# ENVIRONMENTAL ASSESSMENT/REGULATORY IMPACT REVIEW/

# INITIAL REGULATORY FLEXIBILITY ANALYSIS

# FOR AMENDMENT 19

# TO THE FISHERY MANAGEMENT PLAN FOR

# GROUNDFISH OF THE GULF OF ALASKA

# AND AMENDMENT 14

# TO THE FISHERY MANAGEMENT PLAN FOR

# GROUNDFISH OF THE BERING SEA/ALEUTIAN ISLANDS

Prepared by the Staff of the North Pacific Fishery Management Council
and the Alaska Fisheries Science Center
and the Plan Teams for the Groundfish Fisheries
of the Gulf of Alaska and the Bering Sea/Aleutian Islands

Anchorage, Alaska

July 20, 1990

# SUMMARY OF EA/RIR/IRFA FOR AMENDMENTS 19 AND 14
# TO THE
# FISHERY MANAGEMENT PLANS FOR THE GROUNDFISH FISHERIES
# OF THE GULF OF ALASKA
# AND THE BERING SEA/ALEUTIAN ISLANDS

## POLLOCK UTILIZATION IN THE GROUNDFISH FISHERIES OFF ALASKA

At its April 1989 meeting, the North Pacific Fishery Management Council requested that its groundfish plan teams prepare an amendment addressing roe-stripping. The Council reviewed the initial analysis in June and directed that a draft amendment package, including a draft environmental assessment/regulatory impact review/initial regulatory flexibility analysis (EA/RIR/ IRFA), be released for public comment. The draft package was released in August.

In September, because of legal and procedural questions, the Council postponed action on this issue and instructed staff to revise the analysis and include an option of quarterly allowances of pollock TACs. At that time the Council stated its intention to ban pollock roe-stripping and promote full utilization. It also postponed further consideration of action to consider full utilization of groundfish resources until more complete information on losses and discards is available. The Council examined the revised amendment package in December, requested modifications to the alternatives being analyzed, and directed that it be distributed for public review so that the Council could take final action at its April 1990 meeting. In April, the Council deferred action until its June 1990 meeting. In June 1990, the Council voted to approve a ban on the practice of roe-stripping[1], and issued a policy statement that the pollock harvest should be used for human consumption to the maximum extent practicable. In addition, the Council voted to divide the Gulf of Alaska pollock total allowable catch (TAC) into equal quarterly allowances and to divide the Bering Sea/Aleutian Islands TAC into roe (January 1 - April 15) and non-roe (June 1 - December 31) seasons.

Since this amendment, if approved, would not take affect until 1991, the Council took emergency action in December 1989 to regulate the 1990 pollock roe fishery. Specific measures recommended to the Secretary of Commerce included a prohibition on roe-stripping in the Gulf of Alaska and Bering Sea/Aleutian Islands and quarterly allowances of pollock TACs for the Western and Central Gulf of Alaska. The emergency rule to prohibit roe-stripping in the Gulf of Alaska and the Bering Sea/Aleutian Islands was implemented on February 16 and will be in place for a 90-day period which will extend beyond the roe season. The quarterly allowances of the Gulf of Alaska TACs were implemented under existing authority of the Regional Director to respond to a conservation emergency.

This document examines pollock management in the Gulf of Alaska and the Bering Sea/Aleutian Islands with respect to the issues of roe-stripping and seasonal allowances of pollock TACs and the following four potential management problems:

1. Roe-stripping may be a wasteful practice.

2. Roe-stripping may adversely affect the ecosystem as the result of additional discards.

---

1. Roe-stripping is defined as the taking of roe from female pollock and the subsequent discard of the remainder of the female carcass and all male pollock.

3. Targeting on spawning populations may adversely affect the productivity of the pollock stocks.

4. Roe-stripping and/or a large roe fishery may cause an inappropriate and unintended allocation of the pollock TACs among seasons and types of processing (at-sea or shorebased).

The following alternative measures were considered:

1. Do nothing. Maintain the status quo.

2. Prohibit roe-stripping in the pollock fisheries in the Gulf of Alaska and Bering Sea/Aleutian Islands or portions thereof.

3. Require full utilization of all pollock in the pollock fisheries in the Gulf of Alaska and Bering Sea/Aleutian Islands or portions thereof.

4. Implement a seasonal allowance schedule for pollock to place limits on the winter-early spring harvest in the Gulf of Alaska and Bering Sea/Aleutian Islands or portions thereof.

5. Prohibit roe-stripping and implement a seasonal allowance schedule for pollock in the Gulf of Alaska and Bering Sea/Aleutian Islands or portions thereof (a combination of Alternatives 2 and 4): (Preferred).

The Council received abundant public testimony, written comments and industry suggestions favoring a ban on roe-stripping combined with seasonal allowances of the available pollock TAC. Council discussion cited additional concern for the discard of otherwise valuable, saleable product, impacts on pollock stocks and marine mammal populations, and the value of data gathered from a fishery extending over the course of the year. Consequently, the Council voted unanimously to adopt Alternative 5. This includes a ban on roe-stripping, the division of the Gulf of Alaska pollock TAC equally among calendar quarters, and the division of the Bering Sea/Aleutian Islands pollock TAC between roe (January 1 - April 15) and non-roe (June 1 - December 31) seasons. The Council also made a policy statement that the pollock harvest should be used for human consumption to the maximum extent possible.

TABLE OF CONTENTS

## LIST OF TABLES

## LIST OF FIGURES

# 1.0 INTRODUCTION

The domestic and joint venture groundfish fisheries in the Exclusive Economic Zone (EEZ) (3 to 200 miles offshore) of the Gulf of Alaska and Bering Sea/Aleutian Islands are managed under the Fishery Management Plan (FMP) for Groundfish of the Gulf of Alaska and the FMP for Groundfish of the Bering Sea/Aleutian Islands. Both plans were developed by the North Pacific Fishery Management Council (Council) under the Magnuson Fishery Conservation and Management Act (Magnuson Act).

The Gulf of Alaska Groundfish FMP was approved by the Secretary of Commerce and implemented December 11, 1978 (43 FR 52709, November 14, 1978). Amendments 1-11 and 13-18 to the FMP have been approved by the Assistant Administrator. Amendment 12 was adopted initially by the Council at its July and December 1982 meetings but was later rescinded by the Council at its September 1984 meeting without having been submitted formally for Secretarial review. The Bering Sea/Aleutian Islands Groundfish FMP was approved by the Secretary of Commerce and became effective on January 1, 1982 (46 FR 63295, December 31, 1981). Thirteen amendments to the FMP have subsequently been implemented.

The Council uses a formal cycle for processing amendments to the FMPs whereby it solicits public recommendations for amending the Gulf of Alaska (GOA) and the Bering Sea/Aleutian Islands (BSAI) groundfish FMPs on an annual basis. Amendment proposals are then reviewed by the Council's GOA and BSAI groundfish FMP Plan Teams (PT), Plan Amendment Advisory Group, Advisory Panel (AP), and Scientific and Statistical Committee (SSC). These advisory bodies make recommendations to the Council on which proposals merit consideration for plan amendment.

The Council may also consider amendments to the FMPs on cycles other than described above. For example, if a management problem exists which necessitates immediate attention, the Council may initiate the amendment process at any of its meetings. Such is the case for this amendment, which focuses on the issue of pollock management.

## 1.1 Action Contemplated

The issue is whether pollock roe-stripping[2] should be banned or limited in the Gulf of Alaska and/or Bering Sea/Aleutian Islands, whether reduction to meal or oil for all pollock discard should be required, or whether seasonal allowances of the pollock TACs should be adopted.

The Council is considering amending the Gulf of Alaska and Bering Sea/Aleutian Islands Groundfish FMPs in response to the following four potential management problems:

1. Roe-stripping may be a wasteful practice.

2. Roe-stripping may adversely affect the ecosystem as the result of additional discards.

3. Targeting on spawning populations may adversely affect the productivity of the pollock stocks.

2. Roe-stripping is defined as the taking of roe from female pollock and the subsequent discard of the remainder of the female carcass and all male pollock.

4. Roe-stripping and/or a large roe fishery may cause an inappropriate, unintended allocation of the pollock TACs among seasons and types of processing (at-sea or shorebased).

The following alternatives are analyzed:

1. Do nothing. Maintain the status quo.

2. Prohibit roe-stripping in the pollock fisheries in the Gulf of Alaska and Bering Sea/Aleutian Islands or portions thereof.

3. Require full utilization of all pollock in the pollock fisheries in the Gulf of Alaska and Bering Sea/Aleutian Islands or portions thereof.

4. Implement seasonal allowances for pollock to place limits on the winter-early spring harvest in the Gulf of Alaska and Bering Sea/Aleutian Islands or portions thereof.

5. Prohibit roe-stripping and implement seasonal allowances for pollock in the Gulf of Alaska and Bering Sea/Aleutian Islands or portions thereof (a combination of Alternatives 2 and 4) (Preferred).

At its December 1989 meeting, the Council voted in favor of adding Alternatives 6 and 6a that would, respectively, prohibit pollock fishing during the roe season in either the Gulf of Alaska or Bering Sea/Aleutian Islands and establish separate TACs for the roe seasons in both areas. Since both alternatives are special cases of Alternative 4, they will be considered under that alternative. The Council also voted in favor of considering an option for Alternatives 4 and 5 that would restrict all Gulf of Alaska pollock trawl fisheries to the use of midwater gear.

## 1.2 Purpose of the Public Hearing Package

### 1.2.1 Environmental Assessment

One part of this package is the environmental assessment (EA), required by NOAA in compliance with the National Environmental Policy Act of 1969 (NEPA). The purpose of the EA is to analyze the impacts of major federal actions on the quality of the human environment. It serves as a means of determining whether significant environmental impacts could result from a proposed action. If the action is determined not to be significant, the EA and a resultant finding of no significant impact (FONSI) would be the final environmental documents required by NEPA. Otherwise an Environmental Impact Statement (EIS) must be prepared. An EIS is also required if the proposed action may be reasonably expected: (1) to jeopardize the productive capability of the target resource species or any related stocks that may be affected by the action; (2) to allow substantial damage to the ocean and coastal habitats; (3) to have a substantial adverse impact on public health or safety; (4) to affect adversely an endangered or threatened species or a marine mammal population; or, (5) to result in cumulative effects that could have a substantial adverse effect on the target resource species or any related stocks that may be affected by the action.

### 1.2.2 Regulatory Impact Review

Another part of the package is the Regulatory Impact Review (RIR), required by NOAA-Fisheries for all regulatory actions or for significant Department of Commerce or NOAA policy changes that are of public interest. The RIR: (1) provides a comprehensive review of the level and incidence of impacts associated with a proposed or final regulatory action; (2) provides a review of the problems and policy objectives prompting the regulatory proposals and an evaluation of the major alternatives that could be used to solve the problems; and (3) ensures that the regulatory agency systematically and comprehensively considers all available alternatives so that the public welfare can be enhanced in the most efficient and cost effective way.

The RIR also serves as the basis for determining whether any proposed regulations are major under criteria provided in Executive Order 12291 and whether or not proposed regulations will have a significant economic impact on a substantial number of small entities in compliance with the Regulatory Flexibility Act (P.L. 96-354, RFA). The primary purpose of the RFA is to relieve small businesses, small organizations, and small governmental jurisdictions (collectively, "small entities") of burdensome regulatory and record keeping requirements. This Act requires that if regulatory and recordkeeping requirements are not burdensome, then the head of an agency must certify that the requirement, if promulgated, will not have a significant effect on a substantial number of small entities.

This RIR analyzes the impacts that Amendment 19 and 14 alternatives would have on the Gulf of Alaska and Bering Sea/Aleutian Islands groundfish fisheries, respectively. It also provides a description of and an estimate of the number of vessels (small entities) to which regulations implementing these amendments would apply.

### 1.3 Description of the 1989 Domestic Fishing Fleet Operating in the Gulf of Alaska and in the Bering Sea/Aleutian Islands

The domestic (DAP) groundfish fishery off Alaska has grown very rapidly. Catch increased from 63,157 mt in 1984 to more than 1.3 million mt in 1989. The corresponding estimated exvessel value, excluding the value added by at-sea processing, increased from about $27 million to about $328 million (Table 1.1). The value of the resulting processed groundfish products is estimated to exceed $1 billion. The Bering Sea/Aleutian Islands has accounted for 87% of the catch and 70% of the exvessel value reported for 1989. The BSAI area accounted for 93% of the 1989 pollock catch and exvessel value in the domestic fishery.

As of November 1989, approximately 1,417 catcher-boats, 75 catcher/processors, and 7 motherships have participated in the groundfish fisheries off Alaska (Table 1.2). Of these, 133 catcher-boats, 57 catcher/processors, and 5 motherships did so with trawl gear; and of these, 70 catcher-boats, 45 catcher/processors, and 5 motherships reported pollock catch from the EEZ. Through November 1989, 25 shorebased processors had processed pollock for roe, fillets, surimi, and meal; 14 of these plants processed less than 1,000 lbs. The vessels participating in the domestic pollock fisheries range in length from less than 80 feet to more than 300 feet. A more complete description of the groundfish fleet, including its recent growth, is contained in the Economic Appendix for the GOA and BSAI Stock Assessment and Fishery Evaluation (SAFE) reports. The harvesting and processing capacities of the domestic groundfish industry are expected to increase substantially in 1990. However, the growth of domestic (DAP) catch will be constrained by the TACs because most of the foreign and joint venture apportionments have already been eliminated by the expansion of the domestic fishery.

## 2.0 POLLOCK UTILIZATION IN THE GROUNDFISH FISHERIES

### 2.1 Description of the Status Quo and the Need for the Action

Walleye pollock (Theragra chalcogramma) is processed into a suite of products including roe, fillets, surimi and meal. Pollock roe is a particularly high value product that can be obtained from females caught in spawning condition. During the roe season fishery (primarily late January through early April), some operations extract roe and produce other products; some operations, both at-sea and shorebased, utilize only the roe, either during all or part of the roe fishery; and some operations do not extract roe for use as a separate product. During the rest of the year, operations produce various combinations of fillets, surimi, meal, and other products, but not roe.

Pollock has been the mainstay of the groundfish fisheries off Alaska. In 1989, it accounted for 71% of the harvest in all the groundfish fisheries off Alaska. The 1989 domestic (DAP) pollock harvest off Alaska totaled 1.09 million metric tons (mt) and had an exvessel value, excluding the value added by at-sea processing, of about $190 million. This was 78% and 54%, respectively, of the harvest and exvessel value of all DAP groundfish fisheries off Alaska. The wholesale value of pollock products resulting from the catch in the domestic pollock fishery in 1989 was about $600 million.

After being dominated by foreign fishery catch through 1981 and then by joint venture fishery catch through 1986, the pollock TAC in the Gulf of Alaska has been fully utilized by the domestic fishery since 1988. In the Bering Sea/Aleutian Islands, joint venture fishery catch became dominant in 1986 and the domestic fishery is expected to be able to fully utilize the pollock TAC in that area for the first time in 1990.

The rapid expansion of harvesting capacity and both shoreside and at-sea processing capacity of the domestic pollock fishery has been encouraged by the Council and the National Marine Fisheries Service and has resulted in one of the objectives of the Magnuson Act being met. However, it has also resulted in two problems.

The first problem is allocational in nature and occurs when the DAP requests for pollock exceed the pollock TAC of an area. It is characterized by intense competition within the domestic fishery for the limited TAC and by all participants not being able to fulfill their harvesting and processing plans. This intense competition for pollock within the domestic fishery first occurred in 1989 in the Gulf of Alaska. The available pollock harvest in the Gulf had declined from 416,600 mt in 1984 to the 1989 total allowable catch (TAC) of 72,200 mt. The domestic factory/trawler and mothership fleet became a very active participant in the Gulf pollock fishery in 1989. In 1988 the at-sea component took only about 8,000 mt or 14.4% of the 55,724 mt domestic (DAP) harvest. In contrast, during the 1989 pollock roe fishery, factory/trawler and mothership operations harvested about 32,000 mt of pollock, approximately 53% of the initial Gulf of Alaska pollock TAC. This combined with an accelerated rate of harvest by vessels delivering to shoreside processors resulted in all of the initial TAC for the Western and Central Gulf being taken by the time the valuable roe fishery was closed in late March. Until the TAC was later increased, no TAC was available either for the pollock fisheries that had been expected to occur later in the year or for bycatch in other groundfish fisheries.

There was not a similar problem in the Bering Sea or Aleutian Islands in 1989 because the DAP requests for pollock were less than the TACs. However, in 1990 and beyond, DAP requests for pollock in both the Gulf of Alaska and the Bering Sea are expected to exceed the TACs. The 1990 DAP requests for pollock, as adjusted by the Alaska Regional Office, exceed the 1990 TACs by about 52,000 mt or 74% in the Western and Central Gulf and by 556,000 mt or 43% in the Bering Sea subarea. In the Aleutian Islands subarea, the 1990 DAP requests are less than the TAC; however, the allocation problems in the other two areas are expected to spread to this area too.

The second problem concerns the pollock operations in which only the highest valued product, the roe, is retained while the remainder of the catch is discarded. This type of processing is referred to as "roe-stripping". The principal objections to roe-stripping are based on the belief that: (1) it is wasteful; (2) it adversely affects the potential yield of the pollock stocks; (3) it results in additional discards that adversely affect the ecosystem; and (4) it adversely affects the distribution of pollock catch between the competing sectors of the domestic fishery and between seasons by disproportionately increasing the pace of the roe fishery for the factory/trawler and mothership fleet.

This amendment package addresses the allocation problem and the problems associated with roe-stripping and provides an analysis of alternative solutions being considered by the Council.

Roe-stripping is not a new issue. It was considered by the Council in 1987 as part of Amendment 11 to the BSAI groundfish FMP. The issue was raised by those involved in joint venture pollock operations that were seeking protection from operations that practiced roe-stripping and by so doing were able to take a much greater part of the total BSAI joint venture pollock apportionment. This not only left less pollock for the joint venture operations that did not predominately practice roe-stripping, but also significantly reduced the amount of pollock that was available for a pollock fishery later in the year. Those who initiated the request to prohibit roe-stripping had expected to be able to conduct a large pollock fishery later in the year. Although a number of other concerns were raised, including those of waste and adverse biological effects, the Council at that time determined that roe-stripping was principally an allocation issue and did not recommend that it be prohibited. The Council did recommend seasonal allowances of the BSAI joint venture pollock apportionment; however, it did so, at least in part, in response to a separate issue of DAP priority specifically for shoreside processing plants.

When the issue was raised again in 1989, the popular belief that roe-stripping is a wasteful practice was reinforced by the media and much of the discussion emphasized the issue of waste instead of the issue of protecting shoreside processing plants from competition by the domestic factory/trawler and mothership fleet. As a result of this change in emphasis, the alternatives being considered by the Council include measures that prohibit roe-stripping or other "wasteful" practices, require seasonal allowances of pollock TACs, or do both. However, they do not include measures that directly address the allocation of the Gulf of Alaska pollock TAC between at-sea and shoreside processors. The latter issue is the topic of a separate amendment being considered by the Council. The other important result of this change in emphasis is that the initial problem, which was limited to the Gulf of Alaska, is being addressed by proposed actions for both the Gulf and the Bering Sea/Aleutian Islands pollock fisheries.

At its April 1989 meeting, the North Pacific Fishery Management Council requested that its groundfish plan teams prepare an amendment addressing roe-stripping. The Council reviewed the initial analysis in June and directed that a draft amendment package, including a draft environmental assessment/regulatory impact review/initial regulatory flexibility analysis (EA/RIR/IRFA), be released for public comment. The draft package was released in August.

In September, because of legal and procedural questions, the Council postponed action on this issue and instructed staff to revise the analysis and include an option of quarterly allowances of pollock TACs. At that time the Council stated its intention to ban pollock roe-stripping and promote full utilization. However, it postponed further consideration of action to consider full utilization of groundfish resources until more complete information on losses and discards is available. The Council examined the revised amendment package in December, requested modifications to the alternatives being analyzed, and recommended that it be distributed for public review as soon as practicable such that the Council could take final action at its April 1990 meeting. In April, the Council deferred action until its June 1990 meeting.

