.

viii) Salmons

Although its production is not always significantly high, for the period under analysis there happened a marked increase in salmon production, which particularly occurred in the northeast sea area of the Pacific Ocean. This is due mainly to a considerable increase in the U.S. fishing fleet for the salmon fishery in association with a high demand for this fish in Japan. A steady increase of salmon catch in Japan as a result of intensive stocking through salmon hatcheries is also part of the reason.

ix) Fresh Water Fish

For the period under review there also happened a steady increase in the production of fresh water fish such as carps, catfish, tilapias, etc. Thus, the production increased from 5.8 million tons in 1974 to 7.0 million tons in 1982 at an annual increasing rate of 2.3 percent. Such an increased production of fresh water fish is attributed to a marked development of fresh water aquaculture particularly in East and Southeast Asia. The invention of a hybrid variety of tilapia in Taiwan which is characterized by an extremely high growth rate is, among others, noteworthy.

2. Change in Fishery Production by Major Fishing Areas

2.1 Analytical Method Followed

Since around 1970 the FAO Yearbook of Fishery Statistics has started to give catch data for each major fishing area in its Table C. The area size of the major fishing area in use for the compilation of catch data is too large to know actual sea area fished, e.g. the entire area of Atlantic and Pacific Oceans is being divided into only six major fishing areas respectively. Nevertheless, catch data compiled in such a way are still quite worthwhile to see change in fishery production by major fishing areas in relation to the new regime of oceans. To simplify the analytical work, the total fishery production data of 1972, 1977 and 1982 were used, and the results are given in Figure 2.1 and 2.2.

2.2 Findings

There are fifteen major fishing areas, for which change in the total fishery production data were analyzed. Analyses hereunder are, however, made only for some major fishing areas in which significant change occurred.

i) Atlantic, Northwest

This is the sea area which was exploited by fishing fleets from Europe in addition to those from coastal countries, i.e. Canada and the USA. Since 1977 when the EEZ of coastal countries became effective, there happened a marked decline of the fishery production, as almost all of the fishing fleets from Europe were phased out. As a matter of fact, the Atlantic Northwest is the only sea area where a significant decline in the total catch took place in relation to the new regime of oceans. Major component of the production is demersal fish, of which catch of cod has been well recovered due to the reduction of fishing effort.

ii) Atlantic, Northwest

This is the world's second important sea area in terms of fishery production. The major component of the fishery production is demersal fish, which is followed by coastal pelagic fish. Towards 1976 the total production increased, but thereafter it followed a declining trend due mainly to decreased catches of plaice, cod, haddock, Norway pout, whiting, capelin, sprat, mackerels, etc.

iii) Atlantic, Eastern Central

This is one of a few sea areas where foreign fishing vessels are largely allowed to fish. The major component of the fishery production is coastal pelagic fish, which is followed by demersal fish and oceanic pelagic fish. Since 1977 the production has declined to some extent due partly to the withdrawal of foreign fishing vessels. Japan is one of such countries by withdrawing all of her trawlers.

iv) Atlantic, Southwest

This is one of a very few sea areas where there still remains some fishery resources for further exploitation. There appears a clear upward trend of fishery production, though the size is not so big as other sea areas. Since there is the Patagonian Shelf which extends beyond EEZ, resources available are mainly demersal fish. Since 1984 squid resources are newly being exploited.

v) Atlantic, Southeast

As coastal countries do not have much fishing fleet excepting South Africa, this sea area is mainly fished by foreign fishing vessels from developed countries. As the resources of hake have declined in recent years, fish mainly caught are coastal pelagic resources. During the past ten years there appeared a declining trend of the total fishery production due mainly to decreased catch of pilchard and hake.

vi) Pacific, Northeast

This is the world's most productive fishing area, producing nearly one third of the world's total marine production. Both pelagic and demersal resources are equally available. Of these pilchard and Alaska pollack are predominant. Since 1972 there has been marked increase of the fishery production due mainly to the recovery of pilchard resources and increased harvests from oyster and scallop culture.

vii) Pacific, Northeast

Resources available are mostly demersal fish, which are followed by salmons, king crab and snow crab. Of the demersal fishery resources Alaska pollack is predominant. Since 1976 when the U.S. Fishery Conservation Zone was established, the USSR fishing fleet has been completely phased out. Although Japan, Korea and some other countries are allowed to fish in this sea area, the USA fully enjoys catching salmons, king crab and snow crab. However, owing to her intentional catch the king crab resource has collapsed since 1982. Judging from the size of the current fishery production, the magnitude of fishery resources available in this sea area is not as big as that in the Pacific Ocean, Northwest.

viii) Pacific, Western Central

This is a sea area which refers mainly to South Asian countries. Coastal pelagic fish and demersal fish are equally important. Tunas and skipjacks are relatively well caught. Shrimps and cephalopod are also fairly important resources. Until 1978 there was an upward trend of fishery production. Thereafter, however, production has been stagnant, being slightly less than six million tons. Owing to overfishing to demersal fish the proportion of miscellaneous or trash has been significantly high. As almost all fishery resources have been fully exploited, there may not be much further increase in the fishery production with the exception of capture of skipjack and culture of shrimp and some other fish.

ix) Pacific, Western Central

This is a sea area off the southern west coast of the USA and Central American countries. Oceanic pelagic and coastal pelagic fish are important, whereas demersal fish are less important. Owing to the recovery of California pilchard and a marked increase in thread herring there has been a steady upward trend of the total fishery production.

x) Pacific, Southwest

This is a sea area mainly around New Zealand. In spite of ample sea area available the fishery production is extremely insignificant as compared with those of other sea areas, being around only 400 thousand metric tons. Nevertheless, the catches contain valuable fish like sea bream and squid for export.

xi) Pacific, Southeast

This is a sea area which once became famous to the world in terms of an extremely significant catch of anchoveta. Unlike other sea areas almost all catches are coastal pelagic fish, whereas catch of demersal fish is very limited. Owing to a marked decrease of anchoveta catch the total fishery production declined towards the mid-1970s. However, due to a significant increase in jack mackerel and pilchard catch which particularly occurred in the second half of the 1970s the total fishery production is now on the way of recovery.

xii) Indian Ocean, Western

Both coastal pelagic and demersal fish are equally important. The shrimp production is fairly significant. So far there has not been much change in the total fishery production, being around 2 million tons.

xiii) Indian Ocean, Eastern

Towards 1980 there was an upward trend of the total fishery production. Thereafter the production has become stagnant. Owing to inadequacy of catch data of Bangladesh and Burma very little can be said even by species groups.

3. Change in Fishery Production of the USSR and Japan by Major Fishing Areas

3.1 Analytical Method Followed

Both the USSR and Japan are considered as countries with long distance water fisheries operating in the EEZ of other coastal countries. Based on catch data released in the FAO Yearbook of Fishery Statistics how far both countries depend on their long distance fisheries was analysed. To simplify such analyses only catch data of 1972, 1977 and 1982 were used. The results are shown in Figure 3.1 and 3.2.

3.2 Findings

Comparison Between the USSR and Japan

Although the USSR fishery has been affected to some extent by the new regime of oceans, it still depends largely on her long distance fishery operations in the EEZ of other coastal countries. This is due to the scarcity of good fishing grounds along the coast of the USSR. In contrast, Japan's fishery depends primarily on fishing grounds off her islands, although Japan is considered a world leading country in terms of long distance fishery. The USSR has developed her long distance fishery with the aim of catching mainly pelagic fish to deliver more cheap fish to her nations. On the contrary, Japan's long distance fishery has been developed with the aim of catching quality fish so as to meet an increased demand of high price fish which has occurred in relation to the betterment of her nations' living standard.

USSR

The USSR long distance fishery has been almost fully phased out from sea areas off the west coast of Canada and the USA and off Alaska. Even in other major fishing areas the catch of her long distance fishery has declined to some extent since 1977. In contrast, there has been marked increase in her catch in the Far East to supplement her decreased harvest in other fishing areas. It is also noteworthy that her long distance fishery has resumed its operation off Peru.

Japan

The size of catch taken by Japan's long distance fishery in sea areas off other countries is far smaller than that of the USSR. In almost all major fishing areas off other coastal countries Japan's catch has declined since 1977. An increased catch around Japan is attributed to the marked recovery of her pilchard resources, which has well supplemented declined catches in other fishing areas.

4. Conclusion (Recommendation)

i) Demersal resources are in need of taking an urgent action to implement a proper fishery management particularly in tropical countries.

ii) Advancement of mariculture techniques and its implementation should be enhanced to supplement a declined supply of quality fish.

iii) Technological development to convert low quality fish into fishery products preferred by consumers should be strengthened.

Table 1.1 World Fishery Production by Species Groups, 1974-1982 *1

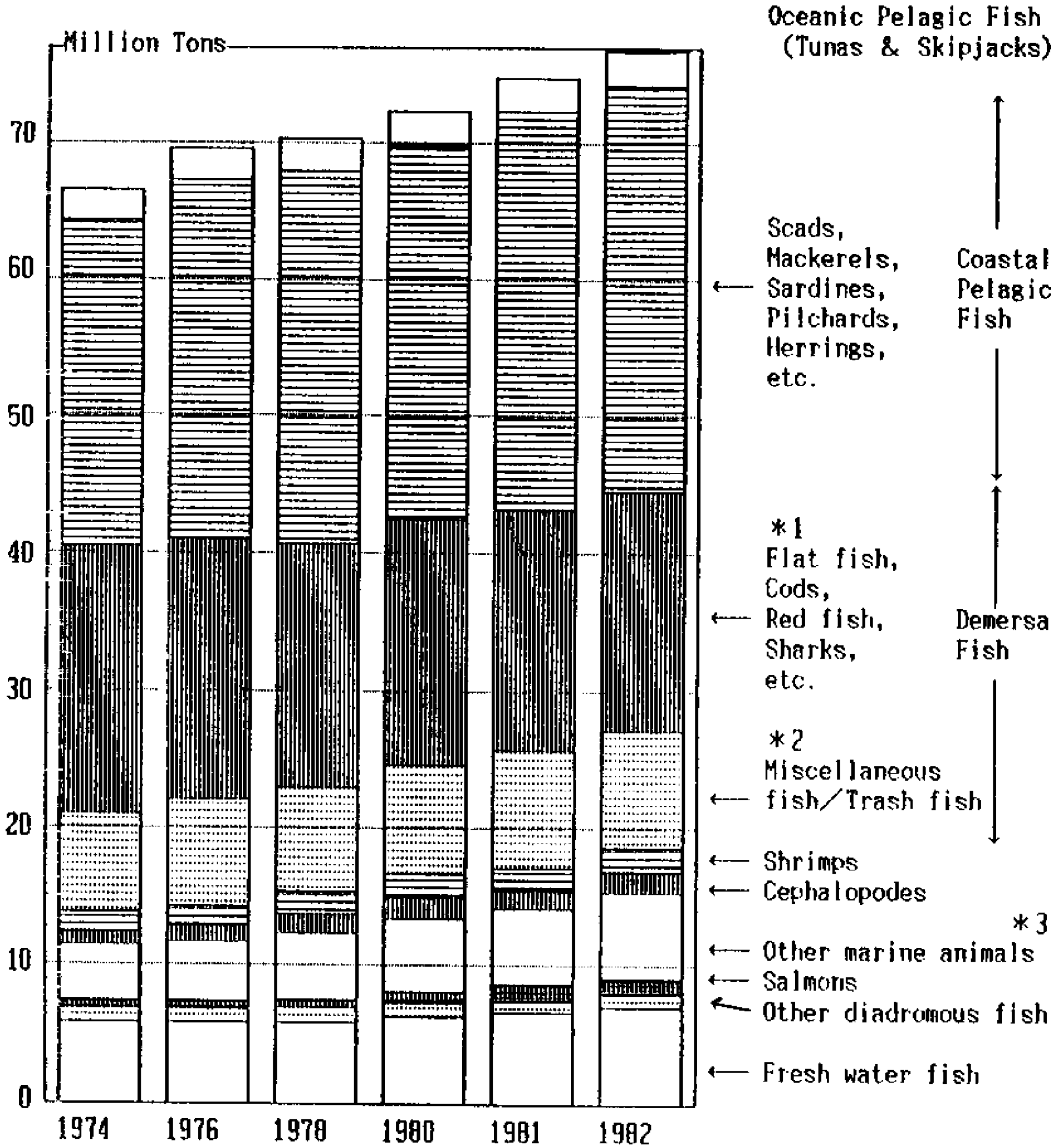
Unit : Million Tons

Year	Total	Marine Fish				Shrimps Penaeidae	Cephalopode	Other Marine Animals	Diadromous		Fresh water Fish
		Pelagic		Demersal					Salmons	Others	
		Oceanic	Coastal	Spe. *2	Others						
1974	66.5	2.2	23.9	19.5	7.2	1.4	1.1	4.1	0.5	1.0	5.8
1976	69.4	2.3	26.3	19.0	7.7	1.5	1.2	4.3	0.6	1.0	5.7
1978	70.2	2.5	27.3	17.7	7.7	1.7	1.3	4.9	0.6	1.1	5.8
1980	72.3	2.6	27.5	17.7	8.0	1.7	1.5	5.4	0.8	1.0	6.2
1981	75.1	2.5	29.1	17.5	8.6	1.7	1.3	5.7	0.9	1.1	6.6
1982	76.8	2.6	29.7	17.4	8.5	1.7	1.6	6.4	0.8	1.2	7.0
Increase during 1974/82	+10.3	+0.4	+5.8	-2.1	+1.3	+0.3	+0.5	+2.3	+0.3	+0.3	+1.2
82/74 %	115	115	128	83	118	126	147	156	160	127	120
Annual Rate %	+ 1.8	+1.8	+2.8	-1.4	+2.1	+2.9	+4.9	+5.6	+6.1	+0.3	+2.3

*1 For the definitions of species groups please see Fig. 1.

*2 Catch of demersal fish which were reported by spcies.

Fig. 1 World Fishery Production by Species Groups, 1974-1982



(Note) *1. Catch of demersal fish which were reported by species.

*2. Catch of fish which were reported as either miscellaneous fish or trash fish. As such cases mostly occur for catch of demersal fish, these catches are treated as part of demersal fish catch.

*3. Mainly shells such as oysters, mussels, scallops, clams, cockles, etc.

Table 1.2 Change in Species Composition of Demersal Fish Catch

Unit : Million Tons

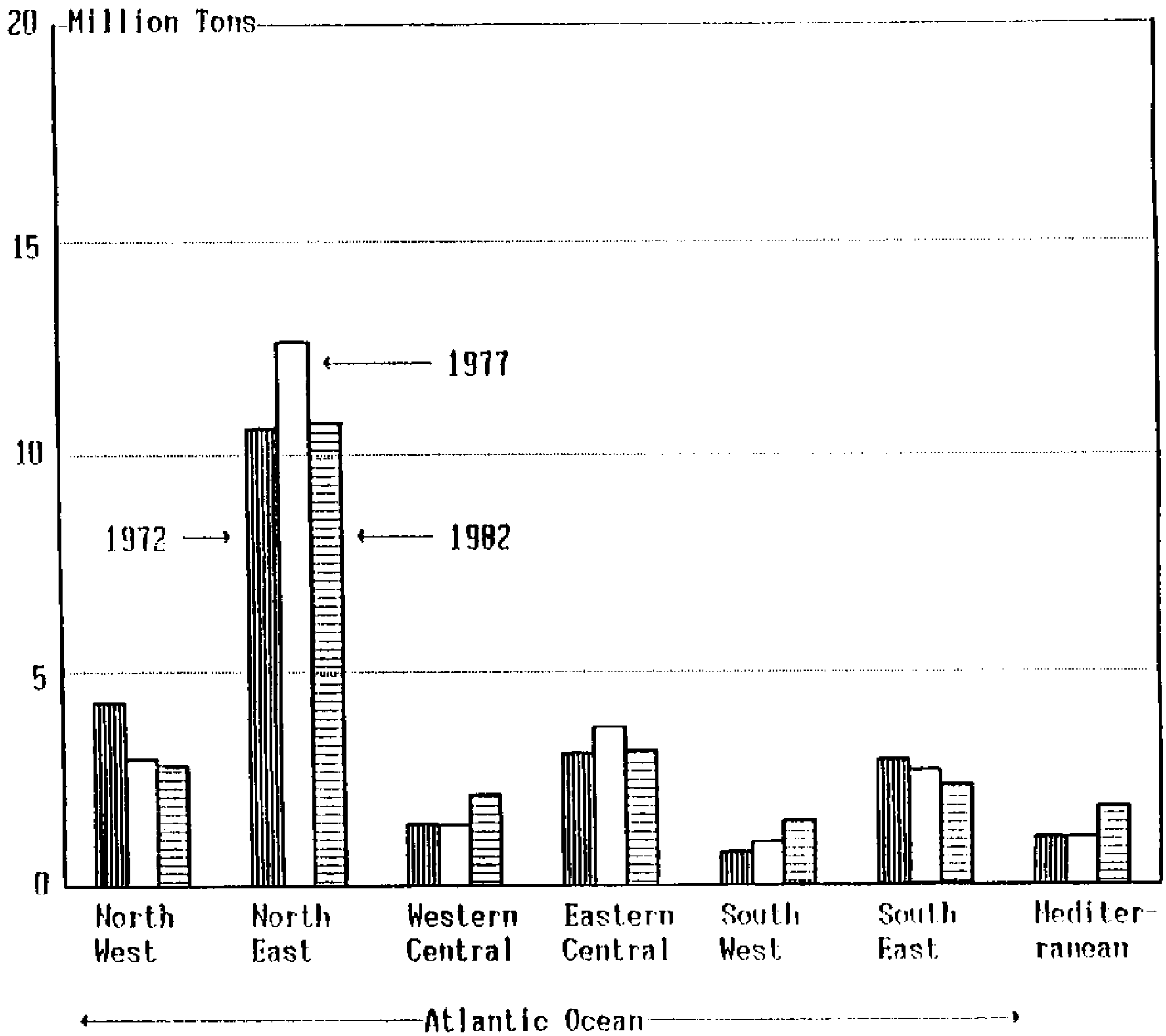
Year	Total	High Quality Fish (Catch Reported by Species)	Low Quality Fish (Catch Reported as Miscelloneous or trash fish)
1974	26.7 (100.0)	19.5 (73.1)	7.2 (26.9)
1982	25.9 (100.0)	17.5 (66.9)	8.5 (33.1)
Increase／decrease	- 0.8	- 2.1	+ 1.3
82／74 %	97.0	83.0	118
Annual Rate of Increase or Decrease %	- 0.4	- 1.4	+ 2.1

Table 1.3 Increasing Trend of Shellfish Production

Unit : Thousand Tons

Year	Oysters	Mussels	Scallops	Clams, Cockles, Arkshells, etc.
1974	740	430	240	900
1982	950	640	500	1,300
Increase during 74／82	+ 210	+ 210	+ 260	+ 400
82／74 %	128	148	208	144
Annual Rate of Increase %	+ 0.3	+ 5.0	+ 9.6	+ 4.6

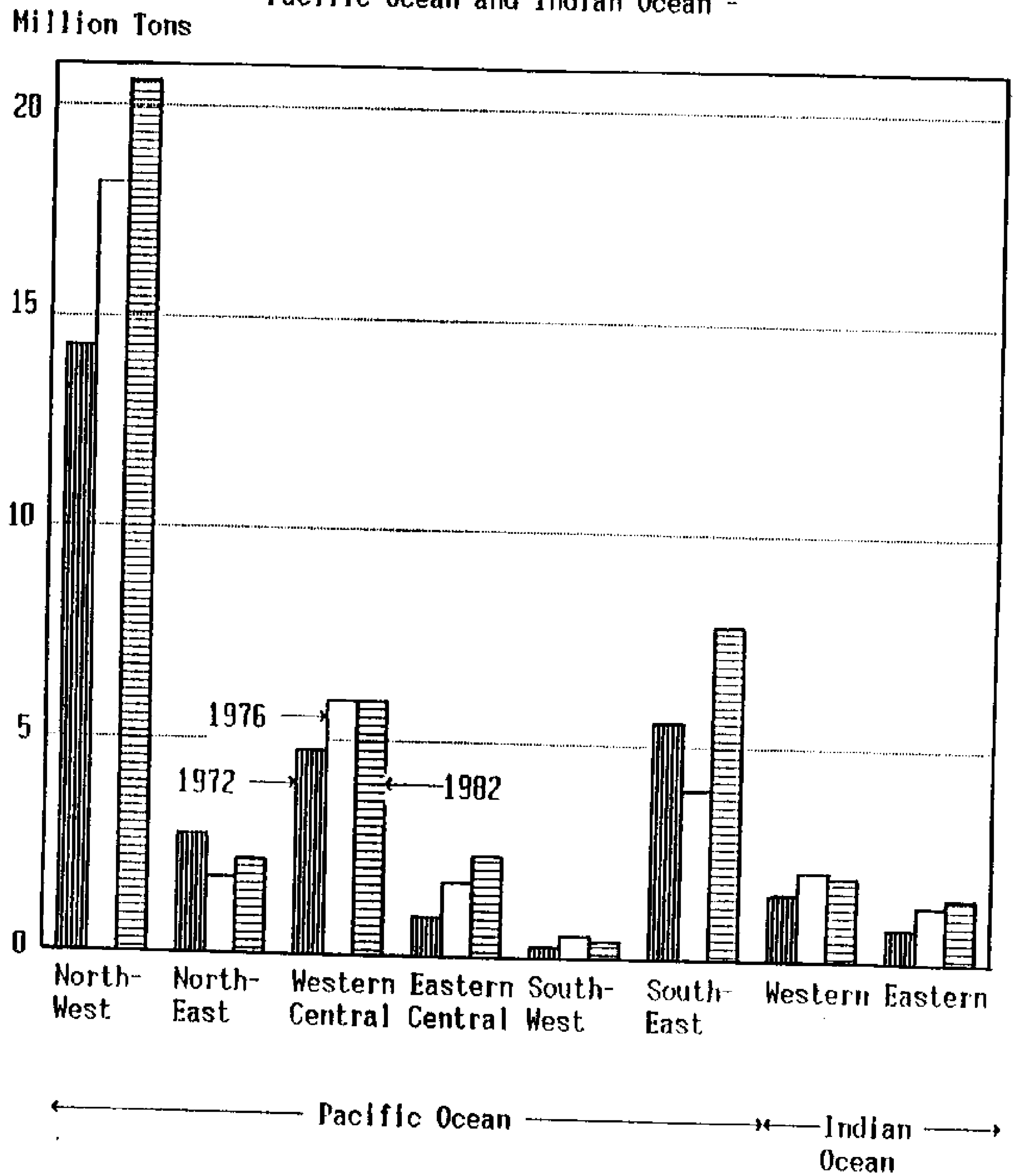
Fig. 2.1 Fishery Production by Major Fishing Areas, 1972-1982 No. 1
-Atlantic Ocean and Mediterranean -



(Note) For each major fishing area the total fishery productions of 1972, 1977 and 1982 are indicated in order from left to right.

(Source) FAO Yearbook of Fishery Statistics, 1982, Vol.54.

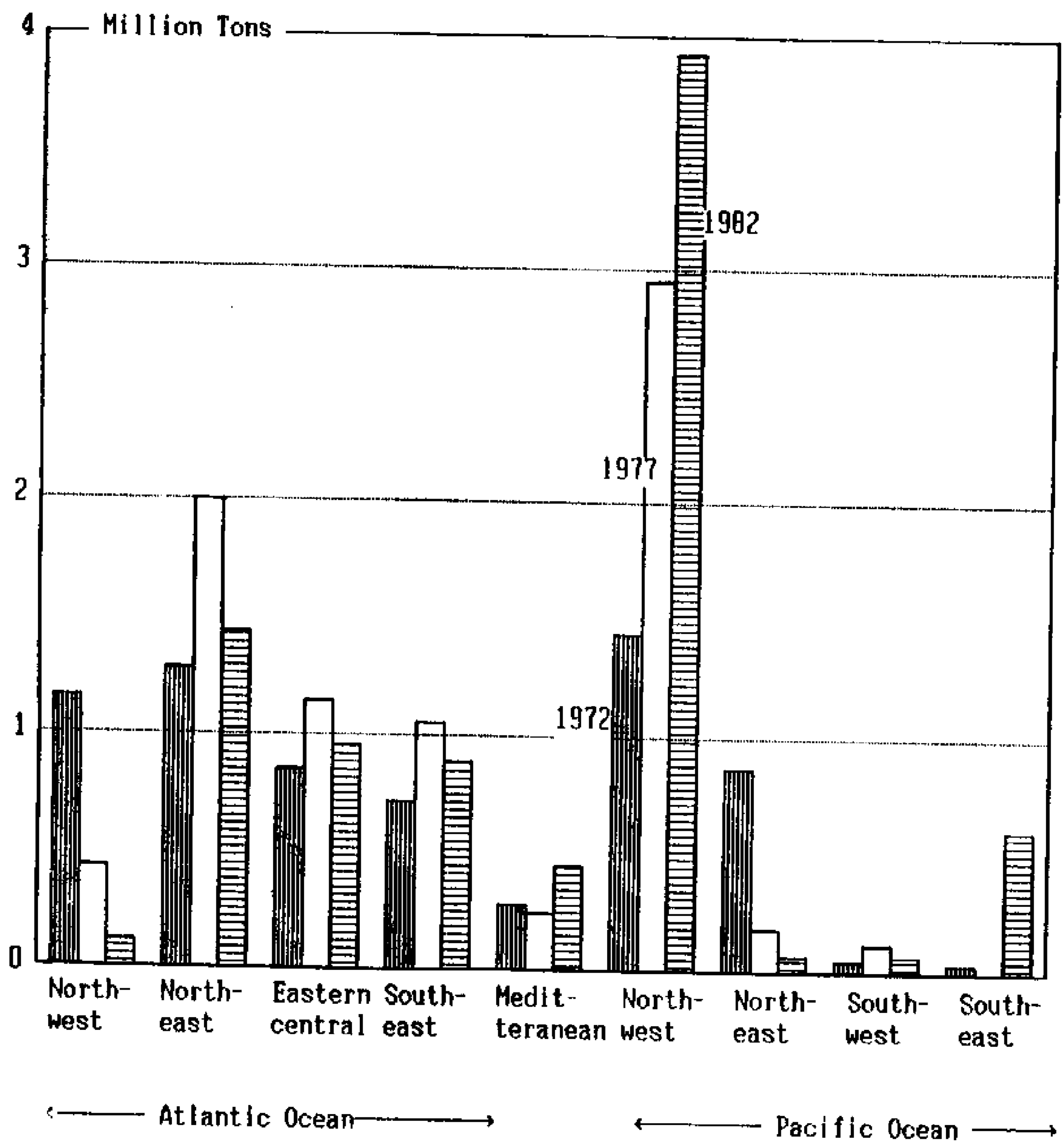
Fig. 2.2 Fishery Production by Major Fishing Areas, 1972-1982 No. 2
-Pacific Ocean and Indian Ocean -



(Note) For each major fishing area the fishery production of 1972, 1977 and 1982 are indicated in order from left to right.

(Source) FAO Yearbook of Fishery Statistics, 1982, Vol. 54.

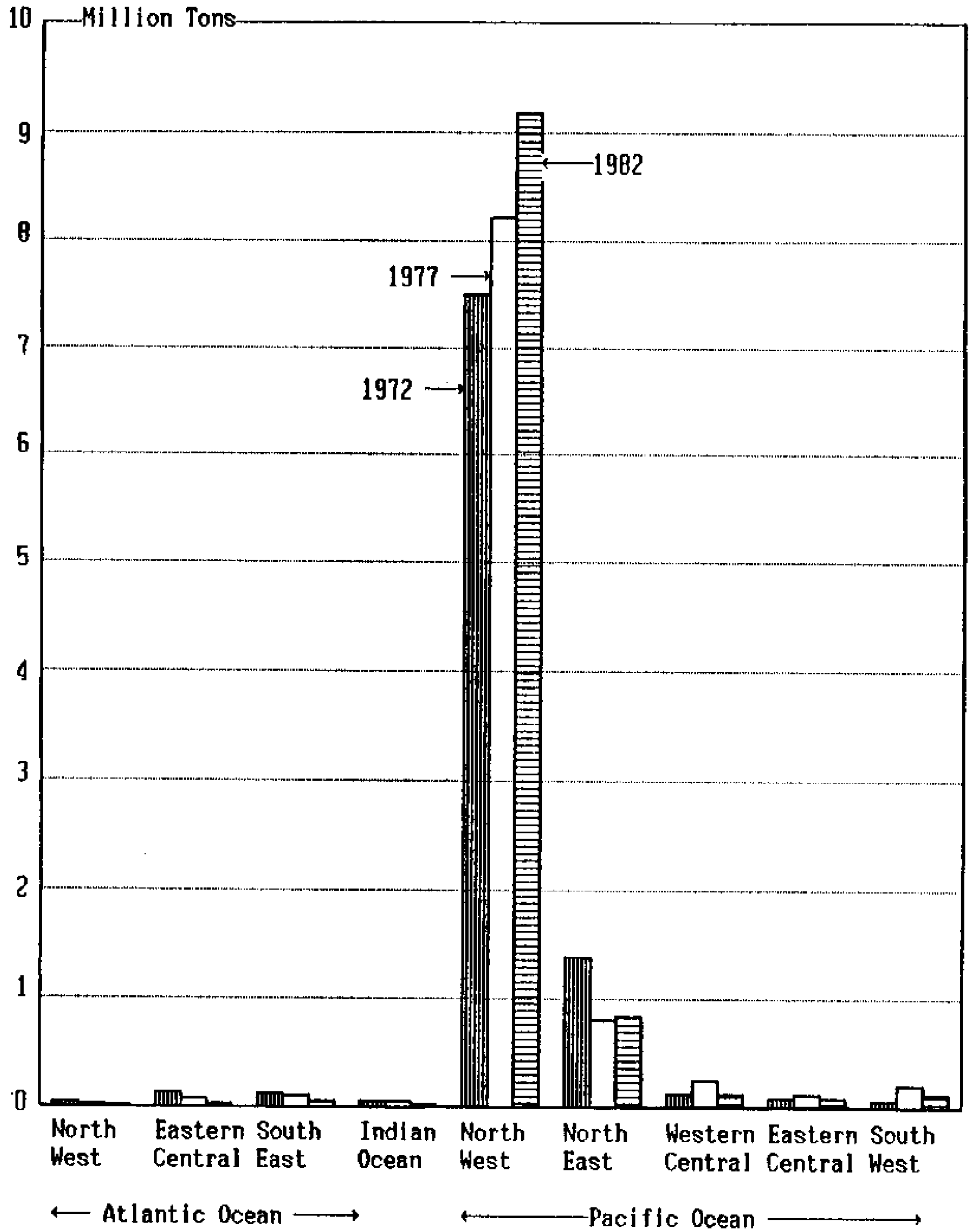
Fig. 3.1 USSR Marine Fishery Prodution by Major Fishing Areas, 1972, 77, 82



(Note) There are some USSR catches taken in other FAO major fishing areas, but these are ignored owing to their insignificance.

(Data source) FAO Yearbook of Fishery Statistics, 1982

Fig. 3.2 Japan Marine Fishery Production by Major Fishing Areas, 1972, 77, 82



(Note) There are some catches taken in other fishing areas, but these are ignored owing their insignificance.

Canada's Experience in the Collection and Use of Fisheries Economic Statistics

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Introduction

Canada's vast fisheries resources extend over three major fishing zones -- the Atlantic, the Pacific and the inland freshwater areas. In each zone, these resources are exploited by three distinct fisheries with varying social and economic conditions. Quite apart from the major commercial fishery, there are less obvious recreational and subsistence or native fisheries. An essential requirement for managing such a vast and complex resource is an adequate monitoring system, one which can provide feedback on progress, on change and particularly on troubles that may be brewing.

While the collection of statistics on the fishing industry dates back to Canada's Confederation in 1867, the Department of Fisheries has only been intensively involved in fishery statistics since the late 1940s. The current fisheries statistical system is a result of continuing evolution. It evolves and expands as the information needs for fisheries management change from simple fish counts at dockside to a more complex quota monitoring by various gear and vessel categories through the use of sophisticated electronic and telecommunication equipment. In addition to the biological resource management, there has been increasing awareness of the importance of social, economic and marketing considerations in the overall management of Canada's fisheries.

In order to meet the increasing and immense variety of information demands, Canada has approached the problem in two ways. First, the regular statistical programs collect basic data such as volumes and values of landings and production of the commercial fishery on an ongoing basis. Secondly, the Department undertakes research vessel surveys and socio-economic and financial surveys to complete the needs of biologists, economists and policy makers.

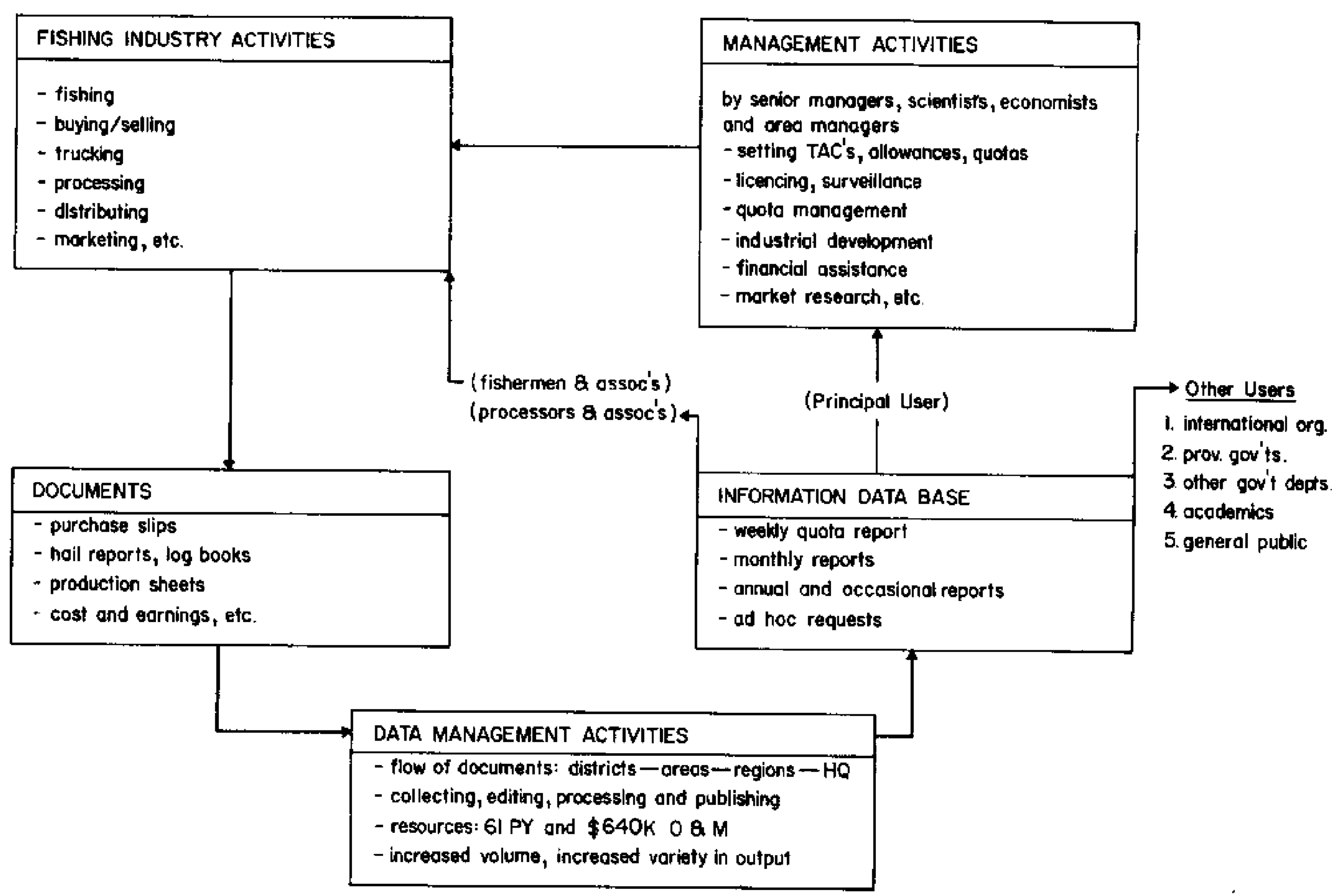
A brief review of the various types of fisheries economic statistics collected in Canada, their usages and limitations with respect to various applications, some information issues and future data needs are given in the ensuing sections.

General Overview

The backbone of the Department of Fisheries statistical system is the information generated from the regular statistical programs. The regular statistical programs currently gather information on catch and effort, landings, production, inventories and prices of the commercial fishery. The operation of these programs is decentralized in three distinct fishery zones, namely, Atlantic, Pacific and Inland. Within each zone, there are separate systems operated by federal regions, with a few exceptions. These exceptions are mainly in the inland regions where data are either collected by the province (Ontario) or by the Freshwater Fish Marketing Corporation (Prairies). In British Columbia, the provincial government is responsible for the production statistics.

The Canadian commercial fishery generates about $1.9 billion annual gross revenues and consists of 78,000 fishermen, 41,000 vessels and 900 plants. In terms of initial data entries, this activity generates over 1.5 million landing sales slips, more than 17,000 plant production reports, and 110,000 licensing documents covering over 150 commercially harvested fish and marine products. Chart 1 illustrates the information flow, the statistical functions and the use management makes of such data.

CHART 1 INFORMATION FLOW & STATISTICAL FUNCTIONS



Landings (catch and effort)

The Department's legal mandate has traditionally been for the protection and enhancement of the fisheries resources. This is strongly reflected in the effort devoted to the landings (or catch and effort) statistics as compared to other types of statistics. Landings and price statistics are derived from sales slips or waybills, while effort information is based on fishermen's log books. Once the raw documents are collected in the field, several quality control tests have to be passed at the coding, data entry and processing stages before the data are finally stored on the computer master files. As such, the error rate within the system is estimated to be well below 5%. Because of the large volume involved, however, backlogs of data to be entered often occur during peak fishing seasons. This results in late or incomplete information on a current basis. In addition, there is always some local direct sales which are not captured by the system but would require extensive policing or follow-up in order to fill in the gap.

Landings (or catch and effort) statistics are used extensively within the Department for stock assessment, quota control, licensing, gross income analysis and infrastructure requirement analysis. Despite the above constraints in data collection activities, the information provided is generally felt adequate to meet various program needs. To provide up-to-date catch data for quota monitoring purposes, daily hail reports from large fishing vessels are used in combination with sales slips records. Effort data are not universally available, particularly for small inshore vessels.

Production and inventories

Production and inventories statistics are mainly derived from monthly and annual plant production reports. They are treated in a similar manner but the resources devoted to it are considerably less compared to "catch and effort" data because the Department's jurisdiction over the processing sector is somewhat different when one considers the constitutional division of powers between the federal government and provinces. As a result, accuracy, completeness and timeliness of data cannot be effectively ensured. The Department's interests in the processing sector have developed over past years. These statistics have assisted in determining cold storage requirement, utilization rate of processing capacities, optimum exploitation of fish resources and product-mixes, and more often are used to measure the current supply and demand conditions on the market. The level of user satisfaction in using production and inventories statistics is in general poor due to aforementioned deficiencies in data collection programs and less efficient data processing and retrieval systems.

Employment and equipment (licensing)

Statistics on employment, boats and gear in the primary sector are derived mainly from the licensing documents which only ensure the quality of the minimum information required for licensing purposes such as name, address, vessel age, size, etc. Plant related statistics are again handicapped by the lack of constitutional authority except for inspection purposes for those plants involved in inter-provincial shipment and export. In addition to the use for licensing or inspection purposes, these statistics in conjunction with landings and production statistics would provide useful proxies measuring productivity, resource exploitation capacity, and socio-economic dependence of communities on the fishing industry.

Surveys

In order to fill in the gaps not covered by the regular statistical system, various types of surveys have been carried out in the past. For example, a comprehensive survey on 1981 fishermen's households incomes and expenses was carried out for the Task Force on Atlantic Fisheries. In 1983, similar surveys were carried out in the Pacific Region on the 1982 fishermen's incomes and expenditures and on vessel owner's costs and earnings. Financial survey of the Atlantic processors was also conducted during the Task Force Study. In 1983, there were two subsequent surveys on both Atlantic and Pacific processors covering a longer period, 1977-82 and 1978-82 respectively. Over the years, there have been small scale vessel costs and earnings surveys carried out in the Atlantic regions. There are also quinquennial National Sportfishing Surveys, which were done for 1975 and 1980. In general, survey statistics are considered more reliable because of more rigorous questionnaire and sample design, and better quality control. The only drawback is the lack of continuity in time which hinders the Department's ability to assess the current socio-economic conditions of the fishing industry. In addition, there is a compatibility problem if the surveys are carried out in a local and isolated manner such as the case for most vessel costs and earnings surveys in different Atlantic regions. This is primarily due to the use of different methodologies and target populations.

Other data sources

Information from sources other than Department of Fisheries has also been extensively used. External trade statistics on volumes and values of fish exports and imports are supplied by Statistics Canada on a regular basis. There is also a wide variety of Statistics Canada published socio-economic and financial statistics which have an identifiable fishery component. Since fisheries contribution to the national economy is relatively small compared to other economic sectors, the socio-economic information base has been weak in the past for the fishery sector. Other major data sources within the federal government include Revenue Canada, Employment and Immigration, Regional Industrial Expansion, etc. Since these are external sources, the Department has little control over the quality of statistics received and there is a general lack of thorough knowledge of the methodologies and assumptions used in deriving these statistics. Effective use of external data sources is desirable not only in terms of economy in data collection but also in light of the need to examine the fishery sector as an integral part of the total economy due to its importance to the regional social and economic conditions.

Apart from Statistics Canada supplied external trade statistics, information on foreign markets, production and prices is usually kept at "species desks" in the Department's Marketing Directorate. These are collected mainly through personal contacts with the industry and in the market place. Given the wide difference in statistical practices in different countries and the high volatility of market conditions, this is possibly the best approach to keep such information manageable and current. Nevertheless, some degree of consolidation/computerization of the existing information bases in the Marketing Directorate could perhaps further enhance the effectiveness and efficiency of the market analysis functions. Domestic prices and price indices of fish products are available from Statistics Canada and Agriculture Canada. There is, however, a need to verify the representativeness of fish commodities included in various price baskets.

Information Issues

The following information issues have often been encountered in the current operation and must be dealt with in the future development of the statistical system.

Legal authority

More and more, fisheries management is taking on an over-all systems approach, i.e., biological resource management with socio-economic and marketing considerations. As a result, fisheries data needs extend more and more into areas where the federal department is lacking jurisdiction, notably information on the financial conditions of the processing sector. This presents a major obstacle to collecting such vital information from the fishing industry. Several initiatives have been looked at to overcome this problem, including amendment to the Fisheries Act and increased cooperation with Statistics Canada and provinces. On the other hand, industry's willingness to participate in the statistical program is also instrumental to ensuring the completeness, accuracy and timeliness of the data requested. It is therefore an educational and feedback process, to ensure that the industrial participants realize the importance and usefulness of the data submitted, both for government management of the fisheries and for their own benefit.

Data collection organization

Canada Department of Fisheries and Oceans (DFO) is a highly decentralized department and as a result, so is the Department's statistical system. Regional statistics units report to regional Directors General and field data collection is under the jurisdiction of area managers and carried out by inspectors and conservation officers whose primary duties do not relate to statistics. In addition, regional economists often conduct socio-economic surveys in response to local needs, which renders any meaningful inter-region comparisons impossible. Several zonal statistics committees, e.g. Statistical Coordinating Committee for the Atlantic Coast (STACAC) and the Fisheries Statistics Committee for the Pacific Coast, have been established to undertake tasks to improve the regular statistical systems and achieve better statistical coordination on a zonal basis. However, there is still a strong need for national compatibility, especially in the area of socio-economic and financial surveys. This goal could perhaps be achieved through the Headquarter's role of National Program Advisor for Statistics and Surveys.

Information technology

One should always be aware and take advantage of the technologies available to cope with the ever expanding data volumes and information demands. The Department's statistical system has suffered from constraints inherent in the original design back in the 60s, based on old system design concepts without adequate user involvement and interface between component systems. The establishment of the aforementioned zonal statistics committees is also to ensure a proper application of advanced information technologies. Both are user-provider committees so that the users are at the forefront of the development to spot trends that are likely to be unproductive from their point of view. As well, recognizing decision making in fisheries management is a multi-disciplinary one and information needs are often overlapping, changing and expanding, a total and dynamic system concept must be adopted in the restructuring of the Department's statistical system. Chart 2 presents the master plan of a total system for Atlantic Canada, which provides an overall and coherent framework for the design of various existing and perceived component systems. Today's advances in data transmission and micro-processing technology, plus the continuing reduction in hardware cost, has given rise to the distributed data processing system concept as shown in Chart 3. This will allow local data entry and retrieval through a telecommunication network with the central data base and thus improve the accuracy and timeliness of the data because of the close proximity to the source of the events.

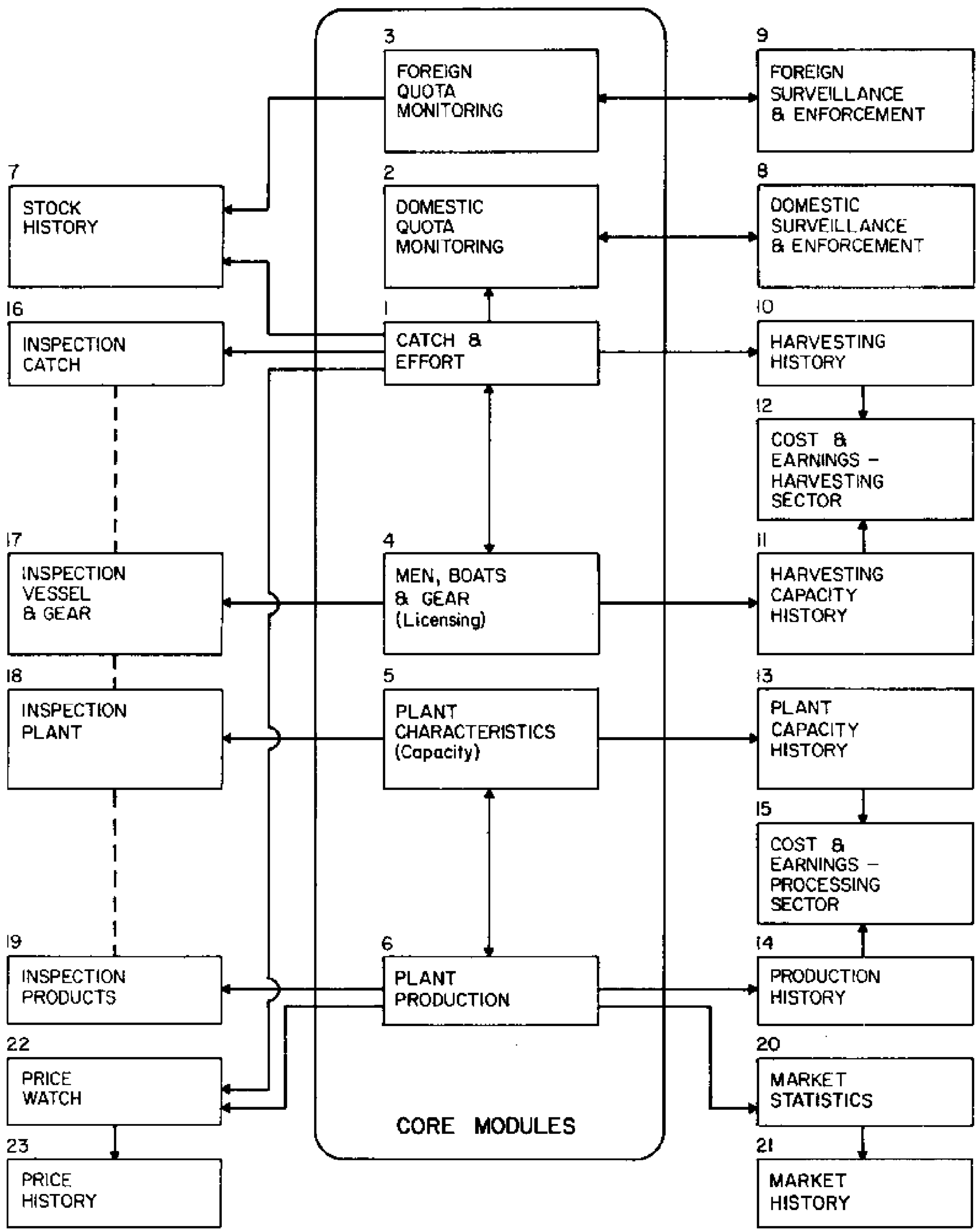
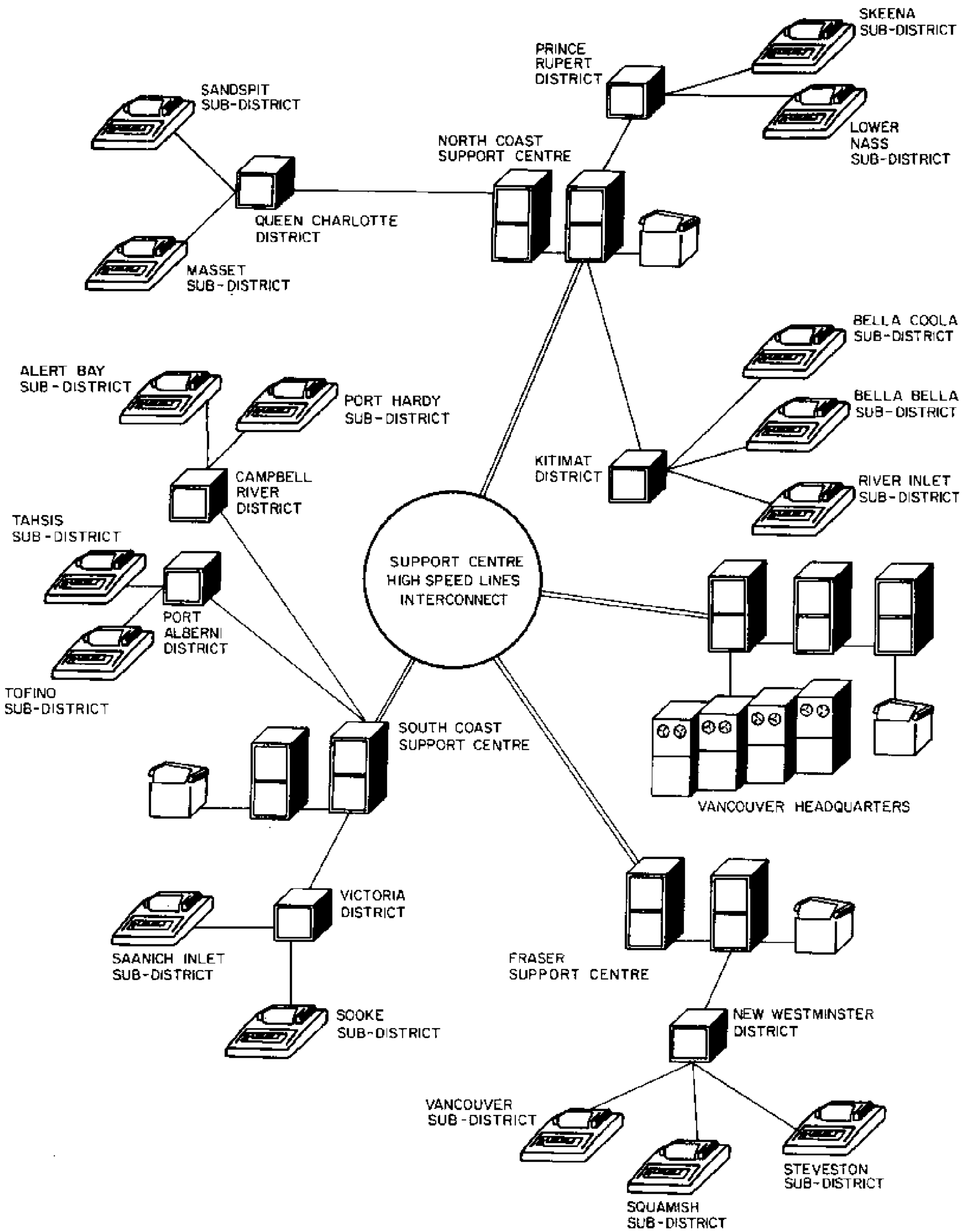


CHART 2 THE OVERALL MODULE STRUCTURE

CHART 3 DISTRIBUTED PROCESSING NETWORK EXAMPLE



Resources (money and people)

The resources available to collect, process and publish statistics have always been extremely limited. It is impossible to satisfy all users and a balance must be struck somewhere. There is always a trade-off between the quality and completeness of data and the cost of achieving these goals. User needs must be prioritized. For example, STACAC had decided to place catch/effort, quota monitoring and licensing of the core modules in Chart 2 as top priorities in restructuring the Atlantic zonal statistical system, while the Fisheries Statistics Committee stated that real time management of herring and salmon fisheries is the primary objective of the new statistical system in the Pacific Region. Alternative means must be investigated, such as application of sampling and other statistical estimation methods. Cooperation with other interested government agencies in sharing data collection and processing resources should be encouraged. A recently established DFO -- Statistics Canada Interdepartmental Liaison Committee is a good example.

