Fishery Access Control Programs Worldwide:

Proceedings of the Workshop on Management Options for the North Pacific Longline Fisheries

Orcas Island, Washington
April 21-25, 1986

Alaska Sea Grant
Report No. 86-4

University of Alaska
December, 1986

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Acknowledgements

The planning and coordination for this project were carried out jointly by the Sea Grant College programs at the University of Alaska and Oregon State University.

We wish to thank Mr. Joe Yuska of Oregon State University for his thoroughness in on-site coordination of the workshop.

This publication is the proceedings of a workshop sponsored by the University of Alaska Sea Grant College Program and the North Pacific Fishery Management Council. These proceedings are produced and published by the Alaska Sea Grant College Program, which is cooperatively supported by the U.S. Department of Commerce, NOAA Office of Sea Grant and Extramural Programs, under grant number NA86AA-D-SG041, project numbers E/66-03 and A/75-01; and by the University of Alaska with funds appropriated by the state.

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Introductory Papers

Introduction

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In the fall of 1985, the Alaska Sea Grant College Program embarked on a project to reopen the dialogue on management alternatives for Alaska's longline fisheries. A logical first step in the process was to discover what the worldwide experience has been to date with various kinds of limited access programs: their successes and failures. This was the purpose of the conference held on Orcas Island in the state of Washington.

The complexity of the controversy surrounding the recent history of the U.S. halibut fishery cannot easily be conveyed in a short introduction: therefore we have included an entire paper on the subject by Hugh Richards and Abby H. Gorham, in addition to an overview by R. Bruce Rettig of the material covered by the conference.

While it is premature and even presumptuous to draw conclusions about the guidance the conference provided to Alaska, its fishing industry, and the agencies responsible for the management of its longline fisheries, certain truths emerge from hearing and reading what participants contributed at the conference.

Most obvious is that there is no single management approach that addresses all the problems a fishery faces, nor is any one approach appropriate for all fisheries.

This implies that to go forward will require large doses of positive, productive interaction between industry and management. Further entrenchment of previously held positions, pro or con, is hardly what is needed. Instead, what is required is for people from all areas of industry and manage-

ment to pool their talents and apply the best available information to find a way that works best for all.

Decisions cannot be made affecting livelihoods of individuals and whole communities without knowing the expected consequences of those decisions. Consequently, large amounts of economic, social, legal, and political information will be required. In the realm of economics alone, much needs to be learned about the distributional effects of different management techniques, the effects of investment incentives, and the structure of the market for fishing rights, however these rights are imparted. As new information is gathered, it should be used to dispel uncertainty. A fisherman or processor needs to have as accurate an idea as possible of the long-term effects on his business that can be expected from a new management policy.

Related to both the need for information and the need to reopen the dialogue on the local level is the need to continue communications at the international level. Many pitfalls can be avoided by learning from the continuing experience of others, whose management systems have been in place longer.

Alaska is in a fortunate position in that the health of its halibut stock is currently good. Most worldwide experience to date with new management strategies has been in hurried response to a resource crisis. Alaska's situation provides a unique opportunity to thoroughly explore the alternatives and undertake the long-term study necessary to make wise management decisions in future years.

Overview

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INTRODUCTION

Restrictive licensing of fishermen, vessels, and gear is a widely used fishery management tool around the world and has attracted increasing attention in the United States in recent years. At the same time, fishermen and fishery managers wish to avoid undesirable outcomes associated with some of the best-known programs. Review of experience in both domestic and foreign limited access fisheries can be a useful starting place in considering new alternatives. Among the variations being considered for U.S. licensing programs are individual transferable quota programs like those recently introduced in Iceland, New Zealand, Canada and Australia, and large-scale vessel reduction programs like those used in Norway and Japan. Economic, social, and biological implications of these programs are of great importance. Fundamental concerns identified by fishermen, such as their need to have the flexibility to operate in several fisheries, must also be carefully considered.

In this chapter, each of the programs discussed at the Orcas Island workshop is summarized briefly. These summaries were prepared from discussion at the workshop and from other publications available, and are offered as a way of integrating papers in this volume with other information. The summaries are not meant to be comprehensive. While I have tried to stay close to the views expressed at the workshop, the items emphasized may reflect my biases about the importance of various issues and questions. The concluding discussion, in particular, is a synthesis of the conclusions of the workshop and my views.

NORWAY

Norway is particularly interesting to Americans, both because a considerable number of U.S. fishermen are of Norwegian descent (and thus have shared value systems) and because it has struggled with some of the approaches currently being considered for Pacific groundfish management. A brief historical outline, based on recent writings of Bjorn Brochmann, may be helpful in understanding why certain measures were undertaken, while other options were not pursued (Brochmann 1983).

From World War I to World War II

At the beginning of this century, the commercial fishing industry was very important in Norway, both economically and politically. A slump in foreign markets for Norwegian fish following WWI led to a long crisis, which had a number of important consequences. First, very powerful sales organizations emerged. Legislation gave these organizations great power over fish prices. While this may have had only a limited effect on fishermen in economic terms, the psychological impact in terms of establishing the perception that fishermen should have power to determine prices and incomes was considerable. Secondly, a public subsidy program for vessel construction was created. Thirdly, the argument that fisheries should be restricted to full-time fishermen was codified into law with the establishment of a general licensing program in 1950. Only persons having had at least three years of practice and who were still in, or connected with, the fisheries could own a fishing boat. Finally, small purse seiners were able to greatly restrict the development of trawlers until the 1960s.

From World War II to 1970

Wage and price controls, which had begun during WWII, were maintained after the war in order to ease the inflationary pressures from the pent-up consumer demands. Given a strong world market for Norwegian-caught fish, the government was able to establish a Reserve Fund from a large part of the export revenues. Over the next few years, this fund was used to raise prices paid to fishermen. When the fund was used up, the sales organizations appealed to and received substantial subsidies from the Norwegian government. In 1964, in order to get rid of the whole system of subsidies and to transform commercial fishing into a normally profitable occupation, the Norwegian government and the Norwegian Fishermen's Association signed the "Main Agreement." Price subsidies were to be phased out. However, the Fishermen's Association was given the right to demand negotiations for subsidies when the wage-earning ability for well-equipped vessels in full-year activity was not reasonably comparable to incomes in other industries.

Measures Since 1970

Measures of particular interest taken in the last decade and a half included the tightening of licensing programs and the introduction of individual vessel quotas and scrapping (buy-back) programs.

By the late 1960s, there was widespread recognition of international overexploitation of a number of fish stocks. As the Atlanto-Scandian herring was depleted, fishing effort switched to North Sea mackerel and herring. After those stocks showed yield decreases, fleets prepared to shift to capelin. A combination of factors, associated with perceptions of possible overfishing, led to a special license system for purse seiners in 1972, which permitted replacement of old or wrecked vessels but no new entry. That same year a similar program was introduced for shrimp trawlers, and later one for the saithe fleet. Deep sea trawling began after purse seining had already been developed. The principal objective of the trawling license control program was to address the concern that new and more powerful technology would be applied to fish stocks already heavily exploited.

Even with the controlled expansion implicit in the licensing system, fleet capacity exceeded bilaterally negotiated quotas. About 90 percent of the capelin quota is divided among the various purse seiners on a per vessel formula. Quotas increase digressively with size. For example, a large vessel may get a quota one third larger than a vessel half its size. This formula is a pragmatic tradeoff between considerations of efficiency, which would lead to larger quotas being given to larger vessels, and considerations of equity, which would lead to attempts to equalize gross revenues among all fishermen. In the cod fishery, the quota is allocated between trawlers (who get the minority of the quota) and the near-shore fleet, which uses a variety of gear types. Only the trawlers have per vessel quotas. Other vessels are primarily regulated through time and area closures.

In 1979, a scrapping program was introduced for the purse seiners under which a vessel owner received six million kroner to scrap his vessel and a smaller sum if the vessel was sold abroad or redeployed out of the fishery. From 1979 to 1985, the fleet was reduced by 80,000 gross registered tons (a decline of about 100 purse seiners with a total cargo capacity of over 100,000 hectoliters). Of this decline, 50,000 gross tons has been attributed to sales and scrapping schemes at a cost of 500 million kroner, which is about $60 million at current exchange rates (Hansen, this volume). A similar program for trawlers led to scrapping of 14 of about 80 trawlers at a cost of 60 million kroner between 1979 and 1981, which would have been about $12 million at exchange rates prevailing at that time (Brochmann 1983).

Discussion

Hannesson (this volume) has recently evaluated the purse seine licensing and fleet reduction program. He states that the licensing system was introduced for several reasons. Rapid depletion (due to a combination of overfishing and environmental change) made the conservation of important fish stocks a consideration of crisis proportions. Something had to be done to sharply reduce fishing effort, but whatever approach was taken would have to take account of the Norwegian public's commitment to the fishing industry. A second reason for introducing licensing was that specific groups of fishermen were concerned that other, more technologically efficient groups of fishermen might affect them adversely. Both of these rationales for change reflected a crisis atmosphere with little explicit attention to economic efficiency. Indeed, the underlying economic objective was not to attain an optimum fleet size, but to reduce the level of subsidization. This partly explains why the cheapest vessels were bought first, then somewhat more expensive vessels were included as well.

Hannesson concludes that economically advantageous aspects of the licensing arrangement (such as license transferability) evolved in response to fishermen's initiatives and were not planned by the government. He also believes that control of such fleet measures as number of vessels, gross tonnage, or cargo capacity was somewhat offset by investments in greater efficiency. Some of this investment (such as fish finders) may have been fruitless in terms of fishermen trying to increase their shares of a fixed total catch, but the investments also increased the value of the catch through better handling, and increased the comfort and safety of the vessel for the fishermen.

Finally, Hannesson concludes that the license retirement program generated more money for the fishermen than it cost the government. There may have been more efficient ways to deal with the overcapacity problem, but the approach taken appears to have been the only politically feasible method available at that time.

ICELAND

Iceland has recently restructured its management of demersal fisheries. After a long history of open access to its fleets, it has now introduced both restrictive licensing and individual transferable quotas. Since these measures appear both to be achieving conservation goals and to have enhanced the profitability of the fleet, they are worth monitoring closely. On the other hand, Iceland's circumstances have special characteristics, so that measures successful there may have to be modified to fit needs elsewhere. Consequently, a brief summary of why Iceland did what it did is included here, as well as a description of its actions (Arnason, this volume).

Before Iceland extended its exclusive fishing zone to 200 miles, substantial foreign fishing took place off its coast. Under these circumstances, restricting fishing effort by domestic fishermen was not politically acceptable. Iceland did impose total quotas for fish stocks that were subject to rapid decline and thought to be susceptible to depletion. Problems that plague the use of total allowable catch quotas--misreporting and nonenforcement--did not present difficulties for Iceland.

The quota imposed on Iceland's herring stocks in 1966 was converted to a complete moratorium in 1972. When fishing resumed in 1976, a program of individual vessel quotas, with limited eligibility for licenses, was introduced. In 1979, quota transfers between vessels were permitted. After rapid expansion in the capelin fishery had led to concern about depletion, a program to limit entry and set individual vessel quotas was introduced in 1981, with provisions for partial transferability of quotas being added in 1986. Following the extension of coastal fishing jurisdiction in 1975, demersal fisheries were managed by a total allowable catch quota. Licenses for individual vessels in the demersal fisheries were restricted in 1978, and a program for individual vessel quotas was added in 1984. Relatively young inshore shrimp and scallop fisheries were quickly placed under a program of license control and total quotas; recently, provisions for assigning individual quotas have also been considered.

The introduction of major management changes in most fisheries appears to follow a crisis. In the case of Icelandic demersal fisheries, the crisis was a decline in landings in 1982 and 1983, in the face of rising effort. As total quotas became increasingly difficult to enforce, a share system was introduced. Each vessel's share is based on its share of the total catch of the species in question during the three years prior to the introduction of the new system (with certain allowable exceptions, such as the necessity for laying a vessel up for repairs during a portion of the base period). The quotas are issued free of charge and normally are renewable (exceptions include violation of fishing regulations).

Individual quotas (or any fraction of them) are transferable, subject to slight restrictions. However, the continued holding of quotas year after year is a privilege, not a right, under law, and hence future quotas cannot be traded; i.e., since a vessel owner expects to receive shares but is not guaranteed them in future years, there is nothing tangible to sell. In addition, allowance is made for a restricted trading of quotas for one species for quotas for another species. While entry is not limited, only vessels that operated in the base period receive quotas.

Some problems have been observed. The most important fear is that individual quotas will increase discards, since fishermen have an incentive to maximize the value of a fixed quantity of fish. Landing prices are regulated in Iceland,

so evidence that appears of problems or lack thereof there may not apply to fisheries where prices fluctuate more and are less predictable. Local information concerning the impact of trip limits on discard rates may be a guide to the possible importance of this issue. On the other hand, Icelandic herring managers have experimented with value quotas as an additional measure to remove the incentive to discard. Such a system appears to have helped in some circumstances, but may have limited applicability. Another problem, which has not been of much concern to date, arises from the possibility of species substitution in quota formulas. There also may be a problem with an alternate option available to fishermen of going to an effort quota instead of catch quotas. These rights to a fixed number of days at sea for a given type of gear give fishermen extra flexibility, but may require additional conservation measures.

The system does appear to have enabled conservation goals to have been achieved with modest enforcement costs, since the threat of loss of future quotas is perceived to be a strong deterrent. Increased profitability has already been mentioned as an important result, as fishermen have saved costs through fewer days at sea (effort, which had been growing at 5-10 percent annually, decreased by 25 percent in the first year of program implementation) and enhanced planning opportunities. Fleet size has not decreased, since the licenses are issued annually and allocation formulas do not encourage rationalization of fishing effort. However, the fishing season has been lengthened and the quality of fish caught has improved. Since retaining a quota requires that vessels be well maintained, operating equipment is now in good condition.

The program is too new to learn much about redistributive effects, but effort and catch does seem to have shifted toward the western region of Iceland. Regulatory costs have been modest, this must be largely attributed to the small number of landing sites.

JAPAN

The Japanese have made extensive use of restrictive licensing and property rights arrangements for many years. A recent FAO report has described these arrangements well (Asada et al. 1983). Parallels in problems and in responses to problems between Japanese experiences and those of other countries are pointed out in a recent FAO technical paper (Beddington and Rettig 1984).

When the Japanese talk about their use of property rights, they mean something a bit different from what most North American economists have in mind. The Japanese property rights system refers to the delegation of much of the management responsibility from the government to a local cooperative that, in turn, decides who fishes and how. In this sense, the Japanese method of handling property rights reminds one of the initial Canadian experiences with Bay of

Fundy herring management. The main reason why this type of system works better in Japan than in most other settings is the strength of its fishermen's cooperatives.

The restrictive licensing system was a response to concerns expressed by inshore, artisanal fishermen about the threat from industrial fleets. This use of licensing to avoid conflicts and governmental headaches exactly parallels the implementation of licensing elsewhere, as for example with limitations placed on Norwegian deep water trawlers. Licensing thus tends to take on the more general purpose of reducing conflicts between groups of fishermen, and acts as the core of conservation-based measures. The Japanese have been forced to engage in the largest fleet reduction program in the world. From 1976 to 1981, more than 1600 vessels were withdrawn from service, at a cost of over 150 billion yen (about 700 million dollars) and a loss of 13,000 fishing jobs.

After a period of rapid growth, economic conditions declined in the Japanese longline tuna fishery. A vessel reduction program lowered the number of tuna vessels from 2,652 in 1975 to 2,075 in 1982 (Matsuda and Ouchi, 1984). Half of this ($5,408,552) was paid for by the Japanese government and half was financed by the remaining fleet under a low-interest, long-term loan from a quasi-governmental financial institution for agriculture, forestry, and fisheries.

NEW ZEALAND

Fishery management in New Zealand is in some ways quite different from the North American experience. There are also interesting similarities. Trawling for finfish has a long history in the inshore waters and has experienced rapid growth in deep water recently (Clark and Duncan, this volume). Inshore demersal catch rose from 46,721 tons in 1977 to 66,959 tons in 1983, while the deepwater catch jumped from 766 tons in 1977 to 29,300 tons in 1983. The inshore catch rose in profitability from 1974 to 1978 and has declined rapidly since, largely due to a shift in composition of catch toward relatively less valuable fish and to large cost increases in fuel and other expenditures.

Foreign fishing operations are being phased out for many valuable deepwater species. Joint venture companies are operating on a company quota arrangement, and initiatives are being taken to convert joint ventures into strictly domestic operations.

Licensing was introduced in 1936 and limited entry licensing after WWII. Limited entry was eliminated in 1963, but was reintroduced when a moratorium was placed on the issuing of rock lobster licenses in 1978. New Zealand extended its fishery jurisdiction in 1978. Since that time, fishery policy has heavily emphasized the replacement of foreign fishing with domestic operations, and the introduction of limited entry programs into many fisheries.

The 1983 Deepwater Trawl Policy formalized the earlier joint venture policy into a management system based on individual company transferable quotas. That same year, the Fisheries Act of 1983 consolidated legislation and introduced the concept of Fisheries Management Plans, and formal recognition was given to major economic and biological problems of the inshore fishery. Staff members of the Ministry of Agriculture and Fisheries have spent the last three years, in consultation with the fishing industry, developing a new management approach based on individual transferable quotas. The ITQ system is worth careful examination, both because of several innovative features and because of the detailed consultations with industry. The following description is based on Clark and Duncan's paper in this volume.

The individual transferable quota is a right to harvest a specified tonnage of a species that is managed under a total allowable catch (TAC) system. ITQs have been designed to have many of the features of other forms of property rights, i.e., they are perpetual and freely transferable, subject to a public recording that a transfer took place. Just as private property is subject to some conditions on its use, some restrictions, such as time and area restrictions needed to protect nursery grounds, are added to the harvesting of ITQs.

The initial allocation of ITQs was based, with slight modifications, on historical catch. Fishermen holding permits in May 1985 were informed of their catch records for the years ending in September of 1982, 1983, and 1984, and were to choose two of these years to use as a historical base average. Of the 1800 notified, nearly 1400 objected to their records on grounds such as errors in statistics, changed fishing patterns, and vessel and gear breakdowns. Objections have been reviewed by review committees, and updated catch histories were given to fishermen early in 1986. Provisional quotas will be identified by mid-1986. At that time, ITQs can be sold back to the government. If needed, provisional quotas can be reduced on a pro rata basis; but such a procedure is to be avoided so as to ensure credibility of the new system in the eyes of the industry. Finally, fishermen can appeal to a specially designated Quota Appeal Authority.

The New Zealand ITQ system is more fully described in Clark and Duncan's paper, but a few more features may be of special interest here. First, a sophisticated trading system is being set up, both to make it easy for the industry to buy and sell quota, and so that the government can use the market system to buy back quota when the TAC needs to be revised downward. Second, resource rentals (annual payments to the government based on the value of ITQs) will be charged to keep the value of ITQs from becoming so high that this program is unacceptable to other New Zealanders (because of a perception of an unfair windfall profit) and to recover the costs of fishery management. Industry members accept the principle of rentals, but have voiced objec-

tions to the level of the charges and to the proposed procedures for setting the rates. Finally, individuals implementing the new program have tried to anticipate quite a number of problems, such as discards and data fouling. Their conclusion is that they need an aggressive enforcement program that will have credibility among fishermen. They also need to follow an adaptive approach, involving ongoing discussions with fishermen and the ability to make changes as needed in response to unforeseen circumstances.

Designing the enforcement system has been made a joint activity of government and industry, both for the purpose of gaining cooperation, and so as to lay the groundwork for a possible delegation of enforcement from the government to some type of Crown corporation in the future. The basic idea is to minimize interference with fishermen, maximize flexibility for operation of fishing vessels, and yet ensure compliance. To do this, a "paper trail" is created. Fishermen keep landing logs, submit monthly landing reports, and can be required to make trip reports. Subsequent purchasers also maintain records. Investigations will emphasize computer analysis, financial audits, and review of source documents, rather than the boarding of vessels at sea or other physical confrontations.

An important part of any enforcement scheme is the nature of the deterrent. In New Zealand, an ITQ regulation violation will lead to forfeiture of the fish caught, and a second conviction will lead to the violator being banned from the fishery entirely. The deep-water operators fear being even suspected of wrongdoing. A boat can be held for up to a week during an investigation. With high operating costs and narrow margins, this fact by itself can act as a strong deterrent.

AUSTRALIA

Fishery management in Australia is particularly interesting to economists because of the extended experience there with limited entry, and to fishermen because of the influential role fishermen have played in the creation of fishery management measures. Normally, a discussion of groundfish management would not refer significantly to Australia, since its fisheries are primarily for mollusks and crustaceans, which are managed quite differently from groundfish. However, many of the trends in Australian fishery management are quite similar to events in the United States. Because of this, a brief summary of two new trends in fishery management are of interest. The following material is drawn from the papers by Lilburn and Robinson in this volume.

Australia introduced license limitation in the 1960s. Although economic goals were not of great concern (and management measures did not contribute greatly to economic efficiency), the limited entry program did appear to assist managers in meeting conservation objectives, while also resolving social conflicts among fishermen. In the 1970s, rising

fish prices, new technology, and high expectations associated with extended fishery jurisdiction were all factors in the rapid growth in fishing capacity. By the early 1980s, the incomes of many fishermen were either constant or declining, primarily due to rising costs (especially for fuel). After intensive discussions among state and federal fishery managers and fishermen, Australian fishery management is moving toward the introduction of individual transferable quotas where applicable, and toward fleet control through effort quotas wherever ITQs will not work.

The Southern Bluefin Tuna Fishery

The introduction of radically different management measures into the southern bluefin tuna fishery followed classical symptoms: an economic and political crisis precipitated largely in response to conservation concerns, but also by a fleet expansion that exceeded the available harvest. While management biologists' greatest concerns came from the stock decline and fear of a recruitment failure, fishermen were concerned for two other reasons: they were facing growing financial difficulties, and the original gear groups (especially pole and bait fishermen operating off the eastern and southern coasts of Australia) were adversely affected by the entry and growth of other gear groups (especially purse seiners and fishermen working off the western coast of Australia, who were operating closer to the major spawning grounds and taking younger and smaller tuna).

Major features of the fishery that made an ITQ program feasible in Australia include: (a) the fishery is based on a single, long-lived species; (b) the bulk of the catch is landed at five or six main ports; (c) most of the fish is either canned or exported frozen, with few processors involved; and (d) the fresh market is so small that black market sales would quickly satiate the market (Lilburn 1986). The ITQ system is a shares system: a national quota is set, and eligible fishermen get individual quotas based upon a formula. The formula to allocate initial shares was based on historical catch records (the best seasonal catch record during the qualifying years) and on the current market value of boats and gear. Robinson, who was involved in setting up the ITQ allocations, describes the process as having been very democratic, with extensive industry deliberations about how the formula should be devised; and yet quite authoritative and decisive in the way that the government executed the policies.

After the first year, only a few conclusions emerged (Lilburn), but these are most interesting. First, the ITQ program did permit an effective conservation program, with a TAC being implemented at a level far below recent catch histories. Secondly, catch capacity declined drastically, with active participants falling from about 130 to less than 60 in one year. Thirdly, the remaining participants have been directing the catch to higher paying markets, with the share being exported to Japanese sashimi markets rising sharply. While this means more money for fishermen, it does raise en-

forcement problems. One fishermen misrepresented his catch and is being prosecuted. To reduce this problem in the future, transshippers must have observers on board. Fourthly, catch location shifted markedly from Western Australia, where the catch was concentrated on small tuna going into canning markets, toward South Australia. This shift is consistent with conservationist and economic objectives, but has raised social concerns about fishing communities in Western Australia. Finally, some of the effort taken away from the southern bluefin tuna fishery appears to have shifted into other fisheries, some of which were already fully exploited. Effort shift is thus a reason to plan wherever possible for several fisheries at a time, rather than treating each as an isolated case.

The Northern Prawn Fishery

Early government involvement in the northern prawn fishery was rather like a motorist driving with one foot on the gas pedal and one foot on the brake. Public subsidies were used to develop the fishery, with the primary intent of increasing settlements in the sparsely populated north. Instead of that goal being achieved, an overcapitalized fishery was created, with the product moved either by road or by sea to plants elsewhere for processing, or else "bulk packed" on board trawlers. Initial limited entry programs, implemented in 1976, included a limited replacement policy intended to stop fishermen from upgrading their vessels to ones with greater capacity. When the replacement policy proved to be unenforceable, it was replaced with one which limited length--to just the size that qualified for a ship-building subsidy program. In addition to having little effect on average vessel size, the replacement policy had no impact on investment in new technology associated with boat design and construction, engine power, navigational aids, and fishing gear and equipment.

With a broad consensus that the fishery was facing a period of economic decline unless drastic actions took place, a joint industry-government committee, relying on advice from an industry organization, developed an input quota scheme. Representatives of the local fishing industry defined "boat units" of fishing capacity, calculated by a formula based on under-deck volume and engine power (Lilburn). These boat units were transferable: a vessel owner wishing to replace his current vessel with one of greater capacity (measured as one with more boat units) could buy boat units from another vessel owner. To fish in the northern prawn fishery, a vessel license had to be "endorsed" with the necessary number of boat units. Also, to get a license for this fishery a person had to retire all licenses to other fisheries.

A Voluntary Adjustment Scheme was implemented, which is to be financed by the industry. Late in 1985, fuel costs began to drop, and prawn prices were high. With rising net incomes, buy-back has become more difficult. For all practical purposes, further fleet capacity reduction may have to wait for an economic downturn. On the more negative side,

some of the capacity which left the northern prawn fishery moved to other prawn fisheries. The northern prawn fishery thus appears to be one more example of the dangers in planning fishery management for one fishery at a time; reducing excess effort in one fishery may increase excess effort in other fisheries.

Lilburn takes great pains to point out that the successes in input and output quota schemes, limited though they may be, are improvements and that these would not have been possible without substantial involvement of the fishing industry at two levels: membership on joint government-industry planning committees, and participation in advisory committees. Such consultation is time-consuming and expensive, but is key to the acceptability of new approaches in Australia.

CANADA

Access to commercial fisheries in Canada began to close in 1968 with a restrictive licensing program for salmon in British Columbia. By the end of the 1970s, 10 fisheries were under separate licensing arrangements, and open access to major fisheries ended. In every case, the new licensing arrangement followed a crisis. The common pattern was an increase in prices, followed by an expansion in fishing effort, followed by stock depletion (not necessarily caused by the fishing effort, but often aggravated by the difficulty in enforcing conservation measures in a timely manner when a fleet had grown too large).

Licensing programs probably started too late and began with excessively large fleets. Criteria for initial allocation of licenses included the grandfathering in of all operators with a recent history of participation and/or investment in fishing. Since holding a license not only allowed current participation, but also preserved future options of transferring the license or remaining in a fishery that might become more valuable, when restrictive licensing began the size of the fleet increased above the number that would otherwise have existed. For similar reasons, license holders were less likely to leave the fishery, thus turning limited entry into "limited exit." The measures, once taken, proved to be substantially irreversible. Any institutional change tends to have inertia; neither the majority of licensed fishermen nor the government has shown great interest in returning to open access.

Whatever the assessment of license limitation, a consensus emerged in the late 1970s that new approaches were needed. The Pearse Commission on the Pacific Coast and the Kirby Commission on the Atlantic Coast drew a great deal of attention, but the government was not able to completely pursue proposals for fishery rationalization. A number of reasons for inaction can be offered: the Minister of Fisheries has changed six times in recent years and there has also been great turnover at senior levels in the Department of Fisheries and Oceans. Fisheries have been generally depressed.

Gear wars have undermined leadership within the fishing industry. Budgets have expanded and contracted. While use of taxation as a management instrument is not being discussed as much as it once was, and while major disillusionment has been expressed with several of the license limitation programs, new initiatives with quota licensing and area licensing have drawn renewed interest.

Atlantic Canada

Groundfish scientists and managers working in the Northeast Pacific can learn much from the Canadian and U.S. experiences with groundfish on the other side of the North American continent. The harvest of groundfish in coastal waters off New England and the maritime provinces has a long and distinguished history. Sadly, stock depletion came to be an integral part of that history, especially with the appearance of large, distant-water fishing fleets. Finally, in 1972, the International Commission for the Northwest Atlantic Fisheries (ICNAF) introduced national quota controls and managed these until the United States and Canada established extended fishery conservation zones.

Atlantic Canada adopted restrictive licensing for offshore groundfish fleets in 1973. The combination of license limitation and traditional fishery management measures were not sufficient to deal with excess capacity and associated problems, especially the politically explosive competition between large offshore trawlers and the many small-scale inshore fishermen. In 1982, enterprise allocations were established for a portion of the offshore trawler fleet (Macdonald 1984). Using a formula based on historical catch, adjacency to the resource, and fishing capacity, the four large fishing companies negotiated quotas with the Department of Fisheries and Oceans. Seventeen smaller companies fished competitively for the remainder of the offshore quotas. The following year, due to restructuring of the major offshore companies, the program was temporarily discontinued. In 1984, at the urging of the Kirby Commission, enterprise allocations were resumed, and were applied to all fishing companies. Currently, in 1986, all allocations are being calculated at percentage shares of total allowable catches and are not transferable (Fraser, this volume). The program is probably too new to be judged fairly. In addition, major policy initiatives to restructure fishing companies, and recent stress associated with high costs and soft markets, makes it difficult to sort out effects of the program from other sources of change. In addition, problems arise from an ecologically and economically highly diverse mix of fisheries, which is intertwined with a rural economy facing high unemployment and few economic development options.

Individual quota programs have been used, and sorely tried, in the Atlantic Canadian herring fisheries. The federal government imposed limited entry in the mid-1970s on a chaotic fishery, which had just seen a decade of rapid expansion of fishing effort and a severe stock decline at a

time of low prices. Major changes were thought to be needed to separate the primary fishing industry from processors, to give fishermen improved bargaining power, and to raise ex-vessel prices by shifting herring from a meal to a food fishery (Peacock and MacFarlane, this volume). Among several actions taken, the Atlantic Herring Fishermen's Marketing Cooperative was given management authority with respect to an over-the-side sale to Polish processing vessels, at a price greatly in excess of the domestic herring price.

A unified management system, with the Department of Fisheries and Oceans setting quotas, and allocations being made by the fishermen's cooperative, so enhanced the earnings of the fishermen, the quality of the fish caught, and the ability to manage the fishery that many people began to see the Bay of Fundy herring fishery as a panacea and as a model for other fisheries. Unfortunately, after three successful years, the program unraveled. A group of fourteen purse seiners split away from the original cooperative to form the South West Seiners Co., Ltd. Fish quality declined as the average size of catch decreased, prices fell, and unreported catches greatly increased, leading to overfishing. In 1983, a new system based on individual quotas was put in place, along with other measures such as area licensing (restriction of each vessel to fish only in its area); a new quota system that allocated quota by areas to fleets and, on a share basis, to vessels within a fleet; a fleet-reduction program; and a new vessel replacement policy. Very serious misreporting problems and enforcement difficulties are the principal concerns at this stage (Peacock and MacFarlane 1986). However, at the outset of the program a commitment was made to keep the program unaltered for ten years. In addition to the administrative and enforcement issues already mentioned, herring fisheries are subject to wide variation in availability and abundance as well as to variation in market conditions. Careful assessment will be needed to separate the impact of the individual quota program from other influences.

Ontario

Based on concern about an imminent collapse in specific Great Lakes fish stocks, criticism of fisheries programs by recreational anglers, and problems with the lake trout rehabilitation program, government-industry discussions in 1979 led to the formation of a joint Committee to Modernize the Ontario Commercial Fishery. In its 1982 report, the committee proposed a program including individual species quotas based on the best three years in the period from 1976 to 1982, transferability of licenses and quotas (quotas could be sold in total or in part), a new license fee system consisting of a base price of $100 plus royalties (in 1987 these are, tentatively, to be 1.5 percent of landed value), reduced regulatory controls on fishing, and improved cooperation in the areas of "self-policing" and fisheries assessment (Haxell, this volume).

When the Ontario Minister of Natural Resources announced his plan to implement an ITQ system in 1984, industry members of the committee repudiated their earlier support. After quotas were initially assigned, 100 of the 900 licensees appealed their quota to quota review committees. Twelve fishermen appealed for government assistance to avoid financial disaster. Self-regulation emerged on Lake Erie with industry, in effect, taking over responsibility for enforcement of the individual quota program. The individual quota program has been appealed through the courts. While the appeal has gone against the challengers at the provincial level and is yet to be heard by the Supreme Court of Canada, the uncertainty introduced by the court case led to a period of overfishing which, in turn, was associated with a sharp drop in fish prices. Aside from that period, fishing has become more orderly, and prices and marketing strategies appear to have improved fishermen's incomes.

Evaluation of the new program is made more difficult by other events. Fish markets have had to adjust to foreign competition, a dioxin scare with respect to smelt, changes in tastes, and cost increases (Cowan, this volume). To gain greater industry acceptance, implementation has been incremental. TAC may have been set too high to meet requests for quotas, thus interfering with goals of protecting stocks. Incidental catch is a point of concern both to the government and to the recreational anglers. Also of concern are compliance problems: catches are not always reported on time, fishing locations are not reported accurately, and a trend toward vertical integration (fisherman becomes a processor and sells to himself) reduces accountability.

Perhaps the most favorable outcome from the program is the enhanced cooperation between the Ontario Ministry of Natural Resources and the fishing industry, both because individual quotas, in and of themselves, delegate more control to fishermen, and because of the extensive consultation process with fishermen.

British Columbia

License limitation has been used as a management technique in British Columbia for almost two decades. While the limited entry program has been effective to some extent in British Columbia, a broad consensus emerged that new approaches were needed in several fisheries (Pearse 1982). The roe herring fishery was one of the most chaotic and unmanageable fisheries in western Canada, with too many licensed vessels, too much investment in vessels, gear, and equipment, and declining production. The following account of recent trends in managing that fishery is condensed from Macgillivray (this volume).

In response to these concerns, area licensing was introduced on an experimental basis in 1981. Each roe herring license applied to a defined area and was good for that area for a period of one year; licenses could not be transferred during a season (other than when a vessel was lost or destroyed);

and a ceiling was placed on the number of licenses for each area. In 1982, the practice of multiple licensing began in both the seine and gillnet fleets and became especially important in the seine fishery. Since 1983, the catch quota for each area has been set well in advance of the fishery and is not subject to revision within the season.

Fishermen and fishery managers alike believe that area licensing has improved the ability of managers to meet biological conservation goals. Risk of overfishing appears to be slightly less, due to the smaller number of vessels on a specific fishing ground at opening. Gear congestion has been reduced. Within both groups (managers and fishermen), a variety of views are held as to the possible impact of area licensing on spawning stocks. Early in the program there was some pressure to take the catch during the opening; this was reversed when the Department of Fisheries and Oceans stopped making in-season changes in the total allowable catch for each area and moved to fixed catch quotas.

Economic gains from area licensing appear to be most favorable for gillnetters. Fuel costs have been reduced, as many vessels stay on one ground instead of moving from area to area. The fleet has also declined in size; the number of licensed gillnet vessels declined from 1305 in 1981 to 957 in 1985. Savings have also been made by seiners, but to a lesser degree, since a larger number of seiners own multiple licenses and single-licensed vessels will move to other grounds to assist pool partners. The number of seiners has declined from 252 in 1981 to 175 in 1985.

Income is being distributed differently due to area licensing. Earnings are more evenly distributed among active gillnetters than in the past, while the earnings in the seine fleet have become less uniformly distributed, with a greater share of the landings being accounted for by the top 10 percent of the fleet and a much smaller share being taken by the bottom 30 percent of the fleet. The advent of multiple licensing has also redistributed earnings from active fishermen to individuals owning licenses and leasing them to fishermen. Some members of the fishing industry greatly resent this fact. As the fishing effort has declined, members of fishing crews have become unemployed, which is viewed as a serious, even if short-term, cost to fishing communities.

Administrative costs have gone up slightly due to an increased work load in the DFO License Division and the need for improved stock forecasts, brought about by the change from in-season closures to fixed area quotas. On the other hand, cooperation between fishermen and the Department of Fisheries and Oceans has improved, making administration and enforcement much easier for the officers involved.

Conclusions

Peter Pearse suggested at the workshop that the Canadian experience leads to five major conclusions. First, a convincing plan must be developed and managers must stick to it.

The plan must be directed at fishermen's key concerns. Fishermen want to know what their circumstances will be in the near future. They want to be better off in terms of both profits and size of landings and they want stocks to be improved or, at least, to not decline. Consequently, plans must be clear and efficient, consistent, and show promise of personal improvement.

Secondly, disaster is the mother of institutional change. When circumstances have deteriorated sharply, a consensus can be formed that a change is needed. As a result, reflective thinkers in the industry and in government should continually be looking for possible improvements. When crises break, the new options can then be offered.

Thirdly, equity is more important to the industry than economic efficiency. Fishermen are concerned about their shares at all levels: their individual share of a vessel's earnings, their vessel's share of the fleet catch, their gear group's share of the total allowable catch, the share of the biomass that is allowed to be caught. The concept of equity is an elusive one. Perceived equity is more important than the share actually received.

Perceptions of fairness are difficult to communicate to outsiders, which leads to the fourth conclusion. Fishermen have to be involved with the process of institutional change. In addition to being the best at making social judgments, they are better able to judge how they are likely to respond to new circumstances than an outsider would be. Involvement is also important to prevent the fisherman from feeling that something is being imposed on them.

Finally, leadership is important. Promising programs have failed because no one was capable of demonstrating leadership when consistent action needed to be taken. While the fact that Canada does not have to resort to a lengthy legislative procedure means that new policies can be quickly implemented, turnover of leaders and the ability of new leaders to step away from previous policies means that those policies are not given a fair trial.

UNITED STATES

Many techniques of restricting entry of new fishermen and allocating fishing opportunities among fishermen have been used in the United States. These include the private ownership and/or leasing of oyster beds, voluntary layups between fishing trips in the Pacific halibut fishery, trip limits (nontransferable vessel quotas) in both Pacific and Atlantic groundfish fisheries, harbor gangs that let new entrants to New England lobster fisheries know the consequences of incursions to some or all of the best grounds, and many other responses from fishermen, processors, and governments that discourage entry. Restrictive licensing, however, has had a relatively short history in the United States. Most of the limited entry programs introduced in recent years are found

in the Pacific states and the Great Lakes states; there is also one major fishery under a limited entry program in the Atlantic.

The idea of license limitation has faced major opposition in the United States, especially in multipurpose, multispecies fisheries. One reason is that fishermen are fearful that restrictive licensing is coming into place in a piecemeal fashion; the solution of a problem in one fishery then becomes the problem in another fishery. This is of great concern to fishermen who have diversified their operating strategies so as to participate in several fisheries within a given year and to shift from fishery to fishery, as environmental forces cause some stocks to increase while others are on a decline. A second concern lies with the price of entry. While ITQ and transferable license programs do allow multipurpose fishermen to operate in several fisheries, fishermen fear that the cost of buying or leasing licenses could make diversification more expensive.

Even when many fishermen become interested in license limitation, such programs are hard to implement. In some areas, processors have opposed restrictive licensing, perhaps because the creation of a smaller, better organization of fishermen would alter bargaining power. In a pluralistic democracy, minorities are often able to exercise a veto, especially when they feel as strongly about something as some groups feel about limited entry.

Allocation is a critical issue in institutional change, especially when a fish stock has been depleted and is being rebuilt. Before fishermen are willing to make short-term sacrifices, they want to know what their long-term gains will be.

When restrictive licensing programs are discussed prior to resolution of allocation issues, the uncertainty about who will receive the future gains makes the whole question of sacrifice an intellectual exercise of little interest to fishermen. Governments find allocation questions very difficult and resort to procrastination via additional studies when new policies may require extended discussion and negotiation with fishermen.

License limitation has been slow in coming because of institutional inertia. Fishery managers are used to managing for biological conservation goals. Economic management not only greatly adds to their efforts, but it is a foreign concept for many.

Finally, one of the greatest difficulties for license limitation in the United States is that it begins with moratoria. A moratorium is a transitional phase, and it tends to be accompanied by a number of problems. In many cases, managers do not move to a permanent system and fishermen begin to think of the uncertain, unstable first phase as the program itself. They become cynical about any form of restrictive licensing, so that it becomes harder to introduce simi-

lar programs elsewhere. Nonetheless, some licensing programs are becoming mature enough to have advocates as well as critics.

Mid-Atlantic Surf Clams

The surf clam fishery that takes place along the Northwest Atlantic Coast of the United States was the first fishery to be placed under federal limited entry in the United States (Nichols, this volume). The reason for this uniqueness may be as much a matter of timing as anything else. The Magnuson Fishery Conservation and Management Act followed wide-ranging discussions among processors, fishermen, and state and federal fishery managers, who were seeking ways to recover from a biological crisis. All the involved parties agreed that recovery would require sharp control over excessive fishing capacity. The surf clam fishery management plan was one of the first to be put into place under the Magnuson Act.

In order to rebuild the surf clam populations while minimizing short-term economic dislocations and preventing excess harvest of the ocean quahog resource, a wide range of management tools were chosen. In addition to the moratorium on new entry, measures included quotas, time and area closures, a new licensing program, record-keeping systems for both fishermen and processors, and vessel marking requirements. The vessel moratorium, which was intended as a temporary measure, has been extended again and again. Although observers disagree on its effects, industry members have supported its continuation largely in the belief that they have borne significant costs to support resource recovery and should be the primary beneficiaries of improved harvests. Nichols concludes, however, that "the moratorium raises all the philosophical issues attendant upon discussion of more refined and comprehensive limited entry management options, but offers none of the management benefits which could be had through a more accurate matching of physical harvesting capacity with maximum sustainable yield."

Michigan

In the nineteenth century, Great Lakes fisheries provided large and valuable commercial harvests to the United States.[1] The cumulative impact of environmental degradation, along with the invasion of the sea lamprey, had devastating consequences for a number of the most valued species. When substantial cooperative efforts between the United States and Canada led to a revitalization of Great Lakes fisheries in the 1960s, fishery managers in the United States acted aggressively to change fishery management as sharply as the ecosystem had been changed.

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[1] Discussion based on unpublished material presented at the workshop by Asa Wright.

Restrictive licensing was introduced in Michigan in 1968. In 1970, licensing arrangements were changed as the lakes were zoned into areas of preference for rehabilitation, recreation, and commercial fishery development. The number of commercial fishermen has greatly declined, with the number of licenses falling from about 1000 in 1965 to about 90 today. Part-time fishermen were the first category targeted for elimination. Michigan attempted to eliminate gill nets in 1974 in order to restrict commercial fishing to gears capable of selecting non-recreational fish. After a period of unsettling conflicts in the courts between the state and Indian tribes, a negotiated 15 year management plan used zoning as a technique to permit Indians to use gill nets in certain waters and to empower states to enforce recreational and rehabilitative zones (with controlled use of commercial selective gear). This cooling-off period allowed the various parties to adjust to rapid changes and to lay the groundwork for future management.

California

California's experience with limited entry programs dates back to the restrictive licensing program introduced into the herring roe fishery in 1974. Like some of the other limited entry programs in California, the herring roe program was a political solution to a social conflict. Recreational anglers and owners of property bordering on San Francisco Bay wanted to ban commercial fishing in the bay entirely; the restrictive licensing program was a compromise to allow commercial fishing to proceed.

While each limited access fishery has its own mix of approaches, the three types of controls used are qualified entry, where fishermen must prove themselves to be knowledgeable and/or experienced before they can be licensed; entry moratorium, where new entry is temporarily frozen in expectation of a future change in arrangements; and limited entry, which has specific conditions for licensing new fishermen. In the choice of limited entry methods, as in fishery management generally, the legislative and executive branches of the California government rarely consider measures aimed at economic efficiency, sometimes pursue stability of fisheries and reduction of social conflicts, but make resource conservation and equitable allocation their central goals (Huppert and Odemar, this volume). The abalone fishery is an example of a fishery where limited licensing was introduced for conservation reasons. To rebuild stocks, California not only limited the number of participants but also required a test to prove that the diver was qualified, in the belief that restricting the fishery to professional fishermen would prevent wastage due to fishing ignorance.

Reluctance to consider economic efficiency, and perceptions of inequity, are key factors in resistance to transferable licenses in California. The California view is that making licenses transferable would create a valuable asset; to enter a fishery would then require the purchase of a an expensive license; this type of limitation on entry is viewed as

an undesirable form of discrimination. All licenses are nontransferable and must be renewed annually. All licenses are personal, except in the troll salmon fishery, where the license is attached to the vessel. Since the vessel can be sold, this troll salmon licensing system is, in fact, a transferable one. The new owner must go to a license review board and show that the vessel has not increased its fishing power in the meantime.

Initial allocation of licenses is based on experience and investment; in most fisheries, new programs grandfather in current and recent participants. The single fishery which has departed most from standard approaches in California has been the troll salmon fishery. When the initial moratorium on new entry into the salmon fishery was replaced by the current program, changes came from the industry itself. As has been true in Australia, serious consideration of economic objectives required a concerted effort on the part of fishing industry leaders.

Oregon

In 1979, the Oregon legislature placed moratoria on its ocean troll and Columbia River gillnet salmon fisheries.[2] The moratoria were imposed for several reasons. One factor was the fear that fishermen displaced from Washington would move into Oregon waters. There also was a belief that if the state did not act, the federal government might impose its own program. Finally, commercial salmon fishermen were having economic troubles, and many people believed that the addition of new fishermen would further worsen the economic circumstances of current fishermen.

At the same time that the salmon moratoria were put into place, a moratorium for the shrimp fishery was passed, largely because of fears that shrimpers then having economic troubles in the Gulf of Mexico were about to move into the Oregon fishery en masse. Since then, moratoria have been placed on the scallop and roe herring fisheries as well. In each case, initial allocation of licenses was based upon liberal grandfathering criteria; since eligibility was based on participation in any one of several base years, fishing effort actually increased after the moratoria took effect. All licensing programs require a small number of annual landings to maintain one's eligibility, but this has been waived for salmon when abundance has been very low in order to discourage fishing on the depressed stock; and under other special circumstances.

A special fishery permit board was created to deal with appeals on license eligibility; its decisions are not reviewable by the Oregon Commission of Fish and Wildlife, which otherwise is the top administrative fishery agency in the state. Most of the licenses are transferable under special

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[2] Discussion based on unpublished material presented at the workshop by Dorothy Lowman.

circumstances and, with the exception or salmon gillnet licenses, provisions exist for awarding new licenses.

The gillnet fishery has been on a long historical decline for a number of reasons, including allocations to Indian tribes and environmental factors that have affected the abundance of important Columbia River salmon stocks. To ease the circumstances of the gillnetters, a modest buy-back program has taken place. The buy-back used a reverse auction process. Sealed bids were received from license holders. The Fish and Wildlife Commission agreed to buy licenses back from the lowest bidders. The Commission also placed a ceiling on what it was willing to pay. The ceiling reflected the views of some commissioners that fishermen have privileges, not rights, and that the state should not buy back something that was never given. The important role of philosophical judgments about the rights and obligations of users of fishery resources makes fishery administration complex and difficult. The buy-back program is now inactive.

Washington

Salmon fisheries in Washington have been subjected to a number of changes in the last decade (Jelvik, this volume). A judicial decision guaranteeing treaty Indian tribes access to a substantial share of the resource required major controls on non-Indian fishermen. Other forces affecting salmon regulation included implementation of the Magnuson Fishery Conservation and Management Act; a renegotiation of salmon treaties with Canada; implementation of fishery provisions of the Northwest Power Planning Act; budget pressures affecting hatchery operations; adverse environmental conditions, including an El Nino event that reduced survival for a number of salmonid stocks and a volcanic eruption that poured silt into important spawning streams; and various market conditions which, at times, severely depressed ex-vessel prices.

Several of the changes were difficult to foresee because of considerable uncertainty on some issues. For example, judicial decisions affecting Indian fishing rights were appealed to the U.S. Supreme Court, a process which took a long time. In the interim, the Washington Department of Fisheries was being served with contradictory implementation orders from state and federal courts. Not surprisingly, under these circumstances, initial buy-back programs were crisis-oriented and poorly planned. At the time that the first several hundred boats were purchased by the state, there was not even a moratorium on new entry, so that early buy-backs included new boats!

While buy-back programs in Washington were initially funded by the federal government, an attempt was made to stretch the limited funds by auctioning off the boats which had just been purchased. Non-Indian fishermen could buy boats so long as they were not used to fish for salmon in Washington. On the other hand, Indians could and did buy some of the

boats to enter the salmon fishery, leading to protests from non-Indian fishermen. The open, public auctions were then replaced with closed auctions, where boats were sold in response to sealed bids. The Washington Department of Fisheries has since decided not to buy back gear or hold auctions any longer. Future buy-backs will deal only with purchase of licenses.

Buy-back programs in Washington do not appear to have had any impact on conservation or economic efficiency. The sharp decline in the total size of some of the fleets may be due as much or more to depressed salmon prices, high operating costs, and limited fishing opportunities, as to any vessel reduction initiative of the state. Instead the implicit goal has always been one of equity. There has been, for example, an attempt to get federal compensation for individuals displaced by federal court decisions. The Department of Fisheries has tried to target its aid to marginal fishermen who may have been hit hardest. The success of these programs is difficult to calculate. In any event, the question is more one of perceived equity than of any observable measure.

Alaska

Several attempts to introduce license limitation into Alaska were declared unconstitutional. The current limited entry statute was passed in 1973, the year after an Alaska constitutional amendment was passed with the explicit intent of allowing the state "to limit entry into any fishery for purposes of resource conservation, to prevent economic distress among fishermen and those dependent upon them for a livelihood, and to promote the efficient development of aquaculture" (Schelle and Muse, this volume). The long and heated discussion of limited entry did lead to thorough consideration of objectives and to the creation of a relatively aggressive program.

Recognizing that late implementation of license limitation programs or decline in the abundance of certain fish stocks could lead to excessive fishing capacity, Alaska created a vessel reduction program. The buy-back program was declared invalid because dedicating public revenue for specific purposes violated the Alaska state constitution. Although alternative approaches can be devised to meet constitutional concerns, the steps taken next will require a careful reexamination of the objectives that Alaska really wants such a program to achieve.

One of the primary motivations for instituting limited entry systems in Alaska was to preserve fishing opportunities for residents of rural Alaskan fishing villages. Since initial attempts to favor such people were denied on constitutional grounds, a complex and expensive system was created that could give rural residents in high unemployment areas higher standing, without directly discriminating against non-Alaskans. How effective the initial allocation method actually was has been disputed. The transferable licenses do

not seem to have shifted fishing opportunities from Alaskans to non-Alaskans, but there does appear to have been a shift from rural areas near the limited fishing grounds to urban areas, and licenses also have shifted from Alaska Natives to non-Natives.

It is difficult to assess the contribution of the limited entry program to the goal of economic efficiency. On the one hand, permit values have risen and permit holders find borrowing money easier, even though they cannot pledge their permits as collateral. On the other hand, there has been an increased use of capital and labor. While increased capital expenditures have led to greater comfort and safety of operations, the higher costs may reflect some dissipation of economic gains.

Limited entry programs appear to be well established in Alaska, yet they are undergoing significant growth and change. The current program must be modified to comply with Alaska laws. Extension to other fisheries will require further modification. New forms of access limitation are likely to be reviewed with interest, as well as caution. These continuing changes reflect both the complexity of the problems facing Alaska fisheries and the diversity of the fishermen working in the state.

DEVELOPING NATIONS

The extension of coastal fishing jurisdiction has presented new responsibilities and opportunities in developing coastal states as well as in the developed nations. For many of these countries, the greatest concern is resolving jurisdictional disputes with neighboring nations and establishing arrangements with developed nations that conduct distant-water fishing. The licensing issue of greatest concern is therefore related to control of foreigners rather than of domestic fishermen.

An extreme case of limited access in a developing nation is Saudi Arabia, where marine fishing is conducted through a state corporation (Newton, this volume). Although many nations have some type of licensing control, few developing countries have introduced substantial license limitation programs. One exception worth mentioning is Malaysia.

Malaysia

The objectives of Malaysian fisheries licensing policy are to eliminate competition and conflict between traditional small-scale fishermen and trawlers in inshore waters, to prevent overexploitation of inshore fisheries, to achieve more equitable allocation of fishing opportunities, to restructure the ownership of fishing units, and to promote the development of offshore fisheries. To achieve these goals, Malaysia decided to supplement traditional approaches of gear restrictions and time and area closures with a two-part approach. The key part of the new policy is area zoning:

zones from 0 to 5 miles, from 5 to 12 miles, and from 12 to 30 miles are each reserved for fishing vessels of increasing size categories, but they are all to be Malaysian; the zone outside 30 miles but within the extended economic zone is to be fished by joint ventures and chartered foreign operators. Within each zone, fishing effort is to be regulated through license limitation (Majid 1984).

Implementation has been difficult, partly due to lack of good data and partly to the social and political difficulties of acting on the data available. The lack of coordination between the fishery management agency and other government agencies has weakened the license control policy. Enforcement has also been a major problem, particularly in gathering support to control the vast number of small, inshore vessels. The further the zone is from shore, the less political difficulty exists with pursuing enforcement, but the greater the cost. All difficulties notwithstanding, Malaysia remains committed to restrictive licensing, and plans to continue this policy.

CONCLUSIONS

Much of the discussion at the workshop was intended to explore specific experiences. To the extent possible, these discussions have been integrated into the material above. In addition, some broad conclusions were reached.

Objectives

One of the most fundamental conclusions is that you get what you strive for, to paraphrase an old saying. Fishery management programs everywhere are the product of complex legal, political, and social systems. Many interest groups are involved, each of which has its own agenda. Fishery rationalization programs are modified to reflect these competing objectives, and not surprisingly their outcomes are strongly affected by the dominant interests involved in designing and executing fishery policy. Objectives generally include conservation (prevention of growth and recruitment overfishing) which is commonly associated with the status of fish stocks; economic efficiency; the economic well-being of fishermen as measured in terms of profits and stability of activities from year to year; political acceptability; administrative feasibility (including administrative and enforcement costs); employment opportunities in fishing communities; the perceived fairness of fishery regulations; and other measures of social well-being.

Economic efficiency is rarely considered in the design of fishery rationalization programs, and most programs fare poorly when measured in terms of economic efficiency. Related objectives of economic well-being of fishermen and fishing communities are rarely attained without the vigorous participation of leaders of the affected fishing industry. Likewise, evaluation in terms of equity relates closely to

how much consultation has taken place with leaders of the fishing industry.

Equity is the most important objective to the successful design of fishery rationalization programs. This begins with the need for the parties involved to develop a clear idea of how a specific program will affect them. Since fishermen will judge ongoing programs for themselves, this usually means that the most difficult phase of a program is its introduction and that the initial allocation of licenses or fishing rights will be the most important issue to discuss.

Individual Transferable Quotas

The workshop also arrived at a few general conclusions about individual transferable quotas. In general, ITQs were thought to be more efficient than other regulatory schemes, as judged by a number of criteria, including economic efficiency. On the other hand, there are few examples of highly successful ITQ programs, and most of those are relatively new. The programs that look most promising, such as Iceland's and New Zealand's, have a number of characteristics that hold enforcement and administrative costs to a reasonable level, such as a limited number of landing sites and good cooperation between the fishing industry and the regulatory authority. As other countries examine the ITQ concept, they will need to carefully consider the likely administrative costs.

One item of great concern with ITQ programs is the possibility of an increase in discards taking place as the fishermen try to maximize the value of the limited catch. This does not mean that ITQ programs should be rejected, for discards are a concern in most fisheries and can be increased by other fishery regulations just as much as by ITQs. As a general rule, fishermen work hard to catch fish and dislike throwing them back to sea even when required to. If the fishermen support the regulatory program, discards may be voluntarily held to a low level. Nonetheless, managers should look for incentives to avoid discards. One alternative that has been tried in Iceland's herring fishery is a value quota, which removes part of the incentive to throw catch back.

Another discard concern comes from limited bycatch in multispecies fisheries. When fishermen have caught all of their quota for a species, but have quota left for others, they can theoretically continue to fish and either dump the limited species or try to pass it off as another species. While most fishermen find such practices distasteful, incentives to reinforce their natural antipathy may be necessary. The programs in Iceland and New Zealand both have provisions that allow fishermen to exceed some of their quotas slightly but involve an incentive that is intended to discourage deliberate overfishing. In both of these countries, the determination of an incentive that will avert massive discarding, while at the same time deterring targeting of species

when a quota is reached, is seen as an issue requiring major attention.

Vessel Reduction Programs

Although programs to limit licenses present more difficulties than were widely recognized a decade ago, they can still be valuable under several circumstances. Since licensing restrictions are seldom imposed until the fishing fleet capacity has become much larger than is needed in a specific fishery, consideration must be given to vessel reduction programs. One seemingly necessary ingredient for the success of such programs is that they be designed with major guidance from fishermen; in some instances they should be created solely by fishermen. When vessel reduction is being undertaken in response to actions of others, as was the case in Washington, where fishing opportunities were being shifted to Indians at federal initiative, financial compensation may be appropriate. In other cases, where the problem has been caused by the entry of too many fishermen and where the only beneficiaries of the program will be the remaining fishermen, then the program should be financed by the industry, as it was in the Japanese skipjack fishery and the Australian northern prawn fishery.

Voluntary buy-back programs work slowly and present financial problems. At the same time, technological improvements may lead to greater fishing power among remaining vessels. In some circumstances, an approach worth serious consideration is requiring the surrender of two vessels' licenses in return for replacing an existing vessel. If 2 for 1 replacement schemes are unrealistic, then a formula involving boat units, such as is used in the Australian northern prawn fishery, should be considered. Australia is making a commitment to move all of its fisheries either into this type of "input quota" program, or into an individual transferable quota program.

The Role of Limited Entry Programs

Workshop participants concluded that neither individual transferable quotas nor restrictive licenses can be effective unless combined carefully with a mix of other fishing regulations. No single approach can deal effectively with problems of excess fishing capacity without creating its own undesirable outcomes. Any form of limited entry must be chosen in combination with other management approaches. This package must be carefully tailored to the specific fishery, with attention to the biology of the fishery as well as to the social, economic, and political environment within which fishermen operate. Finally, fishermen must be involved in a major way in the design of programs, both in order to draw on their special knowledge of all of these factors and to ensure their future cooperation.

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The Demise of the U.S. Halibut Fishery Moratorium: A Review of the Controversy

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PART I: HISTORY OF THE PACIFIC HALIBUT FISHERY PRE-FCMA

INTRODUCTION

The halibut fishery of the American Pacific Northwest has evolved over the last one hundred years through three broad socioeconomic changes and is currently in the midst of yet another possible transition. There are several possible outcomes: halibut may become merely an auxiliary fishery; it may become a limited entry fishery of prime importance to a small number of fishermen; or it may assume some unforseeable character.

This paper will deal primarily with the uncertainties and concomitant strong and polarized feelings engendered by this time of change. It now appears likely that the forces generated by the history of the halibut fishery may prevent any but just a "lowest common denominator" solution in this, its latest change. It is interesting and instructive, however, to trace the route that has resulted in the present situation. Perhaps an understanding of this history and the dialectical imperatives it has generated will allow us to do better with other currently more malleable fisheries.

ABORIGINAL HALIBUT FISHING

> In the Western meaning of the word there is no "economy" in primitive society, only socio-economic institutions and processes. (Dalton in Martin 1978)

The first transition was without doubt the most radical. Indians' limitations of their own fishing effort grew out of a logically consistent world view that was based on consideration for the welfare of the spirits or souls of the natural world (Vecsey 1981). Viewed from their perspective, halibut gave themselves to fishermen who displayed the appropriate reverence, care, and appreciation.

These fishermen were affluent. They followed a different course to affluence, though, than those who came next; theirs was an affluence of limited wants. The affluence to come was one based on closing as much as possible the gap between scarce resources and unlimited wants (Martin 1978).

Which system is ultimately more precarious remains to be seen; at any rate it is clear that native technology was ingenious and quite effective.

> Dixon (1789) observed that seven of his crew in a whaleboat fishing with handlines could not equal the catch made by two Indians fishing alongside with their native gear. (Bell 1981:17)

EXPLOITATION BY THE EXTENT OF THE MARKETPLACE

> What is evident now should have been evident then, that the limit of the area fished was fixed, not by the presence or absence of halibut, but by the commercial practicability of establishing a paying fishery. (International Fisheries Commission in Crutchfield and Zellner 1962:6)

It was obvious from the earliest white incursions into the Pacific Northwest coastal waters that the fishery was enormously rich. The ability to exploit the resource was restricted, though, by the limited capability of getting the fish to market.

As early as 1870, there had been sporadic attempts by sailing schooners to transport iced halibut to ports as far south as San Francisco. For the most part, however, commercial fishing was done near the settlements where the halibut was marketed. These communities were chiefly Victoria and Puget Sound settlements (Bell 1981). As various improvements were made in transportation, the boundary of the fishery gradually moved northward along the British Columbian and Alaskan coasts.

The major force in expansion of the fishery was the establishment of railway communications in the last decade of the nineteenth century, between the Pacific Northwest and the populous East. The change did not happen suddenly, however. The distance was enormous, freight and ice costs were high, and handling of the fish was often so inexpert that the fish would arrive in unmarketable condition. Nevertheless, the high price of Atlantic halibut encouraged continued attempts to transship Pacific halibut--especially in the winter when

the catch of Atlantic halibut was low and the chance of successful transshipment across the cold northern plain was significantly greater (Crutchfield and Zellner 1962).

Concurrently, steamers, which had several advantages over sailing vessels, became the dominant vessels in the fishery. They were better able to negotiate the fiords, strong tides, and rocky harbors of the Pacific Northwest coast. Their auxiliary power enabled fishing to continue during the winter months when the Eastern market was most feasible and favorable. Because steamers could transport a catch to port faster and more reliably, they allowed an expansion of the fishing grounds. Finally, the dory fishing conducted from these vessels was a profitable way to deploy large amounts of gear on the rich virgin beds often encountered in those early years (Bell 1981).

By the end of the first decade of the 1900s, schooners began in their turn to replace steamers as the dominant vessel of the fishery. As the heavy concentrations of stocks found initially on many of the grounds were depleted, the advantage large vessels had in being able to deploy large amounts of gear was negated. In addition, capital for new vessels became more generally available, while vessels with lower manpower requirements proved to be more economical and efficient. This factor was intensified when manpower limitations were imposed during World War I (Bell 1981).

Meanwhile the Canadians had completed a rail line to Prince Rupert, which began to supplant Seattle and Vancouver as the principal landing port for halibut (Crutchfield and Zellner 1962). On September 30, 1914, the first refrigerated railway car loaded with halibut left Prince Rupert for the East Coast. The world's largest cold storage facility for fish was already in operation in Prince Rupert, and other cold storage and ice manufacturing facilities were being built in Alaska. The fishery continued to move northward (Bell 1981).

Fishing intensified during this same time due to a series of technological developments that increased efficiency--e.g. electric lights replaced torches, longlines were set directly from the vessels, power winches increased capability, and diesel engines increased dependability and decreased costs. In short, constant access to the market, extended range of operations, and increased efficiency created the opportunity for large profits. Therefore capital moved into the fishery (Crutchfield and Zellner 1962).

MANAGEMENT BY BIOLOGY

> The commission can and does try to make its regulations interfere as little as possible with the economic conduct of the industry. But the commission has no power to deal with commercial purposes. It can only protect and conserve. (Allen 1936, in Crutchfield and Zellner 1962:32)

As could be expected, the combination of the factors that led to high profits exerted a tremendous pressure on the halibut stocks and resulted in the third phase of the halibut fishery--management based upon biological criteria. Halibut fishing in the southern banks had reached a peak in terms of CPUE (catch per unit effort) between 1904 and 1905. Thereafter the size of fish caught decreased, and effort in terms of gear, bait, fishing days per trip, and distance travelled increased. From the earliest days of commercial halibut fishing, exploitation of the most accessible beds typically became so intense that it lay beyond levels of sustainable yields. It had always been possible as American, Canadian, and then southern Alaskan banks were "mined out" to move on to new beds, but this could not continue indefinitely. Reacting to these signals, Canadian authorities commissioned the first scientific study of the fishing banks. Published in 1915, the study confirmed the steep reduction of population that had taken place on formerly productive banks (Crutchfield and Zellner 1962).

The first industrial impetus toward restricting catch, however, was not primarily biological, but grew out of marketing concerns. The massive capitalization and expansion into new grounds created temporary gluts accompanied by low seasonal prices. In addition, year-round landings made it difficult to get rid of increasing amounts of frozen fish. Since fish caught in winter tended to be lower quality spawners anyway, the industry sought a winter closure of the fishery to provide a period to reduce frozen inventories (Bell 1981).

In 1919 a treaty between the United States and Canada attempted to resolve a number of sovereignty disputes in order to allow an international winter closure of the fishery. However, representatives from the state of Washington protested strongly and ratification by the U. S. Senate failed (Bell 1981).

The halibut industry in both countries continued to lobby for some type of international agreement, and on March 2 the 1923 Halibut Convention was signed. Its goals were less ambitious than those of the early, unsigned treaty, and perhaps more realistic. Basically, it established the International Fisheries Commission (IFC), which it granted with authority to close the season during the winter. It also provided for scientific study of the fishery (Bell 1981).

There followed a series of halibut conventions between the United States and Canada as the two countries sought to adapt to changes in the fishery and to utilize information from the scientific studies provided for by the 1923 Convention. Although price stability and improved yield per unit effort had been the primary motivation in the industry's initial desire to have the fishery managed, biological considerations soon became paramount (Crutchfield and Zellner 1962).

Since most of the older beds were being fished primarily in the summer anyway, the winter closure proved to be ineffective in providing any protection for stocks. Only one area, the eastern side of the Gulf of Alaska, was afforded any protection by this measure. The problems nascent before the 1923 Convention merely intensified: total catch increased, CPUE decreased by a factor of between five and six, and average size and age of the catch decreased drastically. Furthermore, since areas close to market outlets were more severely affected, the condition of the fishery was not uniform (Bell 1981).

By 1928 the commission felt it had gathered enough information to request more specific regulatory powers (Bell 1981). The Convention of 1930, which was the outcome, can be viewed as the definitive break between the old exploitation by the extent of the market phase of the fishery and the new regime of biological management.

The Convention of 1930 instituted a series of traditional fisheries management methods with the sole purpose of protecting fish stocks. These methods included establishment of regulatory areas, limitation of catch by area, licensing of vessels and regulation of their departures, regulation of gear type, and protection of nursery grounds. In addition, the IFC was to continue to collect statistics and conduct scientific research (Bell 1981).

The first imposition of catch quotas coincided with the onset of the Great Depression and a collapse of prices. These factors alone brought landings to their lowest level in decades and greatly facilitated initial acceptance of quotas by the industry (Crutchfield and Zellner 1962). (It may be that another catastrophic situation of some kind will have to exist before the industry will accept another shift in management objectives, such as economic rationalization of the fishery.)

It should be noted that although only biological justifications were advanced for adopting these regulatory powers, use of any of these techniques was bound to have allocative effects. For example, in an attempt to protect spawning and young halibut, restrictions on the use of set nets and trawlers were instituted in the thirties and forties. But these regulations also affected both economic efficiency and allocation (Miller 1984).

In what was to become a fairly monotonous pattern to observers of the halibut fishery, improved health of the stocks led to improved CPUE, increased profits, and hence to additional entry into the fishery. The commission, in what would also become a predictable pattern, reacted by restricting the length of the season.

As the off-season became longer and longer, however, the problem of incidentally caught halibut grew in significance. Finally, under the 1937 Convention, the commission granted authority to address this problem (Bell 1981).

Meanwhile the industry had realized that the shortening of the fishing season was not in its own best interests, and since 1933 it had employed various types of voluntary effort reductions to spread the allowable catch over a longer season. These voluntary measures included: dividing the vessels into two groups, one starting to fish on opening day and the other a week later; requiring in-season lay-ups of up to 14 days; instituting maximum catch limits per trip per crew member (to improve product quality by ensuring shorter trips); and assigning advance arrival dates to each vessel (to keep the supply of fresh halibut in balance with demand.) These voluntary measures were interrupted by World War II but then adopted again in modified form in the 1950s (Miller 1984).

Even with the voluntary measures, however, the trend of ever shorter seasons continued. One result of this trend was that some banks were underutilized while others were overfished when fishing occurred at a time when the halibuts' seasonal migration patterns resulted in low stock densities on those beds. To address this problem the IFC was granted authority by the 1953 Convention to have multiple openings within areas. This convention also set a limitation on the smallest legal size of halibut that could be caught and kept (Bell 1981).

Throughout this time the commission had been successful in allowing stocks to rebuild, and by the early 1960s they were estimated to be at, or very close to, maximum sustainable yield (MSY) (Miller 1984). Catches remained high throughout the 1960s, but severe pressure was being exerted on the halibut population. An expanding trawl fishery, both foreign and domestic, and foreign setlining were taking or destroying many halibut. In particular, it was felt that foreign trawlers were taking a substantial toll of young halibut in the Eastern Bering Sea area and thus preventing their growth and migration into the rest of the traditional halibut fishing waters (Bell 1981). As longline gear was improved the directed halibut fleet had also shown a steady increase, not only in participation rates, but also in efficiency (Miller 1984). In addition, environmental conditions may have led to decreased recruitment into the stocks (Salveson 1982).

There was thus a precipitous decline in stocks and catch in the early 1970s. Season length reversed a ten-year trend and by 1977 had dropped to 47 days. At that point the voluntary program of self-regulation failed, as many of the new entrants into the fishery refused to comply. Voluntary controls had been viable so long as larger vessels and a cadre of professional and union crew members had been predominant in the industry; it failed with the entry of numerous small, independent fishermen into the fishery (Salveson 1982).

Furthermore, 1977 saw the enactment of the Fishery Conservation and Management Act (FCMA) and the establishment of the

200 mile exclusive fisheries zone. With the imminent expulsion of foreigners, it seemed that there should be enough fish available to all deserving Americans, and entry into the halibut fishery was spurred on further.

However, the FCMA included one standard that provided the authority for management to institute one last, major change in the structure of the halibut fishery. No longer would the authority for management be limited solely to biological criteria.

PART II: HISTORY OF THE PACIFIC HALIBUT FISHERY POST-FCMA; THE GATHERING STORM

> Conservation and management measures shall, where practicable, promote efficiency in the utilization of fishery resources; except that no such measure shall have economic allocation as its sole purpose. (Magnuson Fishery Conservation and Management Act, 1977, Sec. 301 a)(5))

With the inclusion of the above national standard and the incorporation of optimum yield or goals, the FMCA, for the first time in U.S. fishery management, codified the legal right and obligation of managers to consider not just biological aspects of the fishery, but socioeconomic aspects as well. The FMCA also provided for the establishment of eight regional fishery management councils charged with the responsibility of developing and modifying fishery management plans (FMPs). The North Pacific Fishery Management Council (NPFMC) was established for the Fishery Conservation Zone waters off Washington, Oregon and Alaska.

The NPFMC (also called the Council) was immediately required to draw up a series of options for the renegotiation of a new Halibut Convention between the United States and Canada. One set of alternatives under consideration was whether to continue or discontinue the functioning of the IPHC. Even at this early time, these deliberations dealt with allocative considerations and the possibility of limited entry. Specifically, Council staff research indicated that retaining the IPHC would be a more viable approach to managing the halibut fishery under a system of free access, while discontinuing the IPHC would be appropriate if a limited entry program were instituted (Miller 1985).

Momentum for adoption of a limited entry program slowly increased in early 1978 as the Council held its first public discussions on the subject (Salveson 1982). Another impetus for limited entry came from an FMP, developed by the Council in anticipation of withdrawal by the United States from its halibut treaty with Canada, that called for providing a viable halibut setline fishery for U.S. fishermen (Miller 1985).

In March 1979, the United States and Canada amended the convention. The IPHC was retained and assumed joint management of the halibut fishery along with the Council. This protocol was not officially authorized by Congress until 1982, and, as we shall see, the timing of Congressional action had dramatic consequences for the future of halibut fishery management. Meanwhile, signs of Council consideration of limited entry became unmistakable in early 1979, when it formed a workshop to discuss limited entry in a number of fisheries, including groundfish (Miller 1985).

These first discussions of limited entry brought quick responses--both spontaneous and organized in nature. Numerous individuals moved to protect their positions or, in many instances, to maintain future options. Thus the number of halibut interim-use permits issued by Alaska more than doubled, from 2,660 in 1977 to 5,543 in 1981. Since only about half of these licensees actually landed halibut commercially, many of the unused permits were most likely bought solely to acquire rights to any subsequent limited Pacific halibut fishery (Salveson 1982). In short, for this fishery, which had historically attracted excess entry, the hint of limited entry acted as a catalyst to turn the rush into a stampede.

Response by industry organizations was prompt. Only three months after the Council established its limited entry workshop in March of 1979, it received its first letter from a fishermen's association requesting implementation of limited entry in the halibut fishery. This letter, from the Petersburg Vessel Owners Association, was followed in September and November by letters from the Fishing Vessel Owners Association of Seattle requesting a moratorium on new entry and enactment of a permanent limited entry system (Miller 1985). The Seattle fleet, historically opposed to all forms of limited entry, had begun to feel that with the adoption of limited entry programs in other fisheries, they would have no good alternatives. As Otto Bogen of the Vigorous put it, "If they can stop me from going seining, they can stop them from going longlining." (Fitzerald 1981:32).

On the other hand, the Kodiak Halibut Fishermen's Association had been established in 1978 specifically to oppose all forms of limited entry. According to their president, Don Baker, limited entry represented only "government interfering in private enterprise" and "a cure worse than the problem." (Fitzgerald 1981). Battle lines were drawn: owners of large, mostly non-diversified longline fishing vessels and their predominantly union crewmen centered in Seattle and Petersburg pitted themselves against the owners and crewmen of small, diversified, vessels in Kodiak and Seward--north against south. Fishermen's organizations staked out positions that they would hold throughout the upcoming years of conflict.

Meanwhile, in mid-1979, the limited entry work group recommended that the Council continue to develop plans for lim-

ited entry. It requested studies to analyze the probable effects of limited entry on the resource, the fishermen, the industry, and the supporting social structures. It also called for evaluation of legal methods of instituting limited entry (Miller 1985).

In early 1980 the workgroup recommended implementation of a moratorium on entry into the fishery. In addition, six goals for limited entry were presented:

1. Prevent expansion of effort.

2. Reduce the current number of entrants.

3. Maintain the economic viability of the halibut longline fishery to allow it to continue as a professional fishery.

4. Stretch the season out over six or seven months so that

   - harvest could be made across all stocks in the range;

   - there would no longer be sudden gluts creating pressure on processors; and

   - cold storage would be reduced.

5. Continue the small, part-time fishery with the existing fishermen.

6. Develop a system that would allow the greatest number of people to make a good living from the fishery (Miller 1985).

It is difficult to see how realization of all of these goals could have been seen as possible. Specifically, goals 2, 3, and 6 have an inherent conflict with goal 5, and only the most imaginative of compromises could have resolved the discrepancy. Such a compromise would either have entailed some extremely complicated (and most likely politically impossible) allocation system or else, as was later proposed as a possible variation on an individual share quota system, it would have involved part of the fishery's being conducted on a limited entry basis and part on a free access basis.

At any rate, the rest of 1980 passed with the Council taking no further action on limited entry, aside from awarding a contract to Tetra Tech to study applicability of limited entry to the Alaska halibut fishery (Miller 1985). The Council continued in 1981 to lay the groundwork for limited entry in the halibut fishery. Fisheries scientists and economists meeting in the early part of the year concluded that a quota-share system would be the best way to accomplish the goal of reducing the level of effort in the fishery. In its September meeting, the Council adopted a series of objectives recommended by the halibut limited entry workgroup. These included economic provisions to accomplish the

following: avoid further overcapitalization; make certain the fishery is composed of owner/operator rights holders; ensure that no one acquires excessive control of fishery rights; minimize administrative costs; allow for extraction of rents and royalties; use past performance to distribute initial rights to fish; and use the market to transfer halibut fishing privileges after initial distribution. As it was felt that license limitation and other forms of limited entry were fairly well understood but that less information was available on the quota-share system, the Council prepared to release an RFP on the applicability of the quota-share system (Miller 1985).

As noted earlier, one of the responses to the possibility of limited entry was a substantial increase in the number of participants in the halibut fishery. For example, in Kodiak, vessels registered for the halibut fishery had increased 72 percent since 1978 (Fitzgerald 1981). As effort increased in all areas, the season was progressively shortened, until, for example, in early 1982 the IPHC set it at only five days in area 2C. In addition, average ex-vessel gross earnings per vessel had declined nearly 29 percent since 1978 (Salveson 1982). The halibut fishery appeared to be undergoing a qualitative as well as a quantitative change. This raised concerns such as that expressed by Donald McCaughran, Director of the IPHC:

> I think the whole fishery loses some credibility when you have these very short seasons. Then there's more pressure from other kinds of fisheries which are in competition in some way. For instance trawlers might very well say, "Look, its not a viable fishery anymore. Why can't we sell the halibut we catch?" These are the dangers we face right now. (McCaughran 1981:38).

He was further worried that with so many fishermen, it would be impossible for any of them to make a full-time living at halibut fishing, and that without a constituency the fishery would not receive the proper amount and kind of attention (McCaughran 1981).

Feelings were running high at the end of the 1981 season. Many fishermen expressed anger and disbelief that area 3A was closed at the end of the season:

> No damn reason the Commissioner shouldn't add five days...the stocks can handle it...Between the Commission and the buyers, longliners are a dying dinosaur. (Glenn Satereo of the Hoover, in Fitzgerald 1981:32)

Others, such as Marvin Gjerde of the Fordenskjold, felt that keeping the season open would have done little long-term good, "...a bigger quota will only draw more boats. We need a moratorium on new boats coming into the fishery." (Fitzgerald 1981:32)

As 1981 faded into 1982 and the Council staff continued its studies, pressures increased for a moratorium. In January

the Council was asked by its Advisory Panel to implement a moratorium and produce a schedule for imposing limited entry. In February three U.S. members of the IPHC Conference Board wrote a letter to the Council with the same request (Miller 1985). Representatives from twelve fishermen's organizations met in Seattle to work out a limited entry plan acceptable to fishermen. In an action that was quite a shock to most observers, even the Kodiak Halibut Fisherman's Association representatives, President Dave Ausman and V.P. Don Baker, endorsed the limited entry package that emerged from this meeting. Baker was quoted as saying, "It is our understanding that a moratorium can't be imposed without commitment to limited entry." (Alaska Fisherman's Journal, April 1982:4) At the end of the meeting a letter requesting action on a moratorium and on share system limited entry was sent to the Council. (Matsen 1982a). The apparent industry consensus reached in that meeting was short-lived, however. In less than a month the Kodiak Halibut Fisherman's Association angrily and unanimously repudiated the vote of its representatives. Apparently the original vote to support limited entry had been taken with only a few members present; now a 118 - 0 majority registered its disapproval. Feelings in Kodiak were expressed by Association member Barb Monkiewicz:

> I suspect the share system was spoon fed through Seattle and Petersburg. I don't know who really started it but it's obvious that they want to reduce the fleet by 75 percent, eliminating people who don't make their whole living on halibut fishing. We don't feel that anyone should have the guarantee that they'll make a living off one fishery. We've had to diversify and so should everyone else. (Alaska Fisherman's Journal 1982a:4)

Debate was intensifying. Proponents argued that limited entry would rationalize the fishery, make fresh fish available to consumers for a longer period each year, increase ex-vessel prices to fishermen since fresh fish sell twice as quickly as frozen, and allow processors and fishermen to plan their operations in advance instead of charging into the chaos of what was nonaffectionately becoming known as the halibut derby. In addition, they pointed out that the ownership of property rights is the essence of the free enterprise system: communal ownership was merely an anachronism from the past (Pacific Fishing 1983). This viewpoint was stated forcefully, and often, by Council chairman Clem Tillion:

> What you have now is the communal system, not the free enterprise system. I believe free enterprise works, and that it means private ownership. Right now, the halibut are owned in common, and that won't work as we are seeing it doesn't work now with the short seasons and the disservice to the consumers who can't get fish at a reasonable price at a reasonable time. (Tillion in Matsen 1982b:19)

> The cowboy of the open range was a glorious figure, but what he produced per acre was a dismal record and if allowed to continue would have destroyed the land itself--compared to a well-run ranch with fences and hay meadows and control of stock numbers, i.e. farm management.
>
> What if we used our timber as we do our fish? No leases or ownership, just the foresters' announcement that logging is open at 6 a.m. tomorrow at such and such a place. First man to the tree gets to keep it, but no chain saw with over a 6-inch blade allowed and in some areas only hand logging. (Tillion 1983:70)

On the other side, opponents argued that limited entry was essentially an infringement on their freedom; it created the danger that shares could consolidate in the hands of a few large-scale fishermen or even absentee corporations; and it further violated principles of free enterprise in that the open halibut fishery provided one of the few ways for a new fisherman to break into the industry. Bill Neff of the Seward Fisherman's Association was one of many fishermen who expressed deep frustration with the Council's actions on limited entry.

> Over the years we have been led to believe that this is a democracy where the people rule. We also feel that any rule or regulation that affects our livelihood should be brought before the people who are affected for a vote and to utilize the system that this country was founded on "majority rules." (Neff 1982:21)
>
> The big push for limited entry is coming from the bureaucrats. They don't understand the free enterprise system. And I don't think Clem Tillion understands the 200-mile limit law. It doesn't say anything about the Council putting housewives ahead of fishermen as far as priorities go. (Matsen 1982b:18)

MORATORIUM!

> In summary we believe that an adequate showing has not been made of the need for the lengthy moratorium proposed in this rule, and that the moratorium would be likely to delay consideration of alternative measures to resolve the halibut management problem in a fair, lasting, and economically efficient manner. (OMB Administrator Christopher DeMuth, June 14, 1983 in Alaska Fisherman's Journal, July 1983)

In spite of the gathering opposition from some participants in the industry, the Council voted unanimously in March 1982 to impose a moratorium on all areas except for Washington, Oregon and the IPHC Area 4 north of 56 N, which was to be excluded for three years to allow fishermen from small western Alaska villages a chance to develop a commercial fishery. However, as mentioned earlier, at the time this vote

was taken the Council did not yet have the authority to implement such an action. That was dependent upon legislative approval by the U.S. Congress of the Northern Pacific Halibut Act of 1982 (Halibut Act), implementing the 1979 protocol between the United States and Canada. Bills before both the House and the Senate were near passage, but it was then late March. The halibut season would open in little over a month; and the moratorium could not be imposed until the legislation passed (Matsen 1982a).

The deadline came and went, and it was not until five days after the May, 12 opening of the season that the Halibut Act of 1982 was finally enacted. It had been impossible to implement the moratorium for the 1982 season as hoped, but in July the Council reaffirmed its intention and stated that the moratorium would be implemented as soon as possible--now the 1983 season (Miller 1985).

Meanwhile the IPHC had set the 1982 season expecting the moratorium to be in place. With its failure, and the resultant deluge of participation in the fishery, quotas were filled as much as twice as fast at expected; in many areas they were substantially exceeded. Even with the shortening of seasons in some areas, management was unable to keep the catch within the quota limit. Donald McCaughran of the IPHC remarked:

> It's getting to be a bloody madhouse out there. The failure of the moratorium this year brought over 450 new boats into the fishery in the Southeast alone, and we only register vessels over five net tons. No telling how many smaller boats came in. (Alaska Fisherman's Journal, August 1982:7)

Even so, the fishing had been good and opposition to the moratorium and limited entry continued within the Alaskan fleet. The Seward Fisherman's Association planned to mail out its own survey to determine the extent of opposition to the plan. Its initial research showed that even though fifteen organizations were for the share system, not all their members were in agreement. According to their information, fisherman sentiment was more than three to one opposed. In addition, the towns of Kodiak, Seward, Whittier, and Kenai were opposed. Seward Fisherman's Association spokesman Bill Neff stated that the Association was prepared to file a class action suit against what its membership considered an unconstitutional distribution of fishing rights based solely on past performance--without a vote from all involved (Neff 1982). In addition, Neff and others were angry that the IPHC had supported the share system. They felt not only that it was overstepping its commission to have taken a position in this type of allocative management decision, but also that the IPHC was simply not performing its intended function well.