Since the amendment, if approved, would not take affect until 1991, the Council took emergency action in December to regulate the 1990 pollock roe fishery. Specific measures recommended to the Secretary of Commerce include a prohibition on roe-stripping in the Gulf of Alaska and Bering Sea/Aleutian Islands and quarterly allowances of pollock TACs for the Western and Central Gulf of Alaska. The emergency rule to prohibit roe-stripping in the Gulf of Alaska and the Bering Sea/Aleutian Islands was implemented on February 16 and will be in place for a 90-day period which will extend beyond the roe season. The quarterly allowances of the Gulf of Alaska TACs were implemented under the existing authority of the Regional Director to respond to a conservation emergency.

## 2.2 The Alternatives

Four management alternatives and the status quo were considered by the Council. Each is defined in this section.

### 2.2.1 Alternative 1: Status quo (no action).

This alternative would result in no changes to the FMPs or implementing regulations. The olympic system fishery would continue, resulting in larger proportions of the TAC being taken early in the year when pollock are aggregated for spawning. The proportion of the catch used solely to produce roe will probably increase. Continued expansion of harvesting and processing capacity of both the offshore and onshore components of the fishery will likely increase the incentive for each participant in the fishery to harvest and process pollock as rapidly as is economically feasible. Operations which choose to retain only roe, and discard all other parts of the harvest would not be prohibited from doing so.

### 2.2.2 Alternative 2: Prohibit pollock roe-stripping in the pollock fisheries in the Gulf of Alaska and Bering Sea/Aleutian Islands or portions thereof.

This alternative would prohibit processors from discarding males and stripped female carcasses after processing only for roe. Such a prohibition would require that the carcass be further processed into one or more of the following: fillet, headed/gutted, surimi, and meal products. The Council may choose this alternative and specify which "next step" processes are acceptable. For example, the Council may decide roe and meal are an inappropriate mix of products or that a requirement for further processing is not met by solely extracting the liver or processing cheeks.

The prohibition on pollock roe-stripping could be applied to only portions of the Gulf of Alaska and Bering Sea/Aleutian Islands management areas (for example, the Shelikof District of the Gulf of Alaska). The Council may also wish to consider separating, for the purposes of pollock management, the Western and Central Regulatory Areas in the Gulf of Alaska, as a sub-option to this alternative. This would enable the Council to exert more precise control on the harvesting and processing of pollock. The Council may specify whether the prohibition on pollock roe-stripping applies to all fisheries or only to pollock fisheries as defined in the Bering Sea/Aleutian Islands by 50 CFR §675.2 and in the Gulf of Alaska by 50 CFR §672.2.

Regulations to prohibit pollock roe-stripping will be influenced by a legal opinion recently issued by NOAA General Counsel (NOAA-GC) concerning NMFS authority to control processing practices (Appendix IV). The brief argues that the Secretary can prohibit roe-stripping on vessels defined as fishing vessels under the MFCMA. This includes all at-sea processing vessels. The opinion states, however, that the authority to regulate onshore processing is less clear. It may not be possible to ban roe-stripping at shorebased plants but it may be possible to prohibit harvesters from delivering product which would subsequently be processed for roe only. The Council was concerned about this method of prohibiting roe-stripping onshore because it would hold fishermen accountable for the actions of shoreside processors. Therefore, the Council asked the State of Alaska to consider such a prohibition on shorebased plants during the current legislative session. The legislature passed such a bill which was signed into law by the Governor on June 14, 1990.

2.2.3 Alternative 3: Require full utilization of pollock in the pollock fisheries in the Gulf of Alaska and Bering Sea/Aleutian Islands or portions thereof.

Given current processing practice and technology, adoption of this alternative implies reduction to meal and/or oil as a final processing step. Each processor would be required to install and use a meal reduction plant or transfer processing waste to a meal processing facility, either at-sea or shorebased. Therefore, this alternative differs from Alternative 2 in that no discard of unprocessed pollock or solid process waste would be permitted. The discard of undersized pollock could also be prohibited.

As in Alternative 2, a full utilization requirement for pollock could be limited to a portion of the management areas (including Western and Central Gulf of Alaska Regulatory Areas), and/or to only the pollock fisheries.

The authority of the Secretary of Commerce to require full utilization of pollock is subject to the limitations mentioned above with respect to prohibiting roe-stripping.

2.2.4 Alternative 4: Establish seasonal allowances for pollock in the Gulf of Alaska and Bering Sea/Aleutian Islands or portions thereof and perhaps restrict the Gulf pollock trawl fishery to midwater gear.

Under this alternative, annual apportionments of pollock to DAP and JVP fisheries would be divided into seasonal harvest amounts. The seasonal allowances would be established and modified within the framework described in this section. Restricting the Gulf of Alaska pollock trawl fishery to midwater gear is an option within this alternative. The implications of several seasonal allowance schedules are considered, including quarterly allowances, no allowances during the roe season, and limited allowances during the roe season.

Unharvested allowances in any one season could be carried over to the succeeding season(s) of that year. Presumably, there would be no carryover of unharvested TAC from the final quarter or season of one fishing year to the first period of the next year. If one season's allowance were overharvested, all subsequent allowances would be proportionately reduced.

This alternative would clarify and expand the current authority to establish and modify seasonal allowances of pollock TACs. There are currently two mechanisms for making seasonal allowances of pollock TACs without amending the FMPs. First, the Council can utilize the regulatory amendment procedure adopted in June 1989 under Amendment 18/13 to establish part or all of the roe season as a closed season. Such an action could be used to limit or eliminate entirely a fishery for roe. Second, the Regional Director has the authority to establish seasonal allowances of TACs if there is a conservation emergency. He did this for the Western and Central Gulf for 1990.

Regulations implementing this alternative could reflect a framework procedure whereby seasonal allowances of pollock TACs for an upcoming year could be accomplished through the existing September - December process of developing initial and final TAC and PSC limit specifications. This approach would provide the Council with the flexibility to change TAC allowances between seasons in response to changing conditions in the pollock fishery. The framework is described below.

As soon as practicable after October 1 of each year, the Secretary, after consultation with the Council, will publish a notice in the Federal Register specifying the proposed allowances of the annual pollock TAC and associated JVP and DAP apportionments for the fishing year. Public comments on the size and dates of proposed seasonal allowances and apportionments of the pollock TAC will be accepted by the Secretary for 30 days after the notice is filed for public inspection with the Office of the Federal Register. The Secretary will consider timely comments in determining, after consultation with the Council, the final seasonal allowances and apportionments of the pollock TAC for the next year. A notice of the final seasonal allowances and apportionments will be published in the Federal Register as soon as practicable after December 15.

The Secretary will base the final divisions of pollock TACs among seasons upon some or all of the following relevant information:

1. Estimated monthly pollock catch and effort in prior years.

2. Expected changes in harvesting and processing capacity and associated pollock catch.

3. Current estimates of and expected changes in pollock biomass and stock condition.

4. Potential impacts of expected seasonal fishing for pollock on pollock stocks, and marine mammals.

5. The need to obtain fishery-related data during all or part of the fishing year.

6. Effects on operating costs and gross revenues;

7. The need to spread out fishing effort over the year, minimize gear conflicts, and allow participation by all elements of the groundfish fleet.

8. Potential allocative effects among users and indirect effects on coastal communities.

9. Other biological and socioeconomic information that affects the consistency of seasonal pollock harvests with the goals and objectives of the FMP.

Table 2.1 lists the average monthly proportions of the annual pollock harvests by Japan in the Bering Sea/Aleutian Islands from 1971 through 1980; Table 2.2 presents the monthly pollock harvest levels from 1986 through 1989; and Table 2.3 lists the 1989 pollock harvest levels by month by type of processor (DAP, at-sea; DAP, shorebased; JVP). Table 2.4 presents examples of quarterly allowances (assuming a 1,450,000 mt total quota) based on (1) equal allowances, (2) allowances reflecting Alaska-wide harvests in 1986-1988, and (3) allowances reflecting 1986-1988 landings proportions in the Gulf of Alaska and Bering Sea separately. Table 2.5 presents examples of a semi-annual allowance scheme based on: (1) equal allowances; (2) TAC apportioned as for 1988 joint ventures (40% January 15 - April 15; 60% April 16 - December 31); (3) allowances reflecting Alaska-wide DAH harvests in 1986-1988; and (4) allowances reflecting DAH harvest in 1986-1988, by management area.

A semi-annual allowance schedule for the directed joint venture fishery was used in 1988 whereby 40% of the JVP was apportioned to the period January 15 - April 15 and the balance to the period April 16 - December 31. The regulatory authority for the 40%/60% season split for joint ventures expired at the end of 1989, although in 1989, at the request of the joint ventures, the split season allowance was not used. Such a system could allow continued roe-stripping, but could be used to limit future targeting of the fishery solely on spawning fish. The roe fishery could be eliminated altogether through the use of early year allowances of 0%.

Selection of this alternative would modify Section 4.2.1 of the Gulf of Alaska Groundfish FMP and Section 14.4.9 of the Bering Sea/Aleutian Islands FMP to permit the Regional Director to make seasonal allowances of the pollock resource. Notices to the public of the Council's preliminary initial specifications, made following the September Council meeting, would also include preliminary seasonal allowances for pollock. Parallel changes would be incorporated into the regulations governing the Gulf of Alaska groundfish fishery (CFR 672.20(a) and (c)) and the Bering Sea/Aleutian Islands groundfish fishery (CFR 675.20(a)).

2.2.5 Alternative 5: (Preferred) Prohibit pollock roe-stripping and establish seasonal allowances for pollock in the Gulf of Alaska and Bering Sea/Aleutian Islands or portions thereof and perhaps restrict the Gulf pollock trawl fishery to midwater gear.

This alternative is a combination of Alternatives 2 and 4; that is, in the Gulf of Alaska and Bering Sea/Aleutian Islands pollock fisheries, roe-stripping would not be allowed, a seasonal allowance schedule would be used, and the option of restricting the Gulf of Alaska pollock trawl fishery to midwater gear is included.

### 2.3 Analysis and Discussion

The merits of the alternatives being considered are to a great extent determined by the answers to the following five questions.

1. Is roe-stripping a wasteful practice?

2. Does roe-stripping adversely affect the ecosystem as the result of additional discards?

3. What is the effect on the productivity of the pollock stocks of a roe season fishery that may be highly concentrated in both time and space and that may target on female pollock?

4. What effects does the timing of the pollock fishery have on the bycatch of crab and halibut?

5. What effects does the timing of the pollock fishery have on populations of sea lions and other marine mammals?

By addressing these questions, the analysis provides information that can be used to evaluate alternative management measures including some that can only be taken by amending the FMPs and some that may be possible without an amendment.

2.3.1 Is roe-stripping a wasteful practice?

Public support for a ban on roe-stripping has been considerable. Much of this support results from the perception that roe-stripping is wasteful simply because it may result in increased discards and a lower total product recovery rate relative to operations which extract roe and other products, or operations which produce other products but not roe. Defining waste strictly in terms of foregone product weight, instead of in terms of the foregone net benefits is inappropriate and can result in misleading conclusions because the benefits and costs of producing different products are ignored. These costs and benefits should be defined as broadly as is appropriate given the Council's goals and objectives, the MFCMA, and other applicable Federal regulations and directives.

When waste is defined in terms of foregone net benefits, roe-stripping is not necessarily wasteful. For example, if the gross revenue derived from producing products in addition to roe is less than the cost of doing so, the production of the additional products would be wasteful unless there are sufficient benefits beyond those reflected by gross revenue. Similarly, if a roe fishery does not adversely affect the productivity of the stocks, it would be wasteful to replace roe production in the winter with surimi and fillet production in the fall if the net benefits of the former are higher.

Under this more general definition of waste, all waste is ultimately measured in broadly defined economic terms; and the focus is on the current and future benefits that can be obtained from a given pollock TAC. The issue concerning the effects on the ecosystem of discards resulting from roe-stripping and the effects of a roe fishery on the long-term productivity of pollock stocks are treated separately in Sections 2.3.2 and 2.3.3.

The fact that roe-stripping occurs indicates that for some operations it is the most profitable use of pollock (at least during some portion of the fishing year). Similarly, the fact that roe-stripping occurred in the Bering Sea, when the TAC exceeded the DAP requests, indicates that in some cases roe-stripping is not just an aberration of a race for fish caused by open access management. The reasons that different operations practice roe-stripping provide additional insights as to whether roe-stripping is wasteful.

Factory/trawlers that are equipped to produce headed and gutted products (H&G), but not fillets, surimi, or meal, extract only roe during the entire roe fishery because, given the price of headed and gutted pollock, roe-stripping is currently the most or perhaps only profitable type of pollock operation for such vessels. In some cases, physical or financial constraints may preclude the installation of processing equipment that would enable these vessels to produce other than roe or headed and gutted products.

Other operations that extract only roe during at least part of the roe fishery can process additional products, but in order to increase profits they choose not to do so. By processing only the roe and subsequently discarding males and the carcasses of females, many processors can increase their daily throughput of fish and thereby, in some instances, increase profits. For each operation, the profitability of roe-stripping and the net benefits of roe-stripping relative to other uses of pollock increase as: (1) the exvessel price of roe increases compared to other products; (2) the recovery rate of roe increases compared to other products; (3) the cost of producing roe decreases compared to that of producing other products; (4) harvesting capacity increases compared to capacity to process beyond roe; and (5) roe processing capacity increases compared to that of other products.

As these factors change in the directions that increase the profitability and net benefits of roe-stripping, roe-stripping becomes profitable to an increasing number of individual operations. Eventually, roe-stripping would become profitable from the perspective of the domestic pollock fishery as a whole. At that point, roe-stripping would not be a wasteful practice unless external benefits and costs are sufficiently large to prevent profits from indicating the best use of the pollock TACs. Even in the case of such externalities, there is a point at which the net benefits of roe-stripping would exceed those of alternative uses of pollock. At or beyond that point, roe-stripping is not wasteful.

Estimates of four components of benefit were produced using information provided by the industry. These measures, expressed per metric ton of pollock catch, are: (1) wholesale value, (2) net wholesale value defined as the difference between wholesale value and variable operating costs, (3) employee days, and (4) employment costs. The latter two are measures of benefits primarily to the extent that labor is not mobile. Estimates for these measures of benefits and estimated operating costs per metric ton of catch for various uses of pollock are presented in Tables 2.6 - 2.10. The operating cost estimates are not measures of benefit, they are used to estimate net wholesale value.

Those estimates, together with estimates of catch for each use in 1989, are used to estimate total benefits from the 1989 pollock catch in the domestic (DAP) trawl fisheries. They are also used to estimate what the total benefits of that catch would have been if there had been no roe-stripping. In making these comparisons, it was assumed that total catch would have remained constant with only the distribution of catch among uses changing. The result of these comparisons are summarized in Table 2.11. Similar comparison in terms of benefits per metric ton of pollock catch are presented in Table 2.12.

The estimates of benefits per metric ton of pollock catch for each type of operations (or uses of pollock) are based on information provided by the industry. The estimates are thought to typify the actual benefits of individual operations. However, there are three reasons why the estimates are not necessarily accurate for each type of operation. First, for each of the six uses there are naturally differences among the individual operations; second, some individual operations did not provide complete information; and, third, it is not known how representative the information provided is for each type of operation. However, these estimates currently constitute the best available information and are useful in determining whether roe-stripping is wasteful.

<u>Gulf of Alaska</u>

The comparison of the total benefits between the actual 1989 domestic pollock trawl fisheries and the hypothesized 1989 fisheries without roe-stripping, but with an equal amount of catch, is useful in determining whether roe-stripping was wasteful in 1989. The estimated gross wholesale value of the actual pollock fishery in the Gulf is $33.5 million; this is $6.2 million or 23% greater than the estimated wholesale value if the roe-stripping operations had been proportionately replaced by other uses of pollock. The estimated net wholesale value of $12.0 million for the actual fishery is $3.6 or 43% greater than the estimated net wholesale value had the roe-stripping operations been replaced by other types of operations. Estimated employee days are 44,000 for the actual fishery, this is 6,600 or 13% less than without roe-stripping. However, estimated employment cost of $9.7 million for the actual fishery is $1.8 million or 23% higher than without roe-stripping. Therefore, in the GOA it is estimated that three of the four measures of benefits would have been lower had roe-stripping operations been replaced with other uses of pollock in 1989. This suggests that roe-stripping was not wasteful compared to other uses of pollock as a whole in the Gulf.

Roe-stripping and other first quarter uses of pollock were clearly competing uses in the GOA in 1989. Therefore, it is also appropriate to compare the estimated benefits of the actual 1989 first quarter pollock fishery with a hypothetical first quarter fishery in which roe-stripping is replaced by the other first quarter uses of pollock. Compared to what first quarter benefits would have been had roe-stripping been replaced with other first quarter uses of pollock, actual gross wholesale value is $6.4 million (27.5%) higher, net wholesale value is $3.5 million (46%) higher, employee days are 6,600 (15%) lower, and employment costs are $1.9 million (29%) higher. This suggests that roe-stripping was not wasteful compared to other uses of pollock as a whole during the first quarter in the Gulf.

Bering Sea/Aleutian Islands

In the BSAI, three of the four measures of total benefits are higher for the actual fishery than for the hypothetical fishery in which roe-stripping is replaced by other uses of pollock; however, the percentage differences between the two sets of estimates are so small in comparison to the potential errors in the estimates that no real difference is indicated. Compared to the total benefits that would have occurred had roe-stripping been replaced by other uses, gross wholesale value for the actual 1989 fishery is 0.4% higher, net wholesale value is 1% lower, employee days are 0.5% higher, and employment costs are 0.9% higher. The percentage differences are so small because roe-stripping operations accounted for less than 3% of the total BSAI pollock catch in the domestic (DAP) fishery in 1989. Therefore, comparisons of total benefits with and without roe-stripping for 1989 is not very useful.

Due to the small percentage of pollock that was taken for roe-stripping in the domestic BSAI fishery, a more useful comparison for the BSAI is the difference between benefits per metric ton of pollock catch. In comparison to all other uses of pollock, the estimated gross wholesale value per metric ton is $60 (11%) higher, net wholesale value is $108 (27%) lower, employee days are 0.05 (13%) higher, and employment costs are $28 (31%) higher for roe-stripping. Although three of the four measures are higher for roe-stripping than for other uses of pollock, net wholesale value, which is a key measure of economic viability, is substantially lower for roe-stripping. This suggests that given the estimates of benefits per metric ton, roe-stripping as a whole was probably wasteful compared to other uses of pollock as a whole. However, there were individual roe-stripping operations or types of roe-stripping operations as a whole that had higher benefits per metric ton of pollock catch than did some individual operations or types of operations that used pollock in other ways. Therefore, roe-stripping by some individual operations was not a wasteful use of pollock.

In 1989, BSAI DAP requests were less than the pollock TAC; therefore, the catch in roe-stripping operations would probably not have been completely replaced by catch by other types of operations if roe-stripping had been prohibited. If none of it would have been replaced, wholesale value, net wholesale value, employee days, employment costs, and catch in the domestic pollock fishery would have been reduced by $18.5 million, $7.6 million, 12,700 days, $35 million, and 29,700 mt, respectively. In 1990 and beyond, DAP requests for pollock are expected to exceed the pollock TACs; therefore, the comparison of benefits assuming the same total catch with or without roe-stripping is probably appropriate.

Roe-stripping and other first quarter uses of pollock were clearly not competing uses in the BSAI in 1989, and they are not expected to be for several years unless the TAC that is available to be taken during the first quarter is substantially reduced. Therefore, the following comparison is perhaps most useful when considering seasonal allowances of TACs. In comparison to all other uses of pollock during the first quarter, the estimated gross wholesale value per metric ton is $39 (6%) lower, net wholesale value is $200 (44%) lower, employee days are 0.02 (5%) higher, and employment costs are $32 (37%) higher for roe-stripping. This suggests that roe-stripping as a whole is probably wasteful compared to other first quarter uses of pollock as a whole. However, as with the comparison for the year as a whole, roe-stripping by some individual operations was not a wasteful use of pollock.