Future Data Needs

Future data needs could be immense, but information is not a cheap commodity. As such, one must concentrate on a prioritized set of information requirements which are essential to the fulfilling of the Department's mandate and major initiatives.

Inshore catch and effort

Up to now, catch and effort data on individual small inshore boats are not available in the Atlantic catch and effort statistical system. Stock assessment is therefore impossible for inshore fisheries which account for more than one-third of the total Atlantic Coast landings. In addition, this information is essential to the testing of the Atlantic Task Force recommended options of gross income stabilization plan and production bonus scheme. The Pearse Commission Report on Pacific Fisheries also recommended expanding voluntary logbook programs and instating compulsory programs where more comprehensive information is required, particularly for the salmon troll fleet.

Industry financial performance

Basic structural characteristics in the industry gave rise to poor economic performance in the fisheries sector. The structure must be known and the interrelationships among participants understood if the industry is to be put on a viable footing. Some of the baseline data to be collected and analyzed include income statements, balance sheets, investment behaviour, transfer of public funds, union agreements and labour practices, marketing ties, corporate structure and ownership, internal pricing policies, etc. This information should be updated on a continuing basis. There is also an urgent need to strengthen the regular production statistics system.

Domestic market

Due to increasing competition on the international fish commodity market and high potential of growth of Canadian fish stocks especially for Atlantic groundfish species, the Department has launched a vigorous campaign to promote fish consumption on the domestic market -- a potential outlet for increased future fish production. The information on the domestic fish market, however, is generally lacking. There is a need for baseline data on more representative wholesale and retail prices, sales as well as inter-provincial movement of fish commodities, exports by origin and imports by destination, etc. The Department will work closely with Statistics Canada, Agriculture Canada, provincial departments of fisheries and the fishing industry to collect and update this information on a continuing basis.

Recreational and subsistence fisheries

It is also necessary to develop improved methodologies and databases dealing with recreational and subsistence fisheries. This information is essential to resolving conflicts and establishing more stable allocations between subsistence, recreational and commercial fishermen notably in the Pacific and Atlantic salmon fisheries and major inland lakes in Ontario and the Prairie provinces. It is also essential to the estimation of economic loss caused by acid rain in inland lakes and rivers.

Conclusions

As time moves on, the statistical system must expand to cope with the increasing demand for information. It would be naive to assume that without any significant increase in resources all the needs could be met by merely applying advanced information technologies. On the other hand, substantial savings could be achieved by wise planning of a coordinated acquisition of information tools and through harmonized interaction between data providers and users.

Multinational Arrangements

Multinational Arrangements and the Role of Bargaining in Fisheries Development

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The possibility of establishing cooperative ventures within exclusive economic zones introduces a new challenge to economists because limited attention has been given to the institutional rules that guide cooperative ventures. Of particular interest is the relationship that exists between the agreement, the allocation of resources, and the distribution of benefits.

Bromley and Bishop (1977) have questioned the preoccupation with efficiency, suggesting that efficiency is without meaning in isolation from reference to distribution. The distributional implications of alternative joint-venture arrangements should be made as explicit as possible even if economics yields no clear advice on what is distributionally preferable. More recently, Chen and Hueth (1982) provide an integrated welfare analysis of policies regarding foreign allocations in a joint-venture environment. However, they did not examine the linkage that exists between the cooperative agreement and the distribution of benefits.

The aim of this paper is to examine the role of bargaining and its effect on the economic benefits realised from cooperative arrangements. We will analyse a joint-venture comprising a transnational company, a host government, and a domestic firm. No special importance is placed on these principal actors. A cost-benefit framework is used for evaluating the benefits of foreign investment. This provides a basis for the following section that examines the link between bargaining, resource allocation and the distribution of economic benefits. A case study is used to illustrate the concepts. The paper concludes with some implications for policy and future research.

Evaluating Alternative Arrangements

Foreign involvement has been prominent in the development of many fisheries throughout the world following the establishment of exclusive economic zones. Quite a variety of arrangements has emerged, including equity participation, and the use of charter vessels. In New Zealand, joint ventures were viewed as a means of extending local involvement in deepwater fisheries previously fished by foreign vessels, gaining expertise, and expanding the catch available to domestic processors (Smith, 1984). Principal actors in these joint-venture arrangements include a foreign government or firm, domestic firms, and the host government.

Methodologies have been developed by Lal (1978) and Weiss (1980) that provide a basic framework for evaluating the net social benefits of foreign investment. This framework can be applied to the situation where private foreign investment contributes to the harvesting of fish. Net local benefits in any particular year are given by:

$$NB = TOP + E + NFI \qquad (1)$$

where TOP = total operating profit at world prices;
$= P_{QW}Q - P_{AW}A - P_{LW}L$;
E = net external effects, such as the transfer of expertise;
NFI = net foreign inflows;
$= K - (\delta + \nu)$

where P_{QW} = social price of fish sold;
Q = catch;
P_{AW} = social opportunity cost of non-labour inputs;

A = non-labour inputs;
P_{LW} = social opportunity cost of labour;
L = labour employed;
K = net capital inflow, including retained earnings controlled by the foreign investor;
δ = repatriated dividends; and,
ν = retained earnings.

Vector notation is used and all commodities are valued using the Little-Mirrlees numeraire.

The conventional test for projects of this nature is to see if they return a positive net present value, using a discount rate that reflects the opportunity cost of capital. Although this framework can be used to test whether a particular proposal, such as a joint-venture, has the potential to return a positive economic dividend to the host country a more complete analysis would seek to establish whether the particular arrangement proposed could be expected to yield a maximum economic dividend. Continuing with the above example, profit to the foreign investor is determined using actual prices (as opposed to the host nation which seeks to maximise social welfare using social prices) and can be expressed as:

$$\delta + \nu = P_{QD}Q - P_{AD}A - P_{LD}L - \rho - \tau \qquad (2)$$

= total profit at actual prices less local claims;

where
ρ = return to domestic capital holders if a joint-venture is involved;
τ = direct taxes (fees) levied on the foreign company;
$P_{QD}Q$ = actual value of output;
$P_{AD}A$ = actual cost of intermediate goods; and,
$P_{LD}L$ = actual cost of labour.

Upon substituting (2) into (1) we obtain:

$$NB = (P_{QW} - P_{QD})Q + (P_{AD} - P_{AW})A + (P_{LD} - P_{LW})L + E + K + \rho + \tau \qquad (3)$$

Equation (3) serves to identify three implications that the specific arrangement has for the potential benefit accruing to the host nation. First, the direct benefits (E,K,ρ,τ) are a function of the rules concerning foreign investment in general and foreign participation in fisheries development in particular. Therefore, different rules, regarding profit repatriation and taxation for example, may affect the level of local net benefits in any given year. Second, if output from the venture is an import substitute and the domestic price of fish (P_{QD}) exceeds the world price (P_{QW}) then there is a social cost per unit of Q supplied. On the other hand, if the domestic prices of inputs (P_{AD},P_{LD}) exceed world prices (P_{AW},P_{LW}) and the venture is forced to buy locally, then social benefits are created in the form of monopoly profits. Finally, many multinational companies have developed specialised techniques, and it is quite likely that the physical coefficients (A,L) in the above model will vary across ventures involving different multinational companies. Different harvesting and processing techniques may imply different net social benefits unless compensated for by changes in direct benefits.

The above framework serves to pinpoint the sources of net benefit that the host nation has some degree of control over. In particular many of the net benefits will be a direct result of the specific arrangement negotiated.

<u>Bargaining and Fisheries Development</u>

Benefits accruing to the host nation are a function of the rules that specify the arrangement and guide behaviour. Rules describing the cooperative arrangement are the result of a bargaining process. Bargaining points include: special tariffs, export duties on non-processed fish, royalty payments for equipment, fees for services and advice, local content requirements, levels of local participation, profit repatriation, taxation, pricing, and the control of management. Collectively, these are elements of the bargaining space over which the agreement is negotiated. The extent of local benefits, via cooperative agreements between host nations and transnational corporations, will therefore depend on the host country's ability to negotiate.

Svejnar and Smith (1984) provide a static model incorporating bargaining power. This model examines the microeconomic behaviour of a joint-venture between a transnational corporation (T), a domestic partner (D), and a host government (G) under conditions of certainty. The three actors cooperate to harvest fish (Q) by means of a joint-venture that makes each participant at least as well-off than if they had not participated. Following Svejnar and Smith (1984) the model is described as:

$Q = Q(X,Y,L)$:
X = inputs supplied by the transnational at price P_X;
Y = inputs supplied by the domestic partner at price P_Y;
L = labour purchased by the joint-venture at fixed price C_L;
$P_X \geq C_X$ = opportunity cost of the transnational supplying inputs to the joint-venture; and,
$P_Y \geq C_Y$ = domestic opportunity cost of supplying Y.

Prices for the inputs are negotiable, although once agreed upon they are constant. Output price P_Q is constant. The host government imposes a profit tax (τ) on the profit share accruing to the transnational corporation and it may impose an import tax (η) on inputs supplied to the joint-venture by the transnational. Finally the government may specify the transnational's maximum shareholding ($\bar{\sigma}$) in the joint-venture.

Each actor is assumed to maximize their profit function (Π_i); for the transnational (T)

$$\Pi_T = (P_X - \eta - C_X)X + \sigma(1-\tau)\ (P_QQ - P_XX - P_YY - C_LL) \tag{4}$$

for the domestic partner (D)

$$\Pi_D = (P_Y - C_Y)Y + (1-\sigma)\ (P_QQ - P_XX - P_YY - C_LL) \tag{5}$$

and for the host government (G)

$$\Pi_G = \eta X + \sigma\tau(P_QQ - P_XX - P_YY - C_LL) \tag{6}$$

Notice that profit to the transnational can be generated by supplying X to the joint-venture at transfer price ($P_X \geq \eta + C_X$. The other source of profit to the transnational is its share (σ) of the joint-venture's profit. The domestic partner is not taxed.

There is no unique solution to the above model which determines each actor's profits, or the specific combinations of inputs, or rules agreed upon. One means of doing so is to assume that each actor will claim a fixed share of profits, in proportion to their bargaining power (γ_i). This is achieved when participants behave as if maximising the function:

$$J = \Pi_T^{\gamma_T}\ \Pi_D^{\gamma_D}\ \Pi_G^{\gamma_G}$$

where γ_T, γ_D and γ_G are the respective bargaining powers and

$$\gamma_T + \gamma_D + \gamma_G\gamma = 1$$

Solving the first order conditions yields:

$$\Pi_T = \gamma_T\Pi \quad \gamma_D = \gamma_D\Pi \quad \Pi_G = \gamma_G\Pi$$

where $$\Pi = \Pi_T + \Pi_D + \Pi_G$$

Since all participants gain a fixed share of total profit (Π), it is known <u>a priori</u> that it is in their individual interests to maximise joint profits. It should also be noted that the solution is independent of P_X, P_Y, η, σ and τ. There are infinite combinations of values for these variables which ensure fixed shares of total profit. For example, if the local government increases its tax rate (τ) on the transnational's profits, then at least one of the other variables (P_X, P_Y, η, σ) must be altered to compensate and maintain the fixed profit share rule. In this case the transnational may increase the price it charges for the inputs it supplies (P_X) to recoup the loss. This model illustrates that the distribution of profits (γ_i) can depend upon the relative bargaining powers of the participants. Bargaining powers are exogenous and fixed in this model, an assumption which may not be tenable in a more realistic setting which includes explicit treatment of time, learning, risk and the existence of multiple objectives.

Bargaining occurred in a timeless world in the above model, where individual rationality is sufficient to ensure an efficient negotiated solution Z*. The search is costless, instantaneous, and occurs under conditions of perfect information. Figure 1 illustrates the situation for two actors and two bargaining elements (say, $z_1 = \tau$ and $z_2 = n$), Ω represents the bargaining space, and $\hat{Z}$ is the initial bargaining point. It is rational to search for Z^* that maximises joint profits. Introducing time explicitly into the analysis adds a further dimension where the host government's objective function is $\Pi_G(t)$ and the transnational's objective function is $\Pi_T(t)$. Negotiations start at $\hat{Z}(t_o-h)$ with agreement $Z^*(t_o)$ being reached after an interval h, the duration of the agreement is shown as k; specific values for these two intervals are endogenous. Content of the final agreement will depend on relative bargaining powers, which are taken to include: the skill of the negotiating teams, the availability and quality of information, access to raw materials and markets, and other factors that influence the set of opportunity costs faced by each negotiating team. The net present value of the agreement to each participant is given by

$$NPV_i = \int_{t_o}^{t_o+k} e^{-r_i t}\, \Pi_i(t)\, dt \qquad i = G,T$$

Introducing time explicitly into the model allows three influences to be shown (Cross, 1965; Contini, 1968). First, differences between the discount rates of participants (r_G, r_T) can influence the outcome. For example, the participant with a relatively high discount rate may forego some potential benefits that might result from continuing with negotiations. Second, the return to participants may change with time. Some factors may be exogenous and uncontrollable, such as world market prices, exchange rate fluctuations, and stock uncertainties. Third, the utility of the agreement may differ once the host country has developed its domestic fishing industry. For example, Figure 1 shows the transnational's objective function to shift over the interval k, $\Pi_T(Z^*(t_o+k)) < \Pi_T(Z^*(t_o))$. The positioning of Π_T in (z_1, z_2) has changed over time. Finally, there are negotiation costs to consider. These may vary between participants and therefore influence relative bargaining powers; higher negotiation costs are more likely to result in the continuance of non-optimal agreements.

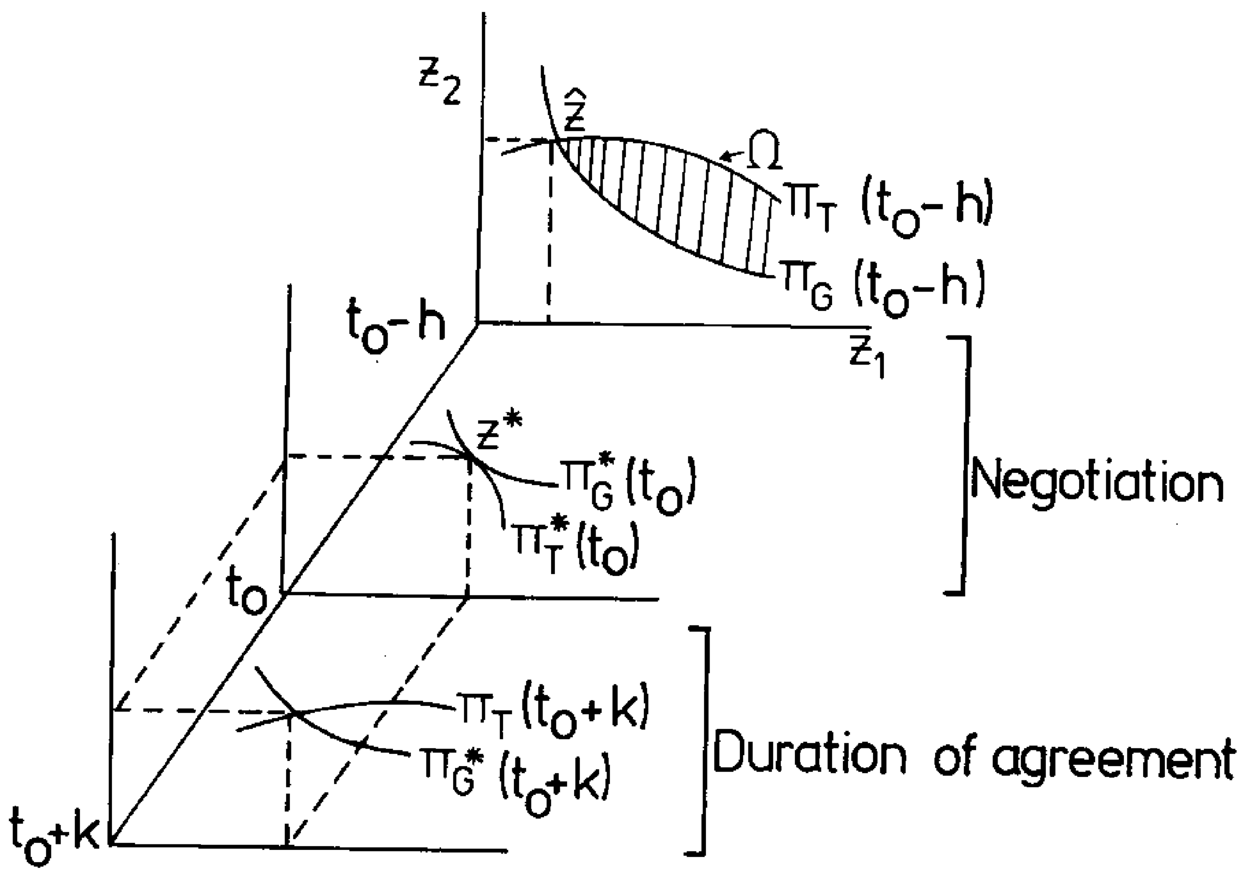

Figure 1. Bargaining Space and the Joint Venture Agreement

If agreements are renegotiated, improved skills and better information may shift the relative bargaining powers of participants. The learning model developed by Cross (1965) uses a time dependent relationship based on the expected rate of concessions by the other participant. For example, if the host country negotiators concede faster than expected, then the transnational negotiators will increase their estimate of the host country's concession rate. Concessions will be influenced by negotiation skills, and the opportunity costs confronting the negotiators.

At the negotiation stage profits are uncertain. Each bargaining team faces a set of probability distributions defined over the variables that codetermine their objective functions. In this regard the task of the negotiators is to secure an agreement that yields the best probability distribution outcomes.

The host country's attitude to risk is likely to differ from that of the transnational firm, as will their respective risk management portfolios. Perceptions of, and attitudes to, risk are most likely to be manifested in the duration of the agreement and the flexibility allowed by the rules regarding behaviour once operations begin.

Incorporating multiple objectives into the analysis may affect resource allocation and the attainment of maximum economic returns. For example, if the government insists on achieving a local employment objective through a joint-venture agreement, then it may cause the joint-venture to operate at below its maximum profit level (Svejnar and Smith, 1984). To illustrate, simplify by dropping taxes and allowing the government to share profits from the joint venture. There are two inputs X and L. The objective function of the local government is:

$$\Pi_G = (1-\sigma)(P_Q Q - P_X X - C_L L)$$

which is maximised subject to the constraints that all other actors receive at least their opportunity costs. First order conditions for the two inputs are:

$$P_Q \frac{\delta Q}{\delta X} = P_X \text{ and } P_Q \frac{\delta Q}{\delta L} = C_L \tag{7}$$

If the local government adds an employment objective, its objective function becomes:

$$\Pi_G = (1-\sigma)\ (P_Q Q - P_X X - C_L L) + E(L) \quad \text{with } E' > 0$$

The first derivative of $E(L)$ is the rate at which the government is willing to trade-off profits for employment. The first order condition for labour now becomes:

$$P_Q \frac{\delta Q}{\delta L} = C_L - E' \tag{8}$$

$$\Rightarrow \quad P_Q \frac{\delta Q}{\delta L} - C_L < 0$$

Comparing (7) and (8) it is apparent that the addition of the employment objective by the local government has indeed been effective in increasing the amount of labour employed by the joint-venture. However, since condition (7) no longer holds, the joint-venture no longer maximises profits. There has been a trade-off of joint-venture profits for jobs. Since the transnational and domestic partner are only concerned with maximising profits, their shares of total profits are now greater than γ_T and γ_D, as they must be compensated for using a non-optimal combination of inputs. Total benefits are still shared according to the rule

$$\Pi_i = \gamma_i \Sigma \Pi_i$$

By recognising other objectives, the government is, in effect, changing the values of the coefficients in equation (3). The degree with which overnment could persist with other objectives, such as local employment, is bounded by the returns other actors could expect from their next best alternatives.

<u>A Case Study</u>

Russell (1983) describes the process by which a joint-venture company, Solomon-Taiyo Limited (STL), was formed between the Solomon Islands government and Taiyo Fishing Company of Japan to develop a tuna fishery. Formation of the cooperative venture, and its operation serve to illustrate points raised by the above model. A government shareholding agency (GSA) was established which acted as the domestic partner participating in policy-making and direction of STL. Formal negotiations started in October 1972. The Solomon Islands government considered the proposal in terms of three main objectives: to reduce dependence on overseas grants-in-aid; to establish a basis for a new domestic fishing fleet; and to provide new employment opportunities. Taiyo's objectives were: to obtain access to fish stocks; to develop a base for exploiting these stocks; and, to achieve a stable profit. Therefore, the government considered the proposal within a multiple objective framework, while Taiyo was primarily concerned with profit maximisation. Russell (1983) also describes the bargaining position taken by each actor at the start of negotiations. For example, GSA considered two issues to be non-negotiable. First a 10% export duty was to be levied on all frozen fish products not processed locally. In this way Solomon Islanders would be compensated for any fish not processed locally, which would decrease local employment opportunities. Second, Taiyo should issue to the Solomon Island's government 25% of the shares of STL without payment. Taiyo wanted pioneer tax concessions to compensate for the risks involved in developing an uncertain resource. This conflicted with GSA's revenue objective. Taiyo also wanted exclusive fishing and marketing rights and preferred the use of chartered vessels. The use of chartered vessels with foreign crews would conflict with GSA's objective of developing a domestically based industry.

Conceptually, these initial demands locate the participants at $\hat{Z}$ in Figure 1, with Ω representing the potential bargaining space.

Agreement was reached after 15 months of negotiations. The demands by GSA were met, but a three year concession on duty, and preferential tariffs were included in the agreement, which satisfied Taiyo's demands for pioneer tax concessions. Taiyo received exclusive fishing and marketing rights. Chartered vessels using labour intensive fishing methods were employed and guidelines were established to ensure the eventual use of domestic labour and vessels. This reflected the host government's objective of expanding local employment opportunities and was a compromise between Taiyo's demands for outright use of chartered vessels and GSA's demands for employment of local labour. The agreement therefore specified values for elements within the bargaining space Ω.

The joint-venture started operating in December 1973. Over time prices and catch both fell, and currency fluctuations caused the profit of the joint-venture to decline, resulting in pressure to improve the efficiency of STL. Taiyo was particularly interested in employing more capital intensive purse seining methods to improve efficiency. By November 1979 the Solomon Islands possessed both vessels and skills previously purchased from Taiyo. These changes prompted a mutual desire to renegotiate the agreement.

As suggested by the model presented above, the relative bargaining power of the participants had changed during the first agreement. Acquisition of skills and capital made GSA less dependent on Taiyo, improving their bargaining power. This was reflected in a new agreement, finalised after 18 months bargaining, in which GSA obtained an increased shareholding and increased control of the joint venture. The use of labour intensive harvesting techniques was retained, recognising that GSA's employment objective was still a major concern, and was to be pursued at the cost of profit maximisation. Taiyo were compensated to some degree for this by a reduction in export duty. Further evidence of GSA's increased bargaining power was its ability to negotiate for the development of more on-shore processing facilities, and the increased use of domestic labour.

Conclusions

Cooperative agreements provide coastal states with an opportunity for developing their exclusive economic zones, and foreign partners with an opportunity to utilise a resource. The advantages of cooperation may be found in the differences that exist between the participants with respect to endowments of: information, knowledge, technique, capital, access to markets, and natural resources. Benefits accrue to participants from exploiting these differences and using them to mutual advantage. A static economic model shows that resource allocation will be efficient if participants seek to maximise joint profits. Participants insisting on multiple objectives, such as profit maximisation and the use of local inputs, may compromise efficient resource allocation. The distribution of joint-venture benefits between countries, depends on each participant's relative bargaining power. This paper provides a framework for evaluating the specific negotiable elements of a proposal for cooperation. These elements define a bargaining space over which the actors negotiate an agreement that determines total benefits and the distribution of those benefits.

The distribution of benefits *ex post* also depends on exogenous influences, such as foreign exchange fluctuations, and operating rules that are poorly specified or omitted, for example, where transfer pricing is possible. Persisting with one agreement over a long period may result in an inefficient allocation of resources. It is usual therefore to renegotiate the agreement when potential net benefits exceed transactions costs. This gives each participant an opportunity to re-examine the entire set of development options. This paper has provided a framework that may prove useful when evaluating the effects of changes in bargaining power, and the economic benefits associated with cooperation when bargaining powers are known. The welfare aspects of cooperation were not examined in depth. Rather, the focus was on the process by which operating rules are established. Future research is needed to examine how specific alternative arrangements influence resource allocation and the intertemporal distribution of benefits.

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The Economics of Coastal State-Distant Water Nations Co-operative Arrangements: Some Long Run Considerations

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It is now generally accepted that, regardless of the ultimate fate of the Law of the Sea Convention[1/], the widespread implementation of Extended Fisheries Jurisdiction (EFJ) is virtually irreversible.[2/] It is also generally accepted that EFJ carries with it the promise of a stream of benefits for coastal states through time. Many articles have now appeared in this and other journals analyzing the nature of these expected benefits.[3/]

It is, however, also clear that, for any given coastal state, these benefits could prove to be ephemeral unless the coastal state addresses successfully the several resource management issues raised by EFJ. One of these issues is the role, if any, to be played by distant water fleets in the exploitation of fisheries within the coastal state's Exclusive Economic Zone (EEZ).[4/]

At the dawn of EFJ, this issue for most coastal states appeared to be straightforward. Distant water fleets should be phased out of the EEZs to the extent allowed by the emerging Law of Sea Convention.[5/] To more than a few coastal states, the distant water fleets had been seen as the cause of serious distress to the coastal state's fishing industry in the pre-EFJ era. The Northwest Atlantic is a case in point, where both the United States and Canada argued that their respective Atlantic coast fishing industries had suffered greviously from the extensive depletion of groundfish resources by distant water fleets, e.g., Soviet fleets. A major justification for EFJ in these countries was the need to restore these resources and protect them from further distant water fleet depredation.[6/]

Of equal, if not greater importance, was the fact the EFJ effected a transfer of resource wealth to the coastal state. It seemed obvious that the coastal state would enjoy maximum benefits from these newly acquired resources, if distant water harvesting and processing activities in the coastal state's EEZ were replaced by those of domestic harvesters and processors. While it might not be possible to bring about this replacement in the short run, it remained an important long term goal. An example of this viewpoint was provided by Canada's federal minister responsible for fisheries in 1974 as he contemplated the advent of EFJ.

> The long term is for Canadians. Canada is not only going to reach out and encompass all of the living resources of her continental slope and shelf, we are going to make sure that they are harvested by Canadians in Canadian owned vessels and processed in Canada as well.[7/]

Since that time the confidence that distant water harvesting/processing would inexorably be replaced by expanded coastal state fishing activity has waned to some degree. To return to the Canadian example, the date at which Canada's EEZ will be free entirely of distant water fleets appears to be receding ever farther into the future.[8/] We shall argue that there may, from the perspective of the coastal state, be sound economic reasons why there should be an ongoing distant water nation presence in the coastal state's zone, not merely in the short run, but in the long run as well. We shall also argue, however, that the aforementioned long run benefits can easily be lost.

Prior to considering the arguments for an ongoing distant water nation EEZ presence, and the counterarguments, we review briefly the coastal state's powers and obligations vis a vis distant water nations under the terms of the LOS Convention. While it is true that the Convention may never achieve the status of international treaty law, it is reasonable to argue that the segment of the Convention pertaining to fisheries will provide the "rules of the game" for relations between coastal states and distant water nations.[9/]

Coastal State Obligations to Distant Water Nations and Cooperative Fisheries Arrangements

We shall define a "co-operative fisheries arrangement" as any arrangement between a coastal state and distant water nation under which a distant water fleet(s) is(are) invited to participate in any aspect of a fishery within the coastal state's EEZ.[10/] As such, the definition covers all forms of joint ventures involving distant water fleets plus so-called "fee" fishing in which distant water fleets are allowed both to harvest the resource and process the catch in return for a cash payment or some alternative form of remuneration. The question then is to what extent is the coastal state required by the LOS Convention to enter into such arrangements.

The relevant article of the Convention is Article 62 which contains the so called "surplus principle." Under the terms of this article, the coastal state is to assess its harvesting capacity with respect to each fishery within its EEZ. If for a given fishery, the coastal state finds that its harvesting capacity is not sufficient to harvest the entire TAC, then a surplus is deemed to exist. The coastal state is required to give "other states", i.e., distant water nations, access to the surplus. In other words, the coastal state is obliged to enter into co-operative fisheries arrangements.[11/]

The obligation is, however, more apparent than real, at least over the long term. Under the preceding article, Article 61, the coastal state is given a virtual free hand in establishing the TACs for fisheries within its zone.[12/] In theory, the coastal state could set the TACs at such levels as to ensure zero surpluses throughout its EEZ.

Let it be conceded that, if the coastal state were to set TACs deemed by the international community to be unconscionably low, it would invite poaching by distant water nations which the coastal state would be able to counter only through the implementation of prohibitively expensive surveillance and enforcement procedures. Over time, however, there would be nothing to prevent the coastal state from eliminating surpluses by setting TACs that were judiciously low, while at the same time building up its harvesting capacity.

Furthermore, Article 62 allows the coastal state to impose a broad range of terms and conditions upon distant water nations with whom it has entered into co-operative fisheries arrangements (c.f.a.s.)[13/] The coastal state is under no obligation whatsoever to grant free harvest or other rights to distant water nations.

Thus, the coastal state could impose terms and conditions that would destroy distant water nation interest in c.f.a.s over time. It is true that Article 300, the "Good Faith and Abuse of Rights" article, has been interpreted by some legal authorities to mean that the coastal state cannot impose terms and conditions that are clearly designed to bar distant water nations from the aforementioned surpluses.[14/] This means, however, only that the coastal state should not be unduly blatant in its attempt to discourage distant water nation interest in its zone.

In summary, the coastal state's obligation to distant water nations is basically that the coastal state should be prepared to endure a phase out period, particularly if the distant water nations had been operating in the zonal waters prior to EFJ.[15/] Beyond that, it is difficult to disagree with the opinion of William T. Burke, a legal authority on the Law of the Sea negotiations, that "... the coastal state is given substantially complete discretion to manage the fisheries for its own exclusive interest, however, narrowly and selfishly conceived they might be."[16/] In other words, the coastal state is given virtually full property rights to the fishery resources within its zone or zones.

Thus, if there is to be a distant water nation presence within the coastal state's EEZ over the long run, then it must be because it is in the selfish interest of the coastal state for there to be such a presence.

The Case for Co-operative Fisheries Arrangements

To make the case for or against a coastal state entering into co-operative fisheries arrangements, we must have a clearer understanding of the object of resource management. It is not sufficient to say that the object is to maximize the coastal state's benefits from the fishery resources within its zone. One must ask further how these benefits are to be defined. Are they to be defined in terms of the benefits enjoyed by the domestic fishing industry, the fishing regions of the country, or the nation as a whole?

While sweeping generalizations are dangerous, it is probably true that the relevant authorities in most coastal states maintain that the object of resource management is to maximize the benefits from fisheries for the nation as a whole.[17/] As a first approximation one might describe the management objective as that of maximizing the contributions which the relevant fisheries are capable of making to the coastal state's national income through time.[18/]

If one accepts this view of the object of coastal state resource management, then it proves to be fruitful, for analytical purposes at least, to examine the case for and against co-operative fisheries arrangements within the context of international trade.[19/] That is to say, if a coastal state enters into a co-operative fisheries arrangement, one can think of the coastal state as importing harvesting and or processing services from a distant water nation(s).

For example, let it be supposed that a particular co-operative fisheries arrangement takes the form of a joint venture in which distant water vessels harvest fish within the coastal state zone for delivery to onshore plants.[20/] The coastal state could then clearly be seen as importing harvesting services from the distant water nation. In substance, there is no difference between a country importing services in this form and importing services in the form of transportation services from foreign deep sea merchant fleets.

If the joint venture were of the reverse form, one in which coastal state vessels harvested fish for delivery to distant water processing vessels operating within the EEZ, then one could think of the coastal state importing processing services. The use of distant water fleet facilities would stand as an alternative to the coastal state employing its own processing services either on or offshore.

"Fee" fishing, in which a distant water fleet both harvests a coastal state resource and processes the catch within the EEZ, can be viewed as a situation in which the coastal state imports both distant water nation harvesting <u>and</u> processing services. Seen in this fashion "fee" fishing is not separate and distinct from joint ventures. Rather it is but part of a continuum. At one extreme there is "fee" fishing in which all harvesting/processing services are imported by the coastal state. At the other extreme, there is no coastal state importation of services. Joint ventures lie in between. Part, but not all, of the required services are imported.

The economic case for co-operative fisheries arrangements, from the coastal state perspective, is straightforward. It is no more than a variant of the economist's argument for free trade. The argument for free trade, in turn, is that, if nations specialize in the production of goods and services in which they have a comparative advantage and import the goods and services in which they have a comparative disadvantage, the world allocation of productive resources will be superior to that which would prevail if nations were to hinder the flows of trade. All will stand to enjoy a higher standard of living as a consequence.

Within the context of fisheries, the argument would run that with respect to a given coastal state fishery, a c.f.a. would be appropriate if a distant water nation(s) has(have) a comparative advantage vis a vis the coastal state in provision of some, or all, of the requisite harvesting/processing services. If the distant water nation(s) has(have) no such comparative advantage, then, of course, a c.f.a. would be inappropriate.[21/]

If a distant water nation does have an aforementioned comparative advantage in the provision of a harvesting/processing service and if the coastal state refuses to enter into an c.f.a., then the contribution of the relevant fishery or fisheries to the coastal state's national income will be reduced for two reasons. First the resource rent to be enjoyed from any given level of harvest will be diminished.

For example, let it be supposed that the coastal state faces a simple choice between full domestic exploitation of a fishery resource and a joint venture arrangement in which distant water vessels harvest the resource for delivery to onshore processors. Let it be further supposed that domestic unit costs of harvesting the resource would average U.S. $0.80 per kilo, while the best ex-vessel price that could be negotiated with the relevant distant water fleet would be U.S. $0.50 per kilo. Using domestic, as opposed to foreign, fleets would thus obviously reduce the rent that the coastal state could obtain from the resource.

It is tempting to offer a counter argument to the effect that, if the harvesting were done by a coastal state fleet, the value-added associated with harvesting would be captured by the coastal state, rather than being lost to a distant water nation. The argument is, at best, misleading.

Return to the domestic unit harvesting cost figure of U.S. $0.80 and suppose that U.S. $0.50 of the U.S. $0.80 would represent value-added, i.e., basically payments to labour and capital. If the U.S. $0.50 were to reflect what labour and capital would receive if employed elsewhere in the economy, then it would reflect what it would cost the coastal state to have such labour and capital employed in the harvesting activity, i.e., it would reflect lost production in other parts of the economy. Value-added captured in harvesting would be offset by value-added lost elsewhere in the economy.[22/]

The second reason that coastal state refusal to enter into a c.f.a. could reduce the contribution which the relevant fishery would make to the coastal state's national income over time is much less obvious. It involves the "under exploitation" of the resource or resources.

In the case of many fisheries, particularly those based on demersal species, the unit cost of harvesting is influenced by the density of the resource. The larger or denser the resource, the higher are the catch rates and hence the lower are the unit costs of harvesting.[23/] It can easily to be shown that the higher the costs of fishing effort, the more incentive the resource managers will have to build up or "invest" in the resource.[24/] In a sense there would be an attempt to offset high effort costs with high catch rates.

Thus to return to our example of a prospective joint venture, if the authorities were to choose the high cost fully domestic option, they might well have an incentive to build up the resource to a greater extent than they would have had they taken the lower cost option. Hence the resource would in a sense be "underexploited," with the consequence that the OSY might be lower than would otherwise be the case.[25/]

Of the factors giving rise to possible distant water nation comparative advantage, some are familiar from the general literature on international trade, others are peculiar to the fishery. We consider an example of each.

Economists tend to give considerable emphasis to relative factor proportions[26/] in attempting to explain patterns of comparative advantage. Thus a country which has a relative abundance of natural resources, but a relative scarcity of labour, could be expected to have a comparative advantage in resource intensive industries and a comparative disadvantage in labour intensive industries. Relative factor proportions certainly are relevant in fisheries. Thus for example, in the capital intensive offshore tuna fisheries in the South Pacific, one is not surprised that fleets of capital rich distant water nations, such as Japan, have a marked comparative advantage in harvesting the resource in relation to the mainifestly capital poor coastal states of the region.

An example in which the basis for a distant water nation comparative advantage lies in the peculiarity of the fishery is provided by fisheries that are highly seasonal and which require the use of expensive, specialized vessel capital. If the fisheries are exploited by coastal fleets that are confined to coastal waters, the vessels may be unutilized, or at least underutilized, offseason. Distant water fleets, on the other hand, may, by the very nature of their operations, be capable of being allocated to other fisheries offseason.[27/]

One simple, yet important, cost concept that has gained wide-spread currency within the last few years, is that of non-salvageable as opposed to salvageable costs.[28/] Non-salvageable costs refers to fixed capital costs that cannot be salvaged, should the activity in which the capital is engaged cease, by reallocating the capital to an alternative activity. In the example cited, then, distant water nation comparative advantage can be said to be based on a relatively low ratio of non-salvageable to salvageable costs. We shall refer to this concept again at a later point in the discussion.

The form which the co-operative fishing arrangement should take, if the contributions of the coastal state's fishery to coastal state national income are to be maximized, will depend simply upon the configuration of distant water nation-coastal state comparative advantages. If the distant water nation(s) has(have) a comparative disadvantage in all aspects of harvesting and processing, then no form of c.f.a. is warranted. If precisely the reverse is true, then a "fee" fishing arrangement is warranted.[29/] If the distant water nation(s) has(have) a comparative advantage in some aspects of harvesting/processing, but a comparative disadvantage in others, then a joint venture type of c.f.a. is appropriate.

It is desirable to recognize at this juncture that there is another advantage that a coastal state might gain from c.f.a.s which, strictly speaking, is quite separate from the concept of comparative advantage. It is also appropriate to recognize on the other side, that there is a negative factor which can disguise a distant water nation's comparative advantage and cause even the most free trade oriented coastal state to reject the c.f.a. option.

The additional positive factor arises from the existence of barriers to international commodity trade. Among the commodities affected by trade barriers certainly must be counted fishery products of relevance to the coastal state. By entering into c.f.a.s the coastal state may as a consequence be granted easier access to the markets of distant water nations, i.e., it will find that the trade barriers to its fishery products are lowered in these markets.[30/]

The negative factor arises from possible willful violation of the terms of the arrangement by the distant water nation partners. To take but a simple example, suppose that a coastal state enters into a "fee" fishing arrangement with a distant water nation. The distant water fleet engages in extensive poaching, of which the coastal state is aware, but is unable to prevent. The poaching constitutes an added cost to the coastal state of the c.f.a. Obviously, if the poaching were sufficiently extensive, it could make the c.f.a. economically unattractive to the coastal state even though the distant water nation had strong harvesting/processing comparative advantages.

If one accepts the comparative advantage argument, then a simple, but non-trivial, proposition follows. The desirability of any given c.f.a. from the perspective of a coastal state may prove to be of indefinite length. While it is true that the pattern of comparative advantage is subject to change and that a particular distant water nation comparative advantage may prove to be temporary, it is wholly illegitimate to assume that all such distant water nation comparative advantages are ephemeral. The history of international trade is filled with examples in which a country's comparative advantages (disadvantages) in various activities change only slowly, if at all.

While the argument for c.f.a.s, as seen from the perspective of the coastal state, is straightforward, c.f.a.s often encounter substantial opposition from within the coastal state.[31/] If the basic argument in favour of c.f.a.s can be seen as a variant on the argument for free trade, the arguments against can be seen to be arguments for protection. The objects of protection, in this instance are, of course, the harvesting and processing segments of the coastal state fishing industry.

Protectionist arguments cannot be dismissed out of hand. While it can be argued that universal free trade would lead to an optimal allocation of the world's productive resources, it does not follow that a policy of free trade is optimal for each individual country. There are arguments for protection that even the most ardently pro free trade economist will concede are legitimate from the perspective of a single country.[32/] One should anticipate that this would apply to fisheries as well.

The Case Against Co-operative Fisheries Arrangements: Arguments for Protection

Before turning to the arguments, we digress briefly to discuss the techniques of protection. Co-operative fisheries arrangements do not fit the standard textbook view of international trade in which competitive foreign exporters trade into competitive domestic markets and in which tariffs constitute a central instrument of protection. All coastal state fisheries are subject to some degree of governmental control. Distant water fleet owners must obtain the consent of the coastal state governmental authorities before gaining access to the EEZ. The aforementioned authorities thus act as quasi-monopsonistic buyers of foreign harvesting/processing services. Tariffs to the extent that they are used by coastal state authorities, are used on a strictly ancillary basis. Rather it is through the setting of terms and conditions of access that protection is exercised. This is analogous in standard commodity trade to the use of import quotas combined with discriminatory rules and regulations.

An example is provided by a coastal state distant water nation joint venture based on whiting (hake) off the coasts of the American states of Washington and Oregon. The joint venture involved American trawlers which harvested the resource for delivery to Soviet factory ships. Domestic processors insisted that one of the conditions of access for the Soviet vessels be that they operate no less than 12 miles from shore. The consequence, other things being equal, would have been that the gross returns to American fishermen participating in the joint venture would have been reduced by 20 percent, largely as a result of lost fishing time and reduced quality of fish. Obviously, such a reduction in returns could have been sufficient to undermine completely the economic viability of the joint venture arrangement.[33/]

With respect to the arguments for protection, it can be stated that one of the most famous and widely applied of the "legitimate" arguments for protection is the so called infant industry argument.[34/] It is one that has direct applicability to the issue of co-operative fisheries arrangements.

The argument can be summarized as follows. While a country may appear to have a comparative disadvantage in a certain activity -- the production of a particular good or service -- it does in fact have a latent or hidden comparative advantage in this activity. Domestic enterprises attempting unaided to become established in this activity, however, would wither in the face of competition from well established foreign rivals. Therefore, the argument continues, the domestic industry should be protected during its infancy until the domestic enterprises have completed the necessary learning and development stage. Once this stage has been completed, the country's comparative advantage will be revealed and the protective barriers can be dismantled.

The argument has particular relevance to the issue of the co-operative fisheries arrangements, because the issue is generally not one of protecting coastal state fishing industries in their existing activities. It is, rather, one of whether it is appropriate to facilitate the expansion of the coastal state industries into activities hitherto dominated by distant water nations. The issue is comparable to the desirability, or lack thereof, of major import substitution programs proposed for developing countries.

While this author has yet to find sources in which the infant industry argument applied to coastal state fisheries has been developed in full, the argument could reasonably be formulated as follows. Prior to EFJ, international fisheries, subsequently to be encompassed by the state's EEZ, held little or no interest to the coastal state fishing industry. The fisheries may have required capital intensive operations with specialized gear and/or vessels, while the fisheries themselves were subject to non-existent or weak management. Thus the investment required was deemed to be excessively risky. The risk for distant water nations, whose fleets moved throughout the world, was far less.

Now that the fisheries are under coastal state and management, the argument continues, the fisheries are of much greater interest to the domestic industry. Domestic harvestors and/or processors cannot, however, compete unprotected against well established distant water fleets. If protection for the coastal state industry were forthcoming and maintained until the domestic fishing industry had passed through the learning and development phase, then the coastal state's comparative advantage, now latent, would be revealed.

During the period of protection, co-operative fisheries arrangements would not necessarily be banned. It is quite possible that distant water nations could be encouraged, indeed pressured, into temporary joint ventures which could then be exploited by the domestic industry as a means of facilitating the acquisition of the necessary technology and skills.

The groundfish fisheries (excluding halibut) off Alaska provide a clear example of the application of the infant industry argument. Prior to EFJ, the large groundfish resources (consisting primarily of pollock) had been international resources and were virtually unexploited by the U.S. industry.[35/] With the advent of EFJ the fisheries came under U.S. control. It was believed within the United States that foreign fleets would be replaced within a reasonable period of time by American harvesters and/or processors.[36/] So important were the opportunities for domestic industry expansion deemed to be, that they were given specific mention in the legislation implementing American EFJ.[37/]

The expansion could not take place immediately, because the industry would require some time to learn the appropriate techniques to make it competitive in the fillet and surimi markets. To encourage the domestic industry, it was offered protection in the form of a deliberately discriminatory harvest quota allocation policy, with quotas being allocated first to those operations using both domestic harvesting and processing, secondly to joint ventures and lastly to "fee" fishing.[38/] This policy in turn was buttressed by legislation such as the Processor's Preference Amendment.[39/]

Although the infant industry argument is legitimate, there are several caveats that should be noted. The first is one that applies to any application of the argument. This is the fact that it is very difficult a priori to determine which of the "infants" do in fact face reasonable prospects of maturing into economic adulthood. There always is the risk that, when such an industry is established behind a protective barrier, it will become apparent that the industry is actually a permanent infant. If the authorities insist upon maintaining the industry, it will become a permanent burden to the economy.[40/]

Moreover, within the context of the fisheries there is the risk that, even if the authorities have sufficient political courage to recognize an error in policy and to let the infant expire, permanent damage may be done. If the experiment continues for an extended period of time before the economic life support system is withdrawn, it could well prove to be impossible to revert to the status quo ante. As we shall argue in a later section, the opportunities for establishing c.f.a.s can readily vanish over time.

Finally, it should be noted that the cost of misapplying the infant industry argument may well be borne largely within the coastal state fishing industry itself. What the authorities are likely to be faced with in the domestic industry is not one, but two, "infants," i.e., one in the harvesting sector and one in the processing sector. There is no necessary reason why the interests of the two infants should coincide. The "infant" harvesting sector, for example, might well enjoy the greatest expansion and prosperity if the vessel owners were able to enter into joint venture with foreign factory ships. Attempts, through the use of protective measures, to foster an "infant" processing sector, which had no real hopes of achieving economic maturity, would obviously come at the expense of harvesting sector.[41/]

While there are legitimate arguments for protection, there are also many fallacious protectionist arguments that are important nonetheless because they have strong political appeal. Such arguments find their place in the debate on a c.f.a.s.[42/] We give but a few examples.

It has been recommended in the United States that measures be undertaken to impose equivalent costs on domestic and foreign fleets operating in the U.S. zone.[43/] This seemingly equitable proposal can be seen as the equivalent of the famous "scientific tariff" argument to be found in the realm of standard commodity trade. This argument maintains that tariffs should be set "scientifically" in such a manner as to equalize domestic and foreign costs. As every student of elementary economics is taught, this is perhaps the most insidious of the arguments for protection, as it strikes at the very heart of international trade. Trade is based upon cost differences. If protective measures were established that equalized all relevant foreign and domestic costs, international trade would be destroyed.

Other fallacious arguments advanced are the equally famous cheap labour (or cheap technology) argument, which maintains that foreigners have an "unfair" cost advantage because of access to low cost labour and/or technology, and the balance of payments argument. The latter argument states that imports should be restricted in order to improve a country's balance of payments.[44]

There is one final argument for protection that should be considered, which commands wide-spread support and which cannot be dealt with as simply as the grossly fallacious arguments just discussed. This is the employment argument. If protective measures are introduced, if the presence of distant water nations is discouraged, then there will be greater employment opportunities within the domestic fishing industry. Where unemployment is severe and chronic as is the case in Atlantic Canada, for example, the argument will obviously carry great weight.

In response to the argument, economists would, without hesitation, make the following concession. When judging coastal state versus distant water nation comparative advantage, the labour costs in the coastal state harvesting/processing sectors should be measured on a strict opportunity cost basis. That is to say, the cost of labour should be measured in terms of what the members of the workforce could have earned elsewhere in the economy. If the only alternative for the aforementioned workforce members is unemployment, then obviously their opportunity cost will be very low, lower certainly than their private cost, the cost to their employers. Thus while on a private cost basis, the distant water nation alternative might appear to be the most attractive, it is quite possible that it would be rejected on an opportunity cost basis. Beyond this, however, one has to ask what other alternatives exist for alleviating the unemployment. Acceptance of the employment argument may serve primarily to allow the authorities the luxury of ignoring the root causes of unemployment.[45]

The Economics of Distant Water Fishing Operations and C.F.A.s: A Commentary

The point has now been made that it is virtually certain to be in the economic self interest of some coastal states, at least, to have an ongoing distant water nation presence in their zones. The distant water nation comparative advantages will not all prove to be transitory. The applicability of the infant industry argument and other legitimate arguments for protection will not prove to be universal.

This then leads to the question of what is required to establish viable long term co-operative fisheries arrangements. In order to address this question, one must first give some attention to the economics of distant water fleet operations and its relevance to c.f.a.s.[46]

The reason that certain fishing nations become distant water fleet operators would seem obvious. The fishery resources in their own coastal waters are inadequate to meet the consumption needs of their own citizens. Hence these nations are forced to turn to distant water fisheries in search of alternative sources of supply. This reason, while appealing, is almost certainly wrong.

While it is true that fish constitutes an important component of the diets of the citizens of many of these countries, and while it is true that their local fishery resources were and are often limited, it is equally true that there exist well developed world markets for fishery products. There is no obvious reason why these countries could not have met and cannot meet their needs through imports. A more plausible explanation is to be found in comparative costs. That is to say, at the time the fleets were brought into being it was more attractive economically for these countries to obtain the required fish through distant water operations than through imports.[47]

The distant water fisheries operations are by and in the large highly capital intensive.[48] The economic attractiveness of these operations is influenced to no small degree by the extent to which the capital costs are salvageable and the extent to which the capital is "malleable." Both salvageability of capital costs and malleability of capital have in turn been strongly influenced by EFJ.