> The Commission should concentrate on foreign and domestic draggers whose reported incidental catch of halibut is as high if not higher than our total allotment. And

> how about all those unreported halibut catches. The Japanese boats have been caught many times for not reporting their catches and underlogging. If we had double the allotment of halibut that we have now, we could have longer seasons and stretch the market out over a longer period. (Neff 1982:21)

U.S. fishermen were also concerned about other U.S. fishermen. For example, even without considering the loss of potential catch to halibut fishermen due to operations of draggers, their part in a share quota system was feared by fishermen such as Mike Mayo from Sitka:

> It's a situation of fishermen vs. fishermen. It's us against the draggers. Our big fear is that once you allow a share system, the big boats and the draggers buy up the shares. The draggers are already putting pressure on to be allowed to sell what they catch incidentally. Our alternative is to stop the draggers. That's it. (Matsen 1982:18)

In the early part of 1983, the Council held hearings in twenty Alaskan communities and in Seattle to take comments preparatory to issuing moratorium regulations. Under these regulations, which were released at the beginning of April, the proposed moratorium was to run from May 1, 1983 to December 31, 1985 (Miller 1985). Approximately 6500 entrants were expected to qualify, since anyone who delivered halibut at least once between January 1, 1978 and December 1, 1982 was eligible. Again, certain areas north of 56 N were exempted to enable native fishermen of the Pribilof Islands, Nelson Island, and Nunivak Island to develop a commercial fishery. (Alaska Fisherman's Journal, March 1983)

With the final denouement imminent, the Kodiak Halibut Fisherman's Association and other organizations, such as the newly formed Independent Fishermen of Alaska, based in Sitka, stepped up the pace of their opposition. Fisherman Mike Delaney expressed some of their concern:

> Kodiak is worried that the guy who is going to buy shares is not going to be a new guy coming into the fishery; they're afraid it will be a highliner with a big boat. Like Weyerhauser never sells timber rights to small gyppo loggers. The little guy is afraid of the big guy. It's that simple. (Alaska Fisherman's Journal, March 1983:22).

Other fishermen were generally in favor of a moratorium and limited entry, although many felt that modifications in the plan were necessary. For example, Mark Lundsten, President of the Deep Sea Fishermen's Union, stated that his union supported the moratorium, with some reservations. Unlike some of the boat owners, his membership did not stand to realize any windfall increase in wealth under a moratorium, but union fishermen felt that the health of the resource and their profession itself were in danger if the status quo continued. On the other hand, although they were willing to

forego upward mobility into vessel ownership for the duration of a moratorium, they were vitally interested in implementation of a limited entry scheme that gave experience at least as much of an advantage as capital in attaining vessel ownership. As currently proposed, however, the share system appeared to them to benefit those with capital, not those with experience (Lundsten 1983).

Other fishermen were dissatisfied because a moratorium without more restrictive limitation of effort would serve little purpose. Sig Mathisen from Petersburg remarked,

> Unless we limit effort, we're talking about 6,500 licenses and we might as well hang it up. (Alaska Fisherman's Journal, March 1983:22)

Even following the April Council vote in favor of the moratorium, and in spite of general industry support, approval was not assured. In May disputes arose between the National Marine Fisheries Service (NMFS) and Council over the need for an appeals procedure and a "regulatory impact analysis" (Pacific Fishing 1984). Council rejected NMFS's requirements because the NMFS Central Office could provide no legal reason for their inclusion (Miller 1985), but the moratorium was in danger of being administratively scuttled. In addition, threatened legal action became a reality when Michelle Weekly of Kodiak and Thomas M. Carlson of Southeast Alaska brought suit before Judge James Fitzgerald in Anchorage, claiming that they would be irreparably harmed by the moratorium and that conflicts of interest by Council and advisory members should be investigated before the moratorium was enacted. However, shortly before the season was to open Judge Fitzgerald refused to issue the requested injunction, and the moratorium cleared its second to last hurdle (Alaska Fisherman's Journal, July 1983).

But two days before the 1983 Alaska halibut season opened on June 16, 1983, Office of Management and Budget (OMB) administrator Christopher DeMuth recommended to the National Oceanic and Atmospheric Administration (NOAA) that the moratorium be killed. He ruled that it was not consistent with the Reagan administration executive order on the implementation of new regulations that affect the economy. Furthermore:

> A simple moratorium on new entry would not, however, resolve the excess investment problem without creating additional economic problems. Indeed, it is unclear that a moratorium would be effective even in addressing the problem of anticipatory entry and investment. A limited access system has been under consideration since 1978, and as a result a great deal of anticipatory entry has already occurred. But at the same time, the moratorium would certainly prevent some individuals and firms from fishing during the 1983-85 seasons who would otherwise participate in the catch. Such a ban on entry by private citizens who believe they can catch and market halibut profitably would surely create new

inefficiencies, particularly in the later years of the moratorium.

> We are also concerned that it would interfere with the basic economic liberties, especially to the extent that the terms of the moratorium conflict with the traditions and work pattern of individuals employed in the fishing industry. (DeMuth letter in Alaska Fisherman's Journal, July 1983)

Ignoring the contradictions contained in this letter and running the risk of being cynical, one wonders how OMB was able thoroughly to analyze a very complex problem from a distance of four thousand miles in a mere matter of days and reject a solution arrived at over the course of years of discussion and compromise by those intimately acquainted with the subject. Clem Tillion's views reflected speculation at the time that there was behind-the-scenes pressure to secure this decision by OMB:

> I'm having trouble understanding why they didn't like the moratorium and I suspect they don't know either. I suspect that OMB is fulfilling a commitment to someone to kill the moratorium, and when you're doing that any excuse is just as good as any other, whether it makes sense or not. (from the Anchorage Daily News in the Alaska Fisherman's Journal 1983:5)

The moratorium was down but not yet out. In mid-summer, the Council requested a new halibut workgroup, composed of representatives from the industry, to recommend whether the Council should adopt a new moratorium for 1984. By a close vote of only eight to seven it recommended that the 1983 moratorium proposal be amended and presented for Council action at its December meeting. But the moratorium finally died at that meeting--although the Council retained the option of adopting some form of limited entry in the future, it voted to discontinue consideration of a moratorium (Miller 1985). A number of factors were felt to be important in this decision. Among them were the long-standing opposition from certain sectors of the industry, the fact that there was already a large number of participant vessels, and, as one member stated, "It's getting so complicated, frankly, that we're getting bogged down." (Pacific Fishing 1984:69). In addition, Clem Tillion, a staunch and outspoken supporter of limited entry in the halibut fishery, was no longer chairman of the Council. Throughout his chairmanship he had fought for a resource that he felt should belong to all the public, including the consumer. He had consistently opposed a "life style management" that merely ended up sending "10,000 fishermen rushing out to fill a quota" (Sabella 1983).

SO WE CONTINUE TO CONTINUE

> It is such a sad thing, I hate to see the halibut season come anymore. (Tommy Thompson in Rau 1984:9)

The 1984 season witnessed a slight slowdown in the increase in vessels, but landings of halibut rose from the 1983 level of 38.4 million lbs to 44 million lbs. The market was having difficulties absorbing a harvest that had doubled in the last four years, and the problem was aggravated by poor handling of the halibut and loss of quality. A 24 hour opening in August caused one fisherman to remark:

> We started out trying to clean every fish, but we were getting a halibut every other hook and we just couldn't keep up. We just ended up throwing them in the hold with ice. (Blackburn 1984:20)

Loss of quality was one factor that contributed to low prices for the processors and fishermen, but as Tommy Thompson, manager of Sitka Sound Seafood explained, it was not the only one:

> With all the fishermen out there and all the fish hitting the market at the same time, there's no way there can be a decent price. Out of our 1.5 million lbs, we sent out only 9,000-10,000 lbs of fresh fish and that market is the surest way to a better price. With a three day season and all the fish coming at once, we can only offer fresh fish for a week or so. We have to freeze the rest and then they go on the market as a commodity and you have to compete with the brokerage price instead of getting top dollar on the fresh market. (Rau 1984:9)

As a result, even though 9 million more lbs of fish were caught the fishermen ended up with $10 million less in revenue (Amerongen 1985). Even some Kodiak fishermen were wondering about the sanity of putting so much work into a one-day season. Other fishermen, such as Jake Phillips, a member of the Council, continued to hope for limited entry:

> Somehow, some way, we've got to limit the fleet and spread the catch out over an eight month period so we can get a fresh fish market going and a better price. We have to give the fishing back to the full-time fishermen who depend upon it, not the part timer with the skiff and three days off his regular job. I would be in favor of a share system based on past performance and depending on the fishery....I fish black cod and I would like to spread my shares out over my incidental halibut catch. It's a crying shame that we have to shake dead halibut from our black cod gear. I could be selling these fish almost all year long to a fresh market instead of feeding them to the crabs and participating in this stupid, stupid type of fishery we now have. (Rau 1984:10)

In late 1984, the Council voted to take an active role in the management of the halibut fishery--directing its staff to prepare more material on management options that would include but not be limited to exclusive area registration,

license limitation, and share quotas. It also stated that one of its goals was to extend the halibut season to make available high quality fresh and frozen fish to the consumer over as long a period as practicable, thereby maximizing the economic return to the fishing industry (Miller 1985).

As 1984 wound down, the Council directed its Halibut Workgroup to prepare materials on management options. These were to be presented at a series of workshops at various halibut fishing communities in late 1985. By the middle of 1985, however, funding problems and the need to devote staff time to rewriting the Gulf of Alaska FMP prompted the Council to turn over the development of this program to Alaska Sea Grant (Miller 1985).

Meanwhile, the IPHC set the 1985 season as a series of very short openings spread over a three-month period beginning in the first of June. The quota was also boosted another 12.7 million lbs over the previous year. Amazingly, the price of sablefish, halibut's long-time poor cousin in the longline fishery, was $1.00 per lb, $0.40 per lb more than halibut. It was expected that this would take some pressure off the halibut fishery, but the sablefish quota was nearly filled in late May and many of these vessels joined the 1985 halibut derby (Freeman 1984). Effort was again high, because even with low prices the quick halibut season represented for many diversified vessels the quickest, largest earnings of the year (Holm 1985). And although the moratorium was officially dead, limited entry still weighed heavy on many fishermen's minds.

> Halibut seems no longer an option, but a requirement to these boats. Although the push for a limited halibut fishery is currently dormant, in the back of many a small boat owner's mind is the fear that it could be revived in some new and insidious form like the recently proposed and protested guild system that would have forced fishermen to pay up front for the right to catch halibut. (Freeman 1985:26)

CONCLUSION

This is merely the tip of the emotional iceberg of the situation in which Sea Grant will present workshops in Alaskan coastal communities on alternative management plans, of which various formulations of limited entry will be prominent. Establishing a dialogue on rationalization of the fishery will be difficult, since most members of the industry seem to have staked out intractable positions. For example, Oliver Holm, President of the Kodiak Fisherman's Association, had this reaction to the projected Sea Grant program:

> As an observer and participant at the N.P.F.M.C. meetings over the last few years I can't help but think that Sea Grant's involvement in your current project is tinged by a bureaucratic predilection to promote a po-

litical change in our fisheries and society--limited entry in some form. I feel it is inappropriate for Sea Grant to be involved in the politics of limited entry. (Holm, letter of October 22, 1985)

Recent developments in the fishery have furthermore contributed to decreasing the possibility of industry rationalization. As stocks of halibut are healthier than they have been in years, there is no pressing biological reason to justify a drastic change in management. A concerted educational effort between 1984 and 1985 resulted in a significant increase in the quality of ex-vessel fish delivered, and, with one and two day openings, even if fish sat a week on ice at the processors' plants it was fresher than in years past, when boats delivered only after up to two weeks on the fishing grounds (Gilbert 1985; Thompson 1985; Woodruff 1985). The IPHC had reacted to the need for fresh fish by spreading the openings over a longer period. In addition, consumers had come to expect large quantities of fresh halibut since the quotas had been increasing year by year, and by 1985 marketers had learned to deliver and sell vast quantities of fresh halibut during its period of availability (Gilbert 1985; Woodruff 1985). Demand was also increased, as Japan entered the market, to buy at a faster clip than expected (Dow 1985a). As a result of these market pressures a halibut price that existed at a very anemic level of around $0.60 per lb at the June opening rose to $1.30 per lb by August as buyers sought to satisfy the demand for fresh halibut and still build up their frozen inventories, which they belatedly realized were quite low (Woodruff 1985).

If, as Clem Tillion had stated, this was management for "life style," many fishermen may have wondered what kind of experience they were privileged to be getting, as tens, hundreds, and even thousands of boats competed for use of the grounds. At times it became a matter of weighing the possible value of fish caught against the likelihood of tangling in another vessel's gear, not to mention the effort of preparing for such short seasons. Yet, even for the fishermen, the fishery remained very lucrative (Holm 1985), and the very short openings had some advantages, as Kris Freeman noted:

> The crew is braced for the hours of work remaining, fortifying themselves with Milky Way bars. In some ways they prefer a two-day sprint to the five-day marathons of recent seasons past. A fisherman can call up the endurance to get through 48 hours easily enough, but by the end of 120 hours a man can be tired enough to be downright dangerous. (Freeman 1985:28)

In short, the system has adjusted to new realities. Not everyone is happy; the implicit reallocative consequences of abandoning the moratorium and thus in effect greatly reducing the possibility of implementing any form of limited entry will decrease if not completely eliminate the professional longliner component of the fishery. But the longlin-

ers still have the option to turn to the vitalized sablefish and groundfish fishery, and will likely do that instead of continuing the fight for halibut limited entry with the tenacity that struggle would require.

Even such fishermen as Ron Hegge, long a strong advocate of halibut limited entry, have come to feel that it is simply too late to effect a rationalization. He believes that as a unique, distinctive fishery from which some professionals can make a full-time living, it is dead, and that it is now time to accept the situation and direct our energies onto those remaining fisheries, such as sablefish, that have as yet not experienced excess effort (Ron Hegge 1985).

> As Americans vie with each other for their share of the resource, we may ignore the rights and needs of other user groups. If we put the North Pacific Fisheries Management Council in the position of a referee between the groups, we will often be disappointed.
>
> Obviously there aren't any simple solutions, but until the different segments of the industry can recognize that regulation and allocation are a reality and start working together to implement them fairly, no solution will be possible. (Ron Hegge 1985:54)

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Workshop Papers

Regulation of Fleet Capacity

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INTRODUCTION

In this document I will describe policy instruments that directly or indirectly affect the nature and level of fishing activity in Norway. Then I will focus on one specific part of the fishing industry, in which the authorities have had to implement certain measures to adapt the fishing fleet to changed conditions.

THE NORWEGIAN FISHING INDUSTRY

In May 1983, the Ministry of Fisheries presented a report to the Norwegian Parliament (Storting) laying down new guidelines for the fisheries policy. The main objectives are:

- to maintain the present pattern of settlement
- to ensure rational management of marine resources
- to ensure safe, reliable places of work
- to increase real profitability in the fisheries

In addition to these main objectives, the Ministry of Fisheries pointed out some more concrete goals, which would be stressed in the fisheries policy:

- to utilize most of the catches for human consumption
- to promote the quality of Norwegian fish products
- to promote the best possible structure in the fishing industry
- to contribute to bringing social conditions in the fishing industry up to the level prevailing in the commercial and industrial sector

Some of these objectives will come into conflict with one another. The political task at hand will of course be to find solutions that accommodate different and often contradictory objectives in a balanced way.

Regulations

An important task will be to ensure that Norwegian fishing activity does not result in overexploitation of fisheries resources and that it is in accordance with international agreements. During the last years Norwegian catches have declined considerably because of a temporary reduction in important stocks of fish such as cod and capelin. However, catches are expected to increase as soon as 1987.

All fishing vessels have to be registered. Registration of a vessel and transfer of ownership to vessels already registered cannot take place without permission of the Ministry or the Directorate of Fisheries. Such permission is given if the party concerned has been fishing for at least three of the past ten years and still is connected to this occupation. The Norwegian fishing fleet consists of about 24,000 vessels. However, only 700 of these are larger than 50 GRT. Table 1 shows the development of the fleet and the catches over the last ten years:

Table 1. Norwegian fleet (1,000 GRT) and catches (1000 tons).

	1975-79	1980	1981	1982	1983	1984	1985
Fishing fleet	378	362	343	341	330	334	316
Catches	2896	2400	2539	2485	2813	2420	2070

The first-hand value in 1985 was about 4500 million kroner.

In addition to the registration system, a government license is required for operating a vessel to fish with specific gear and/or for specific species of fish. Broadly speaking, we can say that a license is required for trawling and purse seine fishing as well as for sealing and whaling. However, a license is not required for shrimp trawling if the vessel is less than 80 GRT (65 ft), nor for seine fishing if the vessel is less than 90 ft. A special license arrangement is required for all vessels seine fishing for sprat.

Originally the license system for trawling was introduced to protect the smaller vessels in the inshore coastal fishing fleet from competition (for fisheries resources as well as for markets). Later license systems were established to put a limit on the expansion of the fleet and to maintain the relative strength between types of vessels and districts.

Licensing is today a less important measure to conserve the fish stocks than it used to be. In recent years the use of quotas has played the most important part in limiting fishing effort. We have different types of quota systems, ranging from quotas for a specific period during the year, to quotas for each individual vessel, quotas per man, or quotas for certain types of vessels. In addition, a temporary ban on fishing has been used as a regulatory measure, along with regulations on mesh size and various requirements for other fishing gear and vessel equipment.

Regulatory measures of this kind need to be considered in terms of these key criteria: (1) The regulations have to be effective in terms of bringing about the expected reduction in total catch; (2) fishing productivity must be maintained; (3) the regulations must be practicable and as easy to administer as possible; (4) the regulations must not be unduly discriminatory, e.g. between certain districts or certain types of vessels.

Financial Aid

The government's policy has been to secure the fishermen an income at about the same level as that of an industrial worker. In 1985 there were about 29,600 fishermen (about 17,000 man-labor years). To assure normal activity within the fishing industry in periods of temporary decline in important fisheries resources and to discourage the current trend of people moving away from scarcely populated areas in the northern and western parts of Norway, it has been considered necessary to grant financial support to the fishing industry. Governmental financial support to the fishing industry must be regarded as an integral part of Norwegian social and economic policy.

Financial support has been given to the fishing industry over the last 30 years. An agreement was concluded in 1964 between the government and the Norwegian Fishermen's Association establishing guidelines for future support measures. The provisions of the agreement emphasize the importance of introducing measures that can promote efficiency at all levels of the fishing industry to increase overall profitability. The specific schemes for support in accordance with the general agreement are arranged through annual negotiations.

Obviously, governmental economic support affects the fishing effort. The effect depends on the way in which the money is used. The amount available in 1984, 1985 and 1986 (million kroner):

		1984	1985	1986
1.	Price support to first-hand sales of fish	596.0	727.5	682.5
2.	Support to reduce operational costs	239.4	245.7	248.7
3.	Income support	126.0	189.0	184.0
4.	Structural programs	84.6	171.5	183.0
5.	Other programs	54.0	41.3	31.8
		1,100.0	1,375.0	1,330.0

The most important instrument used to increase the fishermen's income is the granting of subsidies to support landing prices of certain species of fish. The subsidy is fixed per unit weight of fish landed. The amount (per kilo) depends on the type of fish landed, where it is landed, the type of vessel used to catch the fish, what type of fishing gear is used, and what time of year the catch is landed. This system does to a certain extent affect the composition of the catch and the structure of the fishing effort.

In recent years, an increasing portion of the money made available by the government has been used to encourage structural changes in the industry, as well as to reduce capacity. Grants may be given to promote reorganization of the Norwegian fishing fleet by facilitating sales and/or scrapping of older vessels (90 million kroner in 1986). One program covers purse seiners and sealing vessels (a maximum of 6 million kroner per vessel), another covers parts of the trawler fleet (a maximum of 8 million kroner per vessel), and one program is designed to help bring about structural improvements in the rest of the fishing fleet (a maximum of 75,000 plus 6,250 kroner per GRT).

The fleet of registered fishing vessels has since 1979 been reduced by 80,000 GRT, 50,000 GRT of this through sales and scrapping schemes. About 500 million kroner has been paid out during these years. However, total fleet capacity is still excessive, compared with expected future catch possibilities.

Grants may also be given to improve efficiency in the fisheries, including research on new ways of fishing, vessel construction, innovation, marketing of products, etc. (68 million kroner in 1986).

In 1984 a special support program for readaptation schemes was introduced (25 million kroner in 1986). This included investments intended to improve safety, handling of fish, etc., in the existing fishing fleet. Investment grants can be given of up to a maximum of 50 percent of approved in-

vestment costs. However, grants cannot exceed a fixed amount of money per vessel.

Experiences from the License System

The use of a license system has turned out to have disadvantages.

- Earlier, the fleet had the ability to change to other gear or species if one fishery failed. Licenses tend to cement the structure of the fleet and limit adaptability to new possibilities.

- The license system also tends to cement the structure of ownership. Young and skillful fishermen are not given a chance.

- License systems that include vessels over a certain size also tend to result in the building of vessels just below this size. In this way the license system can be partly undermined. License systems for fishing with a certain type of gear also tend to result in the finding of new ways of fishing and in the development of new types of gear. In this respect the system in fact promotes innovation.

However, alternatives to a license system have not yet been found. When the total catch capacity of the fleet is reduced, the need for licenses will probably also be reduced, provided that there are opportunities to fish for several different species. When the fleet is too dependent on one fishery, there will be a tendency toward overcapitalization in that fishery. In addition, one must avoid stimulating the fishing effort through financial support.

The Regulation of Fleet Capacity in Norwegian Small-type Whaling

The situation that occurred in 1984 in Norwegian small-type whaling was this: following ten years of stable catch quotas for minke whales, the total allowable catch was reduced by 45 percent in one year.

The whaling has mainly taken place in the Barents Sea from May until August and a license, issued yearly, has for several years been required to attend the catch. In 1983, 89 such licenses were issued. The fleet consisted of small vessels (the average size was about 22 meters) with a crew of three to six persons, mostly located in scarcely populated areas in the northern and western parts of Norway.

In addition to the license system and a total allowable catch quota, a maximum vessel quota was used to regulate the catch. However, the maximum quotas only affected a few vessels. If the government were to base the measures only on considerations of economic efficiency, the 20 to 25 most efficient vessels would have been sufficient to take the total allowable catch. Such a dramatic reduction would have

caused severe problems for the other vessels previously engaged in whaling, and severe problems as well for several small communities along the coast, especially in the north, with few employment alternatives. The government thus had to find other solutions to adapt the fleet to changed conditions. One must also take into account that there will be uncertainty as to whether one is dealing with a temporary or a more long-term decline in the stock. The aim of the Ministry of Fisheries was to reduce the fleet to about 40 participating vessels.

Did the vessels have any alternatives to participation in small-type whaling? In the past few years the stock situation has been critical for Arcto-Norwegian cod. Except for an expansion in the catches of deep-water prawns, the alternatives were very few. Forty-one vessels out of the total of 89 vessels in question had the possibility of participating in the deep-water prawn fishery. But some of these had never before participated in this type of fishery and thus did not have the necessary experience.

Since several of the participating vessels were old, a scrapping scheme was considered as a relevant measure to reduce fleet capacity. The grants were administered by the State Fishery Bank according to official guidelines and after application by interested boat owners. The grants could not exceed:

* vessels below 30 GRT: 170,000 plus 2,500 kroner per GRT
* vessels 30-69 GRT: 250,000 plus 2,500 kroner per GRT
* vessels 70-99 GRT: 325,000 plus 2,500 kroner per GRT
* vessels 100 GRT or more: 375,000 plus 2,500 kroner per GRT

If the engine was scrapped too, an additional 375 kroner per GRT could be obtained.

Ten vessels altogether took advantage of this offer and were scrapped in 1984. The total cost of the scheme was 3.2 million kroner.

In addition, the government offered a readaptation scheme. The intention was to offer a grant, instead of issuing a new license. The scheme was administered by the Directorate of Fisheries, again according to official guidelines and after application by interested boat owners. The grants could not exceed 200,000 kroner per vessel. A minimum activity during the past few years was required to obtain the grant.

A total of 1.5 million kroner was paid out to nine vessels. Almost all of these vessels used the grants to invest in better equipment for the deep-water prawn fishery. These vessels had previously participated on a seasonal basis in the prawn fishery, and through the readaptation scheme they were able to extend the period of prawn fishing and also to make their fishing more efficient. Their entry into the deep-water prawn fishery did not affect the fishing opportunities for vessels already participating.

In addition to these financial support programs the Directorate of Fisheries, which issues the licenses, was given permission by the government to refuse to issue a new license for small-type whaling if the vessel already had a license to fish for deep-water prawns or if the vessel had shown little recent interest/activity in small-type whaling. The deep-water prawn fishery had been (and still is) a lucrative fishery, and thus these vessels would not come into financial difficulties if they did not get a new license for small-type whaling.

In all, the measures carried out by the government resulted in a reduction of the number of licenses by 36 percent, from 89 to 57. (Two of these remaining vessels were chartered by the Directorate of Fisheries for biological research during the season and did not participate in the regular fishery.) This was a very considerable reduction, taking into account that it happened from one year to the next. But the reduction, which in terms of catch capacity amounted to about 23 percent, was nevertheless insufficient to maintain economic efficiency.

To ensure that the catch in 1984 was carried out as effectively as possible, a new type of regulatory measure was introduced. The government decided that vessel quotas should be used to limit the catch. Each vessel's quota would be dependent on its catches in previous years.

Until this system was introduced vessel quotas in other fisheries, for example the capelin fishery, had been dependent on the size of the vessel, which meant that all vessels of a given size would get the same quota. However, even though there was a certain correlation between the size of a vessel and its catch, catches of individual vessels varied. This was due to the fact that small-type whaling was not equally important to all participating vessels. They had different opportunities to participate in other types of fisheries. Also, some people just are more skillful than others. A regulation based on the size of the vessel is to the advantage of vessels with little activity or low efficiency, since they can obtain a quota which will result in unchanged or even improved catch opportunities.

The government felt that the burden of the dramatic reduction in the total allowable catch should be equally borne by all participating vessels. Therefore it was decided that each vessel quota should be a proportion of the total quota based on each vessel's highest yearly catch during two of the past three years. Under this system, a maximum and minimum quota per vessel were established.

Experiences from Reducing the Fleet Capacity in Small-type Whaling

Despite the disadvantages of a license system (cementing the structure of the fleet and ownership) the effect of the measures has been positive. By using individual vessel quotas, the owners were able to plan their fishing activity better.

The dramatic reduction in total allowable catch did not result in any financial problems for the participating vessels in 1984, nor for the vessels that had participated previously. An effect of the considerable reduction in total catch was also a considerable increase in first-hand prices, thus further reducing the adverse financial consequences.

However, the consequences would have been more far-reaching if small-type whaling had been a more important part of the fishing industry. In terms of first-hand value, whaling now only accounts for less than one percent of the value of total Norwegian landings.[1]

[1] Pending the outcome of the comprehensive stock assessment that the IWC is to conclude by 1990, and in light of the differing conclusions emanating from various international stock assessments, Norwegian commercial whaling will be scaled down, and halted after the 1987 catch season. Norway will continue work on scientific surveys of whale stocks, i.a. by employing some vessels in scientifically based whaling. The government has appointed an internationally composed group of prominent scientists to assess available research on whale stocks. The situation will be reviewed in light of their findings, and when the IWC has concluded its work on a comprehensive stock assessment. The government will consult further with the whaling community on what measures may be necessary owing to the temporary suspension of commercial whaling.

The Regulation of Fleet Capacity in Norwegian Purse Seining

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INTRODUCTION - THE NORWEGIAN PURSE SEINE FISHERY

The Norwegian purse seine fleet is rather easily distinguishable from the rest of the Norwegian fishing fleet. The vessels, being designed for purse seining, are rarely used in other fisheries. The vessels vary quite considerably in size, from 90 feet or less to 200 feet or more. They go for pelagic species that congregate in large shoals, such as capelin, mackerel, blue whiting, and herring. The economically optimal catch capacity of the purse seine fleet thus depends upon the abundance of only a few species, together with fish prices and fishing costs.

Ever since the early 1970s, entry of new vessels to the purse seine fleet has been regulated. At the present time a government license is required for operating a vessel to fish for capelin, mackerel, blue whiting (which is fished with a special kind of trawl), herring, and sprat. Vessels less than 90 feet or 1500 hl (hectoliter) cargo capacity are exempt from this regulation, however. In this paper we shall consider the background for this regulation, how it has worked, and to what extent it has attained its purpose.

Shortly after the licensing scheme was put into effect, a pseudo-market in licenses developed. It will be argued that this market, and the value of licenses, owes more to incentives for restructuring the fishing fleet than to the overall profitability of purse seine fishing. The government itself may be said to have participated in this "market" through its program of paying vessel owners for giving up their licenses. We shall attempt to evaluate whether this license retirement program has been worthwhile, both in

terms of raising the profits of the remaining vessels and of improving overall economic efficiency.

THE PURPOSE OF THE LICENSING SCHEME

The so-called "power block," introduced in Norway in the early 1960s, revolutionized purse seine fishing. The power block is a device which allows for a mechanical closing and hauling of the seine, making it possible to use larger seines and bigger vessels. As a consequence, the Norwegian catch of pelagic species increased extremely rapidly in the years 1963-1967 and attained a level that has since then rarely been surpassed (see Figure 1). This brought the Atlanto-Scandian herring stock to a nearly total collapse. Although substitute stocks were found, in particular Barents Sea capelin, it was recognized that the catch capacity of the purse seine fleet had reached a level far beyond what was justified by the available fish.

The first step taken to limit the size of the purse seine fleet was a ban on registration of new purse seine vessels, introduced in 1970. This effectively stopped additional vessels from entering the fishery. The aggregate fleet capacity continued to expand, however. Owners of small vessels were permitted to replace them with larger vessels, up to 6,000 hl cargo capacity. Some expansion also took place through alterations of existing vessels, both purse seine vessels and vessels that originally had been designed for a different purpose. To achieve a more effective control of the aggregate fleet capacity, the registration ban was replaced by a licensing scheme in 1973. All existing vessels were licensed at the time that the scheme was introduced. The licenses specified that person X was allowed to operate vessel Y of Z hl cargo capacity to fish some or all of the above-mentioned species with a purse seine. Replacement or alteration of a vessel thus required a new license, and the transfer of licenses between persons or vessels required the consent of the Ministry of Fisheries. Vessels less than 90 feet were exempt from this scheme, which with minor alterations is still in force.

OVERCAPACITY: A PERSISTENT PROBLEM

The licensing scheme that was put into effect in 1973 clearly was insufficient to reduce the catch capacity of the fleet. If operated restrictively, the scheme could be expected to put a limit only on the expansion of the fleet, for there were still ways to expand aggregate catch capacity. First, the efficiency of the existing vessels could be improved by investing in better equipment and outfits, even if alterations that increased the cargo capacity of a vessel were explicitly banned. Similarly, the replacement of a vessel with a new one of the same cargo capacity, but with a better outfit and equipment, would amount to an increase in catch capacity. Secondly, vessels less than 90 feet (or,

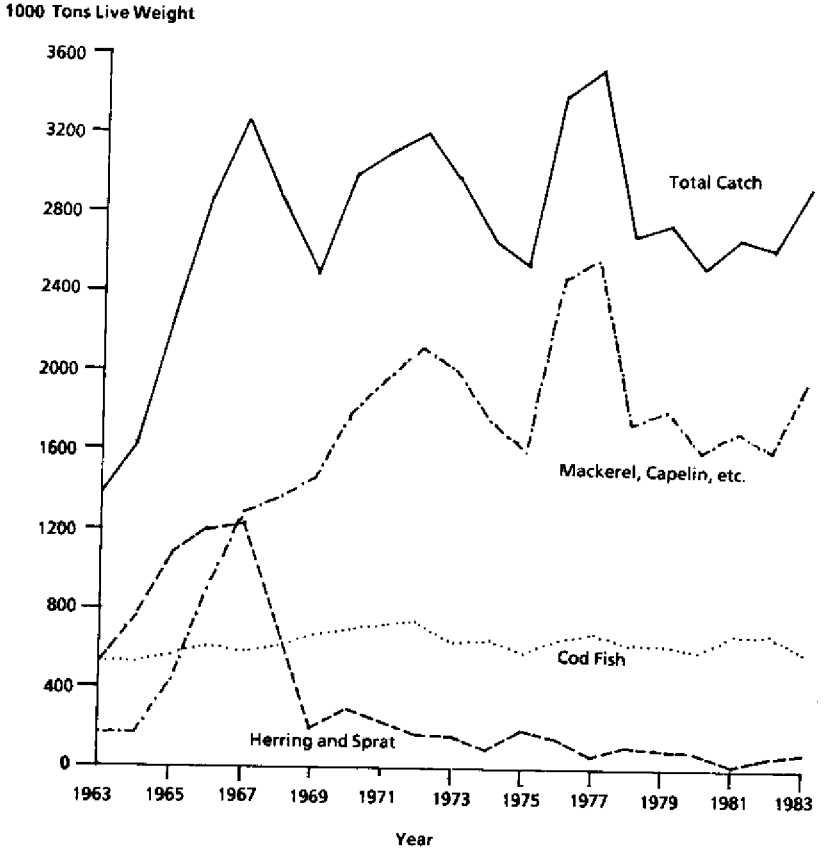

Figure 1. Norwegian catches of fish 1963-1983. Most of the catches of herring and sprat, and mackerel, capelin, etc., are taken by the purse seine fleet. Source: Central Bureau of Statistics: Fishery Statistics.

later, of less than 1500 hl cargo capacity) were exempt from the licensing scheme.

Table 1 shows the development of the licensed purse seine fleet since 1968. Although the number of vessels has fallen almost every year, the aggregate fleet capacity in fact increased until 1978. From 1979 onwards, grants were given for scrapping purse seine vessels, a move which had an appreciable impact on the aggregate catch capacity. This grant scheme will be discussed later.

Table 1. Number of licensed purse seine boats.

Year	Number of boats	Cargo capacity (hl)	Average cargo capacity (hl)
1968	456	1,297,300	2,845
1973	321	1,314,350	4,095
1976	269	1,330,750	4,989
1977	269	1,373,700	5,107
1978	271	1,438,000	5,306
1979	253	1,393,200	5,507
1980	215	1,262,161	5,870
1981	193	1,173,800	6,082
1982	184	1,168,900	6,353
1983	160	1,091,950	6,825
1984	155	1,073,750	6,927

Source: Central Bureau of Statistics: Fishery Statistics

As regards whether the actual catch capacity of the purse seine fleet initially expanded more, or subsequently contracted less, than indicated in Table 1, we have only circumstantial evidence. First, it should be noted that Table 1 only includes licensed vessels. There are no figures easily available on the number of purse seiners exempt from the licensing scheme, but approximate information on this can be obtained by looking at the number of vessels participating in the winter capelin fishery. Table 2 shows the number of unlicensed purse seiners that have participated in this fishery in the period 1979-1985. This number increased about 300 percent in the years 1979-1983, but has since declined. During this period, some new vessels of a size just below the license limit were built. Assuming that all the increased participation of unlicensed vessels in the winter capelin fishery was due to such vessels, we obtain an increase in fleet size of 30,000 hl (20 vessels times 1,500 hl). This is much less than the decrease in licensed cargo capacity over the same period. At the present time, the construction of "undersized" vessels has been made less attractive by a recent requirement to the effect that an unlicensed vessel will only be allowed to participate in the winter capelin fishery if it has already participated for two prior years. We thus conclude that the building of "undersized" vessels does not represent any serious challenge to the license limitation program.

Table 2. Number of unlicensed purse seiners participating in the winter capelin fishery.

1979	1980	1981	1982	1983	1984	1985
12	15	19	19	32	21	22

Source: Directorate of Fisheries

But the number of vessels and the total cargo capacity does not tell us all about the catch capacity of the fleet. Capital stuffing is a phenomenon that often occurs in response to limiting the number of vessels in any given fishery. Table 4 compares a price index of new purse seine vessels to a price index of machinery and transport equipment. The cost of new purse seiners increased about twice as much as the price of machinery and transport equipment in the years 1977-1983. According to those who compile the cost figures for new vessels, this increase is due to the installation of ever more sophisticated equipment for finding fish, handling fishing gear, and preserving the catch at low temperatures; also to the provision of better amenities for the crew. Some of this undoubtedly increases catch capacity. However, other installations increase the value of the catch without increasing catch capacity--which certainly is beneficial from an economic point of view.

Table 3. Cost (1,000 kroner) of new purse seine vessels.

Year	Cargo Capacity (hl)			
	0-4,000	4,000-6,000	6,000-8,000	8,000+
1977	8,337	11,356	13,410	15,996
1978	10,258	14,204	17,044	19,982
1979	10,803	15,123	17,865	19,960
1980	11,639	15,294	18,746	20,581
1981	12,770	16,872	20,148	23,030
1982	14,258	18,847	23,016	27,287
1983	15,925	20,529	24,326	29,364
1984	15,844	22,368	26,098	31,486

Source: Directorate of Fisheries: Profitability Investigations

Table 4. Cost index for new purse seine vessels of 8,000+ hl cargo capacity, calculated from Table 3; compared with the wholesale price index for machinery and transportation equipment.

Year	Purse seiners	Machinery and transportation equipment
1977	100	100
1978	125	108
1979	125	114
1980	129	122
1981	144	130
1982	171	135
1983	184	143
1984	197	148

Source: Central Bureau of Statistics: Yearbook of Statistics

INCREASING RETURNS TO SCALE AND THE PRICE OF LICENSES

To the extent that a license limitation program succeeds in generating rents in the fishery, the licenses will attain a scarcity value. A trade in licenses will develop if such trade is allowed, or will assume whatever forms restrictions on such trading make necessary. Trading in licenses does not seem to have been part and parcel of the Norwegian scheme at the outset; the regulation specifies that a purse seine license pertains to both the vessel and its owner, and that the license will not be transferred automatically to a new owner if a licensed vessel is sold. Nevertheless, a market of sorts in licenses developed, and transfers of licenses were permitted, with certain restrictions and reluctantly at first, but later less so. There is no official recording of transactions in licenses, but the price of a license has been quoted unofficially at 800-1,000 kroner per hl cargo capacity. Transactions in licenses are possible only together with the vessel itself; once a vessel has been bought, the new owner asks the Ministry of Fisheries for permission to have the license transferred to himself. The new owner can either use the newly acquired vessel for fishing, or scrap it and transfer the license to another vessel. The latter has been common practice. Buyers of licenses have merged them with the licenses they had already, in order to buy a new and bigger boat, to gain permission to use the capacity of a vessel they did not have a full license for, or to physically enlarge an existing boat.

As this use of acquired licenses indicates, the reason why a market in licenses developed is not that the licensing program has been successful in generating economic rent in the fishery through a reduction in excessive fleet capacity. In Appendix 1, the gross rate of return on capital is shown for two size classes of purse seine vessels, "small to medium" and "large" vessels. For small to medium-sized vessels the gross rate of return was only 5-10 percent in the years

1977-1984, while for large vessels it was 6-14 percent. This is a rather low rate of return, since it must cover both depreciation and the alternative rate of return on capital. Little room is left, therefore, for economic rent. The fact that licenses nevertheless have a market value appears to be due exclusively to increasing returns to scale in purse seining. These increasing returns to scale are reflected in the rate of return figures in Appendix 1, which are consistently higher for large vessels than for small to medium-sized vessels. Appendix 2 contains further evidence on returns to scale in the purse seine fishery.

In Appendix 1 we also show figures that indicate the value of a license, in case a license is used as a basis for operating a bigger boat. Consider the following. Suppose a boat owner has got a license to operate a boat of 5,000 hl cargo capacity. He plans to buy a new boat, and would like to get one with 10,000 hl cargo capacity. To make this possible, he must buy another boat with a license for 5,000 hl that he can merge with his previous license. How much would he be willing to pay for the license of the extra boat? Appendix 1 shows the average gross profit of the two classes of vessels in which we find boats of 5,000 and 10,000 hl cargo capacity. By dividing the gross profit of a large vessel by the rate of return on a small vessel, we can find the amount that could be paid for a 10,000 hl vessel while earning the same rate of return as on a 5,000 hl vessel. The difference between this amount and the actual cost of a new 10,000 hl vessel shows how much the license of a 5,000 hl vessel is worth, taking the rate of return for a 5,000 hl vessel as a benchmark. These figures are shown in Appendix 1 for each year in the period 1977-1984. The figures vary a great deal from year to year, with an average of 1,600 kroner per hl. This is almost twice the unofficial "price" of 800-1,000 kroner per hl. On the other hand, the difference has the expected sign. The gross rate of return on capital invested in small to medium-sized vessels is probably below long-term economic viability, and so the buyer of a 10,000 hl vessel would hardly be willing to pay the full difference in profitability of 10,000 hl and 5,000 hl vessels for obtaining a license of 5,000 hl. Risk aversion would also pull in the same direction.

THE ATTITUDE OF POLICY MAKERS TOWARDS TRADE IN LICENCES

Trade in licenses does not appear to have been foreseen at the time when the purse seine licensing system was put into effect. Rather, it seems safe to assume that purse seine licenses were not meant to become tradeable assets; the provision that a purse seine license could not be transferred automatically from one person or vessel to another points in that direction. However, a trade in licenses developed anyway. This was accepted by the Ministry of Fisheries, but reluctantly at first. Regulations pertaining to the transfer of licenses stipulated that the license of a purse seine vessel could not be transferred to another vessel, unless the owner of the vessel whose license was being transferred

had been in possession of that vessel for at least two years. This was done explicitly in order to discourage the trading of vessels for the purpose of merging the licenses of two (or more) vessels.

As time went on, policy makers became more and more aware of the economies of scale in purse seine fishing, and inclined more and more to the view that taking advantage of this was a positive thing. The two years restriction on the merging of licenses was thus abolished in 1979. The pursuit of economies of scale was not wholehearted, however. There were still restrictions as to how large a cargo capacity could be licensed on a single vessel, and a limit to the cargo capacity permitted on the basis of merged licenses. The upper limit on cargo capacity permitted when old vessels were being replaced is 10,000 hl. (The cargo capacity of the largest existing purse seine vessels is about 15,000 hl.) According to regulations from 1979, only half of the cargo capacity exceeding 8,000 hl was taken into account when vessels were being replaced. Thus the holder of licensed capacity of 10,000 hl could not replace it with a larger capacity than 9,000 hl. This rule was abolished in 1982, while the limit of 10,000 hl was retained.

This seemingly contradictory attitude towards taking advantage of economies of scale can be seen as a result of the classic conflict between two major objectives of economic policy, equity and efficiency. Merging the fishing licenses of small vessels promotes efficiency, while equity, in the sense of equalizing the incomes of fishermen, requires that all vessels be of a similar size (or that the cleverest fishermen operate the least efficient vessels, a policy that is hardly practical). This equity element has a strong influence upon Norway's fishery regulations; one of its consequences is that the biggest vessels get the relatively smallest quotas in the capelin fishery, the most important of the purse seine fisheries. This procedure has been quite effective in equalizing the incomes of purse seine fishermen. (Hannesson 1985).

As to the public attitude towards the buying and selling of licenses, there is a certain element of resentment. It is argued that the licensing system has created an artificial scarcity, i.e., a limited number of licenses to use purse seine. Those who happened to be in the purse seine fishery at the time the program was initiated got an asset for free, and are now able to pocket the market value of this asset. It is quite possible that this resentment may prove strong enough to topple the licensing scheme altogether. This is, perhaps, a lesson to the effect that if a management program based on limited entry that creates artificial scarcity of vessels, quotas, or whatever, is to be viable in the long term, a substantial amount of that scarcity value must be confiscated through taxation or some other appropriate means.

THE GRANT SCHEME FOR CAPACITY REDUCTION

As already explained, the license limitation scheme was originally put into effect because of overcapacity in the purse seine fleet. The scheme contained no provision for reducing catch capacity, except to the extent that transfers of licenses between individuals would be refused. Thus the scheme could not be expected to achieve much more than to hold the line. In 1979 measures were taken to reduce the overcapacity of the purse seine fleet. This was accomplished by giving grants to those who surrendered their licenses and removed their vessels from the purse seine fishery. In official documents, a 25 percent reduction in catch capacity was mentioned at that time as being necessary for restoring the profitability of the remaining vessels. A still greater capacity reduction would have been necessary to maximize economic rent in the purse seine fishery. (On optimal capacity of the purse seine fleet, see Flaam and Hannesson 1983; Hansen 1979; and Mathiesen 1981.)

The scheme had an immediate effect in reversing the trend of a slowly rising catch capacity; over the years 1979-1984 the capacity reduction accomplished through the grant scheme amounted to 260,000 hl. This is, however, no more than 18 percent of the licensed cargo capacity at its peak in 1978, and so the program has not quite achieved its limited purpose.

The grants were disbursed by the government-owned "Fishermen's Bank" (Statens Fiskarbank) in accord with official guidelines and after application by interested boat owners. No bidding or tendering was involved, but the changes in the guidelines that took place show a certain evolution in the amount offered for the scrapping of purse seine vessels. The original guidelines of May 1979 stipulated two methods for determining the grant:

Method (i): A flat rate of 500,000 kroner per vessel, plus 2,050 kroner per gross registered ton. (The latter could be raised by 15 percent if the engine was scrapped as well.)

Method (ii): A grant equal to the debt secured in the vessel, plus 200,000 kroner.

The method giving the highest grant was to be used, but an upper limit of two million kroner per vessel was imposed.

These rules were changed subsequently as follows:

August 1979: The flat rate in Method (ii) was raised to 500,000 kroner, and the maximum limit was raised to three million kroner per vessel.

November 1979: The maximum limit was raised further, to five million kroner per vessel, and the Ministry of Fisheries was given discretionary power to relax requirements

pertaining to previous participation in the purse seine fishery.

July 1980: The flat rate in Method (i) was raised to one million kroner per vessel, and the maximum limit to six million kroner per vessel.

July 1982: These new guidelines mentioned neither Method (i) nor (ii), but spoke instead of the grant as being determined by reference to factors such as vessel size, licensed cargo capacity, use value of the vessel, etc.; but the maximum limit of six million kroner per vessel was retained.

The successive raising of the grant limits and the relaxation of other conditions amounts to a tendering procedure of a kind. By this process the government buys up the cheapest licenses first, and so would seem to minimize the cost of eliminating excessive capacity. The grant records show that the "price" per hl cargo capacity so "bought" increased over time, particularly in the initial phase of the program, and so did the size of the vessels that were eliminated. It is, however, an open question, and one that will not be answered here, whether this is the best possible tendering procedure. Much will depend on to what extent boat owners are able to anticipate successive increases in the "bids." Problems with this particular form of tendering are, first, that frequent revisions of the guidelines may invite adaptive expectations on the behalf of boat owners, and, secondly, that the process takes a rather long time.

Most of the vessels whose licenses were removed were physically destroyed (in fact, the disbursement of the grant was contingent upon a certificate that the vessel had been destroyed or had been delivered to a shipyard for scrapping). But grants were also given for subsidizing sales of purse seine vessels to foreign buyers, and to domestic buyers for conversion to other purposes. The records show that the grants for this latter purpose were remarkably stable in terms of kroner per hl; on average the grant was 537 kroner per hl, ranging between 427 and 678 kroner per hl. This is a bit below the unofficial "quotation" of 800-1,000 kroner per hl licensed capacity.

THE BENEFITS OF THE GRANT SCHEME

Was the grant scheme worthwhile? There are two ways of answering this question. (1) Did the retirement of licenses so improve incomes for the remaining vessels that they could have paid for the cost of retiring licenses and still be left with a net gain? (2) Did the cost savings achieved by the retirement of vessels outweigh the amount paid for their retirement?

As the fishing of the purse seine fleet is still being regulated through vessel quotas, we may safely assume that the retirement of purse seine vessels did not cause any reduction in the total catch. Thus the only effect, and an in-

tended one, on catches was that the remaining vessels got a higher quota each, the total allowable catch being divided among fewer vessels. The resulting increase in the catch value for each vessel, net of catch-related costs, thus constitutes the benefit accruing to the remaining vessels.

As most of the vessels being retired were rather small (see Appendix 3), i.e. below 4,000 hl cargo capacity, it may be assumed that their withdrawal affected first and foremost the catch quotas in the winter capelin fishery. The summer capelin fishery takes place much further north in the Barents Sea, and the smallest vessels do not partake in this fishery. There are other purse seine fisheries regulated through vessel quotas as well, but these are less important. In any case, as it will turn out that the gains in the winter capelin fishery are in fact high enough to pay for the license retirement program, we need pursue the matter no further.

Since the late 1970s, the vessel quotas in the winter capelin fishery have been determined through a system of "base quotas." Each vessel is entitled to a base quota related to its size (cargo capacity), as shown in Appendix 3. All vessels must register before a certain date in order to become eligible for a vessel quota. When the deadline for registration has passed, the total amount of base quotas is summed across all registered vessels, and the actual vessel quota is found by dividing the total allowable catch by this sum and multiplying by the base quota of the vessel.

From the records of retired vessels it is possible to calculate the implied reduction in the sum of base quotas in the winter capelin fishery, assuming that the retired vessels would otherwise have taken part in this fishery. This is done in Appendix 3. The total reduction amounted to 162,172 hl. In comparison, the total sum of base quotas in the winter capelin fishery in 1985 was 462,700 hl, so the vessel quotas would on our assumption have been 26 percent lower if the grant scheme had never been put into effect. In 1984, which was a worse than average season in the winter capelin fishery, the total catch quota allocated to the licensed purse seine fleet was 2,614,245 hl. Dividing this among more vessels, as would have been necessary if the license retirement program had not been in place, would have reduced the catch value of the vessels participating in the 1984 season by

$$2{,}614{,}245 \times 0.26 \times 0.8 \times 97 \times 0.77 = 40{,}539{,}981$$

that is, about 40 million kroner. The factor 0.26 represents the 26 percent reduction in vessel quotas, 0.8 corrects for catch related costs (these are about 20 percent of catch revenue), 97 is the weight in kilograms of one hl of capelin, and 0.77 is the 1983 price per kg of capelin.

Is this enough to cover the cost of the license retirement program? The total cost of the program was 230 million kroner, in current prices. As most of the grants were given in

1979 and the early 1980s, this amount would be somewhat higher in 1983 prices, but certainly well below 300 million kroner. It would thus take six to seven years to recover these costs through the gains accruing to the remaining fleet (40 million per year, if the 1984 catch is taken as being representative) in the winter capelin fishery only. Looking at the present value of these gains and assuming that they are perpetual and that 1984 was a representative year, it would be necessary to discount at a (real) rate of 14 percent or more in order to reduce the present value of the gains below 300 million kroner. It thus appears beyond doubt that the increases in the revenues of the remaining vessels have been more than enough to pay for the license retirement program.

A similar conclusion is reached from looking at the cost savings achieved by the license retirement program. In Appendix 3, we have calculated the present value of the cost savings, assuming that the vessels removed from the fleet through the license retirement program would otherwise have continued fishing for another five years. (Most of the vessels withdrawn were old and would soon have been scrapped anyway.) This amounts to 285 million kroner, at a discount rate of 7 percent, which is the rate recommended by the Ministry of Finance for project appraisal. This is just about enough to cover the costs of the license retirement program. The cost savings calculated in Appendix 3 do not include labor costs. These must at any rate be assumed positive if uncertain. It seems safe, therefore, to conclude that the license retirement program was worthwhile.

CONCLUSION

The Norwegian purse seine fishery offers an excellent illustration of the waste resulting from free access to fish resources. Technological progress in this fishery led to a very rapid buildup of catch capacity and depletion of fish stocks. Catch capacity was brought under control too late and too halfheartedly, and then mainly to save the fish stocks, not to improve economic efficiency. In fact, economic issues appear at first to have been peripheral to policy makers, and fairly straightforward economic implications of the licensing scheme, such as the trading of licenses, appear to have taken them by surprise.

The regulation of the purse seine fishery has certainly succeeded in avoiding, and perhaps reversing, fish stock depletion. A depletion of the Barents Sea capelin has been avoided, and the Atlanto-Scandian herring appears to be recovering, after a long period of strict catch regulations. But in terms of economic efficiency the regulation has been only a limited success. Thirteen years after the licensing program was put into effect, total fleet capacity is still much greater than needed to maximize economic rent.

Indeed, policy papers indicate that the ambitions of policy makers with regard to economic efficiency go no further than

to reach an economic break-even point for the fleet, thus implicitly accepting that resource rent will be absorbed by excessive costs. The reason why policy makers are interested in such an objective, which might seem not to require any interference with market forces, is that the current framework for fisheries policy (i.e., the 1964 agreement between the government and the Fishermen's Association) may be taken to imply that the government should cover any losses incurred by the fishing fleet (Hannesson 1985).

As a measure to improve economic efficiency, the license retirement program represents an interesting initiative. Buying back licenses at market prices is a way of reducing catch capacity without harming the interests of those who surrender their licenses. Such methods are more likely to gain acceptance than methods which force some to give up fishing, but the equity of such buy-back schemes depends, of course, on the equity of the status quo. The benefits of the Norwegian license retirement program appear to have outweighed its costs, and a serious attempt seems to have been made at minimizing the costs of this program.

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APPENDIX I: RATES OF RETURN ON CAPITAL INVESTED IN PURSE SEINE VESSELS 1977-1984

The following tables show the implied value each year of a 5,000 hl purse seining license. This is found as follows. First, we calculate the average gross profit of a 5,000 hl and a 10,000 hl vessel, respectively, and the rate of return on capital invested in a new 5,000 hl and 10,000 hl vessel. We then put the rate of return of a 10,000 hl vessel equal to the rate of return of a 5,000 hl vessel and calculate the implied cost of a 10,000 hl vessel. The difference between the implied and the actual cost of a new 10,000 hl vessel represents the value of a 5,000 hl license. For source and definitions, see below.

The lines show the following:

Line 1: Gross return on capital
Line 2: Cost of a new fishing vessel
Line 3: Rate of return on capital invested in a new fishing vessel (line 1 divided by line 2)
Line 4: Cost of a new 10,000 hl fishing vessel yielding the same rate of return as a 5,000 hl fishing vessel
Line 5: Implied value of a 5,000 hl license, expressed per hl (line 4 minus line 2 for the 10,000 hl vessel, divided by 5,000)

	5,000 hl	10,000 hl	5,000 hl	10,000 hl
	1977		1978	
1.	1,128,985	2,188,327	669,369	1,411,576
2.	11,355,583	15,996,077	14,203,529	19,982,353
3.	0.0994	0.1368	0.0471	0.0706
4.		22,015,362		29,969,766
5.		1,204		1,997
	1979		1980	
1.	823,171	1,229,868	1,086,133	1,788,224
2.	15,122,593	19,960,000	15,294,250	20,581,000
3.	0.0544	0.0616	0.0710	0.0869
4.		22,607,868		25,186,254
5.		530		921
	1981		1982	
1.	1,267,322	2,015,134	1,047,902	1,649,662
2.	16,872,222	23,030,263	18,847,059	27,287,037
3.	0.0751	0.0875	0.0556	0.0605
4.		26,832,676		29,670,180
5.		760		477
	1983		1984	
1.	1,397,038	2,796,866	1,454,848	3,630,729
2.	20,528,947	29,364,000	22,367,857	31,486,207
3.	0.0681	0.0952	0.0650	0.1153
4.		41,069,985		55,857,369
5.		2,341		4,874

Source and Definitions

The preceding figures have been calculated from the profitability investigations carried out by the Directorate of Fisheries. The result of these investigations, as regards purse seiners, are presented as averages for four groups of vessels. We have taken the results for the 4,000-6,000 hl group as being representative for 5,000 hl vessels, and those for the 8,000+ group as representing 10,000 hl vessels.

The cost figures reported by the profitability investigations do not include labor costs for the vessel crew, as these investigations are concerned with finding the "wage-paying ability" of the vessel, regarding the crew as a residual claimant. We have corrected the cost figures of the profitability investigations in the following way: Capital costs, i.e., vessel insurance, depreciation, maintenance, and interest on capital are excluded. Labor costs have been added. These are calculated by multiplying the number of man years by one and a half times the average wage level in the Norwegian economy (excluding payroll tax, the equivalent of which is included in the cost figures calculated in the profitability investigations). The reason for so inflating the average wage level in calculating the opportunity cost of labor is that the remuneration of purse seine fishermen has been persistently higher than the average wage in the Norwegian economy, sometimes twice as high. We take this as an expression of purse seining being more demanding in terms of skill and effort than normally is the case. Furthermore, investigations have shown that the number of hours worked per man-year in the fishery is considerably higher than in most other industries. In Appendix 2, the assumed opportunity cost of labor each particular year is shown, together with the remuneration of fishermen on the largest purse seine vessels.

APPENDIX II: ECONOMIES OF SCALE IN THE PURSE SEINE FISHERY

The following two tables show average cost divided by average revenue for the purse seine fleet, expressed as a percentage of the figure for the largest vessels.

The figures for 1969-1970 indicate strong economies of scale, particularly for the smallest vessels. As more and more small vessels were withdrawn from the fishery, the signs of economies of scale became weaker. Hence, the most important economies of scale appear to be utilized by abandoning the use of vessels less than 100 feet long.

From 1979 onwards, the capelin fishery was regulated through vessel quotas which increased less than proportionally with vessel size (Appendix 3). This is discernible in the figures; the economies of scale are weaker or not present at all in the figures for 1979-1982. In 1983 and 1984, the vessels in the range 8,000-10,000 hl were allowed a somewhat larger quota in the summer capelin fishery than in the preceding years, relative to other vessels. This could be the reason why there are stronger indications of economies of scale in the figures for 1983 and 1984 than for 1979-1982.

Table A2.1. Average cost divided by average revenue, excluding labor costs, in percentage of the figure obtained for the largest vessels. Note that the size classifications before and after 1977 do not overlap.

	Vessel Size			
Year	80-100 ft	100-120 ft	120-140 ft	140+ ft
1969	155	131	125	100
1970	126	115	96	100
1971	97	100	105	100
1972	97	103	100	100
1973	83	112	103	100
1974	--	101	103	100
1975	119		111	100
1976	98		109	100

	0-4000 hl	4000-6000 hl	6000-8000 hl	8000+ hl
1977	119	106	92	100
1978	104	109	94	100
1979	92	97	101	100
1980	91	95	97	100
1981	85	96	99	100
1982	82	92	96	100
1983	87	103	99	100
1984	91	103	102	100

Table A2.2. Average cost, including labor cost, divided by average revenue, for the purse seine fleet, expressed as a percentage of the figures for the largest vessels.

Year	Vessel size			
	80-100 ft	100-120 ft	120-140 ft	140+ ft
1969	208	156	140	100
1970	185	137	105	100
1971	125	115	112	100
1972	121	118	109	100
1973	108	131	111	100
1974	--	116	109	100
1975	135		119	100
1976	117		118	100
	0-4000 hl	4000-6000 hl	6000-8000 hl	8000+ hl
1977	141	117	97	100
1978	122	119	96	100
1979	108	105	102	100
1980	102	105	98	100
1981	101	106	101	100
1982	98	102	100	100
1983	102	113	105	100
1984	111	114	109	100

In the table below, the assumed opportunity cost of a man-year in the purse seine fishery is shown, together with the average remuneration per man-year for the largest group of vessels.

Table A2.3. Assumed opportunity cost per man-year in the purse seine fishery (150 percent of the average wage in the Norwegian economy, excluding payroll tax), and the average remuneration per man-year for the largest group of vessels.

Year	Cost	Remuneration	Year	Cost	Remuneration
1969	41,013	55,527	1977	101,805	161,487
1970	44,199	74,464	1978	110,018	135,800
1971	49,560	77,294	1979	114,002	133,843
1972	54,425	71,539	1980	125,508	146,588
1973	60,232	115,784	1981	140,333	168,478
1974	68,526	101,719	1982	156,689	159,057
1975	81,018	96,227	1983	170,577	220,527
1976	92,531	155,589	1984	182,798	219,445

Management of the Icelandic Demersal Fisheries

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ABSTRACT

This paper considers the management of the Icelandic commercial fisheries, placing particular emphasis on the demersal fisheries. The structure of the individual vessel quota system in the demersal fisheries is described in some detail and its performance evaluated. A notable conclusion is that the vessel quota system appears to have attained a significant fraction of the maximal attainable economic rents in the fisheries. Finally, there is a brief discussion of the major weaknesses of the demersal management system.

INTRODUCTION

The aim of this paper is to describe the current management regime of the Icelandic demersal (groundfish) fisheries and consider its most important economic effects. Relative to the complexity of the subject, the discussion will of course be rather superficial. However, an attempt will be made to highlight the most pertinent aspects of the Icelandic fishery management from the point of view of the workshop.

The paper is organized as follows: first general background information is provided on the Icelandic fisheries and on the management measures taken in recent years. There then follows a specific consideration of the demersal fisheries and their management. The economic performance of the management system is then examined and evaluated. Finally, the major perceived weaknesses of the current management system are discussed.

ICELANDIC FISHERIES: DESCRIPTIVE BACKGROUND

This section provides a brief factual background about the Icelandic fisheries. An overview of basic data about the fisheries and their potential yield is followed by a description of the fleet, then a discussion of the fisheries' economic performance, and finally a description of the fishery management undertaken to date.

Fisheries and Catches

The Icelandic fisheries are primarily based upon the harvesting of several demersal species of which cod, haddock, saithe and redfish are the most important; and two pelagic species, herring and capelin. In addition to these fisheries there are also significant shrimp, lobster and scallop fisheries. In a typical year, the demersal fisheries generally yield between 75 and 80 percent of the total value of the Icelandic fisheries. The pelagic fisheries usually account for some 15 percent of the total catch value and the remaining fisheries for a little over 5 percent. By far the most important single fishery is the cod fishery, which normally generates some 50 percent of the total value of the catches. A more detailed numerical description of the catch and value data, as well as estimates of their maximum sustainable levels (MSY), are provided in Table 1.

Fishing Fleet

The fishing fleet consists of a wide range of vessel types. For our purposes, it is convenient to decompose the fishing fleet into three classes:

1. Deep-sea trawlers: the deep-sea trawlers are usually between 130 and 250 feet in length. They are engaged almost exclusively in the demersal fisheries employing bottom and, occasionally, mid-water trawl. Due to their size, their range is relatively unrestricted. Consequently they are able to exploit practically any fishing grounds off Iceland. Nevertheless the deep-sea trawlers normally return to home port at the end of the fishing trip to unload their catches. Each trip usually lasts from about five to fifteen days. The deep-sea trawlers comprise almost half of the total tonnage of the fishing fleet, and their share in the total demersal catch is roughly 75 percent.

2. Specialized purse seiners: These vessels are generally over 120 feet. They are primarily engaged in the capelin fishery but some also participate in the herring fishery. The purse seiners are, moreover, technically capable of participating in the demersal fisheries employing gillnets and bottom trawls. Recently, however, as a part of fishery management measures, they have been barred from this fishery. The specialized purse seiners typically follow the capelin schools over great distances and land their catches wherever is most convenient.

Table 1. Icelandic Fisheries: Catch Volumes and Values.

	Average Catch 1980-85 (1000 of mt)	Estimated Catch Values (millions of U.S.$)	Estimated MSY (1000 of mt)	Estimated MSY Values (millions of U.S.$)
Demersal species				
Cod	364.6	146.2	420.0	168.4
Haddock	57.4	20.8	60.0	21.7
Saithe	60.9	13.8	90.0	20.4
Redfish	100.9	32.0	80.0	25.4
Other**	64.1	21.0	60.0	19.7
Total	647.9	233.8	710.0	255.6
Pelagic species				
Herring***	52.2	8.3	90.0	14.3
Capelin	652.5	29.9	900.0	41.2
Total	704.7	38.2	990.0	55.5
Crustaceans				
Shrimp	14.6	11.3	12.0	9.3
Lobster	2.5	5.4	3.0	6.5
Total	17.1	16.7	15.0	15.8
Shellfish				
Scallop	12.9	5.1	13.0	5.1
Total	1382.6	293.8	1728.0	332.0

* At 1984 catch prices.
** Mainly plaice, halibut, catfish, and Greenland halibut.
*** Excluding the Atlanto-Scandian herring fishery, which has produced no yield for the previous 15 years but has periodically become very big. During 1960-66 the average Icelandic catch of this species was 400,000 mt annually.

3. Multipurpose vessels: The multipurpose vessels are generally smaller than those previously discussed. These vessels are, for the most part, neither specialized with respect to fishing gear nor fishery. Most of the multipurpose vessels are technically able to employ trawl, gillnets, longline and purse seine gear and to pursue any of the Icelandic fisheries discussed above. The geographical range of the smaller of the multipurpose vessels, i.e. those under 100 feet, say, is rather restricted, however. These vessels are typically confined to one- to three-day fishing trips exploiting fishing grounds relatively close to their home port,

where they also land their catches. The larger multi-purpose vessels occasionally embark on longer fishing trips to distant fishing grounds. However, except when engaged in the seasonal herring fishery, these vessels generally also return to home port to unload their catches.

Further details about the fishing fleet are set out in Table 2 below.

Table 2. The Icelandic Fishing Fleet December 12, 1984.

	Number	Total tonnage	Average age
I. Deep-sea trawlers			
(i) over 130 feet	107	51,120	10.2
II. Specialized purse seiners			
(i) over 120 feet	55	19,754	15.9
III. Multipurpose fleet			
(i) 40-75 feet	157	4,273	19.0
(ii) 75-120 feet	228	25,284	21.1
(iii) over 120 feet	31	8,231	17.5
Total	416	37,788	
Total fishing fleet	578	108,662	

As Table 2 shows, the average age of the fishing vessels is rather high. This reflects i.a. the effects of more restrictive fishery management measures and explicit official efforts in recent years to halt new investment in the fishing fleet.

Economic Performance

The Icelandic fisheries as they existed until the late seventies can be fairly accurately described as typical free entry competitive fisheries. Not surprisingly, the development of the fisheries has closely resembled the path predicted for such fisheries by the classical propositions of fishery economics (See e.g. Gordon 1954).

Due to the reduction in fishing effort during the war years, the Icelandic fish stocks were at relatively high and stable levels at the end of 1945. The ensuing period has been characterized by a huge (fourteenfold) increase in the employment of fishing capital, as well as a threefold increase in annual catch volumes, accompanied by a corresponding decline in the fish stocks. In value terms, the growth in

fishing capital has exceeded the increase in catch by a factor of more than four. Thus, the capital-output ratio in the Icelandic fisheries is currently less than 25 percent of what it was in 1945. This path of the fishing capital and catch is illustrated in Figure 1.

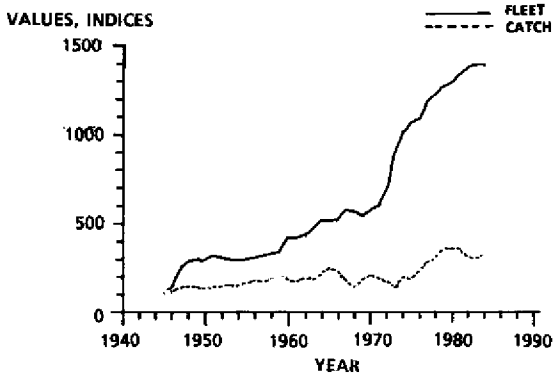

Figure 1. Fishing capital and catch values 1945 to 1984.

The increase in catch volumes has largely resulted from the development of new fisheries, e.g. redfish in the late fifties, herring in the sixties and capelin in the seventies; and from overexploitation of old ones. Thus, the levels of the demersal stocks are currently only 1/2 to 2/3 of their levels in the fifties. The previously huge Atlanto-Scandian herring stock has been unable to sustain significant catches for over 15 years, and the Icelandic spring spawning herring is all but extinct.

The economic results have been most disappointing. Although the available data are incomplete, it is obvious that the net contribution of the fisheries to the economy has been far less than the increase in catch values suggests. In fact, according to the available evidence, the net-value-added (i.e. the sum of wages and profits) generated in the fisheries was about the same in 1983 as in 1969 in spite of a 70 percent increase in total catch values. Most of the difference is explained by the cost of fishing capital, which increased by some 150 percent during the period. Profits in the fishing industry have also been very poor except during relatively brief intervals: for instance in the mid-sixties, due to the very good herring catches, and in the late seventies, following the extension of the exclusive fishing zone. The development of net-value-added and fishing industry profits since 1969 is listed in Table 3.

Table 3. Net Value-Added and Profits in the Fishing Industry.*

Year	Net-Value-Added** (millions of U.S.$)	Profits (millions of U.S.$)
1969	42.9	-0.9
1970	47.0	-1.7
1971	50.5	-3.0
1972	54.6	-6.3
1973	57.3	-9.9
1974	54.3	-14.3
1975	50.3	-17.6
1976	55.2	-13.6
1977	67.1	-10.2
1978	87.5	1.0
1979	93.1	-1.5
1980	101.6	2.7
1981	95.5	-2.0
1982	54.5	-35.0
1983	44.1	-37.5

* Both series are centered three-year moving averages at fixed 1984 prices.
** Defined as the sum of profits and wages.

Fishery Management

As the fishing industry is the single most important industry in the Icelandic economy, the decline in its economic performance has not gone unnoticed. Over the years, various measures have been taken attempting to reverse this trend. However, before the extension of the exclusive fishing zone to 200 miles in the seventies, effective management of the fisheries, especially the demersal ones, proved impracticable due to the presence of large foreign fishing fleets on the fishing grounds. Therefore, fishery management prior to the mid-seventies was minimal, mainly consisting of fishing gear regulations and protection of important nursery grounds. With the extension of the fishing limits, this situation was dramatically changed. During the past decade or so, practically all Icelandic fisheries have been subjected to extensive management restrictions, with the result that free access competitive fisheries are now all but nonexistent in Icelandic waters.[1]

The management measures that have been adopted are primarily designed to (i) preserve the fish stocks, (ii) restrict access to the fisheries, and (iii) reduce vessel competition for catch shares. The most common management measures employed are:

[1] The only significant exception nowadays is the newly developed deep-sea shrimp fishery.

(i) Overall catch quota
(ii) Fishery access licenses
(iii) Individual vessel catch quotas
(iv) Individual vessel effort restrictions or quotas
(v) Individual processing plant quotas[2]

The particular measures employed differ, however, according to fishery and vessel types.

The main stages in the evolvement of the current fishery management system are as follows:

In 1986, due to an alarming decline in the herring stocks, an overall quota system was imposed on the fishery. Since this did not prove effective, a complete herring moratorium was proclaimed in 1972. In 1976, when the herring fishery was partly resumed, an individual vessel quota system with limited eligibility was introduced; and in 1979 fairly unrestricted transfer of the quotas between vessels was permitted.

The capelin fishery, which became very big in the seventies, was subjected to limited entry and individual vessel quotas in 1981, when the stock was seriously threatened with depletion. In 1976 the quotas were made partly transferable.

Following the extension of the exclusive fishing zone to 200 miles in 1975, the major demersal fisheries were subjected to overall catch quotas. The quotas recommended by the marine biologists soon proved quite restrictive and thus difficult to maintain. Hence, individual vessel effort restrictions were introduced in 1978. However, since there were no entry restrictions and the demersal fleet continued to grow, this system proved economically wasteful. Therefore, in 1984, following a sharp drop in the catch levels, the current system of individual vessel quotas for all the demersal fisheries was introduced, as described in the following section.

The inshore shrimp and scallop fisheries were largely developed during the seventies and have, practically from the outset, been subject to limited local entry as well as overall quotas. Recently there has also been movement towards individual quotas in these fisheries.

As may be inferred from the above description, fishery management measures have generally not been adopted on the basis of economic efficiency calculations. The key stages in the development of the management system have usually occurred in response to crises in the respective fisheries due to a sudden reduction in stock levels. Thus, the current herring management system was initiated in 1966 in response to an imminent collapse in the herring stocks. Similarly,

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[2] According to this system, which only applies to some scallop and inshore shrimp fisheries, the local processing plants receive exclusive catch quotas.

the management of the capelin fishery and the current management of the demersal fisheries were implemented in the early eighties in response to the perceived danger of a corresponding collapse in these fisheries. This pattern reflects, above anything else, the reluctance of the participants in the fisheries to accept changes in the traditional organization of the fisheries. Only when faced with a disaster in the form of a significant drop in income due to fish stock or output price reductions, have these interest groups been ready to consider institutional changes in the fisheries.

These sentiments have, to a considerable extent, been reflected in the attitude of the government, not to mention the legislature. In recent years however, as the basic arguments of fishery economics have become better understood, there has been a clear shift in official attitudes. Nevertheless, concern for inter-vessel and regional equity has continued to play a dominating role in shaping the characteristics of the management systems that have been adopted.

THE DEMERSAL FISHERIES MANAGEMENT SYSTEM

The current demersal management system was instituted in 1984. The structure of this management system was the outcome of extensive consultations between the Ministry of Fisheries and the representatives of the main interest groups involved. Hence, at the time of its introduction, the management system enjoyed the general, although not unanimous, support of the participants in the demersal fisheries.

The sociopolitical conditions that made this degree of consensus possible were brought about, as has been the standard pattern in the development of the Icelandic fisheries management system, by a sharp reversal in the fortunes of the fishery. For several years following the extension of the fishing limits to 200 miles at the end of 1975, the demersal fleet enjoyed steadily increasing catches. In 1980-81, in particular, catches were extremely good, almost double the highest pre-1976 level. In 1982 and 1983, however, the catch level dropped dramatically, in spite of rising effort. Moreover, it became increasingly clear that (i) the demersal stocks were in a poor shape and (ii) the current management regime, i.e. free entry combined with vessel effort quotas, was not capable of maintaining an economically viable fishery. Thus, it became generally recognized that new measures were required. Since, as previously mentioned, the demersal fisheries are a major industry in Iceland, financial subsidies were ruled out. Hence the only reasonable alternative for the fishing authorities and the representatives of the industry to consider was institutional rearrangement of the fisheries. The conclusion was a variant of an individual vessel quota system, the details of which will be described below.

The Individual Vessel Quota System: A Description

Although the current demersal fisheries management system is essentially an individual vessel quota system, it has several important features that require some elaboration.

1. Individual vessel quotas: Each vessel is issued an annual catch quota for each of the major demersal species.

   The size of the quota is a simple multiple of the total allowable catch (TAC) and the vessel's calculated share therein. The TAC is determined by the Ministry of Fisheries on the basis of recommendations from the Marine Research Institute. The vessel's calculated share in the TAC normally equals its average share in the total catch during the three years prior to the introduction of the management system, i.e. 1981-83. There are some minor exceptions to this rule of calculating vessel shares, however. If, for instance, the vessel in question has not been operating normally during 1981-83 due e.g. to major repairs or having entered the demersal fleet after 1981, the calculated share is adjusted upwards.

   The annual quotas are issued by the Ministry of Fisheries and are free of charge. An important feature of this system is, however, that no vessel owner can take it for granted that he will be reissued a quota. The Ministry of Fisheries has considerable autonomy in this respect. Thus, according to the Ministry's previous practice, proven seaworthiness and even some minimal fishing activity of the vessel in question seems to be a prerequisite for receiving a quota. Also, quotas can be revoked at any time, if the vessel in question is judged to have violated any of the fishing regulations set down by the Ministry.

2. Transferability: The quotas are transferable subject to restrictions to be described below. The quotas are, moreover, perfectly divisible so that any fraction of a given quota may be transferred to another vessel.

   Between vessels within the same fishing firm, the quotas are transferable without any restrictions. They are also freely transferable between different firms in the same geographical region, provided only that the respective fishermen's unions do not object, which they rarely do. Quotas may also be transferred between regions, provided the respective local authorities agree to the transaction.

   Apart from this, transfers of quotas are only subject to registration with the Ministry of Fisheries. The particulars of the exchange, including the price, are, however, regarded as a private matter entirely and are not registered. As quotas are only issued for a year at a time, transfers of future quotas, although not

prohibited, are not really feasible except on a contingency basis.

In addition to transfers to quotas between vessels, a vessel owner may apply to the Ministry for permission to substitute part of his quota for one species for an increased quota of another. Permissions for these kinds of transfers and the corresponding marginal rates of substitution (exchange ratios) are entirely at the discretion of the Ministry of Fisheries.

3. Alternative Effort Quota: Under certain circumstances, a vessel may be offered the alternatives of a standard catch quota and an effort quota, the latter being measured as an upper bound on the permissible days at sea during the year. Initially this was an option offered to fishing firms that were judged to have been unfairly treated by the standard catch quota allocation mechanism. In 1986, however, this option was made more freely available to other firms.

   The effort quota is calculated to produce, on average, the same catch as an average catch quota for a vessel of a similar type. It is subject to upper bounds on the allowable catch of each species. Hence, there is basically a catch quota, although less restrictive than the usual one, superimposed on the effort quota. The effort quota is, for obvious reasons, not transferable. In other respects, the effort quota is similar to the catch quota. It is issued annually for a year at a time and is free of charge.

   According to the recent practice of the Ministry, it seems that vessels will be allowed to switch between catch and effort quotas at least once.

4. Entry: New entry to the fishery is not directly restricted. However, one of the fundamental features of the management system is that new vessels will not be issued quotas. Hence, while it may be possible to purchase quotas for new vessels in the market, that is clearly inferior to running an older vessel that receives free quotas. Therefore, effectively, the system has been operating as a closed access one.

5. Legal Basis: The individual vessel quota system is based on legislation passed by the "Althing" in 1983 and renewed in 1984 and 1985. The legislation only sets the general framework for the system, however. Therefore, the Ministry of Fisheries has considerable room to implement particular management measures by issuing regulations.

6. Enforcement: Thanks to the very effective landings control system in Iceland, enforcement of the vessel quota system is not much of a problem. Public officials, based in each fishing port, record every landing, determine the volume of each species in the catch,

and assess its quality. Only negligible quantities are likely to bypass this control system. Moreover, since attempts to exceed a vessel's quota may result in permanent withdrawal of a quota for that vessel, it is generally felt that adherence to the quota limits is almost 100 percent.

On the other hand, there is some evidence of less valuable catch, in terms of species composition, size distribution, etc., being discarded in order to maximize the value of the quantity quota. This practice violates the terms of the quota and may be punished by revoking the quota. It is, however, difficult to verify.

THE PERFORMANCE OF THE DEMERSAL VESSEL

It is standard practice to compare the performance of any project with its stated objectives. In this case, however, the objectives were never explicitly stated and are consequently a bit uncertain. The reason is, of course, that the introduction of this particular management system relied on the support of all the most important interest groups connected with the demersal fisheries. Since these interest groups have generally somewhat different, even conflicting, objectives, it proved convenient to leave the exact objectives of the management system largely unspecified.

Nevertheless, it appears that the following were the primary objectives of the system.

1. Conservation of the demersal fish stocks
2. Restoration of normal profitability in the industry
3. Maintenance, as far as possible, of the current regional and personal distribution of benefits
4. Increase of economics rents

Of these objectives, the economically most meaningful one is the fourth. In fact, provided that economic rents are calculated on the basis of true (shadow) prices and include an appropriate allowance for distributional effects, economics rents constitute the key measure of the performance of any management program.

The vessel quota system in the demersal fisheries has only been in operation for a little over two years now and there is as yet scant numerical data on its impact. Consequently it is far too early to conclusively judge the performance of the system. On the other hand, the system has already generated some remarkable results.

Conservation of Fish Stocks

The system is clearly well suited to conserve the fish stocks. In fact, any stock rebuilding program chosen by the fishing authorities can, in principle, be accomplished by setting the appropriate overall catch quotas, provided of course the relevant biological constraints are respected.

Within the framework of the current management system, however, any program of this nature is subject to disturbances stemming i.a. from the following factors:

(i) effort quotas
(ii) species quota substitution
(iii) discarding of catch

Clearly, given the particulars of the effort quotas and possible substitution of one species for another, total catch levels will tend to deviate from the target levels to the extent that these options are exploited by the vessels. On the other hand, this should not be regarded as a serious defect of the management system, since these options are entirely within the control of the fishing authorities and may be restricted at any time or even abolished[3]. Discarding of catch at sea is another matter. It basically constitutes a violation of the quota conditions, and one that is very difficult to prove. This is a problem that may be solvable only via modifications in the basic quota system[4].

In this connection, it may be mentioned that since the institution of the vessel quota system, the decline in the demersal fish stock levels has in fact been halted and to some extent reversed.

Profitability in the Industry

Although total allowable catch levels have not been increased since the introduction of the vessel quota system, the profitability of the demersal fishing industry has improved considerably. How much of the improvement is due to the vessel quota system, on the other hand, is not entirely clear. A preliminary study carried out recently by the Economic Institute concluded that the vessel quota system made it possible for the firms in the industry both to reduce aggregate fishing effort and to exert the remainder more cheaply[5]. Furthermore, the quota system has, in the opinion of the Economic Institute, made it possible for the fishing firms to revert resources from fishing effort to improved quality and thus to increase the value of the catch. The Economic Institute estimates that in 1985 these two factors improved profitability in the demersal fishing industry by some U.S.$15 million.

On this basis, it seems safe to conclude that in its first two years of operation, the vessel quota system has signifi-

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3 Notice, however, possible political constraints on such actions.

4 One possible modification would be to replace catch quota with value quotas, thus removing the basic incentive for discarding of catch.

5 Primarily by concentrating fishing effort in periods when conditions are particularly favorable.

cantly improved the profitability of the demersal fishing industry.

Distributive Aspects

Regional Distribution of Catches: The available numerical data on the regional distribution of the catches for the year 1984 do not indicate a significant redistribution of total catch levels between geographical regions. On the other hand, there seems to have been a considerable shift in the species composition of landings between regions. These data are listed in Table 4.

Table 4. Regional Redistribution of Landings in 1984.

	Geographical Regions			
Species	Southwest	West	North	East
Cod	-20%	+22%	+2%	-7%
Haddock	+22%	+15%	-60%	-20%
Saithe	-10%	+5%	+5%	+5%
Redfish	+20%	-1%	0%	-40%

* The table shows the approximate percentage deviations in landings relative to the allocated catch quotas to the respective regions.

As indicated in Table 4, some overall redistribution of landings to the western part of the country, primarily from the southwest and east, appears to have taken place. This, like the species redistributions, probably reflects comparative fishing advantages and disadvantages in the respective regions.

Personal Redistribution of Income: There is practically no available information on the effects of the quota system on the distribution of personal income in the fishing industry. However, since the quotas are allocated to vessel owners, it is clear that they should not be adversely affected by the system. Moreover, since the total allowable catch level is not dependent on the vessel quota system as such, the aggregate income of the fishermen should not be significantly affected either. However, to the extent that quotas are actually transferred between vessels, it is clear that there will be a redistribution of income between fishermen. Some will gain while others lose. An indication of the magnitudes involved may be gleaned from the available data on quota transfers in Table 6 below.

Economic Rents

It may be assumed that at the time the vessel quota system was installed, the demersal fisheries did not generate any economic rents. After all, these were, notwithstanding certain effort restrictions, basically free entry fisheries.

In fact, due to the unexpected drop in catches in 1982 and 1983, it is most likely that economic rents at the outset of 1984 were actually highly negative.[6]

As yet, there is very little reliable information on the effects of the vessel quota system on economic rents in the demersal fisheries. It is clear, however, that the previous growth in fishing capital has stopped and that aggregate fishing effort has decreased significantly. The numerical details are set out in Table 5 below.

Table 5. Effort and Fishing Capital, Indices.

Year	Fishing effort*	Fishing Capital**
1979	1.000	1.000
1980	1.058	1.020
1981	1.082	1.056
1982	1.234	1.084
1983	1.250	1.091
1984	1.061	1.093
1985	0.993***	1.092***

* Effort measured as ton-days at sea.
** In value terms.
*** Preliminary estimates.

Thus, according to Table 5, aggregate demersal fishing effort fell by some 15 percent in 1984, the first year of the vessel quota system, compared to 1983; and by an additional 6 percent in 1985. At the same time, however, the fleet has remained nearly unchanged. What has happened is that a number of vessels have either largely ceased fishing or reverted to other fisheries[7]. Moreover, most of the other demersal vessels have reduced their fishing effort.

In addition to this, there is evidence that the quality of the landed catch has improved considerably since 1983, indicating that economic resources may to a certain extent have been diverted from fishing effort and towards increase in the catch value, through quality improvements.

Both of these factors, the reduction in the fishing effort and improvement in the quality of the landed catch, have been attributed to the vessel quota system. In 1984, the corresponding economic values have been officially estimated to be equivalent to at least $5 million for the quality increase. Hence, the increase in annual economic rents attributable to these two factors seems to have been in the neighborhood of 15 million.

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[6] See the data on industry profits in Table 3.

[7] Primarily the deep-sea shrimp fishery, which remains the only significant free access fishery in Icelandic waters.

There is another way to approach the problem of estimating the rents generated in the demersal fisheries as a result of the vessel quota system. As the quotas are transferable, a market for quotas has developed. In this market, quotas are exchanged for other valuables such as money. Hence, applying standard economic theory and assuming that the market for quotas is reasonably effective, the value of the fishery, i.e. the economic opportunity rents generated therein, should equal the total number of quota units outstanding multiplied by the unit market price. Unfortunately, while the quantities being exchanged have to be registered with the Ministry of Fisheries, the same does not hold for the prices[8]. However, knowledgeable people in this field have supplied seemingly reasonable estimates of these prices. The pertinent information about the vessel quota market is set out in Table 6.

Table 6. The Vessel Quota Market.