### 2.3.2 Does roe-stripping adversely affect the ecosystem as the result of additional discards?

Seafood processing discard is a major environmental concern. All discards other than live fish are considered a pollutant, and as such may not be dumped into the marine environment of the United States (including all EEZ waters) unless approved by the Environmental Protection Agency (EPA). With the exception of discards from plants that produce less than 1,000 pounds of seafood waste per day, discharges of waste are regulated by either a general or individual permit. Individual permits are given to processors which are required to meet more stringent requirements for waste disposal. Kodiak, Akutan, and Unalaska/Dutch Harbor processors are all required to be under individual permits. As of January 1990, 249 shoreside and at-sea processing plants in Alaska or the EEZ off Alaska were authorized to operate under the general permit and 67 plants had individual permits.

General permit conditions specify that all discard from processing lines is to be ground to particles less than 0.5 inch and discharged beneath the water surface. Individual permits often require screening of the effluent, with screened materials to be disposed of at an approved facility or discharged at an approved at-sea site. Screened materials are reduced to meal, oil, or other product at a reduction facility, if available in the community or transported to designated at-sea dump sites. Currently, there are reduction plants in Petersburg, Seward, Kodiak, Akutan, and Dutch Harbor.

Kodiak processing plants are permitted to use the offshore dump sites depicted in Figure 2.1 when they have too much waste to be handled by the local reduction plant, Kodiak Reduction, Inc. Various estimates are available documenting the quantity of raw seafood waste barged offshore near Kodiak. The Alaska Fisheries Development Foundation estimated that 14,545 mt are dumped per year and another 27,364 mt are processed annually at Kodiak Reduction, Inc. (1987-88). These quantities are for all seafood species. Another approved offshore dumping site is located northeast of Akutan (Figure 2.2), but apparently is not used as frequently as the Kodiak sites.

Information from industry and agency fishery statistics were used to estimate the discards resulting from roe-stripping in 1989 because the fisheries observer programs and industry reporting requirements for 1989 did not provide an accounting of processing discards. The estimates of discards are the products of estimated catch for roe-stripping and the estimated roe recovery rate.

Information from industry indicates that roe-stripping was primarily limited to two types of at-sea processing operations, those that were not equipped to process beyond roe (i.e., H&G boats) and those that could, and often did, produce additional products. NMFS catch statistics indicate that the H&G boats harvested about 15,700 mt of pollock in the BSAI and 9,150 mt in the GOA during the first quarter of 1989. Processor responses indicate that for at-sea operations other than H&G about 8.3% and 47.9% of their pollock catch was for roe only in the BSAI and GOA, respectively, during the first quarter of 1989. Applying these percentages to the NMFS catch data for these operations results in estimates of catch for roe-stripping of about 14,000 mt in the BSAI and 11,600 mt in the GOA for these operations. Combining these estimates with those for H&G boats, the total estimates of 1989 pollock catch for at-sea processing which was used only for roe are 29,700 mt in the BSAI and 20,750 mt in the GOA. Reportedly, an additional 3,000 mt of pollock catch was used for roe-stripping by a processing plant in Kodiak.

Information from the 1989 fishery indicates that roe recovery rates varied significantly among operations but may have averaged about 4% and 7.5%, respectively, for the BSAI and GOA. The higher rate in the Gulf is probably in part explained by a greater ability to target on female pollock in the Gulf. These rates differ from the standard roe recovery rate for pollock of 6.5% that NOAA Fisheries has adopted (Low, et al. 1989). That rate was based upon historic catch information from both the Shelikof Strait area and the Bering Sea. The area specific rates from the industry are used throughout this section.

It is estimated that in 1989 roe-stripping operations had at-sea pollock discards of 28,500 mt (96% of 29,700 mt) in the BSAI and 19,200 mt (92.5% of 20,750) in the GOA. In the BSAI, this is about 3,600 mt or 4,700 mt more than would have been discarded if the roe-stripping operations had been replaced by surimi only operations with a recovery rate of 16% or by roe plus surimi operations with a combined recovery rate of 20%, respectively. The corresponding estimates of the increase in discards due to roe-stripping in the GOA are 1,800 mt and 3,300 mt. The 16% recovery rate for surimi, which is substantially less than published estimates, has been confirmed by several industry sources.

These estimated increases can be put in perspective by comparing them to the at-sea pollock discards that would occur if all pollock were taken in operations that produce other products. In 1989, about 1,067,000 mt of pollock were taken for at-sea processing in the BSAI domestic and joint venture fisheries and about 33,300 mt of pollock was taken for at-sea processing in the GOA domestic fisheries. Had all this pollock been used in surimi only operations, the pollock discards would have been about 900,000 mt in the BSAI and 28,000 mt in the GOA. The estimated increases in discards due to roe-stripping in 1989 of 3,600 mt in the BSAI and 1,800 mt in the GOA amount to 0.4% and 6.4%, respectively, of the total discards that would have occurred if there had only been surimi operations in the BSAI and GOA. The estimated increases in discards due to pollock roe-stripping in 1989 are naturally substantially less in comparison to all groundfish discards or discards from all fisheries.

In 1990 and beyond, it is possible that roe-stripping operations would account for a larger proportion of the pollock catch in both areas and that the increases in discards due to roe-stripping would be greater than those estimated for 1989. However, in the BSAI even if the at-sea catch for roe-stripping were ten times the 1989 level, the increase in at-sea pollock discards of replacing surimi operations with roe-stripping operations would only be about 4%. In the GOA, it is unlikely that the corresponding increase could be as much as 14% because a large part of the GOA pollock catch was taken by roe-stripping operations in 1989.

The effects of seafood waste dispersal over the ocean floor vary by location, and are influenced greatly by local bathymetry, water currents, tidal action, and the volume of waste generated per unit of time. Smothering of bottom organisms, reduction in dissolved oxygen levels due to the biochemical oxygen demand of the waste, and generation of toxic hydrogen sulfide from waste decomposition are all potential effects of large accumulations of seafood waste. Action taken to reduce or eliminate the dumping or dispersal of seafood processing wastes could reduce or eliminate these effects, with the degree of habitat improvement varying from location to location.

Conversely, seafood waste is food for many marine organisms if dispersed in moderate quantities. Sea lions have been noted to congregate around some fishing vessel discard chutes. Gulls and other marine birds, fishes, and benthic crustaceans and other organisms feed upon dead or decaying organic matter. Discard, ground and dispersed widely, could enhance ecosystem productivity to some degree. Conversely, a reduction in discards could diminish productivity in some locations. These relative impacts cannot be quantified given present knowledge.

Given that: (1) processing of pollock for surimi and other accepted product forms already accounts for discard of hundreds of thousands of metric tons of waste; (2) processing of other groundfish contributes substantial discard; (3) the incidental catch of prohibited species must also be discarded; (4) catches of undersized or otherwise undesirable fish or other marine organisms are often discarded; and (5) discards of non groundfish species are substantial, it appears that the incremental discard of pollock from roe-stripping operations may not be significant relative to other practices common to the fisheries in the Bering Sea and the Gulf of Alaska. Current indications are that the amount and type of processing discharge are not negatively impacting the environment, except possibly in confined areas. Such occurrences and other adverse effects of additional discharges of processing waste would be reduced if existing EPA requirements were more closely adhered to, specifically if all processing waste were ground into 0.5 inch particles before being discharged.

2.3.3 What are the productivity effects on the pollock stocks of a roe season fishery which is concentrated in both time and space and which may target on females?

The productivity of a fishery can be measured biologically and economically, that is, in terms of catch, product weight, and net benefits over time. In terms of the wise use of the resources, net benefit is the most comprehensive measure of productivity for the same reasons that foregone net benefit is a better measure of waste than is foregone product weight. However, because catch over time is a critical factor in determining net benefits, the first part of this section focuses on the potential effects of a roe fishery on future productivity measured in terms of catch, that is, biological productivity.

Note that the question being addressed in this section deals with the effects of a roe season fishery, not with the effects of roe-stripping, per se. There are two reasons for this. First, one of the alternatives being considered is intended to limit the roe season fishery without banning roe-stripping. Second, although the timing of the harvest, the compression of the harvest in time and space, and the disproportionate harvest of females are among the factors that may affect the sustainable yield of the pollock stocks, they are primarily determined by the size of the roe fishery and not by the types of processing that occur during the roe fishery.

2.3.3.1 Effects on sustainable catch

The potential biological effects of a roe fishery on the sustainable pollock catch are discussed below.

2.3.3.1.1 Effect of the timing of the harvest

The spawning period for pollock and most other marine fish off Alaska is in late winter to early spring. If harvests are taken prior to the growing season, the yield per individual may be reduced. Preliminary analyses of growth patterns of pollock in the Gulf of Alaska reveal that the growth rate is relatively constant during the year at ages 1 and 2; however, as the fish mature, a seasonal growth pattern is exhibited (Hollowed and Megrey 1989). The analysis indicates that adult pollock have a reduced growth rate or a loss in weight during the winter, and accelerated growth during the summer (Table 2.13). Based on this observation, it is possible to conclude that fishing in the spring could result in a loss of yield per individual, since growth accrued during the year would be foregone.

However, an increase in the net yield to the fishery would not necessarily be realized if the fishery took place later in the year, due to the factor of natural mortality.

A preliminary analysis (Collie 1989) showed that growth outstrips mortality in the early years but falls behind at age 5. Under this set of conditions, there is no advantage (increased yield) to harvesting late in the year versus early in the year.

2.3.3.1.2 Effect of fishing mortality occurring over a short time period.

Due to the amount of effort in the pollock fisheries in conjunction with low quotas, fishing mortality on the pollock stocks is occurring over shorter time periods during the year. This occurred in the 1989 Bering Sea JVP and Gulf of Alaska DAP fisheries. Prior to 1980, the harvest of pollock was predominantly by the Japanese and most of the annual catch was concentrated during the months June-September, outside of the roe season. Since 1981 joint venture harvests have increased, and since 1987 there has been no foreign apportionment of pollock. The monthly distribution of JVP harvest has shifted toward earlier portions of the year (Table 2.1b). In 1987 joint venture catch rates exceeded 10,000 mt per day, capturing over 70% of the annual JVP apportionment during the first quarter, which resulted in harvest of the JVP apportionment well before the end of the year. In 1989 the BSAI JVP apportionment for a directed pollock fishery was about 45,000 mt. This quota was taken in one week (January 15 - January 21). In the Gulf of Alaska, where the fishery was exclusively DAP, the 6,250 mt quota in the Shelikof District was taken by March 21, 1989 and the outside-Shelikof apportionment of 53,750 mt by March 23, 1989. The catch in the last week of the fishery approached 20,000 mt.

A concern related to compressed fishing seasons is the potential of exceeding TAC due to the difficulty in managing a fishery with large amounts of effort occurring over a short time period. Other fisheries, such as the halibut and Gulf of Alaska sablefish fisheries, also experience compressed fishing seasons. These stocks are not thought to be directly affected by fishing mortality occurring over a short time period, rather potential negative effects are associated with overharvest of the TAC. The potential for exceeding TAC can be decreased by the recently implemented observer program and expanded reporting requirements. If necessary, this potential can be further reduced by improving inseason monitoring. The use of conservative TACs greatly reduces the potential for overfishing when TACs are exceeded. Therefore, the major concern is not the compressed season, per se, but rather that the fishery occurs during the spawning season.

2.3.3.1.3 Effect of fishing during the spawning season

An effect of roe harvests can be the alteration of the reproductive capacity of the fished stock. The effect of fishery removals on future recruitment depends on the relationship between the spawning populations and recruits. The relationship between eggs spawned and subsequent recruitment to the fishable population is not clearly evident in most fish populations.

Evidence that density-independent factors play an important role in determining the relative magnitude of pollock year classes in Shelikof Strait is provided from studies conducted by the Alaska Fisheries Science Center's (AFSC) Fisheries Oceanography Coordinated Investigations (FOCI) project. Although studies have not been completed, several environmental factors that may influence recruitment have been identified.

The role of physical factors in determining recruitment success for pollock is an important consideration when attempting to evaluate the impact of large catches of females during the spawning season. If physical factors are a controlling factor, then the eggs and larvae that survive were (1) those spawned during a window of time when environmental conditions were favorable to survival, and/or (2) those spawned in a location favorable to survival. In this context, it would be important to ensure that a significant number of females escaped the fishing fleet throughout the spawning season.

Certainly, density-dependent factors must impact recruitment success at some level of abundance. Based on data for eight year classes (1977-1983), Megrey (1988) found the Ricker spawner-recruit model provided the best description of pollock recruitment in the Gulf of Alaska (Figure 2.3). This relationship was based on a limited number of year classes that represented four strong year classes and four weak year classes.

Wespestad (1988) fit a Ricker spawner-recruit model to the Bering Sea pollock data (Figure 2.4). The time series of Bering Sea recruitment indicates that recruitment is cyclic with increases when the spawning stock is low and decreases when the spawning stock is high. Deviation by individual year classes from expected values appears to be correlated with water temperature. Year classes spawned under relatively warm temperatures generally produced higher than expected numbers of recruits. The estimated pollock spawner-recruit relationship suggests that there is a spawning population size and water temperature which maximizes subsequent recruits; thus, at population levels above or below this level recruitment is reduced.

The key factor in evaluating the role of spawner abundance lies in the determination of the density-dependent relationship. Studies of possible density-dependent factors such as competition for prey, predation pressure, and cannibalism of the young-of-the-year by adults have not been completed. Therefore, drawing conclusions about the impact of a roe fishery based on a Ricker spawner-recruit relationship alone is premature.

Moreover, the Ricker spawner-recruit relationship represents a simplification of a complex series of events that occur during different life stages. Three major simplifications are noted here. First, Ricker (1954) assumed that the number of recruits per spawner was density independent and the slope of the line comparing recruits to spawners was represented by the alpha coefficient. Recent studies show the influence of stock density on the growth rate may also affect the maturity schedule and the fecundity of the future spawning stock (Rothschild 1986). Second, inter-annual variation in environmental conditions may impact recruitment considerably. Several mechanisms for density independent control of recruitment in marine fish stocks have been proposed (Sissenwine 1984, Bakun and Parrish 1980, Shepherd et al. 1984). Finally, the role of other species in modifying the shape of the recruitment curve is not addressed by the Ricker relationship. Skud (1982) hypothesized that species may exhibit shifts in abundance due to changes in the community structure. Under Skud's hypothesis, once a species achieves dominance its population would remain stable until it was perturbed at which time a new species could establish dominance. Considering the simplifications described above, the following forecast of the impact of targeting females on future recruitment of pollock must be considered as only one of many possible scenarios.

Reports from the fishery indicate that pollock segregate by sex prior to spawning and that it is possible to harvest females almost exclusively. Selective removals of males or females will change the population sex ratio and may in turn affect the spawner-recruit relationship if spawners are measured in terms of the total spawning population (males and females combined). A preliminary examination of this was made using the Bering Sea relationship as an example with two extreme characterizations of density dependence (Appendix I). If density dependence is solely related to larval abundance, maximum recruitment occurs at larger spawning biomass levels (including males and females) when the number of females in the population decreases. If spawners are measured only in terms of females, there would be no change. On the other hand, if density dependence is due to interactions with adult spawners, recruitment is shown to change proportionally to the number of females in the population. In reality, density dependence in pollock population dynamics is likely a complex combination of the two extremes described in Appendix I. Therefore, this should be considered an example of the conditions which could lead to changes in the reproductive potential of the stock, rather than a representation of current pollock stock dynamics.

Whether concentration of fishing effort during the spawning season would lead to a decrease in the equilibrium size of the Gulf and eastern Bering Sea stocks is an open question. At least one theoretical model suggests that this is a possibility, given the stock-recruitment relationship assumed in the model (see Appendix II). However, the same model indicates that even though equilibrium stock size would be expected to decrease, the impact on the acceptable catch level is less clear; catch could be higher or lower than in the case of uniform effort distribution. Again, it is noted that this model presents an example of conditions which would result in the decrease of equilibrium stock size, and is not necessarily representative of current pollock stock dynamics.

Without a well-defined stock-recruitment relationship and an understanding of all the factors affecting recruitment, definite conclusions regarding the impacts of targeting on spawning pollock cannot be made.

2.3.3.1.4 Effect of targeting on females

Roe operations, if they can target on females, may have the effect of disproportionately reducing the eggs produced by the spawning stocks, depending on the stock-recruit relationship. If the effects of a roe fishery are evaluated through application of the spawner-recruit curves to spawning stocks, the uncertainty of these relationships must be considered. Spawner-recruit relationships developed for the Gulf of Alaska and the Bering Sea (Figures 2.3 and 2.4) show a great deal of variation around the fitted curve; the shape of the curve depends more on theory than on observations of spawners and subsequent recruits. These spawner-recruit curves reach a maximum at intermediate spawner abundances, suggesting density dependent spawning success. Determination of effects of female targeting in roe season operations depend on whether the current number of spawners is greater or less than the number of spawners which produce the maximum number of recruits.

The 1989 Bering Sea Stock Assessment and Fishery Evaluation report (Bering Sea/Aleutian Islands Groundfish Plan Team 1989) indicates that the pollock resource peaked in the mid-1980s and is projected to decline moderately over the next several years. The estimated stock-recruit relationship may be real; however, it is not possible with the data available to determine whether roe fishing in the Bering Sea, with targeting on females as reported in 1989, would have a positive or negative impact on expected future recruit abundance.

In the Gulf of Alaska the situation is quite different. The 1989 Gulf of Alaska Stock Assessment and Fishery Evaluation report (Gulf of Alaska Groundfish Plan Team 1989) indicates the pollock resource has declined dramatically in recent years. The number of spawners may well be less than that required to maximize recruits. Here, roe fishing with targeting on females as reported in 1989 could have a negative impact on expected future recruits.

The impact of targeting on females in a roe fishery for Gulf of Alaska pollock in 1989 was also evaluated in terms of a potential loss of eggs. The analysis was conducted under the following assumptions:

1. The fishing fleet could successfully target on female pollock and 100% of the catch in 1989 was female.

2. The age specific selectivity for the fishery was equal to that estimated by tuning the Stock Synthesis model (GOA SAFE 1989) to bottom trawl survey data (Hollowed and Megrey 1989).

3. The population at the beginning of 1990 was that estimated using the Stock Synthesis model and the 1987 year class was assumed to be equal to the 1986 year class (0.192 billion).

4. Catches occurred during two seasons: (a) a four-month spring fishing season and (b) a six-month summer and fall season.

5. The maturity schedule was equal to that estimated in Hollowed and Megrey (1989). Fecundity-at-age was estimated using the fecundity-weight relationship derived in Miller et al. (1986); viz.,

$$F = 387.4551 * W^{1.016}$$

Where W is weight in grams. The estimated weight-at-age was set equal to the average spring weight-at-age found in Hollowed and Megrey (1989).

The potential egg production under different levels of exploitation were compared with those expected under a 50:50 sex ratio. Therefore, the percentage reductions in egg numbers reflects the maximum possible reduction. The results are shown in Figure 2.5.

In addition, the high levels of potential egg loss were observed at high exploitation rates which may not provide for a long term sustained yield of pollock.

The impact of this removal to future recruitment is difficult to evaluate. If intra-species competition plays a significant role in controlling pollock stock production, minor reductions in egg concentrations may be advantageous for survival of the young. If, on the other hand, density independent factors are the major controlling factors influencing survival during the early life history period, the additional mortality caused by fishing may be deleterious to the stock. Until the relative importance of density dependent and density independent processes can be quantified, it is difficult to anticipate the net result of egg removals to the stock.