We introduced the concept of salvageable vs. non-salvageable costs at an earlier point in the discussion. We defined non-salvageable costs as fixed costs that capital owners cannot "salvage" by redeploying the capital if the need so arises. The concept of "malleability" of capital is closely related to that of "salvageable" costs and can be defined as the ease with which capital can be shifted to another activity or the assurance that the owners of capital have that they can sell the capital without risk of loss.[49] If capital is perfectly "malleable," then all costs are salvageable. Obviously, in a world of uncertainty, the more "malleable" capital is in a given undertaking, the more attractive is investment in such capital, other things being equal.[50]

One thinks of distant water fleets as having a high degree of mobility and hence as constituting highly malleable capital, in the sense that if an anticipated harvest opportunity collapses the capital can promptly be redeployed. Indeed we suggested at an earlier point that one of the bases for distant water nation comparative advantage lay in the mobility of distant water nation fleets.

Yet even in the pre-EFJ era the degree of capital malleability was not without limits. Within the confines of a single year plan, the degree of malleability was surprisingly low. We take as an example, the Japanese distant water operations with which the author has some familiarity.[51/] It is unlikely that the Japanese experience was (is) unique among distant water nations.

The Japanese fleets of a given company did (and do) operate on the basis of intricate annual plan, work upon which commenced some six months before the plan came into actual operation. The plan was then subject to periodic review once it becomes operational. The plan would involve the several different fishing fleets, plus support vessels such as tankers and carriers.

If there was an unpleasant surprise, in that harvest opportunities in a major fishery in the plan proved to be unexpectedly bad, it would be difficult (although not impossible) to redeploy the fleet, given the brief lead time. Beyond that, disruption in one part of the plan would have a ripple effect upsetting the schedule of the support vessels and thus having an impact upon other fishing fleets. Thus intra-year disruptions could prove to be costly.

For time horizons beyond the immediate year, the fleets did indeed have substantial flexibility by virtue of having wide freedom of access. One could think of the fleet owners as having a broad portfolio of harvest opportunities.

EFJ has of course removed, by definition, this freedom of access. If a distant water fleet owner, private or state, were to lose a major harvest opportunity redeployment of the fleet would mean turning to a remaining high seas fishery, if this were feasible, or much more likely negotiating access to a fishery in another EEZ. The negotiations could of course, prove to be protracted and uncertain at best. Consequently, the "malleability" of capital in the form of distant water fleets, in both short run and long run terms, has been significantly reduced.

The effect of the reduced capital malleability has been compounded by the degree of uncertainty pertaining to given harvest opportunities within EEZs. Prior to EFJ, any given harvest opportunity would be subject to what one might term a "downside" risk by virtue of negative environmental shocks and exploitation by rival fleets. While the uncertainty arising from rival distant water fleets has been reduced if not eliminated, this has been more than offset by negative uncertainties arising from coastal state allocation policy.

An example is provided by U.S. direct groundfish allocation policy, particularly as it pertains to Alaskan groundfish. Up until 1980 it was the policy of the United States to make annual direct allocations to distant water nations at one point during each year. Subsequently, the United States shifted to a "staggered" allocation in which the annual allocation for a given distant water nation was divided into three segments. It was made clear that, whether the second and third segments were granted in full to a distant water nation, would depend upon the United States' perception of that nation's behaviour. The most important of the distant water nations off Alaska, Japan, complained bitterly that the policy made effective annual planning impossible.[52/] The Japanese compaint is not without merit.

The reduced malleability of capital in distant water fleets and the consequent reduced economic attractiveness of distant water fishing operations brought about by EFJ did not initially have the effect of undermining distant water nation interest in c.f.a.s. On the contrary, such interest in c.f.a.s was high in the early days of EFJ.

This was due to another set of factors also linked to malleability of capital. EFJ, along with the other effects described, had the effect of reducing the total number of harvest opportunities available to distant water fleets. Moreover, EFJ spread rapidly, giving the distant water fleets little time to adjust.

Distant water nation fleet capital as a whole is highly non-malleable in the sense that the capital cannot readily, if at all, be redeployed to non-fisheries uses.[53/] The consequence was that, at the dawn of EFJ, the distant water nations were confronted with extensive excess capacity. A recent study by Vladimir Kaczynski points out that Japan, the most important of the non-Eastern bloc distant water nations, saw its distant water harvests decline by almost 50 percent between 1974 and 1980.[54/] In the immediate aftermath of EFJ in 1977-78, the Japanese were forced to withdraw just under 1200 vessels from their fishery operations in the North Pacific alone.[55/] As Kaczynski also points out, severe excess capacity was not a western phenomenon, but afflicted major Eastern-bloc distant water nations, such as the Soviet Union and Poland, as well.[56/]

The consequence of the excess capacity was (and is) that the economics of distant water fisheries operations was placed in an abnormal state. Fleet capital costs could in large part be ignored because they were to a considerable degree inescapable.[57/] Co-operative fisheries arrangements, in turn appeared attractive to distant water fleet owners, so long as they could expect to do somewhat better than to cover their operating costs.[58/] They would appear attractive even if the arrangements were uncertain over other than the short term. It is hardly surprising, therefore, to discover that since the advent of EFJ there has been a great proliferation of joint ventures and other co-operative fisheries arrangements between coastal state and distant water nations.[59/]

This situation, however, is obviously of limited duration. The economic lives of the existing distant water fleets are finite. Eventually the excess capacity will vanish and distant water fisheries operations will be maintained, only if distant water fleet operators (private or state) are prepared to engage in significant fleet reinvestment. Then the economics of these operations will revert to a more normal state and capital costs will come back into their own.

This brings us then to the question of the viability of co-operative fisheries arrangements over the long run. If the c.f.a.s are to be viable over the long run there clearly must at some point be reinvestment in distant water fleet capacity. There is no assurance, however, that such reinvestment will be forthcoming.

We have argued first that there is no obvious reason why these nations must attempt to maintain distant water operations in the EEZs. We have argued secondly that EFJ has resulted in reduced "malleability" of distant water fleet capital within the context of fisheries and that the consequences of such reduced malleability have been compounded by increased uncertainty concerning harvest opportunities with the EEZs.[60/] These factors can be expected both, to reduce the expected return on, and to increase degree of risk associated with investment in distant fleet water committed to operate within EEZs.[61/]

There is one piece of evidence that runs counter to these concerns. This is the large Soviet distant water fleet expansion that has occurred in the teeth of EFJ and apparent Soviet excess capacity. As is noted by Kaczynski, however, this expansion is directed towards the Soviet's attempt to develop unexploited fisheries beyond the existing 200 mile zones, e.g., Antarctica. It is not at all clear that these fleets would be appropriate for operations in the EEZs.[62/]

Seeking Stable Arrangements: Some Tentative Suggestions

It is now fairly obvious what is necessary if a coastal state wishes to ensure a long term distant water nation participation in its EEZ. The c.f.a.s must be sufficiently stable as to provide the distant water nation partners with sufficient security to undertake the required reinvestment.[63/] What is not obvious, of course, is how this stability is to be achieved. It is a question requiring much additional thought and research.

What experience we have had to date permits us to offer two tentative suggestions. The first is that, if stability is to be achieved, the conditions of access established by the coastal state must be such that they are clearly enforceable by the coastal state. If the coastal state imposes access conditions which are beyond the coastal state's enforcement and surveillance capacity, then the arrangement is certain to be unstable. It is virtually inevitable that suspicion of distant water circumvention will arise within the coastal state, that charges of bad faith from both sides will be forthcoming and the viability of the arrangement undermined.[64/]

The second suggestion is that preference be given to joint ventures, as opposed to direct allocations, i.e., "fee" fishing. Joint ventures have the advantage that they are likely to give the coastal state a greater sense of resource security. If there is a sense within the coastal state that the state is losing control over the resources, then protectionist forces within the coastal state must certainly be given comfort and encouragement thereby.

Secondly, joint ventures will create a constituency of coastal state fishermen or processing workers or both in whose economic interest it is to have a distant water nation presence. An example is provided by the fate of Soviet vessels in the American FCZ with the onset of the Afghanistan crisis. All Soviet vessels operating on the basis of direct quotas were evicted from the zone. Only those associated with joint venture activities survived.[65/]

It must be stressed, however, that what is being suggested is a policy of joint ventures preferably, not joint ventures only. In some instances there will be a clear tradeoff between efficiency in a static sense and long run stability. That is to say, in these instances static efficiency considerations alone will favour "fee" fishing arrangements; long run stability considerations will favour joint ventures. How the tradeoff is made will be a matter of judgement.

Finally, we must acknowledge that, for some arrangements, even if the suggestions are correct, they will be wholly insufficient. In particular there will be coastal state fisheries in which it would be appropriate for a distant water fleet to remain within the coastal state's EEZ only for a small portion of each year.[66/] Off season the fleet must turn to fisheries of other coastal states.[67/] Regardless of the strength of the co-operative spirit on both sides, the fate of the arrangement will be dependent upon the actions of other coastal states.[68/]

Conclusions

One of the management problems confronting coastal states as a consequence of EFJ is to determine the role, if any, that should be assigned to distant water nations within the coastal states' EEZs. We have argued that, for some coastal states at least, it will be in their selfish economic interest to maintain a distant water nation presence in their zone over the long run. In such cases, complete exclusion of distant water fleets may benefit part, or perhaps all, of the domestic fishing industry, but only at the expense of the rest of the economy.

If a long term distant water nation presence is to be maintained, however, the nature of the arrangements must be such as to encourage reinvestment in distant water fleet capacity. If the arrangements do not succeed in encouraging such reinvestment, then they will wither over time with probable loss of substantial benefits to both coastal states and distant water nations alike.

What precisely is required to bring about the desired stability, however, is as at best imperfectly understood. The question requires substantial further investigation.

References and Footnotes

1/ United Nations, "Convention on the Law of the Sea," Third Conference on the Law of the Sea, 1982.

2/ See: William T. Burke, "Extended Fisheries Jurisdiction and the New Law of the Sea," in Brian J. Rothschild, ed., Global Fisheries: Perspectives for the 1980s, Springer-Verlag, New York, 1983, pp. 7-49.

3/ e.g., Parzival Copes, "The impact of UNCLOS III on management of the world's fisheries," Marine Policy, Vol. 5, No. 3, July 1981, pp. 217-228.

4/ Or the equivalent thereof, e.g., the Fishery Conservation Zone of the U.S.

5/ Gordon R. Munro, "Cooperative fisheries arrangements between Pacific coastal states and distant water nations," in H.E. English and Anthony D. Scott, Renewable Resources in the Pacific, International Development Research Centre, Ottawa, 1982, pp. 247-248.

6/ Gordon R. Munro and Giulio Pontecorvo, "The taking of living resources: expectations and reality," Proceedings of the Seventeenth Annual Conference of the Law of the Sea Institute, forthcoming.

7/ Cited in: J.W.C. Tomlinson and J. Vertinsky, "International joint ventures in fishing and 200-mile economic areas," Journal of the Fisheries Research Board of Canada, Vol. 32, No. 12, December 1975, p. 2570.

This was not simply a developed coastal state view. Many developing countries apparently took the view that in due course, they would replace virtually all distant water activity in their zone. See, for example: William L. Black III, "Soviet fishery agreements with developing countries: benefit or burden?" Marine Policy, Vol. 7, No. 3, July 1983, pp. 163-174; J.A. Crutchfield, R. Hamlish and G. Moore, Joint Ventures in Fisheries, FAO of the U.N., Rome, 1975.

8/ The aforementioned Canadian minister of fisheries' successor warned in a 1981 speech that: "we must not ... perpetuate some myth that we must catch every fish in our zone. Such a concept is fool's gold!" Romeo Le Blanc, Minister of Fisheries, "notes for an address following the Christening of the Fisheries Patrol Vessel Cygnus" October 3, 1981, Marystown, Newfoundland.

One set of developing coastal states where the replacement of distant water activity is now seen remote is the South Pacific Island States. See: Leslie Clark, "A study on fees and other economic benefits from foreign fishing access to the fisheries of Exclusive Economic Zones of the states participating in the South Pacific Forum Fisheries Agency," in Report of the Expert Consultation on the Conditions of Access to the Fish Resources of the Exclusive Economic Zone, FAO of the U.N., Rome, 1983, pp. 111-124.

9/ The relevant section of the Convention is Part V, "The Exclusive Economic Zone." See n.1. See as well Munro and Pontecorvo, op. cit.

10/ We derive the term from U.N. "Convention on the Law of the Sea," Article 62, §4 (i). The definition which we use is somewhat broader than that used by the U.N.

11/ U.N., ibid, Article 62, §2.

12/ U.N., ibid, Article 62, §1. See: William T. Burke, "1982 Convention on the Law of the Sea provisions on conditions of access to fisheries subject to national jurisdiction," in Report of the Expert Consultation on the Conditions of Access to the Fish Resources of the Exclusive Economic Zone, FAO of the U.N., Rome, 1983, pp. 23-42. The one qualification is that some of the coastal state fishery resources may be shared with neighbouring coastal states. Obviously in such cases, setting the TACs should be a joint responsibility.

13/ U.N., ibid, Article 62, §4.

14/ U.N., ibid, Article 300; Burke in Report of the Expert Consultantion on Conditions of Access to the Fish Resources of the EEZs, FAO pp. 23-42.

15/ Article 62, §3 admonishes the coastal state to minimize the economic dislocation to distant water nations whose fleets have habitually fished in the zone.

16/ Burke, in Brian J. Rothschild, ed. Global Fisheries: Perspectives for the 1980's, p. 46.

17/ e.g., the United States and Canada. See: United States, Congress, PL 94-265 as amended, §3(18) (A); Canada Environment Canada, Fisheries and Marine Service, Policy for Canada's Commercial Fisheries, Ottawa, 1976, p. 53.

18/ Tempered, of course, by social considerations.

19/ See: Gordon R. Munro, in H.E. English and Anthony D. Scott, Renewable Resources in the Pacific, 1982, pp. 247-254; "Fisheries, Extended Jurisdiction and the economics of common property resources," Canadian Journal of Economics, Vol. XV, No. 3, August 1982, pp. 405-425; "Foreign access to EEZs and the derivation of coastal state benefits methods and techniques," in Report of the Expert Consultation on Conditions of Access to the Fish Resources of the Exclusive Economic Zones, FAO of the U.N., Rome, 1983, pp. 143-151; and Guilio Pontecorvo, in Proceedings of the Seventeenth Annual Conference of the Law of the Sea Institute, forthcoming.

20/ As has occurred from time to time in Atlantic Canada.

21/ We qualify this statement at a later point. There may be instances in which c.f.a.s would be appropriate even if distant water nations do not have an obvious comparative advantage with respect to costs.

22/ If the relevant labour and capital would otherwise be unemployed if not engaged in fisheries, then, of course, the situation would be quite different. We address the question of unemployment at a later point in the discussion.

23/ A specific case in point is provided by the groundfish fisheries in the Northwest Atlantic. Gordon R. Munro, A Promise of Abundance: Extended Fisheries Jurisdiction and the Newfoundland Economy, Economic Council of Canada, Ottawa, 1980.

24/ Colin W. Clark and Gordon R. Munro, "The economics of fishing and modern capital theory: a simplified approach," Journal of Environmental Economics and Management, Vol. 2, December, 1975, pp. 92-106.

25/ A few comments are required. Underexploitation does not necessarily result in a lower OSY (Clark and Munro, Journal of Environmental Economics and Management, Vol. 2, pp. 92-106). At the very least, however, there would be a temporary and unnecessary loss of harvests as the overbuilding of the resource took place. If harvesting costs are insensitive to stock density, then, of course, there is no reason why "underexploitation" should occur.

26/ i.e., factors of production, broadly defined.

27/ For a specific case in point see: Munro, A Promise of Abundance, 1980, Chapter 5.

28/ For a discussion of the concept and its relevance to fisheries see: Gordon R. Munro and Anthony D. Scott, "The economics of fisheries management," in Allen V. Kneese and James L. Sweeny, eds. Handbook in Natural Resource Economics, North Holland, Amsterdam, forthcoming.

29/ Both of these polar extremes will be subject to qualifications at later points in the discussion.

30/ From this it follows that co-operative fisheries arrangements may prove economically attractive to a coastal state, even though the distant water nations have no obvious comparative advantage in harvesting or processing.

31/ e.g., the United States and Canada. Munro and Pontecorvo, Proceedings of the Seventeenth Annual Conference of the Law of the Sea Institute, forthcoming.

32/ It is worth noting that virtually every country in the world engages in protectionism to some degree.

33/ A compromise of six miles was eventually reached. Walter T. Pereyra, "Some preliminary results of a U.S.-Soviet joint fishing venture," Journal of Contemporary Business, Vol. 10, No. 1, pp. 7-20.

34/ See any standard textbook on international economics, e.g., Peter H. Lindert and Charles P. Kindleberger, International Economics, Richard D. Irwin, Homewood Illinois, 1982.

35/ Between 1977 and 1980 harvests of these groundfish averaged 1.4 million tonnes per year. American fishermen accounted for less than 1 percent of the harvest.

R. Stokes, Institute for Marine Studies, University of Washington, personal communication.

36/ Robert L. Stokes, "The new approach to foreign fisheries allocation: an economic appraisal," Land Economics, Vol. 57, No. 4, November 1981, p. 571.

37/ U.S., Congress, PL 94-265 as amended, §2(a)(7).

38/ See: West Coast Fisheries Development Foundation, System Strategy for California, Oregon and Washington Fishing Industry and Public Ports Infrastructure Needs and Assessment: Final Report, Portland, 1982, p. 89.

39/ U.S. Congress, PL 95-345. The legislation was designed to amend PL 94-265 (see n. 37).

40/ By the early 1980s, confidence that U.S. fleets would rapidly replace distant water fleets off Alaska began to wane. It seemed particularly evident that distant water fleets as processors of the groundfish would not be displaced in anything like the forseeable future.

It is true that U.S. harvesting of groundfish has expanded via joint ventures with distant water processors. It is also true, however, that the distant water nation of almost overwhelming importance, Japan, entered into such joint ventures under duress. This raises a question as to the long term viability of these joint ventures if the Japanese remain as unwilling partners.

Interestingly, in this regard, a recent empirical study by two American economists, Eric Meuriot and John Gates, suggest that in the Alaskan case "fee" fishing is optimal on a strict economic grounds.

Alaskan Fisheries Development Foundation, Alaska Pollock: Is It a Red Herring? Anchorage, 1982.

Eric Meuriot and John M. Gates, "Fishing allocations and optimal fees: a single and multilevel programming analysis," American Journal of Agricultural Economics, Vol. 65, No. 4, November 1983, pp. 711-721.

Gordon R. Munro, "The economics of co-operative fisheries arrangements in the northeast Pacific," in Edward Miles ed., Marine Policy Issues in the North Pacific, University of California Press, Berkeley, forthcoming.

Munro and Pontecorvo, Proceedings of the Seventeenth Annual Conference of the Law of the Sea Institute, forthcoming.

Stokes, Land Economics, Vol. 57, No. 4, November 1981, pp. 568-582.

41/ The converse, of course, is also true, i.e., the processing sector might experience the greatest expansion if the processors were allowed to enter into joint ventures with foreign harvesters. Unjustified attempts to foster an infant harvesting sector would come at the expense of the processing sector.

42/ The arguments are fallacious in the sense that, if accepted, they will reduce, rather than increase, national income. The protected industries will benefit, of course, but at the expense of the rest of the economy.

43/ Citizens for Ocean Law, "Ocean Policy News," February 1984, p. 3.

44/ Since the 1950s economists have tended to the view that a balance of payments deficit is essentially a macro problem. Piecemeal, inefficiency inducing measures such as setting up barriers aimed at particular imports are likely to make matters worse, rather than better, over the long run.

45/ If there is no unemployment problem in the coastal state fishing communities, then the employment argument is without merit.

46/ See: Munro, in Edward Miles ed., Marine Policy Issues in the North Pacific, University of California Press, forthcoming.

47/ A number of comments are in order. First let it be conceded that in some cases the comparative cost pattern may have been distorted by trade barriers within the distant water nation.

Secondly, Eastern-bloc countries have a reputation for heavily subsidizing their distant water fleets operation (see Kaczynski below). This would seem to contradict the comparative cost argument. The apparent contradiction arises from the distortion created by the artificial exchange rates between western and communist bloc countries. If the Soviets, Poles and East Germans for example, were to import fish they required over and above what can be taken from their coastal waters, much of the imports would probably come from the west (including Japan). If one were to take the true cost or "shadow price" of western currencies to communist countries, the cost of distant water operations would be cast in a much more favourable light.

It is also worth adding that some of these countries, e.g., the Soviet Union, almost certainly derive substantial non-fishery benefits from their distant water fleet operations, i.e., intelligence.

Black, Marine Policy, Vol. 7, No. 3, July 1983, pp. 163-174.

Vladimir Kaczynski, Distant Water Fisheries and the 200 Mile Economic Zone, The Law of the Sea Institute Occasional Paper no. 34, Honolulu, 1983.

48/ Munro, op. cit.

49/ This concept is directly analogous to the financial concept of liquidity.

50/ Consider two investment opportunities. The investments are of equal size, the lifetime of the capital is identical in each case as are the expected gross returns. In the first case the capital is perfectly "malleable," while in the other the capital is "non-malleable." It is easy to demonstrate that the expected net returns will be higher in the first than in the second case. See: Oliver E. Williamson, "Credible commitments: using hostages to support exchange," The American Economic Review, Vol. 83, No. 4, September 1983, p. 523.

51/ Munro, in Edward Miles ed., Marine Policy Issues in the North Pacific, forthcoming.

52/ Ibid.

53/ This is true of capital in fishing fleets generally, of course. For a good description of fishing fleets as non-malleable capital see:

D. Baker, The Capital Development Fund: A Capital Assistance Plan for Fishermen, Report prepared for the Government of Canada, Department of Fisheries and Oceans, Halifax, 1980.

54/ Kaczynski, Law of the Sea Institute Occasional Paper no. 34, 1983, p. 20.

55/ Ibid., p. 23.

56/ Ibid., p. 39.

57/ For a theoretical discussion of this situation in a fisheries setting, see: Colin W. Clark, Frank H. Clarke, and Gordon R. Munro, "The optimal exploitation of renewable resource stocks: problems of irreversible investment," Econometrica, Vol. 47, No. 1, January 1979, pp. 25-47.

58/ Alternatives beyond the 200 mile were extremely limited. In the late 1970s, Ross Eckert was able to argue that in excess of 90 percent of the world's harvests were taken within 200 miles from shore. Ross D. Eckert, The Enclosure of Ocean Resources: Economics and the Law of the Sea, Hoover Institute Press, Stanford, 1979, p. 116.

Eastern-bloc countries anticipating non-fisheries benefit from distant water fishing operations (see n. 47) might well have found c.f.a.s attractive even if fleet operating costs were not being covered.

59/ Kaczynski, Law of the Sea Institute Occasional Paper, No. 34, p. 39.

60/ There has, let it be conceded, been a significant offsetting factor, although how important this factor will be is difficult to judge. The raison d'être for EFJ is that it would lead to superior resource management. If the raison d'être is justified, then the improved management should result in a greater stream of benefits from the fisheries in which distant water nations might share.

One other comment is appropriate at this point. When we talk of reinvestment, we do not mean to suggest that distant water fleets should be restored to the levels that existed prior to EFJ. Improved resource management should bring in its wake a reduced need for fleet capacity. One characteristic of poorly managed fisheries is that fleet capacity, in several senses, tends to become excessive.

Munro and Scott, in Allen V. Kneese and James L. Sweeny eds., Handbook of Natural Resource Economics.

61/ In a letter to the author, Mr. David W. Evans, Senior Fisheries Officer, Ministry of Lands, Energy and Natural Resources, Government of the Solomon Islands writes of an official visit to Japan. In the letter he states that high officials in the Japan Fisheries Association were pessimistic about the viability of their future distant water operations. Of course, this may have been a bargaining ploy. One would, however, be foolish to dismiss these expressed views out of hand. David W. Evans, personal communications.

To the extent that reinvestment does occur, it could well be of a form that would produce less than optimal results for the coastal states. For example, consider a fishery in which maximum efficiency requires highly specialized vessels. If a distant water nation was providing the vessels, it is reasonable to expect that, if fleet reinvestment occurred, the distant water nation operator would sacrifice efficiency for increased "malleability" of capital by bringing in new vessels that were less specialized.

Finally, let us recall an earlier remark about a misapplication of the infant industry argument for protection. We said that, even if the authorities had sufficient courage to admit to their error and to retreat from the policy of protection, substantial damage might nonetheless have been done. The reason is that, while in place, the policy of protection might have acted to discourage distant water nation reinvestment programs relevant to the coastal state's fisheries.

62/ Kaczynski, op. cit., p. 26. Kaczynski's work suggests that most, if not all, of the serious efforts to develop new high seas fisheries is being done by Eastern bloc countries. Suppose that these countries expand their fleets regardless of cost and that the fleets could also operate efficiently in EEZs. Relying heavily on Eastern bloc countries as distant water partners could create political difficulties for more than a few coastal states.

63/ Perhaps this does not apply to the Eastern bloc countries, but see: n. 62.

Ideal situation is that which it is claimed prevails with respect to the successful joint venture between the Solomon Islands and Japan (Taiyo Fishing Company). David Evans (n. 62) writes that each side recognizes that it has a great deal to lose if the arrangement were to break down.

David W. Evans, personal communication.

64/ The viability of the arrangement in the short run, let alone long run, could be undermined.

Report of the Expert Consultation on the Conditions of Access to the Fish Resources of the Exclusive Economic Zone, FAO, 1983. See in particular papers by L. Clark, G. Munro and D. Robb.

We have talked of what coastal states must do to provide long term stability in the arrangements. It goes without saying that if distant water nation partners engage in wilful circumvention of the terms of the arrangements, the arrangements will be, not merely undermined, but destroyed.

65/ Munro, in Edward Miles, ed., Marine Policy Issues in the North Pacific, forthcoming.

66/ We think of cases of highly seasonal coastal state fisheries in which no offseason opportunities exist for the distant water partner(s) within the coastal state's EEZ.

67/ Or possibly the high seas.

68/ This raised the intriguing question of the possibility of interlocking c.f.a.s requiring inter-coastal state, as well as coastal state distant water nation, negotiations.

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Fisheries Management: Theory and Practice

Access to Fishing Zones

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In the development of civilization access to food and shelter was essential to survival. Among the food resources in pre-cultivation ages fish resources were possessed by the physically strong. They were fought for and they were defended. In the modern world strength has played a very important part in enabling nations to exploit living marine resources. This strength has been political, financial, technological and trading based. Strength continues to be a factor in determining who benefits from access to fish resources.

The heedless, careless, incompetent or downright ruthless exploitation of marine fish resources since the Second World War is already well-documented. So are the many resource disasters round the world which resulted from the failure of biological and economic resource management to keep pace with the rapid developments of catching power and technology. Factors which have affected the present state of most fisheries are also likely to influence what can be done in the future. There is a saying that it is no use crying over spilt milk. What we should be doing is making sure we don't spill the milk again.

The 1982 Convention of the Law of the Sea (CLOS) adopted by most nations is a kind of Magna Carta for the social and economic protection of coastal States. I believe that the principles of this accord were to protect the benefits which the smaller and weaker nations could derive from their Exclusive Economic Zones. These nations will only be able to profit from the CLOS if they are able to take full advantage of the sovereignty granted to them under the CLOS.

National jurisdiction over marine resources is now recognised over internal waters, territorial sea, and the Exclusive Economic Zone, which are within 200 nautical miles from the base lines used to establish the territorial sea. There are some areas of over-lapping including archipelagic waters and where fish, without a knowledge of these boundaries, continue to move through zones as migratory, anadromous or catadromous species. The Convention recognises that such problems need to be subject to sensible co-operation between involved coastal States and Distant Water Fishing Nations (DWFNs).

Any legally-worded document becomes immediately the target for the interpretation experts who read the words, and capitalising on the extraordinary versatility of the English language, seek out meanings which suit their own interests.

There is no need in this paper to become involved in the chapter and verse of the CLOS. This is well covered in a paper presented by Professor William T. Burke of the University of Washington, Seattle, at a conference in Rome in April 1983 (FAO Fisheries Report No. 293). Professor Burke's general analysis of the provisions of the CLOS seems to support the view that the CLOS gives the coastal State very wide discretion in fixing an allowable catch, determining its own capacity to harvest, and deciding, if and when it is prepared to declare a "surplus," who should be allocated access and under what terms and conditions.

The granting of access is thus related directly to the abundance of the resources taking into account the need to ensure that they are not over-exploited (a matter given scant consideration by DWFNs in the past), while at the same time enabling coastal States to extract maximum economic benefits.

Not many coastal States are capable of determining their allowable catch even if they have had an established fishing industry with some system of recording catches. Smaller and less wealthy coastal States, particularly those in the Pacific with limited natural resources, would have very little knowledge of the highly migratory but potentially valuable tuna resources which move through their EEZs.

On the other hand, DWFNs with much experience and careful and purposeful research into the fish resources of other countries, can bring a formidable amount of information to support claims for access. Some could even parade plausible arguments about the amount of research they have done while exploiting other countries' resources, in addition to claiming some "traditional fishing rights." They might of course be less forthcoming about some of their questionable fishing practices such as using trawl mesh sizes with little or no escapement and certainly not in compliance with the regulation mesh sizes of the coastal State in whose waters they fished. Some can, and do, refuse to recognise sovereign rights over migratory stocks in the EEZs of smaller coastal States.

There are some critical questions which I feel must be asked about the CLOS and coastal State "obligations." These questions are:

How can many coastal States be expected to comply with the so-called obligations and responsibilities bestowed on them by the CLOS? How can they muster the knowledge and resources to determine the total allowable catch levels? By what means can they estimate what they themselves can catch? How can they dispose of the catch profitably and so extract "maximum economic benefits" from their fishing resources? How can they monitor foreign activities in their zones or arrest offenders?

Even coastal States with a generally high degree of economic development of their other natural resources, find themselves hard-pressed to meet the obligations and responsibilities of the CLOS. In many cases fish resources are already stressed and therefore the milk has already been spilt. In these cases not only has the milk been spilt but most of the cows have gone dry as well.

We are now much more familiar with the need for good fisheries management and the relationship between fishing effort and the capacity of resources to support that effort. At long last the simple truth that a limited number of efficient catching units need to achieve good economic catches without damaging the resource, has finally begun to be accepted. It seems hard to believe that only about thirteen years ago, and long before the "oil shocks," we in New Zealand had to prove to a Parliamentary Select Committee that the main reason dredge oyster prices were high in New Zealand, was that 23 vessels were then catching half as many oysters in a season per vessel under a quota system, as 12 vessels had caught per vessel without quotas prior to 1962. An earlier Parliamentary Select Committee had in 1962, decided to let more vessels in to the oyster fishery on the premise that more vessels in the fishery would bring the price of oysters down by introducing competition and increasing landings.

Coastal States are expected under the CLOS to take over responsibilities for good management of resources which could not be achieved by committees of exploiting nations such as ICNAF. The mere granting of sovereignty can not in itself enable coastal States to achieve the aims of conserving resources, and of optimum utilisation of those resources, while at the same time extracting maximum economic benefits for themselves.

Some smaller coastal States, lacking the means and the ability to assess their allowable catches or to catch them or police them, may elect to grant access to their resources in exchange for other economic benefits. This they are entitled to do and the range of the benefits they may seek will reflect the different economic problems these smaller States are facing. In the absence of clear knowledge of the extent and the value of their fish resources, the chances of these coastal States being short-changed through unwise agreements are great. That they do not know, or do not have the means to determine the wise conservative level of total allowable catch, seems to put the coastal States in the position of failing to honour their responsibilities under the CLOS.

Where a coastal State decides that it is in its own best interests to develop its own means of exploiting its living marine resources to provide employment, to feed its own people and to earn foreign exchange, it may need considerable time and a great deal of help. There are many countries in this position. Wisely the CLOS has made provision for the coastal States to make their own decisions as to how, when and under what conditions, they will move towards achieving maximum economic benefits. That they need time is obvious, but where foreign fishing continues within their EEZs there is need for urgent action.

Just as coastal States may start with the advantage of controlling valuable fish resources, so do some nations start with secure and valuable markets which enables them to develop their own fisheries and also exploit the fisheries of other nations. Most large DWFNs have fished primarily for fish for consumption in their own countries but some have expanded into the international marketing of fish caught in the waters of other coastal States. Often this is done in competition with that same fish when it is marketed internationally by the host State. The granting of sovereignty to coastal States over the living resources in their EEZs has given a form of protection under an international agreement which at least ensures that they can not be dispossessed by stronger States.

However the CLOS has fallen short of providing for some obligations on DWFNs to grant access to markets for the products of developing coastal States. With no legislative backing for the concept of reciprocal or preferential obligations to provide market access it is now left to coastal States to negotiate such access as one of the conditions for granting access to resources.

This comes clearly within the rights of coastal States but places those States in a negotiating arena where the strong can still dominate the weak.

There are many coastal States whose resources DWFNs have been exploiting which have all the means to extract maximum economic benefits and meet their obligations under the CLOS. Such coastal States may have the capital, the scientific capability, adequate technology, a trained labour force, and have a wide range of valuable fish resources within their zones. They have the protection of the CLOS and they can use it.

In addition those States may enjoy the ability and the political and trading strength to negotiate favourable terms governing foreign access to their fish resources. They can also bargain strongly over conditions of access to their own markets for the exports of DWFNs while securing by their strength, favourable access terms for their fish exports.

It will be argued that trading access, duties and other barriers to trade between nations come under the GATT. However in regard to fishing resources it could equally be argued that the weaker developing nations should be helped to extract full benefit from their resources by willing co-operation and not have to resort to GATT.

Barriers to trade unfairly restrict fisheries development. What is the use of giving smaller coastal States sovereign rights to fishing resources if they can be hindered in extracting benefits from those rights? This is where the strong may again succeed at the expense of the weak. The imposition of restrictions by way of import controls, import quotas, tariffs, and a host of non-tariff barriers is a means by which trade can be restricted and as a result fisheries development can be hindered.

The strength of fishing industry organisations in some DWFNs may be applied (often with the support of their Governments) by way of pricing or trading practices calculated to discourage imports from coastal States of the very fish to which those organisations seek access.

Examples of this can be found in the way the U.S. tuna industry receives protection for imports and at the same time is supported by the U.S. Government when fishing without licenses in the EEZs of other States. Right now such a situation has arisen through the arrest by a Pacific nation of an American tuna purse seiner.

Another example with which we in New Zealand are familiar, is the Japanese squid industry's attitude to New Zealand squid industry development. Japanese vessels licensed to fish by trawl and jigging, caught in the New Zealand EEZ last season over 45,000 tonnes of squid out of a total catch of 113,000 tonnes or in other words almost 40% of the total catch, without counting the squid taken by Japanese vessels operating in joint ventures. Japan maintains an import quota system for New Zealand squid caught by New Zealand vessels and applies an import duty against imports of such squid. In addition there now appears to be an active policy of discouragement of New Zealand squid industry development by Japanese restrictions on the availability of Japanese jigging vessels for joint ventures with New Zealand companies and an embargo on the sale of modern squid jigging vessels to New Zealand owners. These present restrictive policies are in contrast to the more co-operative attitudes which applied some years ago.

Another barrier to trade and therefore to coastal States' fishery development arises when the quantities of fish caught under license constitute a significant part of total supply to the major market for that species in a DWFN. This results in quotas and prices for imports from the licensing coastal State being reduced. A practical example of this is the substantial quantity of New Zealand-caught squid placed in the Japanese market, the world's largest for squid, by licensed and joint venture Japanese fishing vessels. These high quantities have a significant effect on the Japanese market share for the New Zealand type of squid. They effectively reduce demand for squid from New Zealand sources by depressing the size of the import quotas and reducing the market price. Levying duty on New Zealand squid exports to Japan has a further depressing effect on the earnings of New Zealand exporters and therefore retards development for New Zealand's own squid industry.

The effect of this sort of situation is that the coastal States are relegated to being suppliers of last resort -- disadvantaged by the results of granting access to the so-called "surplus" a portion of which is created by the coastal State's lack of access to markets.

My experience has been that no contract or written agreement is worth the paper it is written on unless the parties discharge the terms and conditions in the spirit of the agreement. It was heartening to learn that the political representatives of the various nations attending the recent World Conference on Fisheries Management and Development accepted the political commitment for the spirit of the CLOS to be adhered to. Governments may be responsible for the actions of their people politically, but they frequently follow or support what their nationals want for domestic political reasons.

A question now arises as to what Governments should do to ensure that the principles of the CLOS are observed and supported by their nationals. In the case of DWFNs it is imperative that they should review those arrangements which have grown up to support distant water fishing. These could include the following:

(1) The willingness to reduce the numbers of fishing units licensed for distant water fishing.

(2) The negotiation of entry terms more favourable to the DWFN than to the coastal State.

(3) The provision of subsidies and incentives for DWF operations.

(4) The control or reduction of tariff and non-tariff barriers.

(5) Giving less weight to the influence of various political and other trading pressures.

(6) The reduction or elimination of protection and compensation for transgressors.

(7) Increased willingness to provide data and help to developing coastal States without extracting onerous commitments from those States.

If the Governments of DWFNs really want to support the principles of the CLOS and assist the weaker coastal States then they will have to make some politically difficult decisions on these and similar matters.

The Governments of coastal States also need to revise their approaches to the principles for the implementation of the CLOS. For example they could consider the following:

(1) The need to amend the terms and conditions of access covered by bi-lateral agreements made prior to the adoption of the CLOS.

(2) The giving of a high priority to fisheries development and trade.

(3) The negotiation of fisheries agreements for the benefit of their fishing industry trade rather than for other industries or for diplomatic considerations.

(4) The need to use fisheries people in the negotiations with DWFNs.

(5) To work with other coastal States to strengthen their position in a manner similar to that now being adopted in the Pacific by the Forum Fisheries Agency.

(6) The provision of help to other coastal States on fisheries development and marketing.

(7) The avoidance of arbitrary and obstructive attitudes in dealing with DWFNs while maintaining a strong bargaining posture.

What seems to be needed now is positive, constructive political actions from Governments to ensure that the principles of the CLOS are observed and followed by their nationals. This will take time but if and when this does happen the world will be a better place to live in -- especially for the people of the smaller developing coastal States -- and surely that was what the Convention of the Law of the Sea was designed to do.

Recent Developments in the Management of Major Australian Fisheries: Theory and Practice

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Introduction

The value of Australia's production of edible marine resources was estimated at $440m in 1982-83. The most significant contributors to this came from prawns (33 percent), rock lobster (30 percent), finfish (20 percent), scallops (6 percent) and abalone (5 percent) (BAE, 1984). Approximately 70 percent of the total value of production comes from fisheries where limited entry management has been applied.

Fisheries Management in Theory

Since the declaration, in 1979, of the Australian Fishing Zone (AFZ) there has been a concentrated effort to identify and develop management systems appropriate to meet the present and future needs of Australian fisheries. At present about 90% of Australian fisheries are subject to some form of management.

Management Objectives

Under the Commonwealth Fisheries Act 1952 two objectives are specified:

(i) 'ensuring, through proper conservation and management measures, that the living resources of the Australian Fishing Zone are not endangered by over-exploitation' (the biological objective) and,

(ii) 'achieving the optimum utilisation of the living resources of the Australian Fishing Zone' (the economic objective).

It is well recognised by both industry and governments that where a fishery is at biological risk there is justification and a government responsibility to intervene to protect the resource from overexploitation.

The second objective specified in the Commonwealth Fisheries Act 1952 has been the subject of different interpretations. Accordingly it has been difficult to gain recognition for the justification to intervene with fishery management plans on purely economic grounds although the available evidence in Australia suggests that most fisheries are suffering from economic rather than biological problems. There are exceptions and one of these will be discussed later.

It is worth noting that there is now general agreement to the economic interpretation of the second objective in the Act.

In addition each State within the Commonwealth has a responsibility for managing fisheries in waters within its jurisdiction.

Economic Trade-off

Fish stocks derive their economic value from two basic conflicting economic issues:

(i) Stocks can be harvested now as a product of value in the market place or

(ii) Stocks can be 'saved' as inputs to future production.

A third inherent value in fish stocks is the 'conservation' value which intensifies the desire to 'save' stocks. Management of a fishery for economic reasons therefore involves a 'trade off' between these values.

Where fishermen share access to a fish resource the individual has no incentive to 'save' and subsequently benefit from such a saving. Any savings will be open to immediate harvest by other fishermen, or the 'saving' will be available in the future to all fishermen exploiting the resource. Individual fishermen therefore have a strong incentive to harvest the resource and obtain the benefits from their actions immediately. These individual decisions to immediately harvest the resource are perfectly rational from an economic point of view.

However, where all fishermen within a fishery make similar rational decisions, overexploitation and/or overcapitalisation of that fishery will usually occur. Fisheries suffering from these conditions can be identified by persistent low rates of return and/or static or decreasing catch per unit of effort. Generally the more profitable the fishery, particularly if it is unregulated, the greater the tendency for such conditions to develop over time.

When a fishery tends towards overcapitalisation with a consequent persistent poor economic performance, a case for intervention on economic grounds exists. For example, if the result of a flow of investment into a fishery from a number of fishermen creates excessive capital accumulation, intervention could be justified on the basis of more effective utilisation of capital resources in the economy as a whole, or to avoid possible social welfare problems.

Alternatively it could be argued that the fisherman/investor should have accounted for the riskiness of his venture prior to his involvement, and therefore he should accept the consequences of his actions without the benefit of a management regime to protect his investment.

In essence the economic problems generated in fisheries arise from the absence of individual property rights. Individual fishermen do not incur the full costs or the benefits of their individual decisions. These costs and benefits are spread among all who participate in the fishery and indirectly to the community at large.

Management Options

Where management is considered justified on economic grounds, two broad approaches could be used to attack the underlying problems:

(i) The use of taxes or levies to introduce incentives for 'more efficient' capture of the fishing stock and to redistribute the benefits obtained.

(ii) To establish a system of 'property rights' within the fishery which provides the individual with a guarantee of rights to harvest the resource, and fisheries managers with a basis for management control.

Taxes and levies. The general principle of applying a tax or a levy to a fishing industry is based on the argument that such a scheme would reduce private returns sufficiently to force the individual, and consequently all fishermen in a fishery, to adopt a more efficient scale of operation which will improve the returns to the whole fishery.

Taxes or levies on investment in the fishery would have the effect of transferring the potential (high) costs of excess capital and effort incurred by individuals in the fishery to government consolidated revenue. In effect investment taxes or levies would remove the incentive to expand fishing capacity.

Such an approach presents significant difficulties in establishing the appropriate levels of tax or levy. Furthermore, in order to maintain the fleet in an economically efficient configuration, it would be necessary to continually 'fine tune' the taxes or levies to maintain the system. This 'fine tuning' would need to account for new technologies, price and cost changes and changes in the availability of the resource. All of these changes would require detailed monitoring. The cost of such an operation could be prohibitive and such a scheme may be politically unacceptable.

Property rights. The creation of property rights may be partially achieved by restricting access to the resource (i.e. by creating limited entry fisheries). However, Australian experience suggests that limiting access alone is not sufficient to prevent a build-up of fishing capacity with the attendant problems of overcapitalisation and/or overexploitation. The use of other measures that will confer property rights to individual fishermen and provide the basis for effective management control to restrict the emergence of these problems is essential.

In the Australian context, these measures must take account of the following factors:

(i) The on-going eligibility rights to a limited entry fishery conferred on fishermen selected according to specified entry criteria.

(ii) In most cases, the desirability of allowing for the transfer of property rights.

(iii) The desirability of selecting measures that will also be the best available proxies for fishing capacity which will assist in the achievement of effective containment and/or reduction of total fleet fishing capacity in a limited entry fishery.

Selection of such measures may involve controls over specified inputs or outputs, or some combination of these factors. Input measures include the definition of units of fishing capacity of a boat in terms of boat size (under-deck-volume or length), engine power, gear size etc., or combinations of these factors. Output measures include catch quotas or bag limits.

In theory it can be argued that input measures do not bestow direct or effective individual property rights over the resource, while output measures if properly applied, achieve that objective. It can also be argued that input controls are only a short-term remedy to the containment of fishing capacity because uncontrolled inputs may be substituted for controlled inputs (e.g. kilowatts can substitute for boat length). In addition it may be necessary to impose increasing restrictions over an increasing range of inputs in order to contain the effects of technological advancements.

On the other hand, aggregate fishing quotas, while protecting a fishery resource, do not address the problem of overcapitalisation. In fact the use of such measures could exacerbate overcapitalisation by encouraging investment in fishing boats which increase an individual fisherman's competitiveness.

Individual negotiable catch quotas however, introduce property rights which provide an incentive for more appropriate levels of investment by individuals and an incentive for greater productivity. A quota system itself does not encourage more than the efficient individual harvest of specified levels of fish stock. In a technical sense, this may not result in the most efficient pattern of harvesting of the resource but does provide a framework for individuals to become more efficient in their investment decisions. The potential for efficiency gain would, however, be greatly reduced if the quotas were not transferable.

Summary

Management controls over inputs or outputs create their own sets of special difficulties when they are considered as fisheries management measures. Apart from the factors briefly mentioned above, consideration also needs to be given to the feasibility and costs of implementing, monitoring and policing such controls as well as the social costs of the restrictions within the political environment.

Experience in Australia has demonstrated that whether we like it or not, the days of most uncontrolled fisheries are numbered. Some form of control is essential if the problems of overcapitalisation and/or overexploitation of our resources are to be addressed. Once headed down the fisheries management path, decisions on the most appropriate management regime for an individual fishery involve consideration of a large range of complex issues. A final decision involves striking a fine balance between:

(i) Theoretical and practical considerations.

(ii) Allowing individuals to develop their most efficient catching operation with minimum controls.

(iii) Ensuring the appropriate use of scarce capital resources in the catching sector and

(iv) Providing adequate protection for fish stocks.

Fisheries Management in Practice

Two different management regimes which are currently being introduced into two of Australia's largest fisheries are discussed below. A management plan for the Northern Prawn Fishery Declared Management Zone (NPF DMZ) is based primarily on input controls to contain and reduce total fleet fishing capacity in order to improve economic returns to the fishery. Secondly, the southern bluefin tuna resource is seriously threatened by overexploitation and a management plan for the Southern Bluefin Tuna Fishery (SBT) based on individual transferable catch quotas is being introduced to enable a recovery in the size of the fish stocks.

The Northern Prawn Fishery Declared Management Zone (NPF DMZ)

Key Features

The NPF DMZ was created in 1977. It includes Commonwealth, Queensland and Northern Territory waters in the defined area shown in Figure 1.

The main features of the zone are described in Annex 1 and summarized as follows:

(i) The NPF DMZ is a limited entry fishery with the number of fishermen eligible to catch prawns in the area restricted to 292.

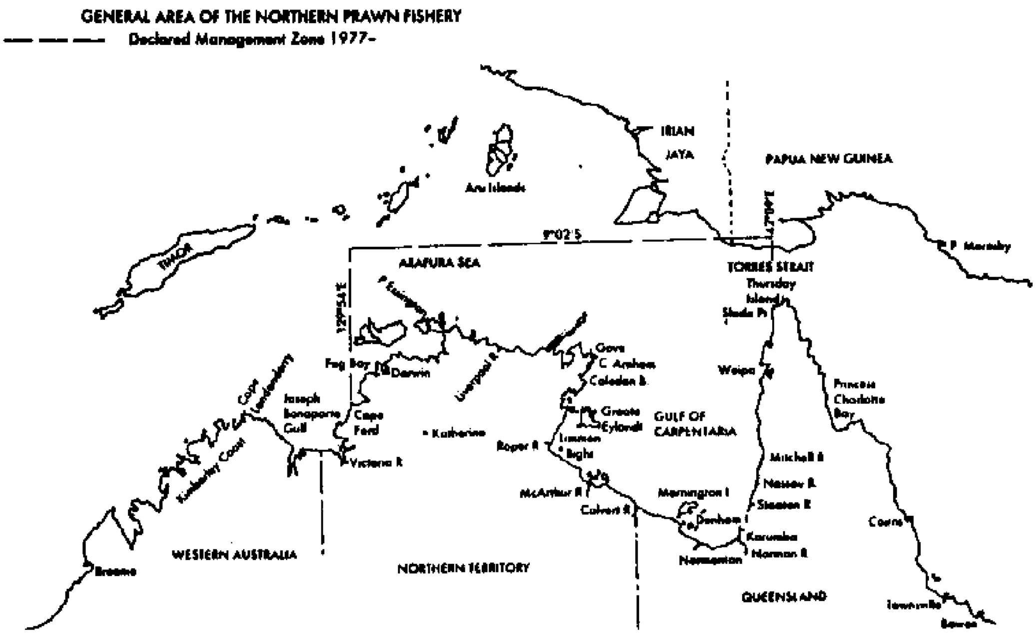

Figure 1.

(ii) The annual value of prawn exports of about $100 million (mainly to Japan), ranks the NPF DMZ as Australia's No. 1 fishery export earner contributing between 50% and 60% of total export earnings from Australian crustacea.

(iii) The zone ranked second to the western rock lobster fishery in terms of annual value of Australian crustacea landings in recent years.

(iv) The total prawn catch has fluctuated around a five year average (1978-79 to 1982-83) of about 9,500 tonnes.

(v) While total average catch has remained relatively constant, the catch per vessel day spent fishing has been declining, and the average number of days per vessel spent fishing has been increasing.

(vi) Total investment in DMZ licensed boats has increased substantially in recent years. The size of replacement boats has increased (many with the aid of a ship-building bounty) and the level of their technological sophistication has improved. These developments have increased the total fishing capacity of the fleet despite the limitation on total boat numbers.

(vii) According to survey information from the Bureau of Agricultural Economics (BAE) for the years 1980-81 and 1981-82, average total returns of between $82.5 million and $89.5 million were achieved in comparison with total annual fleet costs of about $92 million. About 55% of boats were unable to make a positive return to capital while 17% and 25% of boats (mainly in the 20.6m to 23.6m size range) achieved returns to capital of at least 10%.

(viii) A deterioration in the relationship between real prawn prices and fleet costs is expected in the longer term.

(ix) The combination of increasing excess fishing capacity (identified primarily as increasing overcapitalisation of the existing fleet), little increase in the average annual size of the prawn catch, and the deterioration in the relative movements of real prawn prices and fleet costs (particularly fuel costs) has resulted in a serious decline in the overall profitability of the fishery.

(x) Because of the nature of the resource (i.e. essentially a one year reproductive and growth cycle of the highly fecund species), available evidence suggests that the main commercial prawn species, namely the banana prawn (Panaeus merguiensis) and the tiger prawn (Panaeus esculentus and P semisulcatus) are not threatened by overexploitation. In other words the problems in the fishery arise from economic rather than biological factors.

Prospects for Improving Profitability

Three main options for achieving an economic recovery in the fishery are:

(i) Increasing the size of the prawn catch. The available evidence on prawn resources in the NPF DMZ suggests that the scope for substantially increasing the annual catch may be limited.

(ii) Increasing prawn prices at a greater rate than increases in fleet costs. According to analyses by the BAE, the relative movements in real prawn prices and fuel prices are likely to deteriorate in the longer term, and hence the prospects for improving the profitability of the NPF DMZ through increasing real product prices are not good.