	Transfers					
	Cod		Other*		Total	
Year	(1)	(2)	(1)	(2)	(1)	(2)
1984	27.6	10.8%	31.4	12.2%	59.0	11.6%
1985	29.8	11.0%	39.7	18.2%	65.5	13.5%

1. Quantity exchanged in 1000 metric tonnes
2. Quantity exchanged as a fraction of total outstanding vessel quotas

	Prices and Values		
	Price Range (U.S.$ per mt)		Total Quota Values (millions of U.S.$)
Year	Cod	Other*	
1984	44-66	31-45	19-28
1985	63-108	44-78	26-45

* Other demersal species.

Now, on the basis of the data in Table 6, it appears that the total value of outstanding quotas, evaluated at the midpoint of the price range given, was some $24 million in 1984 and $35 million in 1985. Since, as already pointed out, the fishery was an essentially free access one prior to 1984, these sums may be taken as indications of the rents generated by the vessel quota system in the respective year.[9]

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[8] Partly, at least, on the well-grounded assumption that such information would in any case be extremely unreliable.

[9] Notice that these are not necessary positive rents, but rather the opportunity values of the quota.

Thus, we have obtained two estimates of the rents generated by the demersal vessel quota system. Official assessments of the rents generated by reduced effort and improved quality of the catch in 1984 amount to some 15 million. Rent estimates on the basis of quota values yield some 24 million in 1984 and 35 million in 1985. So it seems likely that these are the magnitudes of the economic rents actually produced by the system.

How does the performance of the demersal vessel quota system in terms of rent generation compare with the maximum attainable rents? We may compare the above results of the vessel quota system in terms of fishing effort and rent generation with the corresponding ones that, according to an empirical study of the Icelandic demersal fisheries (see Arnason 1984), maximize the level of attainable economic rents. This comparison is set out in Table 7.

Table 7. Comparison of Optimal and Vessel Quota Results

	Effort Index (1983=1.0)	Annual Rents (millions of U.S.$)
Optimal program	0.45	155*
Current vessel quota system	0.795	35**

* Long run annual levels.
** 1985 estimated level.

According to these results, the demersal vessel quota system has managed to move the fishery a considerable distance towards the maximal attainable economic rents. Total aggregate effort seems already to have been reduced by over a third of what the optimal program requires, and economic rents have attained over a fifth of the optimal policy level.

MAJOR WEAKNESSES OF THE DEMERSAL MANAGEMENT SYSTEM

The performance of the demersal vessel quota system in its first two years of operation demonstrates its ability to significantly increase economic rents. Nevertheless, this management system, in its current form, is not capable of attaining full efficiency. This is primarily due to the system's lack of incentives to reduce fishing capital. Less important defects are the effort quota options and built-in incentives for discarding catch at sea and enhancing seasonal fluctuations of landings. We will now briefly discuss these items.

Fishing Capital

The vessel quota system does not contain any significant incentives for reduction of fishing capital. In fact, by its method of allocating vessel quotas, it discourages disinvestment of redundant fishing capital. This is because ownership of a fishing vessel is a prerequisite for being issued the annual catch quota. Mere ownership, moreover, does not seem to be sufficient. Judged by previous rulings of the Ministry of Fisheries, the vessel must also be in good condition and take a certain minimal part in the fisheries each year. The deprivation of the eligibility for an annual quota, on the other hand, amounts to a significant financial loss. This loss is at least equivalent to the value of the annual quota and may be as high as the present value of all expected annual quotas in the future. Given this prospect, it is not surprising that the demersal fishing fleet has not been reduced since 1983, in spite of a 20 percent reduction in aggregate fishing effort.

Thus it appears that, while the current vessel quota system may be able to bring the aggregate fishing effort reasonably close to the optimum one, it will leave the fishing capital level largely unchanged. Since the existence of fishing capital entails costs even if unused, it is clear that this management system will never attain full efficiency. How close it may get is another matter. On the basis of an empirical study of the efficient arrangement of the demersal fisheries (Arnason 1984), it may be estimated that the highest level of economic rents that is attainable without changing the capital level may be in the neighborhood of 3/4 of the fully efficient one.

A modification of the current system that would successfully remedy this problem would be to issue permanent quotas. This, however, has some rather controversial distributive implications. Another less drastic method would be to issue the quotas for a period that is long relative to the lifetime of the fishing capital, perhaps 10-15 years. This would have two effects. First, given positive personal discount rates, the cost of not being reissued a quota would be reduced. Second, the vessel owners would have the option of divesting themselves of redundant fishing capital for the duration of the quota period and reinvesting just before the scheduled reissue of quotas. This, while not optimal of course, would clearly be economically preferable to the current system.

Effort Quotas

As previously mentioned, the current vessel quota system permits the issuance of effort quotas, provided some conditions are fulfilled. These conditions were in fact relaxed in 1986. However, as is well documented in the fishery economics literature, effort quotas do not eliminate common property characteristics of the resource. Thus, effort quotas do not remove the incentive for excessive investment and fishing effort. Therefore, the main impact of effort quotas

is simply to channel overinvestment into the uncontrolled dimensions of fishing capital[10] until all rents have been dissipated. For these reasons, the effort quota option, especially if it becomes permanent, is a very serious weakness of the current demersal management system.

Discarding of Catch

One way to increase profits under the vessel quota system is to improve the quality of the catch. This, it is easy to see, may entail discarding catch that is inferior in terms of size and general condition. This practice, however, will generally be socially wasteful provided, of course, that the discarded catch will not survive.

A possible remedy for this problem is to replace vessel catch quotas with vessel value quotas[11]. In that case there would clearly be no reason to discard catch excessively. The cost of the value quota system may be reduced precision in the control of the fish stocks. If discarding catch is widespread, however, this cost may be more apparent than real.

Seasonal Fluctuations in Catch

Since the individual vessel catch quota effectively removes the competition for catch shares, the system enables the vessel owners to harvest their share at the most convenient time. This typically suggests a fairly brief fishing season each year. Hence, ceteris paribus, the supply of catch tends to become more concentrated over time under the individual vessel quota system than it does in common property fisheries. In fact, this is what seems to have happened in the Icelandic demersal fisheries since 1983.

The solution to this problem is, of course, flexible landings prices, i.e. prices that adjust continuously to excess demand. In many situations, however, including Iceland's, this is not an attractive proposition due to vertical integration in the fishing and fish-processing industry and consequently monopolistic fish markets.

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10 And there will always be some.

11 Value quotas have worked well in the Icelandic herring fishery, where discarding of catch was previously a significant problem.

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An Evaluation of the Japanese Vessel Reduction Program in Tuna and Skipjack Fisheries (abstract)

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Together with cost inflation in the 1970s and stagnant market prices, the new 200 nautical mile regime has hit the conventional tuna and skipjack fishing industry very hard. As a domestic adjustment, various vessel reduction programs have been put into place.

In cooperation with the Japanese government, the private organization NIKKATSUREN (Federation of Japan Tuna Fisheries Cooperative Association) has led the program; others have followed, including ENKATSUKYO (National Distant-water Tuna Fisheries Association) and KINKATSUKYO (National Offshore Tuna Fisheries Association).

The goal of the Fisheries Special Reconstruction and Adjustment Act of 1976 was to reconstruct small- and medium-scale fisheries, including tuna and skipjack fisheries. Under the act, new government loans and subsidies have been provided for withdrawals of fishing vessels from the fleet.

For distant-water tuna longline fishing, 22 vessels belonging to NIKKATSUREN were withdrawn from fishing in 1976 under the first vessel reduction program. Under the second vessel reduction program, 169 vessels (17.5 percent) out of a fleet of 968 participating vessels, or 48,930GT (19.7 percent) out of 248,775GT (19.7 percent) were withdrawn from fishing during 1981-1982.

For distant-water skipjack pole-and-line fishing, on the other hand, 43 vessels (15,060GT) were withdrawn during 1980-1981, in connection with the construction of 10 economically more efficient skipjack purse seiners. An additional 12 vessels were withdrawn in 1983.

Under the act, the government provided an interest subsidy.[1] The government also provided 1 billion yen ($4,405,286) to subsidize one half of the compensation money for scrapping. Besides, the new purse seiners (499GT/vessel) contributed to the special compensation fund of 770 million yen ($3,395,950).

Owing to such government support, the average payment made by the remaining fishermen amounted to about 50 million yen ($220,517) per vessel for the tuna longliners (including 36 million yen, or $157,772, on the principal), and 25 million yen ($110,258) per vessel for the skipjack pole-and-line fleet (including 18 million yen, or $79,386, on the principal). As a result, a compensation of 150-163 million yen ($661,551-$714,062) per average size vessel (278GT) was paid to vessels being withdrawn from the fleet.

In addition to the official withdrawals, a large number of tuna skipjack vessels have been taken out of operation because of bankruptcy. Consequently, the total number was reduced by 21 percent, from 1,217 to 958, for distant-water tuna and skipjack fishing vessels, and by 25 percent, from 1,299 to 973, for offshore vessels, during 1980-1984.

At the end of 1984, KINKATSUKYO announced a drastic vessel reduction plan for offshore skipjack pole-and-line fisheries. According to the plan, 253 vessels (33.3 percent) will be withdrawn from fishing during 1985-87. For 1985, the average cost for scrapping was 61,510,000 yen ($260,923) per vessel. One half of the funds for this are from national, one quarter from prefectural, and one quarter from local sources. The compensation consists of 2 million yen ($8,484) per "KINKAI KO A" (80-120GT) and "KINKAI OTSU A" (20-80GT) vessel, and 1.2 million yen ($5,090) per "KINKAI KO B" (80-120GT) or "KINKAI HEI" and "KINKAI OTSU B" (20-80GT) vessel. Remaining vessels owe about 300,000 yen ($1,273) per vessel.

It is difficult to evaluate the effect of the Japanese vessel reduction program on the tuna and skipjack fisheries. However, this program along with other efforts, including domestic as well as external adjustments, have moved the industry into a far better position than before. Although competition is increasing among the conventional tuna and skipjack fisheries, purse seine fisheries, and foreign imports, the recent yen appreciation and the drastic reduction

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[1] Eighty percent of the compensation money can be borrowed from the Norin Gyogyo Kinyu Koko, a quasi-governmental financial institution for agriculture, forestry and fisheries, at five percent for 15 years on a three-year account, and the rest must be paid by the remaining fishermen. However, these fishermen can also borrow money from other sources such as Norin Chukin, another quasi-governmental financial institution for agriculture and forestry, at relatively low interest rates.

in world oil prices have reduced fuel cost, which has been crucial for improving the profitability of the industry.

New Zealand`s Fisheries Management Policies - Past, Present and Future: The Implementation of an ITQ-Based Management System

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INTRODUCTION

The main purpose of this paper is to set out the recent fundamental changes to fisheries management policies in New Zealand. The present and future are intertwined; what is being done now will determine the future of the New Zealand fishing industry. The importance of the past, however, lies in its instructive value, viewed with the benefit of hindsight.

We will begin with a brief review of the philosophy underlying the management of New Zealand's fisheries up to 1983, with particular reference to the introduction of the 200 mile EEZ in 1978.

The legislative framework begins with the Fisheries Act of 1908, which provided the statutory authority for developing regulatory, interventionist policies aimed at the biological conservation and protection of the resource. This act remained in force until 1983. For the period prior to the declaration of the 200 mile EEZ, New Zealand fisheries were small, and confined to an inshore domestic industry operating on the Continental Shelf to a depth of 200 metres. New Zealand jurisdiction extended to the 12 mile limit, and beyond this the fisheries were exploited by foreign fishing vessels.

The basic approach to management during this period went through some major, erratic changes. For instance, until 1963 the inshore fishery was managed under a very restrictive licensing system, with extensive gear and area controls. In 1963 the inshore fishery was completely deregu-

lated, and it remained that way until 1978, when a moratorium on the issuing of rock lobster permits was imposed; in 1980 a moratorium on the issuing of further wetfish permits was introduced.

During the period of open entry, government policy explicitly encouraged investment in fishing vessels through incentives, capital grants and allowances, and so on. While the rapid expansion of the domestic industry during this period laid the foundations for its further development into the deepwater fishery following the declaration of the 200 mile EEZ in 1978, it nevertheless exacerbated the natural tendency towards overcapitalization. Economic objectives still remained somewhat unfocused, even after the introduction of the 1978 and 1980 controls to limit entry. In the rock lobster fishery, a number of separately managed, limited entry-controlled fisheries were established, and nontransferable licenses were issued. However, investment in the fishery was not reduced as a result of the new policy, even though economic objectives were cited as a reason for introducing controls. Administrative inflexibility--particularly on the subject of nontransferability--in light of increased effort and investment in the rock lobster fishery, have led to increasing calls from the industry itself for a review of management. For finfisheries, it was gradually realized that economic as well as biological objectives were necessary for effective management, and that the management program had to be improved in order to achieve these objectives.

The declaration of the 200 mile EEZ added a further incentive to develop clear objectives and appropriate management approaches. The government was faced with having to work out strategies for managing the fish resources of a very large and unfamiliar area.

It is interesting to note that the government chose to manage the EEZ and the inshore fisheries virtually as entirely separate entities; the EEZ deepwater fisheries were managed by a policy of limited domestic expansion, joint venture arrangements and licensed foreign nation fishing.

In 1983, three significant events occurred. First a new piece of legislation, the Fisheries Act of 1983, was passed; secondly, the government introduced an economics-oriented management system for the deepwater fisheries, based on individual company transferable quotas; and thirdly, major economic and biological problems in the inshore fishery were recognized.

The end result of these events was the integration of economic objectives and strategies into overall management programs (see Table 1). We believe it is worth spending a little time on each of the three, so as to show just how far-reaching the consequences have been to date and how consequential they will be for the future.

The Fisheries Act of 1983: While consolidating the legislation and introducing the concept of Fisheries Management Plans, the act did not address the key fundamental question of how and with what criteria fisheries should be managed. It relied heavily on the "preservation and conservation" philosophy, with all its attendant regulatory control requirements. The economic dimension was, for all practical purposes, largely ignored.

The Deepwater Trawl Policy: By 1983 it had become clear that the joint ventures had delivered all they were capable of; the biological and economic problems of the inshore fishery focused attention on the inability of traditional management strategies to deal with the new situation, and forced fisheries managers to examine alternatives. The Deepwater Trawl Policy recognized the need for management to be economics-oriented. Instead of relying on inefficient input controls, the resources would be managed through individual company allocations--an output control system based on economic management criteria.

The arguments for and against this approach have been well-rehearsed elsewhere and we do not propose to consider them here. Suffice it to say that this was the first time this approach was taken in New Zealand fisheries management.

The Inshore Fishery: At about the same time that the Deepwater Trawl Policy was being considered, the inshore fishery began showing signs of fundamental economic and biological problems. These can be briefly characterized as overfishing, overcapitalization, potential biological damage to some commercial fish species, and a significantly declining economic performance. The debate then centered on what action should be taken. One school of thought favored satisfying biological objectives through regulatory intervention based on input controls. Another school supported intervention to establish long-term economic management principles, followed by the withdrawal of interference in order to allow more scope for market forces to operate, but within the overall constraint of the biological sustainability of the resource.

The end result of the debate was the decision to consult with the fishing industry on the introduction of an ITQ-based management policy.

The essential elements of the new policy are: the creation of property rights (ITQs); their tradeability; a reduction of governmental intervention, with any such intervention being accomplished through market forces rather than through regulatory interference; and the matching of effort to the resource in such a way as to allow the industry to develop with inbuilt economic efficiency while maximizing returns to the nation.

The basic elements of the new approach to management were first developed for the Deepwater Trawl Fishery. This fishery was not a traditional one for New Zealand fishers, but

Table 1. Summary of New Zealand fisheries management policies.

Jig Squid	Deepwater	Inshore	Rock Lobster	Scallop	Oyster	Paua (Abalone)
Pre-1983						
(a) Foreign license fishing nation allocations, N.Z. government administrative decisions. License fee charged. (b) Joint Venture Policy - N.Z. government administrative allocation to N.Z. - foreign joint ventures. No fee charged.		Regulatory controls on effort, e.g. gear restriction season and area closures. Controlled fisheries. Limited entry. No royalties.	Limited entry. Restricted licenses administered by Fisheries Licensing Authority. Fish size limit. No royalty.	Limited entry. Restricted vessel numbers. Catch Catch Quota (daily and season). Limited season. No royalty.	Limited entry. Restricted vessel numbers. Daily and season catch quotas. Limited season. No royalty.	Restriction on harvesting method, i.e. no air tanks for divers. Limited season. Fish size limits. No royalty.
1983-86						
(a) Foreign license allocations by N.Z. government. Annual adminstrative decisions. License fee charged. (b) Joint venture policy changed to annual allocations to N.Z. fishing companies with no restriction on whether caught by domestic or charter vessels--a forerunner to enterprise ITQ allocations. Resource rental charged.	(a) For trawl finfish fisheries there will be 10% reduction made available to N.Z. companies by annual tender. (b) Allocation of quotas to N.Z. fishing companies. Quotas allocated in perpetuity with freedom to choose domestic or charter vessels--in effect ITQs. Resource rental charged.	Management of fishery by ITQs following an effort reduction scheme involving compensation to fishers prepared to leave the industry. Establishment of quotas on catch history allocation to fishers, which free industry from much regulatory control. Resource rental.	As above. Royalty payable.	As above. Royalty payable.	As above. Royalty payable.	Introduction of IQs (not transferable). Retention of other regulatory controls. Transferability planned. Removal method planned.

Table 1. (continued)

Jig Squid 1986-87	Deepwater	Inshore	Rock Lobster	Scallop	Oyster	Paua (Abalone)
Division of resource into annual and long-term quota. Tendering in perpetuity to domestic industry. Tendering of annual quota to foreign nations and domestic industry. Resource rental payable.	Integration of deepwater policy with inshore ITQ policy. Tendering of foreign nation annual allocations among foreign nations and domestic industry, i.e. annual ITQ tendered to whole industry and foreign nations. Resource rentals.	Extension of ITQ policy to additional species as necessary. Tendering of TAC increase as long-term and annual quota. Reduction of regulatory controls and government intervention. Reliance on market forces to determine resource allocations. Resource rentals.	Possible ITQ policy. Removal of limited entry provisions and restrictive licensing. Resource rental.	Possible ITQ policy. Removal of limited entry provisions and restrictive licensing. Resource rental.	Possible ITQ policy. Removal of limited entry provisions and restrictive licensing. Resource rental.	Incorporation of full ITQ management policy. Removal of regatory controls that reduce economic efficiency. Resource rental

developed after the declaration of the EEZ. Its newness provided a unique opportunity to implement a new policy. In this fishery the ITQs took the form of company allocations.

As the ITQ policy is developed further, the intention is to manage the deepwater and inshore fisheries on the same principles, within an integrated policy. Let us now turn to the details of the policy package.

NATURE OF THE PROPERTY RIGHT

The transferable property right allocated to fishers is in the form of a right to harvest surplus production from stocks. A harvesting right, as opposed to a property right, is an important distinction constitutionally, and has been embodied in the legislation implementing the system of ITQs. Under the Law of the Sea, New Zealand has management rights over the 200 mile Exclusive Economic Zone from its 12 mile territorial sea. Within its 12 mile limit, it has sovereign rights, which, under Westminster-style government, does not mean ownership of the resource by the Crown.

Therefore, in either case, the fish stocks are not owned by the state. The difference between the two forms is that if New Zealand is unable to harvest the identified surplus in the 12-200 mile zone, it is obliged to offer the surplus, under reasonable terms, to foreign nations. The nature of the transferable right is therefore the right to harvest a specified tonnage of the assessed surplus. Under proposed New Zealand legislation, foreign nations or individuals will not be able to own quota. Foreign nations can, however, lease quota for an annual term from the state, thus fulfilling the obligations under the Law of the Sea. Transfers of annual quota from foreign nations to domestic quota holders are also permissible, but not the other way around.

New Zealand quota holders may also charter foreign vessels to catch their quota where catches are beyond the 12 mile territorial sea and beyond certain other specified areas closed to foreign craft.

Because of the nature of the government's involvement in providing adjustment assistance, the charging of resource royalties and rentals, and quota trading, the harvesting right is denominated as a specified tonnage of quota, and not a percentage of any total allowable catch (TAC), and is valid in perpetuity. The government's involvement in adjusting TACs will therefore be accomplished through the buying or selling of quota. It has reserved to itself the right of compulsory acquisition of quota, subject if necessary to arbitration on price paid for quota.

COVERAGE OF POLICY

The ITQ policy will cover most finfish species in the zone, with the exception of tunas and some unstressed species

where present catches are well below estimated yields. It is likely, however, that even unstressed fisheries will be subject to some ITQ management, although the full yield of a fishery may not be allocated initially. This would provide security of tenure to enterprises wishing to commercially develop known resources; and it would control effort diversion.

In order to simplify administration, the number of species presently managed separately under ITQs may be reviewed, with the goal of amalgamating some species and areas.

ALLOCATION OF ITQ'S

ITQs for seven key species were allocated in the deepwater trawl fishery on the basis of investment in catching, of onshore capital, and of onshore throughput in March 1982. The allocations to nine enterprises were initially intended to be valid for a period of ten years. In 1985, the government confirmed the allocations and made quotas for these species, as well as for other inshore fishery species which were to be brought under ITQ management, valid in perpetuity.

The allocation of ITQs, other than those covered under the Deepwater Trawl Policy of 1983, is made on the basis of historical catch, modified by the results of a buy-back scheme and any administrative reductions which may be necessary to more nearly match effort to the available resource. Fishers who held permits in May 1985 were advised in mid-1985 of their individual catch by species for the three years ending in September 1984 and could choose two of these years, the average of which would form their ITQ. They were invited at the same time to object to these catch histories if they wished. Grounds for objection included errors in statistics, changed fishing patterns, or the effect of exogenous breakdowns, etc., which might affect catch histories. Of the 1800 individuals notified of catch histories, nearly 1400 objected.

Objections were considered by six objections committees and a national overview committee. These committees have been advising the Minister of Fisheries of any appropriate amendments to catch histories. This process has taken some eight months, which is considerably longer than was anticipated and has resulted in the deferral of the introduction of the new policies until October 1986.

At the time of writing, fishers are due to receive their updated or altered catch histories and, where objections were successful, will be invited to choose again the two years that will form the basis of their quota. Following the return of these forms to the Ministry of Agriculture and Fisheries (MAF) and the processing of data, fishers will be advised in late April or early May of their provisional quota allocations. These provisional quotas could be amended by fishers deciding to offer quota back to the government or,

alternatively, by the government administratively reducing provisional quotas among all fishers on a pro-rata basis.

Following passage of the Fisheries Amendment Bill and the introduction of the scheme, fishers will still have the opportunity to object before a specially formed Quota Objections Authority set up under the act. This authority, whose decisions are reviewable by the courts, will have power to alter individuals' quotas, should it be found that the catch histories used to determine them were inappropriate. The MAF is obliged to increase the TAC for the species if that is necessary in order to accommodate any increases in quota resulting from the Quota Appeal Authority's decisions. Any future increases in TACs will be allocated on the basis of competitive tenders for purchase from the government. The only, limited, exception to this will be any increases in quota that were previously reduced administratively when initially allocated. In this case, increased quotas, equivalent to the amounts administratively acquired, will first be offered back to individuals who were initially allocated quota and who remain in the fishery.

The tender mechanism proposed, whereby the government sells increases in TAC to all successful tenders at the price per unit (either a parcel or tonnage) of the lowest tender accepted, is "competitive" rather than discriminatory. The purpose of this policy is to emulate a market clearing price as well as to assist in assessing the economic value of fisheries. Similarly, the purchasing back of any future reductions of quota will be by competitive tender; successful tenderers will be offered the price per unit of the highest tender accepted.

Quota will be freely transferable, and thus future allocations will be "market led", subject to the condition that ownership of quota will be retained by New Zealand residents or companies (defined in the Fisheries Act), and that specified limits on quota in any area which can be held by any one individual are not to be exceeded.

It should be noted, however, that owners of quota may charter foreign registered vessels to catch quota, but these vessels are confined to areas of the zone beyond twelve miles and outside other restricted areas. Such foreign chartered vessels are registered as New Zealand fishing vessels under the Fisheries Act and must conform to New Zealand's navigational requirements and standards for safety and hygiene.

ADJUSTMENT ASSISTANCE

An important element in determining the initial allocation of quotas is the program of adjustment assistance whereby a de facto purchasing back of provisional quotas occurs to match fishing effort to available catch. The mismatch of fleet capacity to available catch would have been a major

impediment to the introduction of ITQs for the following reasons:

- Economic pressure placed on fishers whose allocations were reduced substantially below existing levels would have resulted in greater pressures for "quota busting" and also to a more general lack of support for the program by industry.

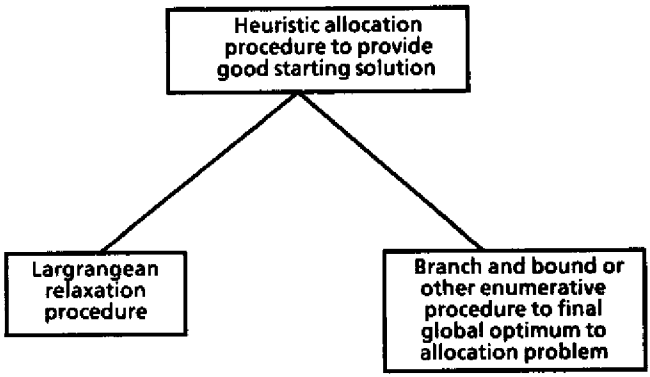
- Extensive administrative cuts in allocations would have differed between species and would thus have upset the traditional proportional of species in the catch mix. This would have added to problems in managing by-catch.

Therefore, the government has agreed to carry out a scheme whereby harvesting rights in excess of sustainable yields are bought back. This will be achieved by fishers voluntarily offering back to government all, or a portion of, their provisional quotas. These provisional quotas will be based on catch histories, as amended by consideration of objections. Fishers will place a value on foregone earnings for adjusting to a lower level of catch, and will be able to submit one or more offers (see Appendix 1). Each offer will place a value on a "basket" or combination of species tonnages offered back to the government. Fishers thus will have the ability to voluntarily adjust their catch mix so as to fit in with their own future fishing plans.

As noted previously, the buy-back is to be conducted on a competitive rather than a discriminatory basis, so that participants are encouraged to bid competitively (i.e. to bid the true opportunity cost of foregone catch) and yet know that if their bid is below the marginal value of the fish stocks they are offering up, they will be penalized. Successful tenderers will receive, as nearly as possible, the same price for equivalent units of fish stocks. The total each will receive will be at least what they bid, and, except for a few, more than they bid.

It is believed that under this system fishers will be less risk-averse and that the marginal values or prices under a competitive regime will be less than they would under a discriminatory regime.

The tender acceptance and pricing problems will be undertaken in two phases; the first to determine the "best" tenders to accept, using a heuristic approach, and the second to determine the price to be paid for each unit of fish stock given up by successful tenderers (see Figure 1). An alternative and more advanced "one pass" procedure of simultaneous acceptance and pricing of quota is also available and may provide a more optimal solution. This solution uses a nonlinear integer programming formulation. Although code for this technique has been written and tested, it may not be used, due to insufficient certainty in finding the best possible solution to a very large-scale problem.



Source: F. Baird 1984

Figure 1. Solution of the tender acceptance and pricing problem.

Should insufficient tenders be accepted to reach desired TACs using available funds, the government could choose to reduce remaining provisional quotas administratively, on a prorata basis. Extensive administrative cuts of this type would upset chosen catch mixes by fishers and would only take place as a last resort if targets were substantially below the total of provisional quotas remaining after tender acceptances. Other options are available to the government, such as offering and advertising prices for specified stocks, or entering into negotiations for purchase from key fishers holding critical stocks at the margin.

On offer forms sent to fishers, a minimum quota will be specified as the amount they would receive, even in the event of administrative cuts. This represents each fisher's proportional share of the TAC, if the TAC is lower than the total historical catch in the fishery. Where a fisher offers a portion of quota back to the government and it is accepted, only remaining provisional quota in excess of the minimum quota would be subject to administrative cuts. Compensation is not payable on administrative cuts of provisional quotas during the initial allocation of quota.

Once tender evaluation procedures and any administrative adjustment of individual quotas have been completed, fishers will be advised of final quotas. On the present timetable, this final notification is due by August. Figure 2 shows a flow chart of the stages in the allocation of quota to fishers.

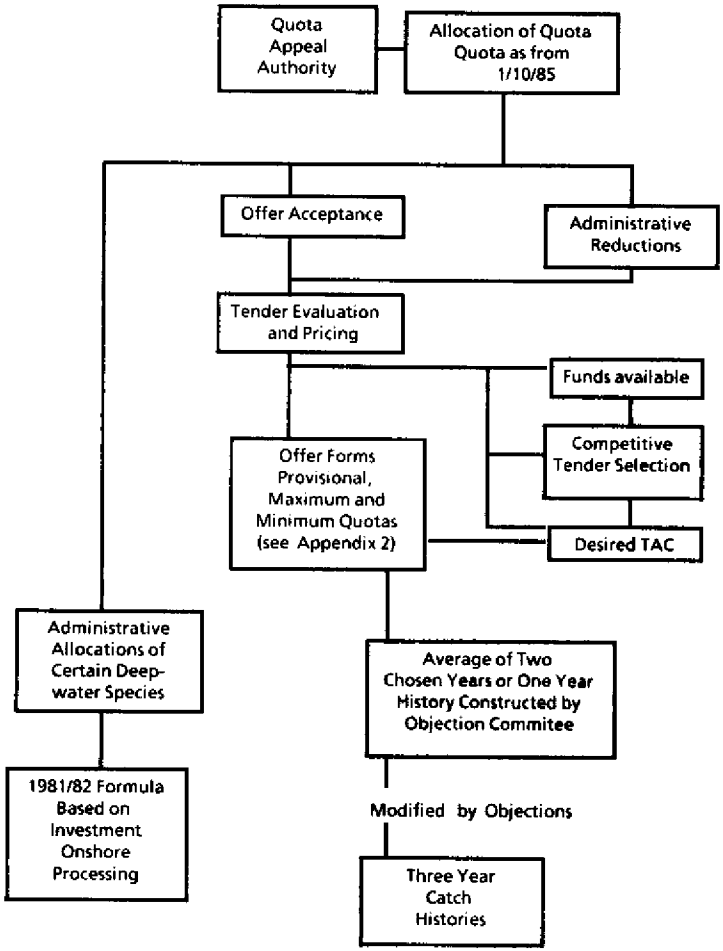


Figure 2. Allocation procedures.

RESOURCE RENTALS

A major element of government policy is the charging of resource rentals to accrue to the state's economic surplus from management of fisheries by ITQs. Government policy has been to gradually increase resource rentals until the value of annual traded quota approaches zero. This objective has met with considerable resistance from the industry, which otherwise generally supports the principle of ITQ management for finfisheries, and also accepts the principle of royalty payments for exclusive transferable harvesting rights to fish stocks.

The disagreement between industry and the government has basically turned on a conflict of interest, although that fact has been somewhat clouded by discussions of the mechanisms of charging resource rentals. It is likely, however, that some windfall gain will accrue to those initially receiving quota at no cost, although it will be hard to measure. This is because the value of vessels transferred in the past sometimes incorporated an element of capitalized surplus, which existing fishers have already paid. This may be reflected in the value of vessels decreasing, once ITQs are introduced, as the capitalized surplus attaches to the transferable harvesting lot. Other reasons why the government is unlikely to reap the entire economic surplus will derive quite simply from the difficulty of setting rentals to reduce annual traded value of quota to near zero. There will be lags in information, as well as difficulties in assessing whether a particular fishery is in equilibrium or whether excess capacity exists, which would mean that marginal costs would be lower than average costs. The shallow depth of quota markets could also lead to significant fluctuations in quota prices at the margin. Setting rentals to reduce marginal values to near zero would thus make it difficult for trading markets to adjust, as prices would in some instances have to be negative.

These factors mean that quota is likely to attract a long-term value.

Nevertheless, the intention by the government to tender increases in quota, and the likelihood that such increases may be substantial in the future, indicate that a significant proportion of the economic surplus of the fishery will accrue to the state. The element of foregone surplus to the state may be regarded by politicians as being an acceptable cost of getting industry support for a mechanism of management to increase overall national income.

The favored mechanism for setting royalties is to link the level of rentals to some proportion of the value of annual

traded quota, with this proportion increasing over five years as overcapacity declines. The industry is nervous about reliance on quota trading for information upon which to set royalties. Industry representatives would prefer to see other factors taken into account, as they believe this equilibrium in quota markets could occur with some excess capacity persisting in the median term. They would like to see a mechanism that sets rentals for more than one year, and would prefer whatever price information on traded quota is used to set royalties to be of a longer term than one year. In the interests of simplicity, they also favor having the level of rentals linked in some way to a proportion of the port price of fish sold.

Most importantly, industry representatives are seeking negotiation on rental levels. This presents some problems. Presently, royalties are treated as a tax, and are therefore included in specific legislation. The state has a sovereign right to tax and does not need to consult with the public before imposing a tax. The alternative of treating royalties as a resource rental, and therefore more in the nature of a contractual agreement between the state and fishers, is preferable. Problems remain, however, in that the basis of contractual arrangements must still be incorporated in legislation and, given the number of significant unknowns, it is difficult to stipulate a specific mechanism through statute that is not too restrictive. These contentious issues are the subject of considerable debate at the moment. Despite these problems, however, the level of royalties paid by the industry has become increasingly significant. Royalties are paid on the basis of quota allocated, not fish tonnage caught.

Enterprises pay a premium for royalty on catches by foreign flag vessels that is equivalent to double the rate set for domestic vessels. Where an enterprise uses both domestic and foreign flag vessels to catch quota species, royalty paid on uncaught quota is paid at the lower domestic rate (see Table 2).

ADMINISTRATION OF ITQ'S

Quota management experience throughout the world has been subject to many problems, often leading to the demise of the management programs. These problems of quota management also exist in New Zealand, although there are four important characteristics of New Zealand fisheries that assist in the management of ITQs. These factors have contributed to the successful management of deepwater fisheries.

The first factor is geographical isolation. "Steaming" to our fishery zones is relatively unattractive, and there is little inter-country rivalry. There is also not much of a problem with policing the activities of foreign boats, which cannot simply "slip" into the fishing zone.

Table 2. Royalties (N.Z.$ per ton).

Species	1983-84	1984-85	1985-86		1986-87
Inshore fisheries	Nil	Nil		Nil	3.00*
Deepwater species			Domest. Vessel	Charter Vessel	
Orange Roughy)		70	100	200	Not yet set
Ling)		15	27.50	55	Quota trading
Squid)		15	23.75	27.50**	
)			47.50	95.00	
Silver Warehou)	3.00*	15	25	50	prices to be
Hoki)		25	8.25	16.25	used as guide
Hake)		15	22.50	45	
Oreo Dory)		15	11.25	22.50	
Rock Lobster	Nil	Nil	Nil		2.5% of Port Price 275
Paua (Abalone)	"	"	"		" 87.50
Dredge Oysters	"	"	"		" 22.17
Scallops	"	"	"		" 27.50

* Token royalty set to establish the principle of charging royalties.
** Two royalties set for two separate fisheries.

Secondly, monitoring of landings is made easier by the orientation of the industry toward export--80 percent of its output, by value, is exported. This limits the extent to which it is possible to absorb, through domestic blowout, illegal catching effort. Exports are so closely monitored that detection of product flow not explained by landings will be relatively easy to achieve.

Thirdly, the central government has legislative jurisdiction to monitor product flows both at sea and onshore. This makes monitoring of onshore product distribution more straightforward than apparent experience with conflicting federal/state jurisdictions would indicate.

Finally, the nature of many of the major resources makes them amenable to management by quota. Two of the species of major economic importance, orange roughy and hoki, congregate in spawning schools. Catch rates are high (in excess of 50 tons per tow) and by-catch of other species can be as low as 1 percent. Management of more diverse inshore stocks, however, is not so straightforward. The major problems which could arise and are being addressed are as follows:

Quota Busting: the flouting of quotas due to inadequate monitoring, enforcement and penalties.

This problem has been recognized in the development of an extensive and comprehensive monitoring system (which is described in a separate section) and the drafting of legislation in order to provide clear backing for penalties and definition of infringements. There is strong support within the fishing industry for rigorous enforcement and severe penalties.

Data Fouling: the falsification of data required for management purposes, as fishers fear detection through cross-matching with administrative records. This can also apply to cost and earnings data.

The monitoring program is designed to provide adequate detection of landings of fish. Where extensive dumping occurs, landings records and catch/effort records can be distorted. This problem can be overcome to some extent in two ways: first by monitoring quota trading prices, which should reflect market perception of the health of different stocks; and secondly by using selective logbook monitoring of catch/effort of responsible industry members to detect changes in stock abundance. The "global" fishing return system, which requires all fishers to record catch/effort data, will continue, in addition to the requirements to complete quota management reports.

PROBLEMS IN DETERMINING REALISTIC TAC'S

Even with incomplete data, it has been possible to set reasonable TACs for most species. Substantial research effort is being targeted toward refining TACs. The ITQ proposal has led to a significant reordering of research priorities.

Higrading: the discarding of lower-quality fish

This is likely to be a short-term, transitional problem and should disappear once the fishery recovers and product value differentials within the same stock diminish in comparison to the costs of dumping. The costs of dumping are significant, and in the end we rely on the fact that fishers go to sea to land fish, not dump it. Various gear restrictions, such as minimum mesh and area restrictions, will also be applied in order to minimize this problem.

Stable stocks, not too easily taken, will assist in this regard, but TACs set too low will promote dumping. The setting of conservative TACs, although desirable in principle, has a cost in reduced industry confidence and in inviting quota busting, as fishers find it easy to take fish that MAF scientists argue are not there.

By-catch: the unavoidable catching of a non-targeted species as a fluctuating proportion of the catch of a target species

This problem is more acute where the by-catch is also a valuable species. Although no fisheries management program can entirely eliminate the problem, a combination of the procedures below are designed to minimize it:

- The effective management and limitation of target species of which by-catch species form a component.

- The allocation of quotas based on catch history modified by fishers' own choices as to how these can be amended through quota buy-back. Extensive administrative reductions, where one species is reduced more than another, will exacerbate the by-catch problem.

- A flexible and easily accessible quota trading mechanism by which information costs are kept low. It is important that the markets for such quota be as geographically wide as possible so as to provide adequate depth, subject to the need to manage discrete stocks separately.

- Allowing for flexibility in meeting the quota. Overruns and underruns of 10 percent of catch against quota are currently allowed for in the proposed legislation; i.e. underruns of up to 10 percent can be carried forward to the following year, and overruns of up to 10 percent can be deducted from the following year's allocation.

Even when the total quota for a stock has been reached, it is permissible to land catch in excess of quota where this is taken as an inevitable consequence of fishing for a target species, but the catch then becomes the property of the state. In effect, the state is charging the fisher a price for quota equivalent to the port price for the stock. Fishers correctly point out that they are unlikely to incur the costs of holding product and bringing it ashore, only to have it become state property. An alternative, more workable way of dealing with the problem is for the state to explicitly become the "seller of quota as last resort" and charge a premium for quota somewhat less than the port price. Fishers therefore would have the incentive to bring their fish ashore, but insufficient incentive to deliberately increase their by-catch. The high and increasing marginal cost of catching the non-targeted species would therefore act comparably to an output tax in constraining effort on the stock. Getting the marginal price right will require administrative adeptness and will no doubt take some time.

In conclusion, there is full awareness of the problems of management of a multispecies resource using ITQs. Nevertheless, it is believed that, with appropriate flexibility in management, these problems can be reduced to acceptable levels. Moreover, many of the problems alluded to are also experienced with any active management policy, including reliance on input controls. Implicit TACs must be estimated, for instance; data fouling is also likely to occur when

fishers perceive a linkage between information they supply and the response of regulatory agencies in taking measures against their interests; the management of by-catch is still a problem where there is heavy reliance on gear restrictions alone is relied upon; and so on.

The alternative of relying solely on input controls was seen as not conferring some of the advantages of ITQ management, while sharing many of its disadvantages.

ADJUSTMENT OF QUOTAS

Adjustment to ITQ "portfolios" will be possible by trading, by the government buying back or selling quota through the trading system or, alternatively, by tender.

A trading system is planned to operate on a VAX 11/750 computer owned by the New Zealand Fishing Industry Board. It will link to a videotex host computer and also to a computer, owned by MAF, which will keep registration records updated. The system will essentially be an electronic trading floor, with access distributed nationwide through videotex terminals. The costs of access will be low (under U.S. $600 per year including terminal hire and subscription) and trading will occur for a two-hour period each day. Trading in one-year quota and quota in perpetuity will both take place, and trading will be "arms length" in that buyers and sellers of quota will be unknown to each other. Each will register offers for purchase or sale, which will be matched by the computer and confirmed. There will also be provision for electronic funds transfers, so that the videotex terminal can be used for purchasing quota. This is possible because the videotex host computer is owned by the "clearinghouse" that is collectively owned by the nation's trading banks. Once transactions have been confirmed by payment of funds, MAF will be informed electronically of the change in ownership.

Face-to-face transactions will be possible, with the one stipulation that the trading exchange be informed of the transaction, so that it can notify MAF. The software for this system is presently being developed and the system is expected to be in operation by July 31, 1986.

A major problem which could affect quota trading has to do with the securing of quota by commercial lenders. There is no provision for the registering of security held over quota by MAF, although it is legal to secure quota. Lenders who wish to hold security are being advised to take title in the quota in perpetuity. They will then be able to lease back the quota held each year for a nominal amount. Fishers will thus be free to trade annual quota in order to adjust their catch mix within the year.

The government itself can adjust quota by purchasing or selling quota, using the trading exchange. Otherwise it can tender to purchase or sell quota.

ECONOMIC IMPLICATIONS OF THE POLICY

The effects of ITQs in the deepwater fishery since 1982 have greatly assisted in the improved economics of this fishery. Profitability improved substantially--due principally to substantial increases in the export prices of deepwater species such as orange roughy. Nevertheless, deepwater quota holders have also attested to the role of ITQs in providing gains in efficiency and also in helping to maintain levels of profitability. Some quota holders have gone to the extent of developing computer programs to help them optimize the use of their vessels in relation to seasons as well as to processing and marketing requirements. Premiums on long-term supply contracts have also been possible because of security of access and the improved ability to plan production made possible by that security.

We expect prices to respond to reductions in the availability of some prime inshore stocks. Japanese purchasers of New Zealand snapper were so concerned about the impact of contracted supply, for instance, that they built up significant inventories of snapper. The year-long deferral of the introduction of ITQs contributed to a recent decline in the price of frozen snapper. The sensitivity of overseas importers to such supply considerations indicates that prices may become firm for some species at the commencement of the ITQ program. The before and after trends in the market beginning on October 1, 1986 will be analyzed with interest to determine price responsiveness to change in market supply and market perceptions.

MONITORING AND ENFORCEMENT

(This section is included with grateful acknowledgement to Dr. Fred Baird of the University of Canterbury.)

An enforcement process is being implemented according to the philosophy that participants in the industry must believe the system of monitoring to be capable of detecting abuse. In other words, the system must not only be capable in terms of its design but it must be believed to be capable so that:

- those who would flout the scheme are discouraged from doing so; and
- those who are concerned about others flouting the scheme believe that the violators will be caught, giving them the confidence that the scheme will protect their rights.

The system, however, must have elements for self-policing by the industry, and in particular must make individual fishers responsible for managing their property right in accordance with the various regulations and laws applying. Although it will be anathema for many to trust the owners of the property right to monitor their use accurately, it is felt that by this means the costs of monitoring can be held to reason-

able levels and policing can be targeted at the small minority expected to abuse their rights in the fishery.

The monitoring scheme regards as pivotal, and uses, the information from fish receivers and from the processing and packing houses, in order to enable a cross-check to be made of the statements provided by fishers. However, the adopted approach is intended to minimize the demands made on the receiving sector for information. It should be emphasized, however, that the receivers' role is essential in verifying the claims of fishers. If there are fishers who are "thieves," then there are others who are "fences."

Electronic monitoring is the only appropriate means of achieving efficiency and reducing the costs of policing. Using manual systems would encourage fishers to believe that they could beat the system. The monitoring philosophy emphasizes the need for computerization of the monitoring phase so that early detection of system abusers is possible and costly investigations are targeted only at those whose behavior is suspect. The aim of any good auditing system is to avoid the auditing of activities which will not be found wanting.

MAF is to administer ITQs through a quota monitoring system (QMS). Much of this system has already been developed, although it will not finally be put in place until the legislation has been passed.

Earlier last year, many fishers and fishing companies received notification of their personal catch history. All of these persons or companies will be receiving or have received copies of the forms and logbooks which will be used for the new administrative procedures.

Persons currently receiving fish from commercial fishers will also have to fill out the forms that are applicable to them under the quota monitoring system. Under the proposed new legislation, receivers will have to be approved by the Ministry and hold a license. When the new provisions are enacted, these receivers will be required to report regularly.

The quota monitoring system will mean some extra work for members of the industry, but taking the time to send in accurate returns will result in a fair deal for everyone and will mean that use of fish stocks can be accurately assessed to ensure the long-term future of the fishing industry. Procedures have been streamlined, and the number of forms and their requirements kept to a minimum.

Accurate reporting is essential. The success of the quota monitoring system depends on it. There are three main forms to be filled in, the Catch Landing Log, the Quota Management Report, and the Licensed Fish Receivers Report. All of these documents are used to confirm information about catching activity and use of property rights.

The Catch Landing Log must be filled in by the skipper or owner of the vessel immediately after landing the catch. In terms of the new system of monitoring the landing point is, to all intents and purposes, the origin of the fish. Fishery Officers can demand to inspect the log, and they and the auditors will use the information contained to verify the reports both of quota holders and of licensed fish receivers.

The basic rule in relation to the recording of fish taken is that all fish, other than those taken pursuant to amateur regulations, is deemed to be taken by a commercial fisherman, who must forward such fish to a licensed fish receiver. Each party is required to record details that can be used to check the veracity of reporting of the other's reporting. The Catch Landing Logs will be cross-checked with the observations recorded by Fishery Officers, and these will be used to confirm details of "fishing on behalf."

The Quota Management Report (QMR) is the prime document for policing of property rights. It is completed and forwarded to a particular MAF office by quota holders at regular intervals, usually monthly. It is imperative for the success of the monitoring scheme that reports by quota holders be furnished by the due date; the Ministry intends to adopt a firm line in this regard. In addition to furnishing a QMR quota, holders will be required to hold, for a period of two to three years, certain supporting documentation from which they can, and at times will, be required to prove the validity of QMRs forwarded to the Ministry.

Examples of such documentation would be: fish received dockets from licensed fish receivers; activity reports from commercial fishers; quantity data; unit price and payment schedules from fish receivers. Details of the information required are being determined at this time, as the auditing package is being completed.

The QMR is a statement by quota holders. All information contained on the report, except for catch activity, can be verified directly, and the catch details will be authenticated in the first instance from licensed fish receiver reports and in the second by catch landing logs and other commercial documentation.

The Licensed Fish Receiver Report (LFRR) is the significant difference between the monitoring approach being developed for the New Zealand fisheries and that which has developed under ITQ management schemes elsewhere. It is our belief that monitoring commercial operations beyond the landing point, as a means of cross-checking QMRs, will provide the vital checks and balances required, make the receivers as responsible as the fishers and quota holders in terms of legal access to and use of the resource, and provide a source of information about fish and fish products. Fish receivers have to share responsibility for monitoring the resource from which they obtain their livelihood. Too often fishers are blamed for not husbanding the resource or for breaking

laws and regulations pertaining to the fishery, while the role of fish receivers in encouraging and making it possible for fishers to so act is ignored.

Many accounting, auditing and economic skills will be employed to ensure that fish receivers are reporting their fish purchases correctly. The LFRR is a report which, like the QMR, must be supported by additional documentation, much of which will be kept at present by those receivers who are operating in a normal and proper commercial manner. It has come to our notice that many of the larger receivers are introducing microcomputer accounting and administrative systems, and we intend to develop software to assist them in completing their LFFR.

The Ministry is organizing its enforcement arm, comprised of fishery officers and audit teams, into regional units. These groups will be given training in the use of professional monitoring and enforcement mechanisms, and in the use of computer systems that will eliminate delays in recording and monitoring and will make feasible cross-checking and investigations almost impossible under manual systems. (For further details on the ITQ package refer to Appendix 2).

SOCIAL IMPLICATIONS OF THE NEW ITQ-BASED MANAGEMENT POLICIES

It was clear to the planners that the new policy would have significant implications for the social fabric of the fishing and fishing-related industries. As has already been stated, the need to reduce catches to levels more nearly approximating the long-term sustainable yields has obvious economic impacts, reaching far beyond the individual fishers.

The Ministry of Agriculture and Fisheries was particularly concerned about the likely impact of the policy on fishing-dependent communities. Indeed the concern went even further and focussed on the potential interaction of the overall policy and its component parts with various community factors, including traditional or ethnic fishing rights. Three specific issues were identified: community viability; future industry structures; and employment.

The Ministry decided to investigate the issues involved and funded a short-term contract to study the potential effects of the ITQ proposals on the Northland area, an area in the northern part of the North Island that was projected to face the greatest adjustment process of any in New Zealand.

The objectives of the study were:

1. to assess the social and economic implications of the ITQ proposals on Northland communities which are dependent on, or closely involved with, coastal fishing;

2. to identify possible modifications of the ITQ proposals that might minimize their adverse consequences;

3. to identify community responses, including alternative employment and social opportunities that would help offset adverse consequences;

4. to provide a basis for, and, if necessary, assist with evaluation and allocation of ITQs.

The study was undertaken in three stages. Stage 1 identified the relevant communities and groups to be studied in depth and relied primarily on available data to establish an information base. Stage 2 consisted of field work aimed at identifying issues important to the communities and investigating key concerns more systematically. Stage 3 was an attempt to evaluate the effect of tendering to surrender fishing rights and suggested possible modifications to the ITQ-based management proposals.

All phases of the study involved significant in-depth interviewing of residents of the communities to identify their perceptions of the issues. The study also sought to evaluate the communications/consultation network.

The information included in this paper on the background, objectives, and methodology of the study is of more interest in the current context than the conclusions that emerged. To summarize the key issues:

- Most fishers are small-scale operators who see themselves as having very little influence in terms of control of the resource or of political power.

- The Ministry of Agriculture and Fisheries is seen as having the final say over the future size and structure of the fishing industry.

- Regional versus central control is of serious concern.

- The life style connected with fishing is highly valued.

- There are no (or very few) alternative employment opportunities.

- There is a high level of uncertainty over all issues relating to the future viability of the local fisheries.

- Concern exists that the "big companies" have greater economic and political power and will win out over the small operator.

- There is significant stress within personal relationships in these communities--largely occasioned by uncertainty.

The study basically concluded that a strategy which gave preference in effort reduction to maintaining the inshore fishery in localities where fishing is of the greatest importance would minimize the impact of changes in the North-

land area. The other side of this particular coin, of course, is that the adjustment pain is shifted elsewhere--either geographically or economically.

What affect this study will have on the decisions of the managers implementing the policy has yet to be seen. Because of the way the study was constructed it led to inevitable conclusions--it did not make the decision-making any easier, although it did confirm the generally held views of those responsible for the policy, i.e. that the adjustment process and long-term consequences would be most severe in those communities most dependent on fishing and located in areas where the greatest catch reductions are required. The extent to which the basic policy and the effort reduction process can be modified to take this into account is yet to be decided. There are a number of schools of thought ranging from taking no account and allowing the policy to operate freely--thus determining the future industry structure on purely resource allocation/economic efficiency criteria--to taking full account of painful social consequences of the policy and modifying it accordingly.

It is likely that the managers will argue for the sanctity of the policy and let the chips fall where they may, but that the political dimension may eventually intrude and modify the policy to some extent. It is the view of the authors that any modifying of the policy will work to the long-term detriment of economic efficiency in the industry and lead to the misallocation of resources. Social problems, particularly regional impacts, may be of overriding concern, but there are considerable difficulties in minimizing these impacts practically, as this would require restricting transferability of quota further in some way, or instituting specifically directed subsidies.

EXTENSION OF POLICY TO OTHER FISHERIES

Policy development to date has concentrated on the two major divisions; the deepwater or distant fisheries and the inshore finfish fishery. The resources of the Ministry of Agriculture and Fisheries have been limited to the implementation of highly complex systems and administrative mechanisms for ensuring that the ITQ based policies have the greatest chance of success.

Planning is proceeding, however, on the extension of the policy to other fisheries. The government has approved consultation with the non-finfish fisheries, with the objective of developing ITQ-based policies for them consistent with the inshore finfish policy.

At the present time the Scallop, Paua (Abalone), Dredge Oyster and Rock Lobster fisheries are managed through a variety of mechanisms, such as quotas, restricted license entry, sack limits, sunrise to sunset fishing restrictions, etc.

It is the government's intention that the consultative process will persuade these industries that it is in their interests to support and promote the use of ITQs in their fisheries. Indeed, it is these fisheries which should prove most amenable to the introduction of the new policies. The existence of restricted licenses, sack and other quota limits for shell fisheries, for instance, will allow the ready conversion of these fisheries to an ITQ-based management regime. This is further assisted by the fact that the resources themselves are not currently under significant pressure and it will not be necessary to have a difficult effort reduction exercise.

IMPLICATIONS FOR LONG-TERM MANAGEMENT

Bearing in mind that the objective of New Zealand's management policies is to maximize the net national benefit from New Zealand's fisheries within, of course, certain constraints such as those imposed by legislation, foreign policy and conservation requirements--some future commercial orientation in fisheries administration could be appropriate.

This commercialization could be based on the principle of a state commercial enterprise leasing the Crown asset (the ITQ) to the fishing industry. The enterprise would have, within certain constraints, the power to trade quotas, establish TACs on commercial/economic criteria, establish resource rentals, set research priorities to reflect commercial importance, and become more market oriented. New Zealand has made no moves in this area yet, but the thought is introduced here to indicate that moves from biological to economic management can lead to the introduction of a more commercial orientation in the conduct of fisheries management.

INDUSTRY INVOLVEMENT - THE CONSULTATION PROCESS

It is our view that the key to the successful introduction of the changes occasioned by moving to an ITQ-based management policy is acceptance by the fishing industry that it will gain from the changes.

The New Zealand fishing industry is by nature conservative and relatively resistant to change. Fishers perceive themselves as independent, free, individualistic--as hunters. They tend also to strongly hold the view that there should only be minimal government intervention or involvement in the fisheries.

As has been stated earlier, a basic tenet of the ITQ policy is the intention of the government to withdraw, as far as possible, from the interventionist regulatory policies of the past. During the consultation process, the government attempted, to persuade fishers that the new policy:

1. would minimize government regulation and intervention;

2. would allow fishers more freedom to choose the method of harvesting, the time of harvesting and the speed at which the allocated resource would be taken;

3. would accordingly improve their economic performance and increase income;

4. would reduce overcapitalization;

5. would ensure preservation of the resource; and

6. would preserve the individual, free, independent, hunting nature of the industry.

The discussion booklet that was published and distributed to the industry as the basis for the consultation procedure was weighted in favor of the ITQ policy. It did cover other management mechanisms, but more by way of considering and rejecting them than by promoting them as alternatives. It is also interesting to note that a key message which emerged at the consultative meeting was that the resource was under serious threat, that something had to be done to preserve and protect it; that the something could well be rigidly enforced Total Allowable Catches for species at risk; and that, as a consequence, the adjustment process could be particularly painful.

Some fishers expressed the view that they were being presented with no real choice, that the consultation process was more an exercise in blackmail than anything else, and that if they did not go along with the ITQ proposal they would be forced out of business. This interpretation is clearly dependent on the perspective of the person involved, although pressure on the resource was the real source of the "blackmail."

In summary, however, the consultation procedure was long, exhausting, detailed and thorough. Over 75 meetings, both public and confined to active fishers and industry participants, were held throughout New Zealand in the space of two months.

The objectives of the meetings were to inform the public and the industry of the proposed management changes and to seek input into the refinement and development of these policies. The level of debate varied, but the discussions were by and large beneficial.

The outcome was a better informed and, more importantly, an involved public and fishing industry, with some feeling of commitment to the policy changes proposed. This involvement was particularly significant in the subsequent implementation of the ITQ-based policy.

APPENDIX I: FISHERIES QUOTA MANAGEMENT SYSTEM TENDER FORM

MAF New Zealand

FISHERIES QUOTA MANAGEMENT SYSTEM TENDER FORM (QMS5)

DATE:

TENDER FORM No.

IMPORTANT:

1. **This form should only be completed after reading the instructions and conditions enclosed.**
2. **If you wish to tender any of your indicative quotas then this form must be completed and returned in a sealed envelope and by registered mail to the address below, no later than:**
3. **Tenders should be sent to: QUOTA MANAGEMENT SYSTEM,**
   MINISTRY OF AGRICULTURE AND FISHERIES,
   P.O. BOX 168,
   WELLINGTON.

SPECIES	AREA	INDICATIVE QUOTA (TONNES) 1 *	INDICATIVE MINIMUM FINAL QUOTA (TONNES) 2	A TENDER ALL INDICATIVE QUOTA (TONNES) 3	B TENDER PART OF INDICATIVE QUOTA (TONNES) 4	C TENDER PART OF INDICATIVE QUOTA (TONNES) 5
Groper	1	10	4	10	6	
Ling	1	12	10	12	–	
School Shark	1	4	2	4	1	
Other	1	4	4	4	3	
TOTAL		30	22	30	10	

* NOTES:

PLEASE ENTER AMOUNT BID (IN DOLLARS)

$ 53,736	$ 9,360	$

APPENDIX II: THE ITQ SYSTEM

Fisheries Bulletin

Published jointly by the Fisheries Management Division and New Zealand Fishing Industry Board

Vol. 1, No. 4, March 1986

THE ITQ SYSTEM

New Zealand's inshore fin fishery will see the introduction of individual transferable quotas (ITQs) in 1986. This new system of management needs the full co-operation of everyone involved in the fishing industry – individuals and companies, fishermen, quota holders and fish receivers alike to make it a success.

This bulletin has been produced to explain the new system and your responsibilities as a partner in New Zealand's fishing industry. At the same time it is also important to point out that some of the instructions and administrative procedures detailed in this bulletin depend upon the passage of the Fisheries Amendment Bill presently before Parliament. If the Bill becomes law in its present form, then these requirements will take effect once notices have been given and Regulations have been made as required by the Fisheries Act. You are nevertheless still required to complete the forms, as appropriate, as these have been authorised in terms of existing legislation.

QUOTA MANAGEMENT SYSTEM (QMS)

MAF will administer ITQs through a quota management system (QMS).

Last year fishermen and fishing companies received notification of their personal catch history. They will now be receiving or will have already received copies of the forms and log books which will be used for the new administrative procedures.

Persons or companies receiving fish from commercial fishermen will also be sent the Licensed Fish Receivers Return (LFRR) forms for regular completion.

Guidelines for using these forms are given in this bulletin – the first in a series which will explain the Quota Management System as it is phased in.

The QMS will mean extra work for everyone in the industry but taking the time to send in accurate returns will result in a fair deal for all and will mean that use of fish stocks can be accurately assessed to safeguard the long-term future of the fishing industry.

The procedures being introduced have been streamlined, and the number of forms and their requirements kept to a minimum.

Investigation teams attached to each registration office will monitor returns and carry out investigations, so that any problems can then be ironed out quickly and personally. MAF officers expect questions and difficulties to arise while the system is getting under way and they want to give fast, efficient assistance. A major reason for introducing the administrative system at this stage is to provide a learning and adjustment period for both the Ministry and the industry.

FISHERIES STATISTICS UNIT FISHING RETURNS

Forms to be completed by commercial fishermen for the QMS are in addition to the usual fishing returns required by MAF's Fisheries Statistics Unit (FSU). To make it easier to send in all returns, the Ministry will use designated local offices to handle all forms and administration.

Fishing returns must still be completed. The only difference will be that they will be forwarded by fishermen to their designated registration office rather than to FSU in Wellington.

Each commercial fisherman, quota holder and licensed fish receiver will be given one registration office to report to using his own distinct identification number i.e., Fisher Identification Number (FIN), Quota Registration Number (QRN), or Licensed Fish Receiver Number (LFRN). The FIN's and QRN's are seven digit numbers, for example: 8520140.

Large companies which have several branches in different parts of the country will still only report to one office; they will also only have one identification number as a fishing operation and, if they have a fish receiving licence, one identification number for this as well.

QUOTA MANAGEMENT SYSTEM FORMS

There are three main forms to be filled in –

1. The Catch Landing Log (CLL), to be completed by the skipper of the vessel each time catch is landed.
2. The Quota Management Report (QMR), which is completed and forwarded to the designated MAF office by quota holders at monthly intervals or as directed.
3. The Licensed Fish Receivers Return (LFRR), which is completed at specified intervals – usually once a month, but more frequently if directed - by those approved and licensed by MAF to receive fish under the quota management system.

These documents are used to confirm information about catching activity and use of harvesting rights. They are described in detail below.

One of the reasons for producing this bulletin showing how to complete all three forms is so that fishermen, quota holders and fish receivers can see what each is required to do under the QMS and see how their reports and documentation will be used to cross-check the reports received from other sources.

There are penalties for supplying false information or failing to comply with reporting requirements. It is hoped they will never have to be used.

FISHERIES MANAGEMENT CATCH LANDING LOG

Each vessel in the fishery will have a current catch landing log. When it has been completely used up it is to be returned to the registration office from which it was issued. A new log will be issued to replace it.

The pages of each landing log have been uniquely numbered and recorded by the issuing office. No other landing log used by any other vessel in the fishery now or in the future, will have pages with the same numbers. If a vessel is sold or leased to another fisherman then a new replacement landing log must be obtained by the new operator. The old catch landing log must be returned to the Registrar of Fisheries to whom the original owner/operator reported. This preserves the confidentiality of information in the landing log.

It is most important that the log book is completed legibly using a biro or similar pen. Keeping accurate and legible books of account will, from now on, be a requirement of the new system. For some this will be a matter of course, but for many others it will require a more formal and disciplined approach.

The Catch Landing Log (CLL) must be filled in by fishermen immediately their catch is landed. This is extremely important, and failure to do so will be in contravention of fisheries legislation. Although this log is not required to be forwarded at regular intervals to a Registrar of Fisheries, as the other documents are, it nevertheless provides an "on-site" record of catch landing activity. Fishery officers and examiners will be able to inspect the CLL on demand and they may also use and extract the information in the log to verify the reports of both quota holders and licensed fish receivers.

Each Catch Landing Log has a set of instructions on how to fill it in. Read these carefully before you try to complete your log.

Remember the following points in regard to fishing activity. They will apply when the new fisheries legislation comes into effect.

(i) If a commercial fisherman has a quota then his identification code is called a Quota Registration Number (QRN); if he has no quota then it is called a Fisher Identification Number (FIN).

(ii) A fisherman may fish on behalf of other quota holders provided he is a quota holder in his own right and has an appropriate fishing permit. He then records this fish against the quota authorizing the taking of such fish in the column marked "Enter quota registration number fish caught against".

(iii) A fisherman may also fish non-quota species on behalf of another fisherman provided the fisherman catching the fish has an appropriate fishing permit. This fish is recorded against the FIN or QRN of the fisherman on whose behalf the fish was caught.

(iv) Non-quota species are not entered on the quota management report (which we shall come to later) as they cannot be deducted from quota held. There is, simply, no quota to report against, but they must be reported in the CLL.

(v) When one fisherman fishes on behalf of another it is the responsibility of the fisherman who catches the fish to forward it to a licensed fish receiver. The licensed fish receiver number must be recorded on the CLL.

(vi) If someone other than a licensed fish receiver wants ITQ or non-ITQ species in amounts greater than the legislation allows then he must go to a licensed fish receiver; fishermen cannot enter into contracts to supply persons who are not licensed fish receivers, or fish for persons who are not commercial fishermen.
The maximums allowable in the Bill are:

fin fish	10kg
shell fish	6kg
rock lobster	2kg.

(vii) There are only three things a commercial fisherman can do with fish he takes. He can sell or dispose of it to a licensed fish receiver, sell it by wharf sale or dispose of it to the Crown. The third option applies when a fishermen has taken fish inadvertently as by-catch for which he has no quota and is unable to obtain any quota.

EXAMPLES OF FILLING OUT YOUR FISHERIES MANAGEMENT CATCH LANDING LOG

(a) Quota holder QRN 8410156 landed 24 baskets of snapper, 9 baskets of trevally and 8 baskets of gurnard. He fished these species in the West Auckland management area (area 9 for snapper and trevally area 1 for gurnard). The catch was forwarded to licensed fish receiver LFR 562.

(b) Quota holder QRN 8412020 landed 20 baskets of snapper, 15 baskets of trevally and 10 baskets of gurnard which he fished on his own behalf and that of quota holder QRN 8411096. It was agreed that the catch should be split, so that 8412020 had 15 baskets of snapper, 5 of trevally and 5 of gurnard taken against his quota and forwarded to licensed fish receiver LFR 526; the balance was to be recorded against QRN 8411096 and to go to LFR 591.
If the above quota holder had (i) inadvertently taken a basket of groper while fishing for his snapper, trevally and gurnard, had no quota for this fish, and advised a fishery officer that he had taken this fish accidentally as by-catch and (ii) instead of sending all his snapper to a licensed fish receiver, had sold one basket as wharf sales, his log would have looked like example (c).

QUOTA MANAGEMENT REPORT

QUOTA HOLDER RESPONSIBILITIES

The Quota Management Report (QMR) is the basic document for the monitoring of harvesting rights.

Quota holders have been or will be supplied with a pad of quota management reports which contain instructions on completing the forms and a simple example. This bulletin provides a more extensive example which explains the various situations a quota holder could encounter in completing a report during the fishing year.

Each quota holder, which includes those leasing quota for the period of the lease, must complete a Quota Management Report (QMR) at the end of each calendar month or shorter interval if this is specified. If no reporting dates are specified or advised by MAF, then a quota holder must submit a report to the designated registration office by the 7th day of the month following the month for which the report is required. This means that each quota holder will send at least twelve QMR's during the fishing year.

The success of the monitoring scheme depends on reports being returned by the due date. As we have said, the normal reporting interval will be monthly but those quota

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EXAMPLE OF FISHERIES MANAGEMENT CATCH LANDING LOG.

TO BE COMPLETED IMMEDIATELY ON LANDING

Date Landed	Fishstock (Species/Area)	1 State	Description Number/2 Container	4 Enter Quota Registration Number fish caught against	Enter Wharf Sales or Licence number of receiver fish sold to	3 Greenweight (kilograms) Once advised of weight
example (a)						
5-3-86	SNA 9	GRE	24 baskets	8410156	562	650 kg
" "	TRE 9	"	9 "	8410156	562	202 "
" "	GUR 1	"	8 "	8410156	562	156 "

when the licensed fish receiver forwards the greenweight amounts these are entered as shown.

example (b)						
6-3-86	SNA 9	GRE	15 baskets	8412020	526	
" "	SNA 9	"	5 "	8411096	591	
" "	TRE 9	"	5 "	8412020	526	
" "	TRE 9	"	10 "	8411096	591	
" "	GUR 1	"	5 "	8412020	526	
" "	GUR 1	"	5 "	8411096	591	

when the licensed fish receiver forwards the greenweight amounts these are inserted here.

example (c)						
6-3-86	SNA 9	GRE	14 basket	8412020	562	
" "	"	"	1 basket	8412020	Wharf sale	5 kg
" "	"	"	"	"	" "	5 kg
" "	"	"	"	"	" "	10 kg
" "	"	"	"	"	" "	7 kg
" "	"	"	5 baskets	8411096	591	
" "	TRE 9	"	5 baskets	8412020	526	
" "	"	"	10 "	8411096	591	
" "	GUR 1	"	5 "	8412020	526	
" "	"	"	5 "	8411096	591	
" "	HAP 1	"	1 "	8412020	Crown	

when the licensed fish receiver forwards the greenweight amounts these are inserted here.

1 State Please code state as follows

Green	GRE	Headed gutted and skinned	HGS
Gutted	GUT	Filleted	FIL
Head and gutted	HGU	Trimmed fillets	TRF
Gilled and gutted	GGU	Shucked or Shelled with gut	MEA
Trunked	TRU	Shucked or Shelled without gut	SHG

2 Specify type of container (eg baskets/bins/boxes etc) of each species landed or fish dose form estimate landed weight

3 Note it is the responsibility of Licensed Fish Receivers to advise you of greenweight of fish you have sold to them. They will therefore apply conversion factors on processed landed catch to calculate greenweight

4 If not a quota holder then enter holer identification number (FIN) on whose behalf fish was caught

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holders who are late or who submit inadequate or inaccurate reports can expect to be required to report more frequently. This could mean fortnightly, weekly or if necessary, at each time of landing for those who are both fishermen and quota holders.

The first report of a fishing year must take account of under- and over-fishing in the previous year. As 1986 will be the first year of the scheme these adjustments will not apply and we shall not need to address this situation until October 1987. There are no examples to deal with these problems at this time, but you will be advised how to deal with this situation during 1987.

In addition to furnishing a QMR, quota holders will be required to hold for a period of at least three years, or longer if requested, certain supporting documentation which the Ministry can use to prove the validity of QMRs forwarded.

Examples of such documentation would be purchase invoices or fish received dockets from licensed fish receivers; activity reports from commercial fishermen; or quantity, unit price and payments schedules from fish receivers. Details of the information required to be held are being determined as the auditing package is being finalised.

The QMR is a statement by quota holders. Some of the information contained in the report, such as opening balances and trading in quota, can be verified from other sources; the remainder of the information, which is detail about fish caught, can be checked in the first instance from licensed fish receiver returns, and in the second instance from catch landing logs and other documentation.

THE CATCHING RIGHTS OF QUOTA HOLDERS.

Quota holders can take fish themselves (provided they have a registered vessel and the appropriate fishing permit) or have other persons who are able to take quota species, fish their quota on their behalf.

Fish which is taken under the right or authority of a quota must be counted against that quota. If a quota holder has somebody to fish on his behalf it is his responsibility to find out how much fish was taken and to record the catch details and the names and numbers of the vessels used. Space for this is on the reverse of the QMR. All quota holders, individuals, partnerships and companies must list the vessels used to catch against their quota whether they own and operate the vessels or not. This links the QMR to the CLL.

You can see from this that you can own quota, which is a right to take fish, and yet not take the fish yourself.

Regardless of whether there is fishing activity against quota, each quota holder must submit a report at least monthly. A "nil" return is a statement that there has been no fishing against that quota since the last report was filed.

POINTS TO NOTE:

(1) A quota holder is somebody holding the right to take fish under quota at a particular time.

(2) Quota holders record only quota species on their QMR.

(3) Quota holders rather than owners of quota are to complete the QMR. If you have leased quota to another quota holder then during the period of the lease you do not report on the quota you have leased out; that is the responsibility of the lessee.

(4) The "commencing quota for month" is the balance at the end of the previous month and is the quota held (not owned) less the amount already caught for the current fishing year.

(5) Overfishing and underfishing of quota are to be permitted. However, there will be no overfishing or underfishing of leased quota unless the lease contract provides for such an arrangement. Quota holders will be able to carry up to 10% of the current year's quota, if unfished at the end of the fishing year, forward to next fishing year; likewise, they will be able to overfish by up to 10% of the current year's quota deducting this from the next year's entitlement.

AN EXAMPLE OF FILLING OUT A QUOTA MANAGEMENT REPORT

Quota holder F.T. Smith, QRN 8421096, owns quota at the beginning of February for 10 tonnes of snapper in area 9, 14.2 tonnes of snapper in area 1, 7.1 tonnes of trevally in area 1, 13 tonnes of gurnard in area 1, 10.1 tonnes of hapuku in area 1, and 15 tonnes of tarakihi in area 1. He leases 1 tonne of hapuku in area 1, but has no rights to overfish or underfish this quota, and leases 1 tonne of tarakihi in area 1 for which he does have rights to overfish.

At the beginning of February (end of January) 1986 he had balances indicated by the bottom line of the quota management report shown in the QMR January example. The minus signs (e.g. –480 or –1605) indicate that he had overfished his quota by this amount; in all other cases he still had some quota left to fish.

In this example we will analyse his February QMR in detail and explain the different situations this fictitious quota holder is in at the end of February.

You should try and understand how the balances at the end of January were arrived at yourself by looking at the numbers in the QMR for January.

Let us look at his February quota management report column by column.

Column 1: During February he caught 578 kg of snapper in area 9, did not change his quota holdings and ended the month with 2638 kg (3216 – 578) of snapper in area 9 remaining.

Column 2: This time he purchased and/or leased 1000 kg of snapper in area 1, caught 1418 kg of the same quota and finished the month with (5819 + 1000 – 1418) = 5401 kg of quota yet to be caught.

Column 3: In this case he began the month having overfished his quota of trevally in area 1 by 480 kg. He leased 2000 kg giving a new balance at total A of (– 480 + 2000) = 1520 kg. He caught 680 kg leaving a balance still to be fished of (1520 – 680) = 840 kg.

Column 4: He has overfished his gurnard in area 1 by 1605 kg. You will recall that he owned quota of only 13.0 tonnes, or 13000 kg, for this fish stock more than 10% so he must cease fishing this species until he has acquired some more quota; even if he does not fish any more, he must obtain some more quota or he will have committed an offence and be liable to forfeiture of quota. During February he leases a further 1000 kg reducing his overfishing to (– 1605 + 1000) = – 605 kg. He catches a further 612 kg and has now overfished by – 605 – 612 = – 1217 kg. The quota he leased does not have any provision for overfishing or underfishing but 1217 kg is less than 10% of 13000 kg so he is not in breach of fisheries law.

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Quota Management Report

Required pursuant to the Fisheries Act 1983

Month or Period Ending: JANUARY | Year: 86 | Page 1 of 1 Pages

Name of Quota Holder: F.T. SMITH.

Quota Registration Number: 842 1096

Telephone Number: 591 0762

Postal Address: 11 THE WHARF, AUCKLAND 1.

Greenweight (kilograms)

Fishstock	SNA 9	SNA 1	TRE 1	GUR 1	HAP 1	TAR 1	BAR 1				
Enter commencing quota for month	5918	5737	1606	-919	2132	1401	11321				
Add quota purchased/ leased during month		2000									
Equals total A	5918	7737	1606	-919	2132	1401	11321				
Enter catch for month	2702	1918	2086	696	1172	793	3409				
Add Quota sold/ leased out during month							1000				
Equals total B	2702	1918	2086	696	1172	793	4409				
Total quota remaining equals (deduct B from A)	3216	5819	-480	-1605	960	608	6912				

Note: Do not forget to complete details of vessel activities overleaf

Signature of quota holder or agent: F.T. Smith. | Date: 2/2/86

It is an offence to supply false information

MAF New Zealand

Quota Management Report

Required pursuant to the Fisheries Act 1983

Month or Period Ending: FEBRUARY | Year: 86 | Page 1 of 1 Pages

Name of Quota Holder: F.T. SMITH.

Quota Registration Number: 842 1096

Telephone Number: 591 0762

Postal Address: 11 THE WHARF, AUCKLAND 1.

Greenweight (kilograms)

Fishstock	SNA 9	SNA 1	TRE 1	GUR 1	HAP 1	TAR 1	BAR 1	WAR 1			
Enter commencing quota for month	3216	5819	-480	-1605	960	608	6912	0			
Add quota purchased/ leased during month		1000	2000	1000							
Equals total A	3216	6819	1520	-605	960	608	6912	0			
Enter catch for month	578	1418	680	612	2112	2204	2404	260			
Add Quota sold/ leased out during month							2000				
Equals total B	578	1418	680	612	2112	2204	4404	260			
Total quota remaining equals (deduct B from A)	2638	5401	840	-1217	-1152	-1596	2508	-260			

Note: Do not forget to complete details of vessel activities overleaf

Signature of quota holder or agent: F.T. Smith. | Date: 4/3/86

It is an offence to supply false information

Column 5: He begins February with 960 kg of quota for hapuku in area 1 not yet fished. His catch amounts to 2112 kg so that he has overfished by (960 – 2112) = – 1152 kg of fish. He owns 10.1 tonnes, 10100 kg, of quota for this fishstock and leases 1.0 tonne, 1000 kg, but this leased quota cannot be overfished. Thus his overfishing is 1152 kg, compared with 10100 kg which he owns. It is more than 10% so he must stop fishing this species and attempt to find some more quota.

Column 6: In this case the fisherman has begun February with 608 kg of tarakihi quota in area 1 unfished. He fishes 2204 kg of this fish stock ending up having overfished by (608 – 2204) = – 1596 kg. He owns 15000 kg of the required quota and leases 1000 kg which he is able to overfish. He thus has 16000 kg of quota which he is able to overfish. His overfishing of 1596 kg is less than 10% of the 16000 kg, so he is not in breach of fisheries law.

Column 7: In this case the fisherman begins with 6912 kg of quota for barracoutta remaining in area 1. He catches 2404 kg during February and decides to lease a further 2000 kg which he does not want to fish. His available quota is reduced by (2404 + 2000) = 4404 kg so he has (6912 – 4404) = 2508 kg of quota to fish.

Column 8: The fisherman does not have any quota for blue warehou in area 1 and his catch of 260 kg, which he says was a by-catch, must be resolved by either buying or leasing quota or, if this is not possible, by disposing of the fish to the Crown.

LICENSED FISH RECEIVERS RETURN

RESPONSIBILITIES OF LICENSED FISH RECEIVERS

Under the new scheme those receiving fish from commercial fishermen must hold fish receiving licences.

Licensed fish receivers must report to MAF in much the same manner as quota holders.

The Licensed Fish Receivers Return (LFRR) is the significant difference between the monitoring approach being developed for New Zealand fisheries and that which has developed under ITQ schemes elsewhere in the world.

The LFRR has been designed to monitor commercial fish receiving operations beyond the landing point. It is a means of cross-checking QMRs and vice versa, and will provide a way of making receivers as responsible as fishermen and quota holders in monitoring the use of the resource.

Fishermen will otherwise be blamed for not husbanding the resource or for breaking the laws and regulations pertaining to the fishery without any cognisance being taken of the role of fish receivers in encouraging and making it possible for fishermen to act irresponsibly.

Many accounting, auditing and financial analysis skills will be used to ensure that fish receivers report their purchases correctly. Just as with the QMR, the LFRR is a report which must be supported by additional documentation, much of which will be kept already by those fish receivers who operate in a proper commercial manner.

A fish receiving licence gives its holder a privileged position in the industry; those who abuse such a position should not expect to be able to continue to hold their licence.

If no reporting dates are specified, a licensed fish receiver must submit an LFRR to the designated registrar's office by the 7th day of the month following the month for which the report is required. This means that each licensed fish receiver will send at least twelve LFRRs during a fishing year.

As with Quota Management Reports, the success of the scheme depends on the reports being returned by the due date and MAF will take a firm line with those who ignore this requirement.

Like quota holders, those who are late with their reports or who submit inadequate reports can expect to be made to report more frequently than once a month.

Once criteria have been established for licensing fish receivers those who are to hold licences under the QMS will be sent the required LFRR forms, which must be completed and forwarded to MAF.

For the purposes of completing LFRRs fish receivers include:

(a) Those who are licensed fish receivers.

(b) Those quota-holding fishermen who conduct wharf sales.

(c) The Crown when it accepts fish for disposal or authorises the disposal of fish.

Quota-holding fishermen in (b) above do not formally hold licences and cannot accept fish from other commercial fishermen. They must however, send in an LFRR showing their wharf sales because these will not appear on any other report and in respect of these sales they are acting like a licensed fish receiver.

POINTS TO NOTE

(1) Licensed fish receivers must not receive fish for sale other than from commercial fishermen. Just as employees must submit an IRD number before employers make wage payments, a commercial fisherman must supply his FIN or QRN before a licensed fish receiver may accept his fish.

(2) Fish receivers must have accounting systems which document purchases of fish and fish products and sales of processed fish. They will be required to provide purchase invoices and sales dockets to document the buying and selling of all fish and fish products. It is likely that more rigorous documentary requirements will be imposed for cash transactions. We are fully aware, particularly with the modern trend towards non-cash payment systems, that cash trading has been and is used as a means of evasion. To date it has been evasion of the taxation system; its future use could be to avoid providing evidence of trading in fish.

(3) Whereas quota holders must record only quota species, licensed fish receivers must record **all** species received by them. Fish receivers must ensure that commercial fishermen clearly indicate the quota holder against whom the fish received is to be recorded. If there is any doubt, and attempts to resolve this are not successful, the fish should be recorded against the commercial fisherman who supplied it. Even non-quota species must be attributed to somebody and

MAF New Zealand

Licensed Fish Receivers Return

Month or Period Ending: FEBRUARY | Year: 86 | Page 1 of 5 Pages

Name of Licensed Fish Receiver: E.S. READ | Licence Number: 562 | Telephone Number:

Postal Address: 25 PACKERS LANE, AUCKLAND 1.

Enter Greenweight (kilograms) for each species received

Name of Quota Holder	FIN or QRN	Species	Weight	Species	Weight	Species	Weight	Species	Weight	Species	Weight	Species	Weight
F.T. SMITH	8421096	SNA	1996	TRE	680	GUR	612	HAP	2112	TAR	2204	WAR	260
"		BAR	2404	KAH	2109	BOT	404						
J.A. GEORGE	8421044	SNA	4010	HAP	964	TRE	1708	GUR	971	KAH	2203	PAR	926
"		RMD	841										

Signature: E.S. Read | Date: 2/3/86

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that somebody must be a commercial fisherman. If he is a quota holder then it will be recorded against his QRN, otherwise it will be recorded against his FIN. Non-quota species are not deducted from anything, but they must be recorded. Although fish receivers will not be able to supply information about the management areas in which the fish species were caught they will be able to give timely information about all fish caught which will provide an early read-out of fishing activity or behaviour.

(4) Fish receivers will be provided with conversion factors for converting fish products to greenweight equivalent. The conversion factors will be the ones currently being used by the Objections' Committees, but more research is required in this area. It will be the responsibility of licensed fish receivers to convert and report all fish received as greenweight equivalent and to inform quota holders and fishermen of the amount of fish received in greenweight equivalents.

(5) Even if **ownership** of fish is retained by a fisherman through to the point of sale either to a consumer or for export, it must, after being landed, be forwarded to a licensed fish receiver who must record details of the fish received. This applies particularly to those fishermen and quota holders who have fish processed and packed on their behalf by licensed fish packing houses.

EXAMPLE OF FILLING OUT A LICENSED FISH RECEIVERS RETURN (LFRR)

This example shows part of an LFRR covering two fishermen who sent fish to licensed fish receiver 562. One was F.T. Smith, QRN 8421096, who sent all his catch to this fish receiver; another was J.A. George, QRN 8421044. Both caught quota and non-quota species. You can see what F.T. Smith reported as his catch of quota species by looking at his QMR for February in our previous example. In our example we assume that both the quota holder and the fish receiver reported correctly. When licensed fish receivers complete their returns, they report only on species since they do not know which area the fish were caught in. Using his records fish receiver 562 found that he had received 1996 kg of snapper from 8421096 (this corresponds to 578 kg of SNA 9 and 1418 of SNA 1 reported by 8421096 on his QMR). In addition his records for February showed 680 kg of trevally, 612 kg of gurnard, 2112 kg of hapuku, 2204 kg of tarakihi, 260 kg of blue warehou and 2404 kg of barracouta plus 2109 kg of kahawai and 404 kg of butterfish, both of which are non-quota species. Once the fish receiver has reported all the species purchased from quota holder 8421096 he starts a new line and reports on the next fisherman or quota holder, in this case J.A. George, QRN 8421044.

ACCURATE REPORTING IS ESSENTIAL.

THE SUCCESS OF THE QMS DEPENDS ON IT.

REGISTRATION OFFICES

These offices will be situated at:

Office ID	Postal	Location
1	Registrar of Fisheries Fisheries Management Div Ministry of Agriculture and Fisheries Private Bag WHANGAREI	Rural Banking & Finance Corporation Building Hunt Street WHANGAREI
2	Registrar of Fisheries Fisheries Management Div Ministry of Agriculture and Fisheries PO Box 3437 AUCKLAND	Wrightson House 10-14 Hobson Street AUCKLAND
3	Registrar of Fisheries Fisheries Management Div Ministry of Agriculture and Fisheries Private Bag TAURANGA	Cnr Elizabeth & Durham Sts TAURANGA
4	Registrar of Fisheries Fisheries Management Div Ministry of Agriculture and Fisheries PO Box 2034 Ahuriri NAPIER	Waghorne Street Ahuriri NAPIER
5	Registrar of Fisheries Fisheries Management Div Ministry of Agriculture and Fisheries Waterfront House Private Bag WELLINGTON	Waterfront House Waterloo Quay WELLINGTON
6	Registrar of Fisheries Fisheries Management Div Ministry of Agriculture and Fisheries Private Bag NELSON	Vickerman Street PORT NELSON
7	Registrar of Fisheries Fisheries Management Div Ministry of Agriculture and Fisheries Private Bag CHRISTCHURCH	Kyle Street Riccarton CHRISTCHURCH
8	Registrar of Fisheries Fisheries Management Div Ministry of Agriculture and Fisheries Private Bag DUNEDIN	Cargill House 123 Princes Street DUNEDIN
9	Registrar of Fisheries Fisheries Management Div Ministry of Agriculture and Fisheries Private Bag INVERCARGILL	Menzies Government Building The Crescent INVERCARGILL

YOUR OBLIGATIONS UNDER THE PROPOSED LEGISLATION

If you are a commercial fisherman or quota holder –

- You must complete your Fisheries Management Catch Landing Log (CLL) every time you land any catch – whether quota or non-quota species.
  You must return a Quota Management Report (QMR) every month or more frequently if directed to - detailing the quantity of fish caught during the period for each of the species for which you have a quota, including quota you have leased from another quota holder. You do not have to report on any quota you leased to another quota holder, however.
- You must hold for three years, or longer if directed to, supporting documentation which can be used by the Ministry to prove the validity of your QMRs.