Even if fishermen are able to target on females successfully, it should be noted that a high proportion of females in the catch does not necessarily imply a similarly high proportion of males in the remaining population. Appendix III describes a model that relates the proportion of females in the catch to the proportion of females in the stock. According to this model, the equilibrium sex ratio in the catch will be more skewed than the equilibrium sex ratio in the remaining population. For example, assuming an overall fishing mortality rate of 0.1 and a natural mortality rate of 0.3, even if 90% of the catch were comprised of females, only about 61% of the equilibrium stock would be comprised of males. The model also indicates that certain proportions cannot be maintained in equilibrium, depending on the overall fishing mortality rate. For example, under an overall fishing mortality of 0.3 and a similar natural mortality rate, it is impossible to maintain a 90% female catch proportion. Appendix III suggests that targeting on females could unbalance the sex ratio of the stock under high exploitation rates. This could be a factor in the Bering Sea where the exploitation rate is greater than 15%, but probably is not an issue in the Gulf where exploitation is less than 10%. Note that fishermen reported less success in targeting on females in the Bering Sea than in the Gulf, reducing the importance of this factor in the Bering Sea.

2.3.3.1.5 Localized depletion

One potential impact of concentrating fishing activities on spawning concentrations of pollock is the localized depletion of discrete stocks. At the current time there is insufficient information to define localized stock boundaries.

Some evidence indicates Gulf of Alaska pollock and Eastern Bering Sea pollock are separate stocks. In an analysis of the allelic frequencies for the protein locus tetrazolium oxidase, Grant and Utter (1980) detected weak genetic differentiation between Bering Sea and Gulf of Alaska pollock. Iwata (1975a, 1975b) and Johnson (1977) also detected differences between Gulf of Alaska pollock and Eastern Bering Sea pollock using biochemical studies.

Fine scale stock differentiation of fish that inhabit localized regions of the Bering Sea or Gulf of Alaska has not been adopted. Dawson (1988) compared age composition data, length-at-age, and morphological features of pollock from the Central and eastern Bering Sea pollock concentrations. He found evidence that pollock in the doughnut hole and the U.S. portion of the Aleutian Basin were members of the same stock which spawned in the vicinity of Bogoslof Island. Dawson also noted differences between the shelf and basin pollock concentrations in most of the data sources.

In the Gulf of Alaska, Hughes and Hirschhorn (1979) noted differences in the relative magnitude of the 1967 and 1970 year classes in the eastern and Central Gulf. In an analysis of length-at-age from commercial fishing operations, Hollowed and Megrey (1989) found that pollock harvested in the Shumagin INPFC area tended to be larger at age than pollock harvested in the Kodiak or Chirikof areas. The explanation for these differences may be due to stock separation or migratory behavior of the stocks.

2.3.3.2 Effects on the sustainable economic yield of the pollock fishery

The effect of a roe fishery on the sustainable economic yield of the pollock fishery is determined by its effects on both sustainable catch and the net benefit per unit of catch.

Information provided by the industry was used to compare four measures of the benefits of the actual 1989 domestic pollock trawl fisheries and those of hypothesized 1989 fisheries without roe season fisheries. In making this comparison, it was assumed that total catch would have remained constant. The comparison is summarized in Table 2.14. Similar comparisons in terms of benefits per metric ton of catch are presented in Table 2.15.

Gulf of Alaska

The estimated wholesale value of the actual pollock fishery in the Gulf is $33.5 million. This is $4.5 million or 16% greater than the estimated wholesale value if the roe season pollock fishery had been replaced by other pollock fisheries. The estimated net wholesale value of $12.0 million for the actual fishery is $5.3 million or 79% greater than the estimated net wholesale value had the roe season fishery been replaced. Estimated employee days are 44,000 for the actual fishery, this is 5,300 or 11% less than with a replacement for the roe season fishery. However, estimated employment cost of $9.7 million for the actual fishery is $0.3 million or 3% higher than with out the roe season fishery.

Therefore, in the GOA it is estimated that three of the four measures of benefits would have been lower had the roe season fishery been replaced with other fisheries.

These results suggest that, in 1989 in terms of three measures, benefits would have been higher with a roe fishery and lower total catch than without a roe fishery but with higher total catch. For example, net wholesale value would have been higher with the actual 1989 GOA pollock fisheries, all scaled back by 50%, than with the actual level of catch but without a roe season fishery.

Bering Sea/Aleutian Islands

In the BSAI, three of the four measures of benefits are higher for the actual 1989 fishery than for the hypothetical fishery without a roe season fishery. However, the percentage differences between the two sets of estimates are smaller than for the Gulf. The main reason for this is that the roe-season fishery accounted for a much smaller part of the total 1989 fishery in the BSAI than in the GOA. The estimated wholesale value for the actual fishery of $567 million is $29 million or 5% greater than without a roe season fishery. Estimated net wholesale value for the actual fishery is $346 million which is $26 million or 8% more than without a roe season fishery. The estimate of employee days is 381,000, this is 10,000 or 3% more than without a roe season fishery. However, employment costs are estimated to be $91.3 million for the actual fishery, this is $0.2 million or 0.2% less than without the roe season fishery. These results suggest that in 1989 in terms of three measures, benefits would have been higher with a roe fishery and lower total catch than without a roe fishery but with higher total catch, but not to the extent they were in the Gulf because the roe season catch was a much smaller part of the total catch in the BSAI than in the Gulf.

In 1989, DAP requests for the BSAI were less than the pollock TAC; therefore, a forced reduction in catch during the roe season fishery would probably not have been completely replaced by catch later in the year. If none of it would have been replaced, wholesale value, net wholesale value, employee days, employment costs, and catch in the domestic pollock fishery would have been reduced by about 24%. In 1990, DAP requests for pollock exceeded the pollock TACs; therefore, the comparison of benefits assuming the same total catch with or without a roe season fishery is probably appropriate.

There was also a difference in the proportion of catch delivered to shoreside processing plants during roe fisheries and during non-roe pollock fisheries later in 1989. The difference was substantial in the GOA but minimal in the BSAI. PacFIN data indicate that 42.5% and 21.5% of the pollock catch was delivered to shoreside processing plants, respectively, for the GOA and BSAI roe season fisheries. The corresponding values for the rest of the year were 99.8% and 22.8%.

### 2.3.4 What effects associated with the bycatch of crab and halibut does the timing of the pollock fishery have?

The seasonality of the pollock harvest may also affect crab and halibut bycatch rates. The late winter/early spring fishery which targets on roe-bearing pollock is primarily an off-bottom trawl fishery with low bycatch rates for halibut and crab. This may change at times depending on the age structure of the population. In the Gulf of Alaska, there was a strong component of older fish in the population in 1988 and 1989. In these years, according to observers, several boats fished mid-water gear just off-bottom or fished on the bottom with bottom trawl gear. The probable explanation for this change is that the fleet was trying to maximize the number of older and larger fish that tend to be more demersal. Therefore, it is possible that fishing practices evolve reflecting changes in the age-structure of the stock.

The timing of the fishery can also have an effect on bycatch rates. Following the spawning season, pollock tend to be found on or near the bottom. The target gear, bottom trawls, can encounter significantly greater numbers of halibut and crab if fished "hard on bottom". Late in the year, it has been suggested that pollock re-establish off-bottom aggregations in advance of spawning early the following year.

Any management measures which divert fishing effort from mid-water to bottom trawling will tend to result in higher bycatch rates for crab and halibut. This would result in greater crab and halibut mortality in the fisheries and/or decreased groundfish catch depending on when the bycatch caps would be taken. Total bycatch would remain constrained by PSC limits.

Gulf of Alaska

A halibut bycatch prediction model is currently used in the Gulf of Alaska to aid the Council in establishing overall halibut PSC limits in the groundfish fisheries in the Gulf. Given current harvest levels, if the Gulf pollock were to be taken 100% with midwater trawls, the estimated halibut bycatch would be 36 mt. If, on the other hand, all pollock were taken by bottom trawls fished hard on the bottom, bycatch would be approximately 2,700 mt.

Depending on the average size of halibut taken as bycatch, the estimated discounted present value of the exvessel value of foregone catch in the directed halibut fishery per metric ton of halibut bycatch mortality in the groundfish trawl fishery ranges from about $1,800 to $7,800. With this range, the discounted present value of a difference in halibut bycatch of 2,664 mt is from $4.8 million to $20.8 million if discard mortality is 100%. If the discard mortality is 50%, the loss would be half of that.

There are two reasons the increase in halibut bycatch in the GOA is expected to be less than this. First, the pollock fishery that occurs late in the year has bycatch rates that are comparable to those of the roe fishery if trawls are not fished hard on bottom. Second, the halibut prohibited species catch (PSC) cap for trawl gear is 2,000 mt and the cap is expected to be taken and, therefore, prevent further bottom trawl fishing even if there is no late pollock fishery. The latter reasons suggests that the real cost of a change in seasonality that increases the halibut bycatch rate is a reduction in the amount of groundfish that can be taken with bottom trawl gear before the halibut PSC cap is reached and the bottom trawl fisheries are closed.

Bering Sea/Aleutian Islands

In the BSAI, a bycatch prediction model was recently developed as part of the analysis for Amendment 12a (controls on bycatch of crab and halibut in the groundfish fisheries). Two relevant scenarios examined were 30% of the pollock taken by midwater trawls, 70% taken by bottom trawls, and the reverse, that is, 70% taken by midwater trawls and 30% taken on-bottom. Under both scenarios the overall halibut PSC limit of 5,400 mt constrained the fishery; thus, if a prohibition on roe-stripping or a split-season allowance leads to this kind of shift to bottom trawl gear, less groundfish would be taken and less exvessel revenue generated (approximately $14 million according to the EA/RIR/IRFA for Amendment 12a). Since, according to the simulation model, crab bycatch is not constraining, switching to bottom trawls would increase the bycatch of C. bairdi Tanner crab and red king crab. The EA/RIR/IRFA for Amendment 12a, using 1988 fishery performance data, estimated these increases as 23,000 red king crab and 160,000 C. bairdi.

The estimated discounted present values of foregone exvessel value in the crab fisheries per 1,000 crab of bycatch mortality for crab of the size taken in the 1988 BSAI joint venture fishery are $12,444 for red king crab and $200 for C. bairdi. Therefore, the discounted present value of the increases are $286,000 and $32,000 for red king crab and C. bairdi, respectively.

If the BSAI fall pollock is not a hard on bottom fishery or if the PSC caps are constraining regardless of the seasonality of the pollock fishery, these estimates overstate the potential effects on bycatch of a change in the seasonality of the BSAI pollock fishery. If the latter is true, a major cost of a change in seasonality would be in terms of foregone groundfish catch and increased fishing costs resulting both from earlier area closures and from additional efforts by the fleet to reduce bycatch rates. This is more likely to be the case with the expansion of the domestic groundfish fisheries and the implementation of the domestic observer program.

Without knowing what additional actions the fleets would take to reduce bycatch rates or what the costs of those actions would be, it is difficult to estimate what the increase in the cost of the caps would be. But the costs would probably be less than or equal to what the cost of foregone catch would be if no attempt is made to reduce bycatch. It is not known whether the aforementioned estimate of $14 million of foregone exvessel revenue is less than or greater than the probable cost.

2.3.5 What effects does the timing of the pollock fishery have on the populations of sea lions and other marine mammals?

National Marine Mammal Laboratory (NMML) research indicates that the recent declines in northern sea lion abundance in Alaska are linked, at least in part, to changes in either the quality or quantity of prey available. It is hypothesized that walleye pollock roe fisheries may be contributing to these declines for at least the following reasons.

1. These fisheries target on dense aggregations of gravid female walleye pollock, which for sea lions are easy to catch (because of their concentration) and may be the most nutritional form of pollock.

2. These fisheries occur in the late winter and early spring, a time when pregnant adult, and newly weaned juvenile northern sea lions would be very vulnerable to nutritional stress.

These remain hypotheses to be tested because evidence linking population declines of these marine mammals to declines in prey availability is insufficient at this time to suggest such a cause-effect relationship.

2.3.6 Comparison of Alternatives to the Status Quo

2.3.6.1 Alternative 2: Prohibit pollock roe-stripping in the pollock fisheries in the Gulf of Alaska and Bering Sea or portions thereof.

A ban on roe-stripping will tend to reduce the pace of the roe fishery because it would eliminate some operations from the fishery and reduce the processing capacity of others. This does not necessarily mean that such a ban will reduce catch during the roe fishery. In 1989, the Gulf of Alaska pollock fishery was closed on March 21. The domestic fishery took 35,666 mt of pollock in 21 days during March, of which about 23,750, or 67%, is estimated to have been taken for roe-stripping. Had the same catch rates been maintained through three more weeks and had some of the roe-stripping operations switched to producing additional products, the TAC could still have been reached during the roe fishery. In 1990 and beyond, the anticipated increases in harvesting and processing capacity make it even less likely that a ban on roe-stripping would be sufficient to assure that the total Gulf of Alaska TAC is not taken by the end of the roe fishery, unless the TAC is substantially increased. There are no indications that this will happen in the next few years.

The situation is quite different in the BSAI since there is not currently sufficient domestic harvesting and processing capacity to take the combined TAC in that area by the end of the roe fishery. Therefore, for the near term, a ban on roe-stripping in this area would tend to reduce the BSAI pollock catch during the roe fishery. It is estimated that 29,700 mt or 12.6% of the domestic (DAP) pollock catch in the BSAI during the first quarter of 1989 was taken for roe-stripping. Therefore, had roe-stripping been prohibited in the BSAI in 1989, domestic catch during the roe season fishery, and perhaps for the year as a whole, could have been reduced by this amount. Any reduction in domestic catch for the year as a whole would prevent the TAC from being fully taken unless joint venture catch was increased.

*Environmental Assessment*

Because a prohibition on roe-stripping would not be expected to affect the size of the GOA pollock roe fishery, the biological effects would probably be limited to those associated with the resulting decrease in discards. Using roe only and surimi recovery rates of 7.5% and 16%, respectively, the difference in discards between a roe-only operation and a roe and surimi operation is an increase in discards equal to 16% of the pollock catch for roe-stripping. Therefore, in 1989 a ban on roe-stripping would have reduced at-sea pollock discards by about 3,300 mt (0.16 x 20,750). Unless the GOA pollock TAC increases significantly, it is unlikely that the amount of pollock taken for roe-stripping and the associated increase in discards due to roe-stripping could double. Under most circumstances, such a change in pollock discards is probably not large enough to have a measurable effect on the ecosystem. This is particularly true if EPA discard requirements are met. The potential effects of discards were more fully discussed in Section 2.3.2.

In the BSAI area, a ban on roe-stripping would potentially affect the ecosystem by resulting in: (1) a small reduction in the size of the roe season fishery; (2) possibly, a correspondingly small increase in the size of pollock fisheries later in the year; and (3) a reduction in discards. The information presented in Section 2.3.1 does not suggest that the first two effects would measurably affect the biological productivity of the pollock resources in the BSAI.

Had roe-stripping been prohibited in the BSAI during 1989, solid waste discards would have been reduced by about 4,700 mt if processing for roe only with a 4% recovery rate had been replaced by processing both roe and surimi with a combined recovery rate of 20%. In the future, roe-stripping operations could account for much more of the pollock catch than in 1989. In that case, the reduction in discards resulting with Alternative 2 would increase. However, even with a several fold increase, the change in discards would remain extremely small relative to total fishery discards and would not be expected to have a measurable effect on the productivity of the BSAI ecosystem. This is particularly true if EPA discard requirements are met

As discussed in Section 2.3.4, crab and halibut bycatch rates may be higher in the pollock fisheries that occur after the roe fishery. Therefore, a partial replacement of the roe fishery with a later pollock fishery could tend to increase the bycatch of crab and halibut. However, the halibut and crab bycatch caps that are in place in the BSAI area combined with the relatively small change in the seasonal distribution of the pollock fishery that would occur should Alternative 2 be adopted are expected to contribute to relatively small changes in bycatch in the BSAI pollock fishery.

*Economic Assessment*

<u>Gulf of Alaska</u>

In the GOA, a ban on roe-stripping would be expected to alter the distribution of catch among different types of operations during the roe season fishery and to lengthen that fishery compared to what it would be without such a prohibition. However, it would not be expected to affect the size of the roe fishery or the amount of the pollock TAC available for later fisheries. In general, catch would be redistributed from roe-stripping operations to those with different uses of pollock during the roe fishery season.

Operations that are only equipped to produce headed and gutted products and roe would be eliminated from the pollock fishery[3]. There were nine factory/trawlers in this category in the 1989 GOA pollock fishery. These vessels accounted for about 9,150 mt or 15.8% of the pollock catch in the GOA during the first quarter of 1989 (i.e., during the roe season fishery). The gross and net wholesale values of this catch are estimated to be about $9.3 million and $1.9 million, respectively. If, in 1989, roe-stripping had been prohibited in the GOA, but not in the BSAI, some of the foregone revenue from the GOA could have been offset by increased effort in the BSAI. The extent of the potential offset is not known. However, the fact that these vessels chose to fish in the GOA suggests that there would be a net loss due to relocation. Had vessels been displaced from the Gulf in 1989, they could have moved to the BSAI without imposing a significant cost on the vessels already operating there because in 1989 DAP requests for pollock were less than the pollock TACs in the BSAI. This is not expected to be the case in 1990 and beyond.

Operations that were capable of producing products in addition to roe but chose not to do so during at least part of the year would not have this option available to them if a roe-stripping ban is strictly defined. The resulting reduction in the catch, revenue, and profits of such operations would be partially offset by increased catch available to all operations that remain in the fishery after the roe-stripping ban eliminates some operations. As with the H&G vessels, if the ban were only in effect in the GOA, part of the loss could be offset by expanding roe-stripping operations in the BSAI. Industry data indicate that these vessels harvested about 11,600 mt of pollock for roe-stripping in the GOA. The resulting gross and net wholesale values were estimated to be $5.4 million and $4.3 million.

In addition to the at-sea roe-stripping operations, 3,000 mt of pollock were reportedly used for roe-stripping by a shoreside plant. The estimated gross wholesale value of the resulting roe exceeds $1.5 million. The net wholesale value is not known.

---

3. This assumes that head and gut processors would be unwilling to process males and female carcasses into headed and gutted product. Given current market conditions, further processing would not of itself be advantageous. However, if the marginal cost of processing pollock for roe and the subsequent marginal cost of producing head and gut product was no less than the marginal revenue obtained, it is likely that head and gut boats would continue in the roe fishery. In other words, it is possible that roe production could subsidize the production of head and gut product, enabling the processor to remain in the fishery, albeit at a lower level of profit. To the extent that this happens, the cost to these vessels and the benefit to other processors of a prohibition would be decreased.

The group of operations that were not involved in roe-stripping in the GOA in 1989 would have benefitted from a roe-stripping prohibition because it would have increased the amount of the TAC available to them. The same would be true, but to a lesser extent, for the group of operations that typically processed beyond roe. Information from industry indicates that this group consists of some at-sea processors and all the large shoreside processors. It is estimated that 34,100 mt of pollock were taken for processing beyond roe during the first quarter. The amount taken for such processing could have increased by 70% had roe-stripping been prohibited in the GOA in 1989. Because the increase in the amount of pollock available for processing beyond roe would be used by both at-sea and shoreside processors and because the prohibition would not be expected to make more pollock available for a fishery later in the year, a prohibition on roe-stripping in the GOA would probably not provide shoreside processors with the level of protection that they desire.

As noted in Section 2.3.1 and Table 2.11, it is estimated that if the 1989 GOA roe-stripping operations had been replaced by the other pollock operations, gross wholesale value, net wholesale value, and employment costs would have decreased by $6.2 million (23%), $3.8 million (43%), and $1.8 million (23%), respectively. However, employee days would have increased by 6,600 (13%).

Bering Sea/Aleutian Islands

The situation was quite different in the BSAI in 1989. In that area, the pollock TACs were more than sufficient to meet the demands of domestic (DAP) fishery. This means that: (1) the different components of the domestic fishery were not racing against each other for pollock; (2) the roe-stripping that did occur was not an aberration of the open access fishery, but rather the result of business decisions made to increase profits; and (3) that a ban on roe-stripping would have decreased the benefits that some received from the fishery without directly increasing the benefits received by others. Therefore, a ban on roe-stripping in the BSAI in 1989 would have decreased the benefits generated by the domestic fishery.