(iii) Decreasing fleet costs. This option appears to offer the best prospects for achieving an economic recovery in the fishery. According to the BAE survey, capital and directly related costs of 264 operational boats totaled about $29 million or almost 28% of total fleet costs. A substantial reduction in these costs could be achieved by removing boats from the fishery.

Management of the NPF DMZ

In the light of the brief overview presented above, the main issues with respect to management of the NPF DMZ are discussed below.

Development of a management regime. Prior to the announcement of the DMZ in 1976, seasonal closures had been introduced into the fishery aimed at optimizing the size of banana prawns at the time of first catch. This element of management has been improved and is still in force.

The next major move was made when a Northern Fisheries Committee (NFC) comprising government representatives of the Commonwealth, Queensland, Northern Territory, Western Australia and CSIRO was convened to consider development plans and the need for management for the fishery. Based on recommendations from NFC, the Australian Fisheries Council (AFC) agreed in October 1976, to limit entry into the DMZ.

A boat replacement policy on a one-for-one basis was introduced as a measure of restraint on fishing capacity. This policy was modified in 1980 to allow for boats of less than 21 metres (DLWL) or 150 gross construction tonnes to be replaced with boats of up to this size and therefore to qualify for a ship-building bounty. Boats in excess of these size criteria could be replaced on a one-for-one basis.

By October, 1982 it had become clear that the boat replacement policies were ineffective in restraining total fleet fishing capacity including the effects of technological innovations in boat design and construction, engine power, navigational aids and fishing gear and equipment. It was also becoming clear that unless innovative steps were taken to dampen the effects of the serious overcapitalisation which was occurring in the fleet, this valuable fishery would face a prolonged period of economic decline. Accordingly AFC directed that a review of the NPF DMZ be undertaken as a matter of urgency to consider the early introduction of measures to restrain existing and potential fishing capacity.

That review was carried out in March 1983 in close consultation with industry. In fact most of the key elements for a revised management plan examined during the review, were based on a report prepared by an industry organisation called the Northern Fisheries Companies Association representing some 200 NPF DMZ licensed boats.

Subsequently a joint industry/government body called the Northern Prawn Fishery Advisory Committee (NORPAC) comprising representatives of seven industry sub-groups, four governments and CSIRO, developed a seven-point management package which was endorsed by AFC in September 1983. The components of the new plan are:

(i) Establishment of a joint industry/government management committee known as the NPF Management Committee (NORMAC) responsible to AFC through Standing Committee on Fisheries.

- NORMAC replaced NORPAC on 1 January 1984.
- An effective working relationship has been established between industry and government representatives on NORMAC.

(ii) Implementation of a new Boat Replacement Policy (BRP) based on unitisation of a boat's fishing capacity calculated by combining under-deck-volume and engine power.

- This policy has been implemented according to a comprehensive set of BRP rules approved by the Minister for Primary Industry and all boats must be unitised by 31 December 1984.
- Boat units are held on a central boat unit register operated by the Fisheries Division, Department of Primary Industry, and boat units are transferable.
- A boat license will not be endorsed to operate in the fishery unless the appropriate number of boat units required to cover the size of the boat are held by the licensee.

(iii) Establishment of a Voluntary License Entitlement Buy-Back Scheme (VLEBBS) to be financed by a compulsory levy on industry.

- A transferrable certificate of entitlement to operate in the fishery must have a minimum of 100 boat units attached to it all times.

- An entitlement with attached boat units, or boat units alone may be voluntarily sold to a small statutory buy-back authority based initially on a tendered price by the vendor. Entitlements and boat units surrendered to the buy-back authority will be lost to the fishery. Disposal of a boat effectively removed from the fishery will be the responsibility of the boat owner.

- Government approval for the establishment of a small buy-back authority with power to borrow off Government budget up to a limit of $5 million is currently being sought.

- This loan of $5 million is required as an initial injection of funds to implement VLEBBS on 1 January 1985.

- Industry has agreed to totally fund VLEBBS through a compulsory, tax-deductible levy, including interest on borrowings at non-concessional interest rates.

- Government authority to impose levy has been obtained and legislation is expected to be passed by Parliament in the 1984 Budget Session.

- Levy payments and buy-back prices paid will be based on the number of boat units held by each fisherman.

(iv) Extension of the NPF DMZ westward to Cape Londonderry on the Western Australia coastline.

- In order to spread total fleet fishing capacity over a wider area.

(v) Implementation of a permanent closure programme to protect prawn nursery grounds, and improvement of a seasonal closure programme aimed at optimizing the size of prawns at first catch.

(vi) Improvement of the structure and effectiveness of penalties for offenses under Commonwealth law in the NPF DMZ.

(vii) Improvement of licensing arrangements involving central control, rationsalisation and streamlining of present arrangements with a view to reducing the number and cost of licenses.

Comments on the management plan. The development of the new plan evolved after consideration of a range of management options including the concept of output controls or quotas. This concept was soon rejected for the NPF DMZ on the grounds that

- The problems to be addressed are essentially economic and not biological (i.e. the resource is not under threat from overexploitation)

- Quotas would be virtually impossible to control in such an extensive fishery, particularly since boats which can remain at sea for months at a time may catch prawns outside the DMZ; with the advent of bulk packing, trawlers may transfer their product to supply boats for direct shipment to overseas markets; and home ports extend from Perth to Townsville. Under these circumstances the costs of controlling and monitoring quotas at the present time would be prohibitive.

Once the decision to concentrate on input controls had been made, a range of possible options was examined in detail. These included alternative proxies for fishing capacity such as gear size and bollard pull. NORMAC has clearly recognised that there is uncertainty about the effectiveness of the results of the selected management measures, particularly the unitised BRP and the VLEBBS, and that these measures will need to be carefully monitored from the outset. If they are found not to be as effective as anticipated in terms of containing and reducing fishing capacity, particularly in relation to the effects of technological innovations, it may be necessary to introduce more stringent capacity control measures. It is intended that a follow-up contingency plan containing such measures be developed as soon as the BRP and VLEBBS become fully operational on 1 January 1985.

Current issues. At the present time the main issues being addressed are:

(i) Difficulties of establishing engine manufacturer's recommended maximum continuous rating in kilowatts for some boat engines as part of the BRP boat unitisation formula.

(ii) The need to amend the Commonwealth Fisheries Act 1952 to provide a sound legal basis for the implementation of new fisheries management regimes, and also to provide a basis for imposing levy in some instances. This aspect is of concern in relation to the timing of the introduction of new management measures.

(iii) The need to resolve a number of issues concerning currently non-NPF DMZ endorsed boats which can demonstrate a commitment to fishing for prawns in the proposed NPF DMZ extension area westward from Cape Ford.

(iv) Finalisation of the detailed operations of VLEBBS prior to the introduction of this scheme by 1 January 1985.

Southern Bluefin Tuna Management Plan

Key Features

Southern bluefin tuna (SBT) is a single stock highly migratory species which spawns in the Indian Ocean south of Java. It is exploited by Japanese longliners virtually throughout the full extent of its migration through the southern oceans between about 30° and 50° from east of South America to east of New Zealand. SBT is also the basis of a substantial Australian pole and line and purse seine fishery and a relatively small New Zealand handline fishery.

The Australian fishery which is concentrated off the southern coast of Western Australia and off the coasts of South Australia and New South Wales has, until recently, been based predominantly on harvesting surface schools of pre-adults for canning purposes. In more recent years there has been a shift in emphasis towards harvesting larger SBT for the sashimi market. Product from the NZ adult SBT fishery is also directed to that market.

The Australian and Japanese fisheries commenced in the early 1950s. Japan's catch expanded quickly to 77,500t in 1961 but has since declined to its current level of about 17,000t. By comparison, Australia's SBT catch grew steadily until the 1970s. During this decade the catch ranged from about 10,000t to 15,000t. In the late 1970s the fishery, particularly off Western Australia and South Australia, expanded significantly and in 1982 a record catch of 22,000t was landed by the Australian fleet of about 140 vessels.

The Australian fishery comprises three prime sectors but is dominated by a South Australian based fleet of about 35 pole and line vessels ranging from wooden hulled vessels of 15 metres to modern specialised steel hulled vessels of 35 metres. Four of the five purse seiners active in the fishery are also based in South Australia. These vessels range from 26m to about 40m in length.

Catches in the New South Wales sector of the fishery have in recent years been well down on previous landings of between 3,000-6,000t. As a consequence many of the pole/line vessels previously engaged in this sector have either reverted to trawling or transferred their operations to South Australia. Only about 12 multipurpose vessels are now based in New South Wales.

The Western Australia sector of the fishery is largely a small scale inshore fishery based on harvesting SBT of less than 3 years old. The bulk of the fleet of about 90 vessels are of less than 15m and relatively few are engaged in the fishery on a full-time basis. None-the-less until quotas were recently imposed on this sector, catches had increased to almost 6,000t in 1982/83 and many were anticipating higher catches in future years.

In addition a number of small scale trolling vessels are engaged in the fishery, largely on an opportunistic basis as an adjunct to their activity in other fisheries off the southern coasts of Australia.

Canneries which are largely dependent on SBT from the domestic fishery are based at Eden (NSW), Melbourne (Victoria), Port Lincoln (S.A.), Albany (W.A.) and Perth (W.A.).

Economic Status of the Fishery

During the 1970s the fishery was subject to significant fluctuations in profitability. These fluctuations resulted as a consequence of variations in SBT availability as well as in prices offered by Australian canneries. Despite these variations the fishery was characterised by a steady increase in investment in large and more sophisticated vessels.

Studies undertaken by the Bureau of Agriculture Economics indicate a substantial deterioration in the profitability of the fleet over the period 1980-81 to 1982-83. The decline was particularly evident in the eastern sector of the fishery which experienced both a decline in earnings and an increase in operating costs. The impact of these factors was such that the average operating surplus of all vessels operating in this sector of the fishery fell from in excess of $120,000 in 1980-81 to less than $10,000 per vessel in 1982-83.

The decline in profitability has encouraged fishermen to more actively pursue alternative markets for their product. Greater emphasis has thus been given to exporting SBT unprocessed, to higher value markets in Italy and more recently Japan rather than directing their catch to local canneries. This situation has exacerbated difficulties already being experienced by the canning sector as a consequence of the availability of low cost canned tuna from overseas sources and relatively low levels of tariff protection.

Given the costs of harvesting SBT and the competitiveness of the international market for canned tuna, it seems inevitable that Australian SBT production will increasingly be exported in an unprocessed state and that local canneries will become even more dependent on obtaining raw material (particularly skipjack) from overseas sources.

Need for Management

Following concern expressed by scientists about the diminishing stock of the fishery, Australia moved to develop and introduce an appropriate management program. This involved detailed consultation not only with the Australian tuna industry and the State Governments concerned but also three rounds of trilateral consultations involving scientists and fisheries administrators from Australia, Japan and New Zealand.

At the second round of trilateral consultations in Japan during April 1982 a scientific consensus on the status of the fishery was achieved. Research indicated that the parental stocks had, by 1975, been reduced from a pre-fishing level of about 600,000t to about 220,000t as a consequence of the combined catch of Japanese and Australian fishermen. Although analysis indicated the level of stocks had been stable until 1980 the scientists concluded that high recent exploitation rates would further reduce stocks and that urgent steps should be taken to ensure that stocks were maintained at the 1975-1980 level of about 220,000. Their concern was that at lower stock levels there could be no certainty that the fishery would continue to produce a satisfactory number of recruits. Subsequent analysis has confirmed the gravity of the situation.

It is clear that the 1982 level of exploitation is inconsistent with the biological analysis of the status of the fishery and there has been a large degree of agreement between Australia, Japan and New Zealand on the need for fishing restraint and the desirability of developing a co-ordinated international approach to the problem.

Development of Management

It was therefore in the context of a clear biological necessity that Australia moved quickly to develop an appropriate management program for its sector of the fishery. In considering the nature and extent of the management plan the following considerations were of central importance:

(i) SBT is a highly migratory species exploited by geographically and economically diverse sectors of the Australian community as well as by Japanese and New Zealand fishermen.

(ii) Although fast growing SBT do not reach sexual maturity until 7 or 8 years old and thus have a long exposure to fishing effort before being capable of reproducing. Fishing effort is thus quite capable of seriously affecting the level of parental stocks and prejudicing the level of future recruitment.

(iii) As a highly migratory species, the availability of SBT to Australian fishermen may be subject to a number of oceanographic and weather factors not related to the biological status of the fishery i.e. availability would be largely unpredictable.

(iv) Considerable excess capacity existed in the fishery (estimates had been made that the Japanese fleet was 2 to 3 times larger than necessary to take its current catch and that the Australian fleet, given favourable oceanographic/weather conditions, had a capacity to take well in excess of its record catch of 22,000t).

(v) Because of the time lags involved between exploitation by Australian fishermen and its impact on adult stocks, the need to effectively restrain the Australian catch was urgent.

(vi) To be effective, any international management arrangement would need to involve the establishment of a global catch quota and any national program would need to be capable of complementing such an arrangement.

(vii) The level of the global quota would depend largely on the age composition of the catch i.e. higher quotas can be sustained if large fish are taken.

(viii) A number of geographically distinct Australian fisheries had developed which were economically dependent on harvesting SBT.

In view of these factors and after a comprehensive round of industry consultations and discussions with scientists and fisheries administrators, the concept of adopting conventional input, capacity-related, controls was rejected. The main consideration in this decision was the uncertain impact capacity restrictions would have on catch and hence the long term level of SBT breeding stocks.

Those associated with the development of long term management arrangements were also conscious that earlier efforts to manage the fishery on the basis of input controls had proved effective in promoting either biological or economic objectives. Indeed, during the course of a "freeze" on entry into the eastern sector of the fishery (1976-1981) both investment and catch increased significantly. It should be noted however that while the "freeze" was introduced in order to promote an improvement in the economic performance and stability of the fishery the current management program has been developed with the primary objective of ensuring the breeding stocks are maintained at a reasonable level.

It was thus decided to pursue the development of a management program based on the establishment of an annual national quota with complementary measures designed to promote an increase in the size composition of the Australian catch.

The decision to opt for a quota-based management program was made easier as quota control and monitoring arrangements would be simplified by the manner in which SBT was landed and marketed viz:

- Almost the entire catch is landed at 5 or 6 main ports.
- The bulk of landings are either canned or exported frozen and relatively few processors and fish buyers participate in the fishery.
- The domestic fresh tuna market is very limited and would be quickly oversupplied if fishermen endeavoured to market a significant proportion of their product through other than established and known channels.

In order to promote an improved catch composition (i.e. a larger proportion of larger fish and hence fewer fish taken per tonne landed) a range of supplementary measures were also considered. These included gear restrictions, size limits and area controls.

Gear restrictions were subsequently considered not appropriate because of the nature of the fishery and characteristics of the gear used. It was thus decided to pursue area closures and size limits options.

Implementation of Management

With the prime objectives of restraining growth in the Australian fishery and providing a suitable framework for more stringent management arrangements, an interim program was introduced from 1 October 1983 incorporating the following elements.

(i) National quota 19,000t

- eastern sector 15,000t
  (purse seiners 5,000t)
- western sector 4,000t

(ii) Reserve quota 2,000t

(iii) Size limits

- eastern sector 70 cm
- western sector 54cm

(iv) Area restrictions

- In addition to being prohibited from operating in the western sector, purse seiners were precluded from inshore areas off NSW and from operating around sea mounts off SA.

Although limites were imposed on each of the sectors no limits were placed on the catch by individual fishermen. The reserve quota was introduced as a means of providing a facility for fishermen to target on larger fish or to diversify operations onto non-SBT species. In this manner purse seiners were to be allocated additional SBT quota if efforts were made to catch non-SBT species and western sector fishermen would be similarly rewarded for taking larger SBT. It was also intended that the reserve quota would cover the development of operations targeting exclusively on large SBT.

A segregation of the two sectors at 127°E was considered desirable, at least initially, to reflect the different structure of the fisheries and significant differences in the characteristics of SBT availability throughout its migration through the Australian fishing zone. Without sectors being established it was felt that the burden of management could be distributed disproportionately amongst Australian fishermen. For example the enforcement of a national size limit of 70cm would have virtually closed the fishery off Western Australia.

Results of Interim Program

It is likely that the Australian catch of SBT during 1983/84 will be of the order of 15,000-16,000t compared with about 22,000t for 1982/83. It is recognised that independent factors such as weather conditions and SBT availability have had a major impact on the productivity of the fishery this year. Despite these factors it has however been necessary to close the purse seine sector of the fishery, and closure of the western sector well before the season concludes on 31 September is likely. Thus while it may not have been the major factor, the management program has made a positive contribution to restraining SBT catch during 1983/84.

The major lesson of the first year of the comprehensive management program for the SBT fishery was the difficulty associated with industry adherence to size limits.

The main factors to prejudice the operation of size limits in this fishery are likely to be common to the management of similar pelagic species and include:

- Non-selectivity of prime fishing methods.

- Regular occurrence of SBT in concentrations containing mixed age classes.

- Fishing strategies which preclude early release of fish and hence high mortality rates associated with sorting and releasing undersized fish.

While size limits have been somewhat successful in redirecting effort, strict size limit enforcement has also resulted in considerable dumping and wastage. This is undesirable from a resource utilisation point of view. It also tends to result in catch data which understates the impact of commercial fishing on the resource. Alternatives such as area/seasonal closures are now being considered.

Long Term Management Program

While acknowledging that the character of the fishery and its biological status dictated the introduction of more restrictive catch quotas, those associated with the management of the fishery have been concerned that the disruptive consequences of an open quota arrangement should be avoided where possible. These consequences were seen as being associated with promoting a more competitive catching situation and hence an inevitably shorter season and a higher capitalisation in vessels and equipment than necessary.

During the course of the last season it also became apparent to industry that there would be a number of advantages associated with progressing to a system of individual catch quotas. In particular such a system was seen as promoting a far more orderly fishery by enabling individual fishermen to tailor their involvement in the fishery to their quota or alternatively to adjust their quota to suit their fishing operations. These considerations are particularly important in a fishery where part of the fleet is concerned with taking relatively large quantities of SBT for canning at low unit values while other participants, possibly with similar financial commitments, are keen to structure their operations around smaller quantities for the higher priced sashimi market.

It is thus proposed that the long term management program for the fishery will be based on a system of individual transferable catch quotas (ITQ's) with few controls on fishing operation except for selective area closures. The allocation of ITQ's to individual fishermen will be based on a formula taking into account their past involvement in the fishery (catch over the period 1980-81 to 1982-83) and their financial commitment to the fishery (current market value of their vessel).

Although the administrative and equity difficulties associated with the initial allocation and administration of limited catch quotas are considerable, this must be viewed in the context of the potential of a system of ITQ's to promote a far more orderly and rational fishery in the longer term. In particular ITQ's are seen as offering a real opportunity for government to distance itself from the commercial area of decisions by fishermen about investment and the manner in which they organise their fishing operations. Thus while the biological objectives are safeguarded by the aggregate level of the quota, a system of ITQ's enables the individual to protect his participation in the fishery by his holding of ITQ entitlements. That is, the actions of each individual are isolated and thus do not directly impact on the nature or extent of participation by other individuals in the fishery. Fishermen can therefore concentrate on organising their own level of participation in the fishery and are less concerned with direct competition with other operators.

While management programs developed for the fishery may ensure the fishery is not overexploited, probably the most powerful forces in determining the future viability and productivity of the SBT fishery are oceanographic/weather conditions and commercial/marketing factors. While it is not possible to influence or indeed predict the former it appears that market forces are tending to support a move to fishing smaller quantities of larger fish for the lucrative sashimi market. In addition, processors are now conscious that the aggregate level of Australia's quota will be significantly influenced by the composition of the catch and have indicated an intention to establish a differential pricing system based on fish size for the coming season. These factors may in the long term prove to be of considerable significance in complementing the endeavours of fisheries managers to reduce the number of SBT taken.

In the final analysis it should not be overlooked that this fishery is based on the exploitation of a highly migratory species and that fishermen from other countries are involved. Without complementary action by those fishermen there can be no guarantee that the Australian program will be completely effective in safeguarding the fishery. Thus, while the Australian Government has placed high priority on developing a responsible management program for Australian fishermen engaged in the SBT fishery it is also very conscious of the need to promote a co-ordinated approach to the problem with the Governments of Japan and New Zealand.

Annex 1. Main Features of the NPF DMZ Catching Sector

Quantity and Value of Catch

The estimated total landings and landed values of prawns from the DMZ for financial years since 1978-79 are given in Table 1. The percentage of total catch comprising Banana prawns is also shown, the remainder of the catch comprising Tiger, Endeavour, King and other prawn species. Values are at current prices.

Table 1. Prawn Landings and Value: NPF DMZ 1978-1982

Year	Total Catch	Landed Value	Average Price Per Kilo	Banana Prawn % of Total Catch
	tonnes live whole weight	$'000	$	%
1978-79	9,279	45,300	4.88	50
1979-80	8,641	42,500	4.92	32
1980-81	12,285	55,800	4.54	43
1981-82	9,614	54,300	5.65	28
1982-83	7,742	63,500	8.20	24

Source: DPI

Table 2 shows the values of landings, exports and imports of total fish, crustacea and molluscs for Australia for the three year period 1978-79 to 1980-81. The harvesting of prawns, lobsters and abalone account for the major part of the total value of production of Australian commercial fisheries and these are oriented to export markets. The dominance by value of the prawn and rock lobster harvests relative to fish and molluscs has been maintained in recent years. In 1980-81, crustacea accounted for about 60% of the value of the total commercial catch of fish, crustacea and molluscs, with prawns accounting for 37% and rock lobster 24%.

Table 2. Fish, Crustacea and Molluscs -- Landings, Exports and Imports 1978-79 to 1980-81, Australia[a] ($'000)

	1978-79	1979-80	1980-81
Fish			
- landings	56,501	58,007[b]	67,289[b]
- exports	4,744	12,836	10,274
- imports	85,865	114,519	133,984
Crustacea			
- landings	176,451	184,137[b]	213,609[b]
- exports	167,267	198,007	171,344
- imports	37,141	35,147	48,297
Molluscs			
- landings	32,355	37,178[b]	50,400[b]
- exports	22,119	31,490	50,345
- imports	1,770	3,282	6,616

a. Market shares (or domestic availability) cannot be computed from the data shown in Table 2. Landings are valued at wholesale prices in principal markets for mainly unprocessed fish etc. and exclude Victorian landings in 1979-80 and 1980-81. Imports and exports are on an fob basis and include substantial quantities of processed and packaged product. Some exports and imports are not differentiated between crustacea and molluscs (and have been included in crustacea).

b. Excludes Victoria.

Source: ABS.

The value of NPF DMZ prawn landings represented 25%, 23% and 26% respectively of the total value of crustacea landings in Australia for the years 1978-79 to 1980-81. The contribution of DMZ prawns to the value of export earnings however, is considerably more important. With about 97%-98% of the total DMZ catch exported at an annual export value of about $100 million, DMZ prawns comprised between 50% and 60% of the value of total Australian crustacea exports in recent years. Between 80% and 90% of total prawn exports are shipped to Japan.

NPF DMZ Prawn Catch in Relation to Time Fished

The trends in catch and relationship of catch to days fished for banana prawns and for tiger/endeavour/king prawns respectively are shown in Tables 3 and 4.

Table 3. Catch and Fishing Time Data: Banana Prawns in the DMZ, 1975 to 1982

Year	Vessels	Banana Prawn Catch (a)	Catch Per Vessel Day (b)	Total Vessel Days Fishing	Days Per Vessel Per Year
	number	(tonnes)	(tonnes)		
1975	105	2,855	0.609	4,690	45
1976	145	4,164	0.648	6,427	44
1977	175	5,956	0.911	6,535	37
1978	193	2,263	0.455	4,977	26
1979	199	4,335	0.662	6,549	33
1980	166 (c)	2,151	0.324	6,625	39
1981	229 (c)	4,409	0.514	8,569	37
1982 (c)	170 (c)	2,437	0.430	5,667	33

(a) Total catch of banana prawns excluding those caught as an incidental component of the trawl fishery catches.

(b) Catch per vessel day based on logbook records pertaining to banana prawn fishing only.

(c) Preliminary data only.

Source: CSIRO and DPI.

Table 4. Catch and Fishing Time Data: Tiger/Endeavour/King Prawns in the DMZ, 1975 to 1982

Year	Vessels	Total Catch	Catch Per Vessel	Catch Per Vessel Day	Total Vessel Days Fished	Days Per Vessel Per Year
	number	(tonnes)	(tonnes)	(tonnes)		
1975	107	1,425	13.24	0.245	5,817	54
1976	145	1,805	12.48	0.261	6,915	48
1977	193	4,071	20.85	0.350	11,637	60
1978	237	4,937	20.07	0.263	19,746	79
1979	240	5,576	22.63	0.299	18,618	78
1980	278 (a)	6,543	32.53	0.227	28,805	104
1981	280 (a)	7,033	25.12	0.224	31,322	112
1982 (a)	261 (a)	6,157	23.59	0.199	30,813	118

(a) Preliminary data.

Source: CSIRO and DPI.

The main points from these tables are as follows:

Banana Prawns

(i) Marked annual fluctuations around an average total catch of about 3,600 tonnes per year.

(ii) An upward trend in total days of fishing with an annual peak in 1981 of about 8,600 vessel days.

(iii) A downward trend in the catch per vessel day.

Tiger/Endeavour/King Prawns

(i) A dramatic increase in total catch from about 1,800 tonnes in 1975 to a peak of about 7,000 tonnes in 1981.

(ii) An equally dramatic upward trend in total days fished peaking at around 30,000 vessel days in 1981

- A decline in catch per vessel day over the eight year period.

It should also be noted from Table 1, that the catch of Banana prawns as a percentage of total catch in the DMZ has almost halved since 1978-79.

DMZ Vessel Size and Fleet Structure

The most recent data on size distribution of the fleet are summarised in Table 5. The total number of NPF DMZ license entitlements was 292 with 265 operational boats and 27 unfilled entitlements. Over 31% of entitlements are attached to boats in the 22-24 metre length class, and 76% of entitlements are attached to boats of less than 24 metres in length.

Table 5. NPF DMZ Boat Classification by Length

Length	Vessels	
	No.	%
less than 16m	22	7.5
16m and less than 18m	38	13.0
18m and less than 20m	36	12.3
20m and less than 22m	35	12.0
22m and less than 24m	91	31.2
24m and less than 26m	31	10.6
26m and less than 28m	5	1.7
28m and less than 30m	3	1.0
30m and over	3	1.0
Unfilled entitlements	27	9.2
TOTAL	292 (1)	99.5 (2)

(1) BAE analysis based on 264 operational boats.

(2) Note equal to 100% due to rounding error.

Source: BAE

As long as the number of unfilled entitlements remains at around the present level (27), a considerable amount of operational fishing capacity is withheld from the fleet. However, these licenses are a continuing threat for increasing total fleet fishing capacity because they could be attached to operational boats at any time. Given that the total DMZ prawn catch has not shown any increase over the last five years (fluctuating around 9,500 tonnes per year), the introduction of up to 27 additional entitled boats into the fleet (to a maximum of 292) at any time in the future could have serious economic consequences. Downward pressure would be put on the profitability of the entire DMZ fleet.

Table 6 shows the average boat main engine power in kilowatts and the large variation in engine power within each size classification of the boats.

Table 6. NPF DMZ Fleet: Main Engine Power by Length Strata

Length Strata	Average Main Engine Power kw	Range of Main Engine Power kw
less than 15.6m	130	80-220
15.6m and less than 17.6m	203	130-276
17.6m and less than 20.6m	223	127-335
20.6m and less than 23.6m	307	224-575
23.6m and above	361	246-596

Source: BAE

The average size of boats and hence the capital investment in the fleet has increased considerably over the years. Larger boats have been built for a number of reasons including:

(i) Increasing competition between operators for a limited common property resource.

(ii) Lowering the minimum size of boat in December 1973, to qualify for the shipbuilding bounty on the construction of new vessels from 200 gross tonnes to 150 gross construction tonnes (or 21 metres design load waterline length). The rate of bounty payable was 25% of the tender price but is now 27% of the cost of construction.

(iii) The need for larger vessels with greater capacity and comfort to remain at sea for extended periods with the capability for wide ranging operations in the NPF and to withstand rough weather conditions. This is associated with (i) above.

(iv) The capability for efficiently employing improved navigational aids and new fishing technology closely linked with the factors in (i) and (iii) above.

In addition to increasing size of vessels and technological improvements in navigational aids and fishing gear, there have been significant changes in other vessel attributes including:

(i) Increased average main engine power from 130 Kw in 1971 to 213 Kw in 1980;

(ii) An increase in the number of boats with dry refrigeration from 10% in 1971 to 57% in 1980;

(iii) An increase in the number of boats with steel hulls from 15% in 1971 to 59% in 1980.

Value of the Fleet

The average market value per boat obtained by the BAE from operator's estimates was $364,600. The total market value of the fleet (264 vessels) excluding the value of license entitlements was estimated at about $96 million. When the market value of license entitlements was added, the total value of the fleet increased to about $110 million. The implied average value of license entitlements as of December 1982/ January 1983 was therefore about $53,700.

In terms of purchase price, the total value of the fleet was $90.4m. This figure is based on what present owners actually paid for their vessels. The average purchase price was about $342,600.

The total estimated replacement cost of the fleet (264) was approximately $159m. Replacement cost is what it would cost to purchase an identical new boat. The average replacement cost was approximately $600,600.

Total crew, including skippers, permanently engaged on NPF DMZ boats was approximately 1,250 persons. During the peak season the number rises to about 1,540 persons. The average period for which the seasonal maximum was engaged was 4.2 months.

The average crew size permanently engaged per boat was 4.7 persons, and the average during the peak period was 5.8 persons.

Economic Performance of the Fleet

The main features on the economic performance of the fleet according to BAE survey data are as follows:

(i) The most profitable boats on average were in the 20.6m-23.6m length range despite the high percentage (70%-77%) of non-subsidised boats in this length class which made financial losses in the two survey years.

(ii) On average, the only other length stratum to make a profit was the 15.6m-17.6m class in 1981-82, with all other boat classes recording an average financial loss in both survey years.

(iii) Over 55% of the fleet incurred financial losses in both survey years, although 25% of the fleet achieved a rate of return of more than 10% in 1980-81 while only 17% of the fleet exceeded a 10% rate of return in 1981-82.

(iv) The variability in financial returns within boat size groups was high.

(v) The overall profitability of the fishery in terms of rates of return to capital has not been encouraging in recent years. (A more detailed assessment of the economic performance of the fleet will be provided in a forthcoming BAE report on its 1983 NPF DMZ fleet survey.)

The Outlook for Prawns

The BAE summary of the outlook for prawns presented at the 1983 National Agricultural Outlook Conference is reproduced below:

". With no significant improvements in catch and with increases in prices received likely to be smaller than increases in costs of production, the Australian prawn industry is expected to face a deterioration in real income over the next twelve months.

. Fuel price rises are expected to keep pace with the general rate of inflation in 1983 and the industry will lose the assistance provided by the Export Expansion Grants Scheme when it terminates in July.

. In the short term, supplies of prawns to the Japanese market appear unlikely to change significantly, maintaining Japanese prices at current levels. However, if there is significant downturn in the U.S. market, some subsequent redirection of supplies to Japan may depress prices.

. The improvements in export prices to fishermen in 1982 should be consolidated in 1983. Export market returns are expected to increase by 6-7 percent as a result of appreciation of the yen against the Australian dollar and a lowering of tariffs in Japan.

. In the longer term, the rate of growth in demand is likely to be greater than increases in the rate of growth in supplies, resulting in an accelerated rise in prices. However, the viability of the industry world-wide will depend heavily on relative movements in prawn and fuel prices.

. The viability of the industry in Australia will also depend on rationalisation of fishing effort being achieved as most, if not all, prawn fisheries have excess capacity."

The most recent update on the outlook for prawns and a short summary of price movements and the total expected catch for 1983 was provided by the BAE in a revised version (October 1983) of its "Fish Products" Commodity Notes published in the Quarterly Review of the Rural Economy 5(3), August 1983.

"The total prawn catch in 1983 will be down by about 10 percent and unit returns to fishermen up by 10 percent on last season's average of $5.10/kg, so that total returns are likely to be stable.

Prices for tiger prawns in the Northern Prawn Fishery reached $11.00/kg, and prices in other fisheries averaged about $6.00/kg. Wholesale auction prices for both school and king prawns at the Sydney fish market in April 1983 were $4.35/kg and $8.75/kg, respectively -- 37 percent and 16 percent higher than in April 1982.

Production from the east coast of Queensland in 1983 is expected to be higher than last year when it was reduced as a result of a low catch in the middle of the year. This increase, however, is likely to be outweighed by a fall in the catch in the Northern Prawn Fishery.

In the nine months ended March 1983, export returns from the prawn sector were $117.4m, 17 percent higher than in the corresponding period in 1981-82 due to the sharp increase in unit values to $11.19/kg (27 percent higher) outweighing the 8 percent decline in exports to 10.5kt (product weight). Export prices have declined and, as a result, the average prices received by fishermen are expected to fall over the next six months. In particular, the prices received on the Japanese market (mainly at the top end) are expected to drop.

In the long term prawn prices are expected to fluctuate with no significant increase in constant dollar terms.

Over the same period of comparison, imports of prawns rose by 5 percent to 5.3kt which were valued at $40.6m, an increase of 33 percent."

International Allocation of Fish Resources and the New Law of the Sea Regime

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Introduction

The new Law of the Sea regime has made the allocation of fish resources among countries a more pertinent issue than ever before. With the important exception of highly migratory species such as salmon and tuna, fish stocks are now enclosed within the territorial waters of a limited number of coastal states. Effective management of fish stocks thus requires agreement between a limited number of countries only, as it is no longer possible for third countries to invoke the principle of free access to become parties to, or to undermine, such agreements. A number of fish stocks have come under the command of a single country.

While the new institutional framework thus seems auspicious for the effective management of fish stocks, the view that fisheries management has not improved much is not uncommon (see, for example, the proceedings of the 17th annual conference of the Law of the Sea Institute, Oslo 1983). It seems appropriate, therefore, to begin by asking the question why the utilization of fish stocks may remain inefficient, despite the 200 mile limit and its enclosure of fish stocks. The fundamental reason is, in our view, that government policies are often guided less by incentives to seek economic efficiency than by political incentives pulling in the opposite direction. One aspect of this is the protectionist fishery policy often followed by governments when there is a mismatch between countries' "ownership" of fish stocks and their comparative advantage in harvesting them. These issues are discussed at some length in the following section.

As a result of the new regime, fish stock management by catch quotas has become widespread. Indeed, this principle is enshrined in the Law of the Sea Convention itself (Article 61), which states that "the coastal state shall determine the allowable catch of the living resources in its exclusive economic zone." The convention further states that "where the same stock or stocks of associated species occur within the exclusive economic zones of two or more coastal States, these States shall seek, either directly or through appropriate subregional or regional organizations, to agree upon the measures necessary to co-ordinate and ensure the conservation and development of such stocks without prejudice to the other provisions of this Part" (Article 63). In Section 3 we discuss the international management of shared stocks in the ICES area,[1/] particularly as it applies to Norway. Due to the absence of a common objective in such an international setting, we argue that the best attainable solution to the management problem may very well be a second-best optimum, where the total allowable catch for each stock is determined on the basis of some biological principle and allocated among the countries concerned according to some agreed rule, while each country manages its fisheries by transferable quotas. Section 3 concludes by a discussion of the Common Fisheries Policy of the EEC, a special case of international fish resource management.

Given a fisheries management regime of country quotas, the question arises whether quotas should be transferable between countries and, if so, at what price. This problem is examined in the last section of the paper (Section 4). We find that management by country quotas will, in the case of independent quotas, lead to a global overcapacity in the harvesting sector. A "free" transfer of "excess" quotas (i.e., that part which a country cannot harvest itself) will further increase the global overcapacity, while transfers at a price will have the opposite effect. By attaching a suitable price to the transfer of excess quotas a globally optimal harvesting capacity may be achieved, but unfortunately there is no market mechanism in sight which would establish the required transfer price. These results are derived on the basis of a specific example and await generalization. There is little doubt that the problem of quota transfer, or quota trade, is an area of research which is relevant, fruitful, and neglected.

The 200 Mile Limit: A Mixed Blessing?

Comparative disadvantage and fishery protectionism

In the 1950s and 1960s vast improvements occurred in vessel design, fishing methods, and storage technology, making it ever more attractive to build vessels that combined fishing, processing, and transportation to market. Being located close to the fishing grounds became less and less important for the comparative advantage in harvesting the fish. The so-called "coastal states" retained their comparative advantage only to the extent that they had limited opportunities in industries other than fishing, or that the new technology suited their factor endowments better than others.' The fishery increasingly became a "footloose" industry, and countries with large markets and little fish sent more and more vessels fishing in faraway places. Japan and the East European countries were particularly active in this process. This development, rather than the depletion of fish stocks per se, may indeed have been the most important reason why the coastal states pressed so hard for the 200 mile limit in the 1970s.

There is little doubt that the 200 mile limit has in a number of cases meant that the right to manage a fish stock rests with a country without any comparative advantage in harvesting it. The proliferation of joint ventures in fishing in recent years is a consequence of this development. To the extent that the 200 mile limit has brought about a protectionist fishery policy and exclusion of efficient fleets, the inefficiency of free access has been replaced with inefficiency of a different kind, but probably of a lesser degree. This does not by itself disprove the thesis that the 200 mile limit provides a better institutional environment than the old regime for effective management of fish stocks, but when the economic consequences of the new regime come to be assessed, the loss from "fishery protectionism" must be accounted for and subtracted from what in our view is likely to be a gain from an improved stock management.

The history of the Common Fisheries Policy of the EEC illustrates the mismatch between proximity to fishing grounds and comparative advantage in harvesting the fish, together with the conflicts arising therefrom. The markets for fish in Europe are to be found mainly on the continent and in England, while the most abundant fish stocks in European waters are located in peripheral areas, such as off Iceland and Northern Norway and, within the EEC, off Scotland and Ireland. In 1970, immediately before opening negotiations with Britain, Ireland, Denmark, and Norway about enlarging the community, the original six countries agreed on a common fisheries policy. The most important principle of this policy was free access for all community vessels to all community fishing grounds. It has been argued (Leigh, 1983) that the most important reason why the original members of the EEC came to agree on a common fisheries policy at that particular time was a common interest in presenting the four applicants with a fait accompli and so ensure access for vessels from the continent to the fishing grounds of Norway, Britain, and Ireland (at this time national fishing limits were only 12 miles). Soon after, however, the common fisheries policy was wrecked by the turmoil of the Law of the Sea, making it necessary to negotiate a new policy. After a decade of tugofwar, a new common fisheries policy was agreed upon by the EEC countries at the beginning of 1983, in which the principle of free access was partly abrogated and coastal fishermen, particularly in Scotland and Ireland, were given preferential rights of access within a coastal zone of six to twelve nautical miles. We shall return to the Common Fisheries Policy in the next section.

Allocation of resources as a political process

The dispersion of fish stocks and their resulting inappropriability by private interests makes the management of fish stocks a concern of national or provincial governments. The misallocation of resources resulting from free access is too well known to need any elaboration, but it does not follow that things will necessarily be any better under government regulation. There are, in our view, two main reasons why governments are likely not to have the necessary incentives to seek economically efficient allocations.[2/] First, the benefits of misallocation (monopoly rents, protective tariffs, intra-marginal rents resulting from free access, etc.) typically accrue to narrow and well defined interest groups, organized around and lobbying for their interests, whereas the benefits of efficiency typically are dispersed over society at large and not easily perceived by each individual, larger though their sum total is. This gives democratically elected governments incentives to pursue inefficient solutions whenever the benefits of these are sufficiently concentrated and well enough lobbied for, and the gains from efficient solutions widely enough dispersed not to be easily perceived by each individual.

Secondly, government regulation quite often means replacing the market with a political process. In accordance with democratic principles, it is often considered a part of good governing to consult those who will be affected by a regulation before it is given a final shape and made effective. This means, of course, consulting those with established interests at the time of consultation. Furthermore, those interests must be direct and discernible enough for people to have been organized to promote and protect them, as no consultation will proceed very far unless there is a body with which regulators are able to meet and consult. This usually amounts to consulting producers' interests, who are thereby given an opportunity to bend the regulations in their favor.

But there are other negative effects of this "regulation by consultation" than just promoting producers' interests at the expense of consumers. The procedure sets aside the market mechanism, replacing it with a political process. To see what this means for economic efficiency, let us briefly recapitulate how competitive markets are supposed to disseminate economic benefits. Economic competition is a deeply undemocratic and ungentlemanly process, rewarding those who are able to produce things more cheaply than others by using better equipment or being more industrious, or those who are better able to satisfy what usually is called, and often misnamed, taste. There is no reason to expect that established producers will be particularly happy with being subject to strictures of this kind. On the contrary there is every reason to expect that established producers will try to limit competition and prevent innovation and entry into their trade. The history of fisheries regulation offers many examples of attempts to persuade the authorities to ban new and efficient fishing gear and methods. On a number of occasions this has been successful; the innovative and efficient more often than not are a minority, and a resented one at that. Let it be said for the record, however, that the dislocations caused by the dynamics of the competitive market are without any intrinsic merits, being rather the cost of an otherwise beneficial economic organization. Here is where one would see a role for the welfare state, in limiting such costs and sharing them equitably without becoming an economic arteriosclerosis, as the tendency has been in recent years.

Towards better management: Rules rather than discretion

The failure of discretionary interventions in the allocation process to produce efficient results calls for a set of rules, not to be bent easily by lobbying or political whims, by which a perfect market may be emulated. In the next section we shall argue that the management procedures whereby catch quotas are allocated among countries in the ICES area provides a good basis for this.

International Fisheries Management in the ICES Area. A Framework for Second-Best Optimization?

The current system of international fisheries management in the ICES area may be described as a three-staged process. First the ICES, through its Advisory Committee on Fisheries Management (ACFM) gives recommendations on catch quotas for the coming year or season, the so called "Total Allowable Catch," known simply as TAC. Then representatives of the countries sharing each stock (here the EEC counts as one country) get together and negotiate the TAC. After having reached agreement, a feat that has not always been accomplished, each country takes, or is supposed to take, appropriate measures for staying within the limits set by its share of the quota.

The management process

The advice given by the ICES is based primarily on biological considerations. The Advisory Committee on Fisheries Management is, however, fully aware that such considerations alone are an insufficient basis for fisheries management. As the Committee says in its 1981 report to the North-East Atlantic Fisheries Commission:

> "...the development of advice for fish stock management should not be entirely the responsibility of ACFM. Ideally, managerial authorities would define their objectives for the different stocks or fisheries and ACFM would thereafter evaluate the biological consequences of these management strategies and define the biological constraints for the attainment of these objectives. Without clear objectives at hand from the managerial bodies, ICES has had to develop certain management objectives which are mainly based on purely biological considerations."

One senses here a certain frustration among the members of the Advisory Committee over the lack of clearly defined objectives on behalf of the political authorities to whom the advice is being given. The attitude of the above quotation is fully consistent with the spirit of bioeconomic theory. On the other hand, a search for a clearly defined objective among managers representing different nations, each with its own set of economic parameters or even non-quantifiable objectives, is likely indeed to be frustrated. The Advisory Committee has nevertheless been forced to come up with something that makes better sense economically than building up depleted stocks to an MSY level as rapidly as possible, a policy that would entail a massive layup of vessels and loss, at least temporarily, of established marketing outlets. This is why the Advisory Committee calculates the consequences of several quota options for seriously depleted stocks, rather than recommending any single figure on the basis of the maximum sustainable yield (MSY) or similar-criteria. This is indeed a procedure that should be adopted for all stocks, in the interest of enlightened management.

Having received the advice from ICES, the governments concerned negotiate the TACs and their allocation among themselves. It is not uncommon that the TACs ultimately agreed upon deviate from the recommendations by ICES, and it also happens that no agreement at all is reached. An appendix to this paper narrates the recent history of TACs for some stocks shared between Norway and her neighbors. The reasons why the TACs are modified or why no agreement is reached vary from time to time and place to place. An easy way in the short term to settle competing claims that add up to more than the recommended TAC is simply to inflate the quota, as has happened on numerous occasions in the past. The failure to reach agreement has sometimes been due to disagreement on how to divide the TAC among the countries concerned, and at other times to protestations about some countries' failure to stay within the previously agreed quota limits.[3/]

The sharing of quotas is, as might be expected, a bone of contention. As far as Norway and her neighbors are concerned, it seems that formulas for this purpose have in most cases been agreed, a notorious exception being North Sea herring. Sometimes these formulas are based on historical catches; this is the case for the internal division of catch quotas within the EEC, and the 40-60 division of the capelin quota between Norway and the USSR. The division of the TACs between Norway and the EEC is based on the distribution of each fish stock between the parties' economic zones respectively. To accomplish this a "zonal attachment" report was prepared, where it was attempted to establish how large a part of a particular stock "belonged" to each zone. This problem has both a static and a dynamic dimension. At any given time the existing stock of fish may be spread over both zones, but many species grow up and mature in one zone while spawning in the other. This report settled the sharing formula for many stocks, the most important and notorious exception again being the North Sea herring. For this stock, like many other pelagic stocks, one encounters the problem that the larger the stock the wider the area over which it is dispersed. It has been alleged that a buildup of North Sea herring would encourage the migration of herring into the Norwegian zone, and thus disproportionately benefit Norway. This could explain why the EEC is less interested than Norway in limiting catches of herring. Similarly a replenishment of the Atlantio-Scandian herring stock would probably revive the old migration pattern towards Iceland, which is why the Icelanders have frowned upon the Norwegian herring quota.

Having agreed on TACs and their sharing, each country is supposed to manage its fisheries so as to comply with the agreed quota. This has in the past often been a rather dismal story, particularly with respect to the EEC. The reason has primarily been the failure of the EEC countries to agree among themselves on the sharing of the EEC quota, a problem that now would appear to be overcome by the agreement on a common fisheries policy, to be discussed below. However, false catch statistics have in the past been a formidable problem and seems likely to remain so, as the supervisory apparatus of the EEC Commission is still very weak.

Biologically based quotas: A second best policy?

As resource economists are quick to point out, quotas based on purely biological criteria such as MSY do not necessarily make good economic sense. However, in an international setting, or when national management is heavily politicized, a clearly defined management objective is not likely to emerge. In the last resort quotas will be fixed, if at all, through bargaining among the nations involved, where playing to the national gallery by obstructionism etc., may be an important element. The question arises, therefore, whether letting the TAC be determined by some sensible biological rule and then allocated among the countries according to some agreed formula might in fact be the best attainable policy. One such rule might be to base TACs on MSY fishing mortalities, modified to avoid large fluctuations in catches. Another rule is to let TACs be limited by a threshold value for the spawning stock, in order to avoid recruitment failures. The latter rule is the basis of the management of Barents Sea capelin, while the former otherwise seems to be the cornerstone of ICES's recommendations. The overriding objectives behind such a rule would be, loosely speaking, the preservation of stocks and stabilization of yields, but it must be acknowledged that the ecological interdependence of stocks poses some awkward problems in this regard, problems which seem to call for what amounts to an economic evaluation of yields from interrelated stocks.

Management by TACs set by biological criteria would have the advantage of reducing the element of discretion in the setting of TACs for shared stocks and thereby limit the possibilities for following economically irrational policies or using quota negotiations as a stage for demonstrating political virility. A management system based on exogenously determined quotas also provides a good basis for efficient fisheries management within each country. By auctioning or otherwise allocating catch quotas to fishermen or fishing enterprises and permitting the buying and selling of quotas, it is possible to achieve an efficient utilization of each country's share in the TAC (cf. Moloney and Pearse, 1979). The problem is similar to environmental management by transferable pollution quotas, cf. Montgomery (1972).

Transferable quotas as a means to achieve efficiency within each country

Since investment in fishing vessels typically is a long term decision variable, quota rights would have to be permanent and transferable in order to achieve allocative efficiency. A potential investor would have to buy the necessary quota allocation for securing an efficient utilization of his vessel, and would be able to sell it when he retires or changes occupation. Clearly it would not be possible to grant rights to a constant annual quota, as fish abundance and thereby TACs vary over time, to a greater or lesser degree. What is possible, however, is to grant rights to a certain percentage of the annual quota, leaving it to the investor to judge how the actual quota is likely to vary. The rate of utilization of his equipment would surely vary, and the investor would have to figure out for himself the appropriate average rate of utilization of his vessel and the quota percentage required. It is, of course, possible that private investors' attitude toward risk will be different from that warranted from a social point of view, thereby introducing some allocative inefficiency. The resulting loss seems likely, however, to be small compared to the gain from using a system of rules emulating an efficient market and minimizing the leeway of discretionary policies contrived for pursuing inefficient solutions.

The common fisheries policy of the EEC

Bioeconomic theory identifies the optimal harvesting of a fish stock as a function of economic parameters such as the price of fish, the cost of fishing effort, and the discount rate. The fact that such parameters normally differ among countries is a reason why countries sharing a stock prefer different harvesting policies. However, the more economic interaction there is among countries, the more one would expect prices and discount rates to be similar. Since an economic community is characterized by a free movement of goods and factors of production across national boundaries, there is reason to expect that the optimal harvesting policy, from the community's point of view, will be uniquely determined. Then, if there is a central community authority empowered to set catch quotas, control fishing effort, and otherwise decide which policy to follow, fisheries management in an economic community should not be any different from management in a single nation state.

A pivotal element in the Common Fisheries Policy of the EEC, approved in January 1983, is that the management of the community's fish stocks is decided by the central authorities of the community. On proposal from the Commission, the Council decides, by a qualified majority, catch quotas and their allocation among member states, minimum sizes of fish that may be landed, zones within which fishing is restricted, fishing gear regulations, licensing of fishing vessels for certain species and areas (demersal species in the Shetland area), and how to monitor member countries' compliance with community regulations.[4/] To some extent this power had been established before agreement on the Common Fisheries Policy was reached. Several cases settled in the European Court of Justice prior to that time established the right of the Commission to veto national conservation measures on the grounds of discrimination against fishermen from other parts of the community, or for otherwise being in conflict with community rules and regulations. However, even if these wide powers give priority to management on behalf of the community over national management, the Common Fisheries Policy is in other respects similar to the management of stocks shared among sovereign states without any supranational authority. Catch quotas are divided into national quotas, and it is up to each member country to utilize its quota as efficiently or inefficiently as it desires. Furthermore, the coastal waters of the community are reserved for local fishermen, as explained in Section 2.

The incentives for the central authorities of the community, particularly the Council of Ministers, to seek efficient allocations are no more impressive than the case is for national authorities. The main difference is that protestations of organized interest groups trying to bend the common policy in their favor often are magnified by the local press and parliament to the point of assuming the dignity of a vital national issue. This has occurred in different countries at different times and for different reasons. Britain became known in the latter part of the 1970s for its obstructionism in fisheries policy when it was trying to acquire a wide national zone for itself (50-100 nautical miles). Access for French fishermen to English waters was exploited by the French socialists before the election in 1981, cautioning the French government at that time against making any compromises. The Danish parliament opposed the Common Fisheries Policy beyond the last minute, ostensibly for the purpose of gaining a marginal improvement in the quota allocation.