If you are a licensed fish receiver –

You must complete a Licensed Fish Receivers Return (LFRR) every month or more frequently if directed to – detailing the greenweight quantity of each species received during the period and the quota holder or commercial fisherman from whom it was received.

ERRATA

Please forgive the few errors we missed when producing the forms you will be receiving. This is a good opportunity to correct them.

1. On the species code page we have the following changes:

Garfish		GAR not FAR
Spiky Dogfish		SPD not SDP
Blue Nose	should be	Bluenose
Seaegg	should be	Sea Egg
Hapuka	should be	Hapuku

2. On the map the co-ordinate 17° 03' E off Tirua Point should read 170° 03' E.

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Edited and compiled by Bretts DCA Limited, Wellington, in association with Buttle Print Communications Limited, Wellington.

Management of Australian Fisheries: Broad Developments and Alternative Strategies

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INTRODUCTION

The aim of this paper is to describe and analyze recent developments in the management of fisheries in Australia, placing emphasis on the management of those fisheries where the final responsibility rests with the Commonwealth government.

The paper sketches the development of fisheries within the 200 nautical mile Australian Fishing Zone (AFZ), and of Australia's fisheries management policies. This survey is followed by an assessment of the policies and practices of fisheries management under the following headings:

- Objectives of Fisheries Management
- Institutional Framework and the Decision-making Process
- Information Requirements for Management
- Management Options, Including Adjustment Programs
- The Timing of Introduction of Management Programs
- Sharing the Costs of Management
- Surveillance and Enforcement of Management Plans

To assist in understanding how the policies have been applied in practice, more detailed assessments of management programs for five selected fisheries are set out in Appendixes 1 to 5. They cover the northern prawn fishery declared management zone, the southern bluefin tuna fishery, the southeastern trawl fishery, the southern shark fishery, and the Spencer Gulf prawn fishery.

AUSTRALIA'S FISHERIES

Australia's fisheries yield an annual commercial value of over A.$500 million. Australia's major dollar earning fisheries are based on crustaceans and molluscs, and these generate substantial export income (over $400 million). The estimated value of production to fishermen and tonnage of exports, imports, production and consumption are set out in Tables 1 and 2.

The lobster, prawn (shrimp), abalone and pearl shell fisheries are high-value, export-oriented fisheries and are fully developed. The main lobster fisheries are located off the west coast of Western Australia and off the states in the southeastern corner of Australia. The major prawn fisheries are located in the warm waters off northern Australia. Localized prawn fisheries have been established in more southerly areas. Abalone is taken in wide areas off southern Australia. Finally, an important scallop fishery has been developed off Victoria and Tasmania. The locations of the major developed fisheries in Australia are shown on the map (Figure 1).

Attempts have been made to establish aquaculture and mariculture operations based on crustaceans and molluscs because of their high value. The most successful has been the oyster industry based in New South Wales and located near the main domestic markets. Oyster farms are now being developed in other southern states and attempts are being made to culture abalone, scallops and pearl oysters. While many attempts are being made to introduce aquaculture operations in northern Australia based on prawns, no large-scale operations have been established.

While the AFZ is one of the largest fishing zones in the world, the level of fish production is low, largely because of the relatively poor productivity of waters off Australia. There are important localized finfish fisheries in the southeast based on demersal fish and shark taken for the fresh fish market. Also, an important Australian fishery has developed based on southern bluefin tuna taken for canning. More recently, high-quality bluefin and yellowfin tuna have been landed for export as sashimi tuna (mainly for Japan).

The major demersal trawl and pelagic fisheries off northern Australia have been developed by foreign fishermen. Australians have been slow to enter these fisheries because of their remoteness, the distance from the major domestic markets in the south, and the multispecies nature of the fisheries.

Stocks of demersal and pelagic fish in the Great Australian Bight are generally low yielding or spasmodic. Recently, further attempts have been made to develop these fisheries, using a small number of trawlers. Finally, an attempt is being made to establish a mackerel fishery in the southeast, aimed at the production of fish meal and fish oil.

Table 1. Estimated Value of Production to Fishermen.

(in 1,000 of A.$)	1983/84	1984/85
Tuna	12,915	14,121
Other	74,560	87,919
Total Finfish	87,475	102,040
Prawns	142,710	164,172
Rock Lobster	137,210	172,002
Crab	N/A	N/A
Other	4,195	1,134
Total Crustacea	284,115	337,358
Abalone	28,590	35,365
Scallops	18,950	19,452
Oysters	21,400	27,786
Other	4,890	2,399
Total Molluscs	73,830	85,002
Pearls	N/A	N/A
Total	445,420	524,400

Source: Bureau of Agricultural Economics

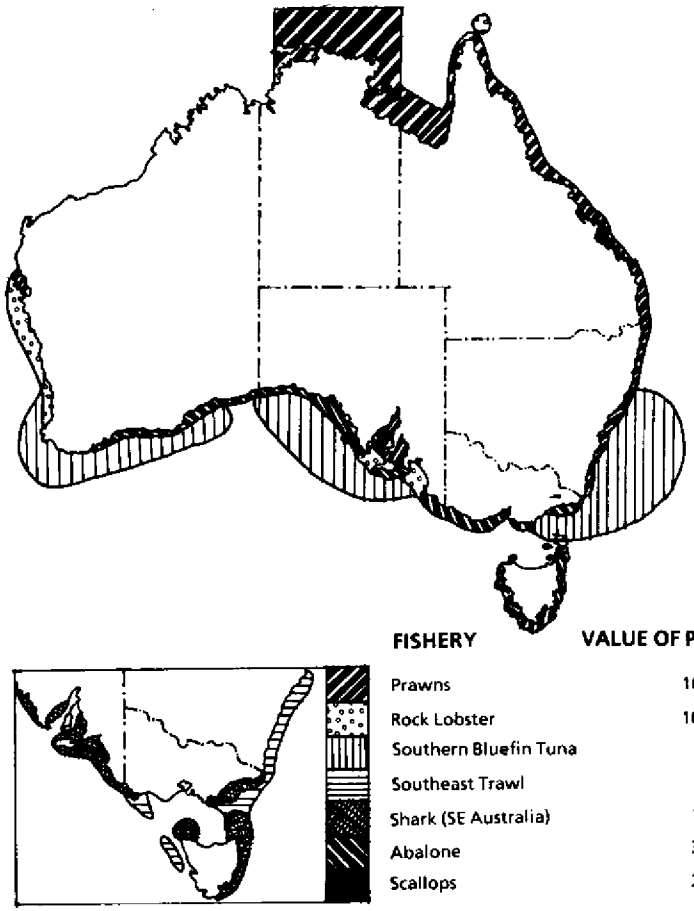
Table 2. Apparent Australian Consumption of Fresh and Frozen Fish; Liveweight Equivalent.[1]

Year	Exports	Imports	Domestic Production	Total Apparent Consumption	Imports as % of Consumption
		(in tons)			
1973-74	1,148	51,285	42,725	92,862	55.1
1974-75	839	44,362	40,780	84,303	52.6
1975-76	1,145	45,545	41,081	85,481	53.3
1976-77	1,374	51,532	45,127	95,285	54.1
1977-78	1,459	50,981	47,122	96,644	52.8
1978-79	2,012	50,450	47,782	96,220	52.4
1979-80	3,805	65,557	52,612	114,364	57.3
1980-81	2,874	67,733	55,184	120,043	56.4
1981-82	5,048	67,754	55,396[2]	118,102	57.4
1982-83	3,989	66,964	54,599	117,574	57.0
1983-84	4,710	78,300	58,170	131,760	59.4

[1] Imports and exports have been converted to liveweight using these factors: whole and beheaded, 1.33; fillets and other prepared or preserved, 2; fish fingers, 1.

[2] Estimated by the BAE.

Sources: ABS (1984), Fisheries: 1982-83, 7603.0, Canberra (and previous issues); ABS (1984), Foreign Trade, Australia: 1982-83, No.5409.0, Canberra (and previous issues).



FISHERY	VALUE OF PRODUCTION
Prawns	165
Rock Lobster	160
Southern Bluefin Tuna	13.2
Southeast Trawl	17
Shark (SE Australia)	10
Abalone	35.7
Scallops	25.1

Figure 1. Major Australian developed fisheries.

To summarize, the high-value fisheries based on crustaceans and molluscs are the mainstay of the Australian fishing industry. They are fully developed and attempts are now being made to supplement supplies through aquaculture and mariculture. Finfish stocks are limited, but there are still opportunities for development based on import replacement (a high proportion of finfish consumed in Australia is imported) and the export of high-value species of table fish and fresh tuna.

MANAGEMENT OF AUSTRALIA'S FISHERIES

For many years the underlying presumption of Australian fisheries administrators was that any Australian was entitled to a Commonwealth fishing boat license (valid to fish beyond 3 miles from the shore) unless the catch in a specific fishery needed to be restricted for management reasons. This approach required that areas, species and fishing methods be defined under management plans.

Prior to and immediately after the establishment of the 200 mile AFZ in November 1979, there was optimism in many quarters about the available fish resources. Expansion and growth was encouraged, despite reservations by some in government and industry that a more cautious approach to the management of Australia's limited resources was warranted. The outcome was a rapid build-up in fishing capacity (investment in boats and equipment) and fishing effort (application of the fishing capacity to fish stocks).

Some state governments, and the South Australian government in particular, adopted a more cautious approach to management by implementing controls on entry to fisheries at an early stage. The controls on entry to the Spencer Gulf prawn fishery in South Australia, which were in 1969, is a relevant example (see Appendix 5).

Because of the high unit value of lobster and abalone, there was a rapid build-up in fishing capacity and effort in these fisheries in the 1960s, and limited entry management programs were established. The limited entry arrangements for the larger prawn fisheries were introduced at a later date, partly as a result of later development of these fisheries, which are located primarily in remote northern regions. Even for these high unit value fisheries, governments and industry were slow to accept that there are economic benefits to be obtained from management. Accordingly, fishing capacity and effort is excessive for all these fisheries, despite implementation of limited entry arrangements. The second-stage controls on the total amount of capacity and effort have often been loose, although restrictions on the quantity and size of gear and the taking of small fish have provided some protection to the fish stocks.

By the early 1980s, increasing costs (particularly for fuel) and stagnating incomes led to concerns being expressed that improved management plans should be introduced for Aus-

tralia's fisheries. Put another way, the circumstances in the industry demonstrated that unregulated or lightly regulated expansion of fishing effort on common property stocks leads to a socially undesirable level of resource exploitation and a lowering of national economic welfare. Low and negative economic returns to individual participants, and declines in total catches as well as in catch per unit of effort, made it increasingly obvious that improved management arrangements for all of Australia's fisheries was required. In early 1983, these developments were given increased impetus by the election of a new federal government, whose prime objective for the fisheries was to implement improved management plans. Later that year, a Senate committee of inquiry into the fishing industry added its call for improvements in fisheries management.

These developments culminated in the recommendations of a national fishing industry conference held in early 1985. The conference endorsed implementation of management plans involving restricted allocation of access rights at an early stage in the development of fisheries. It recognized the need to give individual participants greater incentive to conserve fish stocks. The conference called for greater involvement of operators in decision-making on fisheries management, and it endorsed arrangements for the preparation of management issues papers and draft management plans by industry/government task forces and management committees.

The most recent general development has been the decision taken in July 1985 to cease issuing new Commonwealth fishing boat licenses except on application for development of specified underutilized areas and species. Effectively, this has reversed the earlier approach.

To give effect to these policy decisions, it has been necessary to revise the institutional framework for decision-making on fisheries management, to improve the information base, to closely assess the management options, and to find the money and other resources required. Before examining the institutional framework for decision-making, I will briefly review developments with regard to the objectives of management.

OBJECTIVES OF FISHERIES MANAGEMENT

As I have indicated, until recently a common view in government and industry was that as long as fish stocks were protected from severe depletion or extinction, fishermen should be free to pursue their individual objectives of profit maximization. In the case of some fisheries, social objectives of protecting small-scale operators, particularly in remote areas, were also pursued. There were some cases, in South Australia for example, where objectives of promoting economic efficiency were also pursued, but these were the exception rather than the rule.

When the AFZ was established in 1979 the Fisheries Act was amended to include the objective of optimum utilization of the resources as well as protection of fish stocks from overexploitation.

As I have described, there is now widespread acceptance of the need to allocate fishing rights in order to promote economic efficiency as well as to protect the fish stocks. This objective has been accepted because the obvious disadvantages of open access became apparent through declining fish stocks and profitability. Also, there has been acceptance of the concept that as the Australian fishing industry must compete with the most efficient operators on the world market, efforts must be made to contain and reduce the costs of fishing and to maximize the price received for the fish. As there are few government-induced barriers to imports of fish and fish products, the economic objectives are important for all sectors of the fishing industry. Well-developed management plans offer the prospect of containing fishing costs and maximizing revenue.

This can be achieved by the introduction of mechanisms that will ensure that the total fleet fishing capacity is contained with the objective of maximizing economic yields from the fishery. Moreover, if optimum economic yields are to be achieved, controls will be necessary to ensure that the fish are taken at the best size for marketing.

INSTITUTIONAL FRAMEWORK AND THE DECISION-MAKING PROCESS

Virtually all major fisheries in Commonwealth waters overlap areas of state jurisdiction or extend beyond areas adjacent to one state or territory. Accordingly, a complex of Commonwealth and state committees was established to advise governments on fisheries management. This structure did not provide for timely or effective decision-making, especially as only officials are involved and the conventions of such committees in effect allowed individual states to veto any management proposals in Commonwealth waters.

Because there are differences between governments in fisheries policies, aspirations, resources, and the degree of development of adjacent marine resources, it was difficult to achieve consensus. For example, some states have given a high priority to development of state-based fishing operations and have opposed implementation of management plans until the resources are clearly overexploited. They have also sought to divide fisheries on a state basis in an attempt to promote local development. Unfortunately, the "lowest common denominator solution" has often resulted.

Efforts to overcome these problems have centered on a rationalization of the jurisdictional arrangements for various fisheries and the involvement of industry representatives on the advisory management committees.

In order to rationalize jurisdiction over fisheries, Commonwealth and state/Northern Territory governments have agreed to implement the Offshore Constitutional Settlement. Commonwealth and state legislation has been passed to allow for establishment of a single jurisdiction for particular fisheries. The options are:

- for a state to exercise jurisdiction over a fishery out to 200 miles;

- for the Commonwealth to exercise jurisdiction from low water mark out to 200 miles; or

- for a Joint Authority of the Commonwealth and relevant state ministers to exercise jurisdiction from low water mark out to 200 miles.

If no agreement is reached to accept one of the three options listed, the status quo would remain. That is, the states would continue to exercise jurisdiction out to 3 miles, and the Commonwealth to control fishing operations beyond 3 miles from the shore.

Discussions have been held between Commonwealth and state officials, and representatives of industry, in an attempt to reach agreement on future jurisdictional arrangements on a fishery-by-fishery basis. The results of these discussions are currently being placed before governments for consideration.

Generally, where fish stocks and fishing activities extend to waters beyond one state or territory (and in some cases where fishermen from more than one state or territory participate in the fishery), there will be a continuing need for coordination of policies on management of the fishery. Thus, it can be expected that the Commonwealth will continue to be involved in management of most of the offshore fisheries, either under a Joint Authority, a single Commonwealth jurisdiction, or through maintenance of the current jurisdictional arrangements.

In the last few years, both governments and industry have been concerned to ensure that management programs are carried through on a timely basis and that industry has more involvement in the development and implementation of the plans. As a result, the regional committees of Commonwealth/state/territory officials have been replaced by industry/government task forces and management advisory committees established to advise governments on the management of particular fisheries.

Usually industry representatives are in the majority on the task forces and management advisory committees, and the committees report directly to Ministers through the national standing committee of senior government advisers, rather than through the regional committees of officials. Technical advisory committees also report directly to these industry/government committees. These committees have been es-

tablished in recent years for all major offshore fisheries where the Commonwealth is involved and where Australian fishermen are major participants in the fishery.

Consideration is now being given to the establishment of industry/government advisory committees for fisheries where Australians are not heavily involved. In the past, policy on access to the AFS by foreign fishermen has been reviewed by the one national industry/government committee which has not directly involved local industry representatives.

These industry/government committees have been very successful in resolving conflicts of interest. Over time they have contributed to the establishment of a corporate approach to management among operators, where previously fishermen have concentrated exclusively on pursuing individual objectives. Developments in the management of the northern prawn fishery are a good case in point. These developments are set out in Appendix 1.

INFORMATION REQUIREMENTS FOR MANAGEMENT

It is clearly harder and more expensive to collect good, reliable fisheries statistics than to monitor land-based industries. Moreover, the recent rapid development of Australia's fisheries has meant that for many of them, the biological and economic data bases are not extensive.

Governments have recognized the need to allocate more funds for research and to upgrade the level of expertise. When the AFZ was established in 1979, the government approved the establishment of over 20 fisheries science positions within the Commonwealth Scientific and Industrial Research Organization (CSIRO) to work on AFZ research. In 1982, responsibility for fisheries economic research at the national level was transferred from the policy division of the Department of Primary Industry to the Bureau of Agricultural Economics (BAE).

CSIRO has established research laboratories and units responsible for scientific research in respect to a number of major fisheries. The BAE has conducted a number of economic surveys of particular fisheries and is preparing economic assessments of various management programs. The BAE is currently assessing the prospects for obtaining regular information on the economic situation in fisheries based on a sample of operators. Also, the BAE has examined the components of the cost base to be used in determining levies between operators and, finally, the factors to be taken into account when the government is deciding on the rate of recovery of management costs (proportion of the costs to be met by the operators).

Besides providing CSIRO with additional scientific positions, the government has allocated additional funds to the national Fishing Industry Research Trust Account (FIRTA). Allocations have increased from less than $1 million in 1980

to over $5 million in 1985. Most of these funds are allocated for scientific research, and accordingly the scale of this research has accelerated. While the biological data bases for many fisheries (such as bluefin tuna, northern prawns and western rock lobster) is now well-developed, it will be some time before comprehensive data bases are established for many other fisheries.

With increased emphasis on the pursuit of economic objectives in fisheries management, the most pressing need is for more comprehensive economic data bases for individual fisheries. Such data bases will take some time to establish, especially as there are very few economists with fisheries experience.

MANAGEMENT OPTIONS, INCLUDING ADJUSTMENT PROGRAMS

As indicated, until recently governments in Australia have confined their intervention in fisheries management largely to the pursuit of biological and sociopolitical objectives. Accordingly, controls on fishing activities have generally taken the form of area and seasonal closures, mesh size restrictions, and other restrictions on fishing gear and on the size and types of vessels permitted to operate.

Although limited entry regimes were adopted for many fisheries, generally they have not been administered with the objective of imposing tight controls on fishing capacity and effort. This is because governments have been slow to adopt economic objectives and because many administrators were not convinced that limited entry regimes could be effective in controlling fishing effort and achieving biological objectives. All too often the fishermen were not involved in advising governments on fisheries management, and consequently there was insufficient political will to impose tight controls on fishing capacity and effort through limited entry regimes.

With increased acceptance of economic objectives and with greater involvement of industry representatives on management advisory committees, management plans are being implemented with the objective of matching fishing capacity and effort to the available resource.

A strategy of taxing and imposing levies on fishermen in order to avoid dissipation of economic rents through unrestricted competition has not been followed in Australia. Most established fisheries are heavily exploited, and controls on fishing capacity are not tight. In many cases, profits have not been high. Where high profits have been obtained, they have quickly been capitalized into high license values (licenses are transferable). Accordingly, fishermen have reacted strongly against the imposition of resource rent taxes or levies. Moreover, if taxes were to be introduced for selected fisheries, the fishermen involved would complain of unfair treatment. For those fisheries already managed through an ITQ system, it would not be neces-

sary to introduce taxes, as the biological and economic objectives could be achieved without taxes.

As described, the alternative of establishing a system of "property rights" in order to achieve fisheries management objectives is now being pursued by all governments. However, limiting access is not by itself sufficient to prevent a build-up in fishing capacity and effort. The use of alternative or additional measures to confer more effective property rights is essential and is now being pursued in most of Australia's fisheries.

Selection of such measures involves controls on either inputs (modified limited entry) or outputs (individual transferable quotas--ITQs). In theory, input controls do not bestow direct or effective individual property rights over the resource, as it is impossible and inappropriate to control all inputs resulting from improved technology and the efficiency of individual operators. Also, theory suggests that ITQs offer the prospect of bestowing effective property rights and could result in optimum levels of investment while providing protection for the fish stocks.

Introduction of ITQ fisheries management arrangements is only a very recent development in Australia. To date, such schemes have been introduced only for the southern bluefin tuna fishery (see Appendix 2) and for the abalone fishery in Tasmania and the western sector of the South Australia abalone fishery. It is under consideration for the Bass Strait scallop fishery.

Implementation of an ITQ system can pose considerable problems connection with establishing the total quota, allocating quotas to individual participants and monitoring and enforcing the quota allocations. Where fish are landed at many ports (or transhipped), especially for the fresh fish market; where fisheries are multispecies; where there is insufficient information to establish total quotas; where the species fished are short-lived and variable in periodic abundance, the ITQ system would be very difficult to implement and possibly not be as effective as limited entry coupled with time and area closures (and perhaps input quotas). In addition, the ITQ concept is new in Australia and governments and industry need time to assess it.

While implementation of the ITQ system for southern bluefin tuna (a long-lived and widely distributed species) has been very effective in meeting the stock conservation and economic objectives, concern has been expressed about the social and regional consequences of the rapid transfer of ITQs, as well as the problems of transfer of fishing effort to other fisheries. These issues are discussed in more detail in Appendix 2. Some have suggested that owner operators will be replaced, and that companies and processors will dominate the industry. Proposals for implementation of ITQs for the Bass Strait scallop fishery have involved controls on the maximum holding of quotas and on the transfer of quotas. The prospect of movement of quotas from particu-

lar regions has also caused concern. However, any controls on transfer of quota and on maximum holdings would be at the expense of efficient use of capital and labor.

For most fisheries in Australia, the option of implementing effective input controls is being pursued with the objective of providing more effective property rights. There is clear evidence that biological and economic benefits can be obtained if limited entry regimes are coupled with other rigorous measures to contain and/or direct fishing capacity and effort. The Spencer Gulf prawn fishery is a good example (see Appendix 5).

Introduction of limited entry arrangements is now practically universal for Australia's established fisheries. Such schemes provide an initial break on the build-up in fishing capacity and effort, and at times of high product prices they contain entry of additional vessels. However, fishing capacity and effort can continue to increase, and since they are transferable, the fishing rights attract a value. Accordingly, the investment to be serviced is increased and fish stocks come under increasing pressure.

Attention is now focusing on the introduction of arrangements to establish units of fishing capacity (for example, number of lobster pots used or the horsepower of the engine) to enable capacity to be contained and reduced while allowing freedom for fishermen to maximize efficiencies of operations. The systems being implemented can be termed input quotas. The lobster pot allocations, which have been in operation for many years, are a case in point, and in some of the lobster fisheries pot allocations have been reduced across the board, with each fishermen being required to accept a percentage reduction in his allocation. Although there are limits on the maximum holdings of pots, the percentage reduction allows the most efficient operators to buy out the least efficient. In another fishery, lobster pot allocations have been purchased by the more efficient fishermen, which has resulted in a reduction in the number of licenses and participants. As it is generally agreed that fishing capacity and effort can only be reduced in the longer term if there is a reduction in the number of operators, input quotas must be implemented with this objective in mind.

Another example of the introduction of input quotas is the management program being developed for the Northern Prawn Fishery (NPF). This is discussed in detail Appendix 1. The aim of the program is to reduce the number of active operators from the current level of about 250 to less than 200. Achieving this target has been complicated by the fact that there are over 40 inactive licenses and also by the agreement of the management committee to allow smaller operators to increase the size of other vessels.

The NPF operators agreed to implement a voluntary license buy-back scheme to be funded by a levy on all participants. A higher rate of levy applies for operators of large ves-

sels. In addition, a unitization, or input quota system, has been established, based on underdeck volume of the vessels and engine power. Owners wishing to replace their boats with larger units, or to change engines, must purchase units from other operators. A unit register has been established and is accessible to all operators.

The NPF buy-back system has achieved initial success in that 17 licenses and over 8,000 units have been withdrawn over an 8 month period. However, the concession made to smaller operators to allow them to upgrade without penalty detracts from the overall effectiveness. Moreover, recent improved prawn prices and reductions in fuel costs have improved profitability and increased the costs of buying out units. Unless the buy-back levy is increased over time, the funds generated are not likely to be sufficient to ensure a continuing and substantial reduction in catching capacity and effort.

It is recognized that a buy-back scheme by itself is unlikely to achieve the desired reductions in fishing capacity and effort, particularly where stock conservation is required. An example is the southern shark fishery discussed in Appendix 4. Accordingly, programs have been implemented or are proposed which require the forfeiture of input quotas on replacement of vessels/engines, or require across the board forfeitures of units. Such programs have been introduced for the east coast prawn fishery and the NPF and are proposed for the southeastern trawl fishery (see Appendix 3).

Compulsory forfeiture of input quotas offers the prospect of reducing fishing capacity and effort on a consistent and controlled basis, enabling operators to better plan their investment decisions. It remains to be seen whether the buy-back schemes will continue in these circumstances, but buy-back schemes may still be effective, especially in periods of low profitability. Moreover, funding buy-back schemes from industry contributions allows part of the economic rent to be invested for future management of the fishery, rather than being capitalized into higher license values.

Another important aspect of many management programs is the closure of fisheries with the objective of avoiding growth overfishing (i.e. to ensure that the fish are taken at the optimum market size). Such closures have been implemented for many prawn fisheries and are accepted by operators as offering substantial gains in profitability, especially as large prawns attract a high premium on world markets. The closures also reduce operating costs. However, a good understanding of the biology of the stocks, including stock differentiation, is required. Also, the support of operators, plus substantial penalties for non-compliance, are required.

A system of closures together with unit reduction measures clearly affects other fisheries. Where boats have access to

more than one fishery such transferral of problems can have severe consequences. In recognition of the potential problems, Ministers have agreed that as a general rule all license endorsements must be transferred as one unit. In the case of the NPF buy-back scheme the general rule applies that endorsements for access to other fisheries will be forfeited when the NPF license and associated units are purchased by the buy-back authority.

The problem of avoiding transfer of fishing capacity to other fisheries when input or output units are forfeited is being addressed by fisheries authorities. The license splitting prohibition can be undermined as schemes involving implementation of input and output quotas are adopted more widely. "Unit stripping" is now occurring; this results in the input units in one fishery being sold while the vessel is diverted to full-time operations in the related fishery. The result is that fishing capacity and effort is increased in both fisheries. This problem is receiving urgent consideration by all fisheries authorities.

This illustrates the point that any management scheme requires constant monitoring and corrective measures if fishing capacity and effort are to be contained and reduced. A premium must be placed on monitoring of the fishery and especially on development programs for the monitoring of economic performance, such as those being developed by the BAE.

THE TIMING OF INTRODUCTION OF MANAGEMENT PROGRAMS

Experience indicates that it is very difficult to contain and reduce fishing capacity and effort in a fully exploited fishery. As mentioned, the national fisheries conference held early in 1985 supported early implementation of management programs. The fact that the limited entry management arrangements for the Spencer Gulf prawn fishery were implemented very early in the development of that fishery, and that it is now one of the most profitable fisheries in Australia, demonstrates the benefits of early action. (Also, the involvement of industry at an early stage of decision-making on management of the Spencer Gulf prawn fishery was a very important factor).

In 1985, a development program for the northwest shelf scampi fishery was implemented shortly after the first vessels commenced operations. Developmental licenses have been issued for eight vessels on the basis that the fishing effort should be contained within the bounds of estimates of the available resource. At this stage, vessel licenses are not transferable.

Management programs are now under consideration for two other fisheries which are currently only lightly exploited. With most fisheries subject to management programs, there is a concern that unless management programs are introduced at an early stage of development of a new fishery there could be a rush to stake claims for initial access rights. In-

stead of retarding development, early implementation of management programs offers the prospect of assured rights for those who are able to demonstrate sound programs for the development of both fishing and marketing arrangements.

SHARING THE COSTS OF MANAGEMENT

Implementation of management programs requires expenditure on research, licensing arrangements, and surveillance and enforcement. The government agreed to commit funds to establish new management programs, with the understanding that operators who are allocated fishing rights will contribute to meeting the costs. Thus, the "user pays" principle has now been established. This offers additional benefits in connection with cost containment, as the operators have a direct interest in minimizing the levy.

For the 1985-86 financial year a levy was introduced for the northern prawn fishery declared management zone and for the southern bluefin tuna fishery. The levy was set to recover about $500,000, or 38 percent, of the assessed costs of managing these fisheries.

As mentioned, the BAE is carrying out research to identify the factors to be taken into account in assessing the rate of recovery. The government has indicated that at this time it is not seeking to recover more than 50 percent of the assessed costs of management.

Also, it should be noted that the National Fishing Industry Policy Council is closely assessing the components included in the cost base on which the levy is struck.

SURVEILLANCE AND ENFORCEMENT OF MANAGEMENT PLANS

Surveillance and enforcement of domestic management programs are undertaken by state government authorities on a reimbursement basis. To date the major requirements have related to monitoring the closures of the NPF and the catch quotas for the southern bluefin tuna fishery.

The introduction of the user pays principle has had a major impact in that industry has shown a concern for minimizing costs. This resulted in the simplification of closure arrangements for the NPF and acceptance that costly at-sea monitoring programs should be kept to a minimum.

As monetary penalties for infringements are generally small, the greatest deterrent is the prospect of suspension of the license.

As many of the new management programs have been introduced only recently, it is too early to judge the effectiveness of current surveillance and monitoring programs.

MANAGEMENT OF SELECTED FISHERIES

These developments can be illustrated by reference to management schemes for particular fisheries. A summary of the progress in implementing management plans for five major fisheries is set out in Table 3. More details on the management schemes for four of these fisheries are contained in Appendixes 1 to 4. Details of the South Australian Government's management plan for the Spencer Gulf prawn fishery is set out in Appendix 5. A map identifying the areas of the fisheries is in Figure 2.

Table 3. Management Plans for Some Major Fisheries - Status Report.

		FISHERY					
		Northern Prawn Fishery	Southern Bluefin Tuna	East Coast Trawl	South Eastern Trawl	Southern Shark Fishery	Torres Strait Fisheries
	Industry/ Government Management Committee	Yes	Yes	Yes	Yes	Yes	Yes
	License Review Committee	Yes	Yes	Yes	Yes	No	No
Management Plan	Draft	Yes	Yes	Yes	Yes	Options To Task Force Only	Yes
Management Plan	Interim	Yes	Yes	Yes	Yes	Yes	Yes
Management Plan	Final	Yes	Yes	No	Yes	No	Yes
	Australian Fisheries Council Approval	Yes	Yes	Yes	Yes	No	Yes
	Implementation	Yes	Yes	Interim Only	Yes	Interim Only	Yes
Input Controls	Output Controls	No	Yes	No	No	No	Total Quotas
Input Controls	Limited Entry	Yes	No	Yes	Yes	Yes	Yes
Input Controls	Gear Restriction	No	No	Yes	No	No	Yes
Input Controls	Closed Areas	Yes	Yes	Yes	No	No	Yes
Input Controls	Closed Seasons	Yes	Yes	Yes	No	No	Yes
Input Controls	Capacity Unit Controls	Yes	No	Yes	Proposed	Proposed	Yes
Input Controls	Boat Size Limits	No	No	Yes	(32m) Yes	No	Yes
Input Controls	Vessel Buy-back	Yes	No	Yes	No	Under Consideration	(Trawling Only) Yes

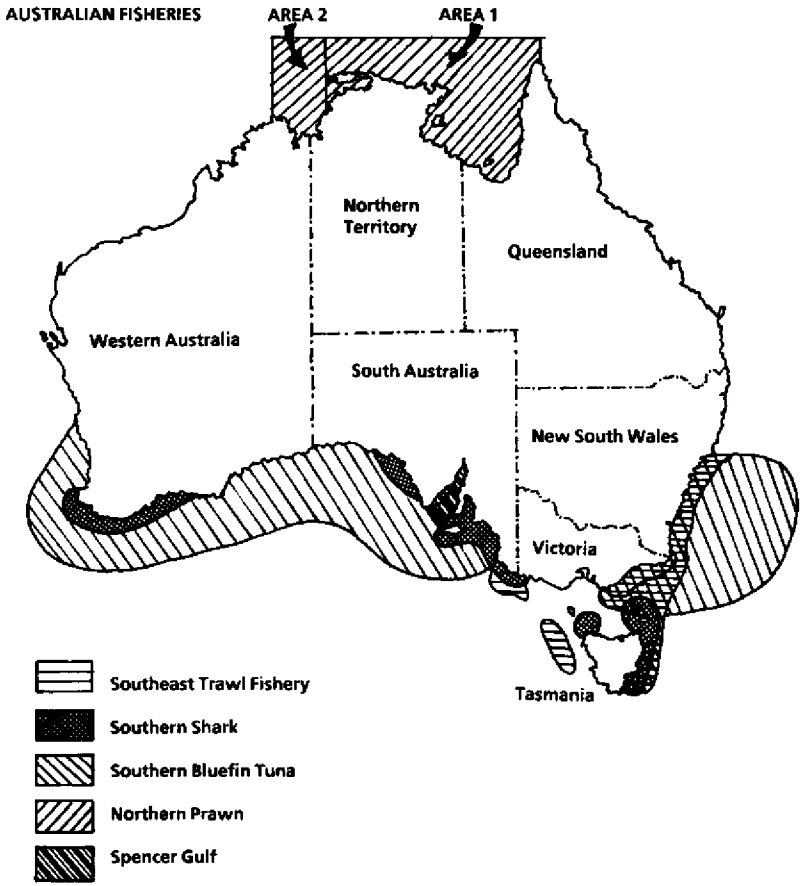


Figure 2. Australian fisheries.

APPENDIX I: THE NORTHERN PRAWN FISHERY

The Declared Management Zone (DMZ) of the Northern Prawn Fishery (NPF) extends over a very large area adjacent to northern Australia, from Cape York (Queensland) to Cape Londonderry (Western Australia). The fishery commenced in the late 1960s with exploitation of the banana prawn (Penaeus merguiensis) stocks in the Gulf of Carpentaria. It subsequently expanded geographically west, and tiger prawn species (Penaeus esculentus and Penaeus semisulcatus) now constitute the major part of the catch. These species have a short life cycle and recruitment (especially for banana prawns) varies considerably from year to year--this variation is considered to be closely related to variable annual monsoonal rainfall. Recent research findings indicating that at least one of the main tiger prawn species, Penaeus esculentus, may have been overexploited, have given renewed emphasis to the need to reduce fishing capacity and effort.

Limited entry was introduced in 1977. Liberal entry criteria meant that 292 boats qualified for licenses, although the maximum number of boats that operated in any year prior to that was approximately 160. Following the introduction of limited entry and decisions by buyers to pay premiums for quality, there was a rapid increase in the number of freezer trawlers over 21 meters in length. The number of persons employed on vessels in the fishery is about 1,200.

During the early development of the fishery, governments viewed it as a means of stimulating economic development and employment in northern Australia. However, shore-based processing establishments on the northern coastline experienced difficulty in overcoming logistical problems and high operating costs in remote areas. A substantial proportion of the fish landings are transported by road and sea to plants elsewhere in Australia for processing, while an increasing proportion is "bulk packed" on board trawlers.

The total catch in the fishery rose from an average of 7,249 tons in 1967-71 to an average of 11,049 tons in 1978-80. Most of the catch is exported. Despite a continued increase in the average size of vessels and the efficiency of gear, catches have not risen.

According to survey information from the Bureau of Agricultural Economics (BAE) for the years 1980-81 and 1981-82, value of catch varied between $82.5 million and $89.5 million--in comparison with total annual fleet costs of about $92 million. About 55 percent of boats were unable to make a positive return to capital, while 17 percent and 25 percent of boats (mainly in the 20.6 m to 26.6 m size range) achieved returns to capital of at least 10 percent. It should be noted that in some cases catching and processing/marketing operations are integrated, and losses in the catching sector can be offset against profits in other sectors of operations.

The combination of increasing fishing capacity, no increase in the annual catch, and the deterioration in the relative movements of real prawn prices and fleet costs (particularly fuel costs) resulted in a serious decline in the overall profitability of the fishery. These difficulties were reflected in the value of transferable vessel licenses, which declined well below their peak value of about $150,000. The recent improvement in the price of large tiger prawn (especially in Japan) resulting in part from the devaluation of the Australian dollar and growing confidence in the new management arrangements, have resulted in an increase in the value of licenses and units of capacity. License values have now returned to the previous high levels.

MANAGEMENT OF THE FISHERY

Early attempts at management were confined to seasonal closures directed at reducing the catch of small prawns. These closures were intended to preserve the unit value of the catch, rather than to conserve stocks. Closures are still applied, and in 1985-86 a total closure extending from early December to early April was in force.

In October 1976, governments decided to limit entry to the fishery. Initially a boat replacement policy was tried that limited replacement boats to the same length as those they replaced. This proved impossible to effectively enforce, and in 1980 a more liberal policy was introduced, permitting small boats to be replaced by boats of 21 meters, in order to allow them to take advantage of a ship-building bounty. The availability of this bounty, designed to encourage the development of the Australian ship-building industry, created obvious problems for management of the fishery.

The division of the fishing fleet into two sectors; one comprising generally small owner-operated boats; and the other larger, company-owned boats, has also had a significant effect on the development of the fishery, and on the development of the current management structure. The fleet structure mitigated against tight boat replacement rules, as the company boats were generally larger and the owner operators resented controls which might operate to their disadvantage. Also, after the introduction of limited entry, many smaller operators sold their licenses to larger firms and moved to the east coast trawl fishery. This contributed significantly to overcapacity in the east coast fishery. This problem of management initiatives in one fishery having an impact on adjacent fisheries is continuing. Longer closure in the NPF in 1984 and 1985 has resulted in a considerable transfer of fishery effort to the east coast prawn fishery, in which a proportion of the NPF boats also have fishing rights. This illustrates the fact that governments need to coordinate management of related fisheries.

By October 1982, it had become clear that the boat replacement policies were contributing to an undesirable increase in total fleet fishing capacity, with increasing average

size compounding the effects of technological innovations in boat design and construction, engine power, navigational aids, and fishing gear and equipment. It was clear that unless innovative steps were taken to dampen the effects of serious overcapitalization, this valuable fishery would face a prolonged period of economic decline. Accordingly, Ministers directed that a review of the management of NPF be undertaken as a matter of urgency, with a view to the early introduction of measures to restrain existing and potential fishing capacity.

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 the governments in September 1983. The components of the plan were:

1. Establishment of a joint industry/government management committee known as the NPF Management Advisory Committee (NORMAC) responsible to AFC through the Standing Committee on Fisheries.

   - NORMAC replaced NORPAC on 1 January 1984.

   - An effective working relationship has been established between industry and the government representatives on NORMAC.

2. Implementation of a new Boat Replacement Policy (BRP) based on unitization 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.

   - Boat units are recorded on a central boat unit register operated by the Department of Primary Industry, and boat units are transferable.

   - A boat license will be not be endorsed to operate in the fishery unless the licensee holds one of the 292 "endorsements" issued when limited entry was introduced, and the appropriate number of boat units determined by the size of the boat.

3. Establishment of a Voluntary Adjustment Scheme (VAS) to be financed by a compulsory levy on industry.

   - An endorsement with attached boat units, or boat units alone, may be sold under the scheme. A tender system was tried initially, but has been replaced by individual negotiations. Endorsements and boat units purchased are cancelled and are lost to the fishery. Disposal of a boat removed

from the fishery is the responsibility of the owner.

- No purchases will be made under the scheme unless all fishing rights attaching to a boat are sold. This is to prevent the scheme from having undesirable effects on associated fisheries.

- The buy-back authority has power to borrow up to a limit of $5 million, with the loan subject to a government guarantee of repayment.

- Levy payments to fund the scheme and buy-back prices paid are based on the number of boat units held or sold by each fisherman.

4. Extension of the NPF westward to Cape Londonderry on the western Australia coastline in order to spread total fleet fishing capacity over a wider area.

5. Implementation of a permanent closure program to protect prawn nursery grounds, and improvement of a seasonal closure program aimed at optimizing the size of prawns at first catch.

6. Improvement of the structure and effectiveness of penalties for offenses under Commonwealth law.

Introduction of the plan's Voluntary Adjustment Scheme was further facilitated by a decision of the government in July 1985 to provide $9 million over three years to support the adjustment programs for the northern prawn fisheries. To date about $1 million has been spent to buy out 17 licenses with attached boat units. Improved returns to fishermen has meant that interest in selling under the VAS has declined, particularly as the administering authority does not want to become a pace setter in the present accelerating price situation. Nevertheless, the scheme is still operational and will have a significant bank to use in the next downturn in profitability (and license values) in the fishery.

Despite improved returns to fishermen, it is considered that in the longer term, catching capacity and fishing effort must be reduced. This need has been given greater urgency by the apparent overfishing of one major species. Improved profitability has resulted in a new round of boat replacements. This, added to existing government incentives to shipbuilders, has resulted in the placement of orders for some 30 large and sophisticated replacement vessels. Attention has therefore focused on the need to supplement the buy-back scheme with a tighter boat replacement policy. Industry representatives have initiated a policy that requires a percentage of units of fishing capacity to be forfeited on each boat replacement. In addition, as a temporary measure, operators will be required to surrender one license endorsement when a boat is replaced.

SUMMARY OF MANAGEMENT ARRANGEMENTS FOR THE FISHERY

As applied in this fishery, limited entry has not constrained the build-up in fishing capacity and effort during times of higher than average profits.

Without a strong lead from ministers and senior officials, and in the absence of an industry consensus, the constraints on the build-up in fishing capacity were ineffective. In fact, some influential industry leaders argued against constraints on fishing capacity on economic grounds and opposed "government regulation."

If increases in fishing capacity and effort are to be contained and reduced under a limited entry regime, additional controls on inputs are required.

Tradeable units of catching capacity (input quotas) have been accepted as the most practical method of constraining fleet effort and catching capacity, while allowing individual operators the flexibility to maximize efficiency of operations.

The Voluntary Adjustment Scheme offers the prospect of a quick reduction in catching capacity at times of low or negative returns, but is less effective at other times. It should be seen as a continuing part of an overall strategy rather than as a short-term solution.

Measures which require periodic forfeiture of units of capacity are necessary if a sustained reduction in fishing capacity and effort is to be achieved under limited entry.

Seasonal and area closures have proved effective in protecting small prawns so as to maximize yield (and value) per recruit.

Perhaps the most important lesson learned from the NPF is that operators must be closely involved in decisions on management. As the confidence of the industry representatives has grown, both in terms of the objectives of management and of the elements of the plan, their willingness to make short-term sacrifices has increased. The greater the responsibility accepted by industry, the greater has been their real contribution to the development of the management plan. "Government regulation" has been replaced by "industry regulation."

Under these circumstances, there has been increased acceptance by industry that regulation of fishing capacity and effort offers benefits to them.

The management measures for one fishery have an impact on the management of closely related fisheries. The introduction of input and output quotas, under which fishermen have access to more than one fishery, has created further problems in containing overall fishing capacity and effort in Australia's fisheries.

APPENDIX II: THE SOUTHERN BLUEFIN TUNA FISHERY

INTRODUCTION

Southern Bluefin Tuna (SBT) is a single stock, highly migratory species that spawns in the Indian Ocean south of Java. It is exploited by Japanese longliners virtually throughout the full extent of its migration across the southern oceans between about 30° and 50°S latitude, 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 New South Wales (NSW) 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 toward harvesting larger SBT for the sashimi market. Product from the N.Z. adult SBT fishery is also directed to the sashimi market.

The Japanese fishery, directed primarily at adult SBT, began in the early 1950s. Following a rapid expansion, the Japanese catch peaked at 77,000 tons in 1961. Since then there has been a steady decline to 20,000 to 30,000 tons per year.

THE AUSTRALIAN FISHERY

Although occasional catches of SBT were recorded off NSW prior to the Second World War, the fishery did not develop as a commercial entity until the late 1950s, when live-bait-and-pole techniques were introduced from North America.

The development of the pole-and-line fleets of South Australia (SA) and NSW was virtually simultaneous. However, the fisheries did differ in several aspects.

The NSW tuna fleet was generally based on harvesting five- to seven-year-old fish, and the vessels tended to be involved in fish trawling during the tuna off-season. NSW catches varied from 3,000 - 6,000 tons, but fell to 1,700 tons in 1982-83, partly because of the stock decline and unfavorable oceanographic conditions.

The SA fleet which concentrated on three- to five-year-old fish was more specialized, partly because of the lack of alternative fisheries. These vessels developed a year-round SBT strategy by operating off SA (December - May/June) and NSW (October - December). The SA catch averaged about 5,000 tons (1963-64 to 1978-79), but increased to 14,000 tons in 1982-83.

A major development in the NSW/SA fishery occurred in 1974 with the introduction of purse seine vessels to the SA fish-

ery. Purse seine fishing was potentially a far more cost-efficient means of harvesting SBT, and although initial results were not encouraging, it was seen to offer the opportunity to take large quantities of SBT.

As a result of concern that purse seiners could adversely affect the fishery, the entry of additional vessels of this type was prohibited in 1975, and for many years only five purse seiners were licensed to operate.

In view of its potential impact on the juvenile fishery, the technique of purse seine fishing was also banned totally in waters adjacent to Western Australia (WA).

The WA fishery for SBT developed much more recently than the NSW/SA fishery, commencing around 1968.

The WA fleet based at Albany and Esperance generally target on two- to three-year-old fish after they migrate down the west coast of Australia and into the Great Australian Bight.

The WA fleet demonstrated wide variations in vessel characteristics and dependence on SBT, but generally the average WA boat was far smaller than SA/NSW tuna vessels.

A Bureau of Agricultural Economics (BAE) survey indicated that in June 1982 the WA fleet comprised 71 vessels, compared with 50 pole boats in the NSW/SA sector. As the BAE definition of "SBT boat" excluded some vessels with a comparatively minor dependence on SBT, the WA fleet could have been significantly larger. The BAE also estimated the values of the fleets: WA - $2.8 million; SA/NSW - $27.8 million (market value, June 1982). More recent estimates put the value of the total fleet prior to the introduction of management controls at $60 million.

An indication of the rapid expansion of the WA industry is that in 1982-83 the WA fleet landed 5,600 tons of SBT, compared with an average of 550 tons per annum over the nine years from 1960 to 1977.

MANAGEMENT OF THE FISHERY

In the mid-1970s, entry to the eastern sector of the fishery was limited and controls were introduced on the number of purse seine vessels permitted to operate. Access to the western sector of the fishery was not controlled, apart from a ban on purse seine operations.

In view of this, and in the absence of scientific advice indicating the need to control catch and effort, the limited entry arrangements in the eastern sector were abandoned in 1981.

The current management arrangements were developed and implemented against the background of an assessment by tuna scientists in 1982 that the breeding stock of SBT had been

seriously depleted by the combined impact of Australian and Japanese fishing effort. The scientists expressed the view that continued unrestrained exploitation of the resource would increase the risk of recruitment failure, as the biomass of SBT had been reduced to a level of about one-third of the virgin biomass (from 600,000 tons to about 220,000 tons). It was evident that any further reduction in the biomass would put recruitment to the fishery at risk, and there was a danger of the fishery collapsing as a commercially viable entity.

At the initiative of the Australian Government, trilateral discussions on an international management arrangement for SBT were instituted with Japan and New Zealand. SBT is a highly migratory species, and it was recognized that effective management could only be achieved through cooperation among the countries exploiting the resource. The first trilateral meeting was held in Wellington, New Zealand, in December 1982. The meeting recognized the seriousness of the situation, but no firm scientific consensus was achieved.

At the second meeting in Tokyo in April 1983, officials accepted a report by scientists from the three countries that indicated clearly the need for catch restraint if the spawning stock was to be sustained at a satisfactory level. The need to develop international management arrangements to address the problems identified was also accepted. The outcome was confirmed at a third meeting in Canberra, (May-June 1984) when scientists indicated that the urgency of their earlier recommendations was increased by changes over the preceding two years.

In 1981, the government established the Tuna Task Force (TTF) to consider the domestic and international management implications of scientific assessment of the SBT stock. The membership of this task force was as follows:

- Australian Fisheries Service (AFS);
- tuna scientists from CSIRO;
- officials from the ministries responsible for the administration of fisheries in NSW, Victoria, Tasmania, SA and WA;
- representatives of Tuna Boat Owners Associations (TBOA) of NSW and SA and the Australian Fishing Industry Council of WA;
- and, more recently, the Australian Fish Canners' Association.

In 1983, in the light of the undertakings agreed to in Tokyo, and following the process of consultation and discussion in the TTF, the Australian Fisheries Council agreed to an interim management arrangement to apply in the 1983-84 SBT season. The Australian Fisheries Council is the major fisheries policy consultation body, consisting of state ministers and the Commonwealth minister responsible for fisheries. Under this interim plan, the SBT catch was limited to a global quota of 21,000 tons, within which separate quo-

tas were set for the WA, NSW, and SA sectors of the fishery; a separate quota was set for purse seine vessels.

At the time that the interim program was introduced, the Minister for Primary Industry indicated that there might be a necessity for tighter long-range controls. During 1983-84, further discussions were held in the TTF. Moreover, as it was clear that fishermen would face major financial problems in adjusting to a lower allowable catch, the SBT industry was the subject of an Industries Assistance Commission (IAC) inquiry that commenced in November 1983. Management options were canvassed in the IAC report, and there were further discussions on management in the TTF.

Both the IAC and the TTF recognized that the management plan would need to ensure a rapid reduction in the total catch. This could only be achieved through a reduction in the total quota. Also, they concluded that there are economic benefits from allocating the quota among participants. Thus, they recommended that ITQs should be implemented, as such a management scheme allows for effective catch restraint without introducing a range of other controls which could have a greater impact on the efficiency of individual fishing operations. Such measures as gear controls or limitations on vessel size or vessel numbers can have a more direct impact on an individual fisherman's ability to determine the most cost-efficient method of operation.

The ITQ system also provides an efficient adjustment mechanism, as the most efficient operators can buy quota from the less efficient.

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 is landed and marketed, viz:

- The fishery is based on a single long-lived species.
- Almost the entire catch is landed at five or six main ports.
- The bulk of fish 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 endeavored to market a significant proportion of their product through other than established and known channels (little incentive for black market cash sales).

Ministers agreed that the new management plan should be implemented from the 1984-83 season. The main features of the plan are:

National Fishery

It was resolved that the fishery should be managed on a national basis but with responsiveness to the large differences in its individual components.

National Quota

Scientific advice was that the quota set under the interim management plan was too high from a biological point of view. A national quota of 14,500 tons was established for 1984-85 on the basis of information available at the time and of assumptions regarding the size composition of the Australian and Japanese catches and the size of the Japanese SBT catch.

Commencement Date

The commencement date was set at 1 October to reflect the start of the fishing season off NSW.

Size Limits and Closed Waters

It was agreed that no size limits would apply to the fishery, but that fishing for SBT north of 34°S off WA should be prohibited, supplemented by a two-month (March-April) closure to an area off the south coast of WA in order to restrict the catch of small fish.

Individual Transferable Quotas (ITQs)

The ministerial resolution provides for the national quota to be "allocated on an individual transferable quota basis to the pole boat/purse seine fleet."

Eligibility Criteria

Ministers agreed that boats would be eligible for allocation of quota if at least 15 tons had been taken in any one of three qualifying seasons (1980-81 to 1982-83).

The criteria for eligibility aimed to objectively identify those fishermen with both current dependence on the fishery and a history of previous involvement. The criteria were neutral in their treatment of individuals and did not favor particular regions or groups. The eligibility years were chosen to reflect the latest situation in the fishery. Years prior to 1980-81 were not used because a significant number of fishermen had left the industry before that season and to have granted them quota would have meant that there was less available for those who were dependent on the fishery. The 1983-84 season was excluded because of the existence of the interim management arrangements and because fishermen were aware that the fishery was being managed, and may therefore have been tempted to raise their catches so as to improve their position.

Allocation Formula

The plan provided for allocation of the national quota among eligible fishermen using a formula incorporating the highest catch in any one of the eligibility years, together with the current market value of boats and gear in the ratio of 75 percent (for catch) to 25 percent (for investment). The aim of the formula was to provide a basis of allocation that uses objective and verifiable data and avoids the use of subjective judgments or parameters.

The decision to allow catch history to be based on an individual's best catch in any of the qualifying years was made to enable fishermen to have a reasonable opportunity to demonstrate catching capacity and to diminish the impact of unforeseen circumstances in any one year.

The above formula was used to determine individual shares, expressed in terms of units, of the national quota. It was applied to 14,045 tons to derive the quota tonnages which were actually allocated. Four hundred fifty-five tons were held to take account of late applications and subsequent revisions as a result of a quota review process instituted by the Department of Primary Industry. Following this process and further discussion at TTF, the Minister for Primary Industry, after consultation with his state counterparts, decided to allocate the balance of the 276 tons equally to three states (NSW, SA and WA).

OPERATION OF THE BAN DURING THE 1984-85 SEASON

The structure of the Australian tuna industry had undergone significant changes since the implementation of the management measures. The reduction in the national allowable catch from 21,000 tons for 1983-84 to 14,500 tons for 1984-85 meant that the level of individual participation in the SBT fishery had to be restricted. Subsequently, quotas ranging from 1.4 tons to 823 tons were allocated to 143 fishermen on the basis of their level of catches/investment in the fishery. Those fishermen whose quotas were less than that required to maintain viable operations sold or leased their share of the national allowable catch. As a result, there was a marked transfer of effort from WA and, to a lesser extent, NSW, to the larger SA based operations.

While the size of its local tuna industry was substantially reduced, it is estimated that WA fishermen received in excess of $2 million from the interstate transfer of SBT quotas. As only 57 vessels remained in the Australian SBT fishery, the level of competition was reduced and fishermen were able to adjust their fishing strategies to concentrate on the higher value fish suitable for sale on the Japanese sashimi market, while at the same time reducing their operating costs.

Conservation goals were achieved, especially in the size composition of the catch where a significant increase has

been observed (in excess of 80 cm compared to the 74.4 cm upon which the 14,500 ton quota was determined). A breakdown of the SBT catch and quota holdings for the 1984-85 season are in Table 4.

Table 4. Breakdown of SBT Catch/Quota Holdings for 1984/85 Season.

SBT Catch - 1 October 1984 - 24 May 1985

By quota holders (i.e. purse seine/pole and line operators)

	By State of Vessel Registration (tons)	By State of Vessel Operation (tons)
NSW	458	108
SA	10,612	11,087
WA	731	606
	11,801	11,801

By non-quota holders (i.e. small-scale longlining or trolling)

NSW	0.363 tons
WA	14.77 tons

Quota Holdings

As of 24 May, SBT quota holdings by states were as follows:

	Initial Allocation	Transfers (net)	1984/85 Season Balance
NSW	1,872	-1,288	584
VIC	150	-150	-
SA	9,271	+3,067	12,338
WA	2,752	-1,359	1,393

The transfers set out above include quota transferred on a temporary lease basis during the current season. All leased quota will be reallocated to owners before the commencement of the 1985/86 season.

Western Australia

The initial allocation of SBT quota for WA fishermen was 2,752 tons, of which 1,359 tons was sold or leased to SA fishermen. The 1984-85 season was very quiet, with only 606 tons, approximately, being recorded. The poor season was attributed to various factors, mainly the interstate transfer of almost half the quota held by WA fishermen, the uncertainty of some fishermen as to their future in the fish-

ery, reduced profitability arising from poor fish availability, and the movement of two of the larger WA based boats to the eastern sector of the fishery.

South Australia

Fishermen in SA held a total SBT quota of 12,338 tons for the 1984-85 season, 85 percent of the national quota. Their initial allocation of 9,271 tons was supplemented by the purchase or lease of quota from WA and NSW.

The 1984-85 season was generally regarded as successful, with 11,000 tons being taken. While this catch is less than those of previous years, the reduction was offset by the higher prices received from sales on the Japanese sashimi market. To assist with the development of the sashimi industry, seven foreign carrier boats were chartered to purchase product from Australian vessels for direct export to Japan. Prices ranging from $1,100 to $1,500 per ton were paid for approximately 3,650 tons of SBT (about twice the price offered by Australian canneries).

New South Wales

The 1984-85 season off NSW was extremely disappointing. Only 108 tons was taken, little of which was caught by locally owned vessels. Of the initial NSW quota allocation of 1,872 tons, a total of 1,288 tons was transferred to SA fishermen. Only one NSW boat operated off SA, compared with the normal five to six vessels.

SUMMARY AND CONCLUSIONS REGARDING SBT MANAGEMENT

The management plan has been very effective in reducing the catch to the level dictated by scientific assessments.

There has been a rapid reduction of fishing capacity, with the number of active participants falling from about 130 to less than 60.

The remaining participants in the fishery have been directing the catch to the most remunerative markets. The process of redirecting the catch to the high-priced sashimi market has not been entirely successful, and further adjustments to methods of fishing, handling and marketing will be required if the returns are to be maximized.

The ITQ system has encouraged participants to adjust their operations to take advantage of high-priced markets.

The need to substantially reduce the total catch at the same time as introducing the ITQ system compounded the problems in introducing the system by accelerating the rapid transfer of quota away from areas where small, canning quality fish were taken, adding to concerns about the adverse social consequences of the scheme. Many small-scale fishermen claimed that the rapid implementation of the program dis-

criminated against them, since they did not have access to large financial resources to purchase quota. It is noted that many of these fishermen sold their quotas at an early date and that since then the value of the quotas has doubled. However, any controls on quota transfer might have reduced the opportunity for fishermen to leave the industry with a "cash settlement," and would detract from the economic benefits of the ITQ system.

The success in achieving the conservation and economic objectives can be attributed in part to the fact that the plan was implemented quickly. It is clear that the longer-term objectives of resource conservation and promotion of economic efficiency should not be subsumed by short-term considerations for the immediate welfare of individual operators.

As in the case with other fisheries, the adoption of improved fisheries management arrangements was achieved only after representatives of the operators were fully involved in the decision-making forums.

The mechanism for allocating quota to participants needs to be sufficiently flexible to take account of special circumstances. The formulas for this fishery were fairly narrow, but had the major advantage of accommodating those with the greatest financial commitment to the fishery. Any mechanism that results in allocating quota to fishermen without a current high level of commitment to, and dependence on, the fishery will create equity problems.

While the ITQ system has some advantages over input controls, it cannot be assumed that it can be implemented for all or even most fisheries. The SBT fishery is one involving a single long-lived species, reliant on a small number of markets (primarily export). Moreover, the biological data base is substantial.

A more conservative approach to the early stages of management would have been aimed at reducing the adverse social and regional consequences of implementing the final plan. It is clear that the imposition of controls on total catches and on fishing capacity and effort should not await clear evidence of overexploitation of a fishery.

The rapid reduction in boats active in the SBT fishery has diverted fishing effort to other fisheries, some of which are heavily exploited. This has heightened the awareness of the need to implement improved management programs for other fisheries and the need to coordinate management of all Australian fisheries.

APPENDIX III: THE SOUTHEASTERN TRAWL FISHERY

This fishery is currently based on multispecies demersal fish stocks located in more temperate latitudes off southeast Australia where population densities are highest and where there is the greatest demand for fresh table fish.

As the fishery is located close to the original centers of European settlement, it was exploited earlier than most other fisheries. The first major phase of development involved the use of steam-powered otter trawlers. Subsequently, Danish seiners exploited inshore areas and the trawlers were forced to operate in deeper waters. The steam trawlers ceased operations in 1961, and for a period the fishery was dominated by Danish seiners.

In the late 1960s, interest in otter trawling was revived; 49 trawlers were operating by 1973 and the number of Danish seiners had fallen to 39. With the gradual extension of trawl grounds to deeper waters and reduced catch rates in inshore areas, otter trawlers now comprise the majority of the fleet. However, Danish seiners still operate in some inshore areas, targeting on tiger flathead and whiting.

The gradual delineation of deepwater trawl grounds off the east coast and substantial initial catches resulted in a rapid increase in the size and number of otter trawlers. The relatively large catches of gemfish (hake) were not maintained; this situation led to calls for government intervention to limit the build-up in fishing capacity.

The fishery expanded further south and into deeper waters. However, available trawl ground and market opportunities for fresh fish were limiting factors. During the late 1970s and early 1980s, imports of frozen fish accelerated to meet the increase in demand for fish and fish products. Attempts to establish fish processing operations based on local supplies were not successful, and the fishery is still based on supplying the major fresh fish markets. With the development of additional deepwater trawl grounds for underutilized species, attention is again being given to possibility of developing fish processing operations.

There are currently about 170 trawlers and Danish seiners operating in the fishery, landing about 17,000 tons of fish.

MANAGEMENT OF THE FISHERY

Until recently the fishery was lightly regulated. The initial reaction to the build-up in catching capacity in the 1970s was to place a limit on the maximum size of vessels at 32 meters, with the provision that up to four larger vessels could be licensed. To date, vessels larger than 32 meters have not been economically viable in view of limited trawl grounds, relatively low catch rates and limited market opportunities for fresh fish.

The rapid increase in catching capacity, combined with the fall in catches of gemfish and increased operating costs (especially for fuel), resulted in calls by industry for controls on access to the fishery. Initially, discussions centered on the introduction of controls on access to the heavily exploited areas on the east cost. Ministers foreshadowed the introduction of limited entry to these areas in a public announcement in July 1981.

During discussions between federal and state fisheries authorities it became apparent that the management plan would need to cover the full range of the fish stocks and potential fishing operations, both of which extended beyond the east coast. In the meantime, effort in the rest of the fishery expanded, and new vessels were built or purchased for operations in lightly exploited areas. Negotiations then commenced with state governments with an interest in the so-called "development areas." These discussions resulted in a draft management plan being developed for the whole of the southeastern trawl fishery.

The draft management plan was published for industry comment early in 1984, and an industry/government task force was established to consult with industry. The plan divided the fishery into two sections, a developed sector and a developing sector, with less restricted entry criteria for the developing sector. The arrangements for the developing sector allowed for controlled additional access with emphasis on the development of integrated fishing and processing operations and with special provisions for operations based in the island state of Tasmania.

While there was general support for limited entry and controlled development of the fishery, the interests (industry and government) representing the heavily exploited sector opposed segmentation of the fishery and demanded that they should have preferred access to the development areas.

Further negotiations resulted in implementation of a management plan for the whole fishery in mid-1985 based on a freeze on new licenses, with the exception that with the aim of developing integrated catching and processing operations, consideration would be given to approval of additional licenses for a small number of larger vessels to be based in Tasmania. Division of the fishery was maintained as an interim measure, pending implementation of measures to address the overcapacity problem on the east coast.

The entry criteria were based on commitment to the fishery during the 12 to 18 month period prior to the ministerial announcements foreshadowing implementation of limited entry. The entry criteria for the east coast were related to the period immediately prior to July 1981, while the criteria for the rest of the fishery were based on commitment prior to January 1984.

About 170 vessels have qualified for entry. Some boat owners who did not qualify are still pursuing their claims, and the process of limiting entry has not been completed.

The economic pressures on fishermen on the east coast have been relieved to some extent by expansion into underutilized areas and species. In addition, some fishermen have commenced longline operations for sashimi tuna, and some are experimenting with other fishing activities. Market opportunities outside Australia for particular species such as whiting are being developed as industry accepts the need to operate in an international marketing environment. Most recently, economic pressures have been eased by the reduction in fuel prices.

Nevertheless, there is increasing acceptance that it is necessary to constrain total fleet capacity, especially in view of limited trawl grounds, uncertainty about fish stock assessments, and the rapid build-up in catching capacity. Major research programs, including a compulsory logbook program, have been established to define resource availability.

An industry/government management committee has been established to advise governments on future management arrangements. Early in 1986, the committee circulated proposals for implementation of a boat replacement policy involving unitization of the fishery based on under deck volume and engine power (with the units to remain separate). This is similar to the plan in operation for the northern prawn fishery, but the proposals include a requirement for surrender of 20 percent of units on replacement of vessels and engineers. Units of fishing capacity would be traded throughout the fishery, irrespective of whether boats are licensed to fish only in certain sectors of the fishery.

It is estimated that a 20 percent unit surrender requirement on replacement of vessels and engines will counteract the build-up in catching capacity by 2 to 3 percent per year. As catching capacity could be expected to increase each year by at least 3 percent, through improved technology and other factors, the 20 percent forfeiture of units on replacement of vessels and engines may only hold the line. Because many new vessels entered the fishery immediately before limited entry was introduced, it remains to be seen whether a 20 percent forfeiture will be effective in containing fishing capacity and effort.

Further measures, including buy-back of licenses, may be required. This depends to an extent on the success of operators in developing new fishing grounds and fishing methods. Governments are providing financial and technical assistance to fishermen to help them expand the scope of their operations to include new fishing methods such as sashimi longlining, off-bottom trawling and mid-water trawling for underutilized species.

The revised boat and engine replacement policy, based on units of capacity, will be submitted to Ministers for con-

sideration later in 1986. Pending implementation of longer-term adjustment measures, there is a prohibition on the replacement of boats and engines except in special circumstances.

OBSERVATIONS ON DEVELOPMENT OF MANAGEMENT ARRANGEMENTS FOR THE SOUTHEASTERN TRAWL FISHERY

The increase in catching capacity and fishing effort has been rapid, has placed the economic viability of the fishery at risk, and also threatens overexploitation of at least some fish stocks.

As it was difficult to establish total catch quotas in view of the multispecies nature of the fishery, and as the fish are landed at many ports for the fresh fish market, an ITQ system was not considered to be a necessary or feasible system at this time.

Adoption of limited entry, with a virtual freeze on boat and engine replacement, was considered to be the best short-term option, pending development of longer-term management arrangements.

While control on access to the fishery has been achieved, the fact that some areas are not fully developed, along with the existence of differing objectives among the governments involved, has resulted in controls on the free movement of vessels in the fishery.

The relatively early implementation of controls on catching capacity and fishing effort in certain areas of the fishery has been achieved at the expense of temporary division of the fishery. However, it would have been divided in a more permanent and restrictive manner in the absence of a management plan covering the whole fishery.

Moreover, during the current period of improved profitability (as a result of lower fuel prices and higher fish prices), additional boats and bigger boats would have been introduced in the absence of limited entry and controls on boat replacement. This suggests that even these rudimentary measures are beneficial in constraining increases in fishing capacity and effort. Improved profitability should be retained rather than dissipated.

As is the case with other Australian fisheries, the involvement of industry in the committee advising on management has focused attention on the economic factors bearing on management of the fishery and has accelerated implementation of the management plan. Also, it has sharpened concerns that the management measures must be cost effective. The pending introduction of the "user pays" principle has resulted in industry taking a greater interest in the costs of management in the licensing and enforcement areas as well as in the research programs in support of management.

Attention is focusing on developing administrative arrangements to record and control trading in units of capacity and to ensure that the system is compatible with management arrangements for other Australian fisheries.

Emphasis must now be given to development of an adjustment program which will result in controlled development of the whole fishery, protection of the fish stocks, and a reduction in the barriers to free movement of vessels. The increased stability provided by the management plan should assist the operators and governments in pursuing these objectives.

APPENDIX IV: THE SOUTHERN SHARK FISHERY

Intensive fishing for shark as a target species is undertaken off all southern states of Australia. Shark is a favored species for use in convenience food outlets, which rely on fish with a firm texture for the "fish and chips" trade.

While more than 10 species of shark are caught, the commercial fishery in the southeastern area is based primarily on gummy and school shark. The WA fishery relies on a wider range of species, although gummy shark is an important component of the catch for fishermen operating in the eastern section of the fishery.

Most shark are landed by full-time shark fishermen. However, shark fishing is a part-time or seasonal activity for a large number of fishermen who combine shark fishing with fishing for lobster, scallops and scale fish. Most shark are caught in gillnets. Longlines are also used, especially where nets are not suitable.

The total reported catch is about 3,440 tons valued at $10 to $12 million per annum, but it is estimated that actual landings have exceeded reported catches by up to 20 percent due to black market sales resulting partly from the prohibition on landing large sharks with high mercury counts.

MANAGEMENT OF THE FISHERY

Until recently controls on fishing activities have been limited to minimum mesh size (6 in.) and minimum length of shark in the southeastern area.

Fishing effort initially concentrated on school shark, but when size limits were implemented in the early 1970s (due to the concerns about high mercury content in large shark) fishermen targeted on the smaller gummy shark. There has been a gradual reduction in mesh sizes as the average size of shark taken has fallen.

The diversion of fishing effort to gummy shark relieved the pressure on the school shark stocks, but by the late 1970s there were renewed calls for controls on fishing effort as additional vessels (particularly full-time shark boats) entered the fishery and as catch rates and size of fish taken continued to fall. Also, there was concern that as access to other fisheries was limited, the shark fishery would become a "sink fishery."

Research was initially undertaken on school shark, but with the shift to gummy shark the research effort was redirected to that species. Initial assessments indicated that mesh selectivity was providing some protection for the large female gummy sharks, and thus it was concluded that there was no need for immediate introduction of further constraints on

effort. Imports of shark at low prices in the early 1980s, combined with improved profitability in other fisheries (particularly scallops), also restrained increases in fishing effort on shark.

However, some scientists continued to express concern because of the vulnerability of shark populations to heavy fishing pressure. Slow growth and low rates of reproduction suggest a cautious approach to management. Fishermen observing the closure of other fisheries added their voices to demands for the introduction of controls on entry and fishing effort.

In October 1984, a scientific workshop was held, and it concluded that effort on gummy shark should be constrained. Falling catches and catch rates together with an imbalance in the sex ratio (numbers of males had fallen to a low level) were observed. Research on both gummy and school shark was stepped up.

Following the scientific advice, the Minister for Primary Industry issued a warning against increased investment and established an industry/government task force to advise on long-term management measures. The task force prepared a paper setting out the management issues and held public meetings in the major ports. While there was general support for limited entry, it was recognized that additional measures were required to constrain and reduce fishing effort.

The option of ITQs was attractive as a measure which would effectively constrain effort and catches while allowing fishermen to maximize efficiencies of operations. However, as the fish are marketed as a fresh product and landed at many ports, it was concluded that ITQs were not feasible, as they would only encourage the already large black market.

The task force is now considering the option of limited entry combined with gear quotas and an increase in the minimum mesh size. While a small increase in the minimum mesh size alone would accommodate a slightly higher rate of fishing effort, such action would discriminate against one sector of the fishery and would not provide a long-term solution to the problem of a continuing increase in fishing effort.

The task force is now concentrating its efforts on developing criteria for entry to the fishery, allocation of gear quotas, and controls on the transfer of gear quotas. Entry criteria based on fishing activities prior to the ministerial announcement is favored by most participants, but in view of the large part-time multipurpose component of the fishery, a long (three-year) qualifying period is required.

Development of equitable criteria for the allocation of gear quotas also poses a considerable problem. Catch records are not reliable, and allocations based on catch would discriminate against multipurpose fishermen. It appears that allocations based on the quantity of gear used is the only equi-

table method. However, this requires verification of gear usage.

The problem of surveillance and enforcement of gear quotas has been the subject of extensive discussions with fishermen. The current proposal is for net quotas to be related to the volume of net on the net drum. This would minimize difficult and costly at-sea enforcement. The longline segment of the fishery is relatively small and has not contributed to increasing effort. However, attention is being given to establishing gear quotas for this segment, based on the length of longline in use.

The introduction of gear quotas would allow for the establishment of an adjustment program designed to constrain and reduce the total amount of gear used, and thus fishing effort. Proposals under consideration involve initial allocation of gear quotas at about two-thirds the level of current gear usage. It is accepted that the fishermen would use the reduced allocation more intensively in order to maintain incomes. The objective would be to facilitate the purchase of gear quotas by the most efficient operators, but a large reduction in the total of the gear units would be required to achieve a reduction in effective fishing effort. Periodic forfeiture of gear units at, say, two-year intervals would be required until effort was reduced to a level that scientists assessed as sustainable. Consideration would be given to introducing a license buy-back scheme to be funded by participants.

Transfer of gear quotas, while desirable from the viewpoint of economic efficiency, raises the prospect of conversion of part-time units into full-time fishing units. Thus, controls on transfer of gear units must be implemented. This will require segregation of vessels between those landing large catches, and part-time or multipurpose vessels landing small shark catches. Assessment are being done to determine the appropriate cut-off point between the two categories of vessels. Additional controls on the sale of gear units for vessels with small historic catches are under consideration.

The fact that fishing pressure is not evenly distributed throughout the fishery is causing tensions between governments and industry groups. Accordingly, some concessions to fishermen operating at the limits of the fishery may be required if segmentation of the fishery is to be avoided. An increase in the minimum mesh size over time may provide a key to addressing this problem.

Some fishermen have ignored the warnings against increased investment in the fishery, and as a result the minister closed the gillnet fishery to new entrants on February 28, 1986. It was considered that the risks associated with uncontrolled entry of new vessels warranted introduction of limited entry in advance of the full management package. Recent entrants will not be allocated license endorsements if they wish to continue to operate in the fishery. Thus, the process of assessing applicants for entry to the gill-

net fishery is now being undertaken in conjunction with development of the full management program.

A draft management plan will be distributed to fishermen for comment prior to submission of recommendations to Ministers later in 1986.

OBSERVATIONS OF DEVELOPMENT ON THE MANAGEMENT PLAN FOR THE SOUTHERN SHARK FISHERY

The large part-time/multipurpose component of this fishery has posed considerable conceptual problems for fisheries managers.

The problems have been compounded because of the need to constrain and reduce fishing effort in the light of evident stock conservation problems.

The most effective means of addressing the stock conservation problems, while avoiding interference with efficient operations, would be introduction of ITQs, but this is not considered feasible.

Attention has focused on the introduction of gear quotas (input quotas), but the fact that about three-fourths of the operators land only small quantities of shark poses considerable problems in devising effective methods of limiting and reducing fishing effort. Introduction of an adjustment mechanism is considered an essential component of this management program.

Relatively unique (for Australia) enforcement and surveillance problems must be overcome if net and longline quotas are to be effective. This will require close cooperation between industry and fisheries authorities.

Controls on trading in gear quotas by operators landing small quantities of shark will be required if the long-term conservation and economic objectives are to be addressed.

Developments in this fishery again highlight the desirability of introducing controls on fishing effort and catching capacity at an early stage in development of fisheries.

Industry involvement in decision-making, and sharing the costs of management between government and operators, are seen as essential to the implementation of timely and cost-efficient management measures.

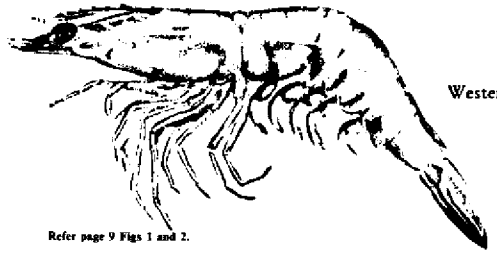
APPENDIX V: THE SPENCER GULF PRAWN FISHERY

This fishery is managed by the South Australian Government. The South Australian Department of Fisheries published a paper on management of the fishery in the June/July 1985 issues of SAFIC (Vol. 9 No. 3). SAFIC is a joint publication by the South Australian Department of Fisheries and the South Australian Fishing Industry Council. A copy of this paper follows.

Management of the Spencer Gulf Prawn Fishery

Introduction

The annual value of a prawn catch is a product of the number of prawns caught, their size distribution and the unit prices of various size categories (Fig 1.). Biological management measures aim in the first instance to establish maximum and stable recruitment. The increase in value of a year-class of prawns as they grow in individual weight and value is countered by natural mortality. At some point in each prawn's life expectancy, it will reach a maximum biovalue (Fig 2.). The regime developed in Spencer Gulf of sampling and stock harvesting at key areas and times of the year has aimed at achieving as close to this maximum as possible. The management of a fish resource becomes in this sense closer to crop or forest husbandry, whereby the producer waits for the best biological and economic conditions to reap the benefits.



Western king prawn *Penaeus latisulcatus*

Refer page 9 Figs 1 and 2.

Management measures also aim to protect spawning aggregations at certain times of the year to further optimise recruitment potential. The success of this kind of management has been well demonstrated in the Spencer Gulf Prawn Fishery.

Authorities to fish for prawns were introduced into the Spencer Gulf Prawn Fishery within two months of the first commercial catches being taken in 1968.

The number of authorised vessels operating in the fishery has remained at 39 since. However total effective fishing effort has increased significantly due to changes in vessel length, engine capacity, net design, operator knowledge and skill and a significantly greater knowledge of the resource as a result of ongoing research. In more recent years, the value of the catch (at the point of landing) has been some $15 million, before value is added by processing and subsequent marketing (Fig 3.). Initially entry was by a permit system under the Fisheries Act, 1971, after appropriate amendments to the Act were introduced. Operators in the fishery were then required to hold South Australian fishing licences endorsed with an authority to take prawns in the Spencer Gulf Prawn Fishery. Early in the development of the fishery, prawn fishing authorities could be held by corporate bodies and were transferable.

As the fishery is a common property resource, there is an incentive to continue to put effort into the fishery until the cost of continuing fishing exceeds the value of the additional fish caught. There is really no personal incentive for one fisherman to take account of the conservation aspects of the resource, unless perhaps in the extreme circumstance where there is the prospect of serious recruitment failure and stock collapse. Restrictions on individual fishing effort have had to be applied by means of restrictions placed on the operations of all licence holders. This has resulted in the development of the existing limited entry management arrangements which specify the number of vessels which may be used in the fishery, the vessel configurations, the fishery equipment which may be used and the number of days during which fishing may take place. With the introduction of the Fisheries Act, 1982, the Fishery is managed under regulations cited as the 'Spencer Gulf Prawn Fishery Scheme of Management'.

Vessel Size

The size and class of vessels presently used in the fishery is a result of management measures to limit the overall effective fishing effort through maximum length and engine horsepower controls and the incentive to acquire larger vessels to qualify for the Commonwealth ship building bounty.

The present designated vessel specifications applying to vessel replacement in the fishery are:

Maximum net headline length, 29.26 metres (16 fathoms);

Maximum overall vessel length, 19.8 metres (65 feet);

Maximum engine horsepower, 272.29 kw (365 brake horsepower).

Vessels in the fishery must comply with these restrictions. The result is that many vessels presently in the fleet have been designed to comply with the length restriction but qualify for the ship building bounty on the basis of gross construction tonnage (>150 gross construction tonnes). The problem of increasing fleet capacity, and hence effective fishing effort, despite designated vessel limitations is shown through examination of changes in fleet structure (Table 1).

Vessels capacity has tended to move towards the maximum permitted by regulation. This table does not reflect a substantial increase through maximising gross construction tonnage and the use of ever more sophisticated technology in all aspects of the fishing operation. However the maximisation of fishing capacity is continually being sought by Industry. The first introduction of improved technology etc usually provides a fishing advantage to that operator. However, once the innovation has been introduced throughout the

Table 1
Average vessel length and main engine kw

Year	Average Length (m)	Average kw
1970	18.2	154
1971	18.1	157
1972	18.1	175
1973	18.1	183
1974	17.5	188
1975	17.3	191
1976	17.3	192
1977	17.4	200
1978	17.3	208
1979	16.9	217
1980	17.0	219
1981	17.0	220
1982	17.2	223
1983	17.4	223
1984	18.0	245

fleet, this advantage disappears. In fully exploited fisheries, such as the Spencer Gulf prawn fishery, such introductions do not significantly increase the total catch but do place a cost impost on the Industry. The most recent development has been the introduction of blast freezing capacity to provide for better quality product and subsequently attract a higher return.

Fishing Effort

Standard indicators of fishing effort such as hours trawled or days fished have been compiled. An indicator reflecting the real effective effort is difficult, if not impossible, to devise. The collection of data required is a compromise between the minimum to provide an adequate and useful estimate, the need to ensure that the quantity of data sought does not deter Industry from providing it, and the ability to store and handle both historic and present data. In order to compare historic effort changes all indicators need to be standardised.

A simple illustration of the increase in effective effort is the introduction of multiple rig nets. In 1970, only 39% of vessels were fitted with double rig. By 1984, all vessels were fitted with double rig. In the absence of any management option to remove vessels from the fishery to compensate for this increase in effective effort, the option of restricting the nights available has been used. Currently fishing nights are restricted to approximately 125 per annum.

Limited Entry Fishery Management

Under the Fisheries Act, 1982 the Scheme of Management for the Spencer Gulf Prawn Fishery limits the number of licences to a maximum of 39. These licences are transferable with the approval of the Director of Fisheries, subject to certain conditions:

(i) The transferor's (sellers) licence has not been suspended

(ii) The transferor is not indebted to the Department for any outstanding fees, payments or instalments

(iii) The transferor has submitted all catch and effort returns up to the date of the transfer

(iv) The transferor has no proceedings pending or likely to be commenced relating to an offence under the Fisheries Act, 1982

(v) The transferee (buyer) (in the case of a natural person) is at least 15 years of age

(vi) The transferee during the 3 years immediately preceding the date upon which the application for transfer is made has not been convicted by Court in a State or Territory of the Commonwealth of any offence involving a breach of any legislation relating to fishing

(vii) The transferee is not the holder of a licence in respect of any other South Australian managed fishery

Licence fees have changed from a nominal annual charge in the early years of the fishery, ($300), to an annual fee which is commensurate with the costs of managing the fishery. Fee discussions between the Government and the industry during 1983-84 resulted in an annual licence fee calculated at 3.5 per cent of the rolling average value of production based on the previous three fishing seasons and the average price paid to fishermen in the last available year. In 1984/85 the fee was $14 049 per licence.

The Economics of the Fishery

The Revenue Side

Faced with a relatively stable annual catch of some 2 000 tonnes, each of the 39 licence holders has two main means of increasing revenue from his fishing operations. These are by taking full advantage of vessel and gear configurations permitted by the Scheme of Management to increase individual vessel performance and by improving the price received for the catch. The latter is achieved by targeting on larger prawns sizes (closing areas of small prawns to fishing) and in quality improvements devised from grading, handling and blast freezing.

Total Industry revenue is similarly increased if average prices can be improved. However, individual increases in fishing power, and fishing effort, will only increase Industry harvest, as one fisherman's gain is achieved at the expense of another fisherman's loss. Stability of catches in recent years suggest that there is little opportunity for such gains in the fishery.

Catch from a survey station—a significant improvement in size has resulted from delaying fishing until prawns reach optimal size—80% of this catch were 21/25 grade. On board 'Intrepid'—Terry Palmer and Greg Palmer.

Maintenance of a stable catch combined with improved quality, offers obvious revenue advantages to the catching section of the industry. This also benefits the processing/marketing sectors in the international context. Improved quality strengthens the market position of South Australian prawn exporters, either in terms of the price paid by overseas buyers, or in maintaining demand in the face of increased competition from other sources (particularly aquaculture product).

The Cost Side

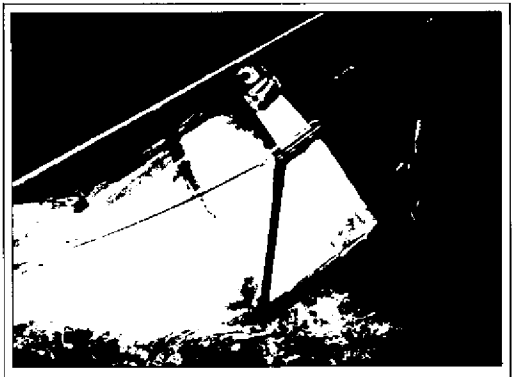
As discussed earlier, there is a strong incentive for operators to maximise

individual fishing capacity within the constraints of existing regulations.

With limited entry arrangements, there is no market incentive for the overall fishing capacity of the fleet to find a level which will provide for the most efficient fleet configuration to take the available catch. Personal cost-effectiveness does not mean that a fleet of 39 vessels operating with existing permitted gear and present closure strategies is the lowest cost means of harvesting 2 000 tonnes a year in Spencer Gulf. In Spencer Gulf removal of some boats would result in no reduction of catches but would decrease the total fleet costs.