As soon as there is more than sufficient domestic processing capacity to take the entire pollock TAC during the entire year, which may occur in 1990, there will exist an allocation problem because the size of the roe fishery may affect the size of the fishery later in the year.

During the 1989 BSAI roe season fishery 16 H&G vessels harvested about 15,700 mt of pollock for roe-stripping. The estimated gross and net wholesale values of this catch are $12.0 million and $2.1 million, respectively. It is estimated that 10 other at-sea processors took an additional 14,000 mt of pollock for roe-stripping with estimated gross and net wholesale values of $6.5 million and $5.5 million. The latter group, and to a lesser extent the former group, could have offset part of these losses by switching to processing beyond roe. In 1989, the only benefit to other operations would have been through the price effect of a decrease in the amount of roe produced. The potential size of this market effect is not known.

As noted is Section 2.3.1 and Table 2.11, it is estimated that if the 1989 BSAI roe-stripping operations had been replaced by the other pollock operations, gross wholesale value, employee days, and employment costs would have decreased by $2 million (0.4%), 2,000 employee days (0.5%), and $0.8 million (0.9%), respectively. However, net wholesale value would have increased by $3 million (1%).

Comparison of catch for shoreside processing and catch for at-sea processing.

In the GOA where the harvesting and processing capacity of the factory/trawler and mothership fleet during the roe season greatly exceeds the pollock TAC, a ban on roe-stripping would be expected to increase the amount of pollock that is delivered to shoreside processors during the roe season, but not later in the year. It would not provide shoreside plants with as much pollock as they expected to have in 1989.

In the BSAI, a ban on roe-stripping would be expected to decrease the quantity of pollock taken during the roe season and increase the amount taken later in the year. There are two reasons why at least initially this may not change the distribution of catch between at-sea and shoreside processors. First, the percentage of catch for at-sea processing was relatively constant for the two seasons in 1989. It was 78.5% during the roe season (i.e., the first quarter) and 77.5% for the rest of the year. Second, at least until harvesting and processing capacity exceed the TAC, a decrease in pollock catch for at-sea processing during the roe season will not necessarily lead to an increase in catch for shoreside plants later in the year. The second reason is expected to be eliminated in 1990 or soon after that.

In the BSAI, such a prohibition would have probably decreased the catch delivered to at-sea processors and had very little effect on shoreside processors, because in 1989 there was sufficient TAC to meet the demands of both groups of processors.

Even without quantifying income and employment impacts it is clear that if jobs and, hence, income, are created or maintained in communities that participate in shoreside processing (for example, Kodiak) jobs will be lost in the at-sea processing sector. It is not possible to characterize a job in one community as "superior" to a job in a different U.S. community.

2.3.6.2 Alternative 3: Require full utilization of pollock in the pollock fisheries in the Gulf of Alaska and Bering Sea or portions thereof.

In addition to eliminating roe-stripping, this alternative would prohibit the discard of solid processing waste by requiring meal reduction as the final processing step for all pollock taken in a pollock fishery. The effects on the fishery would be substantially greater than those of Alternative 2. Most at-sea processors do not have meal plants and currently there is not sufficient meal reduction capacity onshore to meet the requirements of Alternative 3 and existing requirements for seafood waste disposal. This means that the rate of catch and total annual catch would be limited by this alternative until substantial additional DAP meal reduction capacity becomes available. That is unless either temporary waivers are granted or foreign processing vessels with meal plants are used to greatly expand the joint venture pollock fishery.

*Environmental Assessment*

The biological effects of Alternative 3 would be those associated with: (1) the decrease in total catch; (2) the changes in the seasonal distribution of the fishery, particularly in the GOA, due to a decrease in the rate of harvest; and (3) the decrease in the discards of solid waste. If joint venture catch were expanded as a result of this action, the first source of biological effects would be eliminated and the second would be substantially reduced.

The size of the roe season fishery would initially decrease in both the BSAI and the GOA unless joint venture allocations were temporarily increased. The biological effects of a slower paced fishery would be similar to those discussed under Alternative 2, but they would be present to a greater extent.

This alternative would result in a substantial reduction in the discard of solid pollock processing waste. For example, had this processing requirement been in place in 1989, discards associated with the directed pollock fishery of about 1 million mt in the BSAI and perhaps more than 50,000 mt in the GOA would have been eliminated. This represents only part of the total fishery discard in these regions. Furthermore, the biological effects of a decrease in the amount of catch that is discarded as solid waste are not known. There is no indication, however, that the current levels of discards have adversely affected the productivity of the pollock stocks or other components of the ecosystem.

*Economic Assessment*

This alternative would necessitate the installation of processing waste reduction (meal) plants in all pollock processing facilities or, alternatively, delivery of processing by-product for reduction to meal plants either at sea or shoreside. A few DAP at-sea processing vessels currently have meal plants and several additional meal plant-equipped factory/trawlers are expected to enter the fishery in the near future. Currently there are meal plants in Petersburg, Seward, Kodiak, Dutch Harbor, and Akutan and a meal plant is planned for the Pribilof Islands.

The fact that some pollock operations make use of meal plants while others do not and the fact that some are planning to add or expand meal plants while others are not indicate that meal plants are profitable or expected to be so for only some operations given current market conditions and EPA regulations. In the absence of Alternative 3, meal reduction will occur only to the extent that it is economically justified for individual operations. Alternative 3 would result in an economically unwarranted level of meal production, reduce the net benefits the nation can derive from use of the pollock resources, and by roughly doubling the world supply of whitefish meal cause a decline in meal prices that could eliminate the economic viability of existing or planned meal plants.

Many vessels currently fishing cannot physically accommodate a meal production plant (state-of-the-art plants require approximately 60,000 cubic feet of space) and thus, under this alternative, would be either precluded from prosecuting a pollock fishery or required to deliver pollock carcasses to another processor for subsequent reduction. Additionally, onshore meal production facilities currently do not have sufficient capacity to accommodate all shorebased processing waste. Thus, new meal reduction plants would have to be built or existing plants expanded.

Currently, at-sea seafood waste reduction plants may have a 150 mt/day (raw input) processing capacity, while shorebased facilities, less constrained by space limitations, can process 400-800 mt/day. Costs of a state-of-the-art processing plant average approximately $1 million per 100 mt/day capacity. Thus, a 150 mt/day at-sea reduction plant would require investment of approximately $1.5 million, while an 800 mt/day shoreside reduction plant's capital cost would be nearly $8 million. Given the BSAI and GOA pollock TACs for 1990 of 1,380,000 mt and 73,400 mt and assuming a pre-meal product recovery rate of 20%, about 1.2 million mt of pollock by-products would need to be reduced to meal under Alternative 3. If on average, meal plants operate 240 days per year, about $50 million worth of meal plants would be required to process the pollock by-products into meal. Only a small fraction of the required investment in meal plants has been made.

Note that for the meal plant in Kodiak which has a daily capacity of 80 mt of input but made use of 27,364 mt of inputs in a recent year, the operating days per year would be 342. In this report the estimates of annual capacity and investment cost are based on the assumption that on average meal plants will operate 240 full capacity equivalent days per year. If this assumption is incorrect and the average number of full capacity equivalent days is 341, the actual annual capacities would be 42% more than estimated in this report and the investment cost would be about 30% less.

The Alaska Fisheries Development Foundation has indicated that the current daily capacity of onshore meal plants is 80 mt/day in Kodiak, 650 mt/day in Dutch harbor and Akutan combined, but that there are plans to expand capacity to 800 mt/day in Kodiak and 2,450 mt/day in Dutch Harbor/Akutan/Pribilofs. The meal plant capacity in Petersburg and Seward are not considered because, due to their locations, these communities have not been heavily involved in the pollock fisheries. Assuming 240 operating days per year, the current annual capacity in Kodiak of 19,200 mt will be increased to 192,000 mt and the current onshore capacity for the BSAI of 156,000 mt will be increased to 588,000. The current onshore annual capacity in both areas is about 175,000 mt or 15% of the requirement for pollock alone under Alternative 3. The planned capacity of 780,000 mt is 65% of that required for pollock alone. Even if 35% of the meal plant requirements will be met by at-sea meal plants, the planned capacity will be significantly short of what will be required because the onshore meal plants process large amounts of by-products from other groundfish, other finfish, and crab.

Approximately 14 mt of meal is produced per 100 mt of pollock by-products. Therefore, 1.2 million mt of pollock by-products would result in about 168,000 mt of meal. This contrasts with current U.S. production of fish oil and meal of about 150,000 mt [1988 - (AFDF 1989, NMFS 1988)] and 187,000 mt of whitefish meal worldwide [1986 - (FAO 1987)]. Given this level of production, the worldwide market for whitefish meal would be greatly impacted, and U.S. meal prices would be expected to decline sharply from the current price for high quality whitefish meal produced by at-sea or shorebased plants of $600/mt FOB Dutch Harbor (Reilly 1989). The decline in prices could make meal production at the existing meal plants unprofitable and it would make it even more unprofitable for other pollock operations to add or expand meal plants. Adoption of Alternative 3 would require an unprofitable activity (i.e., reduction to meal) to be subsidized by other profitable activities. Such a situation would create strong incentives to circumvent regulations and lead to enforcement difficulties. It would also potentially jeopardize the economic viability of many operations. Discard of flesh would likely be replaced by inefficient use of capital and other resources.

Comparison of catch for shoreside processing and catch for at-sea processing.

Alternative 3 would decrease the domestic (DAP) catch for both at-sea and shoreside processing, at least in the short-run. But it would probably increase the proportion of the domestic pollock catch delivered to shoreside plants. This is because the capacity of the onshore meal plants is being substantially increased and because the physical constraints, and in some cases the financial constraints, of installing a meal plant tend to be greater at sea. If this requirement prevents the domestic fishery from taking the pollock TACs, increased joint venture catch could occur.

2.3.6.3 Alternative 4: Establish seasonal allowances for pollock in the Gulf of Alaska and Bering Sea/Aleutian Islands or portions thereof and perhaps restrict the Gulf pollock trawl fishery to midwater gear.

This alternative could significantly affect the seasonality of the pollock fisheries. For example, the roe season fishery could be restricted in size or eliminated. The option of restricting the Gulf pollock trawl fishery to midwater gear would eliminate mixed species on-bottom trawl fisheries that typically have a catch composition that results in them being considered pollock fisheries given the existing definition of a pollock fishery. The framework which would be used to establish and modify seasonal allowances was described in Section 2.2.3.

*Environmental Assessment*

The information presented in Section 2.3.3 indicates that the biological impacts of seasonal allowances on pollock stocks are indefinite and not precisely quantifiable. A split season measure could be used to limit harvest during the pollock roe season. Constraining the harvest of female pollock during the roe season could increase egg and larval production. If density-independent (environmental) factors play a significant role in regulating pollock abundance, the eggs and larvae that survive are (1) those spawned during a window of time when environmental conditions were favorable, and/or (2) those spawned in a location where environmental conditions were favorable. In this context, it would be important to ensure that a significant number of females escaped the fishing fleet throughout the spawning season. However, the timing of natural mortality must also be considered. If significant natural mortality takes place subsequent to spawning, the removal of a female in pre-spawning condition from the stock in the fall would have nearly the same impact on the spawning stock as the removal of a gravid female during the roe season.

Shifting a portion of the harvest from the spawning season to later in the summer and fall would provide time for additional growth (Table 2.13). Therefore, the net yield per individual would be increased. However, as noted before, due to natural mortality, the net yield to the fishery would not necessarily increase.

Spreading harvest effort over the calendar year may also spread effort geographically, as the pollock will no longer be aggregated for spawning. There is no current basis to suggest that this will have a biological impact on the stock.

Spreading the harvest over time would reduce the likelihood of overharvesting the TAC. Overharvesting TAC is most likely to occur when the harvest rate outstrips NMFS' ability to track those harvests, that is, when large harvests take place within one reporting period. This situation could occur at any time when sufficient effort is directed at the resource. Seasonal allowances would reduce the risk of overharvesting TAC if the overharvest in the early portion of the year is deducted from allowances for subsequent seasons.

Spreading the pollock fishery over a full calendar year would also enhance data collection and this could lead to improved understanding of seasonal changes in pollock distribution and other life history information. However, there are alternative sources for such data. They include the mixed species bottom trawl fisheries that harvest significant amounts of pollock; they also include trawl surveys.

If apportioning part of the GOA pollock quota to a summer or fall fishery would increase bottom trawling activity, less groundfish would be harvested by the time the halibut PSC cap for the trawl fisheries is taken and the bottom trawl fisheries are closed. That is, any action that tends to increase halibut bycatch rates in the Gulf will tend to reduce groundfish catch rather than increase halibut bycatch. This is so because the halibut PSC caps are expected to be taken even if the seasonality of the GOA pollock fishery does not change. Therefore, the option to restrict the pollock fishery to midwater trawls is not expected to reduce halibut bycatch in the GOA trawl fisheries.

In the Bering Sea, the bycatch regime of Amendment 12a, and presumably its replacement for 1991 and beyond, would limit the bycatch of halibut and crab to established PSC limits. Thus, any increases in bycatch rates primarily would translate to reductions in groundfish harvest due to closures of fisheries.

National Mammal Laboratory (NMML) research indicates that the recent declines in northern sea lion abundance in Alaska are linked, at least in part, to changes in either the quality or quantity of prey available. The walleye pollock roe fisheries may be contributing to these declines for at least the following two reasons. First, these fisheries target on dense aggregations of gravid female walleye pollock, which for sea lions are easy to catch (because of their concentration) and may be the most nutritional form of pollock. Second, these fisheries occur in the late winter and early spring, a time when pregnant adult, and newly weaned juvenile northern sea lions would be very vulnerable to nutritional stress. If the pollock roe fisheries contribute more to these declines than other pollock fisheries, a redistribution of catch to the other pollock fisheries would be beneficial in terms of the abundance of sea lions and northern fur seals. The relative contribution of the different pollock fisheries to the declines is not known.

*Economic Assessment*

Semi-annual or quarterly allowances would certainly have reduced the amount of pollock taken in the 1989 Gulf of Alaska pollock roe fishery, as they did in 1990. They would, no doubt, have the same type of effect in 1991 and beyond. As adjusted by the Alaska Region, the Western and Central Gulf DAP requests for pollock during the first quarter of 1990 exceed the TAC of 70,000 mt. Therefore, in the absence of the quarterly allowances, it is assumed that most of the TAC would be taken during the first quarter. If the TAC remains at 70,000 mt and if the Regional Director reserves 10,000 mt of the TAC for bycatch in the mixed species bottom trawl fishery, first quarter pollock catch would be 60,000 mt without quarterly allowances or 17,500 mt with equal quarterly allowances, as were used in 1990.

It is estimated that in the GOA a shift from catch during the first quarter to later in the year would reduce gross and net wholesale value, respectively, by about $77 and $91 for each mt of catch transferred to later in the year (Table 2.15). This means that the 42,500 mt transfer associated with equal quarterly allowances would reduce gross and net wholesale value by about $3.3 million and $3.9 million, respectively.

The Alaska Region has estimated that the DAP demands for BSAI pollock are 452,000 mt, 370,000, 501,000 mt and 564,000 mt, respectively, for the first through fourth quarters of 1990. Equal seasonal allowances of the 1990 BSAI pollock TAC of almost 1.4 million mt would limit catch to 350,000 mt each quarter unless the catch in a previous quarter was less than this. Therefore, catch in the first quarter would be 102,000 mt less than the estimated demand.

It is estimated that in the BSAI a shift from catch during the first quarter to later in the year would reduce gross and net wholesale value, respectively, by about $120 and $110 for each mt of catch transferred to later in the year (Table 2.15). This suggests that a 102,000 mt transfer of catch away from the first quarter fishery would reduce the gross and net wholesale values of the catch by $12.2 million and $11.2 million, respectively.

If the allowance for the first quarter is substantially less than the demand for pollock that quarter, the race for pollock during the first quarter may be intensified, more of the pollock may be taken before the roe season, and the loss in gross and net wholesale values may be larger than these estimates. This was the case in 1990, with the exception of the Shelikof Strait TAC of 6,250 mt, the Western/Central Gulf first quarter allowance was taken by January 29.

If the first quarter pollock fisheries receive no allowance rather than 25% of the TACs, there would be additional losses of $43 million in gross wholesale value and $35 million in net wholesale value for the BSAI pollock fishery. The corresponding estimated additional losses for the GOA pollock fishery are $1.3 million and $1.6 million.

Quarterly or semi-annual allowances that curtail fishing in the Gulf are expected to increase fishing effort in the BSAI area. In 1989 this could have occurred without displacing other domestic (DAP) operations from the BSAI. However, this will not be the case in 1990 and beyond because the domestic demand for pollock in the BSAI is expected to exceed the TAC regardless of the seasonal allowance of the GOA pollock TAC.

If the shift in effort toward the beginning of the year continues, domestic vessels and processors will complete their pollock operations early in the year and would have an extended period during which they would need to find alternative activities. Under Alternative 4, the pollock harvest would be split into two or four shorter periods of the year. The sub-annual periods could be defined by splitting the calendar year equally into quarters or halves, or some other appropriate interval. If the early year quota, say January-March, is taken before the end of March, then harvesters and processors would need to seek alternative activities. Options include participation in other fisheries such as the rock sole fishery in the Bering Sea and the cod fishery in the Bering Sea and the Gulf of Alaska. Presumably, increased harvesting effort in these fisheries will lead to earlier attainment of those species' quotas; thus, if domestic fleet expansion continues, there may develop an annual multi-season fishery with a period of inactivity between "seasons". This will increase operating costs engendered by two or four shutdown/start-up periods per year rather than one.

The specific seasons and allowances chosen will influence the amount of roe-stripping which may occur. If the roe season opens on January 15, as did the 1989 joint venture fishery, less stripping may occur given the lower roe recovery rates at that time of year (Figure 2.6). If the season were to open on February 15, however, one would expect roe-stripping to be much more widespread, given the likelihood of favorable roe recovery rates. Other possibilities for reducing roe-stripping through the use of split-season pollock allowance exist. For example, the Council could establish the first season opening on April 1, effectively eliminating much of the roe fishery.

It has been suggested that the split-season allowance of Alternative 4 or 5 or the newly adopted fishing season amendment to the Bering Sea/Aleutian Islands and Gulf of Alaska Groundfish FMPs (Amendment 13/18) could be used to delay the opening of the pollock fishery such that the roe fishery is eliminated. Obviously, this would eliminate the practice of roe-stripping, but one should note that the loss of revenue to the industry would be substantial. During the first half of 1989, Japan imported almost $50 million of pollock roe from the U.S.

If Alternative 4 is effective in changing the seasonality of the pollock fishery and if that change results in a greater proportion of the pollock TACs being taken with trawl gear fished hard on bottom, halibut and crab bycatch rates will increase. The resulting increases in crab and halibut bycatch would to limited to established levels by the crab and halibut PSC caps. In some cases, such as with halibut in the Gulf, the caps will likely be met regardless of the bycatch rates in the pollock fishery, and the level of bycatch will not increase.

The most significant effect of the postulated increased bycatch rates would probably be the costs they impose on the groundfish fleet. As bycatch rates increase the cost of a given cap tends to increase because the fleet has to take more extreme measures to try to reduce bycatch rates or it has to forego more groundfish catch. The potential magnitude of such costs is not known. Typically the cost to the fleet will be less than the cost that would be associated with the foregone catch if no effort were made to reduce bycatch rates. As noted above, the EA/RIR/IRFA for Amendment 12a indicates that, if the percentage of pollock taken with on bottom gear increases from 30% to 70% in the BSAI, the exvessel value of the foregone groundfish catch would be about $14 million.

The option to limit the pollock fishery in the Gulf to midwater trawl gear would not be expected to decrease halibut bycatch in the groundfish fisheries because the halibut PSC cap for the bottom trawl fisheries is expected to be taken regardless of the bycatch rate in the pollock fisheries. This option would curtail the mixed species on-bottom trawl fisheries that often take enough pollock to be considered pollock fisheries given the current definition of a pollock fishery. This would impose a significant cost on these fisheries. The benefit of this option would be that reducing halibut bycatch in the pollock fishery increases the amount of other groundfish that can be harvested before the halibut PSC cap is taken and the bottom trawl fisheries are closed. These benefits and cost would tend to accrue to the same fleet and it is not known which effect would be greater.