Paraphrasing Voltaire, some are inclined to think that the Common Fisheries Policy is neither common nor a policy, and not particularly concerned with fish.[5/] Time will show whether this is an appropriate characterization. In our view a better outcome is quite conceivable. The main ingredient in the Common Fisheries Policy is the setting of catch quotas and their allocation among member states. There is no doubt that the setting of TACs has in the past been much influenced by political expediency. Competing claims of member states adding up to more than the recommended TAC have often been settled by increasing the TAC accordingly, deferring the replenishment of depleted stocks. But as we have argued above, management by country quotas need not be all that bad. If the TACs are biologically sound, fish stocks need not be far from their optimal levels, as there is most likely much less difference between the MSY level (or safe escapement level) and the economically optimal level than there is between the latter and the free access (or politically expedient) level. Then, if each country divides its allocation into transferable quotas, there will be a strong tendency to eliminate excessive harvesting capacity, as argued above. If the Common Fisheries Policy develops in this direction, it could lead to a near-efficient utilization of the community's fish resources.

Global Optimum and the International Transfer of Quotas

We have argued that a management system based on biologically determined quotas and transferable quota rights within each country will go a long way towards achieving an efficient solution within each country. But what about the global optimum? Will the total amount invested in fishing vessels in all countries taken together be the optimal one, for any given expectation of future TACs? This problem does not appear to have been given much consideration yet in the literature. Below we offer some preliminary thoughts on the matter.

A simple two-country two-stocks model

Suppose there are two countries, each owning a stock of fish. We shall make the following simplifying assumptions:

(i) The fish stocks are identical, except for the probability distribution of their abundance. The harvesting technology, prices and cost parameters are the same in both countries.

(ii) There is no "stock effect" in the harvest function, and so the harvest is proportional to the harvesting capacity applied. For simplicity we shall measure harvesting capacity in terms of fish.

(iii) Harvesting capacity is a long term decision variable and has no alternative use.

(iv) The price of fish and the cost per unit of harvesting capacity are constant. Assuming that variable costs are proportional to the amount of capacity utilized, (ii) implies that variable costs will be a constant proportion of revenue. We may then work with a constant net price of fish, which we shall set equal to one.

(v) Catch quotas vary stochastically over time, due, e.g., to environmental fluctuations and the need to preserve a minimum spawning stock. The probability distribution of catch quotas is assumed to be autonomous, thus ignoring population dynamics (other than the minimum spawning stock requirement).

(vi) The objective of management in both countries is maximization of the present value of expected economic rent, thus ignoring the implications of different attitudes towards risk.

We consider first the case where each country is restricted to harvesting its own stock. Suppose that, at time zero, each country builds the harvesting capacity it desires for the future. If prices are constant over time and since expectations are time-invariant, the optimal harvesting capacity will be constant over time. Finding the optimal capacity amounts to solving the following problem:

$$\max_{K} \sum_{t=1}^{\infty} [EC_t(K) - aK]/(1+r)^t - K,$$

where K is the optimal harvesting capacity, EC_t is the expected catch in year t, a is the rate of depreciation of harvesting capacity, and r is the rate of discount. Since the expected catch is the same every year, we may solve the series and, after multiplying by r, arrive at the equivalent problem:

$$\max_{K} EC(K) - (a+r)K, \tag{1}$$

from which we get the first order condition for maximum:

$$\frac{dEC}{dK} = a + r. \tag{2}$$

That is, the expected increase in revenue resulting from a marginal increase in harvesting capacity should be equal to the (annual) marginal cost of capacity. The latter is equal to the depreciation of capacity plus the foregone return on capital.

Letting f(Q) and F(Q) denote the density and distribution function of the total allowable catch quota, respectively, we may express the expected catch as

$$EC = \int_0^K f(Q)QdQ + K\int_K^{Q_{max}} f(Q)dQ, \tag{3}$$

where Q_{max} is the maximum quota ever occurring. Taking the derivative with respect to K, we may write (2) as

$$1 - F(K) = a + r. \tag{2'}$$

The LHS of (2') is the probability of not being able to take the full quota or, alternatively, of having to use all capacity available. The latter is equal to the expected marginal revenue of capacity, given that we measure revenue and harvesting capacity in terms of fish.

For the purpose of illustration we shall use the following two simple distribution functions for the fish stocks in question:

$$f(Q_1) = 1, \quad F(Q_1) = Q, \ 0 \le Q_1 \le 1; \tag{4a}$$

$$f(Q_2) = \frac{1}{2} + Q_2, \quad F(Q_2) = \frac{1}{2}(Q_2+Q_2^2), \quad 0 \le Q_2 \le 1. \tag{4b}$$

Figure 1 shows the graphs of these functions.

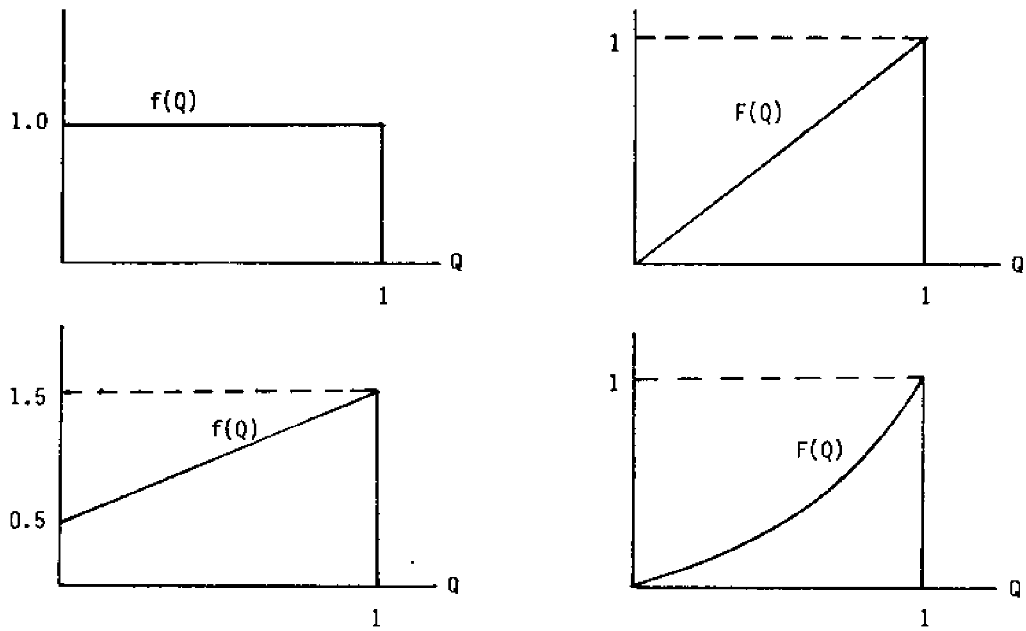

Figure 1

By assigning values to the parameters a and r, we may find the optimal harvesting capacity in each country. For example, if we set a+r = 0.2, we find (from 2') $\overline{K}_1 = 0.8$ and $\overline{K}_2 = 0.86$.

Why optimal capacity in each country amounts to global overcapacity

How do these catch capacities optimal for each country in isolation compare to a globally optimal capacity? The answer hinges, inter alia, on the nature of the joint distribution of the catch quotas. Here we shall assume that they are independently distributed. It is then immediate that the globally optimal capacity will be less than the sum of capacities optimal for each country in isolation without any transfer of quotas. Consider again Equation (2'). The LHS, $1-F(K_i)$, is the probability that country i will not be able to harvest all of its quota when idle capacity cannot be transferred from one country to the other. Sometimes, however, when country i's quota exceeds its capacity, there will be some capacity idle in country j. Therefore, the probability that country i will not be able to take all of its quota will fall, for any given capacity, if it becomes possible to transfer idle capacity from one country to the other. This means that the expected benefits of a marginal capacity extension will be less than otherwise if capacity is transferable. Hence the globally optimal capacity will be less than the sum of optimal capacities for each country in isolation.

Using the above example bears this out. From (4) and since the quota distributions are independent, the joint density function becomes

$$f(Q_1,Q_2) = \frac{1}{2} + Q_2. \tag{5}$$

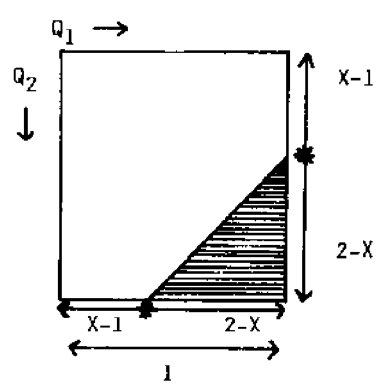

Figure 2

Consider Figure 2. Along the sides of the box we measure the quota from the two stocks. The density function could be shown along a third axis starting in the NW corner. Alternatively, the reader may think of the box as the outline of a probability matrix filled with invisible numbers. Since the harvesting technology is identical for both stocks, the capacity constraint will be a straight line with a slope of 1, like the line cutting off the SE corner of the box. Quota combinations in the shaded area exceed the capacity available, which we denote by X. For the case X > 1 the expected catch is most easily calculated as

$$E(C_1+C_2) = \int_0^1\int_0^1 f(Q_1,Q_2)\ (Q_1+Q_2)\ dQ_1dQ_2 - \int_1^{X-1}\int_1^{X-1+(1-Q_1)} f(Q_1,Q_2)\ (Q_1+Q_2-X)\ dQ_2dQ_1. \qquad (6)$$

Using (5) gives

$$E(C_1+C_2) = -\frac{1}{4} + \frac{5}{3}X - \frac{1}{2}X^2 - \frac{1}{12}X^3 + \frac{1}{24}X^4. \qquad (7)$$

From this the expected marginal catch is easily found:

$$\frac{dE(C_1+C_2)}{dX} = \frac{5}{3} - X - \frac{1}{4}X^2 + \frac{1}{6}X^3. \qquad (8)$$

The above considered case of a+r = 0.2 gives an optimal total capacity of $\bar{X}$ = 1.45, which is less than $\bar{K}_1+\bar{K}_2$ = 1.66, the sum of capacities optimal for each country in isolation.

Optimal harvesting capacity with transferable country quotas

Now suppose that catch quotas are transferable between countries while catch capacity is not. Specifically we ask the question: Will transferable quotas induce each country to so invest in harvesting capacity as to attain the global optimum?

To consider this question we must reformulate the optimizing problem to take into account that excess quotas may be traded between countries. We shall assume that this trade takes place at a constant price per unit. Denoting this price by b, we have $0 \le b \le 1$, where b = 0 implies that excess quotas will be transferred without compensation, so that the country receiving the quota obtains the full net price (equal to one) of fishing the quota. Such free transfers of excess quotas have on several occasions occurred in the ICES area, e.g. between the Soviet Union and Norway, but it is perhaps premature to call it an established practise or principle. With b = 1 the country selling a quota gets the full benefit of the other country's harvesting. While it is less than likely that such lopsided trade would ever occur, this case is useful as a benchmark.

Denoting by EQ_{ij} the expected quota transfer from country i to country j, the objective function of country i becomes (cf. (1) and (3)):

$$\max_{K_i}\ EC_i(K_i) + (1-b)EQ_{ji}(K_i,K_j) + bEQ_{ij}(K_i,K_j) - (a+r)K_i. \qquad (9)$$

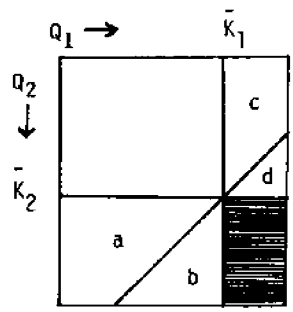

Figure 3

Now we need expressions for the expected transfer of quotas. Consider Figure 3, which displays the same "box" as Figure 2. For quotas in the SE corner of the box (the shaded area) both countries will be using all their capacity, and no quota trading will take place. For quotas in areas a and b country 2 will have excess quotas while country 1 has excess capacity. Therefore, $Q_{21} > 0$ in areas a and b and, similarly, $Q_{12} > 0$ in areas c and d. In areas a and c, the country with excess capacity will be able to utilize all of the other country's excess quota, while in areas b and d the excess capacity in the country short on quota will be insufficient to utilize all of the other country's excess quota. In areas b and d the quota transfer will be constrained, therefore, by the receiving country's capacity. Thus we get (for the case $\bar{K}_1+\bar{K}_2 > 1$):

$$EQ_{21} = \int_{\bar{K}_2}^{1} \int_{0}^{\bar{K}_1} f(Q_1,Q_2)\ [Q_2-\bar{K}_2]\ dQ_1 dQ_2 \tag{10a}$$

$$- \int_{\bar{K}_2}^{1} \int_{\bar{K}_1-(Q_2-\bar{K}_2)}^{\bar{K}_1} f(Q_1,Q_2)\ [Q_2-\bar{K}_2-(\bar{K}_1-Q_1)]\ dQ_1 dQ_2,$$

$$EQ_{12} = \int_{\bar{K}_1}^{1} \int_{0}^{\bar{K}_2} f(Q_1,Q_2)\ [Q_1-\bar{K}_1]\ dQ_2 dQ_1 \tag{10b}$$

$$- \int_{\bar{K}_1}^{1} \int_{\bar{K}_2-(Q_1-\bar{K}_1)}^{\bar{K}_2} f(Q_1,Q_2)\ [Q_1-\bar{K}_1-(\bar{K}_2-Q_2)]\ dQ_2 dQ_1.$$

Inserting (3), (5) and (10) in (9) and taking the derivative with respect to K_i gives the following first order condition for maximum:

$$1 - \bar{K}_1 + (1-b)\ [\tfrac{7}{12} - \bar{K}_2 + \tfrac{1}{4}\bar{K}_2^2 + \tfrac{1}{6}\bar{K}_2^3] \tag{11a}$$

$$- b(\tfrac{1}{2}\bar{K}_1\bar{K}_2 + \tfrac{1}{2}\bar{K}_2^2 - \tfrac{1}{2}\bar{K}_2^2\bar{K}_1 - \tfrac{1}{2}\bar{K}_1^2\bar{K}_2 + \tfrac{1}{4}\bar{K}_1^2 - \tfrac{1}{6}\bar{K}_1^3 - \tfrac{1}{12}) = a + r,$$

$$1 - \tfrac{1}{2}\bar{K}_2 - \tfrac{1}{2}\bar{K}_2^2 + (1-b)\ [\tfrac{1}{12} - \bar{K}_1\bar{K}_2 + \tfrac{1}{2}\bar{K}_1^2\bar{K}_2 + \tfrac{1}{2}\bar{K}_2 - \tfrac{1}{4}\bar{K}_1^2 + \tfrac{1}{6}\bar{K}_1^3] \tag{11b}$$

$$- b(\bar{K}_1 - \tfrac{1}{2}\bar{K}_1\bar{K}_2 - \tfrac{1}{2}\bar{K}_1\bar{K}_2^2 + \bar{K}_2 - \tfrac{1}{4}\bar{K}_2^2 - \tfrac{1}{6}\bar{K}_2^3 - \tfrac{7}{12}) = a + r.$$

From these expressions the optimal harvesting capacities of both countries ($\bar{K}_1$ and $\bar{K}_2$) may be calculated and compared with the globally optimal capacity, for any given value of the quota transfer price (b). Let us look, first, at the two extremes b=0 and b=1. Intuitively it is clear that a free transfer of excess quotas (b=0) will increase the optimal harvesting capacity for each country. A free transfer of quotas cannot but increase the probability that each country will find use for all its harvesting capacity, and so the probability of expanding capacity at the margin will be increased. Calculating $\bar{K}_1$ and $\bar{K}_2$ from (11) confirms this; we now get $\bar{K}_1 = 0.81$ and $\bar{K}_2 = 0.88$ (for a+r = 0.2), a slight increase in the optimal harvesting capacity for both countries. We thus conclude that a free transfer of excess catch quotas between countries will further increase the global overcapacity resulting from restricting the mobility of fishing fleets.

Now consider the case b=1. Here each country has the option of selling some of its quota to the other country at the same price as it would get, net of variable costs, if it elected to harvest the quota itself. This obviously makes it more profitable for each country to sell its quota than to harvest it, but since the other country will not always want to buy any quota at all, it will be necessary for each country to invest in harvesting capacity to some extent in order to secure the maximum benefit of its fish. Obviously it will be less profitable to expand capacity at the margin in this case than when quotas are not transferable; while nothing is gained by buying a quota from the other country, an excess quota can be sold at a profit. Calculating the optimal capacities in this case yields $\bar{K}_1 = 0.66$ and $\bar{K}_2 = 0.70$ (with a+r = 0.2), which implies a less total capacity (1.36) than the global optimum (1.45).

Transferable country quotas: A way of attaining the global optimum?

The fact that the globally optimal capacity lies between the two extreme cases just considered indicates that there exists a quota price $0 < b < 1$ which will induce the two countries to attain the globally optimal capacity. From equations (11) it may be calculated that $b = 0.77$ would result in $\bar{K}_1 = 0.693$ and $\bar{K}_2 = 0.757$, which adds up to the globally optimal capacity $\bar{X} = 1.45$. The problem is, however, that there is no obvious mechanism in sight by which to attain this particular price. The price that results in a globally optimal capacity does not appear to satisfy any simple but sensible rule such as a "balanced quota trade." An additional complication is that the quota transfer price in a two country case would be determined through bargaining, the outcome of which is not easily predictable. In our particular example, however, the quota trade is almost in balance at the transfer price $b = 0.77$. Calculating the expected transfer of quotas (equations 10) yields[6/]

	EQ_{21}	EQ_{12}
$b = 1$	.03517	.02709
$b = 0.77$	.02559	.02564
$b = 0$	.00809	.01341

These results indicate that such generalizations as "the more a stock varies the more quotas will be transferred" will not hold. When total capacity is "low" (b=1), more quotas are on the average transferred from country 2 to country 1 than the other way around. The opposite is true when total capacity is "high" (b=0). The variance of the quotas from stocks 1 and 2 is 1/12 and 11/144, respectively, while the expected quotas are 1/2 and 7/12. At the point of globally optimal capacity (b=0.77) the expected transfer of quotas is almost the same for both stocks, but this is a coincidence; the principle of "balanced quota trade" does not appear to have any intrinsic optimality properties.

From a specific example to general results

The above results have been derived for a specific probability distribution of quotas and on the basis of a number of simplifying assumptions. Generalizations remain to be done. One may still venture some guesses as to what those generalizations might be like. The result that a global optimum entails less harvesting capacity than the sum of individual country optima when fleets are immobile would appear to hold for quotas that are unrelated or whose covariance is negative. For quotas that vary together the result would appear to depend on the strength of the correlation. This has the important implication that the total harvesting capacity for shared stocks will not necessarily exceed the global optimum when individual country quotas are set as percentages of an overall TAC. On the other hand, when countries sharing a stock exploit different age groups of fish, individual country quotas are likely to be negatively correlated, and the total harvesting capacity may therefore exceed the global optimum.

Footnotes

1. ICES is an acronym for the International Council for the Exploration of the Sea, an international organization established at the beginning of the century to promote and coordinate marine research in the northeastern Atlantic. Most European countries, with the exception of landlocked states and the Mediterranean countries are members. The U.S.A. and Canada have also joined the organization.

2. We confine our arguments to democratically elected governments. Finding these somewhat imperfect is not to be taken as an argument for a different system -- enlightened despots are difficult to find, and promising candidates have a habit of turning out nastier than expected.

3. On the recent history of fish stock management in the North Sea and adjacent areas, see papers by Saetersdal and Johansson in "Experiences in the Management of National Fishing Zones," OECD, Paris 1984.

4. Cf. Council regulation No. 170/83, Article 11, Official Journal of the European Community, No. L24, January 27, 1983.

5. For a critical appraisal of the common fisheries policy, see Butlin (1983).

6. $EQ_{12} = -\frac{1}{24} + \frac{1}{12}\bar{K}_1 - \frac{1}{12}\bar{K}_1^3 + \frac{1}{24}\bar{K}_1^4 + \bar{K}_2(\frac{1}{12} - \frac{1}{4}\bar{K}_1^2 + \frac{1}{6}\bar{K}_1^3) + \frac{1}{2}K_2^2(\frac{1}{2} - \bar{K}_1 + \frac{1}{2}\bar{K}_1^2)$,

$EQ_{21} = -\frac{5}{24} + \frac{7}{12}\bar{K}_2 - \frac{1}{2}\bar{K}_2^2 + \frac{1}{12}\bar{K}_2^3 + \frac{1}{24}\bar{K}_2^4 + \bar{K}_1(\frac{7}{12} - \bar{K}_2 + \frac{1}{4}\bar{K}_2^2 + \frac{1}{6}\bar{K}_2^3)$.

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Appendix

Catches and TACs of Most Important Stocks in Norwegian Fisheries (thousand tons).

	1979	1980	1981	1982	1983	1984
Arcto-Norwegian cod						
Recommended TAC	600	390	220-300	240-300	200	150
Agreed TAC	700	390	300	300	300	220
Catch	444	382	399	365	308	
Atlanto-Scandia herring (Norwegian spring spawners)						
Recommended TAC	0	0	0	0	0	38
Norwegian TAC	0	9.3	9.3	12	21	
Reported catch	2.9	9.3	8.7	11.0	13.9	
Catch, incl. unreported	12.9	17.6	12.8	16.7		
North Sea herring						
Agreed TAC	0	0	20	72	98	-
Reported catch	19	13	47	117	98	
Catch, incl. unreported	25	60	141	171		
Kattegat and Skagerrak herring						
Recommended TAC	45	50	53	30-40	30-40	30-40
Agreed TAC	45	50	-	54	-	
Catch, incl. unreported	66	64	171	146		
Saithe, Norwegian Sea						
Recommended TAC	153	122	123	130	130	103
Catch	166	145	175	168	150	
North Sea mackerel						
Recommended TAC	145	0(50)	0(40)	0	0	0
Agreed TAC	145	55.5	40	25	30	
Catch	153	88	67	34		
Barents Sea capelin						
Recommended TAC	1,800	1,600	1,900	1,600	2,300	1,200
Agreed TAC	1,800	1,600	1,900	1,700	2,300	1,200
Catch	1,783	1,649	2,006	1,746	2,211	

Sources: "Report of the ICES Advisory Committee of Fishery Management," ICES, various years. Norwegian Directorate of Fisheries, Marine Research Institute: "Ressursoversikt" (Resource Report), various years.

Comments

The Arcto-Norwegian cod stock is presently at a very low level, due to a combination of overfishing and adverse environmental conditions. The stock is shared mainly between Norway and the USSR, a small part of it being accessible to other countries in the area around Spitzbergen. The TACs agreed by Norway and the USSR have consistently been higher than those recommended by ICES. In addition the TAC was heavily overfished in 1981-1982. For this Norway was responsible, as the agreement with the Soviet Union allowed the Norwegian coastal fleet to continue fishing for cod, even if the Norwegian quota had been exceeded. Norwegian fishermen have generally argued for a high quota and a minimum of regulation.

Atlanto-Scandian herring. This stock was severely depleted in the late 1960s. It used to migrate widely across the Norwegian Sea (between Iceland and Norway), but the remaining parts of it now are confined to Norwegian and Icelandic coastal waters. The fisheries biologists called upon for advice have until recently recommended a total ban on catches. Fishermen and fish processors have pointed out that a small quantity can be sold at a high price, and that markets might be lost permanently if not catered to regularly. The Norwegian authorities have usually conceded these points and permitted herring to be caught on a minor scale. The stock now appears to be on the increase.

North Sea herring. This stock, or stocks, has also been severely depleted, and the biologists' preferred option has been a total ban on catching. The EEC and Norway have in recent years agreed on gradually increasing quotas, which have been grossly exceeded by the Danish fleet, particularly when taking into account unreported catches which the ICES biologists have attempted to estimate. This overfishing and the EEC's unwillingness to reduce its 1984 quota accordingly led to a breakdown in the negotiations with Norway in May 1984. The TACs are set on a seasonal basis; the 20,000 tons that one has shown for 1981 do in fact refer to the period October 1981 - March 1982 etc.

Kattegat and Skagerrak herring constitutes a similar case, except that the degree of depletion appears not to have been quite as severe. The Danish fleet has grossly overfished its quota, causing frustration among other parties sharing this stock (Norway and Sweden), which in 1981 prevented any agreement on TAC from being reached at all.

Saithe, Norwegian Sea. This stock is controlled by Norway alone, like the spring spawning herring. Norwegian catches have generally exceeded the TAC recommended by ICES. The Norwegian fishery is not subject to any quota limitation.

North Sea mackerel. This stock has recently been reduced, partly due to fishing in excess of the TAC. ICES has recently recommended a total ban, while Norway and the EEC have agreed on a relatively small TAC.

Barents Sea capelin. The quota regulation of this fishery appears to have been quite successful. Catches match TACs very closely, and while annual quotas vary there is no downward trend in the stock. The regulation of this fishery is undoubtedly much helped by a rather simple biology and industry structure; only one or two year classes are fished and by relatively few vessels, and the produce is used for meal and oil. The principle of management is to leave a large enough spawning stock and fish the rest of the mature year class. Here we have an example of a "management rule" which apparently has made it possible for the process to run smoothly despite the differences in the economic systems of Norway and the Soviet Union.

Seafood Trade and the National Economy

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I am honoured to be having dinner with and speaking to so many eminent fisheries economists and administrators. With all of you closeted here for almost a week, I have got to wondering how the world's fishing industries would be able to survive without you. If Wellington is any indication (and I was obliged to spend yesterday there), the wheels are still turning, the industry is no worse off today than it was on Monday (could that have been said last week?), and there is even a rumour that the quality of the decisions being made are the best this year.

I am sorry to start on such a negative note, but I do have to say from the outset that my presence here is not a particularly good tribute to the ability of economists in general, or Ian Clark in particular, to keep up with current events. You may have noted in earlier programmes that you were to be addressed by the Rt. Hon. Duncan MacIntyre, Minister of Fisheries. I just thought that you guys ought to know, in case you hadn't noticed, that he has retired, as did his Government on 14 July.

The most up-to-date programme I have seen now lists me as the new New Zealand Minister of Fisheries. I am touched by this -- while recognising my own worth and importance, I did not realise that you economists did. But not -- I am no the Minister of Fisheries -- I am a stand-in. I am General Manager of the Fishing Industry Board -- a do-gooding quango, with just enough Government involvement for our legitimacy to be queried by the industry, and just enough industry involvement for our legitimacy to be queried by officials. In other words, both industry and bureaucrats think we are properly illegitimates.

Last week I had communication with an economist -- I could have called him Keynes or Friedman, but in order to retain his anonymity, I shall call him Ian Clark. When I rang him to query some detail of the progamme, he sprang this duty upon me. I demurred, telling him that it would interfere with my drinking. He told me not to worry, that you wouldn't notice. But he is an economist and so I have ignored his advice -- as a manager I so often do and like ex-Prime Ministers, feel so much better for it. I am stone-cold, boringly sober, and will be in very fine form for a blow by blow, intricately analysed and rigorously argued, three hour expose on the New Zealand fishing industry.

I hope the tenor of my remarks so far will not give you the impression that I am against economists, either in general or individually -- far from it. I am a failed academic biochemist, a profession which has also suffered scorn and contumely, usually by neglect. I therefore know what it is to be part of a persecuted minority. In fact, the stories I tell were originally about biochemists -- I have just changed the appellation to protect the innocent and better suit the circumstances.

For example -- there were once two economists, who, again for the reasons of anonymity, I shall call Ian Clark and Robin Johnson. They went deer stalking in Fiordland, down in the southwest of the South Island of New Zealand. After plodding around in the bush, bumping into trees for a while they eventually shot a deer, a very large wapiti, and called on their walky-talky for a helicopter pilot to come and pick them up.

When the pilot arrived, he agreed to fly out the economists, but not their wapiti, because it would over-weigh the helicopter. "What shall we do?" asked the first economist, whose name, as I have already indicated, was Robin.

"Same as we did with the other pilot last year," said the second economist, Ian. "Give him one hundred dollars and tell him to tie the stag on to the starboard pontoon."

So they did and, when the pilot took off, the helicopter promptly lurched to the right and crashed into heavy scrub. There was an almightly explosion. Bits of helicopter, wapiti and pilot were strewn everywhere, and the two dazed economists were left hanging in the undergrowth.

Ian, slowly recovering consciousness and dripping blood from every pore croaked, "Where are we?"

"About two hundred metres to the right of where we crashed last year," said Robin.

Now, I must acknowledge that this story is a gross calumny. My only motive in recounting it is so that you too will recognise how untrue it is. Economists of the calibre of Ian and Robin would have foreseen the possibility, would have corrected against it, and hence would have avoided the two hundred metre drift to the right.

There are two other points to note from this story. Firstly, its original locale was in Australia, but given the parlous state of CER, what with SMPs and export incentives and devaluation, and how much more successful we were at the Olympics than our Australian neighbours, and the fact that we beat them in the third rugby test, I would not want to add racial innuendoes to their list of complaints. And although I considered sending some American fisheries economists hunting, I decided to do nothing to further upset New Zealand/U.S. relationships, given the precarious standing of ANZUS, and our tendency to make jokes about supply side economics and those who attach any importance to it.

The other point about the story is, as I was at pains to indicate, that our economists would have corrected against any tendency to move to the right or indeed to the left. You may have heard of the southern oscillation -- this is not a meteorological phenomenon, but rather a reference to our three year election cycle, which dominates our economics. We have in fact just veered to the right (interestingly enough by electing an economically-conventional Labour Government, and thereby replacing an interventionist inclined central planning, so-called Conservative Government).

Goodness knows what will happen in three years time. But one thing for sure, our economists will not veer. They are the only unchanging thing in a changing world. They do not lightly modify their views just because of a change of government. They have many years of being incompletely impervious to reason, logic and facts.

As befits my biological background, I have recently conducted a survey on the ways in which economists reproduce. Previously, I though this was by an asexual process, but I can now report that there is a conjugative phase which involves either another economist or a computer. In the absence of either, they have been known to present themselves to managers in a high state of frustration and by some surrogate process, and with even some success, been able to modify and control the manager's mind so that he provides them with a conjugation partner which they need.

But once they have it, i.e., another economist or a computer, you know what happens? They presumably conjugate behind closed doors, perhaps even figuratively, but lo and behold -- out pops a justification for another economist and/or another computer. And as the justification matures, all of a sudden it becomes what it justifies, i.e., another computer and/or another economist, all ready to repeat the same process all over again.

Frankly, the mind boggles. I have the distinct impression that in the right environment they could, like bacteria, double in number every twenty minutes, and within eight hours could take over the world -- that is if they have not already done so. Because already they are infiltrating, and possibly by genetic manipulation, taking over managers. Have you noticed that some economists become managers, and that some managers are obtaining computers?

Friends, we have already lost the battle.

Economics is sometimes referred to as the dismal science, but in my mind it should be referred to as the uncertain art. In given that uncertainty is likely to increase the further the person practising the art is from reality, then obviously an economist is somebody whose certainty and usefulness will be inversely proportional to the distance he is from the real problems. Given, more over, that knowledge about fish also diminishes the further one gets away from the species in question, then it seems to me that the effectiveness of fisheries economists must be inversely proportional to the square of their distance from the product that they are economising over.

In other words, we should send all you buggers to sea in the hope that for once you would really get close enough to what you are analysing to be able to undo all the mistakes currently being perpetuated by fisheries managers. Because despite the abuse I have been subjecting you to over the last few minutes, I really do admire the input which has been provided by fisheries economists, who have developed and promoted more exciting and potentially useful approaches to fisheries management than either managers or to date, fishermen, themselves.

I see that had I been the Minister, I would have been talking about seafood trade and the national economy. I can deal with that very quickly by saying that seafood trade has contributed greatly to the national economy, and that the recent problems in the national economy have tended to stuff up the seafood industry.

Having disposed of that, I would now like to be serious for a few minutes, and take this opportunity to discuss briefly some of the things which have happened and which should happen in the New Zealand fishing industry.

In New Zealand, we are now seeing the inevitable consequences of a number of events set in train over twenty years ago when the industry was delicensed. The intentions of those who supported, encouraged and engineered this move, were probably applauded by most at the time as delicensing enabled the industry to break out of the restrictions which had prevented its growth over the previous twenty-five years. But even then, there were those with the wisdom to recognize that freedom without some boundaries is inappropriate for an industry dependent upon an unseen, unknown, but nevertheless finite common property resource.

Growth since delicensing has been spectacular, in terms of the number of people working, of the number of vessels fishing, of the tonnage being landed, and of the value and volume of fish being exported and sold domestically. But each element of success inexorably brought closer the time when effort would be greater than that which could be sustained by the resource. The stage was set for over-capitalisation, and its inevitable consequences -- economic and biological problems.

An early demonstration of the problem manifested itself in the late 1960s, only a few years after delicensing, in the Foveaux Strait oyster fishery. This static and vulnerable resource was progressively overfished, but conventional wisdom did not initiate solutions. It was the foresight and sacrifice of fishermen themselves which finally brought to a stop the continued expansion in effort. Subsequent control of this effort, and the establishment of a quota, initially covering the oyster industry on a competitive basis, but subsequently applied individually to boats on a seasonal and non-competitive basis, protected the oyster and hence the fishery and those dependent upon it, then and into the future. There was a lesson there, but it was one which was not recognised by many.

Around this time, there was an increase in the level of foreign fishing in many areas. There was still no law of the sea or 200 mile zone and foreign fishermen were catching fish in direct competition with New Zealand fishermen, and were over-exploiting some resources. The obvious expansion of foreign effort concealed domestic expansion, and partly obscured the reality that other fisheries were in potential difficulties because too many New Zealanders were engaged in the fishery.

There were obvious and major benefits arising from the declaration of the 200 hundred mile zone and the progressive reduction of foreign licensed effort. But there was also some confusion in setting appropriate strategies in place to capitalise on the opportunities. Emphasis was placed on expansion, without fully considering where such expansion should take place. The domestic industry was encouraged to "think big" -- but for many, bigness was relative, and resulted in the catching of bigger quantities of fish already under pressure.

Action became necessary, fishery by fishery, to protect firstly the fishermen and then the fish. Controlled or limited entry fisheries were introduced in 1978, to protect a number of inshore fisheries which were being increasingly heavily exploited -- scallops, rock lobster, eels, paua, mussels, oysters, snapper. It also became necessary to apply increasing restrictions on the activities of joint ventures because unrestrained competitive fishing had led to over exploitation of the more highly valued deepwater species.

In a further attempt to check the continuing increase in effort, a moratorium on the issue of any further inshore licences was introduced, as a prelude to more rational management of the fisheries, by means which at that time were still be be devised.

The establishment of the deepwater allocation system was a major step forward, with its key element being the implementation of individual non-competitive transferable quotas. It was inevitably disliked and criticised by those who did not gain allocations, and was queried by those who thought they should have received larger allocations. It is not perfect and there are still problems of equity. But those who did receive allocations were granted them in proportions which related to their previous involvement in the deepwater fisheries in terms of risk, capital and reliance, and it enabled them to rationally exploit these deepwater resources.

During the last year, the inshore problem has continued to grow. Various peripheral activities were tidied up -- unused or little used methods were cancelled, part-timers were excluded. But the root cause of the problem was not officially recognised to the point of authorising action -- the solutions have therefore not been accepted, and no relief is yet possible.

A study undertaken by the National Fisheries Management Advisory Committee and discussed with the industry around the country, revealed it all -- despite some uncertainties over the adequacy of the data base, it was clear that in many parts of the country, not only the fishermen were in jeopardy because of over-capitalisation and inadequate catches, but also the resource itself was endangered, constantly over-exploited by fishermen seeking to remain in the fishery. Even the areas not currently overfished are in jeopardy because of the likely overflow from pressurised areas.

Lassez faire attrition is widly recognised as providing no answer to the problem -- a reduction of effort is the immediate necessity. And for this to take place, there must be some encouragement, some compensation for those forced to leave through economics. The mechanics of such a scheme can be debated, but the reality is that until there is some economic return for those prepared to tie their boats up permanently, they will continue fishing, to the detriment of the stock and those who must depend upon it in the future.

The extent to which effort must be reduced was spelt out in the paper which served as the background to the NAFMAC meetings around the country. The level of compensation needed to restructure the industry is not high -- particularly in comparison with the level of assistance which was provided to other industries whose problems in contrast appear almost incapable of solution. There is a solution for the fishing industry. Many in the industry would like to see Government providing funds for the fishing industry on a one off basis. They see this as a reflection of the fact that the inactivity which led to the problem, occurred despite increasing warnings from the more farsighted in the industry. These warnings were ignored to such an extent that incentives were still being provided encouraging further development at a time when restraints were becoming necessary, and this has magnified the size of the problem and the rate at which the problem peaked.

The fishing industry has been disadvantaged relative to other primary industries and the manufacturing sector, who have received from Government much more financial assistance, absolutely and proportionately than was ever given to the fishing industry. This is a further argument advanced by some as to why Government should specifically contribute.

But ultimately, what is required, is some restructuring or bridging finance, to provide some recompense for those leaving the industry. Given the economic problems faced by the country, it is not unreasonable to expect that this could finally be paid back by those benefiting from the restructured fishery. At the risk of over simplification, the aim is to remove fishermen until the number remaining can, with a minimum of restrictions, catch on an ongoing basis, an amount of fish which will earn them an income commensurate with their effort, effectiveness, and their investment.

Beyond this, however, further over-capitalisation must be prevented -- and there is a growing support for the concept of individual transferable quotas which already work in the deepwater fishery, and which have potential applicability to the inshore fishery.

We very much hope that the authorities will recognise that this is a moment of decision. The opportunity exists to take a major and innovative step forward by accepting the challenge posed by individual transferable quotas. They should ponder over the fact that two of the best managed fisheries in the country, i.e., the Foveaux Strait oyster fishery and the allocated portion of the deepwater fishery, depend for their success on the individual quota approach to management.

They should also ponder over the difficulties here and overseas with traditional forms of management -- which just have not worked. Many of the problems which it is said will prevent ITQs from being implemented already exist, and will apply to any quota system, whether a total quota from which there is no escape or from an ITQ system.

I do not underestimate the difficulties, but I believe the authorities should recognise that their greatest ally in applying any system, but particularly the new system, should and must be the fishermen themselves. It would be naive to ignore the reality that some fishermen could be ignorant or greedy or self-interested -- but the same can also be said about any other sector of society.

But if more responsibility is given and assistance and training is provided to assist those exercising this responsibility, and if more accountability is demanded, it might work.

Our greatest single under-utilised resource is our people -- is someone going to be brave enough and wise enough to recognise this, to use them, and to apply a boldly innovative scheme, involving them, rather than fall back on the unworkable and I would have thought by now, discredited techniques of the past.

I am pleased to have had this chance to be with you and wish you well in the pursuit of your profession, now and in the future.

Optimal Quotas for the Southern Bluefin Tuna Fishery

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Abstract

It is now officially recognized by the Governments of Australia, Japan and New Zealand that the southern bluefin tuna fishery has been overexploited and that harvests must be controlled. A dynamic programming model applicable to multi-cohort fisheries is developed which can be used to find optimal quotas and quota prices through time. Results from applying the model to the southern bluefin tuna fishery indicate that restricting or eliminating the Australian catch of under four year olds would benefit both Australia and Japan.

Introduction

Stocks of southern bluefin tuna (SBT) are an important renewable resource, exploited primarily by Australia and Japan. In recent years the annual value of Australian landings has been around A$13 million, and of Japanese landings around A$240 million. Traditionally, Australia has fished the surface juvenile stocks in her coastal waters, and Japan the mature fish at greater depths in grounds stretching from New Zealand and the southern coasts of Australia to South Africa. Significant Australian fishing of SBT started in the early 1960s. The Japanese have been fishing SBT as a "far seas fishery" since the early 1950s.

By 1971 there was concern that parental stocks had fallen to levels which threatened fecundity (Shingu 1981). The first controls on the fishery were voluntary seasonal restrictions on some longline operations introduced by Japan. Australia prohibited the entry of new Austalian vessels into the fishery from 1976 to 1981. In 1979 Australia established the Australian Fishing Zone (AFZ), which enabled Australia to regulate Japanese access to SBT within 200 miles of her coastline. None of these controls were particularly effective in reducing fishing effort. Annual Australian harvests have increased from about 11,000 tonnes at the end of the 1970s to about 20,000 tonnes in the early 1980s. Fisheries scientists believe that parental stocks are now so low that there is a risk of recruitment failure (see Franklin and Burns 1983). Australia, Japan and New Zealand have responded to this warning by agreeing that the global catch of SBT must be restricted. As an interim measure Australia has announced quotas on Australian coastal catches of 21,000 tonnes for 1983/84. The Australian Government has commissioned an inquiry into what longer-term restraints there should be on Australian fishing, and whether adjustment assistance should be provided if sections of the industry are adversely affected (Industries Assistance Commission 1983).

The purpose of this paper is to develop a dynamic optimizing model which has general application to multiple cohort fisheries, and then to apply the model to the SBT fishery. The model is used for finding optimal quotas, and the corresponding optimal prices of the quotas if they are made transferrable. In the next section a method of deriving optimal stock values as a quadratic function of stock levels is described, using the approach of dynamic programming. The stock value function is used to provide the information on marginal user costs which is required to determine optimal harvesting levels for any year. Various linear approximations are made to the non-linear harvesting and stock updating functions.

Specification of a Dynamic Optimizing Model

The problem posed is the determination of the optimal levels of harvesting from each age category of fish at each stage in the planning period, so as to maximize the present value of the flow of economic welfare from the fishery. It is formulated as a dynamic programming problem consisting of the following elements: the state variables which are the levels of stocks of each age category of fish; the decision variables which are the proportions of the opening stock levels of each age category harvested between stages; the stage return function which is the economic welfare generated by the end of each period; and the state transformation function which specifies the way stocks are updated dependent on rates of mortality and recruitment.

The number of state variables is the number of age categories. In many fisheries problems of this type the number of age categories exceeds three which makes numerical solution of the dynamic programming problem computationally burdensome, if not infeasible. It may however be possible to solve this type of problem analytically instead. If the problem consists of a quadratic stage return function and linear state transformation equations then the optimal return function is often quadratic in the state variables. The problem is then a straightforward one in optimal control theory. For such problems there is little restriction on the number of state variables which can be treated. Although in the specification of this problem the stage return function is quadratic and the state transformation equations are linear, the optimal return function is not quadratic in the state variables. This difficulty is overcome by approximating the optimal return function by a quadratic function.

The stage return function depends on linear average cost and average return functions. These are dealt with in turn. After formulating the stage return function, the stock updating and multistage optimization processes are described.

Average Cost Function

Although the model developed here treats time as passing in discrete units, it is common practice in the fisheries literature to work with continuous time models. A linear function relating the average cost of harvesting over one period to harvesting level is determined which approximates a corresponding function based on a continuous-time model.

As Munro (1981) points out, it is commonly assumed that instantaneous harvest level (l) is proportional to the product of fishing effort and stock numbers (x). This implies that the instantaneous rate of harvesting, l/x, or equivalently, the rate of fishing mortality, f, is directly proportional to fishing effort. Assuming that fishing effort is applied at a constant rate throughout the period, f also remains constant. If the total cost of harvesting over a period is directly proportional to the rate of fishing effort, the total harvesting cost can be written as

$$c = kf \tag{1}$$

where k is the harvesting cost per unit of fishing mortality. The next step is to establish the total harvest obtained over a period for a rate of fishing mortality equal to f.

The stock of fish at each instant t after time zero, x_t, depends not only on f but also on the rate of natural mortality, m, according to the equation

$$x_t = x_0 \exp((-f - m)t). \tag{2}$$

Harvest over one period is therefore cumulative fishing mortality

$$\begin{aligned} h &= \int_0^1 f x_t dt \\ &= x_0 \int_0^1 f \exp((-f - m)t)dt \\ &= x_0(f/(f + m))(1 - \exp(-f - m)). \end{aligned} \tag{3}$$

Equation (3) shows that the total harvest level expressed as a proportion of initial stock, defined as q, is uniquely related to f and m. That is

$$\begin{aligned} q &= h/x_0 \\ &= (f/(f + m))(1 - \exp(-f - m)). \end{aligned} \tag{4}$$

Because of this relationship, it is convenient to make q rather than h the decision variable.

Average cost of harvesting per fish is

$$\begin{aligned} AC &= c/h \\ &= kf/(x_0 q). \end{aligned} \tag{5}$$

Whilst Equation (4) shows that f is a function of q, it is not possible to obtain a simple expression for AC in terms of q. An equation which approximates Equation (5) can be derived using the fitted linear relationship

$$f/q = u(m) + v(m)q + \varepsilon_1 \tag{6}$$

where u and v are parameters dependent on m and $_1$ is the error term. For m = .2, and over the range of q from zero in steps of .02 to a likely maximum in practice of .6, the R^2 of the regression is .98. The approximating linear AC equation used in the model is thus

$$AC = (k/x_0)(u + vq) \tag{7}$$

Fish are harvested selectively by age group. Using subscript i to refer to i-th age group, the total cost of fishing across all age groups is

$$\begin{aligned} \Sigma c_i &= \Sigma (AC)_i q_i x_{i,0} \\ &= \Sigma\ k_i(u_i q_i + v_i q_i^2). \end{aligned} \tag{8}$$

Average Revenue Function

It is assumed that the following linear demand function applies, relating the price of fish, AR, to the weight of fish harvested and sold:

$$AR = r + s(\Sigma\ q_i x_i w_i) \tag{9}$$

where x_i and w_i are initial stock level and the average weight of fish respectively in the i-th age group.

Stage Return Function

The stage return is a measure of economic welfare, equal to the sum of consumers' and producers' surplus, or willingness to pay less total costs. Because the AC and AR schedules are linear, the stage return function is quadratic. The willingness of consumers to pay for the total harvest is given by the area under the demand schedule. Economic welfare is therefore

$$EW = r(\Sigma\ q_i x_i w_i) + .5s(\Sigma\ q_i x_i w_i)^2 - \Sigma\ k_i(u_i q_i + v_i q_i^2) \tag{10}$$

or in matrix notation with time subscripts added

$$\begin{aligned} EW_t &= (W'X'_t r)'q_t + .5q'_t(X'_t W'S'WX_t)q_t - (K'u)'q_t - q'_t VKq_t \\ &= (W'X'_t r - K'u)'q_t + .5q'_t(X_t'W'S'WX_t - 2VK)q_t \\ &= b'_t q_t + .5q'_t C_t q_t \end{aligned} \tag{11}$$

where u and q are vectors; r is a vector with all elements equal to r in Equations (9) and (10); and matrices are defined as follows:

$$S(i,j) = s \text{ for all i and j;} \tag{12}$$

$$W(i,j) = \begin{cases} w_i & i = j \quad \text{for all i;} \\ 0 & i \neq j \quad \text{for all i;} \end{cases} \tag{13}$$

and X, V and K are defined in the same way as W.

Stock Updating

Stock numbers are updated period by period to take account of aging, fishing fortality and natural mortality using a linear approximation to the continuous process described by Equation (2). The best fit equation

$$\exp(-f - m) = \beta_1 + \beta_2 q + \varepsilon_2 \tag{14}$$

provides the regression coefficients for the stock updating equation

$$x_{i,t+1} = x_{i-1,t}\ (\beta_1 + \beta_2 q_{i,t}) \quad i = 2, \ldots \tag{15}$$

The number of fish recruited to the first age category are the following linear function of parental biomass:

$$x_{1,t+1} = e_1 + g\,\Sigma(x_{i,t}w_i p_i) \tag{16}$$

where p_i is the proportion of the i-th age category which is sexually mature.

Equations (15) and (16) can be expressed in matrix form as

$$x_{t+1} = e + Gx_t + H_t q_t \tag{17}$$

where x and e are vectors and e is defined as:

$$e(i) = \begin{cases} e_1 & i = 1; \\ 0 & i > 1; \end{cases} \tag{18}$$

and matrices are defined as:

$$G(i,j) = \begin{cases} gw_j p_j & i = 1 \quad \text{for all } j; \\ \beta_1 & i = j + 1 \quad \text{for all } i \text{ except the last;} \\ 0 & \text{otherwise;} \end{cases} \tag{19}$$

$$H(i,j) = \begin{cases} \beta_2 x_j & i = j + 1 \quad \text{for all } i \text{ except the last;} \\ 0 & \text{otherwise.} \end{cases} \tag{20}$$

<u>Multi-Stage Optimization</u>

The problem is to find the dynamic harvesting strategy which generates the maximum present value of the stream of EW_t (Equation 11), given an initial stock vector, $\bar{x}_1$. That is, the problem is to find

$$y_1\{x_1\} = \underset{q_1,\ldots,q_T}{\text{maximize}} \ \underset{t}{\Sigma}\, \alpha^{t-1}(b'_t q_t + .5q'_t C_t q_t) \tag{21}$$

$$\text{subject to } \ x_1 = \bar{x}_1$$

$$x_{t+1} = e + Gx_t + H_t q_t \qquad t = 1,\ldots,T$$

$$0 \le q_t \le 1$$

where α is the discount factor.

Using the recursive logic of dynamic programming, the initial approach to the problem is to solve a sequence of T single-stage problems, starting with the T-th problem. If at stage T+1 the value of stock is zero, the T-th problem is to find

$$y_T\{x_T\} = \underset{0 \le q_T < 1}{\text{maximize}} \ (b'_T q_T + .5q'_T C_T q_T). \tag{22}$$

Because some of the terms in b_T and C_T include X_T and others do not (see Equation 11), $y_T\{x_T\}$ is not a quadratic function of x_T. However, $y_T\{x_T\}$ may be approximated by a best fit quadratic function

$$\hat{y}_T\{x_T\} = \phi_T + \psi'_T x_T + x'_T \Omega_T x_T \tag{23}$$

where ϕ_T is scalar, ψ_T is a vector and Ω_T is a symmetric matrix.

Equation (23) may be estimated after determining values of $y_T\{x_T\}$ for a suitably large range of x_T.

The problem at the penultimate stage is to find

$$\begin{aligned} y_{T-1}\{x_{T-1}\} &= \underset{0 \le q_{T-1} < 1}{\text{maximize}} \ [b'_{T-1}q_{T-1} + .5q'_{T-1}C_{T-1}q_{T-1} + \alpha\,\hat{y}_T\{e + Gx_{T-1} + H_{T-1}q_{T-1}\}] \\ &= \underset{0 \le q_{T-1} < 1}{\text{maximize}} \ [\alpha(\phi_T + (\phi'_T + (e + Gx_{T-1})'\Omega_T)(e + Gx_{T-1})) \\ &\quad + (b_{T-1} + \alpha H'_{T-1}(\psi_T + 2\Omega'_T(e + Gx_{T-1})))'q_{T-1} \\ &\quad + .5q'_{T-1}(C_{T-1} + 2\alpha H'_{T-1}\Omega_T H_{T-1})q_{T-1}]. \end{aligned} \tag{24}$$

As before, $\hat{y}_{T-1}\{x_{T-1}\}$, a quadratic approximation to $y_{T-1}\{x_{T-1}\}$, is estimated and used in similar fashion to find $y_{T-2}\{x_{T-2}\}$. The process continues until all $y_t\{x_t\}$ are determined.

Having found ψ_t and Ω_t for all t, they may be used for finding the optimal sequence of harvests for years 1 to T by solving the problem

$$\underset{0 \leq q_t < 1}{\text{maximize}} [(b_t + \alpha H'_t(\psi_{t+1} + 2\Omega'_{t+1}(e + Gx_t)))'q_t + .5q'_t(C_t + 2\alpha H'_t\Omega_{t+1} H_t)q_t] \tag{25}$$

for t = 1 and $x_1 = \bar{x}_1$. The solution values for the vector q_1 are used in Equation (17) to update the stock vector from x_1 to x_2. Harvest levels for t = 2 are then found. The process continues for all remaining t. Because stocks at stage T + 1 are assumed to have no value, $\psi_{T+1} = \Omega_{T+1} = 0$, so that for t = T, Equations (25) and (22) are identical.