The difference between the total revenue to the industry and the cost of harvesting the resource is called the economic rent. The reported prices at which licence transfers take place reflect the value of the Fishery as an investment. The price paid for a licence also provides an indication of the economic rent, although the capitalised value of this economic rent would have been largely realised on initial sale of a licence, with subsequent sales providing for 'normal' returns plus an element for business speculation.

Net revenue could be improved by future changes in fisheries management, such as through a reduction in the capacity of the existing fishing fleet. Industry and the Department are presently pursuing means of reducing fishing costs.



A beam trawl used on board the 8.2 metre research vessel 'Raeek' which conducts investigation of inshore juvenile prawn populations.

Research in the Fishery

The Department of Fisheries' research program into the Spencer Gulf Prawn Fishery has two main objectives:

(1) To determine the population dynamics parameters (growth, mortality, reproductive potential and movement) and basic biology of the western king prawn for input into a production model for this fishery.

(2) To determine the distribution of prawns prior to the opening of each harvesting period (October-December and March-June), and to develop a harvesting strategy which will optimise the return from the fishery whilst ensuring protection of breeding and juvenile stocks.

An extension of the research has included a study of post larval and juvenile prawns and environmental conditions of nursery areas in Spencer Gulf.

These programs entail investigations of the following:

(1) Recruitment patterns and size of adult spawning stock;

(2) Spatial distribution, size composition and movement patterns;

(3) Growth rate;

(4) Total mortality and estimates of fishing intensity;

(5) Fishing patterns and effects of closures (eg the increase in bio-value due to growth).

(6) Behaviour of prawns (the effects of environmental factors of catchability, etc).

Specific to the juvenile program are investigations of:

(1) Recruitment patterns to nursery areas;

(2) The growth rate of juvenile prawns in nurserys;

(3) The immigration patterns from nurserys and the relationship to adolescent recruitment patterns to the fishery.

The research program is carried out using both commercial vessels on charter and dedicated research vessels.

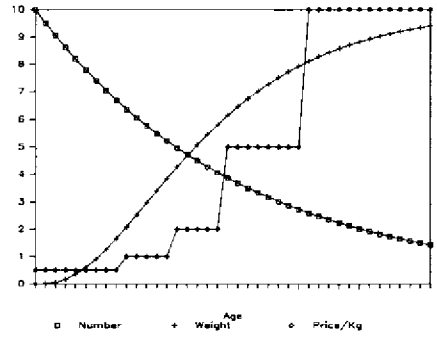
Advice to the Department and Government on management strategies for this Fishery is obtained through the

Tagging prawns on board the 'Melanie-B'. Left to right: Greg Richardson, Shaun McGeever and Niel Carrick.

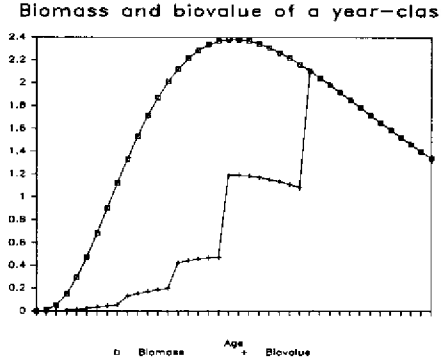
Spencer Gulf and West Coast Prawn Management Liaison Committee. This Committee comprises representatives of the fishing sector, the processing sector and the Research Branch of the Department of Fisheries under the direction of an Industry Chairman. Industry representatives of this Committee have been given the authority to make recommendations on behalf of Industry. Through this Committee, the Research Branch presents the research program requiring commercial vessels for the forthcoming 12 months. On reaching agreement, the Department then calls competitive tenders for the required number of vessels on each survey. Vessel numbers required generally range from four to six, for up to six nights at sea. Initially, each vessel was accompanied by a member of the Research Branch of the Department. However, some skippers and vessel crews have now become proficient in carrying out the duties and can carry out their sector of the program unsupervised. A consideration when selecting tenders is to select one or more inexperienced vessels on each occasion to enable training of their crews, so that a larger pool of competent "research" crews is available from which to pick.

During each survey, each vessel is allocated pre-determined trawl shots, each trawl location being carried out in duplicate. The resulting data are processed by the Research Branch. Within two days a summary listing the catch, catch rates, size distribution etc for each trawl shot (up to 96 trawl shots) are distributed to all 39 licence holders. Detailed analyses and results are presented to the Management Liaison Committee, generally just prior to the opening of each harvesting period or during the monthly moon closures (usually 10 to 13 nights over the full moon period).

In addition to these data, commercial vessels retain samples on a weekly basis for market measuring. These samples, collected from designated trawl stations are measured by contract staff at a Port Lincoln processing company. This provides research staff with a continual indication of the size of prawns being captured throughout the fishing area. This in turn allows the identification of major movements of adult prawns, the recruitment of juvenile prawns into areas and the effect of closures. The designation of vessels to collect these samples is through a roster system



(FIG 1.)



(FIG 2.)

determined by the Management Liaison Committee. This sampling system has on a number of occasions resulted in the very quick closure of areas, in order to protect the juvenile stock, when unexpected recruitment has taken place. When rapid closures are required, Industry is informed by telex of the changes through a privately run radio base at Wallaroo which services Spencer Gulf. In return for this service the prawn Industry and the Department of Fisheries contribute towards the operating costs of this base.

As prawn movement and recruitment can occur over a very short period of time and any closures must have legislative backing rather than be on a voluntary basis, the Department has developed a system of promulgating closure notices with very short lead times. To give effect to this system, the Minister of Fisheries has delegated his power to make notices proclaiming closures to the Director of Fisheries.

The system involves the research staff informing the officer of the Department responsible for legislative changes, who then prepares a notice for signature by the Director and subsequent gazettal. As any change is not effective until the notice has been gazetted, arrangements have been made with the Government Printer to publish a special supplementary *Gazette* on the day of submission. Under this system closure changes have been gazetted with lead times as low as four hours.

The cost of chartering commercial vessels (up to $3 000 per night per vessel) is offset by the sale of catch taken during the sampling period which is retained by the Department in its Research and Development Fund. The aim is for this section of the research program to break even; this has been achieved since the inception of the program in 1980/81.

Additional research data is derived from a commercial log book. Data are provided to the Department by all commercial fishermen on a trawl shot basis. Specific information collected includes date, time of trawl shot, duration of trawl shot, catch in kilograms of western king prawn, location by grid reference of trawl shot and any other relevant observations (eg relating to bottom condition, other species, water temperature and weather, etc). These data are handled in the Department of Fisheries catch and effort system.

Important information on the stocks of western king prawns in Spencer Gulf comes from tagging studies which provide data on growth, mortality and movement. In addition to tagging studies carried out by research personnel, a number of crews on commercial vessels have been specifically trained in the field aspects of mark-recapture work.

For the juvenile investigations, a 27 ft research vessel rigged for double rig beam trawling is used to sample the inshore nursery areas during dark and light phases of each moon period.

Data assembled of relevance to the Fishery includes:

(1) Catch and effort and size composition data of the commercial catch;

(2) Factory size gradings;

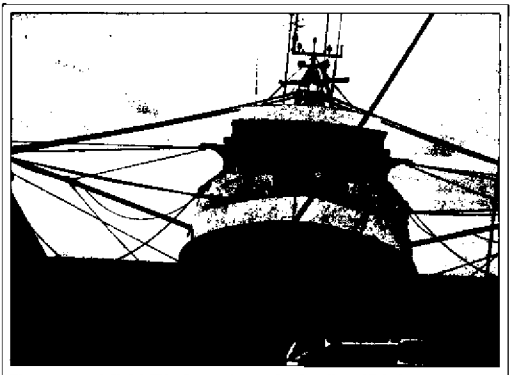
(3) Information relating to recruitment patterns over the northern regions of Spencer Gulf (Port Lowly—Middlebank) and the southern region.

(4) Information relating to the distribution of prawns and their size composition obtained from surveys of both closed and open regions and the effect of closures on increasing of the bio-value as well as facilitating recruitment and protection of juvenile prawns;

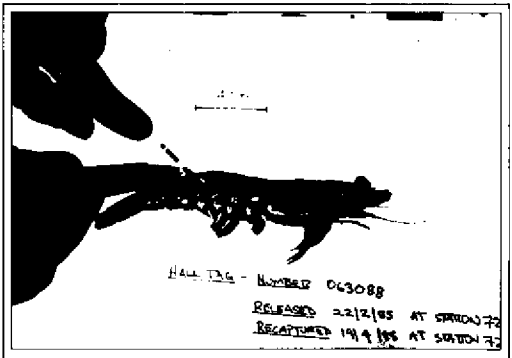
(5) Data relating to growth rate of western king prawns from tagging and cohort analysis;

(6) General movement patterns of western king prawns in Spencer Gulf which assist in the directing of fishing effort at different times of the year.

The present program is extensive and comprehensive in that it addresses all stages of a life cycle on western king prawns in Spencer Gulf, all the known spatial distribution of western king prawns in Spencer Gulf and the effect of intensive fishing pressure on western king prawn stocks by the commercial fleet. Such an extensive program can only be carried out with substantial assistance of the prawn industry itself. Only through the efforts of the Spencer Gulf and West Coast Prawn Fishermens' Management Liaison Committee, the untiring assistance of a number of prawn fishermen and skippers and the industry coupled with energetic and enthusiastic research work by Departmental officers has the success of the program to date been achieved.



The survey vessel 'Nada'. This photograph was taken from 'Intrepid' during a survey meeting at sea while at anchor.



A Hall streamer tag inserted in a prawn. This prawn was recaptured during a survey trawl station.

Enforcement

Surveillance of the fishery is undertaken from Port Lincoln (4 officers), Minlaton (2 officers), Port Pirie (2 officers), with support from Adelaide Head Office.

In 1982/83, in consultation with the Western Waters Prawn Boat Owners' Association, the following strategies were devised to assist surveillance:

(i) A system for the reporting of offences

(ii) A number of boat owners offered their services in providing accommodation for Fisheries

Officers on their vessels, thus providing a patrol medium whilst fishing.

(iii) The Association purchased a number of buoys to mark closure lines. These were placed at strategic points along the closure lines, thus facilitating navigation for the fleet and protecting the known juvenile areas.

In 1982/83, the Department of Fisheries also purchased more suitable vessels for patrol work in the fishery along with other fisheries. An 8.2 metre Shark Cat was placed at Port Lincoln. Although this vessel had limitations under certain weather conditions, it provided a much needed extension to surface surveillance. Seven metre Shark Cats were also stationed at Minlaton and Port Pirie. These, too, are limited in their operation, but are able to provide surveillance within the permanent closure areas and, at times, the perimeters of the shorter term area closures.

Adelaide Headquarters also provide back-up to the country stations, in two main areas:

(i) Helicopter surveillance.

(ii) Mobile land radar and communication.

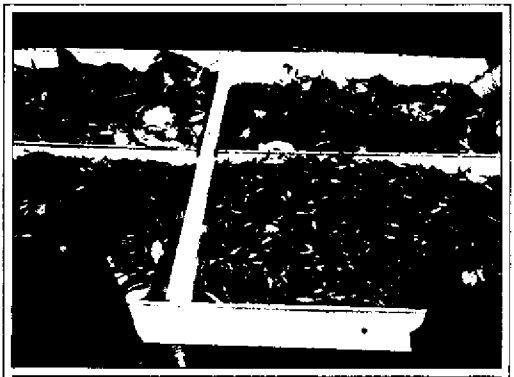
The co-operation between the prawn fishermen and the Department of Fisheries has proven most important in investigating offences. A number of successful prosecutions were obtained, which resulted in fines, and in some cases, in suspension by the Minister of Fisheries of the authority to fish for prawns.

For offences against the present Fisheries Act and Regulations, fines of $2 000 to $5 000 may be imposed, plus an additional penalty, on conviction, of 5 times the wholesale value of the fish taken, or $10 000, whichever is the lesser amount. Suspensions and cancellations of fishery licences are now provided for by the courts, rather than the Minister of Fisheries.

In recent years, fishermen have conducted their own surveillance and, in the most part, have been successful. That has not relieved the Department of Fisheries of its responsibilities for surveillance within the fishery. Surveillance is conducted on an ad hoc basis, utilizing vessels and the land-based radar systems. However, the reduction in the need for Departmental surveillance has enabled manpower to be utilized in other fisheries.

In June and July, 1984, Fisheries Officers underwent a specialised training program in Navigation and Radar. Radar systems, including apparent motion, were studied to the standard of Master (IV). Navigation and navigation aids were also studied, as well as their application as evidence. All Fisheries Officers successfully completed this course, and are recognised as expert witnesses in these fields.

Prawn fishermen convicted by a Court of offences against the Fisheries Act, 1982, have the conviction recorded on their licence. This may have an effect on the value of the licence to those persons intending to sell their operation because the conviction for a prescribed offence shall be attributed to the holder of the licence whether the offence was committed by the current holder of the licence or a previous holder of the licence.



Above: An example of the catch—nearest table separates clean prawns while aft table is catch from 'crab bags'. Nets have crab bags which enable crabs and rubbish to be separated from the prawn catch. 'Melanie B'—trawl station in Spencer Gulf.

Left: Skipper/Owner of the 'Melanie B' R. Bailey about to release tagged prawns from the tagging cage.

Summary

1. The Spencer Gulf prawn fishery is a valuable fishery with high investment costs and returns to individual licence holders.
2. The fishery is confined to a discreet area.
3. The fishery is closely monitored and managed with fishing effort targeted by finely tuned corrections via numerous seasonal and area closures.
4. Management is characterised by a very close working liaison between Department and industry.
5. With stock management under tight supervision and control, there is now a need to address the matter of reducing fleet fishing costs and introducing overall efficiency.

Individual Transferable Quotas in the Australian Southern Bluefin Tuna Fishery

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INTRODUCTION

The author worked in Australia for one year beginning in April, 1985 as a participant in an exchange of fisheries personnel between the United States National Marine Fisheries Service and the Australian Fisheries Service, a division of the Commonwealth Department of Primary Industry. The author participated in the design, implementation and administration of a unique management regime for the Australian southern bluefin tuna fishery. The management regime removed the fishery from the traditional realm of common property resource management and introduced private property rights in the form of individual transferable quotas (ITQs) as the basis for management. ITQs are the allocation in perpetuity of a specific amount or proportion of the total annual quota for a species to individual fishermen. ITQs are transferable. Any individual may buy, sell, rent, lease or trade ITQs.

In this paper, the author describes the development, implementation, and administration of an ITQ management regime for the Australian southern bluefin tuna fishery, with some observations about the effects of ITQ management after one fishing season.

HISTORY OF THE FISHERY

Southern Bluefin Tuna (SBT), Thunnus maccoyii, is a highly migratory species exploited mainly by Japan and Australia. Japan's longline fishery operates in international waters outside the Australian 200 mile zone on deep swimming adult

fish greater than eight years old, and supplies the sashimi market (Figure 1). The Japanese catch peaked in 1968 at about 60,000 mt and has declined steadily to a level of only 17,000 mt in 1984.

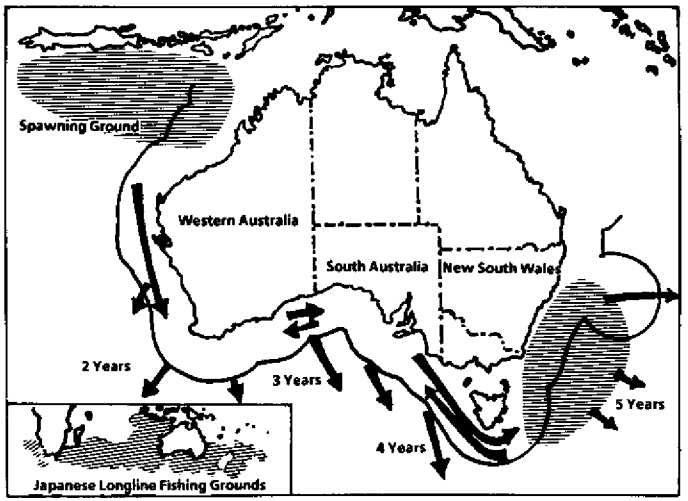

Figure 1. SBT spawning area, migration pattern off Australia, and location of the Japanese longline fishery.

The Australian fishery, which is based on surface swimming juvenile fish (under eight years of age) extends across the southern and southeastern coastline of Australia. Fishing fleets are based principally in three ports--Albany in Western Australia, Port Lincoln in South Australia, and Eden in New South Wales.

About 600 people were employed in the harvesting sector and a further 450 in the processing sector as of 1981-82. Tuna processing includes canning, freezing of whole fish and, on a smaller but increasing scale, preparation for the high-priced sashimi (raw fish) market in Japan.

The Australian fishery has grown from a national catch averaging less than 10,000 mt over the 20 year period 1960-1980, to 21,000 mt in 1982-83. The Australian catch was larger than the Japanese catch for the first time in 1982-83 (Figure 2).

Although occasional catches of SBT were recorded off New South Wales (NSW) prior to World War II, the fishery did not develop commercially until the late 1950s, when pole and bait methods were introduced from North America.

The NSW tuna fleet is based on harvesting five- to seven-year-old fish during a short SBT season. NSW tuna vessels tend to be multipurpose vessels used for trawling in the SBT off-season. The NSW catch varied from 3,000 to 6,000 mt for many years but fell to 1,700 mt in 1982-83, partly because of increased effort in Western Australia and South Australia and partly because of stock decline and unfavorable oceanographic conditions.

The South Australia tuna fleet concentrates on three- to five-year-old fish in more of a year-round fishery, pursued by more specialized tuna vessels than in New South Wales. The South Australia catch averaged about 5,000 mt during 1963-1979, but grew to 14,000 mt in 1982-83.

SBT fishing was mainly by pole and bait vessels until 1974, when purse seiners entered the fleet in NSW and South Australia. Purse seiners now work in conjunction with pole and bait boats, which are given a share of the catch for their part in the operation. The pole and bait boats help find patches of SBT and then keep the patch at the surface using live bait, while the purse seiner "shoots" the patch. Since 1980, purse seiners have accounted for between 21 percent and 25 percent of the total Australian catch, despite the fact that they were banned from Western Australia waters for fear of their potential to increase the catch of juvenile SBT, and were limited to five vessels in the remaining area.

Of particular concern was the growth of the fishery in Western Australia. Prior to 1978, the Western Australia harvest ranged between 300-700 mt per year. It began to grow in 1978, and by 1983 was 6,000 mt, a tenfold increase. Because this fishery was based upon two- and three-year-old juvenile fish, the biological impacts on an already fully-exploited stock were significant. The Australian scientific community now believes that the large number of small fish caught off Western Australia was a major factor in the decline in the SBT parental biomass.

As a consequence of the decline in the Japanese catch of larger, mature fish, and the growth of the Australian catch of smaller, young fish, the world catch has fallen in weight even though the numbers of fish caught have been increasing (Figures 2 and 3).

In 1975, further entry of purse seiners into the SBT fishery was frozen at five. In 1976, further entry of new pole and bait vessels was banned. In spite of this restriction, the catch continued to increase, as fishermen adopted new technology and modified vessels to increase their efficiency and capacity. By 1981, the Australian SBT catch had doubled and the government lifted the freeze on entry, having judged it as ineffective. The freeze on entry into the tuna fishery is now acknowledged to have stimulated a rush of investment, which resulted in a large increase in real fishing effort. Encouraged by a buoyant economic climate associated with rising prices and catches, many fishermen took advantage of the security offered by a limited entry fishery and upgraded

or replaced vessels with larger, more sophisticated single-purpose tuna vessels.

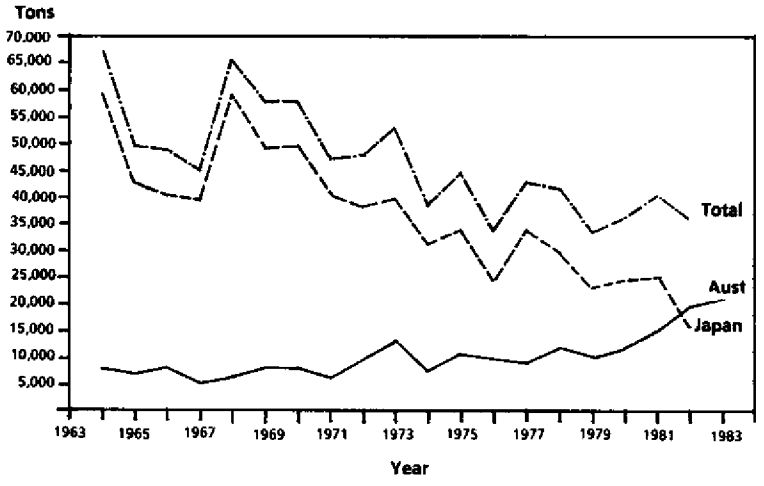

Figure 2. World commercial catch of SBT by weight: 1963-64 to 1982-83.

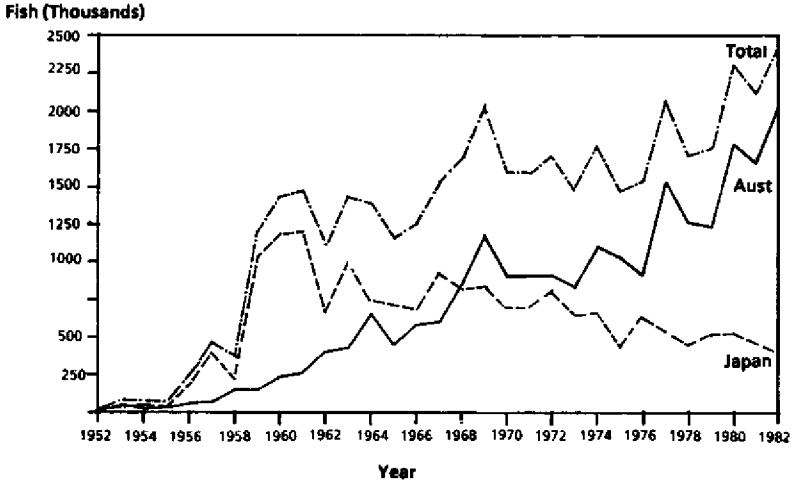

Figure 3. World commercial catch of SBT by numbers: 1952

The average purchase price of pole and bait boats in South Australia/NSW was $675,000 in 1978-79, compared to $137,000 in 1974-75. This increased investment stimulated effort, particularly in South Australia, and contributed to the catch rising from 10,000 to 21,000 mt a year from the start of the freeze in 1976 to 1981-82.

As SBT catches increased between 1980 and 1983, the ex-vessel price paid to fishermen fell by about 30 percent, due to increasing inventories and large supplies on the world market. Thus, gross income declined significantly, costs (40 percent of which were fuel related) rose, and net earnings, or profitability, fell sharply across the whole fleet (Figure 4).

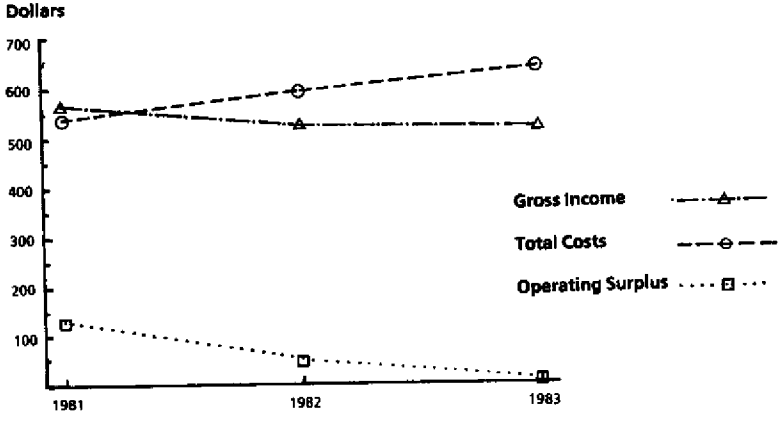

Figure 4. Costs and earnings of Australian purse seine tuna fleet (average $ boat).

SBT STOCK STATUS

The SBT parental spawning biomass dropped from a virgin biomass of an estimated 650,000 mt in the mid-1950s to about 160,000 mt in 1980 (Figure 5). Scientists concluded that any further decline could result in a substantial risk of recruitment failure. They also concluded that to maintain the 1980 level of parental biomass, the world catch of SBT needed to be stabilized at about 30,000-32,000 mt. Since 1980, however, the yearly global catch had exceeded 40,000 mt. Thus the global catch that would result in stabilization of the parental biomass was reduced to about 25,000 mt. Given an expected Japanese catch of 15,000+ tons on the high seas, the Australian catch, it was argued, should be reduced from 21,000 mt to less than 10,000 mt.

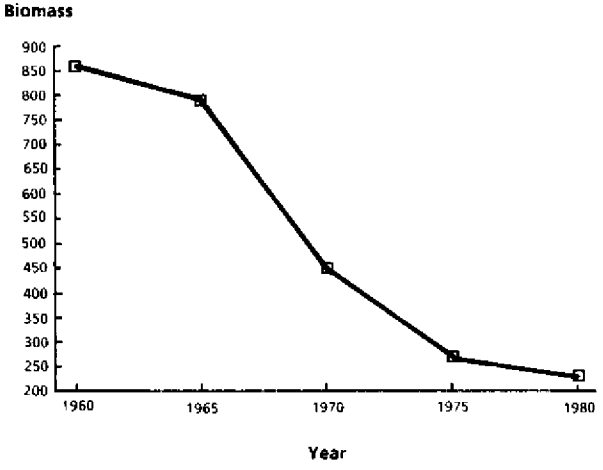

Figure 5. Decline in southern bluefin tuna parental biomass, 1960-1980.

MANAGEMENT OBJECTIVES

The management problem was twofold. First, the SBT stock was at risk of possible recruitment overfishing, the prevention of which required a reduction in the global catch. Because much of the decline could be traced to an expanding Australian juvenile SBT fishery, it was clear that the Australian catch would have to be drastically reduced. Secondly, overcapacity, overcapitalization, low world prices, and increasing costs had made the Australian SBT fishing fleet unprofitable even while taking record catches. Without major structural changes to the fleet, the impending 30 percent to 50 percent reduction in the total allowable catch (TAC) was expected to bring financial disaster to the tuna industry.

With this background, it isn't difficult to deduce at least some of the specific management objectives for the SBT fishery within the overall Australian government objectives of resource conservation and economic efficiency.

Those specific objectives were:

1. to reduce the overall catch

2. to increase the average size of the catch (scientific evidence pointed to the conclusion that increased global yields, or, conversely, smaller required reductions in catch, would result from reducing the exploitation of small, two- to three-year-old fish)

3. to reduce the costs of harvests and improve net returns both to individuals and to the fleet in total--in other words, improve individual profitability and fleet efficiency

4. to remove capacity (i.e. vessels) from the fishery

5. to allow individual fishermen the freedom to make decisions concerning the size, age, and configuration of their fishing vessels, and to freely adapt to new technology and fishing methods

6. to reduce the role of government in making major decisions influencing the economics of the fishery, and to reduce the number and extent of regulations imposed on fishermen

INTERIM MANAGEMENT

While the Australian government and tuna industry considered different types of management measures that would accomplish these objectives, interim management measures to prevent the Australian catch from growing any larger or harvesting a greater number of younger SBT were required. For the 1983-84 season, the following measures were adopted:

1. An Australian quota of 21,000 mt (equal to the record 1982-83 catch) was apportioned to the three states in the form of an eastern sector (NSW and South Australia) quota of 15,000 mt and a western sector (Western Australia) quota of 4,000 mt. The remaining 2,000 mt was a reserve to reward an increase in average size in catch if it occurred.

2. Purse seine vessels were limited to 5,000 mt, their numbers continued to be frozen, they were banned from the western sector, and they were restricted to specific areas within the eastern sector.

3. Minimum size limits of 70 cm and 54 cm were imposed on the eastern and western sectors, respectively. The more juvenile (small) fish that are caught, the fewer SBT grow and reach other fishing grounds, and the fewer attain breeding age even after allowing for natural mortality. Thus, catching more young fish reduces the maximum sustainable harvest.

SELECTION OF THE PERMANENT MANAGEMENT REGIME

The interim management regime was not continued because the Australian national quota of 21,000 mt, given the expected Japanese catch, exceeded the amount required to avoid risking a stock collapse and contributed to an economic climate contrary to what was desired. Three characteristics of the interim management regime, the total and sector quotas, size limits, and restrictions on purse seiners, were all consid-

ered to be factors that were increasing the cost of harvesting SBT. The total and sector quotas create an incentive for fishermen to invest in larger and more costly vessels and equipment so that they can catch a greater share of the quota. Size limits increase the per unit cost of harvesting, as it takes time to search for schools containing legal-size fish and to sort fish as they come aboard. These limits also impose a greater cost on the fishery as a whole, because of the inevitable dumping of undersized fish. Because purse seiners harvested SBT at a cost of about $600/mt, compared to $900/mt for pole and bait boats, restrictions on purse seiners reduced overall fleet efficiency.

The license limitation form of limited entry, although reasonably successful in Australian lobster and prawn fisheries, was not considered to be an effective deterrent to economic inefficiency after overcapitalization and excess capacity had already developed in a fishery.

It was clear that a license limitation system of limited entry was of little value in addressing the SBT problem. It had not controlled increases of effort in the SBT fishery in the past, and would not likely work now, given the historical pattern of "grandfathering" all the current active and marginal participants into the system, and without some way of reducing the incentive to compete economically for a fixed yield. The only chance of reducing capacity and improving profitability in the face of an impending reduction in TAC under a license limitation form of limited entry would have been to reduce the number of licenses by half, thus displacing at least half the fleet. Such a harsh proclamation by the government would most likely have been politically impossible and would not have withstood legal challenges, even under the Australian system of government.

During 1983-84, the Australian government was involved in intense discussions with the tuna industry to arrive at the preferred form of management. The outcome of those discussions was a decision in principle to implement individual transferable catch quotas (ITQs) if a system of allocation to individuals was developed that was acceptable to the tuna industry as a whole.

A system of ITQs appeared to have the potential to accomplish all the management objectives for the fishery. Specific benefits to the tuna industry were foreseen to be as follows:

1. Fishermen would be free from the escalating economic costs of competition with other fishermen for a fixed yield.

2. Fishermen would be able to rely on a certain level of catch, thus being able to plan their fishing operations in the most efficient manner, which should lead to an increase in profits.

3. Fishermen would be free from excessive regulatory burdens, including those that inhibit the adoption of new and more efficient harvesting technologies.

4. Fishermen would be able to choose where, how, and when to fish, and at whatever level of comfort they could afford. Essentially, ITQs can make fishing a more professional occupation.

5. From the management agency viewpoint, ITQs keep firm control over fishing mortality but hold no incentive to increase fishing effort and thereby the need for regulatory responses, which usually inflict economic inefficiencies. Thus, administration should be simpler and cheaper.

6. Fishermen would be able to adjust their quota holdings according to need and ability. Beginners could buy into the fishery at a low level, whereas they might never be able to raise the capital for an entry permit under a license limitation scheme.

7. Adjustment assistance would be provided to members of the industry who chose to sell their ITQs and leave the fishery. This financial assistance would be provided from within the industry for the benefit of the remaining participants, at no cost to the general taxpayers.

DEVELOPMENT OF THE ITQ REGIME

Eligibility

The first hurdle in an ITQ system is--who gets quota and who doesn't?

This is perhaps a good moment to go backwards in time to pick up on an important policy that has been one of the keys to the successful implementation of limited entry systems throughout Australia. One of the undesirable side effects of a government publicly considering limiting access to a fishery is the unintentional encouragement of a rush of speculative capital into the fishery in hopes of obtaining a property right and, hopefully, a windfall gain. Such action thoroughly defeats the goal of the program. Thus, when the government in Australia publicly enters into discussions with the participants of a particular fishery, with the intent of placing that fishery under some form of limited entry, the Commonwealth minister with the fisheries portfolio usually makes a proclamation that as of a specific date (usually the end of the current fishing season), any new entrants to the fishery will not be guaranteed access to the fishery under the final management regime. That action is final, and forms one of the bases for eligibility.

Such a statement was made by the Australian Minister for Primary Industry in November 1983 for the SBT fishery.

Thus, anyone who entered the fishery after the 1983 season was not considered eligible for ITQ.

The eligibility criteria were developed through discussions with the SBT fishing industry, and all are derived from a general statement that any person or company able to demonstrate a significant dependence on the SBT fishery would be eligible for quota.

Significant dependence was defined more specifically as:

1. you must be the current license holder for a commercial fishing boat or produce evidence that you have made a deposit to purchase a new vessel;

and

2. you must have been the licensee of a commercial fishing boat during at least one season between 1981 and 1983 inclusive, and have landed at least 15 mt of tuna with that vessel;

or

3. you can produce evidence that you were employed as a skipper or deckhand for at least two of the three qualifying seasons on a vessel which landed a minimum of 15 mt of SBT, and have licensed your own boat before the cutoff for applications.

With these three eligibility criteria, we "grandfathered" into the ITQ regime all fishermen who had satisfied the 15 mt minimum qualifying threshold during any one of three years and who were currently licensed to fish, or had made a verifiable financial commitment to fish.

How was the 15 mt qualifying threshold established? Of interest were the recommendations of the representatives of the tuna industry, who generally supported 40 mt as the appropriate threshold. However, by examining the landing records of all licensed fishermen who landed SBT between 1981 and 1983, it was determined that very few fishermen had landed between 15 and 40 tons and that the inclusion of these fishermen would do little to either increase capacity or dilute the quota when allocated. It was also considered that, at $600/mt, 15 mt of tuna worth $9,000 could still be considered a significant dependence on the fishery.

What about those fishermen who had landed less than 15 tons during 1981-83? They were not included in the ITQ fishery, but they were not prohibited from taking or even selling SBT. In fact, no licensed commercial fisherman in Australia was prohibited from either taking or selling SBT.

They were, however, capped. By examining landing figures, it was estimated that the total catch by all fishermen who had landed less than 15 tons of SBT during the qualifying period only amounted to about 200 mt. Thus, rules were es-

tablished that created an open access registration fishery for small-time SBT fishermen with individual ceilings (not ITQs) of 5 mt. After a registered non-ITQ fisherman had landed 5 mt, he was required to acquire an ITQ if he wished to continue taking and landing SBT. An ITQ holder, however, was not eligible to take a free 5 mt of SBT. It was acknowledged that this solution was only acceptable if the open access catches did not increase from historical levels. If they do, it is likely that these fishermen will either be incorporated into the ITQ system in some way, be closed off as a group after achieving an aggregate quota, or be excluded altogether.

ALLOCATION OF ITQ'S TO INDIVIDUALS

Once it had been determined who would be in and who would be out in terms of receiving an initial ITQ, the most contentious issue remaining was determining who would get how much ITQ.

Although economists theorize that auctions or even lotteries are the most economically efficient method of allocating ITQs, that type of approach never receives much support from the fishing industry and was not seriously considered.

Fishing communities or fishing fleets worldwide probably have an internal perception, or at least a general recognition exists within those communities, as to how each fisherman rates against all the rest--sort of an unofficial pecking order. The closer one can come to matching that perception through the ITQ allocation process, the better the chance of gaining acceptance for the allocation methodology. This, in fact, was the exact approach taken during development of the allocation formula for the SBT ITQs.

It was first determined through discussions with representatives of the fishing industry that the two most important ranking factors in the eyes of most fishermen were:

1. actual catching performance, and

2. financial investment in the fishery.

Because the choice of a single year's catching performance didn't seem to account for the uncertainties in fishing, applicants were allowed to nominate their best catch from any one of the three eligibility qualifying years. Thus, an unlucky season, or even two, would not unfairly lower an individual's chances for a good quota.

The measure of financial investment was the current market value (CMV) of fishing vessel and gear as approved by a certified marine appraiser. Although we were never totally happy with CMV as an objective measure of investment, other alternatives, such as replacement value or insured value, seemed to have even greater shortcomings.

The next step was to survey the SBT fleet for catch and investment data which could be used to develop an allocation formula. Once the survey was complete, the process of developing the formula began. The strategy was to develop a generalized formula with which to run sequential computerized simulations of ITQ allocations to the entire fleet while changing the weightings of each of the two major parameters relative to the other over the total range of options, from 100 percent past catching performance and 0 percent CMV to 0 percent past catching performance and 100 percent CMV. The generalized formula was:

$$\text{Individual Units} = \frac{\text{Best Catch}}{\text{Total Best Catches}} \times WF + \frac{\text{CMV}}{\text{Total CMVs}} \times WF$$

or

$$\text{Best Season Total Catch}$$

WF=weighting factor. The WF was used both to weigh the two elements of the formula differently and to express a fisherman's units in numbers greater than one.

A cursory examination of the results and a little knowledge of the fleet allowed the discarding of the majority of simulations. The most reasonable range of allocation distributions weighted catching performance to investment in a ratio between 50:50 and 80:20.

Those simulations with too much emphasis on CMV, for example, tended to allocate too much quota to new, more speculative entries into the fleet. Had these options been adopted, million dollar boats with little past history in the fishery, but which had been hastily refitted for tuna fishing, would have qualified for the same amount of quota as boats of equal value but with a proven catch history.

The strategy for the next step was to sit down with the state fisheries management agencies and representatives of the fishing industry and let them take a hard look at the results of the simulations and indicate the weighting distribution that seemed the most equitable.

Surprisingly, the fishermen's representatives did not want to know too much about how one individual fisherman ranked relative to other fishermen in the fleet. They seemed to recognize that no mathematical formula could achieve fairness and equitability for every individual. Too much variability exists among individuals' personal circumstances, so some people will always feel that they have been treated unfairly. This will be true for any method of allocation that is based on conformance to established criteria. The fishermen's representatives were more interested in making sure that anomalies didn't stick out like a sore thumb and that application of the formula would result in the allocation of quota to the fleets based in the different states, and to the different categories of vessels, in a manner that was consistent with the historical distribution.

The results of this exercise produced the following allocation formula, which was accepted by both government and industry:

$$\text{Individual Units} = \frac{\text{Best catch (81, 82 or 83)}}{21{,}000} \times 3{,}000 + \frac{\text{CMV}}{\text{sum of CMVs}} \times 1{,}000$$

21,000 = best single season catch

At this point the Australian Fisheries Council (a body made up of the ministers of fisheries from all the Australian states) met and voted to recommend that ITQs be implemented in the SBT fishery immediately. The Federal Minister for Fisheries accepted the recommendation and on August 15 announced that ITQs would be implemented by the start of the next season, which began on October 1, 1984.

That left just six weeks to take applications; to verify the information on those applications; and to allocate and distribute quotas to successful applicants.

Nearly 200 applications for ITQ allocations were received. ITQs were allocated to 143 fishermen. The TAC was reduced from 21,000 mt to 14,500 mt. The total number of ITQ units was 5,162. Thus, one unit of ITQ equaled 2.712 mt of ITQ. The smallest ITQ was 1.4 mt; the largest was 823 mt; the average ITQ was 98 mt.

For an ITQ to actually be fished, it had to be endorsed on a commercial vessel license as a license condition. The condition said that the vessel could be used to take a maximum of x tons of SBT between the beginning and ending dates of the season.

If an individual bought, sold, or leased ITQ, he was required to have the endorsement on his vessel license changed before he could continue to fish for SBT.

CATCH MONITORING AND ENFORCEMENT

Catch monitoring and enforcement, if anything, is the potential "Achilles heel" of an ITQ system. For ITQ management to be effective, catches must be effectively monitored so that individual ITQs and the total quota can be enforced. Fortunately, the SBT fishery is pursued, and fish are landed, principally in five or six large ports around the southern rim of Australia. By the same token, only five or six major processors are involved. Thus, enforcement efforts could focus specifically on these ports of landing.

The job was somewhat complicated, however, by the fact that Australian vessels were also permitted to sell their catches at sea to Japanese processing vessels, to be processed for the sashimi market. A number of methods of enforcing the catch reporting rules at sea are being considered and tried;

but ultimately, an observer on board the processing vessel will probably be the only workable solution.

The catch reporting mechanism developed was relatively simple. When a vessel unloads at port or at sea, the operator is required to complete, in triplicate, sequentially numbered catch record forms. On the initial (top) copy of the catch form he includes, among other data, the estimated weight of his catch and its destination for processing. The vessel operator is responsible for submitting the initial copy to a fisheries inspector in port within 24 hours of unloading. The second copy (yellow in this case) has to accompany the unloaded tuna to the processing establishment. Regulations were promulgated making it an offense to either sell tuna unaccompanied by the proper documentation or to receive tuna that was not accompanied by a yellow copy of a catch record form. Subsequent to receiving the tuna, the processor completes the yellow form with the exact weight of the tuna and submits the form to a fisheries inspector. The final copy serves as the fisherman's record.

SBT ITQs are freely transferable, as their name implies. In fact, transferability is the key to their effectiveness in achieving management objectives. If one of the goals is economic efficiency, as it was in this case, then any restraints on transferability are impediments to achieving that goal. Therefore, the only restraints to transferability that were imposed were that ITQ could be held only by an Australian national or an Australian-based corporation. This restriction resulted from the fear that the Japanese SBT industry might choose to buy out and eliminate the Australian fishery, as a solution to the conservation problem and their own declining catches.

However, in other social environments and other countries, some restraints on transferability are probably appropriate for addressing specific social and economic objectives. It might be appropriate to protect a regional coastal economy, for example, by placing geographical limits on transferability; or to prevent monopolies and preserve the small business character of the industry it might be appropriate to put a ceiling on the amount of ITQ that can be held by an individual, or to require that ITQ owners be real persons, not corporations, or that the ITQ holder be on board while fishing. It all depends on what social or economic objectives are overriding. Economic efficiency is the only cost. The system of transferability can be tailored to individual fisheries to satisfy a wide variety of objectives and even to overcome perceived faults with the philosophy of ITQs in general. The final measure of success of any management system has to be whether it accomplishes its objectives; and whether it does so at an acceptable social and economic cost.

EVALUATION OF ITQ'S

Because ITQs have existed in the SBT fishery for only one full fishing season, it is too early to determine whether all of the management objectives will be fully achieved. But even in the first six months, some objectives were clearly accomplished. ITQs worth 14,045 tons were allocated to 143 fishermen on October 1, 1984. By February 15, 1985, (5-1/2 months) 85 individuals still held ITQs, which meant that a fleet reduction of 41 percent had taken place. Although 85 individuals still held ITQs, only 57 actually fished the 1984-85 season. Twenty-eight leased their ITQs while they fished another fishery or pursued other interests. Thus, a 60 percent reduction in fleet capacity was achieved in only 5-1/2 months, all without the government determining who could fish and who couldn't, and all the result of supply and demand in a newly created marketplace for ITQs (Figure 6).

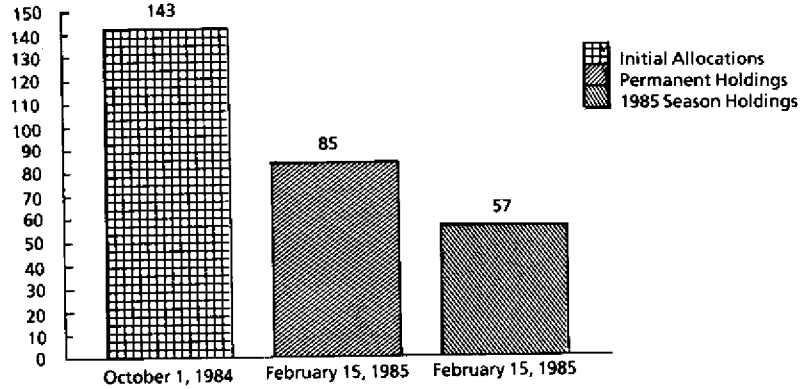

Figure 6. Reduction in the numbers of vessels fishing southern bluefin tuna as a result of quota transfers.

Another objective achieved was an increase in average size of the catch. The trend was for large operators in South Australia to buy out small operators in Western Australia and marginal operators in NSW. Because the Western Australians caught smaller fish, the average size of the SBT catch increased in 1984-85, as a result of transferability, to an average in excess of 80 cm compared to the 1983-84 average of 74.4 cm.

The speed at which ITQs consolidated in the Australian SBT fishery is not necessarily what can be expected from other fisheries where ITQs might be implemented. The driving factor in the consolidation in the SBT fishery was undoubtedly the fact that ITQs were introduced the same season that the TAC was reduced by over 30 percent. Consequently, all fishermen receiving initial ITQs received between 1/2 and 2/3 of their best catch. Thus, because virtually no one in the fleet received what they considered to be an economically viable ITQ, a substantial incentive was created to trade in ITQs. Those who intended to stay in the fishery had to raise capital and buy out, or at least lease from, those who chose to sell out and leave the fishery, or to lease their quota while they considered their options.

Fleet reduction should take place more gradually than it did in this fishery if ITQs are introduced without drastic initial cuts in the TAC.

However, those fishermen who chose to leave the fishery received more compensation for selling their ITQ than if they had been forced out by reduced quotas and by the economics of competing to maintain a traditional share of greatly reduced catch. It is estimated that Western Australian fishermen leaving the fishery have received in excess of $2 million in adjustment assistance from the interstate transfer of SBT ITQs. The total value of all transfers is estimated at over $7 million.

As a point of interest, ITQs began selling for just under $1,000 per ton on October 1, 1984, and were selling for $2,200 per ton 5-1/2 months later.

While the size of the SBT fleet has been substantially reduced, fishermen who have remained in the fishery generally appear satisfied with the results of the management program in its first year of operation. As only 57 vessels remained in the SBT fishery in 1984-85, the level of competition has been greatly reduced and fishermen have been able to adjust their fishing strategies to concentrate on the larger, higher-value SBT suitable for sale on the Japanese sashimi market, while at the same time reducing their operating costs.

It is also clear that with the reduction in the expenditure of capital to harvest the TAC, resource rents will increase. It then becomes a political decision whether SBT fishermen should be allowed to retain all the resource rent thus generated, or whether the government will recover a portion.

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Enterprise Allocations in the Offshore Groundfish Fishery in Atlantic Canada: 1982-1986

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INTRODUCTION

Quasi-property rights in the form of allocations to fishing enterprises (enterprise allocations or boat quotas) have been suggested in recent literature as a means of curbing overcapitalization in the fishery. Under a property rights system, fishermen would be able to develop long-term planning horizons based on their individual allocations and on the length of time such allocations are in place. Harvesting allocations could be integrated with market demands.

A limited experiment in enterprise allocations was introduced into the offshore (trawler) groundfish fishery in Atlantic Canada in 1982. In 1984, this trial enterprise allocation program was extended to include all companies that operate offshore trawlers.

The purpose of this paper is to outline the groundfish management program in Atlantic Canada prior to the introduction of enterprise allocations to the offshore trawler fleet; to describe the enterprise allocation program from its inception in 1982 to the present day; and to outline the benefits expected from the program. The paper will begin with a theoretical discussion of the quasi-property rights concept.

GROUNDFISH MANAGEMENT IN ATLANTIC CANADA

The traditional fisheries located on the Atlantic Coast of Canada have undergone dramatic changes since the early 1970s, when a "catch-if-you-will, catch-if-you-can" situation existed. Since there were no quotas on fish stocks and

no licensing restrictions on fishing vessels, distant water fleets moved into fertile areas, fished down the biomass, then left (Fraser 1985).

In 1972, the International Commission for the Northwest Atlantic Fisheries (ICNAF) introduced national quota controls and managed these until 1977 when the Exclusive Economic Zone was proclaimed for Canada. This gave the government of Canada full control over the harvesting of fish stocks outward to a distance of 200 nautical miles.

The management of the seacoast fishery resource is the responsibility of the federal government as set out in the Constitution Acts. The federal Department of Fisheries and Oceans fulfills this responsibility through various fishery management programs. These programs attempt to maintain the fishery resources at levels which generate continuing economic and social benefits to the people of Canada.

In 1977, prior to the establishment of the 200 mile limit, the federal government introduced a management plan for the allotment of groundfish stocks, the allocation of the stocks and their subsequent regulation. The 1977 plan was designed to prevent further stock depletion by foreign fleets and also to ensure that a workable management plan was in action before the 200 mile Exclusive Economic Zone was proclaimed.

Since 1977, the management of the Atlantic Coast groundfish resource has been governed by annual Groundfish Management Plans. A new plan is formulated for each calendar year, reflecting changes in the biological nature of the groundfish stocks as well as in the socioeconomic, historical, and environmental factors affecting the fishing of these stocks. The annual groundfish management plan is established through a consultative forum. Processors, fishermen, unions and associations participate, as well as representatives from federal and provincial governments.

Groundfish management plans were developed primarily to curb the depletion of fish stocks caused by overexploitation. Economic outcomes generated from the harvesting, processing, and marketing of the resource are now considered in the groundfish management planning process.

The first Groundfish Management Plan established allocations to be fished by the entire Canadian groundfish fleet, including inshore[1], offshore[2], and middle distance[3] vessels. As the years progressed, the groundfish plan became special-

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[1] Inshore fleet--composed of vessels less than 65 feet in length.

[2] Offshore fleet--composed of vessels greater than 100 feet in length.

[3] Middle distance fleet--composed of vessels between 65 and 100 feet in length.

ized, with separate allocations within each stock being reserved exclusively for fixed gear[4] and mobile gear[5] within the inshore and offshore fleet sectors. These specialized management measures minimized competition between the inshore and offshore fleet sectors.

Fishing enterprises have also become complex in the 1970s and 1980s. Both the inshore and offshore fleets expanded during the early 1970s in an effort to increase Canada's share of the annual harvest. Overcapitalization in the fleet resulted. In 1973, licensing limitations were imposed on the domestic offshore fleet. By the 1980s, attempts were being made through regulations to control the "tragedy of the commons"--the excessive depletion that occurs in all open access groundfisheries.

By 1981, these management measures no longer provided for year-round fishing for all fleets. There was heavy competition among the individual vessels of all the fishing fleets, particularly the offshore fleet. Problems of inconsistent quality and of gluts on the markets during the early part of the year, primarily caused by the offshore operators, affected the livelihoods of the seasonal inshore fishermen. In an effort to resolve this bleak situation, quasi-property rights in the form of allocations to fishing enterprises (enterprise allocations) were established in 1982 for a portion of the offshore trawler fleet.

ENTERPRISE ALLOCATIONS IN THE OFFSHORE GROUNDFISH FISHERY

In 1982, the four large fishing companies that operated offshore groundfish trawlers on the Atlantic Coast of Canada at that time (National Sea Products Ltd., Fishery Products Ltd., H.B. Nickersons and Sons Ltd., and the Lake Group) were allotted individual enterprise allocations on a trial basis in most commercially important groundfish fisheries. Individual enterprise allocations were negotiated among the companies using a formula consisting of long-term historical catches, recent fishing activity, adjacency to the resource, and fishing capacity of the fleet. The companies were given assurances that their performance or involvement in the enterprise allocation program in 1982 would not prejudice their future allocations, should enterprise allocations continue beyond 1982.

The 1982 experiment excluded the independent offshore group (IOG) of 17 smaller companies. Offshore groundfish vessels operated by companies within the IOG continued to fish on a competitive basis for the portion of the offshore quotas that had not been allocated to the enterprise allocation program for the larger offshore trawler companies.

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[4] Fixed gear--traps, nets, longlines, weirs, handlines.

[5] Mobile gear--otter trawlers (draggers) and seiners.

In 1983, due to restructuring of the major offshore companies, the enterprise allocation program for the offshore groundfish fleet was temporarily discontinued. However, the industry was convinced of the benefits of enterprise allocations and decided to continue experiments on an informal basis.

Also during the 1982-83 period, a federal government task force was formed to recommend how to achieve and maintain a viable Atlantic fishing industry (Kirby 1983). The federal government accepted a key recommendation in the report of the Task Force on Atlantic Fisheries concerning the implementation of enterprise allocations in the offshore groundfish fishery (Department of Fisheries and Oceans 1986). The task force recommended that the experimental enterprise allocation program continue along the lines established in 1982 for a period of at least five years, with a view to permanent incorporation, including the assignment of allocations as percentage shares of the overall offshore quota (Kirby, 1983; Department of Fisheries and Oceans 1986).

In 1984, enterprise allocations were officially reintroduced into the Atlantic offshore groundfish fishery for all the offshore companies; the resulting restructured companies (National Sea Products and Fishery Products International); and the independent offshore group of companies (IOG). Enterprise allocations were established as percentage shares of the overall offshore quotas in each of the major groundfish stocks on an individual basis for National Sea Products (NSP) and Fishery Products International (FPI), and collectively for the IOG. Percentage shares were not extended to the individual companies within the IOG in 1984. In 1985, the enterprise allocation program continued as in 1984.

For 1986, the enterprise allocation program for the offshore groundfish fishery has been refined and developed as the result of numerous consultation sessions held during 1984 and 1985 between the federal government, the provincial governments and the industry participants. In addition to the annual establishment of enterprise allocations for all of the major groundfish fisheries, enterprise allocations were assigned on the basis of percentage shares for companies within the IOG. Also in 1986, a formula, based on an individual company's percentage share by stock, was developed for sharing stock declines among companies. The industry agreed to share declines on a proportional basis.

One of the major developments in 1986 in the enterprise allocation program for the offshore groundfish fishery was the introduction of an access fee system of licensing. Access fees, linked to each company's enterprise allocations, were introduced in place of the limited-entry form of vessel licensing used previously. Unlike the limited entry licensing system, which assigned a license fee based on the size of the fishing vessel used, the access fee system recognizes the fact that different groundfish species have different values, and assigns a license fee based on the amount and species of enterprise allocations assigned to a company.

CONCLUSION

In theory, the long-term benefits expected from the enterprise allocation program for the offshore groundfish fisheries on the Atlantic Coast include the following:

1. Enterprise allocations should promote acceptance of responsibility for the resource by the participants.

2. Enterprise allocations should reduce or eliminate destructive competition among individual vessels and should prevent competition among companies for a maximum share of the fixed offshore quotas.

3. Enterprise allocations should provide rational capital investment to serve a fishing strategy that seeks to minimize the corporate share of a given quota. This denotes freedom in the field of technology.

4. Enterprise allocations should promote more economically effective and efficient planning in processing operations.

5. Enterprise allocations should reduce market glutting. Harvesting, processing, and marketing operations should become more integrated.

6. Enterprise allocations should encourage better quality standards within the processing plants and on vessels, as well as through dockside grading.

7. Enterprise allocations should help to increase the capital worth of the fishing unit.

8. Enterprise allocations should allow companies to make investment decisions based on their own needs, without concern over the side effects of the investment decisions of others.

9. The implementation of enterprise allocations should promote deregulation of fisheries management programs.

10. Enterprise allocations should allow companies to achieve optimal size through buying out the enterprise allocations of another operation.

11. Enterprise allocations should allow those with a stake in the industry to receive a monetary value for it upon retirement (Kirby 1983).

It is difficult to assess whether the experimental enterprise allocation program has achieved these expected results. Given that the enterprise allocation program for the offshore trawler fleet is in its infancy, harvesting, processing, and marketing trends have not fully developed.

Many of the traditional input management measures[6] have been maintained until the system matures. Over time, the program should allow each company to develop long-term planning horizons linking all facets of operational and investment planning.

Enterprise allocations are assigned in most commercially fished groundfish stocks. Currently, these allocations are not freely transferable from one enterprise to another. Allocations may be temporarily transferred between companies throughout the calendar year to enable the companies to "fine tune" their harvesting plans, but permanent transfers of allocations at the discretion of the companies involved are not permitted (Department of Fisheries and Oceans 1986). The federal government approves all transfers of allocations.

As mentioned earlier in this paper, an access fee licensing system linking the size of enterprise allocations held by a company to the license fee paid was introduced in 1986. The license fee is no longer related to the size and type of vessels operated by the company. However, restrictions have been maintained on the number, size, and type of vessels permitted in the fishery. These restrictions were maintained in order to ensure that the effort in the groundfish fishery does not increase during the experimental period, thereby giving any one participant an unfair advantage over others when percentage shares and allocations are reviewed and possibly renegotiated at the end of this period.

In addition to these licensing restrictions, restrictions have also been maintained on the size of vessels which may be used for specific fisheries. For example, only vessels with brake horsepower less than 1,050 are permitted to fish for cod in the Gulf of St. Lawrence. This restriction recognizes that many inshore fishermen in the area are entirely dependent on this Gulf of St. Lawrence fishery for their livelihood.

The next three years of the enterprise allocation program for the offshore groundfish fleet will continue to be a transitional period, with traditional input management approaches gradually being replaced with new guidelines consistent with the theoretical concepts of a quasi-property rights form of fisheries management. Also during this period, a cost-benefit assessment of the program, considering social, economic, and biological factors, will be necessary to determine the optimum method of management for the Atlantic groundfish fishery for offshore vessels.

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[6] Input management measures--generally impose limitations on entry into the fishery; restrictions on technology used; restrictions on species and amount which may be caught; and limitations on the length of time that a fishery may be conducted.

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A Review of Quasi-Property Rights in the Herring Purse Seine Fishery of the Scotia-Fundy Region of Canada

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INTRODUCTION[1]

The implementation of quasi-property rights (henceforth referred to as property rights) is a new experience generally in ocean fisheries, and certainly it is new to eastern Canada. The concept is well known in economics literature, which, however, rather than dealing with property rights systems, has tended to deal with the consequences of their absence. Chief among these consequences are: excess capacity, the dissipation of rents, the prevalence of low incomes, overfishing, and the depletion of stocks.

To proponents, the establishment of property rights was considered to be the deus ex machina which would remove from the industry some of the deleterious characteristics referred to above, especially with respect to excess fishing effort and the excessive use of capital and labor which would, in turn, yield an improvement in resource rents and incomes. To those involved in its implementation, it could be described, at times, as a "Pandora's Box" that created as many intractable problems as it solved. But there has been progress and a great deal has been learned, mostly from hindsight, about the consequences of granting property rights and about the character of the industry. We are still very much in a state of flux. Moreover, there are seven years to go in the commitment to the herring purse

[1] The views advanced in this paper are those of the authors and not necessarily those of the Department of Fisheries and Oceans.

seine fleet of a property right in a portion of the allowable herring catch, before a definite statement can be made on what this venture has achieved.

Before launching into the chronology of events involving the establishment of property rights, it is appropriate to define our terms and to specify the segment and location of the fishery to be discussed. Two expressions denote the phenomenon of property rights in eastern Canada: enterprise allocations (EAs), and individual vessel entitlements or vessel quotas. The EA term denotes the right a processing firm that owns fishing vessels has to a portion of an allowable catch, but EAs do not specify the amount an individual vessel may catch; when the allowable catch is taken, the fishery is closed. The herring purse seine fishery has an overall fleet quota. The individual vessel owners have a right to a portion of the fleet quota and, beginning in 1983, they acquired the right to sell their quota and leave that particular fishery. Alternately, they could purchase additional quota to a prescribed level and continue in the fishery.

The fishery of concern in this paper is located principally at the southern tip of Nova Scotia and also in the southern part of the Province of New Brunswick at the mouth of the Bay of Fundy. A small part of the fishery takes place during the winter, further east in Nova Scotia in an area called Chedabucto Bay, but that area yields a relatively small portion of the catch (see Figure 1, map).

In order to appreciate fully the responses observed to developments in this industry, it is necessary to understand the social conditions of the region and the attitude of government toward industrial expansion and decline. The region in which this industry is located is heavily dependent on the fishery and offers little alternative basic employment. The fortunes of fishing communities ebb and flow with the fortunes of the industry. Governments, both provincial and federal, have intervened in the industry both in periods of expansion and of decline. What was a new development in the industry in the period under study was the federal government's attempt to reserve the primary fishery for fishermen. The government also promoted and supported participation in management of the fishery by organizations of fishermen. This paper, then, will address property rights as they relate to the vessel quota system of the Scotia-Fundy Region herring purse seine fishery.

DEVELOPMENT, DECLINE AND REORGANIZATION

Individual vessel quotas for the herring purse seiners were granted in 1976 during a period of crisis the origins of which had begun more than ten years earlier, when purse seiners were a smaller component of the primary fishery.

Up until the early 1960s, the herring fishery of the Bay of Fundy region was composed of weirs, gillnetters and a few

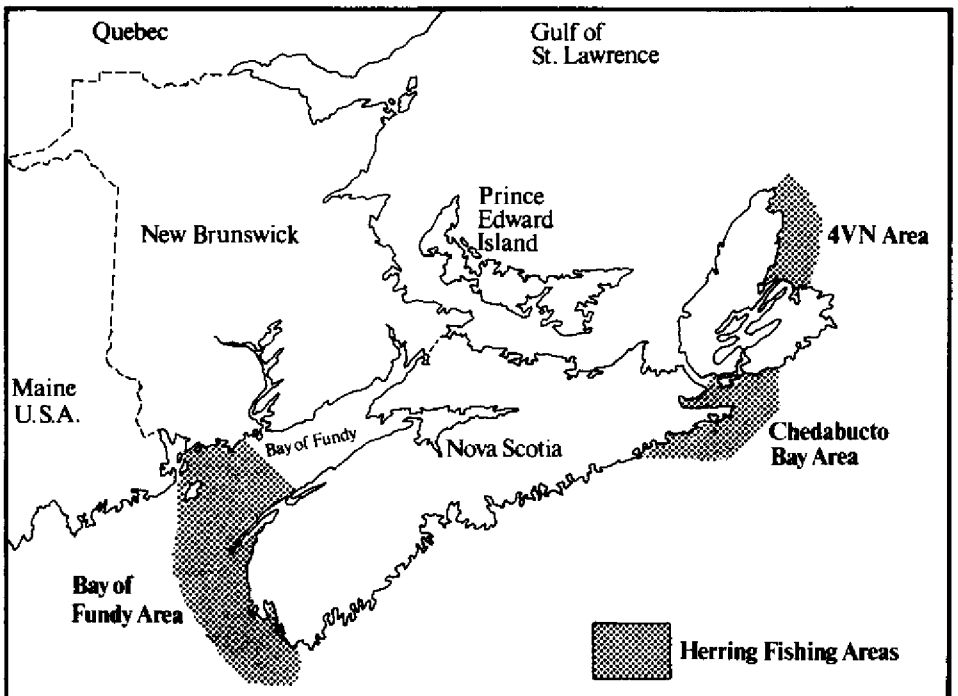

Figure 1. Herring fishing areas of the Scotia-Fundy region of Canada.

purse seiners who sold their catches for the most part to the canning industry. Further north (in 4W and 4Vn), where there had been a winter herring fishery, larger portions of the catch were used for salting and smoking. The use of herring for meal, roe, fillets, and direct sales to foreign vessels, uses that have, over the last 20 years, become dominant or major end product uses for herring, were not factors in the market. In the early 1960s, a herring fishmeal industry began to develop in Atlantic Canada.

New plants were built, old ones expanded; new vessels were built in the region; some moved from the west coast to the east to cash in on the new bonanza. This expansion of fishing effort contributed to a severe stock decline which, coupled with low prices, placed the Atlantic fleet in a state of virtual collapse by 1974. In the interim, the federal government put a stop to the entry of additional purse seiners into the herring fishery--limited entry had arrived.

An investigation of the industry was commissioned in 1975 by the federal minister responsible for fisheries at the time. The outcome of this inquiry signified a philosophical swing in the attitude of the federal government toward the accentuation of socioeconomic considerations in management options. Specific recommendations included a restructuring of the industry to: (a) separate the primary fishery from the processing sector; (b) encourage and support improved bargaining power for fishermen so that fishermen would gain control over domestic marketing of raw fish; (c) phase out the fish meal industry and convert the herring fishery to a food fishery to allow fishermen to benefit from rising prices for herring products in Europe. Measures were taken to avoid fleet reduction before and during the 1976 season.

These recommendations served as a basis for a series of actions beginning with deficiency payments (on the price of fish) to purse seine captains and led to the following events in 1976:

1. Contracts to fishermen representatives to assist in the development of a strategy for the general reorganization.

2. Prohibition of the harvesting of herring for the purpose of using it for fish meal.

3. Compensation to processing companies for losses in plant capital.

4. Formation of a purse seine "club", the Atlantic Herring Fishermen's Marketing Cooperative, to control harvesting and marketing. This control of harvesting and marketing by fishermen included: introducing over-the-side sales to foreign vessels to increase the average landed price of herring; authority to negotiate prices with processors; sharing of catch to avoid dumping; and controlling the days on which the purse seiners fished

and the processing plants to which they delivered their catch.

5. Voluntary acceptance of vessel quotas, including daily and weekly catch limits to match the catch to the production capability of processors. This represented the first attempt at sub-allocation--giving a right to a portion of the allowable catch on a per-vessel basis.

6. Government assistance to aid fishermen in acquiring ownership of the purse seine fleet.

7. Assistance for vessel conversion to improve fish quality.

8. Financial assistance to processing firms to increase capacity for human food production.

THE PROSPECTS OF THE NEW SYSTEM

In 1976, the herring industry of eastern Canada may have been in a mood to try anything that offered a measure of stability. The industry had had a history of instability deriving both from market conditions and from the changing abundance of fish, notably the collapse of many herring stocks in the North Atlantic by the early 1970s. Thus, benefits were anticipated from increased control over the removal of fish from the ocean. Further benefits were anticipated for fishing enterprises that would tailor their assets and activities to the volume of fish allocated to them. Fishing communities saw reason to hope for increased stability of income and employment.

Catch Control

Since fishermen were assured a vessel quota of a fixed tonnage of fish, it was expected that competition on the fishing ground would be reduced. The season would then be extended and gluts would be removed which, in turn, would be expected to avert the weakening of price at the height of the season. Furthermore, vessel quotas held the prospect for the industry to match annual catch to the absorptive power of the market and avoid the depressing effect of surplus production. Effective control over catch by means of quotas would help eliminate overfishing and stock reduction. In short, a vessel quota scenario in the fishery was expected to eliminate panic fishing efforts and provide a controlled harvest where catch could be matched to biological parameters, processing capacity, and available markets.

The Fisherman's Operations

Individual vessel quotas promised fishermen an equal opportunity to earn income, especially if quotas were equal. In other words, they would eliminate extremes in earnings--rich fishermen and poor fishermen. Fishermen could then plan for the year to dispose of catch in such a way as to maximize

revenue; and pursue operational strategies, including investment, so as to minimize cost. Each fisherman would then be in an improved bargaining position, since he could count on the tonnage he had to sell. This would be a major change from an open fishery where skill, equipment, quality of opportunity and privilege play a role in determining the catch, the availability of markets and income.

The Fishing Communities

In most fishing communities there are typical distributions of characteristics among fishermen; namely:

- Only a few fishermen are in the highline category in any fishery.

- Highline fishermen have secure markets; with a few exceptions, they compete for sales.

- Most fishermen on the east coast of Canada come from small communities totally dependent on the fishing industry; therefore, the introduction of management concepts like property rights have the potential for far-reaching repercussions.

For a large portion of the purse seine fleet and the communities they represented, individual entitlements would provide a type of security--increased income for fishermen and more stable and orderly employment in the processing sector--benefits that go beyond the vessels in the purse seine fleet and thus elicited the support of the communities. But despite the potential benefits of property rights in a portion of the TAC to some segments of the industry, to highline fishermen and their crews they represent a restriction on their accustomed style of operation and status in the community. To these people, frustrations could be expected to abound, as restrictions on operations and catch increased. To these proficient crews, any property rights plan would destroy initiative and the incentive for hard work. In addition, the firms dependent on the highliners would experience a change in their style of operation, a change they could be expected to resist.

Management

Vessel quotas were expected to provide other opportunities in the realm of management. One of these was the opportunity for fleet rationalization through the buying and selling of quotas. Along with the vessel quota system, an opportunity would be established for fishermen to participate in the management of the fleet. Where capacity exceeded requirements, a system for dispatching vessels to fishing grounds and to processing plants would provide a measure of order that would not otherwise prevail.

The foregoing paragraphs of this section presented an outline of the expectations of what would follow from the establishment of property rights in the regionally-based her-

ring fishery, burdened with overcapacity and a potential for widespread ruin. If these expectations have not been fully realized to date, it is not so much due to the inevitability of Murphy's Law as to the inability of human ingenuity to conceive the outcome in every detail of such measures.

UNFOLDING OF PROPERTY RIGHTS 1976-1982

Apparent Success, 1976-1978

The observed acceptance and adherence by fishermen, for the first three years, to the system of quotas established for 1976 and continued with modifications since that time, led many observers to believe that a solution was in sight for the management of the unstable herring fishery. There were good reasons for compliance with the plans laid out by the government in conjunction with the representatives of the fishermen and processors. The alternative would have meant severe hardship for the fishery, at least in the short run. The phasing out of fish meal processing in favor of developing a food fishery assured a doubling of the price paid for herring that could be absorbed for food processing. The market price was buoyed by the collapse of the North Sea herring stocks and the subsequent strong demand for Canadian herring in Europe. The price was further supported by a deficiency payment to the purse seiners by the federal government. By participating in the program and accepting the objective for the fleet, all were assured survival. The fishermen were assured of individual shares since the management of the fleet was assigned to their own organization, the Atlantic Herring Fishermen's Marketing Cooperative (Co-op). An over-the-side sale was arranged with Polish vessels at a price for fish much higher than the domestic price. Only those who belonged to the Co-op were able to participate in this program. The season, which was lengthened through the new system, assured every crew the opportunity to take its quota.

The cohesion of the fleet continued in 1977. The fishermen who stayed outside the Co-op in 1976 joined in 1977. This gave them access to over-the-side sales. All accepted the centralized management of the Co-op within the guidelines provided by scientists and administrators of the Department of Fisheries and Oceans. Fish meal processing was stopped altogether; and the price received by fishermen doubled over the year before. The achievements of 1977 continued into 1978.

Cooperation Weakens - Problems in the Fishery

The first three years of the new organization were characterized by cohesion in the fishermen's organization, strengthening of markets and good quality in the natural resource. Difficulties for the industry began in 1979. A splinter group of fourteen purse seiners broke away from the Co-op to form the South West Seiners Co., Ltd. This meant a break in the unified management of the fleet, a rise in the

independent spirit, which had been temporarily suppressed during the times of stress, and dominance of port markets again by processors. The quality of the fish deteriorated with the prevalence of small fish, the frequent occurrence of "red feed", and a high fat content. The difficulties caused by these problems could have been mitigated had all the vessels carried cooling systems. The loss of control by the Co-op made it difficult to monitor quotas; new vessels that had cooling capacity began to exceed their quota, and thus intensified a problem which, while not unknown in the industry before, has bedeviled it since--unreported catches. The lower quality affected both the volume of herring that could be marketed and the price paid for it. The herring fishery appeared to be in trouble again.

The years 1980 to 1983 have been referred to as a nightmare. The depressed markets and inconsistent quality of the herring meant that fishermen received low prices for their fish. Fishermen attempted to offset their declining incomes by overfishing--a problem that continued until a minor abatement in 1985. It became evident that the basic problem of the industry could not be patched over with subsidies, price supports and over-the-side sales. By 1982, it was recognized, and perhaps for the first time admitted, that the industry was suffering from excess capacity, and that viability could only be obtained through a reduced fleet made up of modernized vessels capable of landing high quality herring. Measures to this end were introduced in the management plan of 1983.

Rationalization Becomes an Objective

In 1982, the purse seine fleet to be managed in Scotia-Fundy consisted of 65 vessels. Forty-nine of these were from the Scotia-Fundy Region itself, and 16 were from the Gulf of St. Lawrence Region. Within the Scotia-Fundy fleet, 42 vessels were owned by fishermen, although minority shares in some vessels may have belonged to processing establishments. The Scotia-Fundy fishermen were represented by two associations: the Atlantic Herring Fishermen's Marketing Cooperative, with 35 members and the South West Seiners Co., Ltd., with 14 members. The purse seiners of the Gulf of St. Lawrence belonged to the Gulf Seiners Association. All three associations were, in reality, only loose cooperative arrangements, although the South West Seiners, Co., Ltd. has served as an administrative organization for its members. None of these organizations were exercising much control over their members by 1982. In the 1980s, the organizations lost control, and the independent behavior which had characterized the herring purse seiners in the past again became a dominant characteristic.

The 1983 management plan was designed to correct some of the previous deficiencies as well as to promote conformity with the objectives of conservation, viability and efficiency. This plan contained substantial modifications to previous plans and involved the following steps:

1. Industry consultations. The extensive consultations with representatives of the three seiner groups, which had taken place between 1981 and 1983, were to continue.

2. Separation of the fishing fleets. This separation resulted in the entire 4WX purse seine herring allocation being assigned to the Scotia-Fundy fleet. The purse seiners based in the Gulf of St. Lawrence had their fishing activities confined essentially to that area, with minor catches allowed them in the adjacent area of 4Vn. This action was necessary so that effective quota transfers could occur; that is, only a quota acquired in the same region could be fished by the buyer.

3. Single fleet quota developed. Areas 4W and 4X were combined and a single quota established for the two districts. Previously, there had been a separate fleet quota in 4W and in 4X. Three classes of vessels were identified in this revision: those fishermen-owned vessels fishing only in the Bay of Fundy (Class A); those fishermen-owned vessels fishing the Bay of Fundy and other areas (Class B); and processor-owned vessels (Class C). In most cases, Class A vessels were less than 65 feet; Class B vessels over 65 feet; and Class C vessels over 65 feet in length. The quota of each vessel was a proportion of the fleet allocation and was based on its historical performance.

4. A fleet-reduction program was implemented. This involved granting the right to transfer vessel quotas through sale and purchase as a mechanism to remove vessels, with the constraint that no single vessel could acquire more than 4 percent of the purse seiner allocation.

5. Guarantees were given by the Minister of Fisheries and Oceans as follows:

   - ten-year duration of the program;
   - vessel quotas would remain in effect for the duration of the plan;
   - the purse seine fleet would have an overall quota of at least 80 percent of the 4WX TAC; and
   - no new purse seine licenses would be permitted into the fishery.

6. Vessel replacements were permitted, provided that the fish hold of the replacement vessel be installed with a refrigerated sea water (RSW) or chilled seawater (CSW) system.

This management plan was introduced in August, 1983. Initially, it appeared to function fairly smoothly, but before

the season was over the system again began to reveal flaws. The quota assigned to each enterprise was, in most cases, far less than the vessel's catching capability, and thus misreporting became rampant. The situation was alleviated somewhat in 1985, when the fleet quota was increased by about 65 percent (the increase in TAC was contrary to the advice of DFO biologists). This increase in the fleet quota was a package deal between the Department of Fisheries and Oceans, the purse seiners, and the processing industry. In addition to the extra quota, the agreement included greater access by DFO officers to the information available at the offices of the purse seiner associations. The industry made a collective agreement to manage the fishery in accordance with the management plan, to observe the regulations, and to provide accurate catch data for stock assessment.

In the next pages an attempt will be made to lay out and, as much as possible, explain some key issues in this attempt to implement a property rights system.

MISREPORTING

Most aspects of the misreporting syndrome relate to the dollars and cents of the fishing business and appear to be determined by the following: quality, excess capacity, large debt, price (negotiated or otherwise), and collusion among fishermen and between fishermen and processors. Misreporting can be defined as landings for which no accounting has occurred, or for which the figures supplied differ from the actual. Fish discarded at sea and not reported can also be included within this definition. Recent analysis of this issue for the Scotia-Fundy Region (4WX) indicates a long history of underreporting that since 1973 has differed from the actual by a factor ranging between 1.3 and 1.8. A common conception among fishermen in the Bay of Fundy herring purse seine fishery is that misreporting of landings has always occurred; furthermore, it is not a phenomenon restricted to purse seiners alone. In general one might say, somewhat cynically, that if there is an incentive to misreport, it will be done.

Underreporting sometimes happens before the fish even reaches the shore. When the fish are seined and found to be unsatisfactory due to the small size and/or the amount of "red feed", they are released. Some or all may be killed in the process. Sometimes vessel owners dump whole boatloads at sea rather than face apprehension by enforcement people monitoring quotas. In these cases, neither the kills nor the catches will be reported. This is referred to as "culling at sea". It is a practice that impedes accurate biological assessment and is prohibited by regulation.

Processors typically buy fish for a particular end product; therefore, their willingness to buy a boatload of herring will depend on the yield of fish of the required size and quality. For example, if the yield of the desired quality is 80 percent, 20 percent will not be paid for. Thus, the

sales slip will only show, at most, the amount purchased, and less if there is further underreporting. The fishermen, who consider fish not paid for as fish given away, are also quite happy to see that volume ignored when debits to their quotas are recorded. The seller and the purchaser therefore have a mutual interest in ignoring that portion of the catch. This situation is reinforced by a negotiated price for herring.

There are other relationships between the fishermen and the processing firms that give them an incentive to collude. Processors may own a vessel entirely, or a portion of it. They may extend loans to fishermen. Given this situation, the small size of the quotas, and the available excess capacity, it would be more surprising if no attempt were made to exceed quotas and to fail to report the catch.

Another factor involved in the misreporting of catches derives from misconceptions concerning the schooling of herring stocks. Schooling is a phenomenon of the species unrelated to the size of the stocks. Herring will school whether on the verge of extinction or in great abundance. When the fisherman encounters a school of herring, he sees fish by the millions and may consider his own catch to be insignificant relative to the biomass. He may then view the restrictive advice of the biologist as being fallacious and an unfair imposition.

Attempts to obtain reliable statistics on landings have often been very difficult; and unreliable statistics made convictions in court virtually impossible. There were six possible sources of catch figures. There were the captains' hails by radio. If the officer observing the landing at dockside disagreed with the captain's estimate, he submitted his own hail. A further source was the delivery note that was written up when the fish was transferred to a truck for over-the-road delivery or otherwise changed hands; and there was the sales slip from the final purchaser. In extreme cases, the trucks carrying the fish of a suspect fisherman would be weighed by the enforcement agency, yielding a fifth record. Finally, there was the vessel log record. This hodgepodge of records generated in the industry is frequently unreliable, so the permanent records obtained from them are often less than satisfactory for legal use, or any other use.

Misreporting can be seen as an expression of disagreement with current management strategies. A common purpose does not exist in any portion of this fleet. Each captain views management options as they affect him. As a result, even under the most conciliatory of plans, disagreements will occur. It has been documented in this fishery that when vessel quotas are fully accepted and voluntarily implemented (the 1976-78 case), there will be compliance; if imposed by bureaucracy, however, they will elicit considerable negative reaction: overfishing, misreporting, and challenges to authority all the way to the courts of law.

ENFORCEMENT

Legal Aspects

Once management programs in the herring fishery required fishermen to adhere to their individual quotas, enforcement became a problem. There are several reasons for this. First, when quotas were established, insufficient attention was devoted to the question of enforcement. The enforcement of quotas requires legislation, followed up by detailed regulations designed to implement it. The process of putting all that in place is slow and cumbersome, and it is possible that the experience would have been different had the system of regulations been established before quotas were allotted. Second, although fishermen accepted the rationale of a quota system, some have continued to seek loopholes and to invoke the Charter of Rights in their defense when caught red-handed. To date, there is no regulation stating that a fisherman must weigh the fish he sells. Thus, he cannot be charged with misreporting the weight sold when he can declare ignorance of the exact amount, not having been required to weigh it. Furthermore, the court system does not appear to share the same concern as enforcement bodies regarding issues such as overfishing or exceeding vessel quotas and failure to report the same. Attempts to deter overfishing and to limit individual catches to the quota allotted have consequently taxed to the limit the enforcement manpower of the Department of Fisheries and Oceans. Thus, the attempts to force fishermen to operate within the limit of the individual quotas have met with less than notable success.

Once vessel quotas were put in place in Scotia-Fundy, the catches by the purse seine fleet were not restricted to the total allowable catch. Once a property right to catch a given quantity of fish was granted, it was not rescinded until the season was over. That is, the right of a particular vessel was not compromised because of the activities of others. However, in an attempt to keep catches in line with the TAC, it was found that by assigning a portion of the quota to a short period, for example, a week, and requiring compliance in that period before a reassignment of quota in the following period, a measure of control was acquired. Longer periods led to a lack of continuity, errors, and a backlog of data. This conclusion was supported by written reports of violations brought to the attention of fishery officers--occurrence reports (of which there were 185 in 1985). An element of surprise was added to enforcement by selecting at random where spot checks would be made. Such tight control causes a mushrooming problem in another direction. If, for example, there were a fleet of 40 vessels and four quota periods, the number of quotas to be monitored and enforced for the season jumps to 160.

Earlier in this paper it was pointed out that the proponents of property rights did not envisage a need for additional enforcement; rather, its reduction or elimination was expected. Some fishermen did adhere to the rules, but it

tended to be those whose capability matched fairly closely the quotas they were allowed. There were, however, notable deviations from the allotted quotas. Recent research on this issue has produced estimates that enable us to adjust reported catches in the herring fishery. Between 1973 and 1979, it has been estimated that actual catches exceeded reported catches by a factor of 1.2, and by 1984, by a factor of 1.8, during a time when fishery officers were monitoring landings nightly.

It is clear that given the characteristics of the Scotia-Fundy purse seine fleet, and given a free hand, fishermen cannot be expected to enforce or observe their own quotas. Thus if a quota system were to be introduced in an industry with similar characteristics, extensive enforcement mechanisms would be required to prevent abuse. For the Scotia-Fundy Region, the following series of steps have been considered necessary:

Steps taken in 1985:

1. A condition of license which requires a report of the quantity landed, area and time of fishing

2. A weekly renewal of this condition of license

3. Authority to demand at time of landing a record of all fish caught, bought and sold

4. A requirement that the captain of the vessel provide signed landing slips and log records

5. Annual licensing, including restrictions on gear and area of activity

Additional regulations proposed:

6. Regulations enabling the Department of Fisheries and Oceans to close ports to landings, if deemed necessary to control abuse

7. Regulations requiring purse seiner captains to specify where fish will be landed

8. Regulations requiring the industry to weigh all herring at the point of landing

9. Regulations requiring that all processing records be kept and made available/forwarded to enforcement authorities

In addition, other requirements include coverage at sea with patrol vessels to observe fishing activity and, on land, wharf monitoring.

Costs

It should be obvious from the discussion to this point that the enforcement of the vessel quota system has been time-consuming and costly. The elements of the process are varied and include: the preparation of annual plans, setting up and pursuing paper trails, monitoring, enforcement, and being involved in court proceedings. In addition, other enforcement activities were sacrificed because of the diversion of personnel to the purse seine fishery. Then there were the financial costs involved in all this. For 1985, it is estimated that the cost in salaries and overtime exceeded $500,000. This was for a fishery of 90,000 metric tons with a landed value of $18 to $20 million, involving 42 vessels and 20 to 25 unloading ports.

Government agencies in Canada, and just about everywhere else, depend on the activities and output of the fishing industry to provide the data necessary for analysis and decision-making. Unfortunately, the atmosphere of confrontation that has prevailed in the herring fishery in Scotia-Fundy in recent years makes such a free exchange difficult and sometimes impossible. It might be difficult to put a dollar value on the cost of a lack of mutual respect, but certainly that cost includes a reduction in the effectiveness of public agencies.

CONCLUSIONS

The objective of this paper was to tell a story of the experience in Scotia-Fundy in attempting to implement quasi-property rights in the purse seine herring fishery and, maybe somewhat cautiously, to point to some causal factors in the outcome. The experiment, if such it be, is not over; there are seven years to go, and in the interim there will likely be additional efforts through legal means to exercise tighter control. It is also possible that the number of vessels in the fleet will diminish in the interim. Our views of the experience could very well differ in 1992 from what they are now.

The stated objective in implementing a system of property rights in the herring purse seine fishery was to improve and stabilize the profitability of the fleet, to modernize it, and to give it the capability to land a high-quality product. Wrapped up in all this was the belief that conservation of the stock would be easier to achieve.

The first three years of the system, 1976-79, appeared to be successful. That success has been attributed to the existence of a single management authority--which seems to imply that fishermen were completely independent of fish processors and that the fleet management was completely independent of its members. In this manner a cooperative spirit or peer pressure would compel adherence. Actually, the conditions in the industry at the time, and the incentives offered, made belonging to that management authority (the Co-

op) financially rewarding. In 1979, when markets turned sour, the Co-op itself broke up and fishermen began to exceed their quotas. Nevertheless, after the split in the Co-op the purse seine fishermen formed a separate organization called Fundy Coordinators to manage over-the-side sales to foreign vessels on behalf of all the purse seiners. This organization enabled the benefits of this operation to be shared equally among all crews. It would appear that fishermen will belong to a single organization as long as the benefits exceed the sacrifices.

By 1983 the problem fostered by excess capacity, an insufficiency of quota to give all the vessels sufficient income to be profitable, began to be recognized and addressed. Quotas were made salable. Seven vessels have been removed and their quotas bought by other purse seine owners. Four of those sank prior to the sale of the quotas. The fact that vessels did not have to be disposed of when the quota was sold no doubt facilitated the process. A processing firm that owned two vessels combined the quotas on one vessel and removed the other from the fishery. Only two independently owned and operated purse seiners have sold their quotas. One might wonder at the reluctance to sell a quota obtained free in a fishery that is frequently depressed. The answer appears to be that no one will buy an extra quota when it can be obtained by fishing it and failing to report it. The process has been slow, but with tighter controls, so that catch figures are closer to quotas, more fishermen may be encouraged to take their gain and leave while there is time left in the guarantee. We shall have to wait and see.