The benefits could be obtained at a much lower cost if the restriction only prohibited hard on bottom fishing when pollock is clearly the target species, such as during the roe season fishery or the fall fishery when pollock accounts for over 90% of the catch. Reportedly such fisheries can be, and often are, successfully conducted without fishing hard on bottom. Therefore, a modified version of this option could presumably assure that these "pollock fisheries" have lower bycatch rates without imposing significant costs on these fisheries or the mixed species bottom trawl fisheries.

The Bering Sea/Aleutian Islands management area closed to bottom trawling for pollock and Pacific cod on June 30, 1990. While an estimated 56% of the pollock TAC remained in the BSAI, industry sources have indicated to the Council that it can be fully harvested using pelagic trawl gear.

Comparison of catch for shoreside processing and catch for at-sea processing.

Based on seasonal differences in the distribution of catch between at-sea and shoreside processors in the Gulf in 1989 and based on the distribution of pollock catch between these types of processors during the first quarter of 1990, the proportion of the Gulf pollock catch delivered to shoreside processors is expected to be smallest without seasonal allowances and largest with quarterly allowances. In 1989, 42.5% of the first quarter catch was delivered to shoreside plants, but these plants received over 99% of the catch from later in the year. In 1990, all of the first quarter catch was delivered to these plants. However, the advantage to shoreside plants of quarterly allowances is expected to decrease as domestic harvesting and processing capacity continue to grow relative to the pollock TACs in the GOA and BSAI.

In 1989, the distribution of the domestic (DAP) BSAI pollock catch between shoreside and at-sea processors did not change very much between the first quarter and the rest of the year. Therefore, that distribution is not expected to be significantly altered by the seasonality of the pollock fishery in the BSAI.

The framework proposed for annually establishing seasonal allowances provides the flexibility to respond to changes in the conditions that determine the appropriate allowances. However, it does so at the cost of both decreasing the stability of the regulatory environment in which the industry must operate and decreasing the time and analysis available to evaluate the allowances to be used. The final decisions concerning allowances would be made just before each fishing year begins. It could be very costly for the industry to have to change plans for the first quarter shortly before the beginning of the year. The allowances are critical factors in determining the net benefits to be derived from the pollock fishery and the distribution of those benefits. Therefore, there are benefits to assuring that alternative allowances are adequately considered. The cost of assuring this is probably a decrease in the ease with which the allowances can be changed. It should be noted that: (1) some allowances can impose huge costs on the industry as a whole and/or large segments of the industry; (2) that the information required to prevent this from happening may not be readily available to the Council or NMFS; and (3) the framework involves a political process rather than a market process to establish the allowances.

2.3.6.4 Alternative 5: (Preferred) Prohibit pollock roe-stripping and establish seasonal allowances for pollock in the Gulf of Alaska and Bering Sea/Aleutian Islands or portions thereof and perhaps restrict the Gulf pollock trawl fishery to midwater gear.

*Environmental Assessment*

The environmental consequences of this alternative would probably be a composite of those described for Alternatives 2 and 4. This management option would spread the pollock quota over the year and limit harvests during the roe-bearing season. The information contained in Sections 2.3.1 through 2.3.5 does not indicate whether pollock stocks or marine mammal populations are expected to measurably benefit from such changes.

Any resulting increase in crab and halibut bycatch would be limited by the PSC caps; however, any resulting increase in bycatch rates would tend to decrease the amount of groundfish that was harvested before the caps are taken and some groundfish fisheries are closed.

*Economic Assessment*

The impacts of this alternative are approximately those of Alternative 2 plus those of Alternative 4, that is, decreased gross and net wholesale value, redistribution of benefits to shoreside processors in the Gulf but probably not significantly in the BSAI, and a "two-season" or "four-season" fishery with an increasing amount of down time between seasons. The consequences of the Council's choice of a split-season allowance in combination with a prohibition on roe-stripping will not be as indeterminate as the situation described under Alternative 4. Since no roe-stripping would be allowed, season opening dates would not affect the amount of product that is stripped. Season openings will, however, affect the revenue and profits earned in the fleet as the seasons relate to peaks in roe recovery and quality, catch-per-unit of effort, and costs. The comments in section 2.3.6.3 concerning the benefits and costs of the option to limit the GOA pollock fishery to midwater gear would apply for Alternative 5.

Seasonal allowances in the BSAI would result in roe-stripping and other uses of pollock during the first quarter becoming competitive uses if, for example, the first quarter allowance is less than the demand for pollock that quarter. Information provided by the industry indicate that two measures of benefits per metric of pollock catch are higher for roe-stripping operations than for other operations during the first quarter in 1989 and the other two measures are lower. Estimated gross and net wholesale values are lower for the roe-stripping operations by 6% and 44%, respectively. Estimated employee days and employment cost are higher by 4% and 37%. Therefore, if net wholesale value is used as the main measure of net benefits, roe-stripping would not be a good use of pollock compared to other first quarter uses as a whole.

2.3.6.5 Summary

Alternatives 2, 3 and 5 directly reduce or eliminate the amount of discard associated with pollock processing through regulatory controls on the type of processing that may occur. The amount of processing discard under Alternative 4 may be less than under the status quo depending on the seasonal dates and allowances chosen. The potential changes in the quantity, geographical location, and timing of waste discharge is likely to be undetectable against the background of general processing waste discharge and the ability of the ecosystem to recycle organic material.

Alternatives 4 and 5 will affect the timing of the pollock harvest directly and Alternatives 2 and 3, indirectly. The biological impacts are dependent on the form of the spawner-recruit relationship, the current stock status, and density independent factors. Appendices II and III provide examples of conditions under which equilibrium stock size could decrease due to fishing during the spawning season, and targeting on females could unbalance the sex ratio of the population under high exploitation rates. These models do not necessarily represent current pollock stock dynamics, but are useful in showing some conditions under which adverse effects are possible. Current understanding of pollock stock dynamics and the interactions of marine mammals with pollock do not permit clear-cut conclusions about all the biological impacts of a roe fishery. The research that has been conducted has not established that there are significant adverse impacts under current conditions. While it is not possible to establish that intensive fisheries during the spawning season will lead to stock declines or conservation problems, alternatives which limit or constrain roe fisheries would tend to mitigate any such effects.

Information from the industry indicates that transferring catch from the roe season fishery to a later in the year fishery can adversely affect the profitability of the pollock fishery. It is estimated that the elimination of the 1989 roe fishery could have reduced the wholesale value of the DAP pollock fishery by about $35 million. This would have made some operations less profitable and possibly endangered the economic viability of others.

The issue being addressed is the appropriate allocation of pollock TACs among types of fishing and processing operations and among different seasons. The appropriate allocation is that which maximizes the net value of the pollock fishery, where value is broadly defined to be consistent with Council goals and objectives, the MFCMA, and other Federal regulations. The allocation can affect the value of the pollock fishery through its effects on the sustainable TACs and through its effects on value per metric ton. Whether or not there is sufficient biological information to determine the first type of effects, a significant part of the problem before the Council is assuring that the value per metric ton of catch is not significantly reduced by an "incorrect" allocation of pollock among competing uses. The alternatives being considered are part of a large set of alternative management measures that can be used to influence the allocation of pollock among these uses. The difficulty with most of these alternatives, including those being considered, is that a tremendous amount of information is needed by the Council to make the right allocation decisions and much of the required information is not available. Also, even if the Council makes the "correct" allocation decision in 1990, it does not necessarily follow that a similar scheme wold be "correct" in 1991 and beyond.

## 2.4 Reporting Costs

The expanded reporting requirements and domestic observer program implemented in 1990 should prevent any of the alternatives from resulting in significant additional reporting requirements.

## 2.5 Administrative, Enforcement, and Information Costs

All of the alternatives, other than the status quo, involve additional costs. Additional administration will be required to track the occurrence of discards or to administer seasonal allowances and subsequent closures, if necessary. Enforcement efforts would be intensified to focus on a minor portion of the fishery, specifically segregating the discard of fish from one portion of the processing sector (roe-stripping) from all of the others. Information costs will increase to keep track of data associated with observations of discard or seasonal harvests, or to enforce seasonal closures if necessary.

An issue related to full utilization, but not to roe-stripping per se, is the practice of discarding smaller fish prior to or during processing operations. Such discard occurs onshore and at sea in most target fisheries and is common in the pollock fishery. Enforcement of a prohibition on roe-stripping could eliminate this practice as it would not be possible for an enforcement agent to distinguish between undersized fish traditionally discarded in the normal course of processing and whole, but larger fish, discarded during a roe-stripping operation. One way to maintain current processing practice, assuming a ban on roe-stripping or a requirement for full utilization is enacted, is to specify a minimum size below which fish could be discarded. This too would require significant additional monitoring and enforcement costs to assure compliance.

Enforcement of a prohibition on roe-stripping, as defined above (Alternative 2 and 5), will be difficult. The regulations would probably require some amount of pollock product other than roe to be onboard should an enforcement agent ascertain that there is pollock roe on the vessel. Since a suite of possible products may be produced from pollock, the agent would have to back-calculate the amount of whole pollock implied by the various product forms using published recovery rate tables. It is likely that multiple product conversions will not produce identical whole weight estimates, necessitating some judgement on part of the agent as to whether a violation has occurred. The use of published recovery rates would result in a variety of problems because actual recovery rates can vary substantially among areas, seasons, and individual operations. Depending on enforcement policy and practice, the latitude given vessel captains and plant foremen may render enforcement either ineffective or prohibitively expensive. The difficulty in developing regulations that will successfully implement the intent of the prohibition is non-specific regulations will allow unintended activities to occur, but very specific regulations will prohibit more activities than intended.

Enforcement of a requirement to have meal plants onboard at-sea processing vessels will not be difficult. Verifying that all processing by-product is reduced to meal, however, may be extremely difficult, particularly in the absence of 100% observer coverage. Likewise, determining that all shorebased waste product is going to the local meal plant may prove troublesome. Enforcement of a requirement to deliver processing waste to other at-sea processors or to shorebased processors will be geared to the effectiveness of the Council's observer program and domestic logbook program.

Monitoring and enforcement of a "full utilization" requirement will be extremely difficult and costly. Assuming that long term storage of unmarketable product is not required, and thus that disposal of such "surplus" is permitted, the difficulty in assessing the motives of a producer will make enforcement extremely difficult. For example, consider an operator who, in the absence of the "full utilization" requirement, would have extracted only pollock roe. Required now to utilize the by-product of the stripping operation, the individual, nonetheless, does a poor job of handling, processing, and storing the "mandated" product. The result is, the product is effectively "unmarketable" and thus, may legally be discarded. Can one conclude that the operator is attempting to circumvent the full utilization regulation? Perhaps the individual is just not very good at fillet or surimi production.

## 2.6 Other Related Issues

According to Japanese import data for the period January through July 1988, U.S. exports of pollock roe to Japan totaled 4,793 mt, with an estimated CIF (cost including insurance and freight) value of $15.6 million. One year later, the value of U.S. pollock roe exports to Japan had more than tripled. For the period January through July 1989, U.S. exports to Japan were 6,005 mt, with a CIF value of $47.6 million.

Action by the Council which has the effect of sharply reducing or eliminating the supply of pollock roe may have international trade implications for the United States. In January of 1989, a U.S. Department of Commerce delegation met with Japanese government officials and, at the behest of representatives of the U.S. fishing industry, raised the concern that the import quota for U.S. pollock roe would be sufficient to accommodate market demand. This concern was predicated on expectations of continued strong demand in Japan and a stable supply of U.S. pollock roe product. Nevertheless, if the U.S. is successful in future efforts to relax Japanese pollock roe import quota restrictions, which subsequently prove to have been unnecessary because of reduced roe production, then the position of the U.S. in future fishery import quota negotiations may be eroded.

## 2.7 Impacts on Consumers

The quantities of pollock affected by roe-stripping are currently small relative to total landings and pollock roe is generally exported to Japan. Consequently, U.S. consumers should not be directly affected by a prohibition or limitation on roe-stripping in terms of quantities of product available or prices paid. However, worldwide demand for pollock roe could increase to direct larger and larger amounts of pollock to a roe fishery. Under the status quo, U.S. consumers could experience a decrease in the amount of fillets and surimi available unless the demand for pollock flesh increased as well. Such a redistribution of pollock processing would be eliminated or reduced under Alternatives 2, 3, 4 and 5. However, this benefit would probably not be significant because the world market for roe is not expected to expand significantly and because the domestic demand for pollock is probably sufficiently elastic that any resulting change in the price and availability of pollock in domestic markets would not have a large effect on U.S consumers.

Requiring installation of additional meal production facilities at-sea and shoreside will increase operating costs. Meal production may have to be subsidized by roe, surimi, and fillet production. It is likely that some of these increased costs will be passed on to consumers in the form of higher prices and/or reduced supplies of some products. The industry's ability to transfer these costs will depend on the consumer's response to price increases (the demand price elasticity) and the availability of satisfactory substitutes. Estimates of the price elasticity of demand for pollock products are not currently available.

## 2.8 Redistribution of Costs and Benefits

Under the status quo, increased effort in the pollock fishery will increase the amount of pollock harvested and processed earlier in the year and probably an increase in the amount harvested for roe-stripping. Although we cannot estimate the loss to those who will be able to harvest less pollock either later in the year or during the roe season, the estimates of benefits per metric ton of catch indicate that these losses will probably be more than offset by the increased benefits to those who are able to harvest more pollock during the roe fishery.

Under Alternatives 2 and 5, vessels fishing for processors that did not strip for roe would gain in relation to those harvesters fishing for processors that previously stripped roe. Under Alternative 3, the outcome is less clear, because some operators who currently do not strip roe will, nonetheless, be severely impacted by a "full utilization" requirement. Precisely how additional costs of compliance with Alternative 3 will be distributed among the existing DAP industry cannot be anticipated. One possibility is that domestic catch and benefits would decline and joint venture catch would increase. There might also be increased product exported back into the U.S. due to increased utilization of pollock carcasses for fillets and surimi by foreign processors, although such an increase would not likely be substantial.

It is not clear what redistributional effects Alternative 4 would have; however, should a semi-annual allowance schedule be based on the 1989 harvest levels, the effects should be even less than those expected under the status quo.

If the two groups of processors do not demand more catch than is available, the annual catch of either or both groups would probably be reduced by management measures that reduce catch during the roe fishery. In this case the measures impose a cost on at least one group without providing direct benefits to the other, although, presumably, there would be conservation benefits attributable to such a change.

A management measure that increases the catch for shoreside processing at the expense of at-sea processing will clearly benefit those directly and indirectly involved with shoreside processing. This would include fishermen, vessel owners, processing companies and their employees, and the those involved in the support sectors of the local economies, such as Kodiak.

The additional benefits to this group would be at the expense of similar types of benefits to those directly and indirectly involved with the at-sea component of the pollock fishery. The merits of any such redistribution of benefits, with or without a change in total benefits, are dependent on value judgments concerning the relative value of providing benefits to the two groups.

## 3.0 EFFECTS ON ENDANGERED SPECIES AND THE ALASKA COASTAL ZONE

None of the alternatives would constitute actions that "may affect" endangered species or their habitat within the meaning of the regulations implementing Section 7 of the Endangered Species Act of 1973. Thus, consultation procedures under Section 7 on the final actions and their alternatives will not be necessary.

Also, for the reasons discussed above, each of the alternatives would be conducted in a manner consistent, to the maximum extent practicable, with the Alaska Coastal Management Program within the meaning of Section 307(c)(1) of the Coastal Zone Management Act of 1972 and its implementing regulations.

## 4.0 EXECUTIVE ORDER 12291 REQUIREMENTS

Executive Order 12291 requires that the following three issues be considered:

1. Will the amendment have an annual effect on the economy of $100 million or more?

2. Will the amendment lead to an increase in the costs or prices for consumers, individual industries, Federal, State, or local government agencies or geographic regions?

3. Will the amendment have significant adverse effects on competition, employment, investment, productivity, innovation, or on the ability of U.S. based enterprises to compete with foreign enterprises in domestic or export markets?

Regulations do impose costs and cause redistribution of costs and benefits. If the proposed regulations are implemented to the extent anticipated, these costs are not expected to be significant relative to total operational costs.

The amendment will not have significant adverse effects on competition, employment, investment, or productivity of U.S. based enterprises. Its impact on the ability of U.S. based enterprises to compete with foreign enterprises in domestic or export markets is not known. The amendment should not lead to a substantial increase in the price paid by consumers, local governments, or geographic regions since no significant quantity changes are expected in the groundfish markets.

The Council's preferred Alternative 5 will severely limit roe-stripping and will limit the proportion of the pollock TAC which may be taken in a roe fishery. The rapidly growing demand for pollock by domestic processors exceeded the available TAC for both the Bering Sea/Aleutian Islands and the Gulf of Alaska for the first time in 1990. Limitation of the proportion of the pollock TAC which may be taken early in the year when females bear roe may result in foregone revenues of approximately $15 million (based on the net wholesale value of shifts in harvest as discussed in Section 2.3.6.3). However, the Council feels this is justified, and largely compensated, by the increased ability of harvesters and processors to accurately plan their annual operations in advance and by safeguarding the long term yield of the biological resource.

## 5.0 IMPACTS RELATIVE TO THE REGULATORY FLEXIBILITY ACT

The Regulatory Flexibility Act (RFA) requires that impacts of regulatory measures imposed on small entities (i.e., small businesses, small organizations, and small governmental jurisdictions with limited resources) be examined to determine whether a substantial number of such small entities will be significantly impacted by the measures. Fishing vessels are considered to be small businesses. A total of 1,890 vessels may fish for groundfish off Alaska in 1989, based on Federal groundfish permits issued by NMFS through April 12, 1989. Only a portion of the fleet participates in the pollock fishery. In 1988, 38 catcher/processors and mothership/processors landed pollock (out of a total of 67 trawl catcher/processors and 19 mothership/processors). Through May 6, 1989, 52 vessels reported processing pollock in the Gulf of Alaska and the Bering Sea; 70 catcher-boats also reported pollock catches.

The Council's preferred Alternative 5 is expected to significantly impact a substantial number of small entities.

## 6.0 FINDINGS OF NO SIGNIFICANT IMPACT

For the reasons discussed above, neither implementation of the status quo nor any of the alternatives would significantly affect the quality of the human environment, and the preparation of an environmental impact statement on the final action is not required by Section 102(2)(c) of the National Environmental Policy Act or its implementing regulations.

________________________________ _______________

Assistant Administrator for Fisheries Date

## 7.0 COORDINATION WITH OTHERS

The Gulf of Alaska Groundfish Plan Team and the Bering Sea/Aleutian Islands Groundfish Plan Team consulted with representatives of the Alaska Department of Fish and Game (ADF&G), National Oceanic and Atmospheric Administration - Fisheries (NOAA-Fisheries), the Alaska Fisheries Development Foundation, the U.S. Environmental Protection Agency, members of the Scientific and Statistical Committee and Advisory Panel of the Council, and members of the academic and fishing community. Data used in the analysis were provided by the Alaska Fisheries Science Center's Foreign Observer Program, the Alaska Regional Office of NOAA-Fisheries, and the Council's Pilot Domestic Observer Program. We are especially grateful to those members of industry who voluntarily provided confidential and proprietary data on the conduct of the 1989 pollock fishery and who spoke forthrightly on this controversial topic.

## 8.0 LIST OF PREPARERS

Marcus Hartley, Terrence P. Smith, Harold Weeks, William J. Wilson
North Pacific Fishery Management Council
P.O. Box 103136
Anchorage, Alaska 99510

Rebecca Baldwin, Jim Balsiger, Anne Hollowed, Loh-lee Low, Sandra McDevitt, Bern Megrey, Joe Terry, Grant Thompson, Janet Wall, Vidar Wespestad
Alaska Fisheries Science Center
7600 Sand Point Way N.E., Bldg. 4
BIN C15700
Seattle, Washington 98115

Jessie Gharrett, Jay Ginter, Janet Smoker
Fishery Management Division
NOAA-Fisheries, Alaska Region
P.O. Box 21668
Juneau, Alaska 99802-1668

## 9.0 REFERENCES

AFDF. 1989. No Guts, No Glory. A special bulletin from the Alaska Fisheries Development Foundation, Inc. Holmes and Moore, eds., Anchorage, AK 4 pp.