It will often be the case in problems of fisheries management that the relevant planning horizon is infinite rather than finite. The planner may wish to know the optimal harvests for a finite number of periods ahead, but for an infinite planning horizon. For $\alpha > 0$, T can always be made sufficiently large for ϕ_1 and Ω_1 to be reasonable approximations to the infinite-stage values ψ and Ω. If ψ_1 and Ω_1 are reasonable approximations to ψ and Ω, approximately optimal infinite-stage levels may be obtained over any number of periods by following the same process described above, but substituting ψ_1 and Ω_1 for ψ_{t+1} and Ω_{t+1} in Equation (25).

Modelling Open-Access Behavior

The fishery is often typified as an open-access resource. Because no one participant in the fishery can appropriate any rents generated from fishing, either in the current period or in future periods, harvesting effort continues to be attracted into the fishery until average rent or price equals average cost in the current period. It is straightforward to run the optimizing model to simulate the harvesting behaviour expected for an open-access fishery. The model is run as before, but with $\phi = \psi = \Omega = 0$, to reflect the zero marginal value attached to stocks remaining at the end of the period, and with matrix C in Equation (11) replaced with matrix $\underline{C}$ to include the area under the average rather than marginal cost schedule as follows:

$$\underline{C} = (X_t'W'S'WX_t - VK). \tag{26}$$

The effects on economic welfare of quotas can be observed by placing restrictions on q_t. Kennedy and Watkins (1984) have used the model for studying the effects of Australian quotas on the SBT fishery.

Optimal harvesting levels q^*_t obtained from the optimizing model may be used for specifying either optimal harvesting quotas or the optimal fish taxes to impose on the open access fishery. Instead of levying taxes on catches, the government may achieve the same ends by setting the optimal price for transferrable quotas. The optimal quota price vector to apply per unit weight of fish harvested is the difference between average revenue and average cost at q^*_t, or:

$$QP_t = r - K'u + (S'WX_t - VK)q^*_t. \tag{27}$$

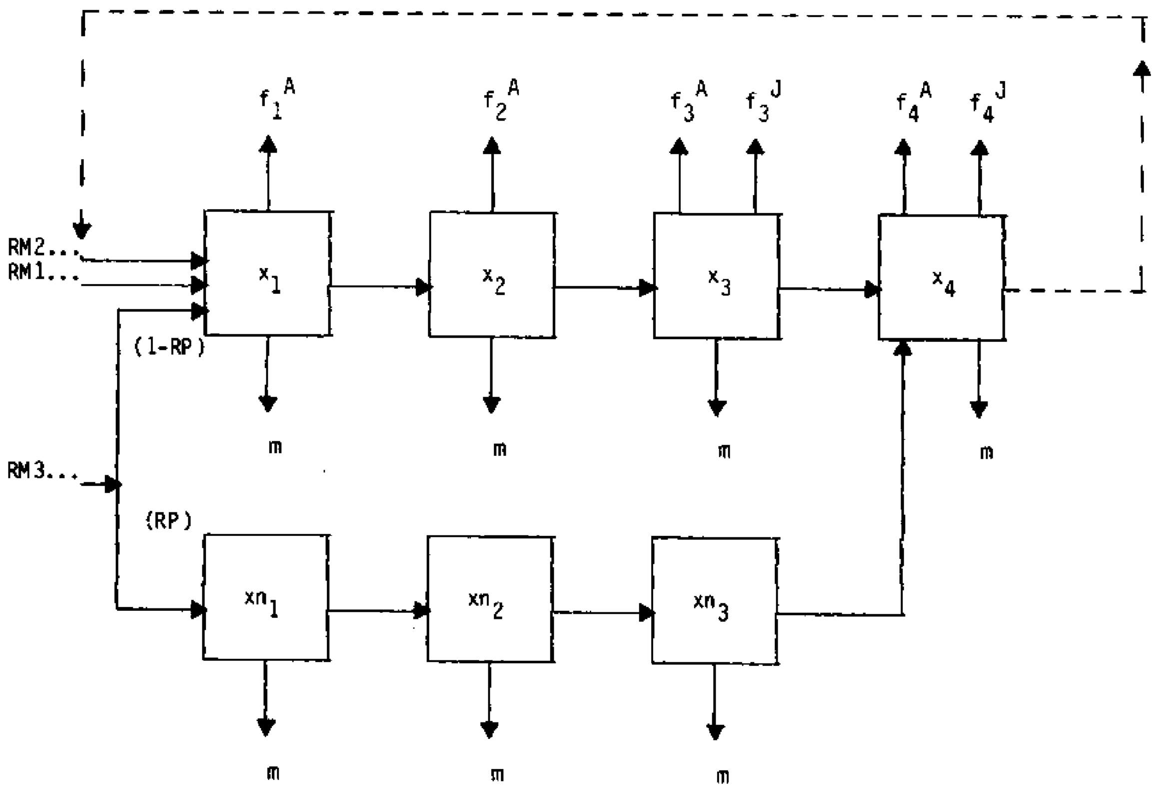
Applications to the Southern Bluefin Tuna Fishery

A model of stock flows

SBT are spawned off the North-west coast of Australia. SBT can live as long as 20 years, though most fish caught are under 12 years. Most of the juvenile fish up to the age of 6 years school in the coastal waters around the southern coastlines of Australia. For most of each year older fish inhabit the more southerly waters of the West Wind Drift. The adults reach sexual maturity at about 8 years.

Although the optimizing model permits the consideration of more state variables than a dynamic programming model solved numerically, the need to fit a stock value function, quadratic in stock levels, still limits the number which can be included. Clearly 20 state variables, one for numbers in each year category, would require too much computation. It is necessary to aggregate year categories into broader age categories. Four categories were chosen, spanning years 0 to 2, 2 to 4, 4 to 6 and 6 to 20. The age groups which are fished are referred to as G1 to G4, respectively.

Because there is uncertainty about the recruitment and migration of SBT, experiments were conducted with three alternative recruitment and migration structures (RM1, RM2, and RM3). These are described with the aid of Figure 1. Each structure has an inflow to G1 and thereafter a flow through successive age groups to G4. For RM1, recruitment to G1 is fixed. For RM2, the flow route is the same, but recruitment to G1 is a function of the parental biomass in G4. RM3 is like RM1 in that recruitment to G1 is fixed, but this is only some proportion of the total fish spawned. The remaining proportion (RP) bypass the fished groups G1 to G3, entering G4 by age 7.



Key

x = fishable stocks

xn = non-fishable stocks

f^A and f^J = Australian and Japanese rates of fishing mortality

m = natural rate of fishing mortality

RP = remaining proportion of spawned fish not recruited to fishable stocks of G1

Figure 1. Alternative Recruitment and Migration Structures for SBT (RM1, RM2 and RM3).

Australia fishes predominantly from G1 to G3 whilst Japan fishes predominantly from G4. However there is an overlap in fishing, with Australia harvesting some fish from G4 and Japan harvesting some fish from G3. Because the different age categories of fish are geographically dispersed, it is assumed that Australia and Japan make decisions on the proportions of opening stock levels to be harvested from each age group. The decision vector q therefore consists of six elements: q_1 to q_4 refer to the proportions harvested by Australia from G1 to G4; q_5 and q_6 refer to the proportions harvested by Japan from G3 and G4. Australian fleets from Western Australia and South Australia fish from G1 to G2, and Australian fleets from South Australia and New South Wales fish from G3 to G4.

Stock updating equations

Although harvesting is modelled on a yearly basis, the state variables x_1 to x_4 represent numbers of fish spanning two or more year categories. An assumption is therefore introduced into the process of stock updating which enables the equations to approximate the results which would have been obtained by updating each year category on an annual basis. It is assumed that a fixed proportion a of fish in G1, G2, and G3 are in the younger year class of each group; also that in G4, a/(1-a) is the ratio of fish aged n years to those aged n + 1 years. If each year category were updated on an annual basis the proportion for each group would instead depend on the harvesting history.

The stock updating equations are:

$$x_{1,T+1} = e_1 + gp_4w_4x_{4,t} + x_{1,t}(\beta_1 + \beta_2q_{1,t})a \quad (28)$$

$$x_{2,t+1} = x_{1,t}(\beta_1 + \beta_2q_{1,t})(1 - a) + x_{2,t}(\beta_1 + \beta_2q_{2,t})a \quad (29)$$

$$x_{3,t+1} = x_{2,t}(\beta_1 + \beta_2q_{2,t})(1 - a) + x_{3,t}(\beta_1 + \beta_2(q_{3,t} + q_{5,t}))a \quad (30)$$

$$x_{4,t+1} = e_4 + x_{3,t}(\beta_1 + \beta_2(q_{3,t} + q_{5,t}))(1 - a) + x_{4,t}(\beta_1 + \beta_2(q_{4,t} + q_{6,t})) \quad (31)$$

$$x_{5,t+1} = x_{3,t+1} \quad (32)$$

$$x_{6,t+1} = x_{4,t+1} \quad (33)$$

To facilitate matrix manipulation, the stock vector x is expanded from four to six elements to match the six elements of the q vector. In this way $q_{5,t}$ for example represents the proportion of $x_{5,t}$ (equal to $x_{3,t}$) harvested from G3 by the Japanese. In Equation (31), e_4 represents the entry of any fish which have bypassed the fishable stocks in G1 to G3.

Allowing for joint fishing

The u and v parameters which partly determine harvesting costs depend on the uncontrollable rate of mortality of the fish, z. The following best-fit equations were used:

$$u(z) = .9560 + .4344z + .0447z^2 - .0141z^3 \qquad (R^2 = .999) \quad (34)$$

$$v(z) = .8502 + .8944z + .3992z^2 + .0583z^3 \qquad (R^2 = .999) \quad (35)$$

In the case of G1 and G2 which are only fished by Australia, the uncontrollable rate of mortality is the same as the natural rate of mortality, m. However, in the case of G3 for example, z for Japan is m + F_3^A, where F_3^A is the rate of fishing mortality occasioned by Australian harvesting. But F_3^A depends on q_3. This means optimal q_5 must be related to optimal q_3 in a way not specified in the model so far. In determining the vector q, an iterative procedure was followed, starting with z_i = m, to ensure that u_i and v_i were consistent with optimal q_i, i = 3,...,6.

Joint fishing of G3 and G4 also means that constraints in the model preventing fishing out all stocks become

$$q_i < 1, \quad i = 1,2 \quad (36)$$

$$q_i + q_{i+2} < 1 \quad i = 3,4 \quad (37)$$

SBT fish are not only harvested by fleets from two nations, they are also sold on two distinct markets. Fish harvested by Australia are either sold to canneries operating in Australia, or exported, primarily to Italy. Shortfalls in Australian harvests can be replaced by imports.

On the other hand, most of the fish harvested by the Japanese is sold on the Japanese sashimi market, at prices about ten times the Australian price. However, for fish to be of sashimi quality they have to be specially processed. At present very little of the Australian harvest is sold on the Japanese market. Demand schedules for Australian and Japanese harvests are therefore specified as independent in the model.

Parameter settings

Table 1 shows the way in which elements in the vectors and matrices in Equations (11) and (17) are assigned values consistent with the modelled structure of the SBT fishery. The bases of the parameter settings used in standard runs of the model, and in sensitivity analysis, are explained below.

Parameters for Australian and Japanese average revenue schedules with elasticities of $-\infty$ and -1 respectively are shown in Table 2. They are calculated assuming that the elasticities applied at the average 1980-82 prices and harvest levels. The behaviour of the Australian market makes it reasonable to assume the demand for Australian harvests is perfectly elastic. The Japanese demand elasticity is based on monthly catch and price data at the major Japanese market of Yaizu from 1978 to 1980. Parameters for other elasticities used in sensitivity analysis are shown in Table 2.

The discount factor α in Equation (21) is based on a real rate of interest of 10 percent.

Following estimates made by Murphy and Majkowski (1981), the rate of natural mortality is assumed to be .2 for all age categories. Alternative values tested were .1 and .25. Murphy and Majkowski (1981) also suggest the rate of outmigration from the main migration flow along Australia's southern coastline may be

Table 1. Assignment of Elements in Vectors and Matrices[a/]

Element	Value	Subscript Range i =	Subscript Range j =	Determined Likewise
r(i)	r^A	1,...,4		
	r^J	5,6		
S(i,j)	s^A	1,...,4	1,...,4	
	s^J	5,6	5,6	
x(i)	x_i	1,...,4		w
	x_{i-2}	5,6		
X(i,j)	x_i	1,...,4	i	W
	x_{i-2}	5,6	i	
V(i,j)	v_i	1,...,6	i	K
e(i)	e_1	1		
	e_4	4,6		
G(i,j)	$\beta_1 a$	1,2,3,5	i	
	β_1	4,6	i	
	$\beta_1(1-a)$	2,3,4,6	i-1	
		5	2	
	gp_4w_4	1	4	
H(i,j)	$\beta_2 ax_{j,t}$	1,2	i	
		3,5	3,5	
	$\beta_2 x_{j,t}$	4,6	4,6	
	$\beta_2(1-a)x_{j,t}$	2,3	i-1	
		4,6	3,5	
		5	2	

a/ Unspecified elements are zero elements.

Table 2. Australian and Japanese Demand Parameters

Demand Parameter	Elasticity			
	Australia, i = A		Japan, i = J	
	$-\infty$	-3	-1	-.5
r^i (A$'000/tonne)	.881	1.173	19.86	27.79
s^i (A$'000/tonne^2)	.000	-.0181	-.419	-.838

.4. In order to approximate such a process of outmigration, some runs of the model were conducted with 40 percent of spawned fish bypassing G1, G2 and G3, i.e., with RP = .4

Given positive rates of natural and fishing mortality, a must exceed .5. For a rate of natural mortality of .2 and the rates of fishing mortality encountered in practice, a is about .6. The sensitivity of results to values of .55 and .65 was tested.[1/]

The average weights of fish in each age category shown in Table 3 are calculated on the basis of a equals .6 and assuming the mid-year weights of fish in each category given by Hampton and Majkowski (1983). The proportions of fish in each age category assumed to be sexually mature are based on the assumptions that all fish reach maturity at the age of 8 years and on the value of a.

Table 3. Age Specific Parameters

Parameter	Age Group (Years)			
	0-2	2-4	4-6	6-20
Average weight of fish (kg), w_i	.98	7.84	21.72	56.93
Initial stock numbers (millions), x_i	12.08	6.39	3.13	2.92
Proportion sexually mature, p_i	.00	.00	.00	.67
Harvesting cost per unit of f (A$m), k_i:				
Australia (i=1,...,4)	9.42	35.59	52.38	130.18
Japan (i=5,6)			599.80	1395.14

The stock updating coefficients, β_1 and β_2 in Equation (14), were determined by least squares regression to be .8171 and -.8890 respectively with R^2 = .999, assuming m = .2. Table 4 shows the values assigned to e_1 and g in Equation (28) and to e_4 in Equation (31) for different recruitment and migration structures. The values are based on the recruitment functions used by Hampton and Majkowski (1983). In the case of RM2, where recruitment depends on parental biomass, the function is approximated by two linear segments. The parameters for RM1 are used in standard runs.

Partly because of problems of lack of data, but mainly because the structure of the model of the SBT Fishery is a simplification of reality, the initial stock numbers and cost coefficients shown in Table 3 are not based on empirical data. They are calculated in a way which ensures they are consistent with the assumptions of the model. The cost coefficients for the standard run were calculated so that, given initial stock levels, first-year modelled harvest levels would equal the average harvest levels for 1980-82. The initial stock numbers for the standard run were calculated so that the average harvest levels for 1978-1980 would be sustainable, assuming fixed recruitment. The sustainability of the average 1978-80 harvest levels is certainly open to question. Support for the supposition rests on recently expressed concerns that it is the post-1980 harvest levels which are not sustainable (see Franklin and

Table 4. Alternative Recruitment and Migration Parameters

Recruitment and Migration Structure	g_1	g_4	e
		(million)	
RM1	6.43	.000	.0000
RM2A[a/]	.00	.000	.0451
RM2B[b/]	4.03	.000	.0143
RM3	3.86	.678	.0000

a/ RM2A is RM2 for parental biomass ≤ 130,800 tonnes.

b/ RM2B is RM2 for parental biomass > 130,800 tonnes.

Burns, 1983). Runs of the model were also conducted with initial stock numbers based on the assumption that the average 1975-78 harvest levels are sustainable.

Operational Details

Because solutions to Equations (22), (24), and (25) were subject to non-negativity constraints on q, and positivity constraints on x, quadratic programming was used as the solution technique. However, none of the constraints were ever binding, which means that the same solutions would have been obtained using the first-order conditions for the unconstrained problem.

Estimation of the response function for optimal stock values was based on a 3 level, 4 factor, complete factorial design. This meant that the 15 regression coefficients were estimated from 81 observations. When the model was run in optimizing mode, instead of open-access mode, the solutions showed increases in stock levels through time because reduced harvesting levels were optimal. The 3 levels chosen for each of the 4 stocks were therefore the initial stock level, plus 2 higher, equally spaced levels. The fits were generally satisfactory. For example, for standard runs of the model, R^2 exceeded .99 for 80 percent of runs, the lowest R^2 being .91.

It was found that for T = 10 and a real rate of interest of 10 percent, ψ_1 and Ω_1 could be taken as reasonable approximations to the infinite-stage values ψ and Ω. The optimal harvest levels which were obtained when ψ_6 and Ω_6 were used as estimates of ψ and Ω changed by a maximum of 4 percent when the estimates were replaced by ψ_1 and Ω_1. Approximately optimal infinite-stage harvest solutions over a ten-year period were obtained in experiments with various versions of the basic model by solving Equation (25) for t = 1 to 10.

RESULTS

Alternative objective functions

The dynamic optimizing model of the SBT fishery was used to find optimal Australian and Japanese levels of harvesting each age category of fish. There are no unique optimal solutions because more than one interest group can be identified. For example, there are potential conflicts of interest between Australia and Japan, and between Western Australia with South Australia and New South Wales, in the management of SBT. The problem of finding optimal harvest levels with more than one interest group making decisions is a problem in game theory. The application of game theory to transboundary fisheries is a growing area (see Munro 1982). The model developed here could be extended to allow for posited reaction functions of the interest groups involved. In this paper a simple approach is taken as a first step. Results are reported from running three variations of the basic model, each with a different objective function. The models, referred to as A, B, and C are described below.

1. In model A the objective function is the single-period function necessary for simulating open access behavior. It is used to obtain the model scenario for no policy intervention which can be compared with results for models B and C.

2. In model B the objective function is the infinite-period function necessary for maximizing the present value of the sum of Australian and Japanese economic welfare flows.

3. In model C the objective function is an infinite-period function for maximizing Australian economic welfare flows only. Japan is assumed to fish the same proportions of stocks in each year, proportions equal to the average proportions for 1980 to 1982. Thus Japan is assumed not to react in any strategic way to changes in Australian harvesting levels.

Optimal harvests

Harvest solutions for standard runs of models A, B and C for selected years over a 10-year period are shown in Table 5 and are summarized in Figure 2 for B and Figure 3 for C. For all runs, the most significant changes in harvest levels occur during the first three years. By year 10 there is little change in harvest levels between years.

Table 5. Harvest Levels by Age Group for Models A, B, and C.

		Harvests ('000 tonnes)					
		Australian				Japanese	
Model	Year	G1	G2	G3	G4	G3	G4
A	1	.70	9.30	4.79	1.41	2.61	21.09
	2	.58	7.27	2.94	1.69	1.21	22.45
	3	.59	7.76	3.92	2.17	1.74	21.98
	.	.	.	.	.	.	.
	.	.	.	.	.	.	.
	.	.	.	.	.	.	.
	10	.59	7.68	3.67	2.00	1.62	22.08
B	1	.00	.00	.00	.00	.00	17.00
	2	.00	.00	.00	.00	.15	18.88
	3	.00	.00	.00	.00	.93	20.54
	.	.	.	.	.	.	.
	.	.	.	.	.	.	.
	.	.	.	.	.	.	.
	10	.00	.00	.00	.00	.00	30.75
C	1	.00	.00	.00	.00	2.60	21.09
	2	.00	.00	.41	.00	2.95	21.94
	3	.00	.00	3.37	2.19	3.30	23.46
	.	.	.	.	.	.	.
	.	.	.	.	.	.	.
	.	.	.	.	.	.	.
	10	.00	.00	8.15	12.97	3.81	26.87

Open access results for model A show that total Japanese harvests (h^J) remain nearly constant over ten years. Australian harvests (h^A) initially fall from the 1980-82 harvest levels shown for year 1, but subsequently recover to levels just under the year-1 levels.

The harvesting profiles for model B with combined Australian and Japanese interests maximized are quite different. Australia does not fish in any of the ten years. Zero fishing by Australia and reduced fishing by Japan permit G4 stocks to rise thereby reducing the cost of harvesting G4. Harvests from G4 almost double over the ten-year period, although the total year-10 harvest is lower than that for model A. As shown in Table 6, total welfare increases by 57 percent. End-of-year-10 G4 stocks are nearly doubled.

The results from model B not only show the maximum combined welfare for Australia and Japan, but also the maximum welfare for Japan alone. This is because Australia's welfare is zero. so it is impossible to increase Japan's welfare at the expense of Australia.

Results for model C show that in order to maximize Australia's interests subject to maintaining fixed proportions q_5 and q_6 for Japan, no fish should be harvested from G1 and G2 in any year. Australian harvesting from G3 and G4 starts from zero tonnes in year 1 and rises rapidly to 21,120 tonnes by year 10. Because of the high rate of weight gain of SBT, the tonnage of fish harvested can be greatly increased by eliminating G1 and G2 harvesting. The total year-10 harvest is 51,800 tonnes for model C,

Table 6. Stocks and Welfare Results for Models A, B, and C.

Model	End-of-year-10 Stocks[a/] (million)				Present Value of Economic Welfare (A$ million)		
	G1	G2	G3	G4	Australia	Japan	Total
A	12.0	6.2	3.1	2.9	.0	722.7	722.7
B	12.6	8.1	5.2	5.7	.0	1134.0	1134.0
C	12.6	8.1	4.6	3.7	13.0	930.4	943.4

a/ Beginning-of-year-1 stocks for all models for G1 to G4 are 12.1, 6.4, 3.1 and 2.9 million respectively.

compared with 37,640 tonnes for model A. The present value of Australian economic welfare over ten years is A$13 million, and that of Japan increases by 29 percent.

A comparison of the welfare results for model C with those for model B indicates that Japan should be able to offer financial inducements for Australia to agree to substantially reduce or eliminate fishing of SBT. This holds given Australia's current fishing technology and marketing opportunities.

Optimal prices of transferrable quotas

The results of models B and C could be obtained from the open access fishery either by enforcing quotas equal to the optimal harvest levels, or by setting an optimal price for transferrable quotas. The optimal quota prices (QP) to be set each year for different age groups are shown in Figure 2 for model B and in Figure 3 for model C. The optimal prices of fish (AR) in each year are also shown for comparison.

To obtain the model B solution no Australian fishing would be permitted. A quota price of A$3000 per tonne would initially be set on the tonnage of G4 fish landed by Japan, falling to A$2000 per tonne by year 10. Japanese fishing from G3 would only be permitted in years 2 to 4, with quota prices of A$4000 to A$3000 per tonne imposed to ensure very low catches.

To obtain the model C solution no Australian fishing would be permitted from G1 and G2 in any year, from G3 in year 1 and from G4 in years 1 and 2. Optimal quota prices on G3 fish landed would rise from A$160 to A$270 per tonne by year 10, and on G4 fish from A$90 to A$150 per tonne by year 10.

Sensitivity analysis

The results obtained were subjected to sensitivity analysis. To keep computing within bounds, only one parameter at a time was changed from its standard value, unless other concomitant parameters had to be changed also. For example, parameters which are concomitant with the rate of natural mortality are the age distribution factor, the average weights of fish by age group, the opening stock numbers and the cost coefficients. In total nine other runs besides the standard run were conducted for each of the models, A, B, and C.

The broad qualitative results which held for the standard run also held for the nine alternative runs. For model B, it is optimal to eliminate Australian fishing in all cases. Japanese harvesting always reaches about 30,000 tonnes by year 10.

For model C, it is optimal to eliminate Australian fishing from G1 and G2 in all cases. Australian harvesting reaches about 20,000 tonnes by year 10 in most cases, though it is over 30,000 tonnes when the age distribution factor is reduced from .60 to .55, or the rate of natural mortality falls from .2 to .1. The distribution of Australian fishing between G3 and G4 is sensitive to changes in most of the parameters.

Runs with the alternative demand parameters shown in Table 2 do not on the whole significantly change the optimal harvesting profiles. An exception is the run for model C with an Australian demand elasticity of -3. In this case the period of waiting for stock recovery before Australian harvesting climbs to 10,000 tonnes is halved. However, from year 5 onwards Australian harvests are lower in this case. End-of-year-10 stocks are virtually the same.

If the recruitment and migration structure RM2 applies, increases in harvesting reduce the parental biomass and hence subsequent recruitment. Optimal harvest levels are therefore likely to be lower than

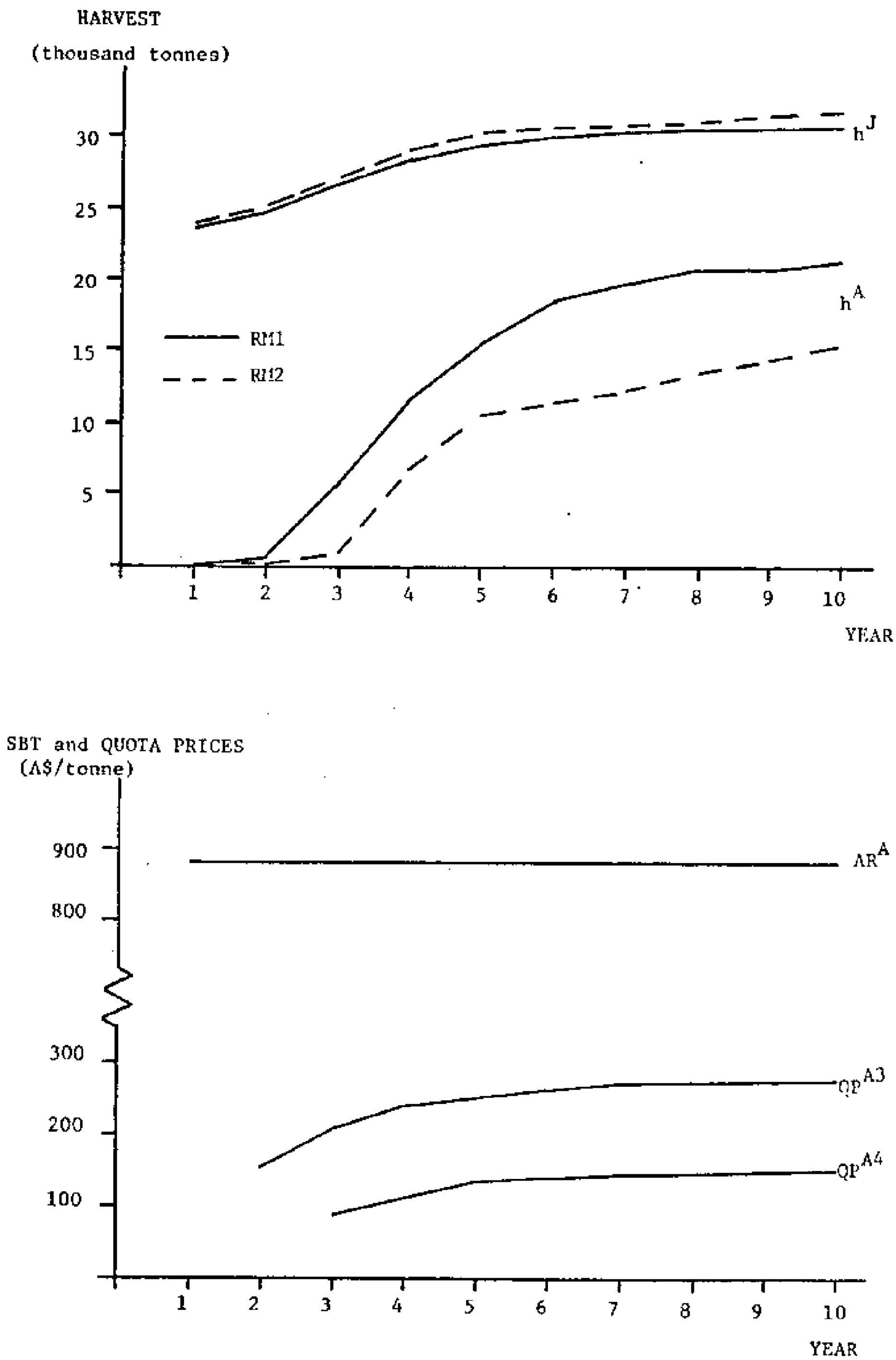


Figure 3. Optimal Harvests and Quota Prices for Model C

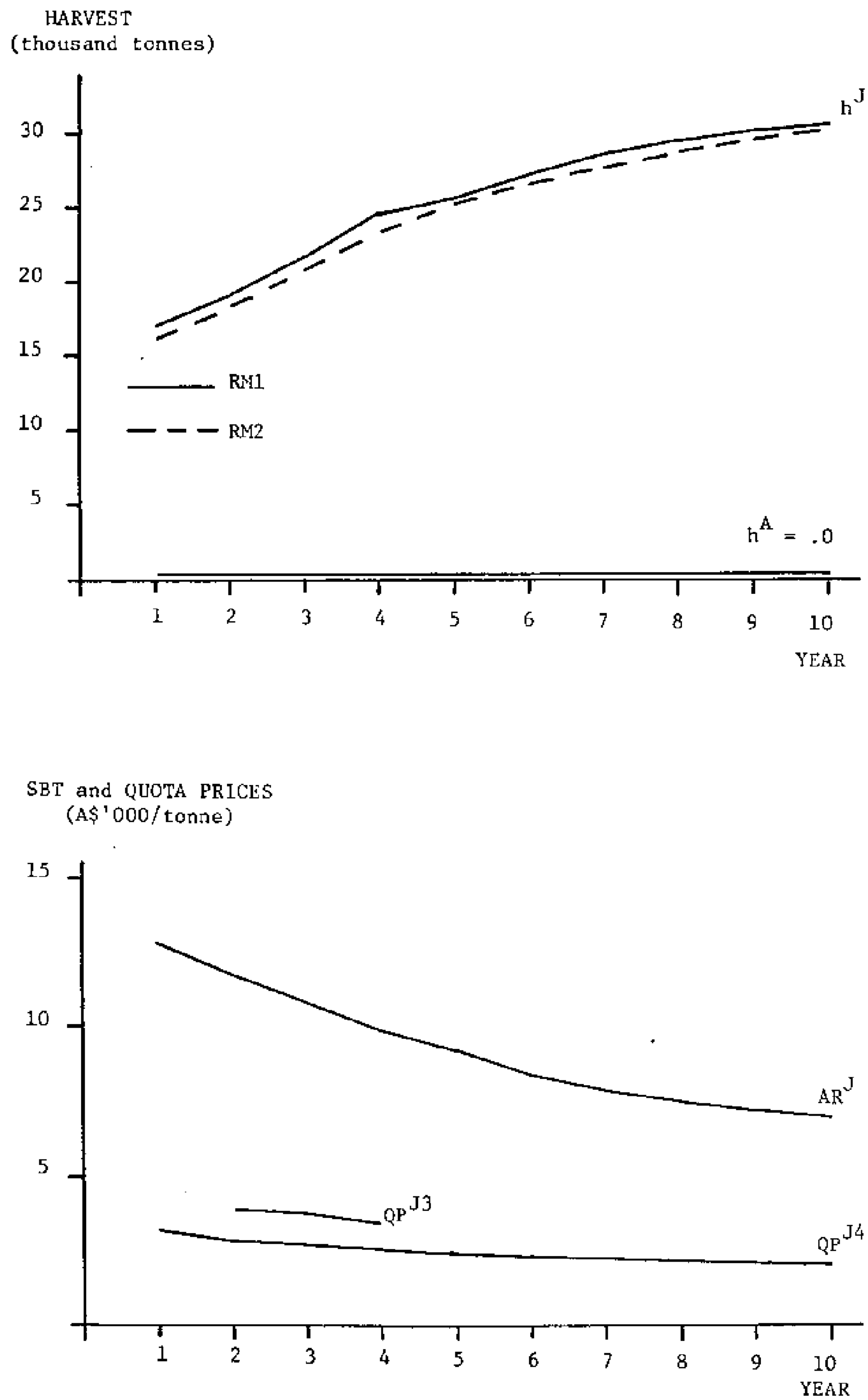


Figure 2. Optimal Harvests and Quota Prices for Model B

under RM1. The optimal Australian and Japanese harvesting levels under RM2 can be compared with those under RM1 in Figure 2 for model B and in Figure 3 for model C. The most obvious difference is that Australian harvests from G3 and G4 are significantly cut back in the case of model C when RM2 applies.

Conclusions

A dynamic programming model of the multiple cohort fishery has been developed which uses quadratic programming for solving a sequence of single-stage harvesting problems. It was shown how the model could be used to deduce the optimal prices of transferrable quotas, assuming that the fishery would be an open-access fishery in the absence of regulation.

Results from applying the model to the SBT fishery suggest that the elimination of Australian harvesting of fish under four years of age is in the overall interests of both Australia and Japan. This is one of two preconditions for Australia maximizing the present value of her economic welfare. The other is that Australian harvesting of other fish should be severely restricted for two to three years. Restrictions should be gradually relaxed over the subsequent seven years, so that after ten years annual Australian harvests of 15,000 or 20,000 tonnes could be sustained, depending on which recruitment hypothesis applies.

In summary the results suggest some justification for the Australian Government's current aim of curtailing Australian fishing of young stock. The results further suggest that Japan could profit by more than compensating Australia for agreeing to reduce harvesting, and even agreeing to cease harvesting altogether. A more likely outcome is for Australia to adopt Japanese harvesting and processing technology, and to gain access to more valuable markets for tuna. There are signs that this is already beginning to happen (see Freeman 1984).

Three important limitations of the current model should be noted. First the model is deterministic. There is no provision in the model to reflect risk of recruitment failure if parental stocks fall too low. A stochastic formulation of the model which recognized such a risk would likely result in recommendations for more severe harvest curtailment.

A related second point is that more knowledge of the biology of SBT could be used to improve the model. More information is required on migration patterns, recruitment, and rates of natural mortality by age group.

Thirdly, it is assumed in the model that capital in vessels and fishing gear is perfectly mobile into and out of the fishery through time. The costs of any adjustment assistance deemed necessary have been ignored. If the costs of changing harvesting capacity were taken into account, optimal changes in harvesting levels through time are likely to be less rapid.

The model could be extended in various ways. The number of state variables could be increased with little additional computation required by using more efficient factorial designs in estimating the quadratic optimal stock value function. This would allow the modelling of more stock and harvesting variables. Another possibility would be to model Australia and Japan as making decisions on harvest quotas alternately, in a competitive instead of a cooperative environment. The dynamic programming framework could be further developed to model such an interactive decision process.

Note

1. $a = 1/(1 + \exp(-f - m))$. For $m = .2$, a varies from .55 for $f = .0$ to .65 for $f = .4$.

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New Zealand's Inshore Fishery: A Summary of Economic Conclusions and Management Options

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The purpose of this paper is to provide a brief description of New Zealand's inshore fishery but more particularly to highlight some important conclusions derived by recent economic analysis of the industry. This analysis was undertaken as part of a comprehensive review of the current status and future management of the inshore fishery which was necessitated by strong evidence in many regions of severe overcapitalisation and biological pressure on inshore stocks.

The inshore fishery is ill-defined and is described either geographically or by the species which are typically caught by vessels defined as 'inshore' and 'deepwater.' Until the early 1980s the traditional preserve of the domestic industry's trawlers was the continental shelf to a depth of 300 metres. Vessels were restricted to these depths by virtue of their horsepower, length and deck working space. It is notable that this area of New Zealand's EEZ comprises only 6% of the total area of the zone.

Since the mid 1970s, however, there has been significant investment in large trawlers of over 20 metres and also significant technological improvements increasing the fishing effectiveness of these vessels. Additionally, in the last two to three years there has been significant expansion by the domestic industry during this period into waters to a depth of 1,000 metres. The offshore resource is concentrated on the Chatham Rise, Challenger Plateau, the Campbell Plateau and waters to the south and west of the South Island. Waters to these depths comprise just over 21% of the total area of the EEZ.

For review purposes the fisheries were divided into 'deepwater trawl' and 'inshore' by identifying species which at the time of the deepwater review in 1980 were typically caught by large domestic and foreign chartered vessels as distinct from smaller domestic vessels. The inshore fishery is now under review and a major objective in management planning is to integrate and harmonise the management strategies for both fisheries to make distinctions between the two fisheries needless.

In 1983 there were 1,641 domestic vessels classified as commercial operations of which 1,626 were less than 30 metres. A significant proportion of vessels in the inshore fishery are involved in more than one method. By allocating vessels according to principal method, the methods which accounted for the most vessels were rock lobster potting (520), trawling (332), set netting (302), lining (214) and dredging (113). The nature of the fishing industry's changing structure is underlined by comparing the domestic catches by major category for 1977, the last year prior to the declaration of New Zealand's EEZ and 1983. The categories identified are inshore demersal and semi demersal species, the species allocated under the deepwater trawl policy and 'other' mainly pelagic and tuna species.

	Catch by Major Category	1977	1983	% Change
Finfish:	Inshore Demersal	46,721	66,959	+ 43
(All figures tonnes)	Deepwater	766	29,300	-
	Other	8,108	19,134	+136
	TOTAL	55,615	115,393	+108
Shellfish & Crustacea:	Rock Lobster	3,539	4,880	+ 38
	Other	18,758	16,990	- 9
	TOTAL	22,297	21,870	- 2
	GRAND TOTAL	77,912	137,263	+ 76.2

The table shows quite clearly a shift in catching towards expansion into the deepwater fishery and only moderate increases in catches in the inshore fishery.

Since the late 1970s inshore fishing interests have been increasingly vociferous concerning the worsening status of their economic position and the sustainability of catch rates. The conclusions of a major study reviewing the inshore fishery confirmed many of these fears by making explicit the somewhat tentative conclusions fisheries scientists held about the sustainability of existing stocks given current catch levels. Concern centered on particular finfish species and the worst areas of overfishing and economic viability were centered in the north and east of the North Island.

The economic problems of trawlers, being the most important sector of the export oriented inshore finfishery, were caused by static or declining catch rates in conjunction with increases in input costs which outstripped increases in revenue and reduced the sector's international competitiveness. The results of the Board's own monitoring of vessels less than 30 metres shown in Table 1 tends to confirm this conclusion and shows that increases in revenue of the vessels sampled have not kept pace with the cost of intermediate inputs and higher costs of capital.

Table 1. Cost and Earnings of Sample of Trawlers Surveyed for Years Ending March 1974 to 1983

Year Ended March	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Average Catch (tonnes)	240	225	230	240	220	220	220	230	220	220
Output ($000)	43.0	51.0	55.6	71.0	84.5	90.0	110.1	140.1	148.6	171.5
Cost ($000)										
Intermediate										
Inputs - Fuel	3.6	6.4	6.5	7.7	8.0	10.5	22.0	34.9	36.1	51.2
- Other	15.8	19.9	21.5	23.8	28.1	32.0	39.6	54.8	54.7	66.6
Labour	18.5	22.0	22.8	30.4	34.6	33.0	31.4	32.6	33.6	42.7
Income (before I&D)	5.1	2.7	4.8	9.1	12.8	14.5	17.2	17.8	24.2	11.1
Interest & Depreciation	7.0	8.0	8.3	7.1	7.0	10.0	19.7	28.9	23.9	25.3
Net Income	(1.9)	(5.3)	(3.5)	2.0	5.8	4.5	(2.0)	(11.1)	0.3	(14.3)
Average Length of Sample (m)	17.0	17.0	17.0	17.5	17.5	17.5	17.5	18.0	18.0	18.0

Table 1 shows that the average catch of the trawlers sampled was around 240 tonnes for the years 1974 to 1977 and since 1978 have remained static at around 220 tonnes per year. While catches appear to have remained static, these aggregate figures disguise increases in effort with increased efficiency of the vessels and also a shift in many instances from inshore species with declining catch rates to lower valued species with high catch rates.

The 1983 analysis of the inshore fishery demanded a more detailed evaluation of policy options for the inshore fishery. Prior to the detailed consideration of such options, however, the following important economic questions required evaluation:

- What contribution and at what cost to the taxpayer does the fishing industry in general and the inshore fishery in particular make to the domestic economy?

- To what extent could any existing benefits be enhanced through appropriate short term restructuring and longterm management programmes?

To answer the first question, a sectorial analysis of effective rates of assistance was undertaken of the fishing industry based on the 1982/83 fiscal year ended March 31, the most recent year for which data were available. Table 2 shows the results of the analysis assuming a 20% cost excess on intermediate inputs sources from local manufacturers. An explanation of each of the items is included as an appendix to this paper. Because of some uncertainty relating to the exact extent of the cost excess coefficient, a 10% and 30% cost excess assumption was also made with results shown in Appendices 2 and 3 of this paper. Nevertheless conclusions from research into rates of protection to local manufacturers indicate that the 20% cost excess coefficient is a reasonable median to use. The cost excess coefficient is an estimate of the extent to which intermediate inputs sourced from domestic suppliers are higher than world prices due to Government protection and taxation policies.

The table shows that in 1982/83, the inshore industry's total output including finfish, crustacea and molluscs, at wholesale or FOB level was an estimated $160.5 million and represented just over 50% of the industry's total value of production. The two most important determinants of the extent of assistance were the penalties the industry pays through sourcing inputs from high cost local manufacturers and on the assistance side, cost of administrative services provided by the Ministry of Agriculture and Fisheries. While the allocation of MAF costs excluded expenses for managing and researching catches by

Table 2. Indicative Estimates of Effective Assistance to the Fishing Industry 1982/83 With a Cost Excess of 20% (all values = $000)

	Inshore Finfish	Total Inshore	Total Domestic	Total Industry
Assisted Output Value (1)	105,912	160,500	189,452	316,539
Less Intermediate Inputs - Catching	32,457	45,881	50,535	155,289
- Processing	20,275		35,211	
Plus Indirect Taxes	518	744	854	1,315
Assisted Value Added	56,290	95,089	111,073	127,353
Less Assistance on Output (2)				
- Export Incentives	1,757	1,800	4,952	14,039
- Domestic Price Effect	466	476	1,311	1,997
Less Assistance on Input				
(Sales & petrol tax rebates on input) (3)	216	336	367	367
Plus 'cost excess' on inputs (4)	10,028	13,231	15,846	22,732
Unassisted value added (5)	63,879	105,709	120,289	133,682
Assistance to Value Adding Factors				
- Courses/Training/FIB	96	154	174	280
- Regional Development	34	43	43	43
- Interest Concessions	958	1,524	1,843	1,900
- Vessel Bounty	203	241	241	241
- Income & Sales Tax Concessions	521	1,228	2,251	2,374
- MAF	2,759	4,432	5,003	8,044
- Sales Tax Exemptions on Equipment	128	236	1,070	1,106
TOTAL ASSISTANCE TO V.A. FACTORS (6)	4,700	7,859	10,626	13,989
NET SUBSIDY EQUIVALENT (2+3-4+6)(7)	(2,889)	(2,760)	1,410	7,660
NOMINAL RATE OF ASSISTANCE % (2)/(1)	2.2	1.5	3.5	5.6
EFFECTIVE RATE OF ASSISTANCE % (7)/(5)	(4.5)	(2.6)	1.2	5.7

Footnotes: Total industry includes joint venture and charter trawl and jig operations.

A detailed outline of the data sources, methodology and cost allocation procedures employed in this analysis are available from FIB Economics Section. NB: Totals may not be sum due to rounding to nearest $000.

foreign licensed and aquaculture activities, it nevertheless includes MAF costs for activities protecting the recreational values of coastal fish resources.

The first important factor to emerge from Table 2 is the significant contribution the inshore and domestic fishing industry is making to the national economy with an unassisted value added of $134 million.

The second major element to emerge from the tables is the low effective rates of assistance which apply to the domestic and inshore industry. At both 20% and 30% cost excess ratios, the assistance to the inshore fishery is negative and with a 10% ratio effective assistance is only 3%. A target for effective rates of assistance for other industries, taking account of the effects of Government protection, assistance and administration costs is generally around 11% indicating that, relative to other activities, the fishing industry made a significant contribution to national income at relatively low rates of assistance.

As a brief aside, this type of analysis is of assistance in measuring the international competitiveness of industries and demonstrates, as far as the fishing industry in general and the domestic industry in particular are concerned, that nominal assistance through explicit export assistance often disguises true rates of assistance received. Such analysis should be useful to cast light on debates which periodically occur between trading partners on the supposed rates of assistance applying to fish exports.

Having established 'prima facie' that the economic contribution of the fishing industry was therefore worth protecting, the next step in analysis was to evaluate the potential economic benefits of a restructured inshore fishery after taking account of management costs in conjunction with a longterm management regime to secure such benefits.

In order to estimate such benefits, the productivity of the fishing industry was analysed from the years 1968 to 1983. The objective of the analysis was to estimate to what extent the productivity of economic resources committed to the industry had changed over the period and thus to draw conclusions on what potential productivity gains were possible if effort and investment in the inshore fishery were reduced. Such an approach is fraught with the usual problems of seeking to postulate future benefits on the basis of historical trends but are nevertheless a preferable alternative to the more tenuous approach of imposing uncertain economic assumptions on a set of separately derived and equally uncertain biological conclusions on the future of inshore stocks.

The methodology employed was adapted from an analysis of Caves and Christensen of productivity on the US railroads (1).

The analysis was designed to trace movement in output of the whole inshore industry, including crustacea, molluscs and finfish which are explained by either the recovery or decline in fish stocks or through technological change. It is summarised in the following function.

$$\Delta x = \sum_{i=1}^{m} [(\tfrac{1}{2}\,\frac{pxq}{R})_T + (\tfrac{1}{2}\,\frac{pxq}{R})_{T-1}]\,[(\frac{q_T - q_{T-1}}{q_{T-1}})] - \sum_{i=1}^{n} [(\tfrac{1}{2}\,\frac{pxQ}{C})_T + (\tfrac{1}{2}\,\frac{pxQ}{C})_{T-1}]\,[(\frac{Q_T - Q_{T-1}}{Q_{T-1}})]$$

where: Δx = % change in productivity being a residual of changes in level of outputs minus changes in level of inputs

p = price

q = quantity of output

R = revenue derived from total output

m = number of species in output

n = number of inputs (in this case four being labour, capital, materials and fuel)

Q = quantity of inputs

C = total costs of all inputs

T = year

The results of the analysis showing changes in the use and relative costs of capital, labour, materials and fuel are shown in Table 3.

The data were estimated from the Board's own monitoring of the catching sector matched against five yearly results of inter industry input-output analyses of the Department of Statistics. As changes in productivity in the inshore fishery were the focus of the analysis, the expansion in 1982 and 1983 by some domestic vessels greater than 30 metres into the orange roughy and hoki fisheries were controlled for.

An index was constructed from the five yearly moving average of changes in productivity from year to year for the period 1967 to 1983. From the base of 100 in 1967 productivity declined by 10% to around 90 for the years 1975 to 1977 and thereafter climbed to be once again around 100 in the 1980s. The effects of a rock lobster 'boom' in New Zealand in the late 1960s accounted substantially for the higher productivity of the industry through to 1972. Nevertheless, even if levels of productivity in the 1980s are compared with those in 1973 and 1974, the increase in productivity is still in the order of only 8% over the ten years.

The major conclusion the analysis suggests is that the productivity of factors invested in the fishing industry is not significantly different from that achieved in the late 1960s. This is despite significant technological improvement over the period. From anecdotal evidence of suppliers of electronic equipment to the New Zealand fishing industry the use of such equipment on the average inshore fishing vessel has probably doubled over the last decade with the exact extent of the increase being dependent on vessel type and use. The prediction of economic theory is that improvements in efficiency would have been dissipated by increases in effort and reduced catch returns. The productivity analysis suggests that this has applied, in general, to all inshore fisheries in New Zealand and not simply the inshore fin fisheries under biological pressure. A reasonable assumption of improvements in efficiency over the period would be 1% per year in view of the evidence of increased usage of electronic equipment and improvements in vessel, engine and gear design. Should such an improvement in the order of 17% over the period have occurred and been dissipated through resulting increases in effort and pressure on the

Table 3. Estimated Changes in Productivity of the Inshore Fishery: 1964-1983

Year	Δ Capital	% Cost	Δ Labour	% Cost	Δ Materials	% Cost	Δ Fuel	% Cost	Overall % Δ in Inputs A	Overall % Δ in Outputs B	B-A Residual	Productivity Index Base 1967=100	5 Year Moving Average % Δ in Residual	Productivity Index of 5 Year Moving Average Base 1967=100
1964			5.1						5.1	8.9	3.8	78		
1965			5.1						5.1	8.6	3.5	81		
1966			5.1						5.1	20.9	15.8	94		
1967		43	6.5						6.5	13.2	6.7	100		100
1968		28	6.5	37		27		8.0	6.5	14.2	7.7	108	7.5	108
1969	5.3	28	8.4	37		27		8.0	7.7	-12.0	-19.7	87	2.8	111
1970	3.3	28	2.9	37		27		8.0	3.1	- 1.5	- 4.6	83	-1.2	109
1971	2.7	28	-12.9	37		27		8.0	-6.1	- 2.1	4.0	86	-1.2	108
1972	1.8	28	- 3.5	37		27		8.0	-1.2	-16.5	-15.3	73	-5.6	102
1973	1.8	27.9	11.9	37.5		27.3		7.3	7.6	12.6	5.0	76	-6.1	96
1974	.9	25.4	18.9	35.6	17.5	28.7	12.4	10.3	13.1	- 1.7	-14.8	62	-5.1	91
1975	-1.1	25.0	29.4	35.1	- 7.7	29.9	-4.8	10.0	7.4	10.1	2.7	63	-3.7	87
1976	7.8	23.0	1.6	39.0	- 8.5	28.0	6.4	10.0	0.7	13.2	12.5	71	-2.0	86
1977	-3.7	27.0	2.7	37.3	3.6	25.7	5.8	10.0	1.7	5.6	3.0	74	1.9	87
1978	17.0	28.8	15.1	37.0	2.6	24.5	13.0	9.7	12.3	22.3	10.0	81	2.9	90
1979	2.2	28.5	10.1	39.2	2.3	19.1	17.0	13.2	6.9	4.6	- 2.3	79	5.4	95
1980	6.9	32.6	13.2	36.8	14.7	17.1	22.0	13.5	12.7	- 0.6	-13.3	69	2.2	97
1981	-1.8	27.8	- 8.1	39.7	-14.5	17.7	-1.8	14.8	-6.4	0.1	6.5	73	1.0	98
1982	-1.1	24.3	- 3.1	41.0	7.5	17.4	5.6	17.3	0.7	6.5	5.8	77	1.3	99
1983	+5.2	24.3	+ 3.1	41.0	5.0	17.4	10.0	17.3	5.1	9.5	4.4	81	0.2	99

Due to data limitations between 1964 and 1968, input changes were measured in crew and other inputs were assumed to have varied by similar amounts over this period. Between 1968 and 1973, input changes were measured by changes in crew and the fleet structure. Similarly, the consumption of these other inputs were also assumed to change by similar amounts over this period.

resource, it follows that this represents the potential benefits possible through improved efficiency from reductions of effort and stock recovery. Should productivity gains improve by 1% per year for the next ten years and be sustained thereafter, the net present value of the benefits over the next 25 years at 10% is $60 million. These gains are only achievable, however, if there are management mechanisms operated in the inshore industry which foster efficiency without increasing effort and this ensures that gains in productivity are not dissipated.