The conversion to modern efficient vessels capable of landing high-quality raw material has also been slow, but by mid-1985 two newly constructed vessels had entered the fleet and four others were under construction. Furthermore, there is evidence of down-sizing of vessels to match the quota and to operate at lower cost.

The exceeding of quotas and the misreporting of catches has been frustrating to the interests of stock management; this problem has been costly and divisive, since some fishermen are apparently allowed to break the law with impunity. Given the excess capacity in the fleet and the "mores" of fishermen it should not have been unexpected. But it appears that an efficient property rights system for independent fishermen requires as a first important step bringing capacity more in line with allowable catches than has been our experience.

ACKNOWLEDGEMENTS

The writers wish to acknowledge the comments and suggestions of M.C. Cormier, Janice Raymond, and Hugh Corston of DFO, Halifax; and Pamela Mace of the Bedford Institute of

Oceanography. We reserve for ourselves the responsibility for any remaining deficiencies and errors.

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Management Measures to Control Commercial Fish Harvest: The Ontario Experience

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INTRODUCTION

Ontario has one of the largest and most valuable freshwater resources in the world. One-sixth of the total expanse of the province is fresh water. The Canadian portion of the Great Lakes covers an area of 33,400 square miles, plus another 34,800 square miles made up of smaller lakes, rivers and streams. The fish populations in these waters have supported a commercial fish industry for approximately 160 years. The industry is the largest producer of freshwater fish in Canada, having caught some 49,927,046 lbs with landed value of $35 million in 1984. This figure represents less than 1/2 percent of the Gross Provincial Product. The industry provides full and part-time employment to over 2,000 fishermen. A further 900 people are engaged in fish handling and processing.

The fishery is widely scattered throughout the province, but is concentrated along the Great Lakes, notably Lake Erie. Fishing vessels range from canoes and gillnetters in the remote northern settlements to large, modern trawlers, equipped with the latest electronic gear, on Lake Erie. In recent years Lake Erie has contributed about 80 percent of the total provincial catch.[1]

[1] Catch statistics and values, and statistics on employment and investment in the commercial fishery, are available from the Director of Fisheries/Ontario Ministry of Natural Resources/99 Wellesley Street West/Toronto, Ontario/CANADA M7A 1W3

Early urban development, the American Civil War, World War I, and the economic expansion stimulated by World War II prompted higher production, which with the effects of pollution and the invasion of the lamprey, alewife and smelt, had a detrimental effect on many fish stocks. Changes in catch composition took place, characterized by losses of larger and more highly valued species and increasing industry reliance on those less valuable. For example, lake sturgeon, lake herring and blue pickerel have virtually disappeared from Lake Erie, leaving a fishery reliant on yellow perch, smelt and white bass.

The early, unlicensed, commercial fishing industry was directed to local (Canadian) markets. Population centers grew, and by 1855 fish harvested from Lakes Huron, Erie and Ontario were being exported to the United States. Commercial fishing licenses were first issued in Ontario in 1890. Although the records are not clear, commercial fish licensing as it has become familiar to current participants came into being in the early 1920s, when fishermen were required to report their catches monthly.

The loss of stocks through exploitation and the depredations of the lamprey in the Upper Lakes caused such disarray in the fisheries that fishermen were allowed to keep their licenses in abeyance from 1957 until 1966. It was during that period that the principle of limited entry was confirmed. In the early 1960s, price aberrations led to the formation of a Fisheries Prices Support Board with the goal of stabilizing yellow perch prices. By the late 1960s the commercial fishery had gained strength, aided by lamprey control, careful and innovative marketing, and a vessel building program supported by the federal government. By the 1970s, the status of fish stocks in Lakes Erie, Ontario, Huron and Superior prompted expressions of concern by the governments of Canada and Ontario. It was agreed that Ontario's fisheries problems required a coordinated strategy if Ontario's sport and commercial fishery values were to be maintained. The Strategic Plan for Ontario Fisheries, published in 1976, was the result. The plan called for the rationalization of the commercial fishery.

FISHERIES ADMINISTRATION PRIOR TO 1984

Other than adherence to limited entry on the Great Lakes (new fisheries managed by species quotas were allowed to develop on northern inland lakes) and a zone quota system in eastern Lake Superior, Ontario practiced a system of management which provided individuals with the right to go fishing on an annual basis. Licenses were issued at a nominal fee, based on the type of fishing gear used, for an unspecified quantity of fish, in an area or lake, for one year. The methods of harvest control may be best described as indirect, limiting gear and harvest efficiency by means of seasons, area exclusions, mesh sizes, gear limits and size limits. During the period from the late 1960s to the early 1980s, fishermen increased their fishing effort through ves-

sel purchase and the use of more efficient gear to compete with other fishermen to gain a larger share of the most valuable species. The catch potential of the fleet expanded, aided by gear improvements (nylon multi-filament, monofilament nets) and fish-finding technology.

As signs of overexploitation became more widespread, managers attempted to contain catch efficiencies further by instituting even more regulations, to the extent that the regulations became almost incomprehensible, even to conservation officers. The fishermen responded by under-reporting catches, introducing further gear innovations, and acquiring larger vessels. The costs of management increased, and so did the costs of operation. Any profit tended to be invested in fishing equipment, and the black market value of fishing licenses, which were ostensibly annual instruments, and which had acquired a speculative value, rose. Moreover, the administrative system made no provision for the reduction of the number of participants. It is trite to say, but true of the situation, that there were too many licensees chasing too few fish.

POLICY DEVELOPMENT, 1979 TO 1982

The commercial fishery's system of administration which no longer met the needs of the industry or of society at large. Spurred on by problems of fisheries resource availability in the Great Lakes, signs of imminent collapse in specific commercial fish stocks, and angler criticism of Great Lakes lake trout rehabilitation measures, which allowed commercial netters to take lake trout, the Ontario Ministry of Natural Resources (O.M.N.R.) began tentative overtures to the commercial fishing industry, represented by the Ontario Council of Commercial Fishermen (O.C.C.F.). As a result, O.C.C.F. agreed in 1979 to join with O.M.N.R. to form a joint "Committee to Modernize the Ontario Commercial Fishery." That committee presented its report in 1982. The report contained elements which served as a basis for the system of commercial fisheries administration system that subsequently developed.

The program goals were:

- protection of stocks
- economic well-being of the commercial industry
- confirmation of commercial fishing as a contributory primary industry
- reduction of conflict with recreational fishermen

Main features of the program were:

1. Harvest control: Individual species quotas were assigned to each fisherman according to guidelines agreed to during consultation with participants. Past performance was a major factor in quota decisions on the Great Lakes. All fishermen licensed in 1983 were considered eligible for a share of the commercial fish al-

location. Calculation of past performance referred to a period of seven years prior to 1983. Fishermen received their share as the average of the three best years recorded in the period. This calculation became known as the "Provincial Formula." There were variations in the years considered because of known effects of weather or poor year class strengths in some areas in the period immediately prior to 1983. The Minister made provisions for appeals when he announced his decision, in January 1984.

The field components of the commercial fish harvest controls include a system of regions (8) and districts (43), staffed by conservation officers. The legal requirement, established under the Ontario Fisheries Regulations, is that fishermen must report catches and sales, up to and including the first transaction, on either a daily (Lake Erie) or monthly (elsewhere) basis.

All sales receipts other than for fish buyers registered by the Department of Fisheries and Oceans are submitted monthly. These fish buyers are in turn required to report their purchases and sales. Then reports are fed into a computerized system programmed to deal with licenses, assigned quotas, monthly harvest, and harvest-quota reconciliation.

2. Transfers of licenses and quota: Ontario's program of commercial fisheries modernization provides each fisherman with a form of proprietary right in the fishery as represented by the sum of the quotas of each species assigned to him or her. These quotas may be sold wholly (requiring Deputy Minister, O.M.N.R. approval) or in part to fishermen in the same fishing zone.

3. License fees: New license fees were introduced: the fee is comprised of a base price of $100.00 plus royalties. The royalties are intended to provide a more meaningful contribution to management costs associated with the commercial fishery. Although they haven't been confirmed, royalties are to be introduced in 1987, and will approximate 1 1/2 percent of the landed value; a gross revenue in the range of $600,000 is expected (Canadian); an increase of more than $500,000. The industry has been led to understand that this contribution will rise as time goes on.

4. Reduced regulatory controls on fishing: Complicated regulations characteristic of indirect means of controlling harvest were dispensed with to a large extent. Many of the important regulations that have been retained are embodied as license conditions. Local workshops were held to promote fishermens' awareness of the new rules of the game.

5. Cooperation: Ontario's program to modernize the commercial fishery came about after prolonged consultation and involvement on the part of industry representatives. This developing partnership was given further opportunity to grow when the Minister made financial provision for further cooperation in the areas of "self-policing" and fisheries assessment, in Lake Erie and Lake Huron respectively; and by encouraging such ventures elsewhere.

PROGRAM IMPLEMENTATION

In January 1984, the Ontario Minister of Natural Resources announced his intention to move to individual species quota management for the 1984 fishing season and subsequent seasons. Perhaps prompted by an awakening awareness of the implications to its rank and file members, who were largely unaware of what had transpired to that date, the Ontario Council of Commercial Fisheries publicly repudiated its former support for individual quotas as a means of administering the fishery, on the basis that the "conditions of acceptance" (more enforcement, more fisheries assessment and centralized control) referred to in a covering letter submitted with the committee's report had not been met. Furthermore, the Executive Vice President of the Council and other Council officers traveled to the local Association meetings, actively counseling fishermen against entering into negotiations on allocation and sharing formulas. Faced with this predicament, the Minister of Natural Resources chose to maintain the momentum towards modernization by resorting to the "Provincial Formula" for quota sharing. The formula recognized the level of fisherman commitment and financial investment as represented in a fisherman's production records. It did not take into account historic conditions of stock strength, nor market forces, which may have made fishing so uneconomical for some that they ceased to fish.

As negotiations reopened in 1984, O.M.N.R. began a series of evaluations of allocation and quota sharing formulas. It was felt that this was needed because of mathematical errors and because industry representatives subsequently presented quota-sharing suggestions that served the industry better than did the Provincial Formula, without threat to the resource. Even so, the Provincial Formula remained the dominant mechanism throughout the Great Lakes. Historical records, Ryder's Morphoedaphic Index based annual yields, and, rarely, fisheries assessment based predictive models used in inland (non Great Lakes) waters, complete the picture of means used to derive allocations to the industry.

RESPONSE OF THE INDUSTRY

The January 1984 announcement and subsequent implementation of individual species quotas stimulated certain responses in the industry, as follows:

Appeals to Quota Review Committees

The announcement of the impending change to individual species quota management was accompanied by the provision of lake quota review committees, with a paid chairman who, having heard the facts put forward by both individual fishermen and the local manager, made recommendations for solution to the Minister. One hundred out of 900 licensees resorted to this form of arbitration.

Appeals for Government Assistance to Avoid Financial Disaster

It is difficult to assess the seriousness of each claim, but twelve fishermen made distinct and substantiated appeals to the Minister for some form of financial relief following the introduction of individual species quota management in 1984. Without exception, these individuals were from Lake Erie; they had chosen to ignore a 1981 Minister's letter advising against further investment in the fishery, and they had incurred heavy debt loads by purchasing fishing operations modest catch performances. Except for two special circumstances resolved by buy-out by the agency, no relief was provided. Ten appellants remain in the fishery, and two have since bought complete or part quotas from others.

Development of Self-Regulation

During the last year or so of the limited access (but unlimited harvest opportunities) administrative system, a group of fishermen and processors in western Lake Erie took steps within the industry to ensure local compliance with license conditions devoted to incidental catch and the walleye quota (the only species in western Lake Erie under quota from 1977 to 1983). Their motivation was clearly to demonstrate the effectiveness of "self-policing" and to deflect the need for province-wide individual species quota management. Despite the inevitable disenchantment that followed the introduction of individual species quotas in 1984, a demonstration of clear resolve to enforce individual quotas by O.M.N.R. prompted continuation and subsequent refinement of the self-regulation which is now in effect at Lake Erie ports. Self-regulation, in its Lake Erie form, requires fishermen to land fish at specified ports and between certain hours and relies on (a) trusted executive officers from the industry with the authority to enter fish houses and verify records and contents of fish boxes, (b) a commitment by the fishermen to the rules established by the processors, and (c) a free exchange of information between the executive officers responsible for self-regulation and the local office of O.M.N.R. The system is now so refined that industry officers have access to O.M.N.R. enforcement files and the fishermen have a clear role in enforcement, formerly wholly the responsibility of O.M.N.R.

Challenge to the System

Although a large proportion of industry participants accepted the implementation of individual quotas with minimum demonstration of reluctance, a segment of the Lake Erie fishermen chose to ignore the strictures imposed by the quota system, on the grounds that the Minister of Natural Resources was not empowered, in law, to impose individual quotas. In September of 1984, a group of fishermen challenged the Minister's power to administer quotas. A series of court decisions created considerable confusion, which was finally resolved in February of 1985, when the Ontario Supreme Court found that the Minister has the power to administer the fisheries by means of individual quotas. That decision was subsequently appealed to the Supreme Court of Canada, where it is yet to be heard. The period of uncertainty in 1984 resulted in a small number of fishermen continuing to fish aggressively until forced to cease by bad weather. These individuals were subsequently charged, as were others who clearly exceeded their quotas without reasonable excuse. On the positive side, the Minister received widespread support from the industry for the retention of individual species quotas during the period of the Court challenge.

Marketing Strategies

The individual species quota system in Ontario is only entering its second complete year of operation in 1986, but it is already apparent that the fish processors have adjusted their operations, and their prices to fishermen. This fact became evident in 1984, when yellow perch, walleye and smelt prices advanced, only to fall dramatically during the period of uncertainty and glut resulting from the court challenge already referred to. Further evidence of price support prompted by demand appeared in 1985, when a group of fishermen in eastern Lake Erie asked for an increase in smelt allocation of some six million pounds. The processing sector greeted the news of the Minister's agreement to the request with expressions of consternation, and the smelt market collapsed. After that episode, industry leaders and processors formally tendered a resolution to the Minister to the effect that any request for allocation or quota increases, in year, be routed to industry representatives for their recommendation, and that 60 days notice be given of any additional allocations, to allow for market adjustments. The prices of high volume, market-vulnerable species, notably yellow perch, smelt and whitefish, are clearly susceptible to changes in supply volume.

Fishing Strategies

Faced with the implementation of individual quotas in 1984, the industry reacted in various ways, depending on local and individual circumstances. Generally speaking, fishermen on the inland lakes fished much as they had before by virtue of long association with quota management in one form or the other. If anything, the fishermen of eastern Lake Superior

were encouraged by individual species quota management, which guaranteed their share of the allocation. In previous years they had been subject to a zone quota system that effectively closed all fishing once the lake trout quota was taken by large operators. Small operators had been left fishless, on the beach, or with only a meager share of the zone allocation. This fishery was really a "racehorse fishery," which terminated in 1984 with the introduction of individual species quota management. Further south, and particularly in Lake Erie, the quotas were sought for and caught with relative haste. Somewhat elevated prices were a factor, but another was a level of distrust of the agency that prompted fishing operators to acquire their share "in case O.M.N.R. changed its mind." In individual circumstances it appears that operators deliberately increased their harvesting efficiency in order to catch their quotas early, thereby justifying requests for further quota assignments in order to maintain local employment. In consequence, any early attempt by the Lake Erie portion of the industry to maximize real income by marketing strategy or harvesting efficiency has been masked.

Acquisition of More Quota

Other than government financed buy-outs, concentrated in Georgian Bay (of Lake Huron), Lake Ontario, and Lake of the Woods, and intended to reduce total harvest on stressed fish stocks in favor of the recreational fishery, movement among fishermen to acquire more quota by purchase only began to gain momentum in mid-1985, one year after introduction of the individual species quota system. Two factors had served to slow reconciliation of quota with fishermen's business objectives until that time. First, and most influential, was the court challenge to the Minister's authority, which was perceived by the industry as a test of the individual species quota system's future. The decision of the Ontario Supreme Court cleared the way for business decisions, and in the period mid-1985 to the present (April 1986) 18 complete fisheries changed hands. Second, was a 1984 decision by the Minister denying sales of part quota due to fears of monopoly. That decision was rescinded in 1985, and since then 70 transactions, worth over $500,000, have taken place involving monetary payments, as well as trading of species. A joint Ministry-Industry appraisal of the effects of such transactions in January 1986 revealed no sign of any developing monopoly.

SITUATION TODAY; OBSERVATIONS

Ontario's individual species quota management system is now in its third year of implementation. Any appraisal of the effect of the system on the fish stocks themselves would be imprudent. Even so, some interim observations on the effectiveness of the system are in order. That some of these are negative in nature may be of interest to agencies considering similar measures elsewhere.

Protection of Stocks

The extent to which fish stocks have been given actual protection has been masked in Lakes Erie and Ontario by the fact that some species were overallocated in 1984, largely because of reliance on past performance (spanning a period of overfishing) as an allocation sharing method. The paucity of year classes supporting the yellow perch and smelt fisheries in Lake Erie and the yellow perch fishery in Lake Ontario continues to give managers cause for concern. Elsewhere, managers have confidence that allocations for all commercial species are within reasonable bounds. Although certain species, e.g. chub in Georgian Bay and walleye in Lakes Erie and Ontario, are showing signs of increased stability, these improvements cannot be ascribed solely to the introduction of individual quotas, except perhaps for walleye in Lake Erie, which has been subject to a quota system since 1977. The other species that is of international concern in the Great Lakes system, lake trout, has not responded to rehabilitation efforts in the time anticipated. The Great Lakes Fisheries Commission has registered a formal concern to all agencies that fishing mortality rates remain in excess of levels necessary to achieve rehabilitation. There is little doubt that the Ontario commercial fisheries harvest, totaling 9,463,665 lbs from Lakes Superior, Huron and Ontario, contributes significantly to the mortality rate; this fact suggests that allocations to the commercial fishery should be reduced.

Lake trout management is further complicated by the incidental catch (by-catch) of lake trout in nets set for other species, including small mesh gillnets set for chub (deepwater cisco) and yellow perch, in Lakes Superior and Lake Ontario respectively. The provision of modest quotas to legalize the sale of incidentally caught lake trout failed because fishermen deliberately sought to complete that quota and exceeded it, to the detriment of lake trout stocks. The effect of individual species quota management in terms of stock protection, as distinct from the effects of strong year classes, will be clearer for smelt and yellow perch in Lake Erie in the late 1980s, and for the longer-lived species such as lake trout and whitefish in the Upper Lakes (Superior, Huron) in the early 1990s. The problem of protection of discrete or distinct genetic stocks in near-port areas remains to be addressed. Current harvest control measures concentrate on onshore monitoring, and there is little opportunity to verify the site of fish capture.

Incidental Catch

The problem of incidental catch (by-catch), represents a twofold threat to the future of the Ontario commercial fishing industry, strongly reliant on gillnets and operating in mixed fish communities. To date, the industry has not seen fit to adjust its activities to reduce incidental catch of sport fish in situations where recreational interests are dominant. The result has been a rising tide of criticism and, more recently, carefully orchestrated campaigns to ban

the gillnet from Lake Ontario. This proposal is seen by the gillnet industry as a challenge to its own survival. The economic leverage of the Provincial recreational fishery, compared to that of the total commercial fishery, is on the order of seven to one.

Secondly, and related to the foregoing, the incidental catch of commercial species of one kind (once that species quota has been filled) may, in many situations, impede the operator's progress towards the completion of another quota, with obvious disadvantageous results. Until recently, fishermen tended to take the attitude that they are entitled to any fish in their nets. Society is now giving notice by means of "ban the gillnet" campaigns that this attitude is not acceptable. By virtue of the losses of sport fish and the impairment of progress towards stock rehabilitation caused by commercial incidental catches, the onus is upon the industry to seek other means of pursuing its activities in areas where recreational fishing is very important to the economy.

Any changeover to selective gear will require substantial investment which, for some operators, may be out of the question, causing further retirement from the industry. Some elements in the industry see any movement towards conversion to live capture gear as an indication of weakness and as a portent of the end of the industry as it is presently constituted. The Ministry of Natural Resources has thus far restricted its activities to the promotion of selective gear.

Distribution of Income and Harvest

The last-minute refusal of industry members to participate in joint decisions on quota sharing formulas resulted in heavy reliance on past performance as the basis for quota sharing for most fisheries in Ontario during the period of quota assignment in 1984. This decision recognized the contribution of long-term active participants to the industry and to the Provincial economy, confirming traditional distributions of income within the fishery. One result was to impede the opportunities for expansion by any newcomers, who will have to invest further if they want to acquire more quota for themselves. Although the picture is not altogether clear, prior to 1984 there were signs in certain parts of Lake Erie of aggressive expansion by newcomers, including round-the-clock fishing and heavy investments in boats and equipment. How much of this was designed to offset debts incurred to finance entry into the fishery, and how much to develop a good fishing record in anticipation of quota management, is not clear. Subsequent to 1984 there have been retirements from the fishery. Retirements have been prompted partly by economic forces at work on individual fishermen and partly by the agency buy-out programs previously described. The extent to which the introduction of individual species quota management has influenced fishermen's net incomes remains to be seen. Their net incomes are

also influenced by individual operators' ability to reduce variable costs.

Cooperation and Deregulation in the Industry

One result of the quota management system instituted in 1984 was that henceforth an operator's gross annual income would be roughly the same as the total value of all the species quota assigned him. Records of investment are primitive, but there are indications that Great Lakes commercial operators are trading their boats back and forth rather than acquiring new ones. (The anticipated life span of a Great Lakes fish tug hull is commonly 30 years.) Moreover, the recognition that fellow participants in the industry are guaranteed their share of the allowable catch has led to greater cooperation between fishermen for mutual advantage.

Although the requirements for reporting catch, effort, location and the conditions of participation are more stringent than before, regulations applying to the means of harvest have been relaxed considerably. The fisheries management philosophy underlying individual species quota management is restriction of harvest to levels which allow for sufficient escapement to ensure continued stability of the stocks. Regulations that were clearly aimed at reducing harvest efficiencies--closed seasons, depth regulations, size limits, limits on gear, etc. have been or are in the process of being removed. In specific instances where there is concern about stock strength, as there is for yellow perch in eastern Lake Ontario, gillnet mesh size regulations are being retained.

Operators who cannot catch their assigned quota, for one reason or another, are permitted to delegate the opportunity to others. Short-term, part-quota sales represent another form of cooperation with the potential to improve harvesting opportunities without threatening the resource. Again, there have been indications of redistribution of quota because of specialization (e.g. smelt trawlers have disposed of walleye quota). These transactions within the industry are signs of reconciliation of quota holdings with business decisions. One other aspect of individual species quota management is the effect on the income of deck hands, which is derived from a share of catch proceeds. The effect of slightly higher market prices has been beneficial to deck hands in the sense that incomes have been correspondingly higher; however, that benefit has been balanced by the tendency for increased efficiency in the industry. Thus, quotas are filled earlier in the year, reducing the period of employment so that it falls short of the minimum necessary to ensure the flow of unemployment benefits through the winter months. Some appeals to O.M.N.R. for larger quotas have been supported on the basis of maintenance of employment necessary to earn unemployment benefits in areas of limited employment opportunity. These appeals were local in nature and did not enjoy wide industry support; they were not granted. The absence of any organization representative of the deck hands makes it difficult to assess their position,

but improved harvesting efficiencies may be offset somewhat by a reduction in labor efficiency prompted by the entry of unskilled workers replacing those attracted to more secure occupations elsewhere.

Compliance Problems

So far as the agency is aware, the 1984 harvest was 60 percent of the total allocation for that year. The final figure for 1985 is not yet known, but the harvest will closely approximate to the total allocation of the important species. Keenly aware of the compliance obligation, O.M.N.R. has deployed twelve commercial fisheries specialists to augment regular enforcement by conservation officers. By the end of 1986, the agency should have a more comprehensive picture of the problems to be dealt with, aside from simple violations of quotas. More than 200 charges related to quotas have been laid to date. The problems that have developed are as follows:

1. Failure to report catches on time: seemingly a minor infraction, prompted by long-term reliance on buyer weights at the fish house, this problem remains an irritant demanding of energy and patience by the managers, particularly when they are dealing with people in the far northern portions of the province where communications are so poor. Deliberate tardiness enables operators to justify fishing beyond quota limitations.

2. Failure to report location of fishing accurately: this may be wholly deliberate on the part of operators prompted by economic considerations such as low profit margins when fishing far from port. Fish stocks located close to home fishing ports may be overfished as a result. O.M.N.R. has yet to come to grips with this difficulty.

3. Trend towards fishermen taking on their own processing: there are moves by fishermen fishing waters other than Lake Erie to undertake more processing and local marketing to enhance real income. This trend enables some fishermen to reduce their accountability in the commercial fish harvest control paper trail. Simply described, fish are accounted for by being sold by John Smith, fisherman, to John Smith, Fish Products. Transactions beyond first sale are not accountable in the current system.

4. On-the-lake infractions: These include the use of non-legal mesh size nets, "dumping" (of too large and too small fish), and illicit landings and exchanges to evade port bound accountability. The extent to which these infractions occur is not yet clear, nor is their significance. If the current trend towards self-regulation continues, it seems likely that the industry itself will provide the best safeguards against on-the-lake infractions.

On the matter of law enforcement, O.M.N.R. takes the position that satisfactory compliance with commercial fishing regulations is attained when the nonlegal activities of the participants no longer threaten the goals and objectives of the program.

Effects of Individual Species Quotas on Market

The effect of the introduction of individual species quotas on the prices of the more important market species such as yellow perch, smelt, whitefish and lake trout remains to be seen. News of the 1984 challenge to the Minister's authority caused yellow perch prices to tumble. During that limited period of a few days, controls on fishing in Lake Erie were virtually nonexistent and markets were flooded. Markets remained soft in early 1985, due to large freezer holdings, but prices had stabilized by mid-1985.

O.M.N.R. - Industry Progress to Copartnership

Since 1984, O.M.N.R. has provided incentives to promote industry cooperation by allocating extra funding for law enforcement and fisheries assessment and by appointing a commercial fisheries liaison officer to troubleshoot issues demanding resolution. More recently, O.M.N.R. has set the scene for further industry involvement in fisheries assessment program reviews, allocation decisions, and communications enterprises designed to promote positive public awareness of the industry and its role in Ontario society. The industry has responded positively and the climate for future cooperation appears favorable.

As already stated, the processing industry is prepared to make adjustments to cope with individual species quota management in Ontario.

Conflict with Recreational Fishermen

Angler groups are supportive of individual species quota management, recognizing that the system represents a much more effective means of controlling harvest than the previous means of administration. Even so, recreational anglers continue to stress dissatisfaction with incidental catch problems in specific waters, as described earlier, and it remains to be seen whether this concern can be accommodated by the commercial fishing industry by reasonable adjustment to specific needs, rather than further confrontation.

SUMMARY

Implementation of the individual species quota system to manage the Ontario commercial fisheries is still going on. The process of setting the system in place has been gradual because of the tacit recognition that the system, in its final form, must enjoy the support of the participants. Each movement to establish a component has been followed by a

pause which allows for the effects to be considered and further refinements made. Even now, O.M.N.R. and the officers of the industry are carrying the news to fishermen of what royalties are to be paid in 1987. Although working out and installing the program has been difficult at times, there has always been mutual recognition that the system which had sustained the industry for the previous 50 years was no longer adequate for the expectations of the industry, nor of contemporary society. O.M.N.R. and the officers of the industry are now, more than ever, partners in a joint endeavor that shows promise of providing good quality fish to non-anglers in Ontario, positive contributions to local economies, fish stock information to resource managers, and improved fish stock stability overall.

Recent Adjustments in Ontario`s Fisheries

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The central concern of this report is with adjustments to Ontario's individual transferable quotas. The quota system will be described briefly. Important concurrent influences in catch, prices, use of labor, and investment in capital will be outlined. Adjustments will be described for some sub-groups.

ONTARIO'S QUOTA SYSTEM

Individual transferable quotas were introduced to Ontario in 1983. Quotas were based on the best three of the past five years' reported catches. Fishermen had two years' notice of the system so that they could avoid making major investments if they so wished. The fisherman's share of total catch used for calculating the quota was applied to the estimate of stocks available, and that became the fisherman's quota. Originally quotas were not transferable, but they were made transferable shortly after their introduction. All or part of a quota could be transferred to a fisherman licensed to fish in the area.

OTHER INFLUENCES

Markets for freshwater fish have been disturbed over the past few years. Significant influences include the reentry of Michigan as a producer of whitefish, a dioxin scare in respect to smelt, apparent changes in taste that have popularized white bass, competition from cultured trout, which has displaced lake trout in the market, and increased difficulty in clearing whitefish production because of changes in

preference in traditional markets. Higher air freight costs from northwestern Ontario have reduced levels of production from that area. It is not possible to quantify the aggregate or individual influence of these factors. However, it is important to note that they have been operating, and that the fishery has had to adjust to these and other circumstances, as well as to quotas.

On balance, it is reasonable to suggest that changes in the smelt, whitefish, and lake trout fisheries have tended to reduce earnings, the effect of higher air freight costs has been to reduce production from northwestern Ontario, and improvements in white bass and perch prices have increased incomes. Species-related changes tend to be concentrated by area according to which species are most fished in particular lakes.

AGGREGATE ADJUSTMENTS

From 1983 to 1984, Ontario's commercial fishermen made a range of adjustments that in retrospect appear remarkably rapid and smooth, given the scale of change as a proportion of the industry.

Total harvest fell from 61 to 51 million pounds. This drop was shared in all areas except Georgian Bay and Lake Superior, where good harvests of whitefish and chub countered the province-wide trend. Reduced landings continue a trend which began in 1979 and was most marked in smelt--this is attributed to the dioxin scare and not to the quota system.

Compliance with quotas appears to be good. Reported catches for valuable species are close to the aggregate of quotas. Enforcement actions have not changed appreciably, and changes are not attributable to the quota system. Variations in enforcement actions from year to year appear to be more related to native fisheries.

Participation in the fishery is declining. Licenses fell in number from 961 in 1983 to 930 in 1984. This change continues a trend. Buy-outs of licenses contributed about one-third of the decline, and retirements contributed the remainder. That licenses were retired rather than sold suggests that they did not have valuable quotas attached to them. This decline in commercial food fishing licenses was not paralleled by a decline in bait harvest or dealers' licenses, which are not quota regulated, and for which new licenses are still issued.

Vessels used in the fishery have declined in number from 1,021 in 1983 to 916 in 1984. New investment in the fishery fell from levels consistently above $3 million to $1.23 million. Total investment fell from $58 million to $53 million. This decline was concentrated in a reduction of fixed assets, as yards and numbers of nets increased. Assets which declined in number and value, besides vessels, included piers, ice houses, and net sheds. Less than 10 per-

cent of this decline is attributable to buy-outs. The change is a fundamental adjustment in the level of investment required for each fisherman to have access to a known volume of fish. Given that nets in inventory remain at earlier levels, harvest capacity is not reduced. The decline in vessels over 40 feet is proportionately larger than for smaller vessels. Investment has been redistributed and total inputs of fixed assets has declined by over 10 percent, without a decline in capacity.

Employment is the largest variable input in the fishery. Between 1983 and 1984, the number of fishermen declined from 1,981 to 1,588. This is a 20 percent decline in employment within the first year of adjustment, following a period of four years when employment had been stable, within a percent or so, from year to year.

IMPLICATIONS

The fishery is clearly more efficient as a result of the year of adjustments.

Input costs are reduced. Total harvests, though smaller, are as a result of unrelated market adjustments worth more than previously. Income to smelt fishermen declined by $1.5 million. Income from sources other than smelt increased by $9.1 million, or more than 25 percent. This increase in income cushioned the impact of change. Of some pleasure for the economist to note is that even though incomes rose, and there was capacity to maintain surplus capital and labor, operators reduced inputs in order to maximize net earnings.

The quota system changed the circumstances of fishermen; where there had been no artificial limit on expected income, now a quota set a limit which would only vary with ability to improve market prices or reduce costs. In the former circumstances, fishermen invested according to their need to compete for a share of the harvest and according to the risks that they were willing to accept. When competition is limited and there is no need to increase risks for an income that is fixed in advance, it is clear that investment can contract, as in fact happened. However, the allocation of quota did not reflect the willingness of fishermen to accept risks, or their costs. Quotas were based on historic catches. Fishermen who had risked investing heavily, but who did not have enough time, skill, or good luck to have that investment pay off with high average harvests, did not receive quotas sufficient to cover their expected costs or to yield an income of a size that they were willing to work for if they could. The only economic remedies for this are the eventual failure of such ventures or an auctioning of some portion of quotas in order that individuals with high costs have an opportunity to purchase sufficient quota. Such people, even in an auction, will be disadvantaged relative to lower-cost operators. The major difference would be in the speed of forced rationalization.

Analysis of fishing behavior suggests that operators whose quota is insufficient to yield a satisfactory income, covering fixed and variable costs, will: introduce measures to reduce costs; poach; buy additional quota; improve their marketing in order to increase prices; or stop fishing.

Incidence of poaching does not appear to be an increasing problem from year to year. People from the Ministry of Natural Resources could address the topic more authoritatively, but it appears not to be a major issue, due in part to improved prices.

Revenue improvements were substantially greater than expected. These improvements were based primarily on increased catches of yellow perch and pickerel. However, some fishermen/packers reported additional effort to find new buyers, and thus increase price competition. In addition, many operators are directing an increasing portion of their production into local retail outlets in order to reduce the costs of marketing and improve competition. Such a redirection of energy from the harvest itself to considerations of quality and marketing would not have been possible in circumstances which forced producers to invest to ensure security of supply rather than quality of output.

Operators reported reluctance to release labor in order to save costs. Reduction in labor exceeded expectations.

The need to adjust to a range of changing circumstances is an ongoing fact of life for fisheries. It is heartening to see the speed at which an industry composed of relatively small-scale participants can adjust to change. In this case, the pain of adjustment was eased by high prices and good harvests. This adjustment will add to long-term stability. The industry is still large enough and widely enough held that no single firm, or age cohort, will disappear and leave a vacuum.

Quotas may cause a change in industry size and structure over time, as the costs of quotas rise and the cost of entry, which will include quota costs, also rises. New entrants will require greater financial backing in the future than heretofore. A tax on production inputs would restrain this potential inflation of entry costs. Currently, improved earnings place the fishery on a basis comparable to other small businesses, and for the time being in circumstances preferable to many parts of Ontario's farm community.

There is some potential for abuse of the quota system, if rapid shifts occur in relative values of species or if the stock assessment system comes to be widely regarded as unreliable. So far these risks have not materialized in Ontario.

The quota system has improved efficiency in the fishery. It has not eliminated capacity for overfishing, but it has reduced that capacity. Furthermore, it is clear that economic

pressure for overfishing has been reduced, as it is now more possible for quota-regulated operators to earn satisfactory incomes. As a result, for the time being, the task of management has been simplified.

Evaluation of Area Licensing in the British Columbia Roe Herring Fishery: 1981-1985

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INTRODUCTION

Purpose

This report evaluates the performance of the area licensing program used in the British Columbia roe herring fishery. Area licensing was introduced in 1981, primarily in response to the management problems associated with the roe herring fleet's excessive fishing capacity. The performance of the program over the period 1981 to 1985 is compared to the initial expectations of Department of Fisheries and Oceans (DFO) personnel and of the fishing industry.

Background

In 1971, B.C. herring stocks appeared to be partially recovered from the collapse caused by intensive fishing during the 1960s, allowing the establishment of a commercial roe herring fishery. The relaxation of Japanese import restrictions on foreign roe herring products the following year provided a lucrative new market for B.C. herring. In response, the roe herring fishery has expanded to become a significant component of the B.C. fishing industry. In 1985, the landed value of roe herring fishery exceeded $50 million, and the wholesale value exceeded $100 million.

By the late 1970s, the B.C. roe herring fishery had earned the reputation of being a fishery manager's nightmare. The Commission on Pacific Fisheries Policy stated:

> The roe herring fishery is extraordinarily hectic due to the unpredictable stocks and available catch, the

> massive and excessive fishing power, the need to limit the fishing time to the moment when the fish are about to spawn and the high values at stake. It is probably the most difficult of fisheries to manage; fishery officers, under extreme pressure and great uncertainty, have to try to restrict openings to a few minutes in many cases, during which fortunes have sometimes been made. (Pearse 1982:104)

The management problems associated with the large roe herring fleet were linked to the following factors:

1. Too many licenses: The limited entry licensing program, instituted in 1974, was not effective in keeping the roe herring fleet at a manageable size (see Table 1). DFO's goal of issuing 150 seine licenses and 450 gillnet licenses was greatly exceeded because it was difficult to deny any "bona fide" fisherman access to the resource (Meyer 1976).

2. Overinvestment: The high incomes earned by roe herring fishermen during the late 1970s led to extensive investment, which increased the efficiency of the fleet.

Table 1. Licenses in the roe herring fishery from 1972-85.

Year	Gillnet	Seine	Total
1972[a]	58	106	164
1973[a]	223	161	384
1974	1,579	252	1,831
1975	1,249	232	1,481
1976	1,285	214	1,499
1977	1,329	245	1,574
1978	1,295	251	1,546
1979	1,302	249	1,551
1980	1,317	251	1,568
1981	1,309	250	1,559
1982	1,322	250	1,572
1983	1,322	249	1,571
1984	1,326	251	1,577
1985	1,327	252	1,579

[a] Estimate of active vessels.

Note: Since 1974 participation has been based primarily on number of licenses issued. However, in recent years the number of licenses eligible to be issued has been used. The change in the method of estimating participation and the reinstatement of several additional licenses by the Minister explain the annual fluctuation in participation.

Source: DFO License Division

3. Declining production: After 1979, it was realized that there was a significant decrease in the quantity of roe herring available. The total harvest over the period 1975 to 1978 had ranged from 60,000 to 85,000 tons. In contrast, the total harvest during the early 1980s was expected to be on the order of 40,000 tons. Consequently, after 1979 fishing opportunities would be limited, and there would be great potential for a large number of vessels to concentrate at each opening.

In an attempt to improve the fishery manager's capability of dealing with an excessive fleet and lower anticipated stocks, several regulatory changes were evaluated prior to the 1981 roe herring season (i.e. no roe fishery, vessel pooling, individual vessel quotas and area licensing). The alternative management options were discussed with industry groups in January 1981, and the majority of industry groups favored area licensing.

STRUCTURE OF THE AREA LICENSING PROGRAM

Original Program Structure

Area licensing was introduced into the British Columbia roe herring fishery on an experimental basis in 1981. Under the program, each holder of a roe herring license was eligible to receive an area license for one of three defined fishing areas. Previously there was no geographic restriction associated with roe herring licenses.

In addition to restricting each roe herring license to a defined area, the area licensing program had the following features:

1. Area choice applied for a period of one year.

2. Licenses could not be transferred from one vessel to another during the season except where a vessel was lost or destroyed.

3. A ceiling was established on the number of vessels that could be licensed for each area. In areas that were oversubscribed, a draw was to be employed to award licenses. In practice, an adequate distribution of licenses was achieved by licensing all fishermen for their most preferred area.

Changes to the Original Program Structure

Area licensing has remained in effect in the roe herring fishery since 1981. However, the original program has undergone several noteworthy changes. A brief description of each of these modifications to the original program is presented below.

Multiple licensing: In 1981, each vessel that participated in the roe herring fishery was licensed for only one area.

The following year, the practice of multiple licensing began in both the seine and gillnet fleets, and since that time multiple licensing has become increasingly prevalent. Multiple licensing is defined as fishing more than one roe herring license area with a single vessel. Multiple licensed vessels are not permitted to have more than one license for any one area (e.g. a gillnet punt cannot fish two licenses in the same area).

Fixed catch quotas for each license area: Until 1983, final management decisions regarding the quantity of roe herring to be caught were made on the fishing grounds. The general strategy was to locate sufficient stocks for spawning purposes plus a surplus, which would be available for a fishery. A fundamental change in the procedure used to establish roe herring catches occurred in 1983 with the introduction of fixed catch quotas for each license area. Under the fixed quota management system, the size of herring stocks is estimated well in advance of the season, and catch quotas are set accordingly. The catch quotas are not subject to revision as the season progresses.

Number of license areas: The boundaries of the three areas were retained, as originally designated under the area licensing program, from 1981 to 1984. The closure of one license area in 1985, necessitated by low herring stocks, prompted the redefinition of areas.

PROGRAM OBJECTIVES AND EXPECTED IMPACTS

It was noted in the introduction that management of the roe herring fishery became extremely difficult in the late 1970s as the mobility and efficiency of the large fleet increased and herring stocks declined. Specifically, the large number of vessels that began to appear at individual openings increased the risk of overfishing and raised concern over the impact of vessel activity on the spawning grounds. These concerns were sufficiently serious to warrant consideration of some significant regulatory changes prior to the 1981 season. After an evaluation of several alternative regulatory programs, area licensing was adopted on an experimental basis.

Area licensing was intended primarily to contribute towards an immediate improvement in the in-season manageability of the herring stocks. The economic impact of area licensing was also held to be important, but it was realized that area licensing by itself did not offer complete short- or long-term solutions to the fishery's economic problems. However, biological manageability was seen as a prerequisite to the development of a long-term management plan that would ensure reasonable, stable returns to participants in the fishery.

Detailed expectations associated with the area licensing program are examined from two perspectives--the fishing industry's and DFO's. Program objectives and expected impacts are grouped into the following major categories: Biological

Management, Economic Rationalization, Equity Considerations, and Administrative and Enforcement Considerations. DFO's expectations are contained in the discussion paper "The Development of a 1981 Roe Herring Management Plan," produced in December 1980. The fishing industry's expectations were drawn from meetings on the discussion paper, which took place in January 1981 with twelve industry organizations represented.

Industry

Biological management: Industry representatives, including fishermen and fish processors, expressed the following concerns regarding the proposed area licensing program:

1. Area licensing would not, by itself, be effective in constraining fleet concentrations (i.e. would not permit fishery officers the flexibility to open smaller fishing areas that could not be opened in the past).

2. Field officers would be put under some pressure to provide relatively equal average landings in each area. Therefore, anticipated catches established for the fishery would be treated as quotas by the field officers, and pressure would be put on officers to open areas that would not warrant an opening based on stock availability.

Economic rationalization: Industry representatives did not express any opinions regarding economic rationalization objectives.

Equity: Industry representatives expressed the following concerns:

1. An unacceptable imbalance in the earnings of individual fisherman would occur due to unexpected variations in catch among areas.

2. Indian fishermen in particular felt that local residents should get the first option to fish in their local area.

Administrative and enforcement considerations: The following long-term impacts were expected by industry representatives:

1. The decentralized nature of management in the roe herring fishery and resulting inconsistent fleet and resource management in various areas of the coast would be intensified with area licensing.

2. Area licensing would cause the break-up of some pools (groups of fishermen with a formal arrangement to share revenues and expenses).

In addition, industry representatives expressed the following short-term concerns about introducing a relatively complex new management program on such short notice:

- The program could not be implemented on time;
- The program, if implemented, would be inferior, full of bugs.
- Some degree of anarchy would result among the fleet as some fishermen might not even be covered by the program or, at least, would not understand it properly.

Industry representatives were also concerned that even if area licensing was not successful in 1981, it would remain in effect in the roe herring fishery and would set a precedent that would result in its implementation in other fisheries, such as salmon.

Department of Fisheries and Oceans

Biological management: The following biological objectives were established by DFO for the area licensing program:

1. To reduce the risk of overfishing by reducing the number of vessels that would appear at each opening (more effective for large openings).
2. To reduce any negative effect on the spawning stocks resulting from large numbers of vessels active on the spawning grounds.

In addition DFO noted the following concern:

> In areas with unexpectedly low available catches, fishery officers could come under pressure to allow a larger harvest than could be justified on biological grounds.

Economic rationalization: The following economic objectives were established by DFO:

1. To minimize the incidence of non-openings due to excessive fishing capacity and achieve a larger total catch than could otherwise be possible.
2. To reduce vessel operating costs, especially fuel, by restricting fleet mobility.
3. To further reduce fishing costs by decreasing the number of vessels participating in the fishery in a given year, provided area licenses became transferable.
4. To facilitate other programs that would induce greater economic efficiency in the fishery.

Equity: The following considerations were noted by DFO:

1. Since the catch available in each area cannot be precisely predicted, fishermen in some areas might catch substantially less than those in other areas.

2. Area licensing would tend to bring about greater equality of gross earnings in the fishery (past variations in gross earnings partly attributable to variations in mobility).

3. The mobility restricting aspect of area licensing would impose a relatively greater hardship on fishermen who have invested heavily in vessels and equipment to increase their mobility and landings in the fishery.

4. Some fishermen would not be licensed to fish in their most preferred area.

Administrative and enforcement considerations: The following administrative and enforcement considerations were noted by DFO:

1. The area licensing distribution scheme would place greater demands on DFO personnel.

2. On-line management would be considerably easier and more secure with a smaller, well-defined fleet.

3. Area licensing would facilitate the allocation of only one gear type, either seines or gillnets, to areas most compatible with that gear type. This would increase the ability of fishery officers to monitor and control the fleet.

4. The identification of vessels with legitimate licenses to fish in a given area could pose problems.

FISHING INDUSTRY REPRESENTATIVES' VIEW OF AREA LICENSING

The performance of area licensing is evaluated below relative to the objectives and expected impacts presented above. This section of the evaluation is devoted to summarizing the fishing industry's opinions, as drawn from discussions with fishing industry representatives and from annual surveys, conducted from 1981 to 1984, of roe herring license holders. In the section titled Department of Fisheries and Oceans' Assessment of Area Licensing, opinions of DFO personnel on their experience with area licensing are presented.

General Observations

The majority of fishing industry groups are satisfied with the performance of area licensing. Area licensing is credited with introducing some stability into the fishery. Fishermen and processors are able to plan more effectively for the fishery in advance of the season, and the frantic

running between locations in anticipation of openings has been greatly reduced. The period during which the fishery is hectic is confined primarily to the actual openings.

Surveys conducted after the roe herring fishery seasons from 1981 to 1983 also provide an indication of the level of support for area licensing within the fishing industry. In 1981, a large majority of gillnet respondents--67 percent--believed that area licensing was an overall success. Support for area licensing was not as strong in the seine fleet, but a slight majority--53 percent--of seine respondents regarded area licensing as a success.

The support for area licensing among fishermen and processors, along with the general satisfaction among fishery managers, resulted in the program's being continued in 1982. Surveys conducted after the 1982 and 1983 fisheries show that area licensing increased in popularity to the point that 86 percent of the gillnet respondents and 78 percent of the seine respondents felt area licensing should continue (see Table 2).

While the majority of fishermen and processors are satisfied with the overall performance of area licensing, many fishermen are unhappy with some aspects of the program. For example, the risk to seine fishermen associated with being limited to few fishing opportunities, and the cost of leasing additional licenses, were criticized by several fishermen.

Table 2. Questionnaire results concerning the performance of area licensing.

Question: Do you think area licensing should continue?

Response (in Percentages)[a]

	Yes		No		Undecided	
Year	Gillnet	Seine	Gillnet	Seine	Gillnet	Seine
1981	72	56	26	43	2	1
1982	81	62	19	38		
1983	86	78	14	22		

[a] Responses were received from 20 to 30 percent of all roe herring license holders in each year.

Industry views regarding the performance of area licensing relative to specific objectives and expected impacts are presented below.

Biological Management

The majority of industry representatives (see Table 3) believe that area licensing has made the roe herring fishery more manageable due to the reduction in the number of fishing vessels operating in each area.

Although industry representatives generally felt area licensing was helpful to fishery officers managing the fleet, there was no consensus regarding the program's impact on the risk of overfishing. Several industry representatives expressed the opinion that area licensing has not improved the fishery officers' ability to limit the catch to a predetermined target. Also, it was noted by some industry representatives that a large fleet is often much less efficient than a smaller fleet--that is, crowding and interference associated with large boat concentrations reduce the effectiveness of the entire fleet. In contrast, some industry representatives felt that a smaller fleet was more manageable and that the potential for extreme overfishing is less. Several industry representatives stated that it would not have been possible to have some openings in the past few years without area licensing; the catch quota would have been too small for the larger fleet.

Table 3. Opinions on the effect of area licensing on fishery officers' ability to manage the fleet.

Question: Do you think area licensing was helpful or harmful to the fishery officers in their attempts to manage the fleet?

	Response (in Percentage)[a]			
	Helpful		Harmful or No Effect	
Year	Gillnet	Seine	Gillnet	Seine
1981	86	76	14	24
1982	89	76	11	24
1983	90	83	10	17

[a] Responses were received from 20 to 30 percent of all roe herring license holders in each year.

A variety of comments by industry representatives concerned the pressure faced by fishery officers when they encountered unexpectedly low stocks in one license area. Several people felt that an opening that was not justified on biological grounds took place in 1981 to ensure the success of area licensing. Many industry representatives noted that fixed catch quotas, introduced in 1983, relieved much of the pressure experienced by fishery officers.

Economic Rationalization

Industry representatives identified reduced operating costs and lower packing costs as the major savings associated with area licensing. These cost savings were attributed to restricted mobility. That is, prior to area licensing, vessels would travel extensively in order to attend as many openings as possible. This often involved running at high speed and racing back and forth between areas. The survey

of roe herring license holders following the 1981 fishery showed that the majority of gillnetters (54 percent of respondents) felt that area licensing reduced their operating costs, particularly for fuel and labor. However, relatively few seiners (27 percent of respondents) indicated that area licensing reduced their operating costs.

In addition, since the length of the season for individual seine vessels was shortened considerably by area licensing, seiners were able to fulfill a great deal of the fish packing requirement. For example, a seiner licensed to fish in an area that has an early season is available to pack fish in other areas. This reduces the number of packing vessels required by the fish buyers and lowers the total cost of transporting fish.

It was noted that factors other than area licensing have contributed to the reduction in fishing costs. For example, since fixed catch quotas were adopted fishermen no longer have had an incentive to find herring in the hope of bringing about additional openings. Instead, fishermen tend to rely on the test boats and patrol boats to locate sufficient stocks to conduct an opening. Therefore, fishing expenses are reduced by spending long periods of time idle while waiting for an opening.

Recent estimates by industry representatives of the total reduction in fuel costs associated with area licensing, fixed catch quotas, and the relatively low annual harvests ranged from 20 to 60 percent. While most industry representatives indicated that vessel operating costs have been lower since 1981, many stated that this saving is insignificant compared to the cost of leasing additional roe herring licenses. It was estimated by one industry group that the cost of leasing licenses was $2.5 million in 1985. This was viewed by many industry representatives as simply an increase in the cost of fishing incurred by those leasing additional licenses. The increase in potential earnings for fishermen leasing additional licenses and the aggregate cost savings associated with fewer licensed vessels in the fleet were not generally recognized.

There was no consensus among industry representatives concerning the impact of area licensing on the total annual catch. However, several gillnetters felt that without area licensing it might not have been possible to conduct some fisheries. This implies that at least some fishermen believe that area licensing increased the total annual catch.

Equity

Two major considerations were raised by industry representatives; first, the impact of area licensing on the distribution of catch among fishermen; and secondly, the unemployment resulting from the practice of multiple licensing.

With respect to catch distribution, it appears that area licensing has affected the gillnet and seine fleets differ-

ently. Seiners acknowledged that the lower vessel concentrations due to area licensing increase the chance of catching fish at each opening. However, since an individual can participate in so few openings, the risk of a seiner catching nothing is greater with area licensing. One seiner explained that before area licensing, many vessels would participate in several openings without catching any fish, but still have a successful season by doing well at just one opening. "Now the whole season is riding on one short opening."

Several seiners stated that they felt compelled to lease additional licenses to reduce the risk of catching nothing for the entire season by being skunked at a single opening. Therefore, it is likely that multiple licensing has an impact on catch distribution, especially if the most skilled fishermen are leasing additional licenses. That is, vessels with more than one license will tend to take a relatively large share of the total seine catch.

Besides area licensing, the reduction in the total annual harvest of roe herring has reduced fishing opportunities and the number of openings a vessel can expect to participate in. In summary, many industry representatives believe that the reduction in openings, stemming from area licensing and lower total catches, have resulted in greater variability in the performance of individual seine vessels.

Industry representatives indicated that area licensing has contributed to a more equitable distribution of the gillnet catch per license. The reason that area licensing affects the seine and gillnet fisheries differently stems from the nature of the two fisheries. A single gillnet does not have the potential to catch a very large quantity of herring in a short time. Therefore, gillnet fishery seasons are typically much longer than seine fishery seasons, and the variation in catch between individuals is not as large as in the latter. Since there is not as great a variation between individual catches at each opening, limiting each gillnet license to roughly the same number of fishing opportunities tends to bring each active license close to an average catch.

Gillnetters did not view multiple licensing as a way of reducing the risk of catching nothing, as some seiners did. Instead, the practice of leasing additional licenses was seen as a business decision, made after considering potential revenues and costs.

The other major equity issues raised by industry representatives relate directly to the impact of multiple licensing. The United Fishermen and Allied Workers Union (U.F.A.W.U.), in particular, has voiced its condemnation of the unemployment resulting from multiple licensing. U.F.A.W.U. representatives noted that while the total labor effort required in the fishery remains unchanged, multiple licensing results in fewer people being employed. In effect, fishermen working on vessels with multiple licenses extend their season

while others, associated with licenses that are leased out, are put out of work.

Some industry representatives stated that crew members on boats removed from the fishery do not necessarily lose their jobs. For example, the crew members on seine vessels withdrawn from the fishery due to multiple licensing are often assigned to other boats in the pool.

Aside from the direct employment impact, multiple licensing has resulted in some crews contributing towards the costs of additional licenses. For example, a vessel owner wishing to fish a second area will normally require the crew to share the cost of leasing an additional license. This appears to reduce the total wages to roe herring crews.

A final noteworthy consideration associated with multiple licensing relates to the transfer of money from active fishermen (those leasing licenses) to license holders that choose not to fish. It is felt that multiple licensing has increased the extent of license leasing. License holders who withdraw from the fishery continue to share in the profits generated. Many people find this situation very distasteful.

Administrative and Enforcement Considerations

Industry representatives had very few comments regarding the administrative and enforcement considerations associated with area licensing. Some individuals felt that area licensing is beneficial to the on-grounds advisory process established in 1985 (e.g. a known group of fishermen licensed for a particular area can be selected as advisors). One individual noted that area licensing gives fishery officers more control of the fleet and improves enforcement capabilities.

DEPARTMENT OF FISHERIES AND OCEANS' ASSESSMENT OF AREA LICENSING

Biological Management

DFO personnel believe that area licensing has improved the management of the roe herring fishery. Management benefits are linked to the success of area licensing in preventing extremely large concentrations of boats at major openings.

A summary of roe herring openings and vessel concentrations over the period 1977 to 1985 is presented in Tables 4 and 5. It can be seen that in the late 1970s, a large number of boats, particularly seiners, began to congregate at some openings. For example, in 1978 there were 200 seiners at the Barkley Sound fishery and in 1979 there were 173 seiners in Skincuttle Inlet.

Table 4. Summary of roe herring seine fisheries 1977-85.

Area	1977	1978	1979	1980[e]	1981	1982	1983	1984	1985
Queen Charlotte Islands									
Number of openings	4	3	4[a]	2	4[b]	3	2	1	1
Maximum number of vessels	138	120	173	35	65	66	71	112	89
Hailed catch (tons)	12,696	11,814	8,492	2,575	5,340	4,082	6,500	4,910	4,825
North Coast									
Number of openings	2	2	1	1	1	0	0	1	1
Maximum number of vessels	170	150	55	40	65			118	53
Hailed catch (tons)	5,359	2,073	1,450	1,690	1,200			1,800	3,007
Central Coast									
Number of openings	3	3	0	0	0	1	1	2	1
Maximum number of vessels	82	70				30	94	120	43
Hailed catch (tons)	5,243	5,756				2,625	2,200	3,900	3,045
Strait of Georgia									
Number of openings	2	4	0	1	1	1	3	2	1
Maximum number of vessels	110	50			37	70	84	59	48
Hailed catch (tons)	4,000	5,575		290	3,000	3,400	6,600	4,438	2,879
West Coast Vancouver Island									
Number of openings	5	3	4[c]	1	2	5[d]	1	1	0
Maximum number of vessels	NA	200	120	29	100	67	48	61	
Hailed catch (tons)	23,735	6,200	13,450	2,403	6,400	4,385	5,100	6,000	
TOTAL CATCH	51,033	31,418	23,392	6,958	15,940	14,492	20,400	21,048	13,756

[a] Includes several small fisheries.
[b] Includes two small fisheries in Area 2W.
[c] Includes one small fishery in Area 27.
[d] Includes two small fisheries in Area 27.
[e] 1980 was a strike year.

Table 5. Summary of roe herring gillnet fisheries 1977-85.

Area	1977	1978	1979	1980[e]	1981	1982	1983	1984	1985
Queen Charlotte Islands									
Number of openings	1	3	3	4	2	1	1	1	1
Maximum number of vessels	45	80	340	126	120	140	140	85	NA
Hailed catch (tons)	1,650	3,051	2,571	1,778	1,732	1,541	1,100	591	1,558
North Coast									
Number of openings	2	2	1	1	1	0	0	1	1
Maximum number of vessels	150	200	300	150	200			73	NA
Hailed catch (tons)	1,632	2,800	1,363	1,290	410			2,208	3,759
Central Coast									
Number of openings	3	3	0	2	4	3	2	1	2
Maximum number of vessels	170	550		150	225	300	500	317	253
Hailed catch (tons)	7,363	10,083		661	2,536	4,175	4,000	3,848	2,262
Strait of Georgia									
Number of openings	4	5	1	1	1	1	1	2	2
Maximum number of vessels	325	320	450	250	500	440	300	714	432
Hailed catch (tons)	8,050	7,877	5,500	3,757	7,024	6,600	8,833	6,650[a]	3,686
West Coast Vancouver Island									
Number of openings	4	4	4	5	4	3	2	2	0
Maximum number of vessels	450	235	380	140	250	150	211	95	
Hailed catch (tons)	13,520	14,650	9,981	3,650	4,661	3,385	2,640	1,226	
TOTAL CATCH	32,215	38,461	19,415	11,136	16,363	15,701	16,573	14,523	11,275

[a] Original hailed catch was 8,325.
[b] 1980 was a strike year.

If area licensing had not been implemented, the trend towards a large number of boats (seine and gillnet) appearing at major openings would have continued. Given the limited opportunities for fisheries due to low stock levels and the high degree of fleet mobility, it would have been reasonable to predict about 200 seiners and 800 gillnetters showing up for an opening. However, since 1981 the maximum number of seiners at a single opening was 112 (Queen Charlotte Islands in 1984) and there have been only a couple of openings attended by more than 500 gillnetters.

The management benefits associated with lower vessel concentrations are summarized below:

Risk of overfishing: Fisheries managers generally indicated that the potential for extreme overfishing increases as the number of boats in an area increases. Specifically, it is more difficult to keep track of the catches of a large fleet and to recognize when the target catch has been reached. Also, a large fleet is often capable of catching more fish than a smaller fleet in a given time period.

Gear congestion: In some areas it is not practical to conduct gillnet fisheries with an extremely large fleet. For example, the physical capacity of an area may accommodate a maximum of 400 gillnets. So far, area licensing has been successful in limiting the number of gillnets in each area to an acceptable level.

Vessel activity on the spawning grounds: Area licensing has resulted in some decrease in vessel activity on the spawning grounds by reducing the number of vessels that would have otherwise participated in the major openings. However, it is not possible to say what impact the reduction in vessel activity has on spawning stocks. Several people involved in managing the herring fishery contend that vessels do affect fish movements, but scientific evidence regarding the implications of this is lacking.

Pressure to meet anticipated catches: As expected, area licensing increased the pressure on fishery officers to provide the pre-season anticipated catch in areas where stock abundance was unexpectedly low. A DFO summary of the 1981 roe herring fisheries on the West Coast of Vancouver Island stated "...with less than average stock levels to work with, the pressure this season was extreme." This situation was reversed in 1983 with the introduction of fixed catch quotas.

Economic Rationalization

Vessel operating costs: Designers of the area licensing program saw that there was great potential to reduce fishing costs by restricting the area which each licensed vessel was entitled to fish. A review of the 1979 roe herring sales slips showed that a large proportion of both the seine and gillnet fleets was highly mobile (see Table 6). Therefore,

it was assumed that vessel operating costs, especially for fuel, would be significantly reduced with area licensing.

Table 6. Mobility of the roe herring fleet--1979.

Number of areas with landings recorded[a]	Gillnet (Distribution of total gillnet boats with landings)	Seine (Distribution of total seine fleet with landings)
One area	43%	26%
Two areas	34%	35%
Three areas	18%	20%
Four areas	4%	20%
Five areas	*[b]	0

[a] Designated areas: Queen Charlotte Islands (Stat. areas 1, 2)
North and Central Coast (Stat. areas 3-10)
Johnstone Strait and Gulf of Georgia (Stat. areas 11-20)
Lower West Coast Vancouver Island (Stat. areas 21-23)
Upper West Coast Vancouver Island (Stat. areas 25-27)

[b] Less than 1 percent

As expected, since 1981 gillnetters have tended to travel only to the areas they are licensed to fish. Therefore, the mobility restricting aspect of area licensing has significantly reduced fuel costs for gillnetters. While many seine vessels with a single license continue to travel extensively to assist pool partners, the speed and route between areas has changed considerably, resulting in fuel savings.

Reduction in the size of the fleet: Designers of the area licensing program noted that if licenses were made transferable then aggregate fishing costs would be reduced with fewer vessels participating in the fishery in any year. The practice of multiple licensing began in 1982 and since then has become increasingly prevalent (see Table 7). By 1985, the roe herring fleet had been reduced by approximately 30 percent.

The reduction in the size of the roe herring fleet will result in significant cost savings in the form of foregone expenditures required to outfit and maintain vessels for fishing herring. That is, with a smaller roe herring fleet, the cost of replacing vessels and equipment is reduced.

It was noted above that some industry representatives felt the cost of leasing additional licenses, due to multiple licensing, overshadows any cost savings attributed to area licensing. In response to this issue the following two points

Table 7. Multiple licensing in the roe herring fishery.

Year	Total no. licensed vessels	No. vessels with one license	No. vessels with two licenses	No. vessels with three licenses	Total no. licensed vessels
1981					
Seine	252	252	0	0	252
Gillnet	1,305		data not available		1,305
1982					
Seine	252	216	18	0	234
Gillnet	1,319	1,087	116	0	1,203
1983					
Seine	252	192	30	0	222
Gillnet	1,325	953	186	0	1,139
1984					
Seine	251	134	59	0	193
Gillnet	1,326	754	286	0	1,040
1985					
Seine	252	99	75	1	175
Gillnet	1,328	602	339	16	957

are noteworthy:

- Presumably, fishermen pay to lease an additional license because they believe that the revenue which will be earned by operating the license will exceed the cost of the license. Therefore, while a fisherman's expenses are increased by leasing an additional license, his potential earnings are also increased.

- The cost of leasing an additional license is a real cost to the individual fisherman, but only represents a transfer of income between individuals from the point of view of the whole fishery. That is, the fleet's total fishing costs are not increased by the practice of leasing licenses. However, the profits generated in the fishery are being shared differently.

Multiple licensing has had some impact on fisheries management by providing the less productive fishermen with an opportunity to lease out their licenses. As a result, the smaller group that remains consists of the better fishermen. This point was illustrated by a comment describing the seiners at an opening in 1985 as a bunch of "Wayne Gretzkys". Fishery managers report that this group of productive fishermen is generally easier to deal with; thus some potential management problems are averted.

On the other hand, multiple licensing may reduce a fisherman's commitment to a given area. A fisherman with one license will want to maximize the value of the fishery in that one area, ignoring what is going on in other areas. However, a fisherman with more than one license may be willing

to compromise in one area, for example, to fish at a lower roe yield than possible, in order to make sure he does not miss an opening in another area.

Impact on total catch: It is difficult to envision how the roe herring fishery would have evolved if area licensing had not been introduced in 1981. With the decline in herring stocks and the trend towards large fleet concentrations in individual areas, it is likely that the hectic nature of the fishery would have intensified. While area licensing has introduced some stability into the fishery, its impact on total catch can only be speculated upon.

Several fishery officers indicated that the fleet distribution achieved by area licensing has resulted in opportunities to conduct fisheries, where this would not have been possible with a larger fleet operating. Other fishery officers disagree, pointing out that in recent years openings have generally been restricted to areas with large surplus stocks, and would have taken place even in the absence of area licensing. There is a similar disagreement among industry representatives concerning the impact of area licensing on total catch. Therefore, no conclusion has been reached regarding the impact of area licensing on total catch.

Facilitate other programs that induce efficiency: Program designers felt that area licensing might lead to other programs that would introduce greater economic efficiency into the fishery. For example, if a group of fishermen were locked into an area for an extended period of time, there would be a greater incentive to conserve and rebuild stocks. Although multiple licensing and annual area selection reduce the potential for this, there are some fishermen that choose the same area every year, thereby developing an ongoing commitment to it. Consistency in area selection is most evident in the gillnet fleet fishing north of Cape Caution.

To date, the only evidence of area licensing contributing to other programs that induce efficiency relates to the creation of the on-grounds advisory process initiated in 1985. Through this advisory process, fishermen and processors assist in determining when an opening will take place, thereby influencing roe yields and the value of the catch. Fishermen and fishery officers agree that area licensing has aided this process, because a known group of fishermen can concentrate on maximizing the value of the fishery in each area.

Equity

Variability in catch among areas: Designers of the area licensing program expected fishermen's earnings to vary considerably because the actual catch in each license area would differ from the anticipated catch.

Table 8 presents the anticipated and actual roe herring catches over the period 1981 to 1985. As expected, there is often a considerable difference between anticipated and ac-

Table 8. Anticipated and actual roe herring catches 1981-1985. (hailed landings: tons)

	Gillnet			Seine			Total	
	Anticipated catch	Actual catch	Percentage difference[a]	Anticipated catch	Actual catch	Percentage difference	Anticipated catch	Actual catch	Percentage difference
1981									
North of Cape Caution	2,225	4,678	110	6,775	6,540	- 4	9,000	11,218	25
Strait of Georgia	8,000	7,024	-12	2,000	3,000	50	10,000	10,024	.2
West Coast (Vancouver Is.)	3,275	4,661	42	7,725	6,400	17	11,000	11,061	.5
1982									
North of Cape Caution	5,400	5,716	6	6,600	6,707	2	12,000	12,423	4
Strait of Georgia	6,350	6,600	4	6,650	3,400	-49	13,000	10,000	-23
West Coast (Vancouver Is.)	4,000	3,385	-15	6,000	4,410	-27	10,000	7,795	-22
1983									
North of Cape Caution	4,600	5,100	11	8,400	8,700	4	13,000	13,800	6
Strait of Georgia	7,300	8,833	21	5,600	6,600	18	12,900	15,433	20
West Coast (Vancouver Is.)	2,000	2,640	32	3,000	5,100	70	5,000	7,740	55
1984									
North of Cape Caution	6,062	6,647[b]	10	10,692	10,845	1	16,754	17,492	4
Strait of Georgia	8,377	6,648[b]	-21	4,409	4,438	.6	12,786	11,086	13
West Coast (Vancouver Is.)	1,102	1,226	11	3,858	6,000	56	4,960	7,226	46
1985									
Queen Charlotte Islands	1,058	1,558	47	4,454	4,825	8	5,512	6,383	16
Prince Rupert	3,307	3,813	15	2,205	3,007	36	5,512	6,820	24
Central Coast	1,984	2,262	14	2,535	3,045	20	4,519	5,307	17
Strait of Georgia	2,976	3,686	24	2,205	2,879	31	5,181	6,565	27

[a] Percentage difference = (Actual catch - Anticipated catch) ÷ Anticipated catch

[b] Sales slip total rather than hailed catch

[c] Since 1983 the "Anticipated catch" is a fixed catch quota

tual catches. For example, in 1981 the gillnet catch north of Cape Caution was double the anticipated catch, while the gillnet catch in the Strait of Georgia was 12 percent lower than the pre-season expectation.

Fixed catch quotas were introduced in 1983, resolving the problem of fishermen's earnings varying due to catch prediction errors. Fishermen know the catch quota in each area prior to the season. However, since the roe herring fleet cannot be controlled to the extent that a catch quota can be precisely met, there are differences between the catch quota and actual catches.

Distribution of gross earnings: Area licensing was expected to bring about greater equality of gross earnings in the roe herring fishery. The mobility restricting aspect of area licensing was expected to limit all fishermen to roughly the same number of fishing opportunities and therefore to result in a more evenly distributed catch.

A review of roe herring catch data by seine vessels shows that seine landings became less evenly distributed after 1981. A summary of the seine catch data is presented in Table 9. It can be seen that there was a significant change in the annual distribution of seine catches between the late 1970s and the early 1980s (i.e. the catch was more evenly distributed in 1977 and 1978 than in 1981 and 1982). The largest difference between the two periods can be seen by looking at the percentage of catch taken by the top 10

Table 9. Roe herring seine catch distribution.

Fleet Ranking[a]	Seine Catch Corresponding to Fleet Rank							
	1977		1978		1981		1982	
	Average catch (tons)	Percentage of total catch	Annual catch (tons)	Percentage of total catch	Annual catch (tons)	Percentage of total catch	Annual catch (tons)	Percentage of total catch
Top 10%	455	22.70	233	21.84	205	38.99	188	36.99
2nd 10%	365	18.23	181	16.59	109	20.77	103	20.30
3rd 10%	270	13.50	156	14.29	81	15.49	73	14.29
4th 10%	230	11.46	140	12.86	60	11.35	52	10.25
5th 10%	195	9.73	113	10.37	45	8.61	38	7.55
6th 10%	170	8.47	91	8.33	20	3.88	29	5.67
7th 10%	145	7.23	73	6.64	5	0.91	16	3.15
8th 10%	125	6.23	61	5.55	0	0	9	1.75
9th 10%	49	2.42	36	3.27	0	0	0.24	0.05
Low 10%	0	0.00	8	0.77	0	0	0	0
Total	200	100.00	107	100.00	52	100.00	51	100.00

[a] For each year all seine vessels with roe herring landings were ranked from highest to lowest catch then subdivided into ten categories with approximately the same number of vessels in each category.

percent and the bottom 30 percent of the fleet. In 1981 and 1982 the top 10 percent of the fleet accounted for a much greater share of total catch than in the previous years, while the bottom 30 percent of the fleet accounted for a much smaller share.

It is interesting to note that the reduction in total catch between 1977 and 1978 was not accompanied by a significant shift in the distribution of seine catch. The number of openings appears to be a critical factor. There were approximately the same number of seine openings in 1977 and 1978--15--while there were roughly half as many openings in 1981 and 1982. The reduction in the total number of openings, combined with the factor of area licensing, resulted in the typical seine vessel participating one or two openings each season. Under these conditions, the seiner that makes one good set takes a large percentage of the total catch, while many fishermen catch nothing.

Unfortunately, catch data for the gillnet fleet were not available in a format that could be easily summarized.

Impact on most mobile fishermen: Area licensing was expected to impose a relatively greater hardship on the most mobile fishermen, especially those who had invested heavily in vessels and equipment to increase their mobility and landings in the fishery.

The issue of investment in mobility not being fully utilized due to area licensing pertains almost exclusively to the seine fleet. Unfortunately, available catch data are not in a format that allows one to distinguish between the impact of restricted mobility on highly mobile vessels and on the more stationary portion of the fleet. In the absence of such information, some general observations are presented.

Several factors suggest that restricted mobility has not had a major impact on the most mobile vessels. First, the ability to fish several areas was regained in 1982 with multiple licensing. Although leasing additional licenses is expensive, it provides the opportunity to make greater use of highly mobile seine vessels. Secondly, since much of the seine fleet continues to travel extensively with pool partners, investment in mobility is being utilized to some extent. Finally, investment in seine vessels was influenced by a number of considerations other than mobility, such as packing capacity, safety and comfort.

Fishermen's selection of areas: In 1981, fishermen were required to submit an area choice form ranking their area preferences in order. In an attempt to ensure that license holders in all areas faced roughly the same stock outlook, a maximum number of vessels eligible to fish each area was set. A draw was to be used to award licenses in areas where the number of applicants preferring that area exceeded the maximum number of vessels permitted. Consequently, it was anticipated that not all fishermen would be licensed to fish in their most preferred area.

Fortunately, all fishermen were licensed for their most preferred area in 1981. In subsequent years there was no maximum number of vessels established for each area. However, a provision was made to allow fishermen to switch areas in order to avoid having too many vessels in a given area.

Administrative and Enforcement Considerations

Administration of area licensing distribution scheme: The introduction of area licensing has resulted in a modest increase in the workload of the DFO License Division. It is estimated that the effort put into roe herring licensing has increased approximately 10 to 15 percent as a result of area licensing; approximately three additional months of work for one person.

On-line management: Area licensing was expected to make in-season management considerably easier and more secure. Fishery officers, faced with a smaller, well-defined fleet, would be able to monitor fishing practices and enforce regulations with greater ease.

As discussed above under "Biological Management," it was concluded that area licensing has resulted in fewer vessels at the major openings than would have been present without area licensing. In addition, fishery officers can establish the boundaries and duration of an opening with precise knowledge of the maximum fleet eligible to fish the area. Finally, the level of cooperation between fishermen and DFO has been raised since the introduction of area licensing.

Allocation of gear to most compatible areas: Area licensing was expected to facilitate the allocation of gillnets and seines to areas best suited to each gear type. Area licensing, combined with fixed catch quotas, has greatly contributed to the designation of seine and gillnet gear to the most appropriate fishing locations.

Identification of vessels: The identification of vessels with legitimate licenses to fish in a given area was cited as a potential problem associated with area licensing. In practice this has not been a problem in the seine fisheries, and it has been at most a minor problem in the gillnet fisheries.

Response to industry expectations concerning administrative and enforcement considerations: Some industry representatives expected area licensing to decentralize management of the roe herring fishery, resulting in inconsistent fleet and resource policies in each area. However, more emphasis has been placed on pre-season planning since the introduction of area licensing. The general management approach and catch quotas are established pre-season, ensuring consistency among license areas in these management functions. DFO staff in each area is then responsible to conduct the fisheries according to the general pre-season plan.

Area licensing was expected to cause the break-up of some pools. It appears that area licensing has led to more pooling and therefore has likely caused some disruption to pools in existence prior to 1981. However, this has not been a contentious issue associated with area licensing.

Industry representatives were skeptical about introducing area licensing with such short notice in 1981. While there were some minor problems associated with the program, it was received favorably by the majority of fishermen and fishery managers involved.

Finally, several industry groups were concerned that, even if area licensing was not successful in 1981, it would remain in place in the roe herring fishery and would set a precedent that would result in its implementation in other fisheries. Since area licensing was considered a success in 1981 by the majority of fishermen, it is difficult to comment on the concern that it would have been maintained even if it was unsuccessful.

The concern over area licensing being applied to other fisheries is more relevant. Some industry groups supported area licensing in the roe herring fishery on the condition that it would not be implemented in the salmon fishery. While the experience with area licensing in the roe herring fishery has not resulted in its implementation in other fisheries, it has kindled considerable interest.

CONCLUSION

Area licensing appears to have helped the roe herring fishery through a difficult period. Without area licensing, the declining abundance of herring in the 1980s and the high mobility of the fleet would have intensified the hectic nature of the fishery. Instead, area licensing generally prevented extremely large concentrations of boats at individual openings and greatly reduced the incidence of high-speed running between locations in anticipation of openings.

The majority of fishermen and processors are satisfied with the overall performance of area licensing. Area licensing is credited with helping fishery officers manage the fleet and contributing to a reduction in the cost of fishing. Similarly, DFO personnel believe that area licensing has improved the management of the fishery.

While area licensing is viewed as a success by the majority of industry representatives, several problems associated with the program have been identified. First, some seine fishermen did not like the risk associated with being limited to very few openings each season. Secondly, some industry spokesmen criticized the way in which unemployment is created by multiple licensing and by crews having to share in the cost of additional licenses. Finally, there were complaints about the cost of leasing additional

licenses and the fact that so much money is being taken out of the fishery by individuals leasing out their licenses.

Some industry representatives associate the decline in herring stocks with area licensing. However, the majority of industry representatives believe that the impact of area licensing on stock management has been beneficial rather than detrimental. In addition, researchers at the Pacific Biological Station noted that herring stocks normally fluctuate in a cyclical nature due to environmental conditions (e.g. ocean temperatures, food rations of offshore predators). For the past several years environmental conditions, particularly in the south coast, have been unfavorable for herring stocks.

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The Past, Present and Future of Magnuson Act Surf Clam Management

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INTRODUCTION

Called by a number of local names, surf clams (Spisula solidissima) are harvested along the Northwest Atlantic coast of the United States from Maine to Virginia. The clams, buried in sandy substrate, are taken by vessels ranging from 20 to more than 300 gross tons, using hydraulic jet dredges. In 1984, 70 million lbs valued at $34 million were landed. Many thousands of fishermen and processing employees depend on surf clams for a living; employment is concentrated in New Jersey, Maryland and Virginia.

Surf clams are the single greatest source of clam meat in the United States, used in fried clam strips, chowders, sauces and other products. Of a record total of 140 million lbs of clam meats available for consumption in 1984, fully half were surf clams. Taken together, the retail value of products derived from surf clam and ocean quahogs, both subject to federal management under the same program, exceeds $150 million.

This paper surveys the history of surf clam management under the Magnuson Fishery Conservation and Management Act, explains and evaluates the management measures currently employed in the federal regulatory program for the species, and discusses a series of broad management options which may reasonably be considered for managing this important fishery resource in the future.

THE HISTORY OF THE MAGNUSON ACT SURF CLAM MANAGEMENT

Efforts to manage the surf clam fishery from a coordinated, national perspective began under the auspices of the State-Federal Fishery Management Program as early as 1973. The National Marine Fisheries Service had been conducting resource survey and assessment cruises for surf clams regularly since 1965. New Jersey, with considerable interest in its substantial local fishery, promulgated inshore clam regulations in 1975. In July of 1977, the Commerce Department declared surf clamming a conditional fishery, restricting the availability of federal funds and loan guarantees used to increase harvesting capacity.

The Fishery Management Plan - First Step

Passage of the Fishery Conservation and Management Act in 1976, and creation of regional fishery management councils, made available an appropriate vehicle for federal management of surf clams. Among the first orders of business for the Mid-Atlantic Fishery Management Council was adoption of a fishery management plan for surf clams and ocean quahogs. The mandate for action was urgent; besides being the focus of heavy and growing fishing pressure, the surf clam fishery had been subject to an anoxic condition off the New Jersey coast in the summer of 1976, estimated to have destroyed 25 percent of New Jersey offshore stocks.

The objectives of the first FMP were simple and have remained consistent. They were: 1) to rebuild declining surf clam populations to allow eventual harvesting approaching the 50 million lbs level, the best current estimate of the maximum sustainable yield (MSY), based on average yearly catch from 1960-1976; 2) to minimize short-term economic dislocations to the extent possible consistent with the first objective, and to promote economic efficiency; and 3) to prevent the harvest of ocean quahogs from exceeding biologically sound levels, and to direct that fishery toward maintaining optimum yield.

A surprisingly wide spectrum of alternatives were considered by the Council in its development of the first FMP. These included taking no action, setting quotas at different levels, imposing size limits (ruled out in the FMP in favor of closing beds of small clams), restricting dredge size (ruled out as contrary to efficiency), vessel quotas (rejected due to lack of data to base them on), and stock certificates (also lacking data for allocation, but suggested as an optimal approach). The early serious consideration of limited entry is not surprising in view of the management problems facing the Council; the resource was in critical condition and economists forecast that the fleet as it existed then could harvest the annual fishery yield in 15 working days!

The Council specified a management program drawing on many of the range of tools available to fishery managers. Measures included annual and quarterly quotas, effort restrictions based on a reduced work week and adjustable allowed

fishing days, closure of areas containing predominantly small surf clams, a licensing program for vessels taking clams and quahogs, a moratorium on entry into the surf clam fishery, reports and recordkeeping for vessel operators and processors, and vessel marking requirements. The plan had a duration of two years, determined by the specification of quarterly quotas. The moratorium was to be in effect for one year, and could be extended for an additional year.

The economic analysis supporting the plan was relatively sophisticated and fairly prescient. Under the chosen management option, the forecast was for much higher net vessel income, stable processing plant employment, and lower consumer prices in the long run. In fact, surf clam prices reached their highest point, $12 per bushel, at about the time of plan implementation. They fluctuated around that point, but tended to decline once the stability of the management program reduced uncertainty about the future of the industry.

Several major actions were taken under the authority of the management plan during the first full year (1978) of management. These included a regulatory amendment providing the details for effort restrictions, extension of the moratorium on new entry into the surf clam fishery for a year, and closure of an area offshore of Atlantic City, New Jersey, due to the presence of concentrations of small surf clams.

Amendment No. 1 - Extension and Housekeeping

The Council was forced to extend the original FMP through an interim action in Amendment 1 while updated scientific data was produced to allow a more complete consideration of new management options. Amendment 1 extended the plan through the end of 1979. Amendments to the Magnuson Act, requiring specification of domestic capacity, also specified additional processor reporting. The amendment also altered the effort control measures, allowing the Regional Director of NMFS to start each fishing quarter with the level of fishing time calculated to allow fishing throughout the quarter. This change reduced the need for administrative adjustments to fishing time.

In comments on the amendment, the New England Fishery Management Council and other New England interests expressed great concern about the inclusion of New England in the vessel moratorium scheme. The original FMP had appeared to exempt the area from this measure, but in practice the exemption was not honored. From this point forward, controversy over the scope and intent of management in New England was a serious consideration in management deliberations.

The amendment also included the suggestion of a need for and direction toward adoption of a per-boat quota allocation system as the principal plan measure.

During the second full year of management (1979), an area offshore of Ocean City, Maryland was closed, due to the presence of concentrations of small surf clams.

Amendment No. 2 - Refinement and Additional Management Measures

With the benefit of two years of management experience, the Council set forth to develop a full amendment to the FMP. Retaining the initial objectives, the plan nevertheless sought long-term solutions to the management problems. Increasing sophistication of the biological and economic analyses supporting management decisions was apparent. Amendment 2 extended the program for two years, through 1981. Alternatives considered and presented to the public included options for allocation and access control. A base year for vessel quotas was proposed, but rejected after public comment.

The amendment as adopted by the Council increased the allowable harvest of ocean quahogs in each of the two years of plan duration, reflecting the considerable growth taking place in that fishery. The amendment also established two management areas--one for New England, one Mid-Atlantic, the boundary being the line demarking official Council authority. A small preemptive quota was set for the New England area. Enforcement was facilitated by making all fishing periods end in daylight hours. Concern about safe vessel operation under restricted fishing time was met by allowing operators to make up lost fishing days during the winter fishery from December through March; this revision, and the expected added opportunity it would give small vessels to fish in winter months, prompted reallocation of quarterly catch quotas to allow a greater proportion of annual yield to be taken in the winter. The moratorium was continued in the Mid-Atlantic and lifted in New England. Revisions were made, however, to make it easier for operators to sell licensed vessels to new operators and to leave the fishery. Areas identified by the Environmental Protection Agency (in fact, the Food and Drug Administration) as contaminated were closed to fishing. The Council advocated development of procedures to reopen beds of small surf clams closed under FMP provision. The Council also advocated a 4 1/2 inch minimum size for surf clams. Neither the reopening provisions nor the size limit were finally approved.

During 1980, the area closed to surf clam fishing off of Atlantic City, New Jersey, was enlarged to include additional beds of small surf clams requiring protection. An area offshore of Chincoteague, Virginia was closed because it held concentrations of small surf clams.

Amendment No. 3 - Framework Management

Two years passed, and the program established under Amendment 2 was scheduled to expire. Within NMFS and the Council, increasing appreciation for clearance and review requirements for actions taken under regulatory authority,

growing out of Reagan Administration attempts to control and coordinate the growth of federal regulation, suggested a need for framework management. Under a framework, a range of management actions could be specified and applied or adjusted as needed to respond to contingencies, avoiding lengthy review and approvals which would otherwise be required.

The move toward framework management, and a cumulation of four years of experience managing the fishery, suggested reevaluation of the program objectives. The objectives were, accordingly, revised. Three new objectives were added to the initial three. These included: 4) provide the greatest degree of freedom and flexibility to harvesters, consistent with other plan objectives; 5) optimize yield per recruit; and 6) increase the understanding of the stocks and the fishery.