Atkinson, Bill. 1989. "Salted Roes", Bill Atkinson's News Report, Issues 281-293.

Bakun, A. and R. H. Parrish. 1980. Environmental inputs to fishery population models for eastern boundary current regions. In: G.D. Sharp (ed.). Workshop on the Effects of Environmental Variation on the Survival of Larval Pelagic Fishes. UNESCO, Paris, Intergovernmental Oceanographic and Atmospheric Administration.

Bering Sea/Aleutian Islands Groundfish Plan Team. 1989. Final Stock Assessment and Fishery Evaluation Report for the 1990 Bering Sea/Aleutian Islands Groundfish Fishery. North Pacific Fishery Management Council. 201 p.

Beverton, R. J. H., and S. J. Holt. 1957. On the dynamics of exploited fish populations. Fish. Investig., London Ser. 2 (19) : 533.

Blotte, Tim. 1989. Personal communication.

Chitwood, Phil. 1989. Personal communication.

Collie, Jeremy. 1989. Personal communication.

Crapo, Chuck, Brian Paust, Jerry Babbit. 1988. Recoveries and Yields from Pacific Fish and Shellfish. Alaska Sea Grant, Univ. of Alaska. NTIS, Marine Advisory Bulletin No. 37.

Dawson, P. 1988. Walleye pollock stock structure implications from age composition, length-at-age, and morphometric data from the Central and Eastern Bering Sea. Proc. int. Symp. Biol. Mgmt. Walleye Pollock, Nov. 1988, Anchorage, Alaska.

FAO. 1987. FAO Yearbook of Fisheries Statistics: Commodities, Vol. 63 : 224.

Grant, W.S. and F.M. Utter. 1980. Biochemical genetic variation in walleye pollock, Theragra chalcogramma, and population structure in the southeastern Bering Sea and Gulf of Alaska. Can. J. Fish. Aquat. Sci. 37:1093-1100.

Gulf of Alaska Groundfish Plan Team. 1989. Final Stock Assessment and Fishery Evaluation Report for the 1990 Gulf of Alaska Groundfish Fishery. North Pacific Fishery Management Council. 190 p.

Harris, J. G. K. 1975. The effect of density-dependent mortality on the shape of the stock and recruitment curve. J. Cons. Int. Explor. Mer. 172:102-113.

Hinckley, Sarah. 1988. Results of the 1987 FOCI survey for late-stage larval and early juvenile walleye pollock (Theragra chalcogramma) in the Gulf of Alaska. Presented at the Workshop on Year Class Variations, Bergen, Norway, September 1988.

Hollowed, Anne and Bernard A. Megrey. 1989. Preliminary Report, Gulf of Alaska Walleye Pollock: Population Assessment and Status of the Resource in 1989. Alaska Fisheries Science Center. 50 pp.

Hughes, S. E. and G. Hirschhorn. 1979. Biology of walleye pollock, Theragra chalcogramma, in Western Gulf of Alaska, 1973-1975. Fishery Bulletin 77(1) : 263-274.

Hughes, Steve. 1989. Personal communication.

Iwata, M.. 1975a. Genetic identification of walleye pollock (Theragra chalcogramma) populations on the basis of tetrazolium ozidase polymorphism. Comp. Biochem. Physiol. 50B: 197-201.

Iwata, M.. 1975b. Population identification of walleye pollock Theragra chalcogramma (Pallas) in the vicinity of Japan. Mem. Fac. Hokkaido Univ. 22:193-258.

Johnson, A.G.. 1977. A survey of biochemical variants found in groundfish stock from the North Pacific and Bering Sea. Anim. Blood Grps. Biochem. Genet. 8:13-19.

Low, Loh-Lee, Janet Smoker, Leslie Watson, Jerald Berger, and Melvin Eklund. 1989. A review of product recovery rates for Alaska groundfish. DRAFT.

Lure, Loretta. 1989. Personal communication.

Megrey, B. A. 1988. Population dynamics of walleye pollock (Theragra chalcogramma) in the Gulf of Alaska. Ph.D. Dissertation, University of Washington.

Natural Resources Consultants. 1984. Operations and Economics of Selected Alaska Groundfish Fisheries. North Pacific Fishery Management Council. NTIS, Council Document #28.

NMFS. 1988. Fisheries of the United States, 1987. Current Fishery Statistics No. 8700. U.S. Dept. of Comm., NOAA, NMFS.

NOAA Fisheries. 1989. Catcher/processor and mothership/processor data base for 1989. Alaska Region, Juneau.

Radkte, Hans. 1989. Personal communication.

Reed, R. K., J. D. Schumacher, and A. W. Kendall Jr. 1988. NOAA's Fishery Oceanography Coordinated Investigations in the Western Gulf of Alaska. Eos Transactions, American Geophysical Union 69 (40) : 890-891.

Reilly, Chris. 1989. Personal communication.

Reuter, Joe. 1989. Personal communication.

Ricker, W. E. 1954. Stock and recruitment. J. Fish. Res. Bd. Can. 11 : 559-623.

Ricker, W. E. 1975. Computation and interpretation of biological statistics of fish populations. Bull. Fish. Res. Bd. Can.

Rothschild, B. J. 1986. Dynamics of Marine Fish Populations. Harvard Univ. Press. Cambridge, MA 277 p.

Shepherd, J.G., J. G. Pope and R. D. Cousens. 1984. Variations in fish stocks and hypotheses concerning their links with climate. Rapp. P.v. Reun. Cons. Int. Explor. Mer., 185:255-267.

Sissenwine, M. P. 1984. Why do fish populations vary? In. R. M. May (ed.) Exploration of Marine Communities. Springer-Verlag, Berlin:59-94.

Skud, B.E. 1982. Dominance in fishes: the relation between environment and abundance. Science 216(9):144-149.

Wall, Janet, Mike Brown. 1989. Personal communication.

## 10.0 PROPOSED CHANGES TO THE FISHERY MANAGEMENT PLANS

## 10.1 CHANGES TO THE GULF OF ALASKA GROUNDFISH FMP

### 10.1.1 Establish quarterly allowances for pollock in the Central/Western regulatory areas of the Gulf of Alaska

In Section 4.2.1, paragraphs (3) and (4) are renumbered as (4) and (5), and a new paragraph (3) is added to read as follows:

> (3) The annual TAC established for pollock in the combined Central and Western Regulatory areas shall be divided into four equal quarterly allowances. Shortfalls or overages in one quarter's allowance shall be proportionately added to, or subtracted from, the following quarters' allowances.

### 10.1.2 Prohibit pollock roe-stripping in the Gulf of Alaska

A new section 4.3.1.2, General Restrictions, is added. The old Section 4.3.1.2, Catch Restrictions, is renumbered as 4.3.1.2.1, a new section 4.3.1.2.2, Processing restrictions, is added, and the old section 4.3.1.3, Gear restrictions, is renumbered as 4.3.1.2.3. Organization, and text of the new section 4.3.1.2.2, follows:

Section 4.3.1.2 General Restrictions

Section 4.3.1.2.1 Catch Restrictions - text unchanged

Section 4.3.1.2.2 Processing Restrictions

> Roe-stripping of pollock is prohibited, and the Regional Director is authorized to issue regulations to limit this practice to the maximum extent practicable. It is the Council's policy that the pollock harvest shall be utilized to the maximum extent possible for human consumption.

Section 4.3.1.2.3 Gear Restrictions - text unchanged

## 10.2 CHANGES TO THE BERING SEA/ALEUTIAN ISLANDS GROUNDFISH FMP

### 10.2.1 Prohibit pollock roe-stripping and establish seasonal allowances for pollock in the Bering Sea/Aleutians

In Chapter 2.0, Section 2.1 ("History and Summary of Amendments"), add to the summary:

Amendment 14 on ________, 1990:

(1) prohibited roe-stripping of pollock; and established Council policy that the pollock harvest is to be used for human consumption to the maximum extent possible;

(2) divided the pollock TAC into two seasonal allowances: roe-bearing and non roe-bearing. The percentage of the TAC allocated to each allowance shall be determined annually during the TAC specifications process.

Add a new Section 14.4.9, Utilization and Seasonal Allowances of the Pollock TAC, as follows:

14.4.9 Utilization and seasonal allowances of the pollock TAC

Roe-stripping of pollock is prohibited, and the Regional Director is authorized to issue regulations to limit this practice to the maximum extent practicable. It is the Council's policy that the pollock harvest shall be utilized to the maximum extent possible for human consumption.

The pollock TAC shall be divided into two allowances: roe-bearing and non roe-bearing. Each allowance will be available for harvest during the times specified in the regulations. The proportion of the annual pollock TAC assigned to each allowance wall be determined annually during the groundfish specifications process. Proposed and final notices of the seasonal allowances of the pollock TAC will be published in the Federal Register with the proposed and final groundfish specifications.

The following factors will be considered when setting seasonal allowances of the pollock TAC:

(1) estimated monthly pollock catch and effort in prior years;

(2) expected changes in harvesting and processing capacity and associated pollock catch;

(3) current estimates of and expected changes in pollock biomass and stock conditions; conditions of marine mammal stocks, and biomass and stock conditions of species taken as bycatch in directed pollock fisheries;

(4) potential impacts of expected seasonal fishing for pollock on pollock stocks, marine mammals, and stocks of species taken as bycatch in directed pollock fisheries;

(5) the need to obtain fishery-related data during all or part of the fishing year;

(6) effects on operating costs and gross revenues;

(7) the need to spread fishing effort over the year, minimize gear conflicts, and allow participation by various elements of the groundfish fleet and other fisheries;

(8) potential allocative effects among users and indirect effects on coastal communities; and

(9) other biological and socioeconomic information that affects the consistency of seasonal pollock harvests with the goals and objectives of the FMP.

TABLE 1.1 Catch and exvessel value in the domestic (DAP) fisheries off Alaska by area, species, and year, 1984-1989.

| | Catch (mt) | | | Value /1 ($millions) | | |
|---|---|---|---|---|---|---|
| | GULF OF ALASKA | BERING SEA/ ALEUTIANS | ALL ALASKA /2 | GULF OF ALASKA | BERING SEA/ ALEUTIANS | ALL ALASKA /2 |
| ALL GROUNDFISH /3 | | | | | | |
| 1984 | 14,779 | 43,378 | 63,157 | 8.9 | 18.8 | 27.6 |
| 1985 | 33,177 | 81,481 | 114,658 | 21.0 | 22.7 | 43.7 |
| 1986 | 60,964 | 106,013 | 167,687 | 37.4 | 27.7 | 65.3 |
| 1987 | 111,399 | 295,892 | 407,333 | 67.4 | 72.9 | 140.4 |
| 1988 | 139,420 | 650,133 | 789,615 | 98.3 | 138.5 | 236.9 |
| 1989 | 166,829 | 1,135,844 | 1,302,807 | 97.5 | 230.1 | 327.6 |
| POLLOCK | | | | | | |
| 1984 | 1,037 | 7,313 | 8,350 | 0.1 | 1.3 | 1.4 |
| 1985 | 15,379 | 30,755 | 46,134 | 2.7 | 3.6 | 6.3 |
| 1986 | 21,328 | 57,904 | 79,808 | 2.3 | 10.0 | 12.3 |
| 1987 | 39,871 | 215,470 | 255,342 | 6.9 | 35.3 | 42.2 |
| 1988 | 53,694 | 516,560 | 570,254 | 8.8 | 86.5 | 95.2 |
| 1989 | 66,585 | 952,285 | 1,018,963 | 11.9 | 165.9 | 177.8 |
| SABLEFISH | | | | | | |
| 1984 | 8,875 | 1,055 | 9,930 | 6.6 | 0.4 | 7.0 |
| 1985 | 11,366 | 3,375 | 14,741 | 15.6 | 3.7 | 19.4 |
| 1986 | 21,684 | 6,013 | 27,770 | 28.2 | 6.6 | 34.9 |
| 1987 | 26,349 | 7,784 | 34,134 | 39.2 | 9.8 | 49.1 |
| 1988 | 30,979 | 6,584 | 37,609 | 65.4 | 13.1 | 78.6 |
| 1989 | 29,577 | 4,369 | 33,946 | 55.2 | 7.2 | 62.4 |
| PACIFIC COD | | | | | | |
| 1984 | 3,231 | 38,658 | 41,889 | 1.0 | 16.7 | 17.6 |
| 1985 | 2,954 | 45,823 | 48,777 | 0.8 | 14.8 | 15.6 |
| 1986 | 8,045 | 34,235 | 42,334 | 2.4 | 8.5 | 10.9 |
| 1987 | 29,454 | 44,708 | 74,192 | 12.0 | 17.0 | 29.0 |
| 1988 | 30,622 | 86,733 | 117,358 | 10.6 | 25.5 | 36.1 |
| 1989 | 41,491 | 117,391 | 158,882 | 12.8 | 38.3 | 51.1 |
| FLATFISH | | | | | | |
| 1984 | 432 | 23 | 455 | 0.2 | 0.0 | 0.2 |
| 1985 | 461 | 81 | 543 | 0.1 | 0.1 | 0.2 |
| 1986 | 1,519 | 6,565 | 8,084 | 0.5 | 2.2 | 2.6 |
| 1987 | 2,633 | 15,855 | 18,518 | 0.7 | 6.2 | 6.8 |
| 1988 | 5,258 | 35,536 | 40,796 | 1.6 | 11.9 | 13.4 |
| 1989 | 5,163 | 36,441 | 41,604 | 1.1 | 10.5 | 11.7 |
| ROCKFISH | | | | | | |
| 1984 | 1,058 | 1,328 | 2,386 | 0.9 | 0.4 | 1.3 |
| 1985 | 2,706 | 950 | 3,655 | 1.5 | 0.3 | 1.8 |
| 1986 | 7,881 | 1,052 | 8,939 | 3.7 | 0.4 | 4.1 |
| 1987 | 12,749 | 10,991 | 23,747 | 8.3 | 4.3 | 12.6 |
| 1988 | 18,293 | 2,640 | 20,943 | 11.5 | 0.9 | 12.4 |
| 1989 | 23,387 | 7,136 | 30,523 | 16.2 | 1.9 | 18.1 |
| ATKA MACKEREL | | | | | | |
| 1984 | 31 | 0 | 31 | 0.0 | 0.0 | 0.0 |
| 186 | 0 | 4 | 4 | 0.0 | 0.0 | 0.0 |
| 1987 | 0 | 124 | 124 | 0.0 | 0.1 | 0.1 |
| 1988 | 68 | 1,947 | 2,014 | 0.0 | 0.5 | 0.5 |
| 1989 | 176 | 17,831 | 18,007 | 0.0 | 6.2 | 6.3 |

Source: PacFIN management data base, extracted 3/7/90.

1/ Values do not include the value added by at-sea processing.
2/ Totals for all of Alaska may include landings for which the region of catch is not specified.
3/ Totals for all grounfish include landings of species/groups not reproted individually.

Table 1.2 Numbers of fishing vessels participating in the domestic groundfish fishery off Alaska, 1989.

Numbers of catcher-boats

| | GOA | BSAI | EEZ | All Alaska |
|---|---|---|---|---|
| All fisheries | 1,095 | 95 | 1,139 | 1,486 |
| All trawl fisheries | 97 | 58 | 134 | 139 |
| All trawl fisheries with pollock | 49 | 28 | 71 | 74 |

Numbers of catcher/processor and motherships

| | GOA | | BSAI | | EEZ | |
|---|---|---|---|---|---|---|
| | C/P | M | C/P | M | C/P | M |
| All fisheries | 52 | 4 | 74 | 7 | 75 | 7 |
| All trawl fisheries | 31 | 2 | 52 | 5 | 57 | 5 |
| All trawl fisheries with pollock | 17 | 2 | 48 | 5 | 48 | 5 |

EEZ does not include State waters. All Alaska includes the EEZ and State waters.

Source: AFSC catcher/processor-mothership and fish ticket files created February 1990.

Table 2.1 Average monthly proportion of annual pollock harvests by Japan in the Bering Sea/Aleutian Islands for 1971-1980. (Low, L., pers. comm.)

| Month | Percent annual harvest (%) |
|---|---|
| Jan | 2.4 |
| Feb | 3.1 |
| Mar | 5.8 |
| Apr | 7.5 |
| May | 7.8 |
| Jun | 10.7 |
| Jul | 17.2 |
| Aug | 17.7 |
| Sep | 14.9 |
| Oct | 7.0 |
| Nov | 3.8 |
| Dec | 2.2 |
| Total | 100 |

TABLE 2.2a Monthly DAP harvests of walleye pollock in the Bering Sea and Gulf of Alaska, 1986-1989. (PACFIN)

| | 1986 | | 1987 | | 1988 | | 1989 | |
|---|---|---|---|---|---|---|---|---|
| MONTH | (MT) | % | (MT) | % | (MT) | % | (MT) | % |
| JAN | 660 | 0.8 | 10,164 | 4.0 | 35,474 | 6.0 | 76,628 | 7.5 |
| FEB | 7,982 | 10.1 | 14,999 | 5.8 | 27,903 | 4.7 | 96,844 | 9.5 |
| MAR | 6,382 | 8.1 | 12,320 | 4.8 | 40,476 | 6.9 | 120,485 | 11.8 |
| APR | 6,834 | 8.6 | 13,290 | 5.2 | 22,705 | 3.9 | 71,057 | 7.0 |
| MAY | 4,985 | 6.3 | 10,618 | 4.1 | 15,033 | 2.6 | 38,755 | 3.8 |
| JUN | 6,281 | 7.9 | 11,748 | 4.6 | 30,777 | 5.2 | 58,996 | 5.8 |
| JUL | 7,639 | 9.6 | 20,744 | 8.1 | 59,469 | 10.1 | 100,958 | 9.9 |
| AUG | 7,367 | 9.3 | 26,515 | 10.3 | 66,166 | 11.2 | 107,702 | 10.6 |
| SEP | 4,200 | 5.3 | 29,449 | 11.5 | 55,007 | 9.3 | 113,897 | 11.2 |
| OCT | 11,076 | 14.0 | 37,013 | 14.4 | 78,648 | 13.3 | 93,180 | 9.1 |
| NOV | 10,096 | 12.7 | 38,893 | 15.1 | 84,320 | 14.3 | 94,532 | 9.3 |
| DEC | 5,730 | 7.2 | 31,383 | 12.2 | 73,496 | 12.5 | 45,929 | 4.5 |
| | 79,232 | 100 | 257,136 | 100 | 589,474 | 100 | 1,018,963 | 100 |

TABLE 2.2b Monthly JVP harvests of walleye pollock in the Bering Sea and Gulf of Alaska, 1986-1989. (PacFIN)

| | 1986 | | 1987 | | 1988 | | 1989 | |
|---|---|---|---|---|---|---|---|---|
| MONTH | (MT) | % | (MT) | % | (MT) | % | (MT) | % |
| JAN | 836 | 0.1 | 41,791 | 4.0 | 152,838 | 18.5 | 49,773 | 17.6 |
| FEB | 93,347 | 10.4 | 313,149 | 29.7 | 142,006 | 17.1 | 11,843 | 4.2 |
| MAR | 186,311 | 20.8 | 238,030 | 22.6 | 31,850 | 3.8 | 5,194 | 1.8 |
| APR | 103,070 | 11.5 | 213,062 | 20.2 | 139,487 | 16.8 | - | - |
| MAY | 19,154 | 2.1 | 140,067 | 13.3 | 203,951 | 24.6 | - | - |
| JUN | 47,888 | 5.3 | 31,039 | 2.9 | 20,559 | 2.5 | - | - |
| JUL | 149,481 | 16.7 | 11,693 | 1.1 | 2,768 | 0.3 | - | - |
| AUG | 144,424 | 16.1 | 2,768 | 0.3 | 936 | 0.1 | - | - |
| SEP | 78,933 | 8.8 | 32,347 | 3.1 | 83,151 | 10.0 | 86,481 | 30.5 |
| OCT | 49,715 | 5.5 | 30,561 | 2.9 | 32,152 | 3.9 | 88,743 | 31.3 |
| NOV | 17,853 | 2.0 | 149 | 0.0 | 10,627 | 1.3 | 33,661 | 11.9 |
| DEC | 6,682 | 0.7 | 577 | 0.1 | 7,750 | 0.9 | 7,614 | 2.7 |
| | 897,694 | 100 | 1,055,233 | 100 | 828,075 | 100 | 283,309 | 100 |