The most clearly identified set of management controls which are likely to satisfy these objectives are individual transferable quotas. Most economists are familiar with the concept of this management approach and there is little need to argue the general advantages attributed to it. The opportunity to assess the effectiveness of the approach in practice is becoming available with its implementation in New Zealand's deepwater fishery in October 1982 and more recently in the Canadian East Coast deepwater fishery. The administration of individual transferable quotas in the inshore fishery is now being actively considered and to be chosen as the most preferred management option, the approach must be considered to result in greater economic benefits than other options through:

- Having lower transaction costs to fishermen than other management approaches through facilitating a co-operative cost minimisation rather than a competitive 'open access' approach to harvesting the resource.

- Having lower administrative costs per dollar of economic surplus from the inshore fishery than other management approaches.

- Having sufficiently low information costs to enable fishermen to plan fishing operations and transfer quotas to maximise the profitability of their enterprises.

Wilson argued quite strenously that the administrative and transaction costs of property or quasi property rights in fisheries given the highly complex, variable and rapidly changing environment may be higher than the costs of their absence (2). While this may be the case in fisheries where species are short lived, stock sizes fluctuate wildly and fishing mortality is due significantly to factors other than fishing pressure, the characteristics of the major species of the inshore fishery in New Zealand make them more amenable to individual quota control and certainly inhibit the applicability of the 'do little,' 'do less' or 'do nothing' approach. Obviously, there will be species and fish stocks in New Zealand such as flat fish perhaps where transaction, information and administrative costs are higher than the benefits which would accrue from individual quota management but these are considered to be a minor proportion of present inshore catches.

There is insufficient time in this paper to discuss the implications of such management controls in detail in the inshore fishery. It is sufficient at this stage to indicate some reasons why in New Zealand's case at least, management through individual transferable quotas for species of economic importance may be the most viable option.

The nature of the inshore fisheries resources is the first factor to be taken into account. The inshore species tend to be slow growing with slow rates of turnover with each stock being relatively small. They are therefore very vulnerable to fishing pressure and fish catching accounts, for many species, for the major portion of total mortality. For similar reasons due to the larger number of year classes which are fished erratic changes in recruitment have less effect on catches. Nevertheless it is conceivable that recruitment as well as growth over fishing due to fishing pressure could be a major cause of the secular declines being experienced in catches of traditional inshore species.

Secondly, the impetus in New Zealand which encourages fishermen to increase capital investment to match or better other fishermen is strong. This is because of the concentration of fishing effort in many fisheries into grounds of limited geographical size, as indicated in the size of the economic fishing grounds outlined in the introduction to this paper. Fishermen also tend to be domiciled in a limited number of ports and thus new techniques of fishing and increases in effort by individuals are quickly emulated. Whilst this proximity has led to the development of information sharing networks and cohesive port based fishermen's organisations, the competitive drive to increase effort, sometimes exerted by one or two individuals, is still strong and influences the behaviour of the fleet as a whole. A prime example of this was the Foveaux Strait dredge oyster fishery which was managed by competitive fishing for a total allowable catch prior to the introduction of individual nontransferable quotas. Stories are told of the activities of one or two vessels in proceeding to the grounds 'forcing the hand' for the rest of the fleet and inducing them to the grounds. A similar situation is threatening to arise in an orange roughy fishery localised in a small ground measuring only a few squared miles off the Wairarapa coast. With the success of a hand-full of relatively small 18-30 metre owner operated vessels, the number of owner operated vessels seeking to enter the fishery is expected to increase threefold to exert more pressure on the resource in the area than it can sustain. Experience from trawl fisheries in the Bay of Plenty and it seems, the Wairarapa coast, indicate that the fleet, if left to its own devices, is capable of fishing resources to a point where their biological viability is threatened. The nature of fishing activity of many fishermen is also far from being random. Their activity is often characterised by carefully planned, regular fishing patterns repeated season after season based on collective experience. All these factors indicate that a system of individual quotas is necessary and is feasible to encourage the catching of fish at the least cost. This would be achieved by the State imposing and enforcing a management system which reduced the rewards of collective competition for a fixed resource and increased the rewards of co-operation through the rationalisation of fishing activities through transfers and amalgamation of quotas. Such an approach would also increase the freedom of choice for individual fishermen to fish how and when they wish. Presently, such choices are constrained by the behaviour of the rest of the fleet.

For the State to impose such controls will be only achieved with extra administrative costs, however. When these increased costs are related to cost per dollar of economic surplus, the administrative costs of individual quotas may be the lowest of the management options being considered. Whilst the inshore fishery is multi species, some nine species account for over 80% of the value of catch and this is the same number of species already allocated under the deepwater policy although there are nevertheless some 1,600 commercial vessels in the inshore fishery compared with only 30 or so in the deepwater fishery. Administrative resources could therefore be concentrated on the major commercial vessels and landings monitored through the 170 or so wholesalers and packing houses which currently operate. As shown by the productivity analysis, the extra annual administrative costs which could be as high as $1 million are likely to be significantly less than the economic benefits which could accrue from even moderate improvements in catching efficiency through reduced effort and stock recovery. The only real economic alternative to such controls would be to minimise the administrative costs of managing the inshore fishery by keeping controls to a minimum. This option, however, would be considered unacceptable by the industry and probably also by the community as a whole which relies significantly upon the inshore fishery for its recreational pursuits. This is because of the biological vulnerability of the species already mentioned and therefore the severe economic and biological dislocation this would cause.

Finally, and most importantly, administrative costs can be minimised through achieving maximum industry co-operation in the administration of such controls. This can be achieved firstly by ensuring full participation by the industry at all levels when details concerning the allocation and administration of quotas are developed and in ongoing administration. Secondly, the inshore fishery is severely over-capitalised in several important regions and the rate at which such overcapitalisation is spreading has recently shown signs of accelerating as vessels move to more productive fishing grounds. Therefore, such controls could be cemented in place where they are introduced simultaneously with an offer by Government to purchase back quotas and thus compensate fishermen who are forced to leave the fishery to achieve effort reduction. The opportunities for the continued co-operation of fishermen could be secured where the Government agrees to take an active role in quota trading whereby total quota reductions could be accompanied by a State offer to purchase back the quota by tender. Similarly, however, the State would also have the right to sell additional catch allocations by tender. Through sale of increased yields by tender and the setting of appropriate royalties a significant portion of the increased economic surplus from the fishery could be earned by the State which would exceed extra administration enforcement costs and even the transfer costs of purchasing back quota during initial effort reduction. Fishermen may be more inclined to accept the less palatable controls on their landings which individual quota management may require in return for the security to their investment Government commitment to the policy would provide. The justification of compensation on social welfare grounds to alleviate hardship of those suffering loss of income, particularly during the substantial reductions in catch and effort which are required initially, should not however be ignored.

New Zealand is not dissimilar to many other countries in the world in seeking to reconcile sectorial and national interests during a period requiring significant economic restraint. Nevertheless, the problems of the New Zealand inshore fishing industry related to many other primary industries are unique and similarly it provides unique opportunities to try innovative remedies. Its problems are not market related -- in general international demand for most fisheries products is strong. Rather the problem is structural and is caused by overcapitalisation which inevitably results from competitive fishing of a common property resource. The economic surpluses which have been dissipated are, we believe, possible to be achieved in the future with appropriate longterm management and limited short-term adjustment assistance. These economic benefits would be earned by the community as a whole through improvements in catching efficiency and stock recovery. Consequently, for the inshore fishery it is possible to argue that policies which serve the best interests of the nation will also, in the long run, prove to serve the best interests of the fishing industry.

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Appendix I

A brief explanation of the terms in Table 1 is as follows:

Inshore Finfish: All inshore finfish species.

Total Inshore: All inshore finfish species plus rock lobster and mollusc fisheries.

Total Domestic: As above with the addition of deepwater species caught by domestic vessels.

Total Industry: The domestic industry combined with joint venture trawl, squid jig, longline and tuna results.

Assisted Output Value: The total value of fisheries output at FOB or wholesale levels after adding pre tax equivalent export incentives to actual realisations.

Intermediate Inputs: Expenditure on 'tradeable' goods, such as gear and fuel. A major proportion of the fuel cost is the cost of the sales tax on diesel. Nevertheless, this tax, while being unequal in impact between industries, is 'non discriminatory' as it applies equally to all users of diesel. It has therefore been included as an intermediate input.

Indirect Taxes: This is the tax applied to machinery such as replacement engines, etc. used on existing fishing vessels. This tax, unlike the fuel tax, is considered 'discriminatory' as the same items installed in inshore fish processing plants are free of tax. It has therefore been included as a 'value added' component.

Assisted Value Added: The value added from industry production before the impact of assistance measures are taken into account.

Assistance on Output: These include the pre tax equivalent of export tax credits and also an allowance for the impact of these incentives in bidding up prices of fish on the domestic market.

Assistance on Input: Assistance measures affecting the intermediate inputs used by the industry.

'Cost Excess' of Inputs: This represents the extent of the extra cost the industry must pay for inputs because they use protected inputs. It includes the impact of tariffs and import licensing. The most recent analysis of this factor was a study by O'Dea of the NZIER which was based on input/output analysis for the industry in 1976/77. Because this is now dated, a range of estimates for cost excess were used being a 10%, 20% and 30% estimate respectively. The results due to these ranges are shown in Appendix 2 and 3. Given the heavy reliance of the industry on such protected inputs the medium estimate of a 20% cost excess co-efficient is considered the most realistic.

Assistance to Value Adding Factors: These consist of assistance measures impacting on the factors of production, i.e. capital, labour and natural resources (in this case, fish).

Net Subsidy Equivalent: This represents the monetary value of all assistance if it had been paid as a taxable subsidy to the industry.

Nominal Rate of Assistance: Output assistance as a proportion of assisted value.

Effective Rate of Assistance: The net subsidy equivalent of assistance as a percentage of unassisted value added. This measure reflects the impact of assistance measures on resources attracted to the fishing industry.

Appendix 2

Indicative Estimates of Effective Assistance to the Fishing Industry 1982/83 With a Cost Excess of 10%
(All values = $000)

	Inshore Finfish	Total Inshore	Total Domestic	Total Industry
Assisted Output Value (1)	105,912	160,500	189,452	316,539
Less Intermediate Inputs - Catching	32,457	45,881	50,535	155,289
- Processing	20,275		35,211	
Plus Indirect Taxes	518	744	854	1,315
Assisted Value Added	56,290	95,089	111,073	127,353
Less Assistance on Output (2)				
- Export Incentives	1,757	1,800	4,952	14,039
- Domestic Price Effect	466	476	1,311	1,997
Less Assistance on Input				
(Sales & petrol tax rebates on input) (3)	216	336	367	367
Plus 'cost excess' on inputs (4)	5,014	6,616	7,923	11,366
Unassisted value added (5)	58,865	99,093	112,366	122,319
Assistance to Value Adding Factors				
- Courses/Training/FIB	96	154	174	280
- Regional Development	34	43	43	43
- Interest Concessions	958	1,524	1,843	1,900
- Vessel Bounty	203	241	241	241
- Income & Sales Tax Concessions	521	1,228	2,251	2,374
- MAF	2,759	4,432	5,003	8,044
- Sales Tax Exemptions on Equipment	128	236	1,070	1,106
TOTAL ASSISTANCE TO V.A. FACTORS (6)	4,700	7,859	10,626	13,989
NET SUBSIDY EQUIVALENT (2+3-4+6)(7)	2,125	3,855	9,333	19,026
NOMINAL RATE OF ASSISTANCE % (2)/(1)	2.2	1.5	3.5	5.6
EFFECTIVE RATE OF ASSISTANCE % (7)/(5)	3.6	3.9	8.3	15.5

Footnotes: Total industry includes joint venture and charter trawl and jig operations.

A detailed outline of the data sources, methodology and cost allocation procedures employed in this analysis are available from FIB Economics Section. NB: Totals may not be sum due to rounding to nearest $000.

Appendix 3

Indicative Estimates of Effective Assistance to the Fishing Industry 1982/83 With a Cost Excess of 30%
(All values = $000)

	Inshore Finfish	Total Inshore	Total Domestic	Total Industry
Assisted Output Value (1)	105,912	160,500	189,452	316,539
Less Intermediate Inputs - Catching	32,457	45,881	50,535	155,289
- Processing	20,275		35,211	
Plus Indirect Taxes	518	744	854	1,315
Assisted Value Added	56,290	95,089	111,073	127,353
Less Assistance on Output (2)				
- Export Incentives	1,757	1,800	4,952	14,039
- Domestic Price Effect	466	476	1,311	1,997
Less Assistance on Input				
(Sales & petrol tax rebates on input) (3)	216	336	367	367
Plus 'cost excess' on inputs (4)	15,042	19,847	23,770	34,097
Unassisted value added (5)	68,893	112,324	128,213	145,047
Assistance to Value Adding Factors				
- Courses/Training/FIB	96	154	174	280
- Regional Development	34	43	43	43
- Interest Concessions	958	1,524	1,843	1,900
- Vessel Bounty	203	241	241	241
- Income & Sales Tax Concessions	521	1,228	2,251	2,374
- MAF	2,759	4,432	5,003	8,044
- Sales Tax Exemptions on Equipment	128	236	1,070	1,106
TOTAL ASSISTANCE TO V.A. FACTORS (6)	4,700	7,859	10,626	13,989
NET SUBSIDY EQUIVALENT (2+3-4+6)(7)	(8,039)	(9,523)	(6,660)	(3,851)
NOMINAL RATE OF ASSISTANCE % (2)/(1)	2.2	1.5	3.5	5.6
EFFECTIVE RATE OF ASSISTANCE % (7)/(5)	(11.7)	(8.5)	(5.2)	(2.7)

Footnotes: Total industry includes joint venture and charter trawl and jig operations.

A detailed outline of the data source, methodology and cost allocation procedures employed in this analysis are available from FIB Economics Section. NB: Totals may not be sum due to rounding to nearest $000.

New Zealand's Deepwater Trawl Policy

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Prior to New Zealand's declaration of the 200 mile Exclusive Economic Zone (EEZ) on 1 April 1978 the N.Z. domestic trawl industry fished primarily in the inshore waters to a depth of 200 metres. The fisheries beyond this boundary were exploited by foreign fishing vessels. It is estimated that in 1975 the domestic N.Z. fishing industry caught some 39,000 greenweight tonnes of fish while foreign fishing vessels caught some 112,000 greenweight tonnes.

With the declaration of the 200 mile EEZ the N.Z. Government had to address the management requirements of the fish resources in a very large and relatively unfamiliar area and address them within the framework and responsibility conferred by the law of the sea.

The N.Z. Government adopted a three-pronged approach in the initial developmental stages. Firstly a package of assistance measures was introduced to encourage fishing companies to expand into the deep-water fisheries that existed but were not exploited at that time by the domestic industry. (These measures included a duty free vessel importation scheme, concessionary interest and suspensory loan schemes, investment allowances and tax incentives.) Secondly, the Government recognised the significant risks associated with expansion into this unfamiliar area and encouraged N.Z. fishing companies to establish co-operative arrangements with foreign fishing companies in the form of 'joint-ventures.' The third aspect of the Government's policy was to enter into Government to Government fishing agreements with those nations that had traditionally fished in N.Z. waters and to establish foreign licensed fishing allocations of surplus resources.

The most significant development was the advent of the so-called 'joint ventures.' Their development was seen as; firstly enabling relatively small domestic fishing companies to acquire technology and expertise in totally unfamiliar fisheries, vessels, catching, processing and marketing techniques; secondly developing knowledge of and access to international markets; thirdly providing significant volumes of fish for on-shore processing plants; and fourthly allowing N.Z. companies the opportunity to assess and evaluate the economics of participation in New Zealand's deeper water fisheries without significant high risk capital investment.

It is generally acknowledged that not only did the joint venture phase of New Zealand's EEZ development play an important role in the learning part of the N.Z. industry's approach to the unfamiliar deepwater fisheries but it also encouraged a significant and quite dramatic expansion in the N.Z. fishing industry.

A.J. Duncan in a paper on the 'Economics of the Deepwater Fishery' in "New Zealand Finfish Fisheries: The Resources and Their Management" has stated that "Exports of fish increased from 34,000 tonnes ($63.3 million) in 1978 to 190,000 tonnes ($253m) in 1982. Exports of the deepwater trawl finfish resources identified in the policy increased in the same period from less than 4,000 tonnes in 1978 (worth some $1.2m) to over 26,000 tonnes in 1982 worth approximately $45 million f.o.b. The degree of throughput in onshore processing plants of deepwater trawl species increased from a greenweight input of about 7,000 tonnes in 1978 to 42,000 tonnes in 1982. Associated with the expansion of joint ventures, onshore processing employment in the industry rose from about 1,500 employees in 1975 to an estimated 3,500 in 1982. Investment in the deepwater fishery's catching sector also increased dramatically to stand at approximately $39 million in 1982. On-shore investment by companies participating in the deepwater fishery in 1982 stood at some $114 million (at insured value) of which about $50 million was devoted to the processing of deepwater species."

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By any standards these statistics show the dramatic and rapid expansion of New Zealand's fishing industry as a direct result of participation in 'joint ventures' for the exploitation of the deepwater fisheries in New Zealand's EEZ.

While these developments were impressive it became clear at the beginning of 1982 that the joint ventures had served their purpose and in fact were seen as beginning to create management and economic problems that could prove difficult to solve. The catching sector, while largely foreign-owned, was heavily over-capitalised. This in turn led to significant pressure being placed on a limited number of high value species, notably orange roughy and hoki. There was a trend toward increasing catching capacity to ensure maximisation of shares of the scarce resource. This is a very familiar phenomenon in many fisheries in many parts of the world.

In the light of this the N.Z. Government, in association with the industry, decided it should address the issue and devise a policy response that would enable the development of a stable and rational long term management strategy for the deepwater fishery.

Traditionally, fisheries management authorities have imposed a wide array of measures to control the quantity of inputs allowed into a fishery in order to conserve the fish resources. N.Z. has been no exception to this approach to management. This approach, involving a complex network of effort controls -- controls on gear, days fished, net sizes, vessel numbers, tonnage, horsepower, closed areas, closed seasons etc. -- leads to increasing inefficiencies in harvesting the resource and ultimately in the failure of the control mechanisms to be effective. This in turn leads to resource depletion.

The considerable concern that existed over this form of regulatory management led managers to review alternative regimes.

It was concluded that a management system based on controls on output offered a greater promise of long term economic and biological stability in the deepwater fishery. The output control system preferred was that of individual company transferable quotas or company allocations.

The following were significant factors in reaching this conclusion. Firstly the allocation of the resource within a fixed identified TAC ensured that the resources would be protected and preserved as commercial stocks. Secondly, it removes the basic cause of over-capitalisation i.e. the need for participants to 'gear-up' to catch as large a share of the resource as possible.' Thirdly, it enables participants to determine the most efficient means and time of harvesting the resource. Fourthly, it enables participants, through quota transfers, to concentrate in areas and on species in which they have a comparative advantage. Fifthly, and most importantly the approach was seen as placing much of the regulatory aspect and almost all of the decision-making aspects in the hands of the industry -- but under Government determined guidelines and broad rules, rather than in the hands of the management authorities. Accordingly, within certain rules, participants in the deepwater fishery would be left free to make investment decisions about onshore and catching sector investment in such a way as to harvest, process and market the deepwater resources in the most cost efficient way.

Before discussing the Government guidelines it is worth considering the criteria used to establish the eligibility of companies and to allocate the resource. This was the most difficult and complicated part of the exercise. In the end the Government decided on an administrative allocation system based on three criteria:

(i) A measure of the level of domestic investment committed to existing or potential deepwater vessels measured at indemnity or insured value.

(ii) A measure of the level of deepwater catch which had been supplied for onshore processing within New Zealand.

(iii) A measure of onshore investment together with a measure of the extent to which this was committed to the processing of deepwater species and a factor which measured the utilisation of such investment.

Based on these criteria the resource was allocated to eligible qualifying companies. To qualify to hold an allocation a company had to be at least 75.1% N.Z. owned and the calculation of an allocation had to meet a minimum size to ensure economic development.

There was also an allocation made to the domestic fleet of non-company owned vessels. This was called the 'others' category and was designed to provide for the development and expansion into the deepwater fishery of those vessels of a suitable size to take advantage of the fishery.

One of the most significant aspects of the policy was the decision to allow the allocation-holding companies the freedom to choose how they harvested the resource. There was much debate about whether some preference should be given to domestically owned vessels. In the end companies were left to choose their most cost efficient harvesting method and if this involved the continued chartering of foreign vessels than this was considered acceptable.

While companies were able to choose the harvesting method, the Government did impose, as a condition of the allocations, that 35% of the quotas must be processed onshore in New Zealand.

Other Government guidelines were:

(i) Allocations were made for an initial 10 year period.

(ii) Trading in allocations must be reported to the Government.

(iii) No one enterprise is permitted to acquire ownership of more than 35% of the allocated resource.

(iv) Increases in TAC's will be, depending on their size, either pro rated among existing allocation holders or tendered.

(v) As the deepwater trawl policy involves the alienation of a public resource for private benefit a royalty payment is levied on allocations.

(vi) If and when non-allocated species come under fishing pressure they can and will be included in the deepwater allocation system.

(vii) Vessels must report daily positions and weekly catches.

In determining the guidelines for the policy the Government was conscious of the need to minimise regulatory interference and maximise the freedom of allocation holders to develop the deepwater fishery in the interests of economic efficiency. The Deepwater Trawl Policy has been in operation now for almost 18 months and is to be the subject of regular reviews. The reviews are unlikely to lead to significant changes in the important basic elements of the scheme.

It will be interesting to watch future developments within the policy. In particular the degree of onshore processing, the growth of interest in the catching, processing and marketing of non-quota species, the development of N.Z. owned catching capacity and the degree to which companies investment decisions are influenced by security of access to the resource.

It is the view of those closely associated with monitoring performance within the policy that the policy has worked well and has by and large fulfilled all that was expected of it.

New Zealand's Inshore Fishery: A Perspective on the Current Debate

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Introduction

There is severe overfishing of snapper, trevally, terakihi and rig in New Zealand. Other species under pressure include groper, red gurnard, school shark and blue warehou. Northland (East Coast), West Auckland, Hauraki Gulf and the Bay of Plenty face the most serious problems. Only a small number of vessels land most of the inshore catch:

50% of the fish is landed by 1.5% of the vessels
90% of the fish is landed by 20% of the vessels.

The immediate solution being sought by the National Fisheries Management Advisory Committee (NAFMAC) is to buy back vessels from full time fishers using taxpayer funds. The Committee has estimated that over-capitalisation of boats and gear in the industry amounts to $28 million of which $26 million is in the four North Island regions.

No compensation is sought for part-timers who represent half the fisheries and who land about 5% of the domestic catch (Berryman, 1983). These fishers have already had their licenses removed although a few part-time fishers have been able to have their licenses reinstated. No research has been undertaken into the social, ethnic or economic backgrounds of the part-timers, and thus we do not know what has been the impact on their lives or livelihoods of removing their licenses. At best we know that there has been no great organised protect by the part-timers.

This paper examines the historical, distributional and economic efficiency aspects of managing the inshore fishery. A discussion on how these theoretical aspects affect the inshore fishery is given using New Zealand snapper as an example. The potential for effort transfer is covered in some depth as a solution to the overfishing problem in certain species.

Brief Overview of the History of Fisheries Management

Whaling was introduced to New Zealand in 1792, almost 50 years before British sovereignty was proclaimed and before the first immigrants arrived under an organised colonization scheme. By the turn of the 19th century falling prices for whale products and the drastic reduction of commercially important whale species lead to the demise of the industry. Populations have never fully recovered.

New Zealand's jurisdiction extended to three nautical miles off the coast -- historically the distance of a cannonball shot. By 1914 a policy of judicious exploitation was introduced, coupling fisheries development with conservation. This policy was reversed in 1927 with conservation as the sole objective. Seasonal closures for all methods of fishing were introduced and danish seining was prohibited because it was deemed to be excessively efficient. Northern fishers established a strong and successful lobby to get an exemption for their area. In 1929, trawling in the Hauraki Gulf was also prohibited.

Licensing was introduced in 1936 for the catching, wholesaling and retailing sectors under the first Labour government. Further action was taken in 1937 following concern at overfishing although the total catch at the time was only 30,000 tonnes. This catch level ought to be compared with the 470,000 tonnes that was extracted from New Zealand's waters in 1977 -- in the latter case over-fishing really was occurring. It seems more likely that in the aftermath of the Depression (Riley, 1980) fishers were concerned with depressed market prices for fish.

In 1945, a one-man licensing authority was established which introduced minimum fish sizes, gear restrictions, area closures and non-transferable vessel licenses. These licenses specified one port landing fish. Old fishermen tell stories of rotten-hulled dingies with a license number clearly painted on the side being sold for thousands of pounds. Although the sale of licenses was technically illegal, the fishing industry appears to have had little difficulty in finding ways around the law. A wide disparity in fish prices was also evident at this time. The fact that high priced prime species in one port were being discarded in other ports, and vice versa, simply highlights how familiarity with fish species can lead to entrenched consumer attitudes. With high profits obtainable from prime species there was no pressure to market the lesser known species.

By 1955 the restriction to land into only one port became impractical. Larger vessels with a greater fishing range blurred the boundaries between the different regions. This restriction was removed but limited licensing remained. Enthusiasm for developing the fishing industry and its export potential culminated in open access fishing being introduced in 1963 along with the formation of the Fishing Industry Board. In 1965 New Zealand's fishing zone was extended to 12 miles. Foreign licenses vessels were phased out of this zone and only allowed to operate more than 12 miles offshore by 1970 (Bradstock, 1979). This changed in 1978 when the 200 mile Exclusive Economic Zone was put into effect. The effects of this additional effort beyond the 12 mile zone are being felt today. A second major cause of over-fishing was the encouragement given to the domestic industry by the Government from 1978 to 1984 in the form of low interest and suspensory loans and duty free importation of new and near-new vessels.

A raft of controls were introduced in 1963 for the Foveaux Strait Oyster Fishery to prevent the explosion of fishing effort which would have accompanied open access. This has generally been lauded as a management success. In contrast, the Nelson scallop fishery collapsed within 15 years of having an open access policy. Scallops, Ellesmere eels and rock lobster are now all managed through controlled fisheries.

In recent years foreign effort has largely been replaced by co-operative ventures and domestic deepwater vessels. The squid and bluefin fisheries are controlled by vessel numbers but the deepwater demersal fishery is managed through a policy of individual transferable quotas which were introduced in 1982.

Theoretical Issues of Fisheries Management

The effect of open access on a renewable common property resource is well known to analysts. The following account summarises some of the major points to set the stage for the discussion later in the paper.

Fishers will expand effort until AR = MC for each operator. Consequently industry effort in some species is forced to the point where total collective costs equals total collective revenue. This is shown in Figure 1 below, where effort is expanded to the point E.

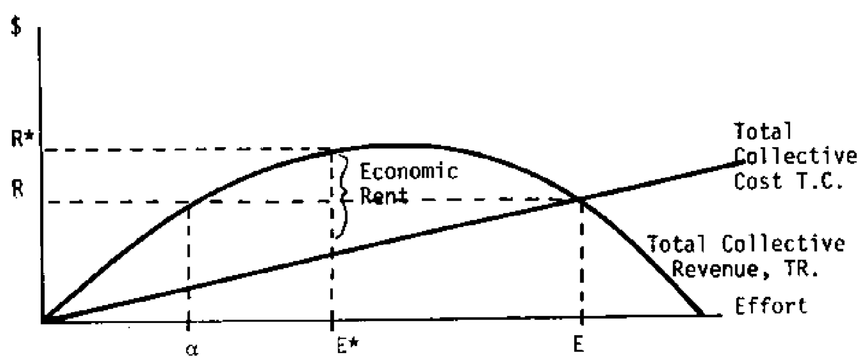


Figure 1. Fishing Effort and Revenue

At point E economic rents are dissipated, indicating a misallocation of resources and over-capitalisation in the fishery. The same level of revenue can be obtained at the point α, with a corresponding decrease in both effort and total cost.

At this open access equilibrium (E), overfishing in a biological sense occurs. Breeding stocks are excessively harvested, and this is termed the "user cost." Future harvest is being foregone in preference to present consumption.

Resource management of a common property resource is firstly a problem of finding the optimal harvest (E*) for each specie which maximises collective benefits over time from the resource stocks. Secondly, fisheries resource management is concerned with designing a scheme to ensure that the catch is restrained to that level. Returning to Figure 1, this means we should reduce effort and move back towards E*. Finding the exact level of effort is a complex calculation, and is better handled by a dynamic framework than a simple static one. So far we have been concerned solely with private resource use. However, intervention by the State to direct private resource use introduces the need to economise on both sets of resources. As Wilson [1982] points out, it is not difficult to conceive of a fisheries management scheme in which the benefits of improved fisheries management are outweighed by the costs of intervention by the State or a State sponsored agency.

A static analysis can be useful to demonstrate the immediate effects of reducing effort. This is shown in Figure 2, where effort is reduced from Q to Q^1, fish prices will increase to the extent that demand is less than perfectly elastic. This is shown as the move from P to P_d in Figure 2.

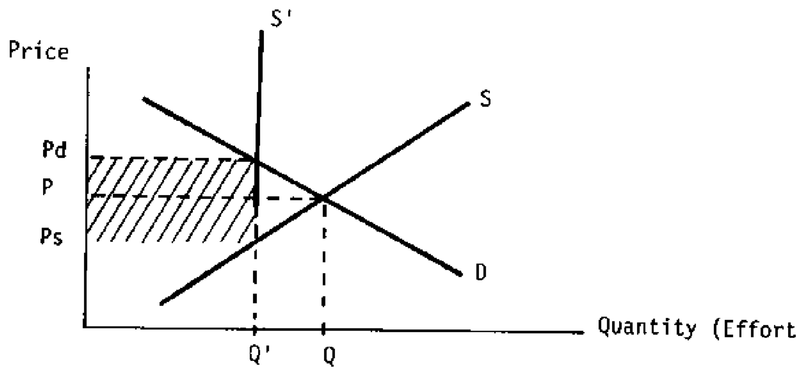


Figure 2. The Value of Fish Quotas

In the presence of the quota restriction, economic rents accrue to the quota holders equal to the difference between the demand (P_d) and supply price (P_s) per unit. This raises two distributional issues. The first concerns who should receive the rents -- the State? all existing fishers? large fishers? The second issue concerns how to transfer quotas.

Decreasing current effort to Q^1 may increase harvest in the future if overfishing is taking place. This is the backward bending supply curve in a dynamic sense, and is shown in Figure 3. Effort increases as the price rises, yields increase past a sustainable yield, and future yields decrease (Clark, 1976, p. 154; Hannesson, 1979, p. 65).

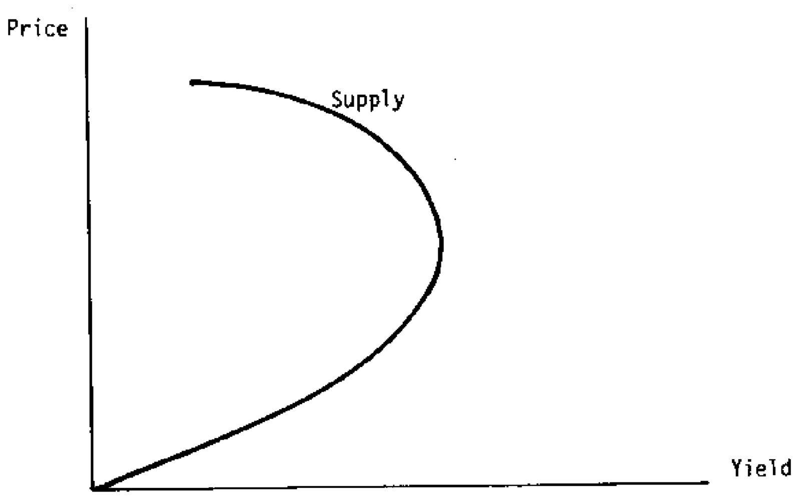


Figure 3. Backward Bending Fish Supply Curve

Unless some restriction is placed on harvest, an open access situation may lead to reduced future supplies where high prices entice increased effort from fishers. The same result can be expected from an artificial lowering of the cost structure, as has happened in New Zealand with input subsidies.

Dynamic effects upon the fish stocks are shown in Figure 4. Starting from the current time period (t_0), fish stocks are at a level given by X_0. Concern is expressed, because the optimal time path is considered to be higher at X*. Resource managers now have to decide upon an optimal time path from time t_0. This is precisely the problem for some species of fish in the New Zealand inshore industry (NAFMAC, 1983). The dynamic nature of the problem is such that if X* was the optimal time path at time zero, it may not be the optimal time path at t_0. This is the Samuelson Turnpike theorem; once we have left the turnpike X*, it may not be optimal to return to that path. Clark (1978) has shown that the factors influencing the optimal rate are the time horizon, the price responsiveness to changes in supply, the discount rate used, and the stock recruitment rate.

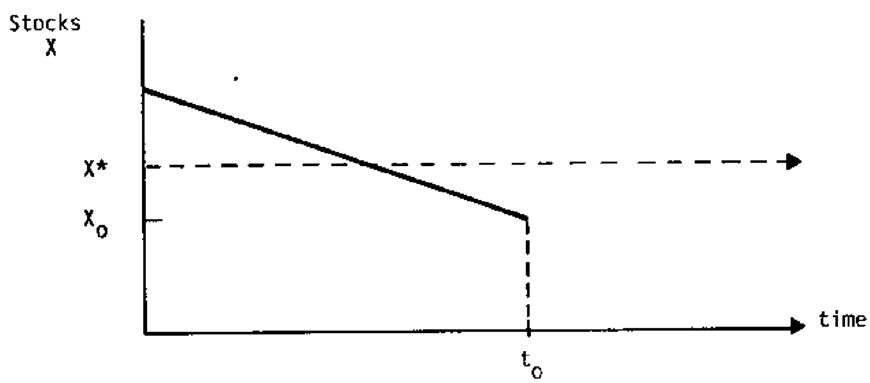


Figure 4. Resource Stocks Over Time

The planning horizon receives little consideration in practice, although determination of the time period may alter the path. Increasing the terminal period (T) to infinity implies an application of the Turnpike theorem as shown in Figure 4.

The path advocated for threatened inshore species is to harvest an interim yield lower than the proposed long term yield (NAFMAC, 1983). Let us call the point in time at which harvest changes from interim to long term harvest t. This gives a different time path from present time to the change, t_0 to t, than from the change onwards, t to T. No economic or biological justification for these differing time paths is provided by the New Zealand Fisheries managers, except in very general terms: "The chances of recovery are improved if in the short term catches are dropped below present sustainable yields" (Major, 1984).

Price responsiveness may alter the optimal harvest. Given that we are optimising economic returns from the resource over time, subject to constraints, the problem may be expressed as:

$$\text{Max PV} = \int e^{-rt} R(X,E)\, dt \qquad (1)$$

where: PV ≡ present value
r ≡ discount rate
R ≡ net revenues
E ≡ harvest or effort (assuming linearity)
X ≡ fish stocks
t ≡ time.

Changes in price are reflected in R, and we would expect optimal harvest to be less with a price responsive resource. The price elasticity of demand is a measure of the degree of responsiveness.

Uncertainty as to future price trends complicates analysis of optimal harvests. If real prices are increasing over time, and changes in effort are costless, then delaying harvest may increase benefits. Anderson (1977, p. 43-46) discusses this relationship in a present value framework between two time periods, but this can be extended to several time periods using a control model. If the converse holds, and fish prices are dropping, then an increased harvest is called for. The assumption of costless changes in effort may be a heroic one, as this assumes a high opportunity value can be placed upon the fishing capital and some alternative use exists in the short term for this displaced capital.

A similar increase in harvest can be expected with a high discount rate (equation 1). Using a zero discount rate implies that the optimal harvest is approximated by the maximum biological yield, while an infinite rate will lead to the same harvest as an open access situation. Some positive real rate will be intermediate between these two extremes.

The stock recruitment rate or growth function (X) may also have some impact upon the optimal time path (Anderson, 1977; Clark, 1976). With a specie that has a long life span coupled with low reproductive rates the optimal path may be to harvest early. Faster growing and highly reproductive species such as squid are the opposite situation -- increased economic justification can be made to reduce the short term harvest for long term benefits.

Limiting access will not automatically remedy fishery management problems, as more factors are involved than just simply the problem of open access (Rothschild, 1983). Many actors are involved in the play besides fishers -- boatbuilders, processors, policy managers, bankers, retailers, exporters, and the final consumer. These interactions, as well as complex biological interactions in the fish stocks, need to be recognised in long term management plans.

Problems of overcapitalisation are accentuated by fluctuating incomes and government policies formulated to encourage fishing. During periods of high incomes, measured by increased prices, high yields, or lowered costs, investment is encouraged in the industry. When returns decrease, these same investments may be trapped because of low opportunity values, staying in the industry and accentuating problems of overfishing. This is essentially the problem known to agricultural economists as asset fixity (Johnson and Pasour, 1981). With the next swing in prices, more investment is encouraged and the cycle continues. The end result may be what Crutchfield (1979, p. 746) describes as the ultimate absurdity as investment is encouraged because prices are rising due to biological scarcity, thus contributing to the overfishing of the species. The expansion of the domestic fleet following the introduction of the 200 mile zone in 1978 has been an example of this asset fixity situation. Many of the vessels built ostensibly for the deep water were found to be too small to work offshore and have become locked into the inshore fleet.

Open access will usually lead to both overcapitalisation and overfishing. Some form of supply control may be needed to ensure both an optimal harvest rate and to prevent overcapitalisation. That harvest rate is likely to be modified by many factors. Positive discount rates, falling real prices, short term planning horizons, and slow biological growth and reproductive rates will tend to increase the optimal harvest. Similarly, increasing real returns, high growth and reproductive rates, and a long planning horizon will tend to decrease harvest. Input subsidies and asset fixity will accentuate the problems of overcapitalisation.

Policy Options for Supply Control

Four alternative methods of supply essential are commonly considered for fisheries management:

(a) gear restrictions and season closures;
(b) taxes on either inputs or outputs;
(c) license schemes;
(d) quotas, both total resource and individual.

Limitations of the first three are well documented. Gear restrictions lead to distortions from a minimum cost harvest, while seasonality restrictions do not address the common property problem. The use of taxes on either inputs or outputs to internalise the externalities is a theoretically appealing solution, but unfortunately it is impractical. Neither stochastic influences nor asset rigidity can be handled easily by taxes. Licensing of vessels or fishers leads to an inefficient allocation of resources from both of the critical perspectives. Overcapitalisation is encouraged as vessels' productive capacities may be increased, leading to increased pressure on the resource.

This leaves the option of quotas. Total seasonal quotas have been applied. They will usually lead to a modern times Oklahoma land rush as fishers compete for their share of the quota. Individual quotas, expressed as a percentage of the allocated catch, present an attractive solution. Short run efficiency is achieved as fishers have control over choice of inputs to minimise cost. Once initial allocations have been made, transferability of quotas would facilitate long run efficiency. An open market enables operators to freely enter or leave the industry. There are two kinds of costs that would face individual fishers: the usual costs of production (harvest) and the costs (including opportunity) of holding or acquiring a fishing quota. Thus, in terms of traditional microeconomic theory, an operator will adjust marginally to a profit maximisation position. Formal mathematical proof of this is contained in an appendix by Moloney and Pearse (1979, p. 865-6) and discussed in Clark (1982, p. 281-1), using the familiar maximum principle. By the process of Walrasian treatment, rights will accrue to the efficient operators. Values of these rights will indicate values of the resource and also indicate the possible economies of size by their eventual distribution.

Transferability could either be on a temporary basis enabling some flexibility during a particular season, or a long term basis. Stochastic effects in yields for a particular species between seasons can be accommodated by setting a total species harvest and expressing individual quotas as a percentage.

New Zealand has had experience with transferable quotas in the deep water industry. The current inshore problem differs in many ways from the deep water industry. Major differences are that few operators are involved in the deep water recovery, leading to lower enforcement costs, and the initial allocation of quota was facilitated by not having to withdraw capacity from the industry.

Enforcement costs involved with policing of an inshore quota system are likely to be high. Initial allocation of quotas to larger commercial operators may reduce these enforcement costs, as it is presumably easier to police a smaller number of vessels. However, this may well be at the expense of an equitable allocation of the quotas, and may not encourage the most efficient harvesting techniques. Selection of the quota allocation on the basis of administrative ease is most unlikely to lead to an appropriate distribution of wealth or increase earning potential amongst fishers. Such a procedure also begs the question as to whether the quota rights ought to be granted at zero cost to fishers at all. There are some precedents in this area. Increasingly New Zealand import quotas are not granted to traders but are sold by tender on an annual basis resulting in the rent accruing to taxpayers.

Questions of the possible administrative options for the quotas are contained in Duncan (1984), albeit in a preliminary manner. As discussed in Meaney (1980), enforcement costs are likely to depend upon both the marketing channels available and the unit value of the fish. Few market outlets are easy to control, as many small distributors accentuate the problem of keeping track of landings. Similarly, a high unit value of fish increases incentives to sell non-quota catches. These administrative enforcement costs may constitute a considerable percentage of gains made to the industry by the quota system.

In spite of these problems, transferable quotas must be considered an excellent long term solution. Efficiency is enhanced by enabling operators to move to a least-cost situation and, provided the initial allocation is equitable, no major distributional issues are involved. Multi species harvest can be accommodated by both inter and intra seasonal transfer of quotas for each species. Intervention costs and the need to equitably distribute initial allocations are the two major problems associated with the system.

Distributional Issues

Some major equity issues are involved if a quota policy is introduced. The first issue has already been decided -- units not "wholly or substantially involved in the fishery" (NAFMAC, 1983) have been arbitrarily precluded from the industry. No compensatory arrangements have been discussed with this numerically large section of the industry who represent half the number of fishers. No attempt even appears to have been made to ascertain either who these people are or the effects of precluding them from the industry. This decision is especially interesting in view of the call from commercial fishers for $28 million in compensation -- the industry appears to have the power to decree who shall not participate in the gains from the compensation scheme, thus, by proxy, deciding who shall. Crutchfield (1982) and Pollnac and Littlefield (1983) both contain a discussion on possible effects on part-time fishers and social impacts. Indeed, as Scott (1979, p. 731) suggests "arbitrary expulsion of part-timers and sport fishers with low catches should take a prize for high-handed, inefficient discrimination." Non-operated permits have also been cancelled, thus penalising another sector of the industry.

Having made some preliminary decisions on who shall not be allocated quotas, the next major question is, how should the quotas be allocated? Given that quotas are freely transferable, any initial distribution can be altered to achieve an optimal allocation. This is because holding a quota represents an opportunity cost to the fisher and will be a factor in the perceived revenue flow (Clark, 1982). Options to trade a quota can be included along with all other decisions open to an individual. Once allocated, quotas will have some value accrue to them, thus the distributional issue problem is the initial allocation (Moloney and Pearse, 1979; Crutchfield, 1982). This is the same issue addressed by Gardner with respect to re-distribution of Federal Lands in the United States. He concluded "once this initial re-distribution effect worked itself out, equity would cease to be so important an issue with market traded goods, since presumably no free market exchanges would occur unless both buyer and seller believed the trade would make them better off" (Gardner, 1983, p. 223).

Several systems exist for initial allocation of these rights. These include a tendering system coupled with a buy-back scheme, allocation based upon historical catch, or allocation based upon either investment or productive capacity in the industry (NAFMAC, 1983). One suggestion cited in Scott (1979) is for every active fisher in the industry to be allocated a portion of the quota, and fishers to be given an incentive to trade quotas to a suitable size to catch a profitable amount of fish. Such a system takes care of one aspect of the distributional problem, but leaves unanswered the question of the taxpayer's rights in such a scheme. Some economic rent could be extracted by setting a price on quotas to start at some predetermined date. Some short term adjustment problem would occur. Allied with these decisions is the question of the form of the quotas -- size of the parcel, maximum holding for any individual or company, time length of the allocation. Over-riding some of these considerations is the possible question of compensation. The New Zealand Federation of Commercial Fishermen has submitted a proposal for effort reduction which includes a compensation clause for those prepared to withdraw from the industry. However, this should be balanced by a fee system for quotas allocated to those remaining, as one would expect a rent value to accrue to the permits. As pointed out by Anderson (1983), the maximum rent will not accrue until the industry has had time to adjust to a cost minimum situation. This compensation problem is recognised by New Zealand managers (Duncan, 1984). This question of compensation appears to be a vexing one, and the long suffering taxpayer may be excused for wondering why the rents which should accure to the nation are, in fact, negative rents being paid to retire vessels.

Effort Transfer

One of the major problems facing the inshore fishery is overcapitalisation. This problem may not be significant if financial resources could be diverted to other uses. There are two major economic reasons which tend to restrict the individual from transferring resources to alternative species -- the opportunity cost incurred and the cost of developing a new industry.

The opportunity cost faced by an individual fisher harvesting an alternative species is the income foregone from not harvesting the traditional species. This can be a major cost to the fisher. However, if quotas are introduced, fishers no longer face this opportunity cost, thus encouraging effort transfer. Research and development costs facing an individual in any new industry can be substantial. These costs involve information gathering, development of harvesting techniques, on board handling methods, processing technology, and marketing of the fish. Once these initial problems have been overcome, the cost structure for both the pioneer and others would decrease. Indeed, Samuelson et al. (1967) consider that fisheries effort transfer is a classic example of the infant industry problem:

"Thus, a school for fishermen might become feasible when the industry grows to a certain size: and this training might cause a downward shift of every firm's cost curves as the industry Q rises," p. 499.

Potential species include discarded inshore species such as anchovy, barracouta, small red cod, conger eels, frostfish, small gemfish (< 45 cm), small hoki (< 45 cm), grendier, kahawai, jack mackerel, small monkfish (< 25 cm), grey mullet, yellow eyed mullet, sea perch, pilchard, southern blue whiting, spiny dogfish, skates -- small (< 45 cm) and large (< 80 cm), rays, seadragons, seahorses, octopi, scampi, jellyfish, and crabs. Additionally, potential exists in fisheries which have traditionally been regarded as offshore, despite their proximity to the coast. Species include squid, southern bluefin tuna, skipjack, orange roughy, big eye tuna, yellowfin tuna, East Coast albacore and ribaldo.

The squid fishery is very large. It is being managed to an estimated Total Allowance Catch (TAC) of 90,000 tonnes/year. At an average f.o.b. export price for 1983 of NZ$1.62/kg the resource is worth nearly NZ$150 million annually. It should be noted that this year the jigging fleet has extracted an extra 30,000 tonnes of squid over the theoretical TAC. Moreover squid prices are continuing to rise (Kitson, 1984). Thus the squid fishery alone is nearly as valuable as the total inshore catch.

There has been little research into developing a method that is suitable for inshore vessels although fishers are convinced that profitable methods exist. But their cash flow cannot support sustained research. There are undoubtedly problems such as handling on board for quality and restricted quota access to the Japanese market (O'Donnell and Ting, 1984). Fishers also complain that the lights of the foreign and co-operative venture fleets draw the squid out to sea for distances of up to 20 miles. Two major methods of capture are used, jigging and trawling, with the jig-caught squid usually commanding a premium on the Japanese market (Mattlin, 1983). The squid caught by jigging are relatively costly, and more research needs to be conducted on New Zealand's participation in this industry. On the other hand, Colman (1983) considers that New Zealand has a major potential for developing our squid resource, with trawl squid becoming the basis for a substantial onshore processing industry.

Southern bluefin tuna catches by Japanese longliners have been declining. However, it is still a very valuable fishery in the order of NZ$25 million f.o.b. in 1983 (Gibson, 1984 pers comm[1]). New Zealanders on the West Coast have since 1979 developed a highly efficient method of catching bluefin which has not yet been transferred to the larger East Coast fishery. By comparison, in 1982 the large 23 crew Japanese longliners caught on average 5.6 bluefin/day. The small three crew West Coast trolling and handlining vessels landed 6.5 bluefin/day of comparable quality. Developing an East Coast, New Zealand catching operation has the dual effect of conserving both the inshore and the bluefin fisheries. On the one hand it transfers effort out of the inshore fishery and on the other it gives New Zealand fisheries managers a lever for reducing foreign effort. Harvesting of juvenile fish off the east coast of Australia and possible effects of El Nino have contributed to the catch decline in the latest season for southern bluefin in New Zealand. O'Donnell and Sandrey (1983) estimated the value to both fishers and the nation of developing this resource. They concluded that providing fishers with information and organising an initial catching and marketing operation resulted in potentially substantial returns to both individuals and the nation.

The declining catch is a classic "user cost" problem -- the small migratory fish are harvested by Australians for low value canning before they reach New Zealand waters at maturity. It is only carefully handled mature bluefin which are highly valued on the Japanese market. Recent research (Meuriot and Gates, 1983) show that foreign nations fishing in the U.S. 200 mile zone are enjoying a substantial wealth transfer as measured by willingness to pay. If these results are applicable to New Zealand and some of the surpluses can be captured by producers, later mature species may be profitable.

Orange roughy is currently being harvested off the Wairarapa Coast by Wellington trawlers, despite doubts that inshore vessels could harvest at 900 meters depth. This new glamour export fish was "known locally from only a few museum specimens until 1975" (Robertson and Grimes, 1983, p. 15). Ribaldo has been successfully gillnetted by Kaikoura fishers at 700 meters, and they now plan to try gillnetting at 900 meters for orange roughy. There is also a considerable resource of slender tuna, particularly off the Otago Coast.[2] The D.S.I.R. is currently researching consumer acceptable ways of using this oily fish.

Jack mackerel is an example of a so-called less preferred species. Robertson and Eggleston (cited in Jones, 1983) revised the New Zealand estimated yield of mackerel to between 48,000 and 187,000 tonnes annually, and although Jones cautions that these estimates are "dubious," he considers that a large resource exists. The 1981/82 average annual domestic inshore catch was 2,350 tonnes in contrast to a long term inshore yield of 30,000 tonnes (Jones, 1983). The use of a project manager to co-ordinate information and development may be a less costly alternative policy than vessel buyback schemes.

Barracouta has topped domestic landings by volume in recent years (NAFMAC, 1983), and has an estimated long term yield of 30,000 tonnes annually. This specie earned $10 million in export receipts for 1983 (N.Z. Dept. of Statistics, 1984), and has considerable potential in South Island regions. A 15 month price subsidy was introduced in 1980, and this contributed to increased catches in the subsequent year (Hurst, 1983).