The fishery was changing, as a result of recovery of the resource and maturity of the industry under management. The FMP had provided four years of relative stability, but attrition of vessels was becoming evident. Understanding of the dynamics of the stocks and fishing practices was more sophisticated. Brief attention was given to separating the Mid-Atlantic into two areas, New Jersey and Delmarva, to match fishing effort and resource abundance. Practical impediments led to rejection of this proposal. For the first time, a full-fledged limited entry program, in the form of vessel allocations, was presented as a management alternative.

The Council finally adopted the amendment, specifying a 5 1/2 inch size limit to optimize yield per recruit and, incidentally, to reduce the rate of harvest of surf clams. The amendment also revised the effort control program to make fishing periods end at 6:00 p.m.; extended the make-up provision from November through April of each year; set the quarterly quotas as equal throughout the year; established procedures for reopening the beds of small surf clams; closed under the FMP, with separate management controls until the areas could be fully integrated with the fishery; and provided ranges from within which annual quotas for both surf clams and ocean quahogs could be selected each year on the basis of scientific data and of industry, Council and NMFS consultation.

The size limit measure and the quota setting procedure were implemented by emergency regulation to take effect before the plan was approved, thus allowing NMFS and the Council to immediately use these provisions to address problems in the fishery.

The amendment as adopted by the Council also included a five-year program to reduce the number of licenses in the fishery. Only one permit would be issued for every four vessels leaving the fishery. Vessels would be required to meet minimum landing requirements, or be considered retired.

After considerable deliberation, this measure was not approved by NMFS.

During 1982, a portion of the area which had been closed and then expanded off of Atlantic City, New Jersey was reopened, using the procedures provided in Amendment 3.

Amendment No. 4 - The New England Fishery Emerges

Tension existed between the New England fishery and its council and the Mid-Atlantic fishery and its council from the start of management under the FMP; the friction increased after passage of Amendment 1. New England supported an undeveloped resource and was disposed to minimal control of fishing activity. The Mid-Atlantic faced a need for strict conservation and was willing to impose the measures needed to achieve it. This remained essentially a philosophical issue until the 1983 discovery of significant and commercially exploitable surf clam beds in New England. Strict measures in the Mid-Atlantic at the time made alternatives such as the New England fishery more attractive, and led to heavy fishing pressure in New England. The small preemptive quota was quickly taken, mostly by Mid-Atlantic vessels, and the New England fishery was closed, leaving the few local operators with no offshore clam fishing alternatives.

The situation repeated itself in 1984, as more exploratory fishing off New England located beds of surf clams on Georges Bank. In an atmosphere of crisis, with the benefit of emergency regulatory action, the New England area quota was increased. With voluntary compliance by the industry and the concurrence of both councils, the new resource was surveyed and assessed. Amendment 4 was produced to double the upper bound of the New England quota range. The new quota was to apply to the area west of 69 degrees. A minimum surf clam size for New England, consistent with that applied in the Mid-Atlantic, was proposed. Bimonthly harvest guidelines and effort control through trip limits, thought to be better than control of fishing time in meeting the needs of a fishery with long steaming times and highly variable weather, were proposed.

Due to the rapid pace of change and development in the fishery, Amendment 4 was never approved. However, some of its essential features were incorporated into Amendment 6.

Amendment No. 5 - An Embarrassment of Riches

Significant year classes of surf clams spawned in the Mid-Atlantic just after the FMP was first adopted. With a six- or seven-year growth cycle to harvestable size, these clams by 1983 and 1984 formed extremely dense concentrations which could be harvested at lower cost, often close to home ports. Some vessels were able to make two fishing trips, loading fully, within their allotted twelve-hour fishing periods. The legal minimum size of 5 1/2 inches required that the clams be sorted to meet enforcement tolerances. Mechanical

sorters were placed on many boats, and very significant proportions of total catch were culled and returned to the sea. Unfortunately, mortality to culled clams is so high as to create an unacceptable waste of the resource, which had been rejuvenated only after a long wait and considerable sacrifice.

Vessel operators were reluctant to avoid culling. They could obtain a higher return per hour fished by culling than by avoiding the dense beds of mixed clams. With resurgent demand for surf clam products bolstered by low historic prices, processors were eager to buy greater quantities of product. Prices to the fishermen could be cut and still provide higher returns per trip due to higher landings from the dense beds.

The Council moved to reduce the waste of the resource and end the intolerable situation in which much of the fleet was operating in a technically illegal range of landings. Emergency regulations issued in late 1984 set the size limit at 5 1/4 inches. Amendment 5 revised the 5 1/2 inch size limit, specifying criteria for selecting a size based on stock distribution and discard rates. A floor was set at a maximum yield per recruit size of 4 1/2 inches.

Since the amendment was intended to reduce the amount of enforcement action needed for small clam violations, enforcement was a matter of concern. According to estimates, inspecting clams for size at processing plants would cut enforcement cost per inspection in half. The amendment provided for tagging each cage of surf clams landed with a tag issued to the harvesting vessel, thus establishing a more reliable trail of evidence, which could be expected to lead to increased recovery for violations. Finally, the regulation included a presumption that any surf clams taken on a day authorized for fishing in federal waters were in fact taken in federal waters. As a result, fishermen could not claim that sublegal clams were taken in unregulated state waters.

Amendments 4 and 5 both differed radically from those which came before in that they were essentially single-issue actions, produced under severe time pressure to respond to existing crises. While both amendments were developed against a backdrop of chronic overharvest of surf clam quotas; a 10-12 year stock depletion horizon and no evident recruitment to replace the exploited year classes; and a steady decline in the real price and value of surf clam meats, neither amendment was intended to address, or was capable of addressing, these broader fishery issues. By consuming scarce planning time and attention, these amendments may actually have frustrated efforts to develop a more coherent, long-range solution to the problems underlying the symptoms which were being treated as crises.

During 1984, special action was taken to increase the allowable harvest from the Mid-Atlantic area. An area known as the Philadelphia and DuPont closure, which had been closed

due to environmental degradation, was reopened, following a finding that the environmental problem had been corrected.

Amendment No. 6 - Housekeeping in Crisis

The speed and confusion which surrounded development of Amendments 4 and 5 took their toll. Some measures proved in need of clarification. Harvest rates from the fishery continued to rise with increasing recruitment at greater densities; the management program had to control harvests within the quotas by restricting fishing time at lower levels than had been dreamed possible. Some adjustments were required to make this work. Increasing sophistication about the magnitude and extent of the New England resource, and greater experience with monitoring and controlling harvests from that area, aided specification of a management program for the entire New England area.

Amendment 6 divided the New England area into two management units; Georges Bank and Nantucket Shoals. Each area has its own set of quota ranges and control measures. A prohibition was suggested to prevent operators from landing more than one trip of surf clams in the Mid-Atlantic during their assigned fishing period. The Regional Director was also to be prevented from allowing fishing periods shorter than 12 hours. Both measures were intended to reduce catch rates. Special notification procedures were established to keep track of vessels moving between the variously defined management areas. The application of the surf clam minimum size, and operation of the annual quota setting process, were clarified.

Despite the fact that no new or radical policy was set forth in the amendment, a considerable portion of what the Council proposed was deleted in final NMFS approval action. The disapproved portions included bimonthly quotas and effort control measures for New England, the trip and fishing time modifications proposed for the Mid-Atlantic, and a part of the fishing zone notification program that would have reduced mobility of vessels. The disapproval action primarily reflects recognition within NMFS that measures or portions of measures were simply beyond the resources of the agency to implement, and that the cost of obtaining or diverting additional resources was not offset by corresponding benefits. The agency also appeared to recognize that some of the proposed measures were indirect efforts to restrict effort through administrative complication--the sort of constraints least favored in an era of deregulation.

As of this writing, the Council has revised and resubmitted portions of Amendment 6, establishing a comprehensive management program for the Nantucket Shoals surf clam fishery, and limiting Mid-Atlantic surf clam fishing to one trip per authorized fishing period. A final agency approval decision is due by April 10, 1986.

During 1985, fishing time for Mid-Atlantic surf clams was regularly restricted to six hours every two weeks. For the

first time, effort controls were imposed on ocean quahog fishing. The fishing week for quahogs was reduced. As the year closed, the surf clam fishery was closed for two weeks. The ocean quahog quota for 1986 was set at six million bushels, the maximum amount allowable within the range defined as optimum yield for that fishery.

THE PRESENT PLAN'S STRENGTHS AND WEAKNESSES

Despite the considerable intrusion the surf clam management plan makes on the lives and operations of the regulated public, and despite the oft-repeated promise that another management regime might reduce that intrusion, freeing up resources and energy for more lucrative pursuits, no coalition for change has yet been forged. Any incremental shift will affect marginal activity. Those marginal effects loom large when they are subjected to the glaring examination of self-interest. A larger shift, to a program substantially different from the present one, entails great uncertainty. Even where impacts can be quantified through economic, social and political analysis, the public displays an automatic and perhaps reasonable distrust of the analysts.

If force for either incremental or substantial change develops, it can come only through recognition of the drawbacks of the current regime and with some indication of possible benefits arising from the proposed alternative. We have attempted to analyze, both descriptively and quantitatively, the effects of the current regulatory program. A descriptive analysis of the measures presently contained in the surf clam management program, and their effect on the resource, the regulated public, and the administering agency, follows:

Permits

Vessel operators must obtain permits to fish for surf clams or ocean quahogs. The permits serve several functions. First, they provide information about participants in the fishery. Most federal fishery permit programs do this poorly, if at all, since permits are usually issued without limit and at no cost. Operators typically request permits, even those they have no need for, to guard against exclusion should licenses be limited in the future. The surf clam permit program for the Mid-Atlantic does a better job than many in the information-gathering function, because criteria of eligibility, including active participation in the fishery, must be met in order to get and keep the permit. Still, a number of vessels probably continue to be licensed, more on speculation than for their fishing ability. The permit program for New England illustrates the point made earlier. Hundreds of permits have been issued for that fishery since licenses were made available, yet only a handful of local operators participate in the fishery. The cost of administration of a permit program which provides no benefit to the public is wasted. But the cost of screening

permits and establishing eligibility criteria may be even higher.

The second and most important function of surf clam permits is to implement the vessel moratorium for the Mid-Atlantic fishery. Only vessels active in or being built for the fishery as of November 1977 are eligible for permits. Those vessels can be replaced if they leave the fishery involuntarily; or they can be transferred freely to new owners. The moratorium permit is not difficult to administer, with the exception of the provision for vessel replacement. Surf clam permits have become commodities of some value, recognized, if not by the government, then by the fishing community. Vessel replacement requires an administrative determination that a vessel left the fishery involuntarily during the moratorium, that it is of substantially similar harvesting capacity to the vessel it replaces, and that the replacement vessel is owned by the owner of the lost vessel. It has become obvious that each element of this test, no matter how apparently clear, is subject to interpretation. The incentives for the fisherman are great, and the number of vessels being replaced has escalated as the fleet continues to age. The desire for consistency and fairness, to avoid unnecessary rigidity and adapt to realistically changing circumstances, makes this provision a difficult administrative problem.

A final purpose of the permit is to provide a means of enforcement against violations of the management program. Permit revocation and heavy fines are provided as penalties. Permit suspension and the placing of conditions on permits have been employed against chronic or serious violators. As presently administered and defined, the permit has no direct effect on conservation.

Reports and Recordkeeping

Reports and recordkeeping are a daily burden on both fishermen and processors. They provide NMFS with baseline information on catch per unit of effort, fishing effort, and total removals from the fishery. Logbooks have become increasingly important as the progress towards fishery quotas has accelerated. Timely management data is now more critical than when the program began. The resort to area management in New England makes accurate attribution of stock removals more important.

Despite the time and effort involved in reporting, compliance with logbook reporting from both vessels and processors has been consistently good. Logbook data has been put to good use in analyzing fishery performance and stock distribution, and in adjusting management measures for effective conservation and minimal disruption of fishing activity. The open exchange of information between fishermen, managers and scientists has done much to maintain good working relations. No significant changes in the reporting system seem required by circumstances. Some of the data collected, or

the need for such frequent reporting, might be obviated by a different management system.

Vessel Identification

Each licensed vessel must bear Coast Guard documentation numbers, with the size of the numerals determined by the size of the vessel. This provision is included in the implementing rules for every fishery management plan; it has been of particular importance for the surf clam fishery because so much of the current plan's enforcement must be conducted at sea. The documentation numbers allow ready identification, used to determine whether vessels are fishing during their designated fishing periods. No fisherman has ever seriously objected to the identification provisions; they do not require significant effort or expense to install or maintain. They also serve a general identification purpose which may aid search and rescue efforts and other activities aside from the management program.

Catch Quotas

Harvest quotas have been a central part of the management program since the first FMP. They have been refined through the provision of a flexible process and a range from which annual quotas are selected, and by the addition of new quota areas to permit exploitation of the New England resource as it is now understood.

The frequent survey cruises and assessments produced for the surf clam resource provide extremely good information for selecting annual quotas. Progress toward meeting the quotas can be measured by examining the mandatory catch reports. Varying the quotas, increasing them as resource abundance has recovered over the last several years, has been an effective and acceptable means of rebuilding the stocks.

Because of the sporadic and unpredictable nature of recruitment to the surf clam fishery, it seems unlikely that quota management will be abandoned. Managers will always be faced with a finite stock which needs to be husbanded over a long time period. Sound business practice cautions against allowing the fishery to go through boom and bust periods, as would be likely to happen if annual harvest guidelines were eliminated. Quota management is the underlying premise behind most if not all forms of limited entry or property rights control; most proposals for stock certificates and limited entry condition the annual value or size of the access rights on fluctuations in stock abundance.

The problem arising from quota management in the surf clam fishery today stems from the multiple management area concept used to address the emerging New England fishery. The division into separate areas and quotas has resulted in increasingly difficult problems of monitoring progress, enforcing different measures for different areas, and accurately assessing stocks in comparatively small geographic areas.

Effort Restrictions

Effort restrictions have been used since the plan was first approved to try to keep harvests of surf clams within the quarterly and annual quotas. The primary purpose of the fishing time restrictions is to balance available access to the resource to avoid the need either to close the fishery or to undergo sharp fluctuations in supply. Regardless of the amount of fishing time per week, the harvesting sector of the industry will have an opportunity to take the quota, and the amount of clams thus landed will have a relatively fixed value. Thus, the effort restrictions probably have more significance to processing plant operators and workers than to vessel operators. Without incoming product, processing workers can be laid off; large fluctuations in landings may create physical capacity problems in the shucking and processing establishments.

The original FMP was too optimistic about the extent to which fishing time would have to be restricted in order to accomplish the stabilization goal. It envisioned reductions in fishing time only to 48 hours per week. Within a year, time was regularly being cut back to 24 hours per week, and several closures had occurred. No one could have envisioned the present situation, in which operators have only six hours to fish every two weeks; such a restriction would have been simply inconceivable in 1977.

Over time and with experience, the effort control provisions of the plan have been refined. Vessel operators have been given increasingly greater latitude in selecting fishing times, changing them when needed, and claiming make-up time for fishing periods lost due to poor weather. However, the increasing density of surf clams, and the tremendous gains in effective fishing power through improvements in gear and instruments, render the fishing time restrictions incapable of effectively constraining harvests, unless they are reduced to levels which can best be described as draconian.

Stabilizing catches by regulating hours of fishing time is an indirect tool. For any given week, managers cannot know how many vessels will fish their allowable hours, or what their catch per hour fished will be. An inevitable delay of a week to two weeks in reporting landings complicates the process of adjusting time, as does the requirement for legal notice to the affected operators. While the agency has developed special procedures for rapid collection of information, and expedited clearance and publication of notices altering fishing time, the process is still cumbersome.

From any agency perspective, fishing time regulation is costly and, as an indirect tool, inefficient. Enforcement of the measure requires substantial effort and constitutes one of the largest segments of total enforcement resources. Yet the level of enforcement seems insufficient to preclude illegal activity.

Some if not all surf clam fishermen suffer as a result of agency inability to achieve management objectives using the prescribed measures. Unless and until enforcement deters all violations, benefits will accrue to the pirate, at the expense of the law-abiding citizen. The cost to the industry of administrative difficulty is more direct, although usually short-term. Closures resulting from failure to match harvests with guidelines impose intense short-term hardships on vessel operators and processors alike.

Closed Areas

Due to Small Clams:

A number of relatively large tracts have been closed to fishing for surf clams due to local predominance of small surf clams. Areas are usually first identified by survey tows or commercial fishermen, then closed when scientific studies clearly show that they contain large, dense beds of small clams which will benefit from protection. This provision was part of the initial plan and thus predates the minimum landing size limit. Although the Council considered both area closures and size limits, selecting closure over size control in the initial FMP, it would not be likely to make the same choice in a comparison done today.

The area closures at first represented a relatively prompt and simple means of protecting small clams in dense aggregations. Enforcement, while difficult, was possible. But as the clams in the closed areas grew, they became more and more attractive to fishermen. Several abortive attempts preceded final agreement by NMFS and the Council on criteria for reopening some of the closed areas, and on measures to be applied during the reopening. Reopening part of the closed areas off Atlantic City, New Jersey was a costly, time-consuming, difficult, and perhaps confusing exercise for agency and clammers alike. More effective means of reopening may exist, but opinion overall within industry and the agency would probably be in favor of eliminating area closures as a management measure. Retention of the authority for closure in the future may be prudent, due to lack of final resolution of the discard mortality problem under the minimum size provision and to the possibility that exceptional recruitment could occur over an existing bed of clams. Such an event might require protection through closure, rather than size restriction, to guard against premature exploitation and high dredge mortality of the mixed bed.

An immediate problem with the small clam closure provisions has arisen because of the introduction of the adjustable minimum surf clam size. The area closure and reopening provisions are triggered when resident surf clam size distributions meet specified percentages by size. These sizes and percentages were established before the minimum size limit was part of the management program; moreover, the trigger points do not "float" along with the minimum size. Attention should be given to making the triggers for the area

closure and reopening provisions consistent with current legal minimum sizes.

Due to Environmental Degradation:

As many as four different areas have, at times, been closed to surf clam and ocean quahog fishing because of environmental degradation. The areas include sewage, industrial, and toxic waste disposal sites. Areas are closed when the Food and Drug Administration's Shellfish Sanitation program identifies them as degraded; that agency also administers a closure program. The areas can be reopened following a determination that the adverse environmental conditions have been corrected. One such area was reopened in 1984, following studies sponsored by the Food and Drug Administration that showed correction of the contaminant problem.

Area closures due to degradation serve an informational purpose, and also allow the Council and NMFS to show on record that certain practices may have harmful effects for the fishing industry and the public. The Council has been particularly active in trying to bring to the attention of officials and the public the effects of the environment on fishery production and yield. Closure is a means of making that statement.

Vessel Moratorium

The vessel moratorium by its own terms was to last only one year from the date of the FMP, with the possibility of a one-year extension. The Council, NMFS and the industry all expected that the moratorium would shortly be replaced with some other form of management, likely vessel quotas based on the first year or two of experience under the plan.

Now that eight years have passed and the moratorium is still in place, the initial optimism seems misplaced. On the several occasions when the moratorium has been extended, heated debate surrounded the action. Throughout all the debate, the industry itself has strongly supported continuation, primarily on the justification that restrictive management measures have imposed serious costs on those in the fishery; and that therefore they should be the primary beneficiaries when the resource is able to provide returns on the investment.

This argument has probably been valid in the past. But with management measures continuing to be restrictive and interest in the surf clam fishery from outside participants increasing, reasonable questions can be asked about how much sacrifice is involved in holding a surf clam permit, at least relative to other regional fisheries. The moratorium is not now and probably never has been effective as a stand-alone management tool. Only through rigorous application of controls on effort have managers been able to constrain harvesting capacity in the fishery. The moratorium raises all the philosophical issues attendant upon discussion of more refined and comprehensive limited entry management op-

tions, but offers none of the management benefits which could be had through a more accurate matching of physical harvesting capacity with maximum sustainable yield.

Size Restrictions

The surf clam size limit was first proposed by the Council in Amendment 2. It was rejected because it was seen as duplicating the small clam area closure mechanism and because of concern that the size selected was an economic rather than a conservation measure. The rejection proved to be a mistake; after a crisis which the size limit could have alleviated, a limit was added as part of the management program. However, during 1983 and 1984, changes in the size distribution of clams, and in the ability of the market to absorb smaller surf clams in greater amounts than had been expected, led to a need to change the size limit.

Responding to these developments, the Council wisely specified an adjustable size to improve the versatility of the measure. Still, as long as different sectors of the industry use different sizes of clams, and as long as the fleet is arrayed along the coast with varying access to beds of different size clams, the specification of a size will cause contention. The need to have a definite standard by which to document violations, and the large volume of clams represented in a typical trip, make enforcement difficult.

Problems and Priorities of Surf Clam Management Today

Under the Magnuson Act fishery management process, identification of problems and priorities is primarily the responsibility of the fishery management councils as the policy arm of federal fishery management efforts. While leaving the final definition of problems and priorities to the Council, we can, from our review above and our experience in administering the surf clam management program, suggest the following as areas that need attention to improve the surf clam management program:

1. Improving the effort control provisions of the surf clam management program

2. Reducing the complexity, or improving the integration of, the various area management schemes for surf clams

3. Increasing the operating latitude of surf clam vessel operators; reducing incentives or pressures for unsafe vessel operation

4. Fostering controlled and sustained development of the ocean quahog fishery throughout its range

5. Resolving inconsistencies between the small clam area closures criteria and the adjustable minimum surf clam size

As the review indicates, many of these problems have been issues since managers first grappled with the surf clam fishery eight years ago. Others have emerged as a consequence of attempted solutions, and as other more important problems have dropped away through time and through the successes of the management program. Problems that have persisted for nearly a decade cannot likely be banished through any single adjustment to the management program; an incremental approach, concerted or reactive, may well continue to be the best means of improving surf clam management. The important requirement is that problems be recognized and that active efforts continue toward achievement of the effective, efficient and cooperative long-term conservation regime that all would agree is the ultimate objective.

Conclusion

The surf clam fishery is subject to a wide range and considerable total burden of management measures. Careful design, or more rigorous application, of some of the measures might obviate the need for others. For example, quota management by itself could be at least the major portion of an effective program; similarly, effort restrictions, size restrictions, or a moratorium are measures any one of which, if properly designed, could carry most of the management burden. The problem to date is that measures have been added and enlarged under the press of emergencies; an effort to step back, integrate, and eliminate duplication or overlap has not been possible.

Regardless of what decisions are made about the future of surf clam management, this situation of redundancy should be a matter of some concern. The combination of all these measures, where one or two alone might achieve the same conservation and management objectives, generates serious demands on the resources of the National Marine Fisheries Service; the burden on the regulated public is no less substantial.

ALTERNATIVES FOR THE FUTURE

Management alternatives can be considered across at least two dimensions. The first is philosophical. Despite the concrete problems and limited resources for debate, an extraordinary amount of fishery management planning effort is devoted to considering and making compromises from extreme philosophical positions. The second dimension is substantive. Given agreement that management is a worthwhile objective, or that limited entry is a proper tool to deal with the problems posed in a given fishery, what sort of program accomplishes that job best, at the lowest cost to the regulated public, the agency, and consumers? This discussion will focus on the substantive dimension of alternative selection, but to get to that level of analysis, philosophical issues must be considered.

The philosophical dimension can be likened to a series of steps. How far do we want to go with management? How much

are we willing to invest, how many precedents are we willing to overturn? The substantive dimension deals with tools, with matching problems to solution and considering the quality of the fit. The philosophical dimension is the real arena for policy selection--here the choices are made that widen or narrow the range of substantive alternatives.

Review of the history of the surf clam management plan and its amendments illustrates that any consideration of management alternatives starts with a slate which has been covered and erased many times. The initial plan and the first three amendments were thoughtful and energetic efforts at a comprehensive solution. The parties were seeking complete agreement on an optimal solution to the management problems. Frustration with that process, evident through the eventual lack of results or consensus, suggests that our objective in considering and selecting an alternative might better focus on acceptable, rather than optimal, solutions. Many of the proposals rejected in the past might have served us as well as or better than the present amalgamation.

Philosophical Dimension

Society uses a variety of means to make policy choices. In the United States, the vast majority of policy choices are made by and through the market. Other informal mechanisms exist, but when and if the market fails we usually turn (reluctantly) to government.

When the government involves itself in an area such as fishery regulation, it does so on the premise that someone will benefit. That someone will generally not be the government. Resource management almost always requires public expenditures, and the public should be able to expect a return on its investment. Industry may also be called upon to accept short-term sacrifices under a conservation or enhancement program; it has a right to expect a return on that investment. Determining who will benefit, and how, is the responsibility of the policymaker.

Bound up in this whole problem of fishery management are the concepts of allocation and distribution. Here again, the issue has more than one dimension. The first has to do with distribution over time. What proportion of the total available stock will be consumed, and what portion will be invested--left in the ocean to perpetuate and augment the stocks? Distribution over time determines the size of the pie that will be available to fishery participants in any one year. The investment decision implies that distribution over time also determines the size of all future pies.

The second distributional dimension has to do with allocation. Given a pie of given size, how will it be divided among all those who have real or imagined claims upon it? Both distributional dimensions have the potential to raise contention. However, the second, which in essence is a zero-sum game among interested parties, is the most contentious issue facing any resource manager.

An allocation of access is implicit regardless of the manner in which the surf clam fishery is regulated. Given the existence of federal management authority, lack of management implies an active decision on the part of the government to allow potential benefits from the resource to be dissipated--actually, allocated by default to those in the best position to take advantage of them. The question distinguishing one management alternative from the next is whether any sort of coherent social policy underlies, or is achieved by, the allocation of access arising from the regulatory system. If the management authority chooses not to specify who will acquire access, benefits will accrue to those best able to adapt to or affect the shape of the regulatory program. All else held constant, those with the greatest access to financial, planning and legal resources will be in the best position to increase their share of access to the regulated species.

Option Number One: A Minimum Management Program

A good starting point in considering alternatives to the present surf clam management program is to assess the minimum measures required to fulfill obligations under the mandate of the Magnuson FIshery Conservation and Management Act. Such an approach is valid, both in light of the limited resources currently available for the purpose of surf clam management, and to be consistent with the prevailing public policy of limiting the scope of regulation.

Debates of the sort required to define this point of minimum regulation have occurred with some frequency, both in the formal Council and committee forums and among managers and the affected public. Most agree that the essential concern is to direct the fishery to achieve optimum yield. Optimum yield, of course, is a concept embracing social and economic considerations as well as the biological capacity of the resource. As such, optimum yield can only be defined within the context of whatever management objectives are espoused by the Council. We cannot for these purposes assume that the objectives supporting the present plan would be retained if there were a shift in management philosophy toward favoring minimum controls.

Thus we are forced in defining a minimum management program to define a set of hypothetical objectives. Consistent with minimizing the effect of our management program on economic allocation and distribution, we would adopt the minimum management program capable of attaining maximum sustainable yield from the surf clam fishery over time. That yield will be a function of production of the stock, which results from fishing effort and recruitment. Fishing effort can be controlled through direct and indirect management measures. Recruitment, particularly recruitment for surf clams, is controllable only to the extent that we can alter spawning stock sizes, age of capture, and thus yield per recruit; and perhaps, under a more sophisticated program, it is also controllable through stock enhancement efforts.

Our minimum management program can therefore be limited to some form of control over fishing effort and yield per recruit. An overall quota would be the simplest measure for constraining total fishing effort. A minimum harvest size limit would give the most direct control of yield per recruit. This specification of a management regime, similar to proposals advanced within the Council forum as an expression of desperation with lack of progress toward a more comprehensive and durable program, quickly sharpens the focus of debate. Once the minimum measures have been described, the extent to which the current management program incorporates a market basket of measures to soften the direct effects of the conservation regime becomes apparent.

The measures in the current plan are for the benefit not only of the industry and public, but also of those who are charged with administration of the management program. Experience with surf clam management, and indeed with every other management program under the Magnuson Act, demonstrates that unless a regulatory system is capable of addressing equity issues and providing a residuum of economic viability for participants, it will quickly be undermined through avoidance, violation, legal challenge, or political intercession. Since all of these forces are, once released, beyond the control of the managers, the shape and result of the final management program which unleashes them may have little to do with the minimum conservation needs sought to be met.

Option Number Two: Traditional Tools

Once managers begin the process of addressing social and economic issues arising from the first order decision to constrain harvest, they unleash a powerful force tending to increase and expand their role, their responsibilities, and their obligation to the regulated industry. Traditional fishery management tools such as quotas, effort limits, size limits, closed areas, and seasons all introduce some element of economic or operating inefficiency; they must, since the manager's duty under traditional control schemes is to prevent fishermen from overharvesting. The only apparent way of accomplishing this is to force the fishermen to be less efficient.

Managers find it easy to fall into the practice of using traditional tools. They find it particularly easy to do so in the context of piecemeal emergency problem solving--the sort of problem solving that has attended surf clam management since the FMP was implemented in 1977, and which has increasingly become the norm in the last several years. As problems appear, traditional solutions to those problems have been incorporated into the management program.

The drawback to this approach is that each traditional tool is limited in its effect. The total burden of many tools, each valid to solve a small, isolated problem, may be both considerable and perverse. The opposite of synergy may occur: the sum of the parts may be less than the whole; its

negative effect on fishermen more stifling than each individual burden taken alone. The differing real objectives underlying each aspect of the program can produce a complex and confusing, if not contradictory, whole.

Option Number Three: Restoring Private Stewardship

Would introduction of limited entry and property rights into the management of marine fisheries under the Magnuson Act be the final extension of a concept universal in other areas of human relations, revitalizing and rendering effective our mandate to conserve and enhance fishery resources; or would it be a not-so-noble economic experiment eliminating the last vestiges of what remains a special way of living and earning?

A commentator has suggested that limited entry in some of its forms, by creating property, makes the operation of free enterprise, and the market forces we rely on so heavily, possible in fisheries, where they are otherwise absent. Instead of viewing limited entry or other forms of property rights creation as an extension of the regulatory burden, we might instead consider whether such management alternatives could be a means of reprivatizing most of the business decisions inherent in operating in a regulated industry.

This potential is certainly available in the surf clam fishery. Fishermen operating clam boats see that a great many business decisions are either made directly by the government (seasonal product flow, raw material configuration, working hours), or are made by industry in the shadow of a dominating requirement to comply with an intensive and intrusive regulatory regime. We view the third option for managers as the creation of some form of property rights. These rights can be short or long term. The longer the term, the more valuable and stable the right, the higher the capitalized value of the right, and the more likely that it will induce retirement of excess capacity and encourage efficient market trading of access opportunity. The rights can be permanent. The rights can be given away, by lottery or based on some criteria, or they can be sold, at a fixed price or at auction. The rights can take the form of fishing time, fishing trips, bushels landed, or allocation of exclusive operating areas. We will examine a series of management options that have the potential to return management decisions and control of the industry to the participants in the fishery, while retaining for managers the authority and power to carry out their mandate for conservation.

Substantive Dimension

A NOAA Technical Memorandum released in July of 1985, "Fishery Management--Lessons from Other Resource Management Areas," identified four major alternative types of management tools. These include limits on inputs, direct control of output, taxes or fees, and areal rights.

Limits on Inputs

Input limitations include specification of fishing time, vessel size, and gear type. Limited entry, through control of the number of fishing units, could be a form of input limitation. Input controls are particularly attractive where the annual allowable yield from the fishery is unknown, but is assumed to be a function of applied effort. Such would be the case with surf clams if management were targeted at allowing all clams to reach the size of maximum yield per recruit, if that size were above the level of sexual maturity. Under such a regime, a gear type that harvested only clams which had reached the target size, and caused no ancillary mortality, would be an adequate and effective input limitation management tool. Fluctuations in annual landings could be accepted with the confidence that the reproductive capacity of the stock and its total production were being protected and maximized.

A principal problem with input limitation is that control of one type of input creates incentives for operators to compensate by increasing their capacity through greater or more efficient use of other inputs. In an industry where operators use a variety of inputs in different combinations, controls on selected inputs can affect different user groups differently. Control of any input at a nominal level encourages the entire industry to adopt that level as its standard of operation.

Input control has been one of the primary surf clam management tools. The program limits the number of fishing days in a week, the number of hours in a fishing trip, and the total number of vessels with surf clam permits. Attempts to broaden the use of input limits, for example through controls on dredge size and number, have been counterproductive. Input limitations imply artificial constraint on factors which vessel operators can and perhaps should be able to optimize. The lengthy process of plan approval and implementation, combined with a tradition of grandfathering existing practices, has created what the industry calls an "arms race" every time additional input limitations have been seriously considered. Before effective controls can be adopted, every operator has reached or exceeded the proposed control level.

A more theoretical objection to input limits arises because of their indirect operation. Fishermen are favorably disposed to controls that do not directly constrain their net income. Such controls allow room for initiative and innovation by the individual so that he can expand his income despite the operation of an overall management program. But indirect controls give no assurance to managers that the management objective will be achieved. In this respect, input controls degenerate into a sort of game. Managers know the level of stock removal they can accept. This is their measure of performance and will be the key to program success. Input limits translate this level into fishing hours, days, trips, gear type, or operating units. If gear effi-

ciency increases, a given input level will increase effective fishing mortality, resulting in frustration of the management purpose. This scenario has been played out in almost all management programs.

Indirect measures such as input controls imply greatly increased costs of supervision. The enforcement resources required to monitor total landings are of significantly lower magnitude than those required to monitor time at sea, net mesh size, or days fished. The analogy to a game applies again. What cost is the agency willing to bear to allow fishermen the illusion that they are not operating under overall constraints? Given finite resources, playing this sort of game is likely to mean that the objective of fishery management will either not be achieved, or that it will be achieved imperfectly at best.

Direct Output Control

For a fishery where sustainable yield can be calculated with some precision, direct control of outputs is probably the most efficient and effective management tool. Annual surveys and stock assessments for the surf clam fishery have enabled fishery scientists to chart with some accuracy the relative abundance of surf clams each year for nearly a decade. Thus, the surf clam fishery appears to be an active candidate for management through direct output control.

Direct control of outputs is attractive from a manager's perspective because it holds promise for facilitating enforcement, or for reducing the cost of such enforcement. Surf clam fishery output consists of surf clams. They are bulky and must be landed in ports. The Mid-Atlantic region, where most surf clams are taken and landed, has a relatively small number of ports of a size and configuration and proximity to labor and land to allow surf clam operations to occur. These ports can be effectively covered by enforcement personnel with far fewer resources than must be used to monitor fishing activity over thousands of square miles of sea surface.

Taxes or Fees

Many natural resource regulatory programs are based on taxes or fees. As direct economic signals, taxes and fees have the capacity to help restore market incentives where they do not otherwise exist. A tax or fee imposed on pollution discharge, equal to the cost of cleaning the environment of that discharge, creates an incentive for the discharger to minimize his release of pollution, or gives society resources to either clean up the discharge or compensate those who are harmed by it. As long as the fee or tax accurately reflects the true cost of clean-up, it can also serve as a true market system to internalize the cost of behavior detrimental to social welfare.

If a fee or tax is allowed to become obsolete, it may lose its value. A fee or tax is a kind of snapshot effort at es-

tablishing a market where none exists. Most markets remain in session continually, and thus perform their clearing function on a continual basis; they rarely become obsolete.

The distinction between tax and fee is that the level of a tax is set legislatively by policy to encourage or discourage a particular activity, while a fee is payment for benefits received or conferred. In the federal system, only Congress can establish and regulate the level of a tax. Since Congress must be involved in decisions to administer tax rate changes, since Congress is frequently absorbed in affairs it considers more pressing than management of the surf clam fishery, and since changes in the level of the tax are the primary means through which harvests are to be regulated under a tax system, a fundamental impediment to tax-based management exists, recognized in the Magnuson Act and by commentators on the Act. With the experience and expedited procedures we have developed through regulatory administration, the National Marine Fisheries Service could readily determine appropriate economic incentives and alter them as required to balance optimum yield and harvest. The problem is in obtaining authority to conduct such an activity.

Agencies are permitted to establish and administer schedules of fees based on Congressionally defined criteria. Fees can be adjusted based on changes in the cost of providing agency services or on the value of those services as received by the fee payer. Use of fees as a substitute for taxes thus offers some promise, particularly because the cost of surf clam management is substantial enough that if recovered through fees, it could generate real economic effects on demand for fishing access. If higher fees were required to generate such demand effects, monies collected through the fee system could be applied to compensation or buy-back programs for displaced operators, or for a stock enhancement program.

Areal Rights

Areal rights are particularly effective where notions of property are firmly established, and the risks of poaching or inadvertent trespass can be minimized. Areal rights are, of course, the basis for all real property ownership. Unfortunately, the ocean bottom represents a significant enclave of resistance against the development of areal rights.

Many fisheries have been managed under some form of areal rights. The Magnuson Act itself is a claim of areal rights. It asserts exclusive jurisdiction over resources in proximity to the United States coast and establishes a priority of right for United States citizens for the exploitation of those resources. The Mid-Atlantic Council has been in the forefront of asserting this right and employing its ramifications for the benefit of the American fishing industry. Various states have also asserted area management authority, which may have beneficial effects for their own residents.

The areal rights of sovereign political entities are, however, of a different nature from those contemplated in a fishery management program. With the exception of the overlap between federal and state authority, sovereign entities have clear and exclusive claims, inviolable in the absence of major conflicts involving fellow sovereigns.

Sovereigns generally have more resources and ready access to the coercive effect of police power and sanctions to uphold their claims. Usually, it is a subject of the sovereign who will be operating within the claim; anyone in the territory of a sovereign is subject in some measure to its coercive power. Sovereign claims are usually geographically large, and thus easier to delimit and patrol. Where a sovereign asserts an areal right, it is often in the interest of its subjects, each of whom may exercise diligence to detect and/or report violations of the right that may diminish their own enjoyment of the sovereign's franchise.

Private parties given areal rights lack many of the attributes that make sovereign areal rights possible. Leases of oyster bottom are the most common and most familiar areal rights. They are characterized by relative proximity to shore, relative ease of supervision by the proprietor, and local or community traditions that help to enforce appreciation and respect for the value and sanctity of the territorial claim.

Offshore oil leases and mineral claims share many of the attributes of fishery areal rights. We may thus use some of the policies and procedures developed for these federal leasing and granting activities as a starting point for our own analysis. A fundamental difference is that currently used machinery for extracting oil and minerals offshore is large, bulky and immobile. In contrast, the machinery for extracting fish may be small and fast. Mobility of poachers is a significant factor in considering an areal rights proposal.

Technological developments have probably enhanced the feasibility of areal rights for surf clam fisheries. The combination of improved LORAN navigational gear and plotter control of vessel operation make it possible to direct a vessel with considerable accuracy to a specific area, and confine fishing operations to within that area. However, these technological advances also make it easy for poachers to exploit their neighbor's claims. No simple technology exists to exclude or detect the presence of trespassers. Since much surf clam fishing bottom is well offshore, subject to the effects of pollution, weather, and predation, the individual clam fisherman may see little to gain in converting to an areal rights based management system. Many factors beyond the fisherman's control could have significant effects on his investment.

The possibility of using areal rights to foster clam stocking or other yield enhancing practices exists. But it may be that these benefits alone cannot overcome the practical

difficulty of enforcement and allocation of the initial areal rights, or that other means, such as industrywide subscription and cooperative yield enhancement, or direct federal programs, would be more practical organizational structures to support an investment program on the scale likely to be required to produce serious results.

CONCLUSION

We have examined the past, the present, and a series of possible futures for surf clam management. As it the only fishery managed under a federally-administered limited entry program, the surf clam industry offers an opportunity to study the effects of such a program, the problems in administering a limited entry program under the Magnuson Act, and the difficulties of adjusting and developing the program when circumstances and perhaps objectives have changed. The Mid-Atlantic Fishery Management Council is just now beginning to prepare Amendment 7 to the original fishery management plan. Many observers hope and expect that the amendment will establish limited entry in some form as a permanent management program. The decision rests with the Council, which will likely need all the advice and support it can get in this major effort.

A Review of California's Limited Entry Programs

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INTRODUCTION

Access to California's commercial fisheries has been increasingly restricted through a variety of limited access programs. Until 1974, when the state limited the number of licenses in the herring roe fishery, all of California's fisheries operated under the traditional open access system. Commercial fishing vessel registrations and annual commercial fishing licenses have long been required by the state, but these were available to all applicants at a nominal fee. Since 1974 seven restrictive licensing systems have been established, and the pace of change in the licensing systems seems to be accelerating.

The California Department of Fish and Game (CDF&G) distinguishes three different types of limited access systems: (1) qualified entry, (2) entry moratorium, and (3) limited entry. The first type is designed to assure that fishermen are knowledgeable and/or experienced in a fishery before they are permitted to operate a vessel in that fishery. For example, the Fish and Game Commission requires that new recipients of gillnet permits meet specific qualifications. These include having either a year's experience as a crew member on a licensed vessel, a history of activity in the fishery, or a passing score on a proficiency examination administered by CDF&G. Qualified entry programs do not place a limit on number of participants in a fishery, but they may slow down the pace of new entry.

A moratorium on new permits puts a stop to all new entry and is usually a preliminary step to setting up a limited entry system. As the name implies, a moratorium freezes the num-

ber of permits issued for a particular fishery as of a specific date. Although a moratorium temporarily permits no new entry, it also seeks no reduction in numbers of fishermen. Two examples are the 1980 temporary moratorium on salmon fishing licenses (replaced with a limited entry system in 1982) and the moratorium on general gillnet fishing permits that went into effect on January 1, 1986. Implementing legislation for the latter moratorium requires CDF&G to prepare a report assessing the need for a limited entry program for the gillnet/trammel net fishery by January 1, 1989.

A full-blown limited entry program has specific procedures and conditions for licensing new fishermen. California fisheries under limited entry programs include (1) the herring roe fishery, (2) the commercial abalone fishery, (3) the salmon fishery, (4) the drift gillnet fishery for shark and swordfish, (5) the experimental driftgill net fishery for swordfish off central California, and (6) the nearshore set gillnet and trammel net fishery off central California. Some of these programs set goals for total numbers of participating fishermen or vessels. Others simply control the conditions of entry. The legislature did not establish numerical goals for the salmon limited entry system, for example, but it did require that the Commercial Salmon Fishing Review Board and Fish and Game Commission determine the number of new permits to be issued annually. In contrast, the Fish and Game Commission set a specific goal of 100 operators in the abalone license limitation program.

This paper describes the objectives sought and principles adopted in California's limited access systems, followed by a brief description of each existing program. The final section offers a summary and some observations regarding present difficulties and future directions for limited access systems in California.

PRINCIPLES AND OBJECTIVES IN CALIFORNIA'S PROGRAMS

California's limited access programs have sought a wide variety of objectives, including (a) to enhance conservation of fish resources, (b) to protect the commercial fishing industry, (c) to reduce the numbers of incidentally killed marine mammals and seabirds, (d) to minimize potential conflicts between competing commercial fisheries and between sport and commercial fisheries, and (e) to "insure efficient and economic operation of the fishery." Only the experimental central California drift gillnet swordfish permit program fails to mention fish stock conservation as an objective. That program seeks "to allow increased access to the swordfish resource." The central California gill and trammel net program is most concerned with incidental take of mammals and birds, while the drift gillnet shark and swordfish program seeks to minimize conflicts and to conserve shark populations. Only the herring roe license limitation program includes economic efficiency as a specific objective.

Our review of stated objectives for limited access programs reveals that traditional notions of physical conservation and equitable allocation remain central to the state's conception of its role in regulating commercial marine fisheries. Stability of the fishery and reduction of social conflicts play somewhat smaller roles. The standard economic objectives of efficiency and rent-maximizing have a minimal influence on California's decisions. CDF&G personnel have frequently stated that CDF&G is primarily responsible for conservation of the fish stocks and secondarily for the resolution of user conflicts, while the industry itself must take the lead in developing management programs specifically intended to increase economic efficiency.

Besides avoiding economic efficiency objectives CDF&G generally prefers to prevent fishery permits from becoming assets of value to individual fishermen. When transferable permits are sold on the open market, they may take on significant value, as has happened in Washington and Alaska. Two objections are raised to the transferable permit. One objection is that potential regulatory problems may arise when fishermen with a substantial investment in their permits resist necessary restrictions on the fishery. A second and more important objection is that a substantial price attached to a transferable permit represents a windfall gain attributable to the newly created property right. Furthermore, this permit price creates a discriminatory barrier to new entrants. Only those citizens who inherit a permit or are sufficiently affluent to purchase one will have access to the fishery. These objections have extensively influenced the character of all limited entry programs in California.

Transfer of permits to heirs and working partners is permitted under specific conditions in all California limited entry programs. For example, a spouse, child or sibling of a deceased, retired or incapacitated permittee can obtain the permit if proof can be given of physical, working participation, aboard the permittee's vessel, in the limited entry fishery.

There are some additional common characteristics found in California's limited entry programs. Eligibility for initial permits is based upon past participation in the fishery or upon substantial investment prior to the enactment of the limited entry or moratorium program. California law specifically permits entry during the first year of a limited entry program to any commercial fisherman with twenty years of general experience and at least one year of participation in the target fishery. Permits are generally issued annually, and retention of permits from year to year is often contingent on continued participation in the fishery. Permits may not be held by corporations or partnerships and are attached to the person except in the salmon fishery, where they are attached to vessels. Allocation of new permits when they are available is generally based upon qualifications, including past participation and experience. Selection among

equally qualified applicants is usually accomplished through a drawing.

LIMITED ACCESS PROGRAMS

Herring

The modern California herring roe fishery began in the San Francisco and Tomales Bays to satisfy Japanese demand during a period of shortage and high roe prices in the early 1970s. Salmon sport fishermen and local residents were disturbed and concerned by the sudden emergence of the fishery. At their behest, legislation was introduced in 1974 to prohibit commercial take of herring except for use as bait. Before the beginning of the 1974 winter fishing season, CDF&G negotiated a compromise bill which gave the agency authority to establish a permit system and an annual catch quota. During 1974 and 1975 the number of permittees was limited to the number of participants in 1974--seventeen. Participants were chosen by drawing from among qualified applicants. As roe prices escalated, CDF&G was pressured to allow additional fishermen to participate. In 1976 a total of 57 fishing vessels were licensed to fish in the two bays.

The limited entry system established in 1977 allowed a total of 267 vessels to enter. All previous participants were "grandfathered" into the fishery and an additional 150 new licenses were allocated in 1977. That number steadily increased to 447 in 1982. To qualify for renewal, a permittee must have had a valid permit the previous year and must have actively fished, or demonstrated an intent to fish, the previous year. Permits cost $50 per year and may be revoked for fishing violations.

In addition to control over the number of participants, the management system enforced quotas based on spawning biomass estimates derived from surveys of roe depositions in the bays. To reduce the congestion and competition in restricted fishing areas, an odd-even platoon system for gillnet vessels was introduced. Vessels with odd-numbered permits fished during odd-numbered weeks, and vessels with even-numbered permits fished during even-numbered weeks. In addition, a small number of purse seine and lampara vessels were licensed to fish. A third "experimental" gillnet platoon was added in 1980, and these vessels are permitted to fish only during the month of December, before the opening of the traditional fishery in January.

The increasing complexity of regulations was not necessitated by fish stock depletion. In fact, spawning biomass estimates indicated that herring populations were increasing. Management measures were designed more to alleviate social problems than to provide protection to the resource. Intense fishing pressure was motivated by extremely high ex-vessel prices. The reported price rose to nearly $4,000 per ton in 1980. A highlining purse seine vessel in 1979 reportedly sold more than $120,000 of fish in little more than

two weeks. The prospect of extraordinary profits brought intensely competitive fishing into a part of San Francisco Bay that is highly urbanized and environmentally sensitive. Fishing boats were competing for limited space with each other, commuter ferries, and yachts. If the resulting conflicts had not been addressed, non-fishing interests would have pushed harder for prohibition of the commercial fishery.

A nine-member advisory committee was formed to advise the CDF&G director on annual regulation changes. The Fish and Game Commission establishes a maximum limit of permits to be issued by gear type and area. These permits are issued to the owner, operator or leasee of a fishing vessel. The vessel to be used must be specified in advance, and the permits are nontransferable, except that permittees may designate another fishing vessel under certain circumstances.

New permits are issued whenever the number of permits allowed exceeds the number of renewals. Applicants must be licensed commercial fishermen and must own, operate or lease a currently licensed fishing vessel. The method of selection is a public drawing from among the qualified applicants.

Abalone

The abalone limited entry system adopted in 1977 was one aspect of a comprehensive program established by the Fish and Game Commission with the goal of restoring abalone stocks and increasing yields. After an intensive study it was concluded that one cause of declining abalone stocks was mortality of abalone under legal size that were picked and replaced. This problem was largely due to the excessive number of divers in the fishery, many of whom were inexperienced. From 1973 to 1975, 30 percent of the divers active in any year were new to the fishery and about 50 percent had less than 2 years' experience. CDF&G, with the support of industry organizations, recommended a limited entry program to remove inexperienced divers from the fishery and to reduce overall fishing effort to reasonable levels. The Fish and Game Commission established a limited number of nontransferable diving permits and made provision for issuing new licenses when the number of permittees fell below a set number. Crew members are also required to purchase permits, but there is no limit on the number of crew permits. Diver permit fees were set at $200 annually and crew permits at $100.

In 1977 licenses were initially issued to 397 divers who had participated in 1976. Annual renewal of the license requires a minimum landing of 6,000 lbs or 20 landings, defined as a minimum of two dozen abalone per landing. Permittees may obtain a waiver of the minimum landing requirement under certain circumstances. Permits may be revoked due either to failure to meet minimum landing requires or to fishing violations. From 1976 to 1985 the number of diver permits issued dropped from 397 to just under 1975. In

1985, further amendments to the regulations established the target number of diving permits at 100. To qualify, new applicants for permits must have at least three years experience as an abalone diver or crew member or must pass a proficiency test. When there are more applicants that permits available, a public drawing is held among qualified applicants.

Salmon

During 1979 the California legislature passed a bill establishing a two-year moratorium on participation in the commercial salmon fishery. This followed a recommendation from the Pacific Fishery Management Council calling for all Pacific Coast states to limit entry into the salmon fishery. The stated objective was to halt the increase in fishing effort while the merits of a permanent limited entry program were examined. Some concern regarding the salmon fleet was warranted by the long-term trends in the fishery. Between 1960 and 1978, the number of commercial vessels landing salmon in California grew from 1,365 to 4,919, while inflation-corrected ex-vessel value of salmon landings per vessel fell from $8,290 to $3,460 (in 1985 dollars).

The moratorium required commercial salmon vessel operators to have a salmon validation permit as well as the usual California commercial fishing license and a salmon stamp. This validation permit was nontransferable and revokable. Each permit holder was authorized to have up to two crew members on board with him who were not qualified individuals, and, after approval of a substitution application submitted to CDF&G, he could have another person serve in his place under his permit for up to 15 calendar days.

To qualify for a salmon validation permit, an applicant needed to show only that he or she had sold at least one salmon during at least one of the years 1974 through 1979, or that he had possessed a commercial fishing license and assisted with the capture and sale of at least one salmon, or that he had made a substantial investment in becoming a commercial salmon fisherman in California during the qualification period. During 1980, a total of 5,119 troll vessels landed salmon in California. In 1981 the number dropped to 4,102, and in 1982 the number of active trollers in California was 4,013.

During the moratorium various segments of the commercial industry in California, led by the Pacific Coast Federation of Fishermen's Associations, developed a comprehensive proposal for a limited entry system. As amended and enacted into law, the limited entry system creates a commercial salmon vessel permit which is issued to owners of vessels used to land salmon in California during 1980-82, to persons who possessed a commercial salmon permit under the moratorium and who had under construction or contracted for construction a vessel for entry into California's salmon fishery, and to other persons who meet specific criteria as determined by the newly-created Commercial Salmon Fishing Review

Board. The permits are to be renewed annually by application to CDF&G. They may be suspended or revoked by the Fish and Game Commission for violation of fishing regulations or because application for renewal is not submitted.

A person may gain new entry to the fishery by purchasing a vessel already licensed under a vessel permit. Licenses are attached to vessels and cannot be sold or transferred separately from the vessels. If a licensed vessel is lost or retired from the fishery, the permit is reissued to the vessel owner and can be placed on another vessel within one year if that new vessel has a salmon fishing potential no greater than the original vessel, as determined by the review board. New entry may also be obtained by application for a new vessel permit issued by CDF&G. New permits may be issued by lottery in the future, under criteria to be established by the review board. The number of new permits is to be based upon the health and status of the salmon resource, and on the economic stability of the commercial salmon industry. To date, no new vessel permits have been issued.

The salmon limited entry system is still an interim system. To devise a permanent system the law calls for collection of information on the salmon fishery, including the impact that equipment and experience have on the fishery; and submission to the legislature of a report containing this information. Originally the interim system was to expire on January 1, 1986, but it has been extended. During the first three years of operation of the new system, the number of vessels landing salmon in California has dropped from 3,223 in 1983 to 2,308 in 1985. The number of permits issued dropped from 4,617 to 3,712 during the same three-year period. The shrinking fleet size is largely due to diminishing abundance of salmon stocks, which necessitated increasingly restrictive ocean fishing regulations, and to a host of adverse economic conditions. No buy-back or other directed fleet reduction program has been enacted.

General Gillnet Permits

These general permits were created in 1981 to apply to all state waters. This permit program constituted a "qualified entry system" until a moratorium on new permits was established on January 1, 1986. These are annually renewable, nontransferable, revokable permits issued to applicants who have worked for at least 12 months on vessels using gillnets or trammel nets, or who have passed a proficiency examination administered by CDF&G, or who have landed at least 10,000 lbs of fish worth at least $10,000 during a 12-month period, or who have landed at least 1,000 lbs of fish taken in gillnets in at least four of the five license years prior to date of application. Until 1986 there was no specific attempt to limit the numbers of such permits. The qualification requirements and annual $50 fee may have restrained entry somewhat.

The new moratorium prevents the issuance of new gillnet or trammel net permits except to people applying before January

1, 1986 to take the examination, and then passing it. Renewal of existing, valid permits is allowed; and permit holders having landed fish in at least 15 of the preceding 20 years may transfer their permits to other qualified persons. CDF&G is to prepare and submit to the legislature by January 1, 1989 a report assessing the need for recommending a limited entry program for gillnet permits. The temporary moratorium expires on January 1, 1990.

The permit moratorium was accompanied by additional restrictions on the use of gill and trammel nets in harvesting California halibut. These included altered minimum fish size limits, a requirement that mesh size be no less than 8 1/2 inches, and a limit on the amount of net to be fished by any permittee to 1,000 fathoms (6,000 ft). All those fishing under the drift gillnet and gill/trammel net permit described below must also possess one of these general gillnet/trammel net permits.

Drift Gill Fishery for Shark and Swordfish

In the late 1970s it was found that drift gillnets with greater than 8 inch mesh size are effective at capturing thresher shark, bonito (or mako) shark, and swordfish. A new fishery developed, primarily in southern California waters, using this gear, but it faced several problems that resulted in public pressure to limit or eliminate the fishery. First, the use of drift gillnets to take swordfish provoked a "turf battle" for swordfish with the established harpoon fishery. Secondly, the reported take of marlin, a species strictly reserved for recreational fishing in California, was a severe provocation to numerous and influential recreational fishing interests. Thirdly, scientific research suggests that the shark populations are relatively slow-growing due to low reproductive rates, and that they could be rapidly depleted by excessive fishing. Finally, protected marine mammals (such as the California gray whale) can be inadvertently entangled, harmed and killed by the nets. All of these factors contributed to political pressures which called for limiting entry.

Initially, most of the fishing covered by this permit occurred south of Point Arguello, but it was not limited to the southern California region. Drift gillnet fishing spread as far north as Oregon and out to sea beyond 200 miles. A special permit for shark drift gillnet fishing was instituted in 1980. These nontransferable, revokable permits were initially issued to persons who had taken shark by drift gillnet in 1978 or 1979, or who had made prior significant investments in the fishery. The program also established a permit fee of $150, restrictions on the size of nets used, restricted fishing seasons, a logbook requirement, and an observer program. The 1980 regulations also included allowable incidental catch tolerances for marlin and swordfish. Permit holders are required to designate which vessels they intend to use, but they may transfer to another vessel after notifying CDF&G by written request.

In 1982 the program was modified to reduce fishing effort on the highly depletable shark populations by implementing a limited entry system with a target limit of 150 permits. Because more than 200 permit holders were active in 1982, no new permits were to be issued until the number of active permits fell below the target fleet size. In addition, modifications were made to unrestrict the catch of swordfish, to close the fishery from February 1 through April 20, to reduce the incidental take of marine mammals, and to establish various other time-area closures which reduce conflicts with commercial harpoon and recreational marlin fishermen. In order to provide additional protection to thresher sharks, in 1985 additional regulations were implemented that prohibit fishing within 75 miles of the coast during June 1 to August 15. In effect the program now recognizes the drift gillnet as a directed swordfish fishery, which needs to be managed to protect the marine mammals and thresher shark populations and to reduce conflicts between the drift gillnet fishery and other sport and commercial fisheries.

Central California Special Gillnet and Trammel Net Permits

The gillnet and trammel net fishery for halibut, white croaker and rockfish in central California between Monterey and Point Reyes (including the Gulf of the Farallons) expanded rapidly in the early 1980s. The number of general gillnet permits issued in central California increased from 97 during 1981 to over 500 during 1984. Many of the new fishermen were recent immigrants from southeast Asia. As with the southern California drift gillnet fishery, the growth of the gillnet and trammel net fishery spawned tensions and controversies with better-established commercial fishermen, recreational fishermen, and other marine interests. Of particular concern was the widespread killing of seabirds and marine mammals in the nets deployed in nearshore, shallow water. Many of the birds and mammals affected are legally protected by the Migratory Bird Treaty Act, the Marine Mammal Protection Act and the establishment of the Point Reyes/Farallon Island National Marine Sanctuary.

All commercial operators in this fishery were, of course, required to obtain general gillnet and trammel net permits. Under intense public pressure to resolve the incidental mortality problem, the state restricted the use of the nets in shallow waters (waters of less than 10 fathoms in depth). After extensive meetings between CDF&G personnel and concerned groups, the legislature passed a bill in 1984 expanding the closed areas, creating closed seasons, restricting the allowable length of nets, and requiring that fishermen obtain a nontransferable special permit to use a set gill or trammel net in the nearshore area (generally within 3 miles of land) off San Francisco and other central California areas. Licensed gillnet fishermen operating further offshore are not required to have this special permit. Some closed areas and seasons were designed to protect sea otters in Monterey Bay and to protect sea lions and harbor seal rookeries at Ano Nuevo Island. Others were intended to re-

duce seabird mortality and to reduce conflicts between gillnet fishermen and salmon troll fishermen in the Farallon Islands.

Fishermen were issued new special gillnet permits until March 31, 1986. To obtain a permit, a licensed owner or operator of a vessel must have possessed a valid general gillnet permit and must have presented evidence of (1) 10 or more landings of halibut, croaker or rockfish caught by net, or (2) an investment of at least $2,000 in nets, or a net reel, or other kinds of gear; this investment had to be substantiated by receipts and matching cancelled checks. (This requirement was a problem for the southeast Asian refugee fishermen, most of whom do business in cash; the problem was remedied through subsequent legislation.)

Since April 1, 1986, only previous permittees who have demonstrated involvement in the fishery have been able to renew. Each permittee may miss one year out of five in order to fish in some other fishery.

The number of permits for the fishery is now limited to 135. When the number of annual renewals falls below 135, new permits will be allocated by a random drawing among qualified applicants. An annual renewal fee of $125 is levied on permit holders. The permit system is scheduled to expire on April 1, 1989. CDF&G is required to prepare a report before the expiration date determining the optimum number of gillnet fishermen for the fishery.

Central California Experimental Drift Gillnet Swordfish Fishery

To allow increased access to the biologically healthy swordfish population off California, 35 experimental fishing permits were created in 1984. These nontransferable, revokable and annually renewable permits were made available to persons holding a valid general gill and trammel net permit, possessing a California commercial fishing license in each of at 10 previous years, and having a gillnet with mesh of at least 14 inches and a net reel for retrieving the net. If there are more than 35 qualified applicants, the 35 permits are allocated by random drawing. All permit holders can renew without demonstrating participation. If not all 35 permittees apply for renewal, the excess permits will again be distributed by random drawing to new applicants who meet qualifying conditions. Since holders of drift gillnet permits in southern California may also fish north of Point Arguello, this special license does not limit the number fishing in central California, but it does prevent the central California special permittees from fishing in the south.

A fee of $150 is charged for the permit. Restrictions on the use of this experimental permit are similar to restrictions on drift gillnet fishing south of Point Arguello. These include a maximum length of net (no longer than 6,000 ft), prohibition of fishing within 12 miles of shore, clo-

sure of the Gulf of the Farallons, a closed season from February 1 from August 15, and a requirement that nets not be in the water from two hours after sunrise to two hours before sunset.

CONCLUSIONS

Our review of limited entry programs in California provides ample evidence that this form of fishery regulation can be adapted to a wide range of circumstances and can be implemented in combination with various other regulations. The systems have been tailored to each fishery's particular problems, needs, and political situation. Although California has not ventured beyond the nontransferable fishing license, it has explored a surprising number of variations of license limitations. Licenses are limited by gear (general gillnet) or species/gear combination (salmon troll, abalone diver), or gear and area (drift gillnet). In the case of San Francisco Bay herring roe fishermen, an almost inconceivably complex set of regulations has been developed (two gears, two platoons of gillnets, special "experimental" permits, annual quotas split into gear types, individual seasonal catch limits for purse seine vessels, etc.).

Initial allocation of permits generally "grandfathers in" all past participants (at least if they have written documentation), and all limited entry systems provide means for new fishermen to enter when there are additional permits available. Although the criteria are not clear for determining the optimal number of permits in some fisheries (and are still being studied for salmon troll and gillnets), the bureaucratic mechanism for regulating entry at the desired level has been established. Discussions are currently proceeding on future limited access systems for sea urchin divers, groundfish trawlers and lobster fishermen.

The licensing programs have established useful overall limits on new entry to many of the state's crowded commercial fisheries. In several instances the limited entry systems are simply one part of a complex regulatory response to serious social and political pressures. Some of the fisheries (herring roe and possibly inshore gill/trammel net) could have been legislated out of existence if the license limitation response had not been invoked. Thus the permit system can be rated a success at dealing with some social and political difficulties. Also, where limiting entry has placed an upper bound on fishing effort, it has probably enhanced the efforts to reduce mortality of seabirds and mammals and may provide some protection to easily overfished shark populations.

Conservation policies behind California's limited entry systems have not begun to deal explicitly with the standard economic issues concerning commercial exploitation of depletable resources. The state government has not publicly acknowledged the need to assess economic aspects of fisheries, including the assessment of potential economic rent,

effects of regulations on "capital stuffing" and overcapitalization in the fishing fleet, and equitable allocation of net resource values and resource management costs. Some of the limited entry legislation calls for a report on optimal or desirable number of licenses. This may imply a need for detailed economic analysis, but it is not yet clear how CDF&G and the Fish and Game Commission intend to deal with the economic issues. Past policy has tended to ignore these by insisting that CDF&G has no such responsibility and that the industry should develop proposals to deal with economic factors.

The history of commercial fisheries regulation clearly suggests that this is an unrealistic approach; private industry does not normally deal very successfully with overall economic efficiency issues in the absence of clearly defined property rights in the fish populations. So long as California's governing institutions adhere to the concept of "public resource" in ocean fisheries, and prefer to allocate fishing rights through public administrative rather than private market systems, it is likely that California will continue to use nontransferable fishing license systems.

ACKNOWLEDGEMENTS

The authors derived substantial assistance from the following CDF&G personnel in Sacramento: Gene Fleming, Don Schultz, and Bill Maxwell. CDF&G Biologist Doyle Hannan, stationed at the Southwest Fisheries Center in La Jolla, California, also provided helpful comments. The discussion of herring and abalone limited entry programs was largely paraphrased from Mel Odemar's presentation, "Fishing for Answers," to the Oregon Coastal Zone Management Association's conference held at Agate Beach, Oregon in March, 1985.

Washington State's Experience with Limited Entry

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MANAGEMENT'S EXPERIENCE

Washington State's experience with overuse of the salmon resource has been a long-standing problem. Overuse and dimishment of resources over the last twenty-five years culminated in an abrupt crisis when federal courts divided the Washington salmon harvest into treaty-Indian and non treaty-Indian catch in 1974. By then, the salmon resource was already being depleted by increasing capitalization in the salmon fleet. Inadequate planning, and nearsightedness of resource users, had resulted in the resource being stretched to its limits. These factors, as well as the court-mandated reduction in allocations, severely depressed the salmon fishery.

Today, twelve years later, the effects are still apparent. Fishing seasons were held at record lows in the 1984 coastal troll fishery. Users were allowed to voluntarily suspend their fishing privileges and discontinue fishing without loss of their licenses. Only 377 vessels landed troll salmon, compared to 1,844 in 1983. In 1985, the fleet had recovered to the point that 1,259 vessels landed salmon. However, this still amounted to a 32 percent drop in fishery participants from 1983. The depressed 1984 season indicates that the effects of the reduced salmon allocation, combined with overproduction by users, has not yet been overcome.

Those court decisions had repercussions in the non-Indian commercial fleet that changed the future course of management for Washington's salmon resource. The court decisions, however, only brought to the surface an awareness of the tremendous production capacity in Washington's vast salmon

fleet. Records indicate that increases in the number of commercial licenses began in the late 1940s and continued until the license moratorium of the mid-1970s.

Prior to the license moratorium, the size of the fleet varied according to the size of the salmon run. If there were inadequate salmon, the users did not fish, or moved to more productive waters. Managers did not need to use other methods to regulate resource use. The length of the season was determined in advance, and there was enough time for users to fish until the salmon passed through their fishing grounds.

Washington's salmon fishing grounds have been divided for many decades between outside fishing grounds (Pacific Ocean fisheries) and inside fishing grounds (Puget Sound, Grays Harbor, Wallapa Harbor, Columbia River fisheries). The outside fishery is the larger fleet but has troll gear, which is less efficient and allows many salmon to pass through the outside fishing grounds and into the inside net fisheries. The inside fleets are smaller in number, but the various nets (gill, seine, reef) have a greater ability to intercept the salmon.

The ability of a user to enter either of the fishing grounds is based on available capital. The most expensive fishing is in the net fisheries, where equipment such as seine nets and gillnets must be replaced frequently, and traditional fishing seasons are later in the year during the more hazardous late fall, winter, or early spring seasons. Under these conditions there have been fewer users attempting to enter these fisheries than to join the troll fleet, which grew to its excessive size partially because the fishing is during the summer season and the cost to enter the fishery before 1976 included only the vessel and its associated troll gear (lead, line, gurdies, etc.).

Both the inside and outside fleets continued to grow until fisheries managers proposed a license moratorium in 1976 to comply with the non-treaty salmon allocations. Limited entry in the salmon industry began with this moratorium on the issuance of new licenses. An upper limit was established on the number of issued salmon licenses. This limit could not be exceeded and was reduced by non-renewal of a license. The goal of the moratorium was to stabilize the size of the fleet and to prevent increase in catch potential.

The moratorium was to be used as a limited entry tool to begin the fleet reduction process. The process of reduction still continues.

During the reduction years, managers recommended tighter seasons and gear restrictions (mesh size, barbless hooks, etc.) to ensure protection of the resource. Since the fleet would still remain too large for many years, the management philosophy was to disregard the production potential and to maintain seasonal quotas per fleet. The quotas were reviewed during the open seasons and samplings of catch were

taken by managers; closures of the season occurred when necessary to prevent overharvest. This process continues and will be used so long as the fleet's catch potential, as determined by the large number of issued licenses, remains too high to be adequately determined. The current license system does not address the size or catch capacity of a vessel.

Licenses are freely transferable within each gear group and area (troll, seine, Puget Sound gillnet, Wallapa Harbor/Columbia River gillnet, Grays Harbor/Columbia River gillnet, and reefnet). The possibility of a larger vessel receiving a smaller vessel's license and becoming a higher production vessel is not addressed in the current salmon license structure. With nonrestricted transfers, there are not adequate means of determining the fleet's actual potential. Changes in composition of the fleet can cause it to become overproductive.

USER'S EXPERIENCE

In the years following the 1974 court decision, the nontreaty users found themselve unable to influence or control their own fisheries' future. Communities whose only livelihood is fishing saw great economic decline. The state was not able to assist these fishing communities because of the overall declining economic conditions of the mid-1970s and the overburdened state assistance programs. Fishermen, being self-employed, were not eligible for unemployment compensation. Even public assistance could not be obtained, as fishermen owned valuable fishing vessels. In addition, banks foreclosed on loans made against fishing vessels and industry businesses.

The complexion of those communities changed. There was no longer an attitude of self-sufficiency. Even though fishing was not an assured-income business, other benefits, such as the quality of life achievable in a fishing community as opposed to a city, and the satisfactions of battling nature versus battling bureaucracies, were highly prized; but these communities had no control over their future. Their fate was determined by courts, bureaucracies and politicians. They fought hard, but the courts ruled against them for many years.

As the decisions were outlined clearly by fisheries managers, the users and their communities began to go from anger at the changing system to apathy. During this period of apathy, (approximately 1978-1983) the coastal newspapers reported increasing suicides, family disputes, murders, and other forms of social disorders. In 1984, it became apparent that there would be not just a limited fishing season, but possible none at all.

The communities began to face reality. There would never be a return to the "good old days." As this acceptance grew, new leaders emerged, ones capable of working within the new system and demonstrating effective cooperation with managers

and politicians. These leaders will play a major role in helping communities to regain a sense of participatory control over the fisheries. Experience with the benefits of negotiating cooperatively, as opposed to engaging in court battles, showed the fishing communities how to change and to regain control of their livelihood.

SUMMARY

During the past decade, the Washington State salmon fleet has been reduced by 234 percent. Approximately $20 million in federal funds have been used to bring about this reduction through a buy-back of licenses. The limited entry-reduction effort will continue; however, the last federal funds were received this year. The need for further limitation/reduction in Washington is still evident. In 1985, the Washington troll fleet had 500 non-producing licenses compared with an average 150 during the 1983 season. These non-salmon-producing vessels are not being scrapped. They will enter another fishery, such as bottomfish or crab, if the resource becomes available. Currently, vessels can hold licenses for any of these fisheries.

Managers from both crab and bottomfish fisheries foresee possible overproduction if salmon producers enter alternate fisheries. The future of all Washington fisheries is now being examined by managers. Changes in philosophy have enhanced the possibility of cooperative management and responsible user participation.

Efficiency and Distributional Aspects of Alaska's Limited Entry Program

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HISTORICAL BACKGROUND

Introduction

Alaska's limited entry statute was passed in 1973 during a time of poor statewide salmon returns (see Table 1 for time series salmon harvest data). Two earlier post-statehood attempts at limited entry had failed.

In 1962, an act passed by the Alaska Legislature would have allowed the Board of Fish to restrict fishing within an area to residents, whenever it was determined that the expected salmon run was less than optimum. The act was declared unconstitutional before any regulations could be implemented (Morehouse and Rogers 1980:75-77).

In 1968, the Alaska Legislature passed a statewide salmon net gear entry restriction program. Gear licenses were to be restricted to those who had previously held a gear license, or to those who had held commercial fishing licenses and fished as crew for at least three years within the given area. The courts again declared the legislation unconstitutional, concluding that it created a closed class and put future entry into the fishery in the hands of that class (Morehouse and Rogers 1980:76-78).

In August of 1972, Article VIII, Section 15 of Alaska's Constitution was amended to allow the state "to limit entry into any fishery for purposes of resource conservation, to prevent economic distress among fishermen and those dependent upon them for a livelihood, and to promote the efficient development of aquaculture." Subsequently, in April

Table 1. Yearly comparative salmon catch and value to fishermen by species, 1962-1983. (Pounds and Value are in thousands)

	Chinook (King)		Sockeye (Red)		Coho (Silver)		Pink (Humpy)		Chum (Dog)		Total	
Year	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
62	8,738	2,698	52,946	11,130	15,321	3,161	143,278	20,296	57,652	4,832	277,935	42,117
63	9,160	3,126	35,455	7,643	17,581	3,008	125,117	14,472	35,748	3,046	223,061	31,295
64	11,567	3,661	54,131	12,246	20,953	3,582	162,280	17,173	62,689	4,694	311,620	41,356
65	11,008	3,048	142,034	30,802	17,666	4,362	74,872	7,684	29,262	2,376	274,842	48,272
66	9,350	2,948	92,766	19,736	16,112	3,705	162,866	22,093	52,229	5,718	333,323	54,200
67	11,632	3,100	53,521	11,864	13,022	3,342	28,822	3,240	31,518	3,082	138,515	24,628
68	11,245	3,865	48,695	12,723	20,968	5,361	148,445	20,490	55,916	7,015	285,269	49,454
69	10,746	3,505	71,734	18,046	8,033	2,229	105,967	15,711	22,668	2,934	219,148	42,425
70	11,546	5,034	150,812	37,249	11,897	3,511	117,717	15,562	54,490	6,616	346,462	67,972
71	11,971	4,688	87,287	22,848	11,459	2,820	86,259	13,517	54,726	7,536	251,702	51,409
72	9,972	3,731	41,983	13,180	13,034	5,582	59,968	10,881	64,823	11,918	189,780	45,292
73	8,916	7,880	35,248	15,326	9,836	7,469	36,610	11,666	45,880	17,715	136,490	60,056
74	9,290	6,944	32,246	22,119	12,820	8,677	40,072	13,861	37,174	13,975	131,602	65,576
75	7,165	5,354	42,848	19,262	7,745	4,405	49,970	16,053	32,060	10,850	139,788	55,924
76	8,915	8,446	75,689	45,991	11,158	10,064	102,419	34,871	47,675	18,582	246,856	117,954
77	12,102	14,499	89,770	68,273	15,403	14,624	129,554	45,574	60,548	27,802	307,377	170,772
78	16,304	20,179	116,767	113,992	19,978	21,119	183,993	62,502	52,614	26,105	389,656	243,897
79	15,054	22,597	171,824	189,592	23,918	28,053	186,838	74,908	45,043	29,008	442,677	344,158
80	12,536	17,035	186,664	114,123	22,462	17,796	217,886	84,517	71,812	34,386	511,360	267,857
81	15,746	23,748	225,956	196,301	26,051	23,853	244,677	105,851	99,572	47,578	612,002	397,331
82	16,897	27,080	189,555	156,533	46,559	40,146	219,426	47,476	90,247	38,752	562,684	309,987
83	15,683	18,233	305,661	212,817	26,890	16,186	193,977	47,974	79,186	25,015	621,397	320,225

Source: ADF&G Catch and Production Statistics

of 1973, Alaska's current limited entry statute was passed. The purpose of the law was to promote "the conservation and sustained yield management of Alaska's fishery resource and the economic health and stability of commercial fishing in Alaska by regulating and controlling entry into the commercial fisheries in the public interest and without unjust discrimination." The purposes of the statute closely followed the purposes allowed under the constitutional amendment. The emphasis was on conservation, economic welfare and stability (Morehouse and Rogers 1980:78-82).

The 1973 act avoided explicit discrimination against nonresidents and avoided creation of a closed class. It established the three-member Alaska Commercial Fisheries Entry Commission as a regulatory and quasi-judicial agency in charge of implementing and administering the program.

Program Basics

The statute provides for a specific license-type limited entry program. Permits are issued to individual skippers and are not necessarily tied to vessels or vessel ownership. The Commission does not have the authority to implement other types of programs, such as individual fishermen's quotas.

The Commission can limit a fishery whenever it concludes that such an action would serve the purposes of the statute. For limitation purposes, fisheries are defined by species caught, gear type utilized, and area fished. While flexibility exists, the Commission generally defines fisheries in recognition of existing managerial and regulatory distinctions. For example, in Cook Inlet the Commission defined the salmon drift gillnet, salmon set net and salmon purse seine as separate fisheries for limitation purposes, paralleling the manner in which the gear groups are managed.[1]

Under the statute, entry limitation is to be a two-stage process. In the first stage, the Commission declares a maximum number of gear units, which generally reflects recent participation levels. It is important to note that this first-stage reduction to maximum numbers is a much less generous "grandfathering" rule than those which occur under most moratoria or limited entry programs. Due to turnover in fisheries, many programs "grandfather in" potential participants in numbers that greatly exceed current participation levels. Maximum numbers, while reflecting recent participation levels, generally represent a considerable reduction in the number of potential participants.

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[1] This practice can sometimes lead to post-limitation participation increases, a problem which will be discussed later in the report.

An application period is held following the maximum number determination,[2] and anyone who participated in the fishery as a licensed gear operator prior to the qualification date may be eligible to apply for one of the limited number of permits. Generally, the number of eligible applicants will exceed the maximum number of permits, thereby creating an allocation problem. Under the statute, the Commission must develop a ranking system which measures the relative hardship each applicant would suffer if excluded from the fishery. The limited number of permits are then allocated to the highest-ranking applicants.

Hardship ranking systems are based upon the two broad concepts of past participation and economic dependence. Under these concepts, the Commission is asked to consider criteria such as years of participation, consistency of participation within a year, investment in vessel and gear, availability of alternative occupations, reliance on alternative occupations, and relative income dependence. In practice, surrogate measures are found for each criterion. These are then "weighted" relative to other criteria through the assignment of "points." Hence, hardship ranking systems are commonly called "point systems."

Alaska's initial allocation system is both complex and expensive compared to those based upon simple rules utilized in limited entry programs elsewhere. Moreover, the consequences of the allocation system remain controversial and unclear. This topic will be developed more fully in the section on distributional aspects of the program.

Under each ranking system, the Commission is directed to determine those priority classifications (point levels) of applicants who would only suffer minor economic hardship if excluded from the fishery. Any applicant awarded a permit at a point level above this "minor hardship point level" receives a transferable permit, while applicants awarded permits at point levels at or below the minor hardship point level receive nontransferable permits that expire upon the individual's death.

Transferable permits allow entry and exit and avoid the possibility of a "closed class." Most of Alaska's limited fisheries are dominated by transferable permits. In the salmon hand troll fishery the opposite is true. Prior to limitation this fishery was dominated by casual participants and high turnover rates. As a result, the Commission established a relatively high minor hardship point level, and the vast majority of permits were awarded to applicants falling below that level. The unusual character of the fishery, coupled with the nontransferable permits, has led to a dramatic post-limitation fall in participation.

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[2] The qualification date under the statute is January 1 of the year in which the maximum number regulation is adopted.

There are numerous restrictions on the use privileges associated with entry permits. The permits can only be owned by natural persons and thus cannot be allocated to or transferred to corporations, partnerships, companies, etc. An individual can only own one entry permit in any given limited fishery. The use privilege may be modified or revoked by the legislature at any time. Failure to renew an entry permit for two consecutive years results in forfeiture of the permit. An entry permit cannot be legally leased or rented to another fisherman except under very restricted "emergency" situations. Entry permits may not be "pledged, mortgaged, or encumbered in any way" (except for participation in certain state loan programs)[3], and they may not be legally "transferred with any retained right of repossession or foreclosure, or on any condition requiring a subsequent transfer."[4] This last feature essentially prohibits pledging the permit as collateral except through state loan programs. All of these attenuations were apparently put on the use privilege to prevent development of a "permit lord" class. The legislation favored "professional fishermen" and attempted to prevent the possibility that permits would fall under the control of fish processors. Some of the tradeoffs associated with the restrictions will be discussed later in this paper.

In the second stage of Alaska's limited entry program, the Commission is directed to determine an optimum number of units of gear in a limited fishery, and if that number is less than the maximum, the Commission is directed to start a buy-back program to reach the optimum number within a ten-year period. The buy-back program is to be funded by a tax of up to 7 percent on permit holders' gross earnings, and the Commission is directed to pay "fair market value" for permit, vessel, and gear.

The second stage of Alaska's program has never been implemented for a variety of reasons. In January of 1985, the Commission received an Alaska Attorney General's Opinion to the effect that elements of the buy-back portion of the statute are unconstitutional. It is clear that considerable changes will have to be made in the legislation in order to develop a feasible fishermen-funded fleet reduction option (see Schelle and Muse 1984 and Muse and Schelle 1986c for more general information on buy-back, and particularly on problems associated with Alaska's program).

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[3] An exception to the rule is that permits can be transferred to Alaska's Department of Commerce and Economic Development and Alaska's Commercial Fisheries and Agricultural Bank. Changes in the statute in 1979 allowed residents to use their permits as collateral to obtain subsidized loans from these agencies.

[4] AS 16.43.150.

History of Limitation, 1974 to 1985

Table 2 provides detailed information on the initial issuance of permanent permits by limited fishery. All salmon fisheries except the hand troll and those in the Arctic-Yukon-Kuskokwim (AYK) regions were limited in 1974, with permanent permits allocated in 1975. The AYK fisheries were limited next, with permanent permits allocated in 1976. In 1977-1978, the Southeastern roe herring seine and gillnet fisheries were limited, as were the Prince William Sound roe herring seine and Cook Inlet herring seine fisheries. In 1980 and 1981, the salmon hand troll, Kodiak roe herring seine and gillnet, and Prince William Sound roe herring gillnet fisheries were placed under limitation. Table 3 provides detailed information on the distribution of permanent permits in these fisheries as of year-end 1985.

In 1984, the Southeastern tanner crab pot fishery, red/blue king crab pot fishery and brown king crab pot fishery were limited. In 1985, the northern Southeastern inside sablefish longline fishery and the southern Southeastern inside sablefish longline and pot fisheries were also placed under entry limitation. As of this writing, hardship ranking systems are still being devised for these groups of fisheries, and permanent permits have yet to be allocated.

EFFICIENCY ASPECTS OF ALASKA'S LIMITED ENTRY PROGRAM

No Explicit Efficiency Objective

According to Morehouse and Rogers, explicit economic efficiency objectives were absent from Alaska's legislation and from most debates prior to passage of the law. Conservation, sustained yield management, and the economic welfare of fishermen and fishing communities were frequently cited as objectives. Morehouse and Rogers felt that talk of reducing the waste in labor and capital would have met with hostility (Morehouse and Rogers 1980:79-83).

Even the optimum numbers portion of the statute outlines a set of conflicting and amorphous criteria. The statute directs the Commission to establish optimum numbers based upon a reasonable balance of the following general standards:

"1. The number of entry permits sufficient to maintain an economically healthy fishery that will result in a reasonable average rate of economic return to the fishermen participating in that fishery, considering time fished and necessary investments in vessels and gear.

"2. The number of entry permits necessary to harvest the allowable commercial take of the fishery resource during all years in an orderly, efficient manner and consistent with sound fishery management techniques.

"3. The number of entry permits sufficient to avoid serious economic hardship to those currently engaged in the

Table 2. Total number of initial permit holders, by fishery and resident type, 1975-1985.*

	All Permits Issued to					All Transferable Permits Issued to**					All Permits	
	Alaska Rural Local	Alaska Rural Non-Loc	Alaska Urban Local	Alaska Urban Non-Loc	Non-Resident	Alaska Rural Local	Alaska Rural Non-Loc	Alaska Urban Local	Alaska Urban Non-Loc	Non-Resident	Alaskan Total	Grand Total
Limited in 1975												
Southeast Seine	93	0	119	0	206	93	0	119	0	206	212	418
Southeast Drift	83	2	224	3	157	83	2	224	3	157	312	469
Power Troll	201	5	453	10	277	201	5	453	10	277	669	946
Yakutat Set Net	124	3	0	21	18	124	3	0	21	28	148	166
PWS Seine	167	6	15	18	55	167	6	15	18	55	206	261
PWS Drift	337	19	11	28	139	337	19	11	28	139	395	534
PWS Set Net	17	0	4	2	7	17	0	3	2	7	23	30
Cook Inlet Seine	48	0	31	1	0	48	0	31	1	0	80	80
Cook Inlet Drift	110	8	244	13	184	110	8	244	13	184	375	559
Cook Inlet Set Net	193	24	446	26	56	193	24	446	26	56	689	745
Kodiak Seine	76	14	160	20	109	76	14	160	20	109	270	379
Kodiak Beach Seine	12	2	18	1	2	11	1	17	1	1	33	35
Kodiak Set Net	44	2	77	14	50	44	2	77	14	50	137	187
Chignik Seine	29	12	0	28	21	29	12	0	28	21	69	90
Pen/Aleutian Seine	102	0	0	3	14	102	0	0	3	14	105	119
Pen/Aleutian Drift	99	0	0	13	44	99	0	0	13	44	112	156
Pen/Aleutian Set Net	98	0	0	7	7	98	0	0	7	7	105	112
Bristol Bay Drift	647	130	0	226	737	647	130	0	226	737	1003	1740
Bristol Bay Set Net	591	30	0	163	151	514	29	0	148	137	784	935
	3071	257	1802	597	2234	2993	255	1800	582	2219	5727	7961
Limited in 1975												
Upper Yukon Gill Net	56	3	12	1	1	56	3	12	1	1	72	73
Upper Yukon Fishwheel	114	2	15	1	0	114	2	15	1	0	132	132
Kuskokwim Gill Net	665	1	172	0	0	663	1	172	0	0	838	838
Kotzebue Gill Net	53	2	157	6	1	53	2	157	6	1	218	219
Lower Yukon Gill Net	689	7	0	11	1	689	7	0	11	1	707	708
Norton Sound Gill Net	176	1	23	2	0	176	1	23	2	0	202	202
	1753	16	379	21	3	1751	16	379	21	3	2169	2172
Limited in 1977-78												
SE Herr Seine	2	0	39	0	3	2	0	39	0	3	41	44
SE Herr Gill Net	8	0	63	1	15	8	0	63	1	15	72	87
PWS Herr Seine	29	22	3	39	9	29	22	3	39	9	93	102
Cook Inlet Herr Seine	25	1	24	16	7	25	1	24	16	7	66	73
	64	23	129	56	34	64	23	129	56	34	272	306
Limited in 1980-81												
Hand Troll	678	6	1235	51	152	286	1	362	11	37	1970	2122
PWS Herr Gill Net	13	0	7	0	4	13	0	7	0	4	20	24
Kodiak Herring Seine	5	4	30	0	3	5	4	30	0	3	39	42
Kodiak Herr Gill Net	3	5	28	17	1	3	5	28	17	1	53	54
	699	15	1300	68	160	307	10	427	28	45	2082	2242
Overall Total	5587	311	3610	742	2431	5115	304	2735	687	2301	10250	12681

* The Table includes 172 permits which were later revoked because of administrative error, forfeit, or criminal action.
** By 1985 66 nontransferable permits had become transferable through adjudication.

Table 3. 1985 year-end distribution of permit holders by fishery and resident type.*

	All Permits Held by					All Transferable Permits Held by**						All Permits	
	Alaska Rural Local	Alaska Rural Non-Loc	Alaska Urban Local	Alaska Urban Non-Loc	Non-Resident	Alaska Rural Local	Alaska Rural Non-Loc	Alaska Urban Local	Alaska Urban Non-Loc	Non-Resident	Dept. of Comm.	Alaskan Total	Grand Total
Limited in 1975													
Southeast Seine	57	0	124	1	234	0	57	0	124	1	234	0	182	416
Southeast Drift	84	4	230	1	148	1	84	4	230	1	148	1	320	468
Power Troll	220	1	497	11	212	1	220	1	497	11	212	1	730	942
Yakutat Set Net	112	9	0	23	20	0	112	9	0	23	20	0	144	164
PWS Seine	118	22	17	34	70	0	118	22	17	34	70	0	191	261
PWS Drift	275	32	8	68	150	1	275	32	8	68	150	1	384	534
PWS Set Net	14	2	2	10	2	0	14	2	1	10	2	0	28	30
Cook Inlet Seine	41	0	38	0	1	0	41	0	38	0	1	0	79	80
Cook Inlet Drift	106	2	275	9	164	1	106	2	275	9	164	1	393	557
Cook Inlet Set Net	190	32	438	10	74	0	190	32	438	10	74	0	670	744
Kodiak Seine	76	13	163	30	93	4	76	13	163	30	93	4	286	379
Kodiak Beach Seine	5	1	21	2	5	0	4	1	21	2	4	0	29	34
Kodiak Set Net	18	5	107	14	43	0	18	5	107	14	43	0	144	187
Chignik Seine	44	9	0	23	14	0	44	9	0	23	14	0	76	90
Pen/Aleutian Seine	90	2	0	8	19	0	90	2	0	8	19	0	100	119
Pen/Aleutian Drift	69	2	0	21	64	0	69	2	0	21	64	0	92	156
Pen/Aleutian Set Net	76	2	0	15	16	1	76	2	0	15	16	1	94	110
Bristol Bay Drift	559	123	0	291	764	1	559	123	0	291	764	1	974	1738
Bristol Bay Set Net	447	49	0	216	219	0	385	45	0	206	204	0	712	931
	2601	310	1920	787	2312	10	2538	306	1919	777	2296	10	5628	7940
Limited in 1976													
Upper Yukon Gill Net	41	2	20	6	1	0	41	2	20	6	1	0	69	70
Upper Yukon Fishwheel	99	3	28	2	0	0	99	3	28	2	0	0	132	132
Kuskokwim Gill Net	650	6	162	11	2	0	650	6	162	11	2	0	829	831
Kotzebue Gill Net	46	6	154	10	3	0	46	6	154	10	3	0	216	219
Lower Yukon Gill Net	626	20	0	53	5	0	626	20	0	53	5	0	699	704
Norton Sound Gill Net	159	1	27	13	2	0	159	1	27	13	2	0	200	202
	1621	38	391	95	13	0	1621	38	391	95	13	0	2145	2158
Limited in 1977-78													
SE Herr Seine	1	1	35	1	5	0	1	1	35	1	5	0	38	43
SE Herr Gill Net	6	1	52	2	26	0	6	1	52	2	26	0	61	87
PWS Herr Seine	31	23	2	30	16	0	31	23	2	30	16	0	86	102
Cook Inlet Herr Seine	18	6	25	10	14	0	18	6	25	10	14	0	59	73
	56	31	114	43	61	0	56	31	114	43	61	0	244	305
Limited in 1980-81													
Hand Troll	638	12	1145	45	146	0	284	5	383	13	59	0	1840	1986
PWS Herr Gill Net	17	0	4	2	1	0	17	0	4	2	1	0	23	24
Kodiak Herring Seine	8	4	26	1	3	0	8	4	26	1	3	0	39	42
Kodiak Herr Gill Net	2	5	32	15	0	0	2	5	32	15	0	0	54	54
	665	21	1207	63	150	0	311	14	445	31	63	0	1956	2106
Overall Total	4943	400	3632	988	2536	10	4526	389	2869	946	2433	10	9973	12509

* This Table excludes 172 permits which were revoked by the Commission.
** By 1985, 66 nontransferable permits had become transferable through adjudication.

fishery, considering other economic opportunities reasonably available to them."[5]

While an economist might choose to interpret these criteria as marching orders for a movement toward an improvement in economic efficiency, there is certainly no directive to maximize economic rents. Nevertheless, Alaska's program may have had some impact on efficiency. The following section outlines particular aspects of the program.

Input Controls

Alaska's program is a license-type limited entry program. Such programs try to contain excessive effort and hence excessive costs by attempting to control the inputs which produce effort. How effectively this can be done depends heavily on the nature of both the fishery and the licensing scheme. Such programs can be undermined by increasing uncontrolled capital and labor inputs in order to increase fishing power. These processes may drive up total costs, thereby dissipating benefits created by the program.

At first glance, it would appear that Alaska's limited entry program is poorly equipped to contain such events. The Commission can merely control the number of participants in a fishery, and has no major management authority beyond that power. All other traditional measures such as efficiency limiters on gear, size constraints on vessels or vessel attributes, gear limits, area closures, and controls on fishing time, are regulated by the Alaska Board of Fish. As a result the Commission has tended to implement the program only in fisheries where the fishing operations are relatively homogeneous and where the fishing capacity of individual operations have been heavily constrained by pre-existing Board of Fish regulations.

Increases in capital inputs: Upon closer inspection, Alaska's program may be more successful than many with respect to containing the process termed "capital stuffing" or "overcapitalization at the intensive margin." Pre-existing input controls are often present when a fishery is limited, and thereby constrain capital stuffing options. Licensing by species, gear, and area may have prevented some of the problems that occurred under British Columbia's program. When British Columbia's program was implemented, a salmon license was issued that was not gear or area specific. As a result, trollers and gillnetters who received licenses upgraded to larger seine or combination vessels, which led to a dramatic increase in fishing capacity immediately after limitation. As a result, a "net ton per net ton" replacement rule was invoked, and additional restrictions on the licenses have been added through time. Alaska's licensing scheme may have constrained some of these post-limitation capital stuffing problems experienced by British Columbia.

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[5] AS 16.43.290.

However, it is clear that Alaska's salmon fleets have changed significantly since limitation. A 1982 Commission report (Schelle et al. 1982) examined changes in the vessel attributes of a number of limited fleets over the 1969 through 1980 time period. In most cases, rather dramatic post-limitation increases can be seen in many of the attributes which may be positively related to fishing power. Average age often fell over the time period. The number of documented vessels in the fleets increased. As an example, Table 4 provides data illustrating this point for the Peninsula-Aleutians salmon seine fishery.

These increases in the magnitude of vessel attributes since limitation have also been associated with increases in the estimates of average vessel and gear values reported by fishermen in sundry cost surveys.[6] For example, estimates of real average vessel and gear values in the Cook Inlet salmon drift gillnet fishery roughly doubled between 1973 and 1982 (Muse and Schelle 1986a:39). Similarly, estimates of the real average vessel and gear values in the Prince William Sound salmon seine fishery have more than doubled over this same time period (Muse and Schelle 1986b:44).

The reader should be aware that most of Alaska's small boat salmon fleets are diversified, and many vessels participate in other, non-limited fisheries. Thus, in many instances, decisions to invest in more fishing capacity may be made in order to increase returns in non-limited fisheries.

Increases in labor inputs: Comparisons of operating cost surveys also indicate that since limitation, labor inputs per operation have increased in some fisheries. For example, average crew size in the Cook Inlet salmon fishery was reported to be 1.8 persons in 1973, 2.2 persons in 1979, and 2.4 persons in 1982. Similarly, average crew size in the Prince William Sound salmon seine fishery was reported to be 3.5 persons in 1973, 4.2 persons in 1979, and 4.6 persons in 1983. (results reported in Muse and Schelle 1986a:34 and Muse and Schelle 1986b:36)[7]

Evidence of Economic Rents

In theory, the market price of a permit should represent the present certainty equivalent value of the expected future stream of "net returns" accruing to the marginal permit holder. Net returns could include "above normal profits," psychic income, and any other return resulting from permit ownership.

The Appendix provides data by fishery by year on the number of permits, nominal and real average permit prices, and nom-

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[6] The reader should be cautious about these comparisons of survey results, as nonresponse bias may be present.

[7] The reader should note again that these crew size estimates may be influenced by non-response bias.

Table 4. Peninsula/Aleutians salmon purse seine, years 1969-1980.

Year	Fleet Size		Reg. Length	Reg Breadth	Reg Depth	Gross Tons	Net Tons	Vessel Age	Horse Power	Diesel	Wood Hulls	Steel Hulls	Glass Hulls	Alum Hulls	SOLM Lbs	SOLM Gross
1969	77	Mean	35.9	13.05	5.58	20.67	13.48	13.89	142.16	.699	.959	.041	.000	.000	98,966	$11,047
		SDLV	8.1	2.29	1.60	15.52	10.29	10.44	55.11						89,499	$10,706
		Count	74	59	59	66	75	72	70	73	74	74	74	74	77	77
1970	97	Mean	35.9	13.08	5.62	21.78	13.90	14.70	147.09	.686	.943	.046	.011	.000	179,158	$26,389
		SDLV	8.0	2.39	1.70	16.64	11.05	10.70	70.09						194,558	$34,115
		Count	87	73	73	76	88	83	82	86	87	87	87	87	97	97
1971	102	Mean	36.2	13.47	5.96	25.20	14.98	14.72	152.82	.713	.905	.063	.032	.000	117,089	$15,352
		SDLV	9.1	2.69	1.78	18.71	12.71	11.26	81.10						93,990	$12,965
		Count	95	73	73	76	96	87	90	94	95	95	95	95	102	102
1972	82	Mean	36.8	13.35	5.79	24.66	14.96	15.79	160.31	.747	.908	.053	.039	.000	40,911	$ 7,883
		SDLV	8.7	2.57	1.73	18.16	12.50	12.42	79.28						54,102	$10,973
		Count	76	63	63	65	78	72	72	75	76	76	76	76	82	82
1973	68	Mean	35.0	12.75	5.28	19.73	12.92	14.86	151.79	.708	.924	.000	.076	.000	34,372	$ 7,370
		SDLV	7.3	2.14	1.46	14.04	9.39	10.63	54.33						43,676	$ 9,489
		Count	66	53	53	55	64	64	61	65	66	66	66	66	68	68
1974	50	Mean	36.2	13.02	5.50	22.30	14.50	14.33	158.94	.840	.820	.060	.120	.000	27,681	$10,666
		SDLV	8.5	2.60	1.64	16.34	11.03	11.29	66.20						36,252	$14,556
		Count	50	42	42	44	50	49	49	50	50	50	50	50	50	50
1975	57	Mean	38.9	14.18	6.06	29.33	19.21	16.06	178.20	.804	.768	.089	.143	.000	22,385	$ 7,877
		SDLV	10.2	2.89	2.02	22.01	15.01	13.68	81.11						24,938	$ 9,409
		Count	56	49	49	51	56	54	55	56	56	56	56	56	57	57
1976	87	Mean	36.6	13.72	6.00	26.86	16.57	15.97	169.56	.762	.783	.096	.120	.000	149,650	$42,597
		SDLV	10.7	3.00	2.10	22.08	14.86	12.58	91.92						117,109	$33,702
		Count	84	65	65	71	83	78	82	84	83	83	83	83	87	87
1977	84	Mean	36.1	13.28	5.78	23.59	14.88	16.68	162.13	.815	.778	.049	.173	.000	98,049	$29,257
		SDLV	9.9	2.63	1.86	19.25	12.98	13.30	80.06						71,988	$25,149
		Count	81	64	64	70	81	76	80	81	81	81	81	81	84	84
1978	108	Mean	33.7	13.37	5.75	22.98	14.10	14.72	154.73	.657	.722	.083	.194	.000	234,094	$85,966
		SDLV	10.4	2.70	1.86	19.87	12.92	13.02	88.88						177,965	$71,244
		Count	108	73	73	83	98	101	105	108	108	108	108	108	108	108
1979	123	Mean	35.1	13.93	6.24	27.17	17.29	12.60	176.02	.719	.585	.098	.317	.000	281,232	$146,751
		SDLV	10.6	2.68	1.89	20.68	14.32	12.32	101.12						243,556	$156,216
		Count	123	90	90	98	112	117	118	121	123	123	123	123	123	123
1980	128	Mean	37.2	14.50	6.65	33.89	22.14	10.76	207.36	.816	.461	.133	.398	.008	453,704	$138,584
		SDLV	10.8	2.87	1.96	22.53	15.91	11.13	111.55						398,094	$123,591
		Count	128	92	92	104	113	124	122	125	128	128	128	128	128	128

inal and real average gross earnings. As can be seen, real permit prices in many salmon fisheries increased dramatically as both run sizes and real salmon prices improved in the late seventies. Moreover, within a fishery there appears to be a positive association between real average gross earnings and real average permit prices.

Wilen has noted that permit values do not necessarily imply that rents are being captured or ever have been captured by permit holders (Wilen 1979:855-58). Nevertheless, it is difficult to believe that such substantial permit values could be sustained over time if economic rents were not being captured.

Karpoff[8] provided empirical support for the theory that permit prices represent the present value of future net earnings streams accruing to a marginal permit holder in a limited fishery. He found that fishermen considered past net earnings in forming future expectations, and that Alaska Department of Fish and Game forecasts of run sizes were capitalized into the value of a permit. He also found support for the proposition that an Alaska Department of Commerce and Economic Development subsidized loan program for permit purchases had a positive effect on permit prices when it was implemented in 1979, as the subsidy was partially capitalized into the value of an entry permit.

Karpoff also examined non-pecuniary benefits and other aspects of permit markets. In general, his results support permit pricing theory and indirectly suggest that the program has generated economic rents.

Evidence of Post-limitation Participation Increases

License-type limited entry programs often provide a variety of means whereby post-limitation effort and fishing power can be increased. Under Alaska's program, licensing by species, gear and area fished has sometimes backfired.

A prime example is the limitation of the Peninsula-Aleutians salmon fisheries. Purse seine, drift gillnet, and set net gear are all used in the area. However, prior to limitation most participants fished a combination of these gears, opting to fish different gears at different times. As a result, many participants received permits for two or more gear types.

After limitation, when conditions in the fisheries had changed for the better and permit prices had become substantial, the opportunity costs of holding one or more permits idle for portions of a salmon season rose considerably. As a result, holders of multiple permit sold off their excess permits and concentrated their efforts in a single fishery. Thus, while the number of permits remained relatively con-

[8] A listing of Karpoff's publications on entry permit pricing can be found in the bibliography.

stant, the number of participants in these fisheries has increased dramatically. Moreover, participants who concentrate on a single fishery tend to fish on a more full-time basis.

This phenomenon is shown in Table 5. At initial issuance, 230 persons received 387 permits in the Peninsula-Aleutians salmon fisheries. At year-end 1985, 345 separate individuals owned the remaining 385 permits.

Table 5. Peninsula/Aleutians salmon fisheries limited in 1975.

Permits Held	Initial Issuees	1985* Year-end
Drift	53	131
Drift/Seine	32	8
Drift/Seine/Set Net	43	3
Drift/Set Net	28	14
Seine	33	96
Seine/Set Net	11	12
Set Net	30	81
Total persons	230	345
Total permits	387	385
Total persons/permits	0.59	0.90

* The 1985 year-end count of permits may be less than the number of permits initially issued, due to revocations.

Source: State of Alaska Commercial Fisheries Entry Commission

Recently, statutory changes have been made that should reduce the problem for future limitations. The Commission now has the power to "tie" multiple use privileges which any individual might receive into a single non-severable permit. This authority will be utilized in the recently limited Southeastern crab fisheries.

DISTRIBUTIONAL ASPECTS OF ALASKA'S LIMITED ENTRY PROGRAM

The Desire to Capture and Protect Wealth for Local Residents

Economic arguments in support of license-type limited entry programs to regulate common property generally cite the potential for improved economic efficiency relative to other politically feasible regulatory alternatives. Typically, advocates of the economic efficiency criterion also support a world or national accounting stance. Aggregate wealth would indeed increase if public decision makers adopted such notions.

Political discussion in support or opposition to limited entry tends to take a more provincial tone. State, local, and

individual accounting stances are more likely to be motivating factors where programs involving the creation, capture and protection of wealth are concerned. Rationalizing local fisheries yields little support if the wealth is captured by "outsiders" while needy "locals" are excluded.

Alaska's limited entry statue carefully avoided discriminating against non-residents. Nevertheless, Alaskans and their legislators remain concerned that the program benefit Alaskan fishermen and rural Alaskan fishing communities. Distributional aspects of the program continue to be a major area of controversy.

Initial Allocations

As noted earlier in this paper, the initial permit allocation system under Alaska's program is quite complex. Such systems are also expensive to design and implement relative to allocation systems based upon simpler rules. Moreover, individual rankings under these point systems are frequently disputed and challenged, leading to administrative proceedings and hearings which are costly to both the applicant and the state. Those dissatisfied with Commission decisions often resort to legal challenges, which add further to the social costs of the program. Since the program's inception, the Alaska Supreme Court has issued forty decisions on challenges to the statute or its administrative implementation (Alaska Commercial Fisheries Entry Commission 1985). While the basic program has been upheld, decisions against the Commission on aspects of previously adopted and utilized hardship ranking systems can be extremely disruptive, and "patching" the problem can be another costly administrative exercise.

Why was such a complex and expensive allocation system chosen? Auctioning the rights would have been a low-cost allocative procedure that would have captured some of the future rents for the state. Allocating the permits based solely on an individual's landings would have been a much simpler procedure than hardship ranking systems, and would have given rise to fewer costly disputes with respect to an applicant's ranking.

Allan Adasiak, a former commissioner, suggested that the complex ranking system was adopted because of a concern that poor and economically dependent rural and/or Native Alaskans would not do well under simpler alternatives. In a 1978 paper, Adasiak stated the following:

> To begin with, the legislature considered and rejected proposals to issue permits to individuals strictly on the basis of their catch records, which would have put permits into the hands of only the better performers. A primary concern was the effect such a system might have in some native villages when different cultural values and institutions sometimes resulted in relatively low catch levels. To remove less effective fishermen could deprive subsistence oriented communi-

ties from a significant though perhaps relatively small amount of cash needed for the continued functioning of those communities. (Adasiak 1978:278)

Adasiak continued:

> Alaska's system for allocating entry permits is complex. It was made that way to avoid the social and economic dislocation that would have occurred if permits had been awarded on some simple basis such as level of catch. In terms of allocating between residents and nonresidents, the system has retained the pre-limit balance to within plus or minus approximately 3 percent. To the extent that we have studied it, the system has also distributed permits to individual communities almost exactly in proportion to the number and types of units of gear fished prior to limited entry. (Adasiak 1978:285-86)

Adasiak appears to imply that the allocation decision roughly maintained the pre-existing resident/non-resident mix, but that simpler allocation rules would have benefited non-residents.

Not everyone agrees with Adasiak's analysis. Some authors feel strongly that the complex system was heavily biased against Native fishermen with language barriers and different cultural backgrounds (see for example Petterson 1980). This charge has been made concerning the application of limited entry in the Bristol Bay salmon fisheries. J.A. Koslow was partially funded by the Alaska Legislature in 1979 to do a survey on the impacts of limited entry in Bristol Bay. Koslow reported the following:

> In examining the impact of limited entry policy among the different fishery groups in Bristol Bay, a clear dichotomy was found between local and non-local fishermen. Non-local fishermen were generally well-equipped and able to realize any increased rent due to limited entry, i.e. a rate of return above that which would accrue to an open entry fishery. On the other hand, local rural communities appeared to suffer under the present system. Initially, some local residents of long-standing experience fishing and who considered themselves legitimate Bristol Bay fishermen were unable to obtain permits. The permit application made apparent allowance for local fishermen by awarding points for rural residence and degree of dependence upon the fishery, although, for the latter, only during 1971-72. However, the application's implicit definition of a legitimate Bristol Bay fisherman was based upon the non-rural fisherman, one who fishes every season, good or bad, and fishes the entire season, both the peak and tails of the run, and who maintains written records of income and has sufficient education to comprehend a complex application process. The application failed to recognize the need of local rural residents to maintain a diversified economy in the face of the drastically

> fluctuating salmon runs. These conflicting tendencies within the permit application created apparent anomalies: permits were received by some fishermen who first skippered only several seasons prior to the institution of limited entry, while longstanding Bristol Bay fishermen who went elsewhere during those years were denied further access to the fishery. (Koslow 1982:415-25)

The debate over which groups were helped most by the complex and expensive initial allocation system will probably continue until data can be more thoroughly analyzed.

Post-limitation Changes in Permit Ownership

The Alaska Legislature has long been ambivalent toward the concept of free transferability. Immediately after implementation of the limited entry program, it asked the Commission to prepare a special report on alternatives to free transferability. In 1979, it funded studies to examine the consequences of transfer activity and to reexamine alternatives to free transferability.

It was recognized that free transferability would encourage permit turnover and promote efficiency in exchange. Legal scholars had counseled that it was more legally defensible than other transferability options. Free transferability would allow parents to transfer permits to their children, allow permits to be inherited upon the death of the holder, allow persons to enter and exit fisheries at times opportune to them and would obviate the need for an expensive bureaucratic process to handle permit reallocations. All other transfer options were inferior with respect to these criteria.

However, many Alaskans dislike the concept of windfalls accruing to those who receive initial allocations. Others fear that permits will leave the state, or that permits will be transferred away from isolated fishing communities that are "local" to a limited fishery, thereby eroding the fragile economic base. The following sections review the evidence on distributional changes which have resulted from permit transfer activities.

Langdon's study: By 1979, some legislators had become concerned about the escalating prices of entry permits and feared that permits were gradually flowing from Alaskans to more competitive outsiders. At the time some legislators had become concerned about the escalating prices of entry permits and feared that over time, permits were flowing from Alaskans to more competitive outsiders. They also feared that young rural Alaskans would lack the means to enter limited fisheries. Once again, the legislature wanted to examine alternatives to free transferability.

Dr. Steve Langdon of the University of Alaska was funded to do an in-depth study of entry permit transfer activities. His study covered the period from mid-1975 through late 1979

(Langdon 1980). To examine permit flows, Langdon defined the following five residency classes relative to each limited fishery:

1. N = Non-resident
2. AUL = Alaskan resident living in an urban area local to the limited fishery
3. AUN = Alaskan resident living in an urban area non-local to the limited fishery
4. ARL = Alaskan resident living in a rural area local to the limited fishery
5. ARN = Alaskan resident living in a rural area non-local to the limited fishery

Langdon found that younger people were entering the limited fisheries (average age was falling), that relatively high rates of intrafamily transfers were occurring, and that residents had made a slight gain, relative to non-residents, in the number of permits held. However, Langdon also found a decline in permit ownership by rural residents and a gain in permit ownership by urban residents of Alaska. Langdon found the trend disturbing, as the following indicates:

> Values, attitudes, and assumptions of different Alaskans will vary significantly about the relative importance of these elements in deciding what is to be done about limited entry and what is to be the proper place of Alaska's fisheries in the fabric of Alaskan society. However, any public policy dealing with a common property resource that systematically, whether intentionally or unintentionally, places one group of Alaskan citizens at a disadvantage relative to another requires close scrutiny. If close scrutiny reveals unacceptable outcomes, then changes to ameliorate the disadvantages that do occur are warranted. With that principle in mind the tremendously high cost of permits coupled with the availability of financing and the loss of permits by rural Alaskans are the two most important public policy issues that emerge from this study of transfer patterns in the limited salmon fisheries. (Langdon 1980:66)

Langdon went on to offer hypotheses on why the pattern of transfers away from rural areas had developed, predicted that it would probably continue, and stated that the "net permit outflow" must be regarded as a significant threat to the rural Alaskan economic base and the well-being of rural Alaskans." (Langdon 1980:73)

Langdon cited a number of factors which might support the view that initial permit holders in rural areas had higher percentages of marginal fishermen than did other resident types.[9] Permit holders who consistently achieve net returns

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[9] Langdon cited less wealth, smaller investments in fishing capital, less mobility to adjust to changing conditions (continued)

below the opportunity cost of the permit are likely to become sellers. Langdon noted that one might expect the movement of permits from rural areas to stop once the percentage of rural permit holders earning below average net returns fell into rough parity with other residency classes.[10] He went on to note, however, that as permits become more expensive, fewer rural residents would have the wherewithal or the access to financing to allow them to offer competitive bids for permits which come onto the market. This latter factor, if true, would suggest that the movement of permits from rural areas may continue.[11]

Commission studies on permit movements: Langdon's study partially allayed legislative concerns that entry permits were being transferred en masse to non-residents. However, the finding that permits were being transferred away from isolated rural fishing communities to urban areas of Alaska raised new questions and concerns.

As a result of these issues, the Commission began its own detailed report to keep the legislature and public apprised of trends in permit ownership. The report, "Changes in the Distribution of Permit Ownership in Alaska's Limited Fisheries," has been updated periodically (Dinneford et al. 1983; Dinneford and Kamali 1984; Dinneford 1984; Dinneford and Hart 1986).

The Commission utilized the resident type definitions developed by Langdon, with only minor changes. The Commission's studies indicate that trends identified by Langdon have continued. Table 6 provides data on the net result of transfers of permit ownership by the Alaska rural local resident type, over the 1975-85 time period. The net decline of 637 permits has resulted in increases in permit ownership in the five other resident types. Permit ownership by Alaska urban non-locals and non-residents has increased substantially as the result of transfers (net) with Alaska rural locals. At year-end 1985, the highest percentage of entry permits are still owned by Alaska rural locals. However, ownership by

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(continued)
in a fishery, and a higher percentage of older fishermen as factors which might indicate that a disproportionate number of rural permit holders are marginal fishermen. It should be noted that all of these factors are not necessarily indicators that a fisherman will be doing more poorly on a net return basis.

10 Karpoff has noted that the permit price should indicate the present value of marginal net returns, not average net returns.

11 Hypotheses concerning the reasons for the movement of permits from rural areas of Alaska remain largely conjecture. Little empirical work has been done on the topic. Many factors may be involved.

this resident type has fallen from 44.1 percent at initial issuance to 39.5 percent at year-end 1985.

Table 7 provides similar data for both urban and rural residents who are "local" to limited fisheries. Local permit ownership has also declined in every year since 1975 as the result of net transfer activity. Again, permit ownership by Alaska urban non-locals and non-residents has increased substantially as the net result of transfer activity with persons local to limited fisheries.

Permit ownership by Alaskan Natives: Since the statute was conceived, concerns have been expressed about how Alaskan Natives would fare under the state's limited entry program. As noted above, one former commissioner felt that the complex initial allocation system was adopted in the hope that it would provide permits to economically dependent Natives and isolated fishing communities. It was felt that less heavily capitalized Native fishermen who divided their time between subsistence and commercial fishing activities might not do as well under a simpler allocation system based upon total catch.

How well the stereotype tends to fit Native fishermen and their fishing activities is a matter of conjecture. It may vary considerably depending upon the group and the area of the state. Obviously, many Native fishermen are highliners who have large investments in their operations.

How Alaska Natives fared in the initial allocation also remains a matter of dispute. As noted above, some authors feel they did poorly.

Because of the continued trend of permit transfers away from rural fishing communities, further questions about Native permit ownership arose. The largest absolute decline in permits held by Alaska rural locals has occurred in the Bristol Bay salmon fisheries, where local communities are dominated by Alaskan Natives.

In 1984, the Commission, with the cooperation of the Bureau of Indian Affairs (BIA), was able to merge a computer file of the Alaskan Native roll with entry permit files, thereby providing estimates of which permit holders were Alaskan Natives. The Alaskan Native roll is a list of eligible claimants under the Alaska Native Claims Settlement Act.[12] The matching process was complicated due to differences in spellings, social security numbers and birth dates between the files, and because of this the results of matching the data should be considered as approximate.

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[12] Under agreement with the BIA, the ethnicity of a permit holder remains confidential information. Such information cannot be disclosed to other individuals, agencies or organizations.

Table 6. Transfers from Alaska rural locals to other resident types by year, 1975-1985.

Year	From Alaska Rural Local	To Alaska Rural Local	Net Alaska Rural Local Shift	Net Shift: Alaska Rural Non-Local	Alaska Urban Local	Alaska Urban Non-Local	Non-Resident	Dept. of Comm.*	Net Urban Shift	Net Non-Local Shift**
1975	44	59	15	0	4	-1	-18	0	3	-1
1976	82	55	-27	-3	13	7	10	0	20	4
1977	135	70	-65	2	35	13	15	0	48	15
1978	156	89	-67	2	18	22	25	0	40	24
1979	137	56	-81	5	9	37	30	0	46	42
1980	148	59	-89	1	32	35	21	0	67	36
1981	151	72	-79	4	12	42	21	0	54	46
1982	155	79	-76	6	1	43	26	0	44	49
1983	148	63	-85	8	9	43	22	3	52	54
1984	128	74	-54	5	2	10	37	0	12	15
1985	115	86	-29	2	-1	16	9	3	15	21
Totals	1399	762	-637	32	134	267	198	6	401	305

* This column consists of foreclosures by the Dept. of Commerce or C.F.A.B.
** Non-Local includes the Alaska Rural Non-Local, Alaska Urban Non-Local, and Dept. of Commerce/C.F.A.B. resident types.

Table 7. Transfers from Alaska rural local and urban local permit holders to other resident types by year, 1975-1985.

Year	From Alaska Local*	To Alaska Local*	Net Alaska Local Shift*	Net Shift in Resident Type Due to Transfer Activities with Alaska Local Permit Holders: Alaska Rural Non-Local	Alaska Urban Non-Local	Non-Resident	Dept. of Comm.	Net Non-Local Shift**
1975	35	85	50	0	0	-50	0	0
1976	72	82	10	-14	8	-4	0	-6
1977	105	98	-7	0	10	-3	0	10
1978	155	128	-27	2	19	6	0	21
1979	153	72	-81	7	42	32	0	49
1980	137	85	-52	1	33	18	0	34
1981	132	71	-61	0	40	21	0	40
1982	192	94	-98	3	43	43	9	55
1983	176	84	-92	10	43	36	3	56
1984	154	79	-75	-2	7	73	-3	2
1985	157	107	-50	4	18	24	4	26
Totals	1468	985	-483	11	263	196	13	287

* Alaska Local permit holders represent the combination of Alaska Rural Local and Alaska Urban Local permit holders.

** Non-Local does not include Non-Residents.

The results were summarized in a report by Kamali (1984), which indicated that from 1975 through 1983, 5,448 of the 12,515 permanent permits (43.5 percent)[13] that were initially issued went to Alaskan Natives. If the Arctic-Yukon-Kuskokwim fisheries are excluded from the data, the data still show that Alaskan Natives received 3,438 out of the 10,350 permits (33.2 percent) initially issued in the remaining limited fisheries.

Kamali also reported the 1983 year-end distribution of entry permits. The data revealed a substantial decline in permit ownership by Alaskan Natives. By the end of 1983, Alaskan Natives' ownership of entry permits had fallen from 44 percent to 38 percent. Excluding the AYK salmon fisheries, permit ownership by Alaskan Natives in the rest of the limited fisheries had fallen from 33 percent to 27 percent. The largest decline in permit ownership came among Alaskan Natives who lived in rural areas local to limited fisheries, but ownership of permits fell among Alaskan Natives of all resident types.

Causes of the decline in rural and Native permit ownership: The reports cited above indicate that permits owned by Alaskan natives and persons living in rural fishing communities have declined due to transfers. What are the causes of these trends and will they continue?

To date, no attempt has been made to examine why such trends are occurring. Langdon formulated a number of hypotheses but provided no empirical data. A major concern of Langdon's was that many rural residents simply lacked the ability to finance a permit purchase. In his transfer study, Langdon stated:

> Factors on the buying side of importance are the availability of capital for permit purchases, and the ability of rural residents to meet requirements necessary to gain access to financing for permit purchases. Rising costs of technology and permits both will make outright purchases of permits less and less possible so that entry into the fisheries will become more and more dominated by the availability of financing. The discussion on financing requirements of the private sector, as well as the examination of the operation of the State loan program to date revealed a gloomy picture indeed of access to financing by rural residents. Without major modifications in permit financing requirements by the private sector, major intervention in some fashion by the State, and/or new sources of capital made available to rural residents, then even if

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[13] The number of permits reported by Kamali will differ slightly from those reported in the most recent update of "Changes in the Distribution of Entry Permits in Alaska's Limited Fisheries, 1975-1985," due to revocations and retroactive changes in the permit files during 1984 and 1985.

> significantly fewer permits are put up for sale by rural residents in the future, other rural residents will not be able to purchase even those few permits. Financial conditions in rural Alaska make it unlikely that they will be able to reverse the outflow of permits that has occurred to date, thus, the only strategy available becomes stabilization of what remains by emphasizing intrafamilial and intracommunity transfers, presumably at some rate considerably below the prevailing market price. (Langdon 1980:71-72)

Langdon also examined state-subsidized loan data through mid-1979, and concluded that the loans were going to persons with substantial net worth. In a later report, Focht and Schelle (1983) examined data on the subsidized fishing loan program administered by the Alaska Department of Commerce and Economic Development (DCED) covering fiscal years 1979 through 1982. These data revealed that the number of "permit related" loans per 1,000 permit holders were much lower among rural populations and in remote regions of the state during the time period. Ancillary data from the Entry Commission's transfer survey revealed that DCED-subsidized loans financed more urban purchases of rural-held permits than rural purchases of urban-held permits over calendar years 1980 through 1982. While these facts are interesting, the authors noted that the data presented were inadequate to confirm the hypothesis that the subsidized-loan program played a contributing role in the movement of permits from rural to urban areas of the state during the time period. They also noted that the new, targeted-loan program which became effective in FY 83, may have altered the geographical distribution of DCED-subsidized loans. Data on the new targeted loan program have not been examined.

To the extent that financing a permit purchase is a problem for poor persons in rural areas, relaxing the statutory restrictions on using the permit as collateral and on leasing the permit might allow alternative methods of financing to emerge. In a policy discussion paper, Muse (1984) presented arguments for and against relaxing statutory restrictions on the leasing of limited entry permits. Muse noted that permits are leaving rural villages at the same time that many have complained that young villagers cannot afford to get into limited fisheries. Muse felt that permit leasing might provide a low-cost means for poorer persons to gain entry. Those who became successful fishermen could accumulate the necessary resources to purchase a permit.

Those who are against leasing dislike the idea that permits could be owned by an "absentee landlord," fear that it may provide a means for the processing industry to establish greater market power over fishermen, and note that it will lead to participation and effort increases in already overcrowded limited fisheries.

Similar arguments can be made with respect to the statutory prohibition on using the permit as collateral. Rural Alaskans who sell their permits might be more inclined to

provide transferor financing to a local buyer, if they could contractually guarantee that the permit would be returned, should the buyer forfeit on the payment schedule. Buyers could pledge a portion of their earnings over time as a payment stream equivalent in risk-adjusted present value to the permit's market value. Removal of such restrictions might provide a natural means for poor persons in rural areas to arrange alternate financing.

Opponents of removing restrictions on using permits as collateral assert that doing so would make financing easier for everyone and therefore would increase demand and drive up the price of permits, putting them farther out of reach of the rural poor. Moreover, they assert that it would encourage a "permit landlord class" and, like leasing, might lead to intensified effort.

Work needs to be done to better identify the reasons for the decline in permit ownership by Alaskan Natives and rural Alaskans. Should these trends continue, pressures for significant program changes may evolve. Once the causes have been identified, major questions will remain concerning what policy changes are appropriate.

SUMMARY

The efficiency impacts of Alaska's limited entry program remain somewhat ambiguous. High permit values suggest that the limited fisheries are generating rents. However, studies of vessel characteristics, vessel and gear market values, and average crew sizes indicate that individual fishing operations now use capital and labor inputs more intensively than they did at the start of the program. In addition, many fisheries have experienced increases in post-limitation participation.

It is debatable whether or not Alaska's complex and expensive initial allocation system gave rural Alaska residents an advantage or a disadvantage. However, evidence on permit transfers indicates that there have been net movements of permits away from rural areas "local" to limited fisheries and from Alaska Natives to non-Natives. The reasons for these trends remain unclear.

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APPENDIX: ALASKA'S LIMITED FISHERIES 1975-85

The fishery codes in Table A.1 have four characters. These codes should be interpreted as follows:

1. The first character in the code is a letter that represents the species caught. The following species codes are used in the table:

   G = roe herring
   S = salmon

2. The second two characters in the code are numbers that represent the gear utilized. The following gear codes are used in the table:

   01 = purse seine
   02 = beach seine
   03 = drift gillnet
   04 = set gillnet
   05 = hand troll
   15 = power troll
   34 = herring gillnet

3. The last character in the code is a letter which represents the area fished. The following area codes are used in the table:

   A = Southeastern
   B = Statewide
   D = Yakutat
   E = Prince William Sound
   H = Cook Inlet
   K = Kodiak
   L = Chignik
   M = Peninsula-Aleutians
   P = Upper Yukon
   T = Bristol Bay
   W = Kuskokwim
   X = Kotzebue
   Y = Lower Yukon
   Z = Norton Sound

Thus, for example, G01A represents the roe herring purse seine fishery in Southeastern Alaska.

Table A.1. Alaska's limited fisheries 1975-1985.

Fishery	Year	Resident Permit Holders	Nonresident Permit Holders	Percent Resident	Permanent Permits Fished	Est. Avg. Gross Earnings (Nominal)	Est. Avg. Gross Earnings (1985 Dollars)	Est. Avg. Permit Price (Nominal)	Est. Avg. Permit Price (1985 Dollars)
G01A	1977	36	2	95	16	$ 11,445	$ 20,317	-	-
	1978	37	4	90	27	$ 45,737	$ 75,457	-	-
	1979	38	4	90	40	$121,932	$315,586	-	-
	1980	38	4	90	42	$ 41,745	$ 54,498	-	-
	1981	38	3	93	35	$ 70,763	$ 83,699	-	-
	1982	39	3	93	40	$ 63,180	$ 70,414	-	-
	1983	37	5	88	40	$108,229	$116,866	-	-
	1984	37	5	88	42	$ 73,136	$ 75,747	-	-
	1985	38	5	88	-	-	-	-	-
G01E	1977	77	8	91	45	$ 13,305	$ 23,618	-	-
	1978	78	13	86	66	$ 14,370	$ 23,708	-	-
	1979	80	12	87	78	$ 77,256	$114,501	-	-
	1980	77	15	84	69	$ 26,900	$ 35,118	$45,000	$58,747
	1981	76	16	83	90	$ 56,728	$ 67,098	-	-
	1982	78	15	84	84	$ 29,536	$ 32,917	$71,250	$79,408
	1983	83	14	86	67	$ 25,228	$ 27,241	-	-
	1984	86	14	86	92	$ 22,145	$ 22,936	$63,857	$66,137
	1985	88	14	86	-	-	-	$66,375	$66,375
G01H	1977	57	4	93	43	$ 28,651	$ 50,861	-	-
	1978	60	7	90	39	$ 4,957	$ 8,178	-	-
	1979	59	9	87	30	$ 16,319	$ 24,187	$27,500	$40,758
	1980	58	10	85	-	-	-	-	-
	1981	57	11	84	-	-	-	$ 7,917	$ 9,364
	1982	59	10	86	1	X	X	-	-
	1983	59	11	84					
	1984	60	12	83	-	X	X	-	-
	1985	59	14	81	-	-	-	$16,700	$16,700
G01K	1984	5	0	100	4	$ 41,227	$ 42,699	-	-
	1985	39	3	93	-	X	X	$36,000	$36,000
G04A	1979	-	-	-	22	$ 13,694	$ 20,296		

- The value 'x' is used to maintain confidentiality.
- Missing '-' values indicate no available data.
- 1984 Permits Fished and Gross Earnings information comes from preliminary 1984 fish ticket data.
- 1985 Permits Fished and Gross Earnings data are not yet available.

Table A.1. (continued)

Fishery	Year	Resident Permit Holders	Nonresident Permit Holders	Percent Resident	Permanent Permits Fished	Est. Avg. Gross Earnings (Nominal)	Est. Avg. Gross Earnings (1985 Dollars)	Est. Avg. Permit Price (Nominal)	Est. Avg. Permit Price (1985 Dollars)
G34A	1978	10	0	100	-	-	-	-	-
	1979	35	4	90	-	-	-	-	-
	1980	38	6	86	39	$ 3,383	$ 4,416	$ 13,362	$ 17,444
	1981	39	6	87	41	$ 13,541	$ 16,016	$ 13,875	$ 16,411
	1982	47	12	80	39	$ 14,750	$ 16,439	$ 27,500	$ 30,649
	1983	47	20	70	57	$ 31,616	$ 34,139	$ 29,167	$ 31,495
	1984	63	19	77	74	$ 17,606	$ 18,235	$ 39,583	$ 40,996
	1985	64	23	74	-	-	-	$ 45,000	$ 45,000
G34E	1982	22	2	92	-	-	-	-	-
	1983	23	1	96	22	$ 4,773	$ 5,154	$ 17,000	$ 18,357
	1984	22	2	92	23	$ 5,662	$ 5,864	$ 24,000	$ 24,857
	1985	22	2	92	-	-	-	$ 29,667	$ 29,667
G34K	1984	8	0	100	6	$ 5,803	$ 6,010	-	-
	1985	54	0	100	-	-	-	$ 15,600	$ 15,600
S01A	1975	198	200	50	269	$ 21,453	$ 42,880	$ 10,633	$ 21,253
	1976	202	207	49	278	$ 39,493	$ 74,631	$ 9,222	$ 17,427
	1977	196	215	48	322	$ 76,280	$135,413	$ 16,667	$ 29,587
	1978	193	220	47	371	$ 74,245	$122,489	$ 30,929	$ 51,027
	1979	189	224	46	317	$ 61,847	$ 91,664	$ 39,917	$ 59,161
	1980	193	221	47	330	$ 88,646	$115,727	$ 39,778	$ 51,930
	1981	194	220	47	360	$101,767	$120,370	$ 40,435	$ 47,827
	1982	186	228	45	366	$ 76,870	$ 85,672	$ 20,636	$ 45,289
	1983	188	228	45	333	$ 99,071	$106,977	$ 38,531	$ 41,606
	1984	186	231	45	377	$ 92,033	$ 95,319	$ 40,884	$ 42,344
	1985	186	230	45	-	-	-	$ 37,907	$ 37,907
S01E	1975	164	46	78	160	$ 22,446	$ 44,865	$ 8,000	$ 15,990
	1976	194	53	79	228	$ 24,285	$ 45,891	$ 10,700	$ 20,200
	1977	198	57	78	218	$ 40,547	$ 71,980	$ 29,800	$ 52,901
	1978	193	64	75	191	$ 24,957	$ 41,173	$ 24,272	$ 40,044
	1979	192	66	74	233	$111,311	$164,974	$ 33,846	$ 50,163
	1980	197	61	76	227	$ 84,804	$110,711	$ 38,259	$ 49,947
	1981	190	69	73	257	$169,167	$200,091	$ 74,250	$ 87,823
	1982	188	71	73	247	$ 74,875	$ 83,448	$ 97,587	$108,761
	1983	187	72	72	255	$ 45,694	$ 49,340	$143,186	$154,612
	1984	188	73	72	252	$ 84,049	$ 87,049	$131,695	$136,397
	1985	191	70	73	-	-	-	$109,625	$109,625

Table A.1. (continued)

Fishery	Year	Resident Permit Holders	Nonresident Permit Holders	Percent Resident	Permanent Permits Fished	Est. Avg. Gross Earnings (Nominal)	Est. Avg. Gross Earnings (1985 Dollars)	Est. Avg. Permit Price (Nominal)	Est. Avg. Permit Price (1985 Dollars)
S01H	1975	49	0	100	32	$ 32,035	$ 64,031	-	-
	1976	62	1	98	43	$ 11,593	$ 21,907	-	-
	1977	72	0	100	55	$ 43,843	$ 77,830	$ 10,625	$ 18,861
	1978	74	0	100	61	$ 22,249	$ 36,707	$ 40,000	$ 65,992
	1979	74	1	99	71	$ 78,095	$115,745	-	-
	1980	73	2	97	64	$ 21,339	$ 27,859	$ 82,785	$108,076
	1981	73	2	97	73	$ 86,919	$102,807	$ 83,714	$ 99,017
	1982	76	1	99	59	$ 29,716	$ 33,119	$ 84,267	$ 93,916
	1983	78	0	100	69	$ 24,340	$ 26,282	$ 90,000	$ 97,182
	1984	77	1	99	52	$ 25,106	$ 26,003	-	-
	1985	79	1	99	-	-	-	$ 58,375	$ 58,375
S01K	1975	242	92	72	223	$ 15,746	$ 31,474	$ 4,571	$ 9,137
	1976	262	96	73	319	$ 49,076	$ 92,738	$ 9,736	$ 18,398
	1977	270	95	74	324	$ 47,409	$ 84,160	$ 17,611	$ 31,263
	1978	74	97	74	358	$ 71,431	$117,847	$ 47,611	$ 78,549
	1979	273	101	73	350	$ 51,315	$ 76,054	$ 66,045	$ 97,885
	1980	275	100	73	356	$ 62,878	$ 82,087	$ 70,960	$ 92,638
	1981	280	95	75	315	$ 79,355	$ 93,861	$ 69,605	$ 82,329
	1982	284	92	76	336	$ 38,873	$ 43,323	$ 75,511	$ 84,157
	1983	289	88	77	336	$ 30,083	$ 32,484	$ 69,903	$ 75,481
	1984	286	92	76	290	$ 71,303	$ 73,849	$ 61,265	$ 63,452
	1985	290	89	77	-	-	-	$ 46,337	$ 46,337
S01L	1975	64	21	75	80	$ 20,917	$ 41,808	-	-
	1976	72	18	80	74	$ 70,922	$134,021	-	-
	1977	73	17	81	87	$180,706	$320,790	-	-
	1978	76	14	84	89	$189,302	$312,311	-	-
	1979	76	14	84	90	$159,758	$236,777	-	-
	1980	76	14	84	89	$ 79,392	$103,646	-	-
	1981	74	16	82	90	$215,829	$255,283	-	-
	1982	74	16	82	90	$147,032	$163,867	-	-
	1983	74	16	82	90	$113,753	$122,830	-	-
	1984	75	15	83	90	$195,087	$202,052	$322,500	$334,013
	1985	78	12	87	-	-	-	$321,233	$321,233

Table A.1. (continued)

Fishery	Year	Resident Permit Holders	Nonresident Permit Holders	Percent Resident	Permanent Permits Fished	Est. Avg. Gross Earnings (Nominal)	Est. Avg. Gross Earnings (1985 Dollars)	Est. Avg. Permit Price (Nominal)	Est. Avg. Permit Price (1985 Dollars)
S01M	1975	95	13	88	51	$ 8,412	$ 16,814	-	-
	1976	99	13	88	84	$ 43,223	$ 81,678	-	-
	1977	100	13	88	82	$ 30,041	$ 53,329	-	-
	1978	104	11	90	103	$ 94,365	$155,684	-	-
	1979	102	15	87	112	$162,502	$240,845	$ 66,000	$ 97,819
	1980	97	20	83	115	$151,486	$197,764	$102,500	$133,814
	1981	98	19	84	134	$184,960	$218,771	-	-
	1982	99	19	84	109	$160,150	$178,487	-	-
	1983	98	20	83	114	$119,778	$129,336	$195,000	$210,561
	1984	98	20	83	113	$190,799	$197,611	$243,333	$252,020
	1985	100	19	84	-	-	-	-	-
S02K	1975	20	1	95	7	$ 7,513	$ 15,017	-	-
	1976	22	1	96	17	$ 13,714	$ 25,915	-	-
	1977	27	3	90	23	$ 12,114	$ 21,505	-	-
	1978	30	3	91	28	$ 14,840	$ 24,483	-	-
	1979	30	3	91	26	$ 20,550	$ 30,458	$ 36,500	$ 54,097
	1980	31	3	91	32	$ 22,861	$ 29,846	$ 41,375	$ 54,015
	1981	32	2	94	29	$ 25,933	$ 30,673	$ 42,429	$ 50,185
	1982	32	2	94	29	$ 10,762	$ 11,994	-	-
	1983	32	3	91	26	$ 5,875	$ 6,344	$ 50,000	$ 53,990
	1984	32	3	91	25	$ 12,341	$ 12,781	-	-
	1985	31	3	91	-	-	-	$ 23,750	$ 23,750
S03A	1975	293	138	68	380	$ 9,727	$ 19,442	$ 9,211	$ 18,411
	1976	313	136	70	403	$ 20,340	$ 38,436	$ 10,213	$ 19,300
	1977	323	137	70	428	$ 27,155	$ 48,205	$ 16,262	$ 28,868
	1978	329	134	71	448	$ 20,673	$ 34,106	$ 34,604	$ 57,090
	1979	324	140	70	425	$ 25,916	$ 38,410	$ 41,763	$ 61,897
	1980	322	142	69	424	$ 21,557	$ 28,143	$ 41,250	$ 53,852
	1981	319	145	69	427	$ 21,286	$ 25,178	$ 43,898	$ 51,923
	1982	316	150	68	412	$ 24,467	$ 27,269	$ 38,650	$ 43,075
	1983	322	145	69	420	$ 17,719	$ 19,132	$ 34,653	$ 37,418
	1984	318	149	68	424	$ 31,264	$ 32,380	$ 34,615	$ 35,851
	1985	324	144	69	-	-	-	$ 36,245	$ 36,245

Table A.1. (continued)

Fishery	Year	Resident Permit Holders	Nonresident Permit Holders	Percent Resident	Permanent Permits Fished	Est. Avg. Gross Earnings (Nominal)	Est. Avg. Gross Earnings (1985 Dollars)	Est. Avg. Permit Price (Nominal)	Est. Avg. Permit Price (1985 Dollars)
S03E	1975	366	128	74	388	$ 6,860	$ 13,712	$ 3,089	$ 6,174
	1976	390	124	76	462	$19,708	$ 37,242	$ 4,500	$ 8,504
	1977	393	131	75	492	$20,726	$ 36,793	$ 13,750	$ 24,409
	1978	383	145	73	502	$17,410	$ 28,723	$ 27,742	$ 45,769
	1979	384	147	72	488	$15,763	$ 23,362	$ 35,632	$ 52,810
	1980	392	139	74	382	$12,257	$ 16,001	$ 27,810	$ 36,306
	1981	398	133	75	465	$23,673	$ 28,000	$ 32,836	$ 38,838
	1982	384	147	72	512	$42,479	$ 47,343	$ 46,337	$ 51,643
	1983	396	137	74	519	$18,508	$ 19,985	$ 61,760	$ 66,688
	1984	393	141	74	515	$34,551	$ 35,784	$ 53,544	$ 55,456
	1985	388	146	73	-	-	-	$ 55,991	$ 55,991
S03H	1975	291	162	64	258	$11,117	$ 22,221	$ 3,911	$ 7,817
	1976	342	172	67	446	$17,537	$ 33,140	$ 5,552	$ 10,492
	1977	359	180	67	497	$26,414	$ 46,890	$ 9,643	$ 17,118
	1978	365	184	66	538	$38,281	$ 63,156	$ 36,825	$ 60,754
	1979	370	184	67	545	$15,384	$ 22,801	$ 82,636	$122,475
	1980	373	181	67	517	$12,710	$ 16,592	$ 67,224	$ 87,761
	1981	375	179	68	544	$17,724	$ 20,964	$ 67,629	$ 79,992
	1982	382	172	69	543	$42,789	$ 47,689	$ 58,176	$ 64,837
	1983	390	165	70	549	$34,084	$ 36,804	$ 69,919	$ 75,499
	1984	400	156	72	545	$15,741	$ 16,303	$ 67,962	$ 70,388
	1985	394	163	71	-	-	-	$ 62,605	$ 62,605
S03M	1975	109	43	72	90	$10,473	$ 20,933	-	-
	1976	110	43	72	115	$19,346	$ 36,557	$ 6,333	$ 11,967
	1977	108	46	70	111	$24,332	$ 43,195	$ 10,286	$ 18,260
	1978	109	47	70	132	$38,904	$ 64,184	$ 15,000	$ 24,747
	1979	107	49	69	143	$89,812	$133,111	$ 60,625	$ 89,852
	1980	103	53	66	149	$35,358	$ 46,160	$ 92,454	$120,699
	1981	101	55	65	147	$86,654	$102,494	$123,500	$146,076
	1982	98	58	63	149	$88,638	$ 98,787	$128,833	$143,584
	1983	96	60	62	150	$79,477	$ 85,819	$157,700	$170,284
	1984	96	60	62	151	$69,639	$ 72,125	$186,429	$193,085
	1985	94	62	60	-	-	-	$175,176	$175,176

Table A.1. (continued)

Fishery	Year	Resident Permit Holders	Nonresident Permit Holders	Permanent Percent Resident	Est. Avg. Permits Fished	Est. Avg. Gross Earnings (Nominal)	Est. Avg. Gross Earnings (1985 Dollars)	Permit Price (Nominal)	Permit Price (1985 Dollars)
S03I	1975	767	649	54	979	$ 9,087	$ 18,163	$ 1,166	$ 2,331
	1976	918	704	57	1299	$14,882	$ 28,122	$ 2,536	$ 4,792
	1977	947	716	57	1315	$17,982	$ 31,922	$ 6,180	$ 10,971
	1978	973	727	57	1506	$31,775	$ 52,422	$ 21,638	$ 35,698
	1979	971	746	57	1636	$72,912	$108,063	$ 64,588	$ 95,726
	1980	967	750	56	1661	$42,129	$ 54,999	$ 91,925	$120,008
	1981	964	756	56	1683	$64,423	$ 76,199	$ 84,327	$ 99,742
	1982	961	763	56	1697	$39,238	$ 43,731	$ 95,936	$106,921
	1983	990	737	57	1707	$72,176	$ 77,936	$ 98,923	$106,817
	1984	974	755	56	1716	$52,147	$ 54,008	$116,905	$121,079
	1985	979	759	56	-	-	-	$117,983	$117,983
S04D	1975	131	16	89	94	$ 4,752	$ 9,498	-	-
	1976	140	16	90	132	$ 9,568	$ 18,080	$ 6,000	$ 11,338
	1977	141	17	89	142	$15,061	$ 26,736	$ 7,000	$ 12,426
	1978	142	19	88	152	$16,843	$ 27,788	$ 10,480	$ 17,290
	1979	143	21	87	152	$19,755	$ 29,279	-	-
	1980	146	18	89	155	$14,446	$ 18,859	$ 32,500	$ 42,429
	1981	146	18	89	156	$16,751	$ 19,813	$ 26,682	$ 31,559
	1982	144	20	88	147	$15,099	$ 16,827	$ 32,792	$ 36,547
	1983	144	20	88	144	$ 8,319	$ 8,983	$ 27,250	$ 29,425
	1984	145	19	88	140	$16,465	$ 17,053	$ 23,750	$ 24,598
	1985	146	18	89	-	-	-	$ 25,862	$ 25,862
S04E	1975	21	5	81	-	-	-	-	-
	1976	23	5	82	1	X	X	-	-
	1977	21	7	75	13	$10,962	$ 19,461	-	-
	1978	23	5	82	2	X	X	-	-
	1979	23	5	82	7	$12,700	$ 18,822	-	-
	1980	24	4	86	10	$ 5,259	$ 6,865	-	-
	1981	24	5	83	3	X	X	-	-
	1982	27	3	90	5	$ 4,639	$ 5,170	$ 19,400	$ 21,621
	1983	28	2	93	17	$ 8,842	$ 9,547	$ 24,167	$ 16,096
	1984	28	2	93	19	$22,665	$ 23,475	$ 31,250	$ 32,366
	1985	28	2	93	-	-	-	$ 32,375	$ 32,375

Table A.1. (continued)

Fishery	Year	Resident Permit Holders	Nonresident Permit Holders	Percent Resident	Permanent Permits Fished	Est. Avg. Gross Earnings (Nominal)	Est. Avg. Gross Earnings (1985 Dollars)	Est. Avg. Permit Price (Nominal)	Est. Avg. Permit Price (1985 Dollars)
S04H	1975	608	44	93	333	$ 5,096	$10,186	$ 2,250	$ 4,497
	1976	670	42	94	536	$ 9,461	$17,878	$ 1,778	$ 3,360
	1977	690	41	94	545	$14,876	$26,408	$ 4,821	$ 8,558
	1978	698	44	94	600	$18,985	$31,322	$ 9,824	$16,208
	1979	702	42	94	606	$10,176	$15,082	$23,412	$34,699
	1980	697	47	94	590	$10,424	$13,609	$18,362	$23,972
	1981	685	59	92	596	$14,792	$17,496	$15,276	$18,068
	1982	693	51	93	600	$20,304	$22,628	$17,200	$19,169
	1983	683	60	92	625	$16,242	$17,538	$18,340	$19,804
	1984	669	74	90	577	$ 9,399	$ 9,735	$17,881	$18,519
	1985	678	66	91	-	-	-	$16,312	$16,312
S04K	1975	103	36	74	80	$ 4,104	$ 8,203	$ 5,380	$10,754
	1976	133	43	76	142	$16,034	$30,299	$ 3,900	$ 7,370
	1977	137	44	76	144	$19,172	$34,035	$ 6,600	$11,716
	1978	139	45	76	158	$22,746	$37,526	$19,800	$32,666
	1979	138	47	75	164	$23,363	$34,626	$33,667	$49,898
	1980	138	48	74	167	$21,263	$27,759	$38,750	$50,588
	1981	141	45	76	168	$34,882	$41,258	$41,278	$48,824
	1982	138	48	74	169	$29,032	$32,356	$39,817	$44,376
	1983	139	47	75	172	$16,831	$18,174	$76,525	$82,632
	1984	141	46	75	168	$26,552	$27,500	$57,200	$59,242
	1985	147	40	79	-	-	-	$56,357	$56,357
S04M	1975	76	6	93	35	$ 4,500	$ 8,995	-	-
	1976	98	7	93	50	$ 7,898	$14,925	-	-
	1977	95	11	90	55	$12,062	$21,413	$ 5,150	$ 9,142
	1978	100	8	93	58	$19,788	$32,646	-	-
	1979	99	9	92	78	$47,383	$70,226	-	-
	1980	98	11	90	81	$24,508	$31,995	$15,625	$20,398
	1981	98	11	90	84	$58,427	$69,108	$54,278	$64,200
	1982	95	14	87	89	$35,691	$39,777	$54,636	$60,892
	1983	96	13	88	92	$37,487	$40,478	$55,420	$59,843
	1984	95	14	87	101	$58,356	$60,439	$50,374	$52,172
	1985	95	15	86	-	-	-	$50,313	$50,313

Table A.1. (continued)

Fishery	Year	Resident Permit Holders	Nonresident Permit Holders	Percent Resident	Permanent Permits Fished	Est. Avg. Gross Earnings (Nominal)	Est. Avg. Gross Earnings (1985 Dollars)	Est. Avg. Permit Price (Nominal)	Est. Avg. Permit Price (1985 Dollars)
S04P	1976	35	0	100	10	$ 1,333	$ 2,518	-	-
	1977	44	0	100	28	$ 3,202	$ 5,684	-	-
	1978	46	1	98	29	$ 4,099	$ 6,762	-	-
	1979	48	1	98	37	$ 9,197	$13,631	-	-
	1980	47	1	98	36	$ 3,465	$ 4,524	-	-
	1981	64	0	100	38	$ 6,357	$ 7,519	$ 5,000	$ 5,914
	1982	71	1	99	45	$ 3,999	$ 4,457	$ 8,366	$ 9,324
	1983	70	2	97	40	$ 2,631	$ 2,841	$10,600	$11,446
	1984	69	1	99	38	$ 4,162	$ 4,311	-	-
	1985	69	1	99	-	-	-	-	-
S04T	1975	592	124	83	357	$ 2,539	$ 5,075	-	-
	1976	620	139	82	500	$ 4,022	$ 7,601	$ 2,755	$ 5,206
	1977	669	155	81	485	$ 5,378	$ 9,547	$ 2,695	$ 4,784
	1978	733	158	82	636	$ 9,683	$15,974	$ 8,507	$15,035
	1979	745	165	82	745	$22,780	$33,763	$18,184	$26,951
	1980	728	185	80	770	$14,496	$18,925	$32,014	$41,794
	1981	714	200	78	805	$24,479	$28,954	$26,000	$30,753
	1982	705	211	77	819	$12,173	$13,567	$37,394	$41,676
	1983	712	217	77	831	$17,579	$18,982	$41,246	$44,537
	1984	715	216	77	845	$12,869	$13,328	$41,533	$43,016
	1985	718	213	77	-	-	-	-	-
S04W	1976	688	0	100	455	$ 2,135	$ 4,034	-	-
	1977	761	0	100	648	$ 5,584	$ 9,913	-	-
	1978	765	1	100	692	$ 3,246	$ 5,356	$ 6,100	$10,064
	1979	780	1	100	714	$ 5,893	$ 8,734	$ 6,420	$ 9,515
	1980	782	0	100	705	$ 3,895	$ 5,085	$ 6,912	$ 9,024
	1981	784	1	100	733	$ 4,762	$ 6,633	$ 8,339	$ 9,863
	1982	829	2	100	748	$ 5,742	$ 6,399	$ 9,722	$10,835
	1983	828	3	100	753	$ 3,281	$ 3,543	$10,222	$11,038
	1984	829	2	100	768	$ 8,344	$ 8,642	$ 9,894	$10,247
	1985	829	2	100	-	-	-	$10,043	$10,043

Table A.1. (continued)

Fishery	Year	Resident Permit Holders	Nonresident Permit Holders	Percent Resident	Permanent Permits Fished	Est. Avg. Gross Earnings (Nominal)	Est. Avg. Gross Earnings (1985 Dollars)	Est. Avg. Permit Price (Nominal)	Est. Avg. Permit Price (1985 Dollars)
S04X	1976	118	0	100	74	$ 2,172	$ 4,105	-	-
	1977	175	0	100	155	$ 5,601	$ 9,943	-	-
	1978	177	0	100	158	$ 1,955	$ 3,225	-	-
	1979	180	0	100	162	$ 5,888	$ 8,727	$ 5,200	$ 7,707
	1980	193	1	99	154	$ 9,494	$12,395	-	-
	1981	208	3	99	182	$18,268	$21,608	$ 7,812	$ 9,240
	1982	216	3	99	195	$10,828	$12,068	$ 9,591	$10,689
	1983	216	3	99	186	$ 2,386	$ 2,576	$13,083	$14,127
	1984	216	3	99	180	$ 6,198	$ 6,419	-	-
	1985	216	3	99	-	-	-	$10,475	$10,475
S04Y	1976	677	1	100	518	$ 3,101	$ 5,861	-	-
	1977	691	1	100	598	$ 5,988	$10,630	-	-
	1978	691	4	99	638	$ 6,446	$10,635	$ 6,700	$11,054
	1979	698	4	99	653	$ 9,810	$14,539	$ 5,834	$ 8,647
	1980	700	3	100	647	$ 7,584	$ 9,901	$ 9,060	$11,828
	1981	703	3	100	661	$12,093	$14,304	$ 9,333	$11,039
	1982	703	4	99	660	$ 8,023	$ 8,942	$18,250	$20,340
	1983	698	5	99	650	$ 7,382	$ 7,971	$22,630	$24,436
	1984	699	5	99	670	$ 7,580	$ 7,851	$28,441	$29,456
	1985	700	4	99	-	-	-	$22,917	$22,917
S04Z	1976	169	0	100	78	$ 1,947	$ 3,680	-	-
	1977	174	2	99	139	$ 3,281	$ 5,824	-	-
	1978	176	0	100	153	$ 5,381	$ 8,878	$ 4,350	$ 7,177
	1979	175	2	99	152	$ 5,326	$ 7,894	$ 6,300	$ 9,337
	1980	175	2	99	138	$ 3,804	$ 4,967	$ 7,833	$10,226
	1981	194	1	99	148	$ 4,757	$ 5,627	$ 9,450	$11,177
	1982	199	1	99	159	$ 6,656	$ 7,418	$10,100	$11,256
	1983	199	2	99	165	$ 5,654	$ 6,105	$11,500	$12,418
	1984	199	2	99	139	$ 5,221	$ 5,408	$13,150	$13,619
	1985	200	2	99	-	-	-	$12,167	$12,167
S05B	1982	660	36	95	450	$ 4,294	$ 4,785	$ 3,828	$ 4,266
	1983	1973	148	93	931	$ 2,661	$ 2,873	$ 4,948	$ 5,343
	1984	1975	163	92	844	$ 4,625	$ 4,790	$ 4,732	$ 4,901
	1985	1847	139	93	-	-	-	$ 5,109	$ 5,109

Table A.1. (continued)

Fishery	Year	Resident Permit Holders	Nonresident Permit Holders	Percent Resident	Permanent Permits Fished	Est. Avg. Gross Earnings (Nominal)	Est. Avg. Gross Earnings (1985 Dollars)	Est. Avg. Permit Price (Nominal)	Est. Avg. Permit Price (1985 Dollars)
S08P	1976	80	0	100	28	$ 1,663	$ 3,143	-	-
	1977	107	0	100	87	$ 2,363	$ 4,195	-	-
	1978	107	1	99	93	$ 4,676	$ 7,714	-	-
	1979	114	0	100	91	$ 4,171	$ 6,182	-	-
	1980	114	0	100	90	$ 5,643	$ 7,366	$ 9,320	$12,167
	1981	123	0	100	98	$ 7,851	$ 9,286	$10,893	$12,884
	1982	130	0	100	88	$ 5,840	$ 6,509	$10,500	$11,702
	1983	129	1	99	91	$ 3,939	$ 4,253	$11,643	$12,572
	1984	129	1	99	84	$ 4,491	$ 4,651	$12,333	$12,773
	1985	131	1	99	-	-	-	$11,667	$11,667
S15B	1975	619	230	73	652	$ 5,637	$11,268	$ 5,303	$10,600
	1976	677	238	74	696	$11,729	$22,164	$ 5,065	$ 9,571
	1977	698	231	75	722	$16,360	$29,043	$ 8,831	$15,677
	1978	717	217	77	783	$21,553	$35,559	$15,457	$25,501
	1979	719	220	77	785	$26,545	$39,342	$26,680	$39,542
	1980	705	234	75	814	$15,526	$20,270	$33,596	$43,860
	1981	713	226	76	770	$20,715	$24,501	$28,938	$34,228
	1982	719	221	76	788	$25,253	$28,144	$21,630	$24,107
	1983	725	214	77	791	$16,774	$18,112	$20,878	$22,544
	1984	725	215	77	778	$28,736	$29,762	$19,624	$20,325
	1985	733	209	78	-	-	-	$21,530	$21,530

Source: Alaska Commercial Fisheries Entry Commission

A Review of Management Schemes in Developing Countries

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INTRODUCTION

With the exception of coastal states in Latin America, the extension of fisheries jurisdiction to 200 miles by developing coastal states occurred mainly in 1980-81. The extended maritime zones of developing coastal states is, therefore, as a generalization, about five years old.

Management of fisheries in developing coastal states' extended fisheries zones (EFZs) is, however, only now commencing. To date, most management activities in EFZs have been directed toward reaching fishing agreements with foreign fishing nations, either in the form of licensing agreements or as joint ventures. The requirement in Articles 61 and 62 of the Convention on the Law of the Sea (UNCLOS) that coastal states "shall determine the allowable catch..." and "give other states access to the surplus..." is the basis for the existing actions taken by developing coastal states in allocating the use of fishery resources in extended maritime jurisdictions. The provisions, however, permit coastal states a great deal of latitude in determining whether to allow foreign fishing and in setting the conditions under which foreign fishing may operate. In fact, many developing countries continue to give access to other states because of a combination of factors. Among these factors are long-term national objectives for increasing the share of the catch by the domestic fleet (repatriation), technological constraints that prevent developing coastal states from attaining fishing capabilities similar to those of developed countries, and trade barriers to the markets of developed countries for the species taken.

However, not all developing countries have initiated management measures through licensing agreements with foreign nations. This is because the basic effect of the extensions in fisheries jurisdictions was not a transfer of wealth in fishery resources from developed countries to developing countries. Instead, using the 1978 gross value of global catches (excluding tunas) taken by distant-water fishing nations in zones of other states, the value of these catches was divided approximately two-thirds to the developed and one-third to developing countries (FAO 1981b:95).

For the developing coastal states, of the $1.8 billion in catches taken by distant-water fleets in 1978, 40 percent came from the East Central Atlantic area and 24 percent from the Southeast Atlantic area. A further 10.7 percent was caught in the Southwest Atlantic area. The principal beneficiaries from extensions in fisheries jurisdictions among the developing coastal states were, therefore, the West African coastal states (64 percent) and the Argentina, Falkland/Malvinas area in the Southwest Atlantic.

For most of the Indian Ocean and Western Pacific, no appreciable change (excluding tunas) occurred from extensions in fisheries jurisdictions. For the coastal states in these areas, most of the non-tuna resources were already fully exploited, and in some cases overexploited, by national fleets.

For the developed countries, two regions dominate in terms of value of catches. Japan, the Soviet Union, and Western Europe account for more than two-thirds of the value of fish taken in the extended jurisdictions of all developed countries. The value of the Northeast Atlantic catches is about three times the value of the Northwest Atlantic's, while the Northwest Pacific catches have about four to five times the value of the Northeast Pacific's.

In sum, three regions of the world provide approximately 50 percent of the global supply and value of fish. These regions are the Northwest Pacific, the Northeast Atlantic, and the West Central Pacific. Both developed and developing coastal states are involved.

MANAGEMENT ISSUES IN DEVELOPING COUNTRIES

As a result of the changes in the distribution of fisheries resource wealth due to the enclosures of marine areas by EFZs, developing countries can be classified into three basic categories: overexploited, fully exploited, and underexploited--which require widely differing approaches to management. Discussion follows for each type:

Overexploited fisheries: Characteristically, the principal type of overexploited fishery in developing countries is the trawl fishery for tropical shrimps. The value of shrimps is so significantly higher than that of other demersal species

that trawlers have continued to enter the shrimp fisheries, which has resulted in declining catch rates. In some countries, the demersal trawl fisheries are economically viable only because of the incidental catch of shrimps. In others, the trawl fishery is shrimp specific and the by-catch is discarded at sea. Most of the overexploited shrimp fisheries are in coastal states located between the Red Sea and the Gulf of Thailand, in the northeast corner of South America, and in parts of West Africa.

For most of these fisheries, the decline in catch rates has resulted either in declining license revenues from foreign vessels or from joint venture enterprises; in uneconomic performance of the national enterprise companies involved; or in increasing conflict between the shrimp trawlers and artisanal fishermen as the trawlers are forced to operate in the more productive, inshore areas. Government management responses to this problem have included an outright ban on trawling by increasing the distance from shore in which trawlers may operate; and increasing subsidies to the fleets.

Interestingly, Saudi Arabia, which permits only the National state Company to operate in the shrimp fishery, has managed to avoid the problems encountered in other countries. The company, acting as "sole owner," reduced the size of its fleet from 29 to 20 vessels, imposed a closed season in order to catch larger-sized shrimp to improve value, and imposed a larger mesh size than normal. As a result, average catch per vessel is more than three times higher than in neighboring countries; catch rates are higher and the catch has a higher unit value.

In Kuwait, where fishing effort for shrimp now totals 12,000 fishing days, with consequent low catch rates and poor economic performance, the Kuwait Institute of Scientific Research has proposed to the government an innovative approach to reduce fishing effort to the optimum of 3,000 fishing days. The proposal is to convert existing shrimp licenses into new licenses based on the fishing power of the vessel--one unit of fishing power to be equivalent to one unit of engine horsepower. It is suggested that the licensing authority pay a premium to existing license holders who surrender their license prior to conversion. Those that remain will be issued with a new license with a nominal fishing power of 80 percent of existing fishing power. Since fishing cannot commence until the vessel has 100 percent of its nominal fishing power, trading in fishing power units will reduce overall fishing effort. Each year, the nominal fishing power per license will be reduced, until the appropriate overall level of 3,000 fishing days has been achieved. It is further recommended that trawling for finfish be banned, with only the licensed shrimp trawlers permitted to operate (Mathews, Burgess, Shulaib 1985).

Egypt has for a number of years controlled the number of trawlers operating in the Gulf of Suez. Other countries, using a subsidy scheme to assist the trawler fleet in over-

coming the economic consequences of overfishing shrimp, have experienced no improvement in overall vessel performance in terms of higher catch rates.

Southeast Asian countries face problems with their tropical demersal fisheries. These fisheries, which may be characterized as multispecies (more than 100 marketable species) have continued to record increased overall levels of landings, despite decreased catches per unit effort. Off the west coast of Peninsular Malaysia, the total catch by trawlers increased by 153 percent from 1971 to 1978, while the proportion of shrimp landings in the catch decreased from 33 percent in 1971 to 19 percent in 1978 (FAO 1985a:13). One study has recorded changes in catch rates of trawlers at 0.88 metric tons per trip in 1966, compared with 0.14 in 1978 (FAO, EEZ Report).

In the inner Gulf of Thailand, the total marine catch by Thai trawlers has remained relatively constant; 788,000 tons in 1972 compared with 724,000 tons in 1981. The average catch rate of demersal fish has fallen from 231.6 kg/hr in 1963 to 38.9 kg/hr in 1980 (SEAFDEC 1985:5).

The sustained level of landings has occurred as the result of changes in species composition, with most of the increase attributable to "trash fish" species, used for purposes other than direct human consumption. The consequence therefore has been sustained levels of landings with declining total revenues.

It is difficult to determine what would be effective in improving these fisheries. Control over fishing effort is most certainly necessary but, due to the numbers of fishermen involved, is politically difficult to achieve. Only Malaysia has achieved control over the absolute number of vessels to be allowed. Mesh size regulation is not well suited to these fisheries, owing to the variety in shapes of the species.

Indonesia imposed a ban on the use of trawl gear in the Java Sea in response to the overfishing situation with demersal species and to increasing conflict with artisanal fisheries. The ban has resulted in an increased abundance in most species within a relatively short time. Shrimp are now harvested at a larger size. The significance of the ban is that the regulation of trawl gear for these fisheries is complex, because of the gear's inability to be selective in catch and its overwhelming efficiency compared with many types of artisanal fishing gears.

Since the majority of fishermen are in the artisanal fishery, it may be anticipated that, for political reasons, constraints against trawling will occur more frequently. Furthermore, artisanal fishermen in rural economies usually have no other employment opportunities. As has been demonstrated in Indonesia, abolishing trawlers does not necessarily result in reduced levels of landings. Further development of artisanal fishing gears, in terms of efficiency, can

maintain the catch level on a more selective basis and thereby improve the overall value of landings.

In most cases, trawlers have overshadowed the usefulness of artisanal fishing gears, and governments are more frequently being forced to address the issues resulting from unrestricted development of the trawler fleets. Few countries have protected the rights of longline fisheries from trawlers, and what measures have been imposed relate only to the right to use longline gear with other gears in areas denied to trawlers. Usually such measures are included in the establishment of reserve areas for artisanal fishing gears within the first three or five miles from shore, a common practice imposed in Asia as well as in some West African countries before EFZs were established. As a means to prevent trawlers from operating in the reserved areas for artisanal fishermen, several coastal states have experimented with artificial reefs, not only as a means of improving the habitat for certain species, but as effective barriers to trawling.

Notwithstanding the overfishing situation created by unrestricted access to fisheries by trawlers, the immediate inshore fishing areas in most developing countries with large populations are overfished.

Even though the fishing gears used are often low in productivity, overfishing occurs because of the large numbers of fishermen involved. Since these inshore areas in tropical fisheries are highly productive, management of the use of the resources by artisanal fishermen will be necessary before maximum economic and social benefits can be obtained. The complexity of this problem will require a long-term solution.

Fully exploited fisheries: Since world catches in marine areas began to level off at about 60 million metric tons in the last half of the 1970s, with marginal increases in the 80s (64 million in 1980, 67 million in 1983), it is generally understood that conventional marine resources are fully exploited. Variations in the global level of catches are the result of sometimes highly variable changes in the abundance of pelagic species. Often, these changes involve variations in the relative abundance among small pelagic species (FAO 1985b:2). For example, the Japanese sardine increased in abundance from a level of 9,000 tons in the 1960s to 4.2 million tons in 1983. At the same time, Peruvian anchovy continued to decrease--to 1.8 million tons in 1982, and only 126,000 tons in 1983--the lowest level since the fishery started more than 30 years ago.

The implications of the above are that further increases in global catches from conventional marine species cannot be expected, and therefore that excessive fishing effort from overexploited resources cannot be redirected to other fisheries. However, the landed value of present catches can be significantly improved by introducing more selective fishing methods, directing the timing of fishing effort, and reduc-

ing wastage. Few examples can be given, however, of these practices having been implemented in fisheries that are considered fully exploited. In most cases, fisheries have to become clearly overexploited before actions are taken.

Underexploited fisheries: There is still controversy concerning estimates of underexploited resources, particularly in offshore areas of coastal states' EFZs and in oceanic areas. The most significant increase in fishing effort in the last few years has occurred within the oceanic areas of the Southwest Atlantic. Here, distant-water fishing nations have increased catches to 600,000 metric tons, which includes several high-valued species such as squid and prawn. Since most of the species now being captured are taken from virgin stocks, the question of sustainability of the yields is under review. Experiments have also been conducted with krill caught in the same region, but at this time the economics do not justify a fishery.

In the Arabian Sea, large quantities of meso-pelagic species are known to exist, and technology has been developed to capture these species. Again, economic considerations prevent commercial exploitation of these stocks. Because all of these oceanic resources require industrial technology to harvest them, they are not of immediate interest to developing countries.

Substantial quantities of pelagic species are still underexploited; mainly on both coasts of southern Latin America. Utilization of these stocks has been prevented to date by lack of markets and by the costs associated with producing a product competitive with preferred pelagic species; for example, the decline in Peruvian anchovy has not been accompanied by significantly greater utilization of the increased abundance of sardines.

Controversy exists over the size of available resources in the offshore areas of several coastal states. Estimates have been given that would justify investment in offshore fishing vessels. However, existing national fishing vessels capable of fishing offshore have not found the offshore fishery to be commercially viable.

CONSTRAINTS TO THE MANAGEMENT OF FISHERIES IN DEVELOPING COUNTRIES

Many constraints exist on the imposition of management measures on fisheries in developing countries. Perhaps the major obstacle is the lack of the necessary degree of infrastructure, and of administrative expertise. As long as fisheries resources remain common property, government intervention will be required.

Secondly, population pressures and urban concentrations have forced governments to adopt policies ensuring low-priced food supplies to urban centers: policies which have resulted in failure in the agriculture sectors of several

African countries. However, the need for governments to be concerned with adequate supplies of foodstuffs to increasing populations is basic. For this reason, management of fisheries is considered by many countries to be contrary to the need to increase food supplies.

Thirdly, management actions taken by many countries, particularly developed countries, are not encouraging in their solution of overfishing problems in tropical fisheries (FAO 1983).

What appears to have been overlooked in the assessment of the need for management measures, aside from the obvious goals of conserving resources, obtaining higher landed values, reducing the costs of fishing, and increasing fishermen's incomes, are the potential returns for the use of the resource, the economic rents. For example, the waste in capital and human resources in overfishing the fishery resources in Malaysia has been estimated at U.S. $100 million a year, without any decrease in the present level of landings (FAO, Report of the FAO Investment Center Fisheries Sector:16). As a further example, the potential rents for the cephalopod fishery of ex-Spanish Sahara have been estimated at U.S. $200 million annually (UNDP/FAO 1979). The management of fisheries should therefore be considered in a positive light as having the potential to achieve the rational use of these resources. The calculation of potential economic rents should be basic to the logical development of fisheries. Instead, the practice seems to be restricted to the adding up of fisheries yields by species as an indication of growth. Without being accompanied by basic economic information such as prices and the formulation of price-weighted outputs, the existing catch information is of interest only on a limited biological basis.

Continuing to base development on the premise of increased yields is no longer valid. Indeed, it never should have been considered valid, since growth is an economic factor, not solely a physical measure. Investment in fisheries should be directed toward those activities that can provide an appropriate return on capital. Those management actions taken by developing countries which provide higher values for certain species, reduce fishing costs, and improve incomes to fishermen, should therefore qualify for investment by international donors and lending institutions.

The World Bank, in reviewing the performance of loans to fisheries projects between 1964 and 1981, concluded that the rates of return on investments have repeatedly been less than expected (International Bank 1982). The bank now recognizes as essential that countries be able to assess the supply and regulate the exploitation of the resource.

With this positive response towards fisheries management by the World Bank, together with the experience gained to date by developing coastal states in managing foreign fishing vessels, an increase in management actions taken by govern-

ments can be anticipated. Since extensions in fisheries jurisdictions have been promulgated, several countries, such as Morocco, have advanced, particularly with regard to strengthening institutional and administrative mechanisms. The South Pacific Forum Fisheries Agency, based in Honiara, Solomon Islands, successfully monitors access by foreign tuna fishing vessels to the EFZs of its member island states, facilitates negotiation of license fees, and maintains a regional register of vessels licensed to operate.

TRADITIONAL MANAGEMENT SYSTEMS IN DEVELOPING COUNTRIES PRIOR TO ADOPTION OF EFZ'S

Nearly all the management measures described so far have been related in some way to extensions in fisheries jurisdictions, that is to say extensions beyond 12 miles, or the territorial seas. In a number of developing countries, however, there have been some long-standing fisheries management schemes, which have provided stability in fishing effort and catches for long periods of time. These are known as traditional management measures and usually involve controlled access to the fishery, either from the beach or to specific areas. Many of these systems endured until the Second World War and after, but appeared to collapse with the advent of mechanized fishing, particularly by trawlers; as well as with the transformation from community-based local economies to market economies; and with population growth (as identified by various authors).[1]

Of those known to still exist are the beach-seine rights in Sri Lanka; rights established in several Ivory Coast lagoons; and instances where tribal rights remain strong in some areas of the Pacific and West Africa (Alexander 1977; Ruddle and Akimichi 1985).

Another interesting approach has been the tax on landed value of fish in the Maldives; the 50 percent tax has curtailed expansion of fishing effort by reducing the total revenue curve (FAO 1981a).

CONCLUSIONS

It is now recognized almost universally, particularly since the FAO World Conference on Fisheries Management and Development held in Rome, June-July 1984, that where there is open access to resources for nationals, there is little incentive for individual fishermen to conserve the stocks. Governments therefore should seek to ensure that fishermen have clearly defined fishing rights (FAO 1984:19).

Measures by which fishermen can be awarded fishing rights range from license limitation schemes, as practiced by Australia, Canada, Malaysia, New Zealand, Japan, and the United

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1 See Berkes 1985 for review of author's contributions.

States, to the assignment of territorial use rights (TURFS) as in Japan (Asada, Hirasawa, and Nagasaki 1983:26). It should be noted that TURFS would appear to be particularly applicable to species that are relatively sedentary in their behavior. For species that are migratory, control of access can achieve a measure of stability in fisheries that are otherwise widely fluctuating. Between these options are the individual transferable quota systems practiced in Australia, Canada, and New Zealand. In order for these quota systems to work, fish landing points must be few enough to allow effective monitoring.

No universal method is currently identifiable. This is not surprising, since management measures should be designed in accordance with the specific species involved and the prevailing socioeconomic conditions (Beddington and Rettig 1984:33).

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