Quality Improvement

Higher prices for better quality is possible. The iki-jime technique (spiking the brain) coupled with meticulous handling has been widely used in Northland, Auckland and the Bay of Plenty. Current price schedule to the fishers is $4.90/kg for first grade iki jime snapper compared with $2.30/kg for trawl caught snapper (Peters, 1984, pers. comm[3]). Other species can also be prepared for the sashimi market, notably trevally, albacore and jack mackerel (Scott, 1984, pers comm[4]). Improvements in the general level of fish quality could be a result of efforts in establishing quality control programmes, quality assurance programmes, peer group pressure, better staff management, improved infrastructure, price differentials for quality or education programmes. Some programmes have been undertaken by the N.Z. Fishing Industry Board and the Fishing Industry Training Council.

Catching method has a major impact on quality. Trawling generally lands a higher volume of lower quality fish with a shorter shelf life than lining. (It is also relatively fuel intensive and capital intensive.) A move to more benign catching methods would conserve stocks and is likely to increase the price.

Hikurangi Fisheries gives a dramatic comparison. From 1 January to 1 March this year each of their pair trawling vessel caught over 15 times the amount of snapper as the longliners and over 1,500 times the amount of trevally. Despite this current legislation prohibits them from transferring their licenses from pair trawling to longlining. Yovich (1984, pers comm[5]) says the trawlers would be just as profitable if converted to longlining because of lower costs and higher fish quality.

In some ports poor quality is severely reducing the price. One extreme example is the quality of blue cod in Southland where it is regarded and used as rock lobster bait.

Further Processing

Value is added to fish by maintaining it in a state as close to live as possible. Care in handling, processing, thawing, and transporting are the main concerns. However, special processing techniques such as brain ablation, cold anaesthesia and modified atmosphere packaging are available. There is a wide range of fish processing options such as free flow fillets, breaded fish pieces, compounded fish minces, and fermented, salted, brined, pickled, marinated, smoked, half dried and dried products. There are country specific products such as smoked jack mackerel for Europe, squid snacks for Asia and stranger still dried shark fin soups and ling bladder isinglass. Product development has been occurring rapidly although it is still only the tip of the iceberg. Increased government input is evidenced by the jump from two to seven fish processing scientists since 1979. One research project with exciting potential is a method to control the post capture metabolism of the muscle. In effect the fish is dead, but its muscle is kept alive using low cost technologies.

Application of Proposed Policy to Snapper

The option of doing nothing and letting attrition of resources from the industry occur is one policy that needs to be considered. It has been dismissed by managers: "this particular option cannot be seen as realistic" (NAFMAC, 1983, p. 11). Under some conditions, a "do nothing" option may be less costly than the proposed buy-back scheme. The following would negate the wisdom of an intervention policy:

1. Slow growth rate of the species.
2. High discount rate imposed by society.
3. Price not responsive to changes in supply.

4. Decreasing real prices over time.
5. Positive external effect resulting from a prey-predator relationship.
6. Low opportunity value to excess capacity.
7. High enforcement costs.
8. High intervention costs.
9. Large social impacts caused by a forced displacement of resources.
10. Increased effort/catch ratios as stocks decline.
11. High level of catching skill required.
12. High natural attrition rate.
13. High levels of uncertainty regarding biological factors.

Impacts of each of these conditions upon the economically optimal policy will be discussed. This analysis looks at snapper which is one of the major species landed in New Zealand for which considerable concern has been expressed about overfishing. Results may be generalised to other species.

Snapper is the main inshore specie by value, for which NAFMAC (1983) suggest a 44% interim and 24% long term reduction in yield is needed. Regional differences are more dramatic -- a 77% interim and 46% long term reduction are suggested for the Bay of Plenty region. Major concern has also been expressed over the Hauraki Gulf snapper. This area landed 40% of the New Zealand snapper catch for the 1981/82 years, but in spite of concern over the species, only a 10% long term yield reduction is proposed (NAFMAC, 1983).

1. Biological growth rate.

Economic efficiency is achieved when marginal costs are equated to marginal benefits. Costs include the opportunity cost of earlier capture and reinvestment of the funds received as well as direct fishing costs. Benefits include changes in value of future harvest if the stocks are left and the value of retained stocks in breeding, which is termed the user cost. Individuals will only recognise the user cost and changes in value of future harvest if they have an incentive to do so. This incentive is lacking in an open access situation.

Snapper are a long lived species which are thought to live for 50 to 60 years. Using data from Vooren and Coombs (1977) the following rate of change in average weight for snapper was estimated.

Table 1. Snapper Growth Rates

Age (Years)	Rate of Change (%)
0- 1	-
1- 2	300
2- 3	100
3- 4	50
4- 5	30
6- 7	20
7- 8	12
8- 9	10
9-10	9
10-11	8

Source: Vooren and Coombs (1977).

Table 1 gives some indication of possible changes in value, assuming a homogeneous price, of snapper. Incorporating both a mortality rate and price changes over time into the analysis would allow the optimal harvest age to be calculated.[6] The problem of selective harvesting to maintain breeding stocks is unanswered.

2. Discount rates have an impact upon optimal harvest strategies.

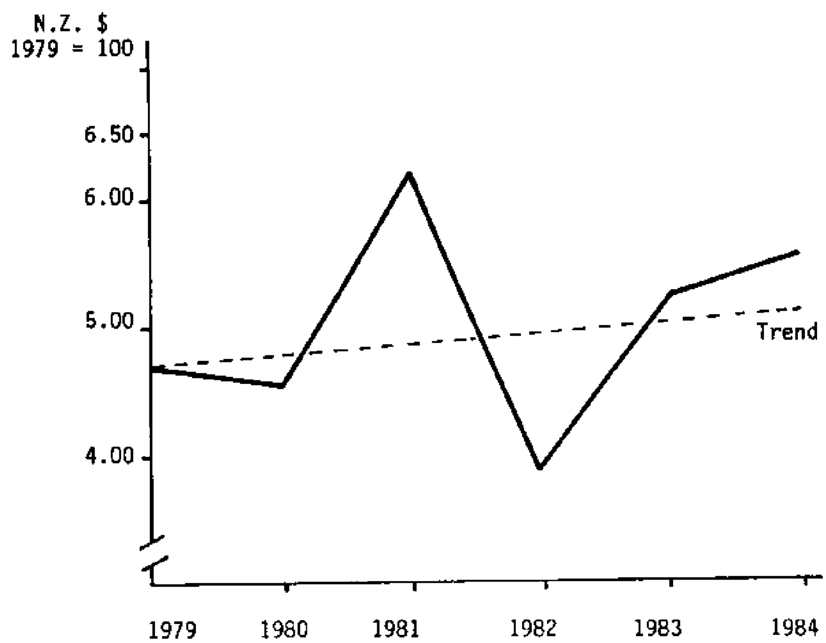
Most public projects in New Zealand are required to pass the criteria of a 10% real discount rate. This is a high real rate, and would probably have a devastating impact upon fish stocks if the same criteria is applied to the fishing industry. However, some positive rate of interest must be used, suggesting that economically and biologically optimal yields will differ (Larkin, 1977).

Suggested snapper interim yields are 5,950 tonnes and long term yields of 8,100 tonnes annually on a national basis. Given a positive discount rate and slow biological growth rate for snapper, it is difficult to see the justification for divergence between interim and long term yields. Social adjustment costs and a possible low opportunity value of vessels would further question the logic of diverging interim and long term yields.

3. Factors likely to influence the price of snapper are supply of snapper, cross elasticities with substitutes such as other fish, chicken and red meats, marketing effort, and New Zealand's relative share of exports. Exports to the year ended December 1983 were $19,022,535 for snapper, suggesting that foreign markets determine New Zealand's domestic price. However, New Zealand's influence on the world snapper market is only slight.

New Zealand has many substitutes, both alternative fish species and other protein forms, which would increase the elasticity of the domestic market. Any reduction in supply will initially reduce consumers' welfare. Whether that welfare will be reduced in the medium to long term will depend, amongst other factors, upon substitutability of alternative species. If the export market is the residual market then foreign consumers will bear the full loss in consumer surplus, the extent depending on the effect of the reduction on the world market.

4. Snapper prices, as measured on the Japanese market, have been increasing in real terms over the 1979-1984 period. These prices are shown in Graph 1. Increasing real prices negate the effects of a discount rate, and reduces the optimal harvest level. Conservation is encouraged. For the same reason, continual depreciation of the New Zealand currency vis a vis major trading partners would also act as an incentive to conserve snapper for future harvest.



Graph 1. Average Snapper Auction Prices Tsukiji/kg Expressed in Real N.Z. Dollars

Source: F.I.B. Bulletin July/August 1984.

5. Snapper predation may be harming mussel beds in the Marlborough Sounds.

Although this example is a regional problem, it is an example of prey-predator relationships. Paddle crab predation on toheroa beds and octopus predation on rock lobster are further examples of this market failure. If strong predation is occurring, then it is beneficial to increase the harvest rate of the predator.

6. Overcapitalisation by size in the fishing industry would indicate that larger vessels should be withdrawn from the industry, in contrast to the management option of withdrawing smaller vessels. Prospects for transferring effort to alternative species are also enhanced. Some preliminary work on returns to vessels by size are discussed in the NAFMAC (1983) report, and concludes that "40% of the fleet comprised of trawlers greater than 18 meters may incur significant losses." Alternative uses of smaller vessels may be limited -- the only other usage of vessels already excluded may be as pleasure craft. However, even if vessels have no alternative use, it may be better to scrap equipment than to

consider overfishing. Alternative usage of capacity is a stronger argument for transferring effort than for continuing to overfish a particular species. If vessels have a high opportunity value in an alternative usage, then restricting effort becomes more attractive. The cost of supply control is reduced.

7. To be effective, a system of individual transferable quotas must be enforceable and effectively enforced. Specification of penalties for violations must be made clear. Randall (1981) considers that Pareto efficiency is ensured where a set of nonattenuated property rights includes specification, exclusion, transferability, and enforcement. Thus individual transferable quotas are relatively cost effective although they are nevertheless high and may negate the benefits derived from legislation.

8. Enforcement costs are only one aspect of the total intervention costs. These costs can, for example, include the cost of specifying the wrong harvest level. In a complex biological system, such as the New Zealand multispecie fishery, these intervention costs may be substantial, and the reader is referred to Wilson (1982) for further discussion.

9. Social impacts of displacing fishers by arbitrary measures can be considerable. This problem has not been addressed in the current debate, particularly with respect to part-time operators. The snapper fishery is particularly affected by social impacts because it is harvested by a large proportion of recreationalists, part-timers and small operators. Social costs arise from displacement in many sectors of the economy, and as Wilson (1982) concludes, it is not clear that management imposition of property rights gives rise to greater net social benefits than the current system. In a period of relatively high unemployment, as exists in New Zealand, should emphasis be given to labour enhancing technologies such as the iki-jime longliners?

10. Natural market forces operate to protect the species where effort per unit of harvest increases as stocks decrease. However, some species are relatively easy to harvest at specific times and locations such as during spawning. Often trawling catches large volumes of spawning snapper on the trawl grounds, a situation which may need consideration.

11. Individuals' skill and knowledge acquired over time may also alter catch to effort ratios. This is the cost of acquiring knowledge on the location of fish at any time, and the skill factor involved may be high. If this skill factor is high, less justification can be made for restricting entry into the fishery because skill acts as a natural barrier. Snapper in the north eastern waters of New Zealand does not have this skill barrier compared to other fisheries and regions.

12. Attrition can be rapid from the fishing industry. In June alone, an estimated $4 million of vessels sank off the New Zealand coastline. Does this revise the $28 million buy-back costs downwards by a corresponding amount? Restricting further entry into the industry may be adequate to ensure protection in the medium term if attrition is high.

13. Uncertainty has scarcely been addressed in this paper. Some species have much more information available with a greater degree of certainty than others. Snapper is one of the species where there is relatively more knowledge, and therefore intervention is more easily justified.

All of the above factors need to be considered before it can be concluded that benefits will accrue to society from intervention. Many authors are concerned that net benefits to justify intervention cannot be demonstrated. Wilson (1982) concludes with "there is no reason to believe,...in strong contrast to standard theory, that fisheries resource property rights or their bureaucratic simulation provide a clearly superior and socially economical institutional context for the management of fisheries" (p. 433). In a similar vein, Bockstael (1980) considers that if fishery management cannot take account of interdependencies among existing competing users and among potential users over time, then the purpose of management is sacrificed and intervention is unjustified. While recognising that some controls may be needed to protect species, justification for intervention in the New Zealand inshore industry has not been clearly demonstrated.

The current debate has, until now, focused on two parties -- larger, full-time fishers and management agencies. Small part-time operators have been dismissed from the set. Neither consumers nor taxpayers have been considered. Other participants include processors, displaced workers, and the citizens of New Zealand as owners of the resource.

Conclusions

Overfishing is occurring in some inshore species of fish in New Zealand waters, although the problem varies by region. Given that some form of supply control is necessary, ITQ's are economically efficient. Transferability ensures that a least-cost harvest is obtained as fishers trade quotas and are free to select capture methods and timing. The initial allocation of quotas raises two equity issues. Firstly, how should the allocation be made, and secondly, to whom should rents accrue? However, although the equity problem is important, the usual Kaldor-Hicks type of compensation criteria can be applied to the overall efficiency question. Consideration should be given to part-timers though, as the effect of supply control on this sector may be considerable.

Possibilities for effort transfer need to be investigated. Numerous under utilized and less preferred species are plentiful in New Zealand waters, and the introduction of ITQ's presents an opportunity to evaluate exploitation of some of these species. Two factors currently deter individuals from transferring effort, the opportunity cost involved and initial infant industry costs. While recognising that ex ante determination of likely winners is difficult, expenditure on research and development may alleviate the need for a buy-back scheme. Harvest costs are initially lowered if resources withdrawn from the traditional species are used, and initial development expenditure may be needed to achieve economies of scale in new areas.

Finally, several factors are likely to influence the optimal harvest levels for each particular species. These include price effects, discount rates, biological relationships, and the opportunity value of excess capacity. Although benefits may accrue as a result of supply control, substantial costs are likely to be incurred. These intervention costs include enforcement, monitoring, and general regulatory costs as well as the cost of specifying a sub-optimal harvest level for particular species. Fisheries management is more complex than maximising surplus accruing to fishers -- the roles of other actors in the play need to be considered.

Footnotes

1. D.J.M. Gibson, Scientist, Fisheries Research Division, Ministry of Agriculture and Fisheries.

2. D.A. Robertson, Scientist, Fisheries Research Division, Ministry of Agriculture and Fisheries, pers comm.

3. T. Peters, Managing Director, Kia Ora Fisheries.

4. D. Scott, Scientist, Fish Processing Research Group, Department of Scientific and Industrial Research.

5. A. Yovich, Managing Director, Hikurangi Fisheries Limited.

6. See Sandrey and Zwart (1984) for an application of this theoretical framework to the optimal slaughter age of deer in New Zealand.

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Notes

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Fisheries Management, Seafood Trade, and Public Policy in Australia

Brian R. Archer
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It was with real enthusiasm that I accepted the invitation to participate in this conference. Then I started wondering about my relationship with the professionals of the industry -- those whose industry it is, whose livelihood is in the industry, whose capital is invested in it, whose entire training and education are built around it, and whose future is in the hands of politicians such as myself, and how you, the traders, economists, analysts, administrators and scientists would accept my observations.

For my own clarification I draw a distinction between the fishing industry and the fishing support industry. Unlike most of the other speakers, I come before you with no professional aids -- no pictures, no slides, no graphs, no technical theories, no econometric models, and no jargon, just observations.

The topic suggested to me covers some matters already well covered by other speakers, so I'll tend to stay close to the politics -- coloured by my personal conclusions and experiences.

In case you are not already aware, and in case my Australian colleagues have not already got the message across, fishing policy and administration in Australia is complicated by many factors, including --

* Our 200 Mile Zone, giving us an enormous area of water which unfortunately is amongst the poorest in the world.

* Being a Federation of States, there are times when I think it is fair to say that total agreement is difficult to obtain.

* Basically, inshore catching is in the hands of the States, offshore with the Commonwealth. Trade (both export and import) and foreign fishing for instance, are in the hands of the Federal Government; licensing is in both.

* More then half of our total catch by value is exported, and more than half of our domestic consumption is imported. You know the situation -- what we eat we don't have, and what we have we either don't choose to eat, or can't afford to.

* Our social structure and our geographic location makes everything exported from Australia expensive on world markets.

Members of Parliament and the Industry

My job -- a self imposed one -- is to keep abreast of what is happening; to listen and to read, to try out ideas, to initiate discussion, and to report to the decision making area of government: I do this from a place in Opposition as I did whilst in Government, and will do so on all occasions.

The industry is dependent on people such as myself, while the reverse is not the case. So it is with the Administration at large; whether a Member of Parliament or member of the bureaucracy, a scientist, analyst or whatever, we come and go, but the industry as such goes on and on, relying on our knowledge, our investigations, our philosophies, our judgment, and usually our common sense. The responsibility I feel this places on me, and my kind, is considerable.

Australia's Federal System

Australia's Federal system provides that the States administer their own functions in fishing as in other matters. I support this basic federalist philosophy -- while at the same time recognising every one of the multiplicity of problems it creates; the three mile State limit before entering Commonwealth waters; and that, before entering the Economic Zone; the fact that while we recognise State boundaries, many of the fisheries involve the waters of more than one State, but the fish do not seem to understand that!

Tasmanian fishermen scalloping in Tasmanian or Commonwealth waters could be prosecuted if they enter a Victorian port with a scallop dredge on their boat, but without a Victorian license. This would be despite the fact that they were not, and had no intention of fishing Victorian waters, and even if it were in a case of breakdown or injury! Such is our Federal system.

My Australian colleagues have covered the various Zone operations already, and that requires no repetition.

With my own interests, I have spent considerable time in discussion with MP's from all States, and State Fisheries Officers from all States but one.

Australia's Cost/Price Structure

Australia is a trading nation; the majority of what we mine, grow or make involves trade; our minerals, wheat, meat, dairy, produce, dried fruits, apples, stone fruits, wool, honey and fish, to name but a few, all are dependent upon factors arising in other countries, as well as our own.

Not only are we affected by our own costs of production, or our own currency value, but on the state of the economies and political interventions in many other countries which seek to supply the same or similar products to those same third markets.

As our economy improves or declines, and as this happens in certain other countries (one in particular) we have the added hazard of encountering export problems, often coupled with sudden predatory imports on our domestic markets.

With exports representing such a major percentage of our total production, we have the ruinous and anomolous situation of being in the hands of a totally domestic cost structure for our expenses, yet being in the hands of open International market prices for our income, as Mr. Siegel has observed.

Our rapid and continuing loss of competitiveness, despite exceptional improvement in efficiency, is a matter of great concern to those Australians who have regard for the long-term position of the industry, employment and investment of our country.

Export Standards and Regulations

Then there are the questions of standards and requirements. There are none higher in the world than those to which our practitioners and processors operate. The Australian consumer of Australian fish is very well protected, the overseas consumer of Australian fish likewise. But the Senate Enquiry found two items both disturbing and anomolous. Firstly, Australia receives no undertakings from countries whose fish we import that the standards of procurement and processing are similar to those we require of our own industry, and secondly, our regulations often impose excessive costs and requirements upon our exporters that are greater than the purchaser seeks or expects, and greater than they receive or require from competitive sources of supply.

In matters such as these, the zeal and responsibility of good departmental officers can so often simply be out of line with a realistic appreciation of the market place. It is this sort of area where political discussion with all those involved can go a long way towards seeking and explaining reasons, or towards producing agreements. Unfortunately however, discussions sometimes continue interminably, with all parties becoming increasingly unreasonable and frustrated as time passes.

Too often procrastination and delays, deliberations and discussions, people taking holidays, and a whole range of alternatives that may seem quite valid to those on the sidelines of the industry, take over, while totally inadequate action is taken to show consideration for those whose money is, as they say, "up front."

In Australia, despite our high cost structure, expensive delivery cost to potential markets, and the pressure of the competing suppliers (many of whom are beneficiaries of production and export incentives), we have an export inspection tax which acts as a further penalty.

Government/Industry Relations

At the time that I became involved with the fishing industry, the relationship between the Government and the industry was appalling -- there was no relationship. The establishment and development of the Australian Fishing Industry Council (AFIC), largely through the efforts of one man, saw substantial improvement for several years. Regrettably the operation peaked on high expectation and has now declined, and this in itself, is a matter of considerable concern to all involved with the interests of the industry.

There were two problems involved with this situation. Firstly many of the suggestions made from experience and in good faith had been totally ignored, and secondly, it is my belief that because of the lack of involvement by the industry in the final decision making and implementation process, that ultimately some of the requests and proposals put forward by industry may have become unreasonable.

The fact was, the industry reached a stage where it was not convinced that the costs and effort was commensurate with the benefits being achieved.

While the AFIC operated effectively, and while it had men of the appropriate calibre to represent the industry, a workable relationship existed. However, please remember that there is a vast difference to the industry between being a member of an industry committee responsible both for and to that industry in the decision making process, and being a member of a Government Advisory committee, depending on the Government's pleasure for one's appointment, but not bearing the ultimate responsibility to either industry or government.

Management Generally

I have not found it uncommon for those in peripheral positions, the fishing support industries and Parliamentarians, to take the view that they really are the industry, instead of being the guide and servant of it. It is part of my philosophy that Government should be identified as little as possible, its role being facilitation rather than direction, and its job to establish a system whereby the free enterprise system can operate more efficiently and effectively -- no more, no less. Members of Parliament in particular have an advisory and ombudsman role.

The Ministers ultimately make the decisions, and if they perform their operation effectively, will rely equally on suggestions and recommendations on the one hand from their Departmental officers, and on the other hand from industry, parliamentary and other advice. To rely too much on one without adequate consideration of the other, too often leads to problems and creates difficulties that usually take a lot of time and considerable acrimony to rectify.

As Departmental Officers generally cannot be expected to have much, if any, practical experience in the industry, the importance of Ministers receiving adequate, objective and even-handed information cannot be over-estimated. That incidentally, is one of the major reasons that I decided to become involved with fishermen when I entered Parliament. They were totally unrepresented, not one member of either House or of either political persuasion in the Australian Parliament was actively representing fisheries interests to the Parliament.

Fisheries administration in Australia is in the Department of Primary Industry -- down with Forestry and Mushrooms and offering a last hiding place for impending retirees, or a bottom rung for those heading to the top. It is not a career posting, and it is the industry that suffers (murmers of Hear! Hear! from other countries I guess are in order at this point).

What this demonstrates is that we cannot and should not expect those without an intimate knowledge of the industry to have any great understanding of that industry. Also, no amount of pure theory can be a substitute for an experienced, realistic, common-sense assessment.

Until we have a system involving career opportunities, the overall position is unlikely to develop as is necessary for the industry.

Fishermen and Their Industry

As one who has visited about 50 fishing ports in Australia, several of those on many occasions, I do not find it difficult to engage ordinary fishermen in conversation, if I talk their language, to find out what they are thinking and talking about amongst themselves.

I don't even find it hard on occasions to gain their acceptance that there need to be changes made, once they believe that I know what I am talking about, and that such changes are in the interests of the industry generally.

When I want to talk to fishermen, I like to do it on the wharf or in their favourite haunt, with them in their working togs. That is when I find maximum communication is possible. Few fishermen speak confidently when they are at organised meetings, and only the very exceptional ones will open up to a Minister or a meeting in Canberra. If we give the fishermen full and correct and comprehensible information and seek their solutions to the problems that become identified from time to time, I am sure that the chances of success are better than if imposed by the Government unilaterally.

As my friends in the DPI could confirm, I have at times found it necessary to argue for both higher and lower catch levels, increased and decreased foreign fishing quotas, longer and shorter seasons, but in every case my arguments have been based on what I believed and was convinced that the resource would stand, and what would be best for the maintenance and development of Australia's fishing industry. I would expect that all members attending the conference would do likewise.

To achieve appropriate results, co-operation and full participation from the industry is essential. If one wishes to create a foulup of great magnitude, one simply imposes new rules upon fishermen without adequate discussion, explanation and contribution from them.

Mr. Belgrave's comment that a report of 2 years standing had not yet been discussed with N.Z. Fishermen is, I assure you, no local phenomenon.

Matters common to the industry and regularly raised by them are, I guess, well known to those members who actually mix with the industry. According to them it seems

* That we all have a well developed talent to detect and elaborate on industry problems, but too often, to avoid discussing those problems with the industry,

* Then there is often the process of justification for the existing Government or bureaucratic decisions, or of

* Developing a system of creating delays in the discussion or acceptance of all suggestions and developments that have not arisen from within their own precincts. However I am sure that this would not apply to any members attending the IIFET conference.

Communications

May I outline what I regard as The Classic Case of lack of communication. The Government's administration of prawn fishing in the Gulf of Carpentaria was, at best, dismal during most of the 1970s. Every management decision seemed to aggravate the problems, and when our Senate Enquiry met with fishermen, crews, processors and major companies in what was one of the most amusing evidence-taking episodes of my life, we found that all the poaching and seasonal closure problems could be solved if we took notice of the fishermen and others, and let them attend to the problems themselves. In four hour's discussion, the fishermen said that they would be the best judges of when it was time to open the season (and that usually it was opened too early!); the processors said that they could agree amongst themselves that none of them would buy small or pre-season prawns; and the fishermen said that they themselves could patrol the areas in question to ensure that there was no poaching.

Years of heavy-handed administration had dealt with all these matters from Canberra; the people concerned were never deemed sufficiently competent or unbiased to be asked for solutions. We pay a lot of professionals to solve problems, even when they were problems that perhaps never need have existed, and/or sometimes may even have been created.

I am happy to say that the Gulf arrangements are now the best they have ever been, even allowing for the fact that the economics leave quite a lot to be desired.

I am pleased to give the credit that is due to those industry people for the way they saw this through, and for the model they have established.

Fisheries Administration Problems

In my opinion, the greatest crime that I have seen committed in fisheries management and administration is always the same one -- delay. Delays in making decisions and taking action -- procrastination. Recognising problems and not taking action within the appropriate time frame.

Around Australia I could list many such instances including --

* Investigator Strait prawn fishery,

* Gulf of Carpentaria prawns,

* South East trawl,

* Shark Bay,

* Bass Strait scallop fishery,

* Southern Bluefin Tuna fishery, and so on.

In every case, during the time which elapsed between the raising of the fire alarm and the arrival of the brigade, the enterprise was nearly in ashes, from which point the recovery is slow and painful, and the losses sustained by those people who play these games with their own money -- real money -- is intolerable.

Intervention in Management Policy

I believe that the philosophy of intervention should be industry inspired, rather than Government inspired. Once there is any Government intervention, the risks for the status of the private sector become entirely different. To intervene partially and often, then requires Governments to intervene either permanently or totally.

Objective Decision Making

So who wins? Decisions have to be made with the following objects (and many others) in mind.

* Local requirements for electoral reasons,
* Party philosophical and platform constraints,
* International responsibilities,
* Sociological concerns,
* Sensible and responsible conservation,
* Budgetary constraints or considerations,
* Administrative simplicity,
* Satisfaction of industry needs.

The local MP, the Minister, the Government, the Department, the State, the United Nations, the Industry, or whoever, probably all have different ideas on the "right" decision, and none of those views should be ignored.

Overall Industry Management Structure

Recently I was asked to make a recommendation on how I saw a reasonable management structure for our fishing industry, and I made the suggestion that there are four equally important areas of the industry.

* Administration,
* Operation,
* Research, and
* Education and training.

A structure which adequately represents all those areas with balance would very appropriately look after the present and the future of the industry. Without pointing the finger at any particular group, all I would say is that such a balance is not currently being achieved.

Research

One of the major weaknesses has for years been in our research area, where a lack of priorities and designation, and woeful fragmentation has been the feature. With

* Autonomous universities and colleges around Australia,
* Departments of fishing in every State,
* The Maritime College,
* Commonwealth Scientific and Industrial Research Organisation, and
* Two major Federal fishing funds,

there is quite a lot of research being undertaken. How much of this is co-ordinated to flow on from existing knowledge is unclear, as are the matters of how much research is duplicated, how much is pure research with no specific goal, how much was undertaken with the industry's needs in mind, and how much was undertaken to improve the researcher's personal academic qualifications.

What I do say is that the situation has started to improve, but that fishing interests representing all four facets previously referred to should determine priorities, the organisations funded, personnel, and allocation of funds to those priorities.

The industry needs research -- research that is relevant, comprehensive, representing value for money. Research involving the practitioners of the industry must surely be proposed by or be demonstrated to them to be of value, and progress must be reported to them if full co-operation is to be expected.

The removal of antagonism or indifference and the obtaining of full industry co-operation makes all the difference to the success of so many trials and so much research.

An area that I would nip in the bud is that of aspiring researchers gathering and being given sole access to vast amounts of information, then regarding it as their own and bottling up vital trends, conclusions etc. for 2 to 4 years while it suits their personal timetable, when an industry -- and not only the fishing industry -- could be in dire need of those facts.

Future expansion of the fishing industry rests with the identification and development of new fisheries. This will require a sustained research effort, not only to identify potential new fisheries, but to ensure that they are exploited wisely and profitably. In doing so, we must also break the chain of simply seeking to overcome one problem by just passing it down the line to where we then create the same or another problem in another fishery.

Status of the Industry

On a positive note, the status of the industry in Australia has shown great improvement lately, and I believe that it will continue to improve. The attitude once held that fishermen were "waterborne peasants" and could be treated accordingly is now substantially gone. The fact is that they are far from being peasants; they run big businesses, they invest big money, increasing numbers of fishermen are intensively skilled and highly professional, and becoming more so all the time.

They are perfectly capable of facing issues, of using their skills and knowledge, and of developing the industry of the future, given the guidelines of the National Fisheries Policy which at last clearly identifies the objectives and strategy for the rational utilization of Australia's total fisheries resource.

Artificial Restraints

During the conference there has been a continuing reference to artificial restraints. Fishermen and their technology have become more and more efficient, not only in Australia but worldwide, and this very fact extends the major problem of increased catch. Consider what radio, radar, sonar, nylon, refrigeration and fibreglass alone have done to fishing.

The whole range of artificial and generally inefficient controls, including licensing and seasonal restraints, break down due to the compensating catch increases which regularly and apparently automatically occur simultaneously.

I have not yet seen any restraint measure implemented in Australia that has not, initially at least, resulted in increased effort being applied. Recovering from that expansion is always so difficult, as we well find in the Bass Strait Scallop fishery in Australia right now!

World Fisheries

With co-operation between the myriad groups involved in fishing on a worldwide basis, starting with fishermen and taking in the entire range of fishing support industries, governments and international organisations, sensible management policies can be implemented to protect fisheries from over or inefficient exploitation, and preserve the product and the industry for future generations of fishermen and consumers.

In Conclusion

The one common denominator is that all fisheries seem to have problems. So, I say to you all that there is no special merit in

* The identification of problems, or in

* The production of historical facts, or in

* The presentation of Economic or Scientific Models and Theories,

* Or in so many other things that you have so worthily and expertly presented,

UNLESS you can demonstrate how you propose to develop that theory or data to DO something, particularly for the benefit of the industry you support.

I regard this conference material as a presentation of a most useful range of background and position papers, and I put it to the executive to look at it that way also.

May the next conference be designed to build on the matters identified here, specifically to demonstrate how much of the theory and conclusions can be used to benefit the economical, sociological and biological aspects of the fishing industries of the world.

This organisation studying, as it does, the economics and trade in fishing and fish, is the ideal forum for discussing the issues, establishing the causes, and producing the cures.

In the years ahead I believe the Institute will have a considerable influence on "Fishing International" and I am very pleased that I was given the opportunity to participate in the conference.

PROFILE OF THE AUTHOR, AUSTRALIAN SENATOR BRIAN R. ARCHER

Senator Brian Archer represents Tasmania in the Federal Parliament of Australia, and has done so since 1975. During that time he has been a member of and mostly Chairman of the Liberal/National Parties' Fishing Committee.

As Chairman of the Senate Standing Committee on Industry and Commerce, he presented a report to the Parliament entitled "Development of the Australian Fishing Industry." Taking over 2 years to produce, and involving the most thorough investigation and visiting programme ever undertaken for the Australian Fishing Indsutry, it enabled Senator Archer to put a political and an industry viewpoint together in a way that provides a blueprint for the next decade.

There are not many fishing ports or organisations in Australia where the Senator is not known. He has visited industry people in Japan and Taiwan, New Zealand and the United Kingdom, and has been a regular participant in industry matters in the Parliament and throughout the Australian industry.

Senator Archer lives on the North West Coast of Tasmania, on a farm with a sea-frontage to Bass Strait, and where the family interests involve the breeding of stud beef cattle and sheep, and the growing of vegetable crops.

A Management Agency Perspective of the Economics of Fisheries Regulation

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Introduction

There is an extensive literature on the economics of fisheries management, but very little has been written from the perspective of the management agency. The question of which types of controls will meet economic efficiency or other objectives has received considerable attention (Crutchfield, 1961; and Anderson, 1977, Chapter 5). However, the problem of selecting and optimally implementing a management regime taking into account enforcement, noncompliance, limited agency budgets, and other such real world problems has not been analyzed. That is, we really do not have a rigorous analysis of how fisheries agencies rationally can go about the business of managing fisheries. The purpose of this paper is to fill that void. The discussion will be in terms of an autonomous agency with considerable flexibility because this will facilitate a general discussion. In those instances where flexibility is limited by legislative mandate, the agencies will have constraints other than those described below. In those instances where regulation activities are spread over several agencies (i.e., management councils set quotas but the Coast Guard does the enforcement) the analysis here must be thought of as the operation of a cooperative interagency task force. From the discussion, however, the problems which may arise if such cooperation does not exist is easy to discern. Further research on the economics of noncooperative agency behavior would be useful.

The paper will proceed as follows. First the management problem from the agency's perspective is discussed by describing the actual types of control variables. Then the less than direct relationship between agency control variables and fishing industry behavior and its importance in practical policy is described. The final section analyzes the economic problem of running a fishing agency. A mathematical analysis of the problem is left to an Appendix, which, among other things lists the relationships that will be important in undertaking proper management.

What Are the Control Variables?

Although in most formal fisheries economics models, the control variable is either fishing effort or fishing mortality, and sometimes the size at first capture, in actuality these are only indirectly controlled by fisheries agencies. The only things that agencies can directly control is the governing instrument, the monitoring procedure, and in some cases, the type of penalty, as well as the levels of each of these activities or instruments. Industry behavior with respect to effort, mortality, etc., is controlled by the way individual firms react to the control instruments selected and the way they are implemented.

The first control variable is the choice of governing instrument. There are many particular types from which to choose: input controls, closed seasons, closed areas, individual transferable quotas, limited licenses, etc. Once an instrument (or a combination of several) has been selected, it is necessary to determine the level at which it is to be operated. For example: Which should the total quota be? How many licenses should be issued?

Determining the type and level of the governing instrument, however, will not by itself change fishermen's behavior. The program must be monitored and hence the second control variable is the type of monitoring procedure. Here again, there is a wide range from which to choose: dockside, sea surface, or aerial observation, reviewing financial or other records, etc. Once a monitoring program has been selected, it is necessary to determine its extent of use, which usually is a decision on the amounts and types of resources that will be allocated to it.

The third control variable is the penalty structure. Even with monitoring or enforcement, there will be no change in industry behavior if there is no penalty for deviant behavior. Possible choices are jail terms, boat or gear confiscations, forfeiture of catch, and fines. Again, once the type of penalty has been chosen it is necessary to determine the level. That is: How high should the fine be? How long should the jail sentence be?

In summary, fisheries agencies only indirectly control industry behavior and they do so by selecting a combination of governing instrument, monitoring program, and penalty structure. Further, the controls open to a management agency can be thought of as fixed and variable. The fixed controls are the particular instrument, program, and structure while the variable controls are the level at which each are set. The operational goal of a fisheries management agency should be to select the proper combination of fixed controls and to use them at the appropriate levels such that, given their budget constraint, the optimum industry behavior change can be accomplished.

The Relationship Between Control Variables and Fishing Behavior

As pointed out above, a fishery agency only indirectly controls industry behavior by the choice and implementation of governing instrument, monitoring program, and penalty. For purposes here, assume that fishing behavior can be measured by fishing effort, denoted by E. With no regulation, the equilibrium level of effort will depend upon the price of fish (i.e., the demand curve), the cost of producing effort, and the relationship between harvest and effort which is determined by the biological productivity of the stock. In its simplest form, this equilibrium can be thought of as the intersection of a total revenue curve and a total cost curve in the Schaefer analysis (Gordon, 1954; and Anderson, 1977, Chapter 2). A change in price, cost, or biological productivity will change the open-access equilibrium operation point.

The motivating forces behind fishermen's behavior do not change under regulation. Each will still try to maximize profits. The only difference is that they must now do so given the constraints imposed by the regulation program. The individual firm will continue to produce extra units of effort as long as it is privately profitable to do so. With regulation, however, they also may find it profitable to undertake regulation avoidance activities which make it more difficult to detect prohibited fishing behavior. Avoidance activities can be anything from underreporting catch to subterfuges such as fishing or landing fish at night or the use of remote ports or fishing grounds. It is a separate activity from producing fishing effort and firms will allocate resources to it as long as the returns (increased illegal catch or reduction in penalties) and greater than the resource cost to engage in it. Individual fishing firms will select that combination of effort and avoidance activities that maximize profits given the nature of the existing regulation regime.

To completely understand the profit maximizing behavior of regulated fishing firms, it is important to realize that it is directly related to success of the monitoring program in detecting deviate or prohibited behavior. In general, the amount of otherwise restricted fishing that is detected will be a function of how much is produced, and the amount of avoidance activity (both under the control of individual firms), as will the allowable level and the amount of monitoring activity (both under the control of the management agency). This can be expressed as follows:

$$C^D = C^D \overset{(+)(-)(-)(+)}{(C, A, \bar{C}, m)} \qquad (1)$$

Let C^D be the amount of a particular control variable that is actually detected, C the level that is actually produced by the fishery, and $\bar{C}$ is the allowable level of the variable. For example, if the control variable was a quota, C would equal actual catch, $\bar{C}$ the allowable catch, and C^D the measured catch. The terms A and m refer to the amount of avoidance activity and monitoring, respectively. The signs in parenthesis represent the likely sign of the first derivative with respect to that variable.

The detection function will be different for various control instruments. For example, catch restrictions are easier to monitor than are area closures or are gear restrictions when more than one type of gear is allowed on the boat. Therefore, equation (1) emphasizes a very important aspect of management. Although there has been little or no research on the nature of the detection function, it is an integral part of applied fisheries management. To be specific, certain control variables which look good in theory may have a detection function such that the percentage of detected output to the allowable output is very low at any level of monitoring, and, as such, they will not likely be successful.

The detection function is important for the individual fisherman because it determines the level of penalties and hence, their profit maximizing combination of effort and avoidance activities. The penalties to the fishing firm will be a function of the difference between the detected and the allowable amount of the control variable. Taking this into account, the fishing firm will produce marginal units of effort as long as the value of the catch is greater than the sum of the harvesting cost and the expected penalty cost. At the same time, it will be produce avoidance activities as long as the cost of the marginal unit of avoidance activity is less than the reduction in penalty payments. For a more detailed discussion of this see Anderson and Lee, 1984.

Given the above behavior on the part of individual firms, the aggregate regulated equilibrium level of effort and avoidance activity will depend upon the price of fish, the cost of harvesting, the biological productivity of the stock, as well as on the allowable level of the control variable, the amount of monitoring, and the size of the penalty or fine. Therefore, if price, cost, and biological productivity remain constant, it follows that the equilibrium regulated level of effort and avoidance are indirectly determined by the actions of the agency. In terms of the above notation, the agency directly controls C, m, and K, and the individual firms choose their profit maximizing combinations of E and A accordingly. Therefore, the agency will indirectly control E and A as represented in equations (2) and (3).

$$E = E\,(\overset{(+)}{\bar{C}},\ \overset{(-)}{m},\ \overset{(-)}{K}) \tag{2}$$

$$A = A\,(\overset{(-)}{\bar{C}},\ \overset{(+)}{m},\ \overset{(+)}{K}) \tag{3}$$

The signs in parentheses represent the likely sign of derivatives. The effect of a change in avoidance activity is particularly interesting. In all likelihood avoidance will first increase but then decrease with m. Avoidance will be zero with no enforcement (noncompliance may be high, but there will be no incentive to distort the perceived amount of the control variable because there is no monitoring). It will initially increase with m, however, because monitoring increases the chances of detection and it be privately productive to reduce the detected portion of the controlled output. Ultimately, however, avoidance activity will fall back to zero as monitoring increases because it will increase the chance of being caught enough that the productivity of detection avoidance decreases.

Again there has been little research on the nature of these relationships, but if a fishery agency hopes to regulate with any degree of accuracy it has to know what effects different policies will actually have on industry behavior. Knowledge of these functions will help them to determine which control variables are more suitable to their particular problems.

Before moving on to the next section, several comments concerning avoidance activity are in order. These activities are important for two related reasons. First, if economic efficiency is important in fisheries management, then it is necessary to take into account the degree to which any control program will encourage avoidance activity. The cost of such activities are really an implicit cost of the program in the sense that resources producing goods and services elsewhere in the economy are directed to the fishery. The unfortunate thing about these costs is that there are no net offsetting benefits. They merely allow the industry to operate at a socially undesirable level of output, the problem for which the control program is trying to correct. In the literature, these uses have been called directly unproductive profit-seeking activities (Bhagwati (1983)). Second, avoidance activities are important because they can affect the general overall productivity of a management regime. That is, while they have no socially beneficial effects, the private benefits of reduced detections lowers the potential benefits to be gained from a management program.

The Economics of Management Agency Operation

The basics of the economics of agency operation can be most easily presented in terms of a specific problem. The problem is described and analyzed in some detail in the Appendix. The purpose here will be to discuss the common sense results of that formal analysis.

Consider a management agency which has two independent fisheries under its control. Its goal is to optimally manage these fisheries given the budget allotted to it by the legislature. Assume, as is most likely, that the legislature also determines the nature and extent of the penalty program, which for purposes here will be a fine. Assume also that the objective of management is the maximization of the present value of output although any other quantifiable objective would do as well. In terms of the above discussion, the problem facing the agency is to select the proper combination of governing instrument and monitoring device and then select the optimal level of both. This must be viewed as a stepwise problem, however. First, for each of the possible combinations of governing instrument and monitoring device, the level of each which generates the highest net present value must be found and the net gain noted. The second step is to identify the combination which, when used optimally, will generate the highest net benefits.

Consider first the problem of optimal management for a given combination of governing instrument and monitoring device. The issue here is to select the appropriate level of each control variable given the budget constraints. To make the problem more tractable at this level of discussion, assume that the cost associated with each governing instrument is fixed. In this case the reduced problem is to determine how to allocate the discretionary funds (i.e., the total budget minus the fixed cost of the governing instrument) toward monitoring the two fisheries. (This fixed cost assumption may be too restrictive in cases such as a quota where the reliability of estimated allowable catches will vary with research costs. In that instance it would be necessary to optimally allocate the budget between research and monitoring for the two fisheries.)

The first order conditions for the solution to the problem as stated are presented in equations (A1) to (A4) in the Appendix. The optimal level of the governing instrument for either of the fisheries is where the increase in marginal net value to the fishery due to the change in effort which results from the change in the governing instrument is equal to the marginal avoidance cost generated. (See equations (AI) and (A2).) That is, changing the governing instrument will have an effect on the actual output of effort produced which will in turn affect the level of benefits generated by the fishery. At the same time, however, changing the governing instrument will also change avoidance costs indirectly through its effect on the motivation of the individual fishermen to use resources to avoid detection. Only if the former is positive and greater than the latter does it make sense to change the governing instrument. Note that there is no agency cost per se involved here. Since programmatic costs are assumed fixed, changes in the size of the control variable (i.e., the size of a quota), will not affect management costs. The only costs are the indirect effect on industry avoidance costs. The point is, however, even though these costs will never show up in an audit of agency books, they must be considered in determining the optimal management program.

The problem of determining the optimal level of monitoring is different, however. First, there is an actual agency cost, and second, there is a budget constraint. Looking at each fishery independently for a moment, optimal monitoring occurs when the last dollar spent on monitoring yields at least a dollars' worth of net benefits. The marginal net benefit from monitoring is the change in the value of harvest minus the change in avoidance costs. See equations (A3) and (A4). In general, an increase in monitoring will reduce illegal effort and therefore, reduce the waste of overfishing (causing a positive gain), but it will also either increase or decrease avoidance costs.

If, before the uncommitted budget is exhausted, a point is reached where the last dollar spent on monitoring produces a dollars' worth of benefits, and further increases in monitoring will produce lower benefits, monitoring activities should be fixed at that level and any remaining funds should be returned to the treasury. The budget constraint is not binding, and further monitoring will result in net losses.

However, if there are not enough funds to push the net benefit from a dollars' worth of monitoring in both fisheries to a dollar, there is a binding budget constraint. In this case, the discretionary dollars must be spread amongst monitoring the two fisheries according to where the net benefits are the highest. In policy terms this means that otherwise independent fisheries become independent from an agency perspective because a dollar spent on one fishery is not available to be spent on the other. The optimum allocation of the fixed budget will occur where the net benefit for the last dollar spent in monitoring in both fisheries is equal. If the net marginal benefit is not the same in both fisheries, total benefits can be increased by shifting a dollar from the fishery where the net benefits are lower to the one where they are higher.

All else equal, the above analysis means that those fisheries with lower avoidance costs, lower harvest costs, and higher values of output will be the ones where it is more profitable to use available monitoring funds because monitoring them will produce higher benefits. In certain instances, it may be that the entire monitoring budget should be spent on only one fishery because the returns of even the first unit of monitoring in a lower valued fishery may not be as high as the returns to the last dollar spent on the more profitable fishery at the point where all monitoring funds are spent on the latter.

It should be pointed out that when the budget constraint is binding, the reverse argument can be made concerning funds from the general treasury. Since the last dollar spent on monitoring on either fishery generates more than a dollars' worth of benefits, it will make economic sense to increase the agency budget provided it is used on monitoring.

This completes the analysis of the optimal management given a specified combination of governing instrument and monitoring device. There are, however, many combinations of instruments and management devices that could be used, especially with more than one fishery to manage. If the above conditions are achieved for a particular combination, net benefits (i.e., the difference between gross benefits and the sum of the fixed programmatic cost for the governing instrument and the discretionary funds used on monitoring) will be as large as possible given that combination and budget constraint. A similar analyses is necessary for all relevant combinations so that the agency can select the one which produces the highest net benefit.

Summary

To those familiar with the microeconomic theory of the firm, its similarities to this analysis should be obvious. While a management agency is not trying to maximize profits per se, if it is to operate optimally it must engage in maximizing behavior. And while doing so it must take into account the nature of its indirect control over industry behavior (see equations (1), (2), and (3)) and its budget constraint. In one sense the control relationships may be thought of as the agency's production function. It can be seen from this analysis that while the level of the governing instrument (i.e., how high should the quota be) commonly receives the most attention in policy debates, more properly the focus should be on a wider range of control variables. In particular, the type and amount of monitoring is very important. In many ways, monitoring is the real driving force behind management. Further, it is very important when it comes to the proper allocation of agency budgets. It cannot be stressed enough that there is more than one control variable for fisheries management and discussions which ignore the complete range of variables open to an agency unnecessarily limit the focus and hence the chances of achieving optimal management.

It is also important to note that the net benefit of any management regime is a function of many variables. The literature has clearly shown that one difference between quotas, gear restrictions, closed areas, etc., on the one hand and those instruments which try to limit effort (i.e., taxes, transferable individual quotas, etc.) on the other, is the efficiency with which effort is produced (Rettig and Ginter, 1978; Pearse, 1979; and Sturgess and Meany, 1982). This analysis, however, shows that ease of enforcement and the effect on avoidance behavior are also important for the overall efficiency of a management program. In this light, the former group of instruments, their production inefficiencies notwithstanding, may not be as undesirable in an overall sense as commonly believed.

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Appendix

Many of the problems faced by fisheries management agencies can be described in terms of the following example. Assume the agency manages two independent stocks of fish, red fish and blue fish. Each are regulated by an allowable effort program. The agency has a budget from which it must pay the programmatic costs of the controlled effort program, which are assumed fixed, and the costs of monitoring, which depend upon the amount of monitoring applied to each fishery. The problem for the agency is to select the appropriate levels of allowable effort in the two fisheries and to allocate the uncommitted funds (i.e., those not used from programmatic costs) to monitoring the two stocks. Further these decisions should be made such that the present value of harvest is maximized. With a fixed price for both types of fish, the value of harvest in any one year expressed a function of agency control variables is:

$$P^r y^r[E^r(\bar{E}^r, m^r, k^r), X^r] - c^r(E^r) - \gamma^r A^r(\bar{E}^r, m^r, k^r)$$

$$+ P^b y^b[E^b(\bar{E}^b, m^b, k^b), X^b] - c^b(E^b) - \gamma^b A^b(\bar{E}^b, m^b, k^b)$$

$$- m^r - m^b$$

where P^i = price of fish

y^i = harvest of stock i

E^i = actual amount of effort in fishery i

$\bar{E}^i$ = the allowable amount of effort in fishery i

m^i = the dollar amount spent on enforcement in fishery i

k^i = size of fine in fishery i (assumed fixed by the legislative)

X^i = stock size for stock i

c^i = cost function of effort for fishery i

γ^i = unit avoidance cost for fishery i

A^i = amount of avoidance for fishery i

The $E^i[\ ]$ and the $A^i[\ ]$ functions are the effort and avoidance functions which show the indirect relationship between industry behavior and agency controls. See equations (2) and (3) above.

The first order conditions for an interior solution to the constrained Hamiltonian for this problem are:

$$[MNV_{E^r}]\, E^r_{\bar{E}^r} - \gamma^r A^r_{\bar{E}^r} = 0 \qquad \text{(A1)}$$

$$[MNV_{E^r}]\, E^r_{m^r} - \gamma^r A^r_{m^r} - 1 = \lambda \qquad \text{(A2)}$$

$$[MNV_{E^b}]\, E^b_{\bar{E}^b} - \gamma^b A^b_{\bar{E}^b} = 0 \qquad \text{(A3)}$$

$$[MNV_{E^b}]\, E^b_{m^b} - \gamma^b A^b_{m^b} - 1 = \lambda \qquad \text{(A4)}$$

In all cases the subscripts refer to first derivatives. The term in brackets represents the marginal net value of a unit of effort applied to a particular fishery. It has been expressed thus for notational simplicity. More formally, it can be expressed as:

$$MNV_{E^i} = (P_i - \Psi_i)\, y^i_{E^i} - c^i_{E^i} \qquad \text{(A5)}$$

The term Ψ_i can be interpreted as the shadow price of a unit of stock in place (Clark, 1976, Chapter 4). Thus, the marginal net value of a unit of effort is the net marginal value of harvest (market price minus shadow price times marginal product of effort) minus the cost of production.

Equations (A1) and (A3) imply that the level of the control variable $\bar{E}^i$ should be increased as long as the gain which results (which depends upon the change in the actual level of effort produced due to a change in the control variable and the size of the MNV_E) is equal to the marginal avoidance costs that are brought forth from the industry.

Equations (A2) and (A4) imply that the uncommitted funds should be allocated to the monitoring of the various stocks until the marginal returns to the last dollar spent on each stock are equal. The marginal return to monitoring is the product of change in actual E due to a change in monitoring times the MNV_E minus the resultant avoidance costs generated. In no case, however, should monitoring be used to the extent that marginal returns become less than a dollar. In that case, the budget is not binding on the maximization process and excess funds (i.e., those affected will have negative net returns) should not be used.

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