TABLE 2.2c Total monthly harvests of walleye pollock in the Bering Sea and Gulf of Alaska, 186-1989, (Dap, JVP and TALFF). (PacFIN)

| | 1986 | | 1987 | | 1988 | | 1989 | |
|---|---|---|---|---|---|---|---|---|
| MONTH | (MT) | % | (MT) | % | (MT) | % | (MT) | % |
| JAN | 1,513 | 0.1 | 51,998 | 4.0 | 188,312 | 13.3 | 126,401 | 9.7 |
| FEB | 107,277 | 8.1 | 328,399 | 25.0 | 169,909 | 12.0 | 108,687 | 8.3 |
| MAR | 200,945 | 15.1 | 250,385 | 19.0 | 72,326 | 5.1 | 125,679 | 9.7 |
| APR | 111,120 | 8.4 | 226,368 | 17.2 | 162,192 | 11.4 | 71,057 | 5.5 |
| MAY | 27,608 | 2.1 | 150,711 | 11.5 | 218,984 | 15.4 | 38,755 | 3.0 |
| JUN | 89,780 | 6.8 | 42,850 | 3.3 | 51,336 | 3.6 | 58,996 | 4.5 |
| JUL | 235,725 | 17.7 | 32,535 | 2.5 | 62,237 | 4.4 | 100,958 | 7.8 |
| AUG | 241,596 | 18.2 | 29,763 | 2.3 | 67,102 | 4.7 | 107,702 | 8.3 |
| SEP | 157,279 | 11.8 | 61,872 | 4.7 | 138,158 | 9.7 | 200,378 | 15.4 |
| OCT | 87,371 | 6.6 | 68,596 | 5.2 | 110,800 | 7.8 | 181,923 | 14.0 |
| NOV | 48,224 | 3.6 | 39,996 | 3.0 | 94,947 | 6.7 | 128,193 | 9.8 |
| DEC | 20,931 | 1.6 | 32,493 | 2.5 | 81,246 | 5.7 | 53,543 | 4.1 |
| | 1,329,369 | 100 | 1,315,966 | 100 | 1,417,549 | 100 | 1,302,272 | 100 |

Table 2.3 1989 pollock harvest in DAP and JVP fisheries off Alaska, data by month, in round metric tons.

| | BERING SEA/ALEUTIAN ISLANDS | | | | | GULF OF ALASKA | | | | | ALL AREAS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | DAP | | | JVP | TOTAL BSAI | DAP | | | JVP | TOTAL GOA | GRAND TOTAL |
| Month /1 | At-sea | Shoreside | Total | | | At-sea /2 | Shoreside /2 | Total | | | |
| January | 53,588 | 17,146 | 70,734 | 50,256 | 120,990 | N/A | 3,923 | 3,923 | 0 | 3,923 | 124,913 |
| February | 78,012 | 14,596 | 92,608 | 11,843 | 104,451 | N/A | 11,609 | 11,609 | 0 | 11,609 | 116,060 |
| March | 72,655 | 20,788 | 93,443 | 5,194 | 98,637 | 38,448 /2a | 9,114 | 47,562 | 0 | 47,562 | 146,199 |
| April | 60,760 | 7,712 | 68,472 | 0 | 68,472 | 185 | 30 /2c | 215 | 0 | 215 | 68,687 |
| May | 43,127 | 2,723 | 45,850 | 0 | 45,850 | 69 | N/A | 69 | 0 | 69 | 45,919 |
| June | 44,667 | 15,304 | 59,971 | 0 | 59,971 | 107 | 0 | 107 | 0 | 107 | 60,078 |
| July | 68,935 | 23,751 | 92,686 | 0 | 92,686 | 147 | N/A | 147 | 0 | 147 | 92,833 |
| August | 97,403 | 24,994 | 122,397 | 0 | 122,397 | 77 | N/A | 77 | 0 | 77 | 122,474 |
| September | 72,006 | 28,356 | 100,362 | 86,551 | 186,913 | 47 /2b | 8,638 /2b | 8,685 | 0 | 8,685 | 195,598 |
| October | 69,769 | 18,763 | 88,532 | 89,100 | 177,632 | N/A | N/A | 0 | 0 | 0 | 177,632 |
| November | 86,649 | 25,677 | 112,326 | 34,496 | 146,822 | N/A | N/A | 0 | 0 | 0 | 146,822 |
| December | 59,659 | 13,655 | 73,314 | 10,315 | 83,629 | N/A | N/A | 0 | 0 | 0 | 83,629 |
| | 807,230 | 213,465 | 1,020,695 | 287,755 | 1,308,450 | 39,080 | 33,314 | 72,394 | 0 | 72,394 | 1,380,844 |

1/ All DAP "months" calculated to the Saturday nearest the last day of the calendar month:
end dates: 1/28, 2/25, 4/1, 4/29, 6/3, 7/1, 7/29, 9/2, 9/30, 10/28, 12/2, 12/31.

2/ N/A - not available: fewer that 3 individuals (at-sea) or 4 vessels (shoreside)
(2a) includes Jan, Feb, Mar (most in March)
(2b) includes Sep, Oct, Nov, Dec (most in Sep)
(2c) includes April, May

Sources: DAP At-sea: weekly production/receipt reports, database dated 2/27/90
DAP Shoreside: fish tickets, database dated 2/22/90
JVP: PacFIN report #210 dated 3/8/90

DAP data include discards: JVP data include landed discard

Table 2.4 Approximate quarterly harvests of pollock in the Bering Sea and Gulf of Alaska under three quarterly allowance distributions (assuming a 1990 TAC of 1,380,000 mt in the BSAI and 70,000 mt in the Western/Central GOA).

| | | Bering Sea/Aleutian Islands (assumes 1,380,000 mt TAC) | | Gulf of Alaska (assumes 70,000 mt TAC) | | Total |
|---|---|---|---|---|---|---|
| Scenario | Season | Share | Apportionment | Share | Apportionment | TAC |
| Annual TAC apportioned equally between quarters | Jan-March | 25% | 345,000 | 25% | 17,500 | 362,500 |
| | April-June | 25% | 345,000 | 25% | 17,500 | 362,500 |
| | July-Sept | 25% | 345,000 | 25% | 17,500 | 362,500 |
| | Oct-Dec | 25% | 345,000 | 25% | 17,500 | 362,500 |
| | | | 1,380,000 | | 70,000 | 1,450,000 |
| Annual TAC apportioned as was harvest in 1986-88, BSAI and GOA combined | Jan-March | 33% | 455,400 | 33% | 23,100 | 478,500 |
| | April-June | 27% | 372,600 | 27% | 18,900 | 391,500 |
| | July-Sept | 25% | 345,000 | 25% | 17,500 | 362,500 |
| | Jul-Dec | 15% | 207,000 | 15% | 10,500 | 217,500 |
| | | | 1,380,000 | | 70,000 | 1,450,000 |
| Annual TAC apportioned as was harvest in 1986-88, BSAI and GOA separated | Jan-March | 33% | 455,400 | 40% | 28,000 | 483,400 |
| | April-June | 28% | 386,400 | 2% | 1,400 | 387,800 |
| | July-Sept | 26% | 358,800 | 8% | 5,600 | 364,400 |
| | Oct-Dec | 13% | 179,400 | 50% | 35,000 | 214,400 |
| | | | 1,380,000 | | 70,000 | 1,450,000 |

Note: 1989 quarterly harvest in BSAI: 25% (J-M), 14% (A-J), 32% (J-S), 29% (O-D).
1989 quarterly harvest in GOA: 87% (J-M), <1% (A-J), 11% (J-S), 2% (O-D).
Combined: 28% (J-M), 13% (A-J), 31% (J-S), 28% (O-D).

Table 2.5 Approximate semi-annual harvests of pollock in the Bering Sea and Gulf of Alaska under four semi-annual allowance distributions (assuming a 1990 TAC of 1,380,000 mt in the BSAI and 70,000 mt in Western/Central GOA).

| Scenario | Season | Bering Sea/Aleutian Islands (assumes 1,380,000 mt TAC) Share | Apportionment | Gulf of Alaska (assumes 70,000 mt TAC) Share | Apportionment | Total TAC |
|---|---|---|---|---|---|---|
| Annual TAC apportioned equally between seasons | Jan-Jun | 50% | 690,000 | 50% | 35,000 | 725,000 |
| | Jul-Dec | 50% | 690,000 | 50% | 35,000 | 725,000 |
| | | | 1,380,000 | | 70,000 | 1,450,000 |
| Annual TAC apportioned 40%/60% as in 1988 joint ventures | Jan 15-Apr 15 | 40% | 552,000 | 40% | 28,000 | 580,000 |
| | Apr 16-Dec 31 | 60% | 828,000 | 60% | 42,000 | 870,000 |
| | | | 1,380,000 | | 70,000 | 1,450,000 |
| Annual TAC apportioned as was harvest in 1986-88, BSAI and GOA combined | Jan-Jun | 60% | 828,000 | 60% | 42,000 | 870,000 |
| | Jul-Dec | 40% | 552,000 | 40% | 28,000 | 580,000 |
| | | | 1,380,000 | | 70,000 | 1,450,000 |
| Annual TAC apportioned as was harvest in 1986-88, BSAI and GOA separated | Jan-Jun | 61% | 846,906 | 45% | 31,311 | 878,217 |
| | Jul-Dec | 39% | 533,094 | 55% | 38,689 | 571,783 |
| | | | 1,380,000 | | 70,000 | 1,450,000 |

Note: 1989 Semi-annual harvest in BSAI: 39% (J-J), 61% (J-D).
1989 Semi-semi annual harvest in GOA: 87% (J-J), 13% (J-D).
Combined: 41% (J-J), 59% (J-D).

Table 2.6--Estimated gross wholesale value per metric ton of pollock catch (excluding discards of undersized fish).

| | GOA | BSAI |
|---|---|---|
| H&G operations | $1,021 | $762 |
| Other roe-stripping operations | $ 465 | $464 |
| Other at-sea operations, first part of year | $ 331 | $762 |
| Other at-sea operations, later in the year | - | $587 |
| Shorebased operations, first part of year | $ 440 | $353 |
| Shorebased operations, later in the year | $ 436 | $361 |

These estimates are based on 1989 information provided by the industry.

Table 2.7--Estimated net wholesale value per metric ton of pollock catch.

| | GOA | BSAI |
|---|---|---|
| H&G operations | $213 | $132 |
| Other roe-stripping operations | $370 | $393 |
| Other at-sea operations, first part of year | $166 | $572 |
| Other at-sea operations, later in the year | - | $378 |
| Shorebased operations, first part of year | $114 | $ 96 |
| Shorebased operations, later in the year | $101 | $117 |

These estimates are based on 1989 information provided by the industry. Net wholesale value is defined as wholesale value minus operating costs. The estimates for the shoreside operations account for the operating costs of the catcher-boats.

Table 2.8--Estimated employee days per metric ton of pollock catch.

| | GOA | BSAI |
|---|---|---|
| H&G operations | 0.63 | 0.54 |
| Other roe-stripping operations | 0.30 | 0.30 |
| Other at-sea operations, first part of year | 0.30 | 0.25 |
| Other at-sea operations, later in the year | - | 0.28 |
| Shorebased operations, first part of year | 1.00 | 0.90 |
| Shorebased operations, later in the year | 0.74 | 0.67 |

These estimates are based on 1989 information provided by the industry. The estimates for the shoreside operations include the employment on the catcher-boats.

Table 2.9--Estimated employee costs per metric ton of pollock catch.

| | GOA | BSAI |
|---|---|---|
| H&G operations | $421 | $202 |
| Other roe-stripping operations | $ 33 | $ 24 |
| Other at-sea operations, first part of year | $ 57 | $ 77 |
| Other at-sea operations, later in the year | - | $ 84 |
| Shorebased operations, first part of year | $143 | $114 |
| Shorebased operations, later in the year | $141 | $115 |

These estimates are based 1989 information provided by the industry. The estimates for the shoreside operations include employment costs on the catcher-boats.

Table 2.10--Estimated operating cost per metric ton of pollock catch.

| | GOA | BSAI |
|---|---|---|
| H&G operations | $808 | $630 |
| Other roe-stripping operations | $ 95 | $ 71 |
| Other at-sea operations, first part of year | $165 | $191 |
| Other at-sea operations, later in the year | - | $209 |
| Shorebased operations, first part of year | $506 | $436 |
| Shorebased operations, later in the year | $521 | $430 |

These estimates are based on 1989 information provided by the industry. The estimates for the shoreside operations include the operating costs on the catcher-boats.

Table 2.11--Comparison of estimated total benefits between roe-stripping operations and other uses of pollock in the 1989 domestic (DAP) fisheries.

| | GWV | NWV | EDays | EC | Catch(mt) |
|---|---|---|---|---|---|
| **Gulf of Alaska** | | | | | |
| Actual 1989 fishery | $33.5 | $12.0 | 44.0 | $ 9.7 | 66,600 |
| 1989 fishery with roe-stripping replaced by other uses | $27.3 | $ 8.4 | 50.6 | $ 7.9 | 66,600 |
| Actual first quarter fishery | $29.7 | $11.1 | 37.6 | $ 8.5 | 57,900 |
| First quarter fishery with roe-stripping replaced | $23.3 | $ 7.6 | 44.2 | $ 6.6 | 57,900 |
| Actual first quarter roe-stripping operations | $14.7 | $ 6.2 | 9.2 | $ 4.2 | 20,750 |
| Actual first quarter other uses | $15.0 | $ 4.9 | 28.4 | $ 4.2 | 37,150 |
| **Bering Sea/Aleutian Islands** | | | | | |
| | GWV | NWV | EDays | EC | Catch(mt) |
| Actual 1989 fishery | $567 | $346 | 381 | $91.3 | 1,005,100 |
| 1989 fishery with roe-stripping replaced by other uses | $565 | $349 | 379 | $90.5 | 1,005,100 |
| Actual first quarter fishery | $155 | $101 | 97 | $21.3 | 236,100 |
| First quarter fishery with roe-stripping replaced | $156 | $107 | 97 | $20.3 | 236,100 |
| Actual first quarter roe-stripping operations | $ 18.5 | $ 7.6 | 12.7 | $ 3.5 | 29,700 |
| Actual first quarter other uses | $136 | $94 | 85 | $17.8 | 206,400 |

GWV= Gross Wholesale Value in millions of dollars  
NWV= Net Wholesale Value in millions of dollars  
Days= Employee Days in thousands of days  
EC= Employment Cost in millions of dollars  
Catch(mt)=Catch in metric tons

Table 2.12--Comparison of estimated benefits per metric ton of catch between roe-stripping operations and other uses of pollock in the 1989 domestic (DAP) fisheries.

| | Gulf of Alaska | | | |
|---|---|---|---|---|
| | GWV/mt | NWV/mt | EDays/mt | EC/mt |
| Actual 1989 fishery | $503 | $180 | 0.66 | $146 |
| 1989 fishery with roe-stripping replaced by other uses | $409 | $126 | 0.76 | $119 |
| Actual first quarter fishery | $513 | $192 | 0.65 | $146 |
| First quarter fishery with roe-stripping replaced | $403 | $132 | 0.76 | $114 |
| Actual first quarter roe-stripping operations | $710 | $301 | 0.45 | $204 |
| | Bering Sea/Aleutian Islands | | | |
| | GWV/mt | NWV/mt | EDays/mt | EC/mt |
| Actual 1989 fishery | $564 | $345 | 0.38 | $ 91 |
| 1989 fishery with roe-stripping replaced by other uses | $562 | $347 | 0.38 | $ 90 |
| Actual first quarter fishery | $656 | $430 | 0.41 | $ 90 |
| First quarter fishery with roe-stripping replaced | $661 | $455 | 0.41 | $ 86 |
| Actual first quarter roe-stripping operations | $622 | $255 | 0.43 | $118 |

GWV/mt= Gross Wholesale Value in dollars per metric ton of catch
NWV/mt= Net Wholesale Value in dollars per metric ton of catch
EDay/mt= Employee Days in number of days per metric ton of catch
EC/mt= Employee Cost in dollars per metric ton of catch

Table 2.13 Estimated mean weight-at-age of pollock for each season (in grams).

| Age | Jan - Apr | May - Aug | Sep - Dec |
|---|---|---|---|
| 1 | 17.786 | 60.511 | 100.660 |
| 2 | 128.439 | 214.411 | 273.580 |
| 3 | 294.140 | 388.487 | 455.301 |
| 4 | 460.377 | 542.490 | 611.960 |
| 5 | 601.550 | 664.696 | 734.890 |
| 6 | 711.798 | 756.406 | 826.652 |
| 7 | 794.034 | 823.162 | 893.276 |
| 8 | 853.805 | 870.945 | 940.909 |
| 9 | 896.619 | 904.842 | 974.688 |
| 10 | 927.051 | 928.743 | 998.558 |
| 11 | 948.670 | 945.687 | 1015.407 |
| 12 | 963.859 | 957.619 | 1027.308 |
| 13 | 974.661 | 954.238 | 1023.769 |

Table 2.14--Comparison of estimated total benefits between roe season pollock catch and catch later in the year in the 1989 domestic (DAP) fisheries.

**Gulf of Alaska**

| | GWV | NWV | EDays | EC | Catch(mt) |
|---|---|---|---|---|---|
| Actual 1989 fishery | $33.5 | $12.0 | 44.0 | $ 9.7 | 66,600 |
| 1989 fishery with roe season catch replaced by later catch | $29.0 | $ 6.7 | 49.3 | $ 9.4 | 66,600 |
| Actual roe season catch | $29.7 | $11.1 | 37.6 | $ 8.5 | 57,900 |

**Bering Sea/Aleutian Islands**

| | GWV | NWV | EDays | EC | Catch(mt) |
|---|---|---|---|---|---|
| Actual 1989 fishery | $567 | $346 | 381 | $91 | 1,005,100 |
| 1989 fishery with roe season catch replaced by later catch | $538 | $320 | 371 | $92 | 1,005,100 |
| Actual roe season catch | $155 | $101 | 97 | $21 | 236,100 |

GWV= Gross Wholesale Value in millions of dollars
NWV= Net Wholesale Value in millions of dollars
EDays= Employee Days in thousands of days
EC= Employee Cost in millions of dollars
Catch(mt)= Catch in metric tons

Table 2.15--Comparison of benefits per metric ton of catch between roe season pollock catch and catch later in the year in the 1989 domestic (DAP) fishery.

| | Gulf of Alaska | | | |
|---|---|---|---|---|
| | GWV/mt | NWV/mt | EDays/mt | EC/mt |
| Actual 1989 fishery | $503 | $180 | 0.66 | $146 |
| 1989 fishery with roe season catch replaced | $436 | $101 | 0.74 | $141 |
| Actual roe season catch | $513 | $192 | 0.65 | $146 |
| | **Bering Sea/Aleutian Islands** | | | |
| | GWV/mt | NWV/mt | EDays/mt | EC/mt |
| Actual 1989 fishery | $564 | $345 | 0.38 | $ 91 |
| 1989 fishery with roe season catch replaced | $536 | $319 | 0.37 | $ 91 |
| Actual roe season catch | $656 | $430 | 0.41 | $ 90 |

GWV/mt= Gross Wholesale Value in dollars per metric ton of catch
NWV/mt= Net Wholesale Value in dollars per metric ton of catch
EDays/mt= Employee Days in number of days per metric ton of catch
EC/mt= Employee Cost in dollars per metric ton of catch

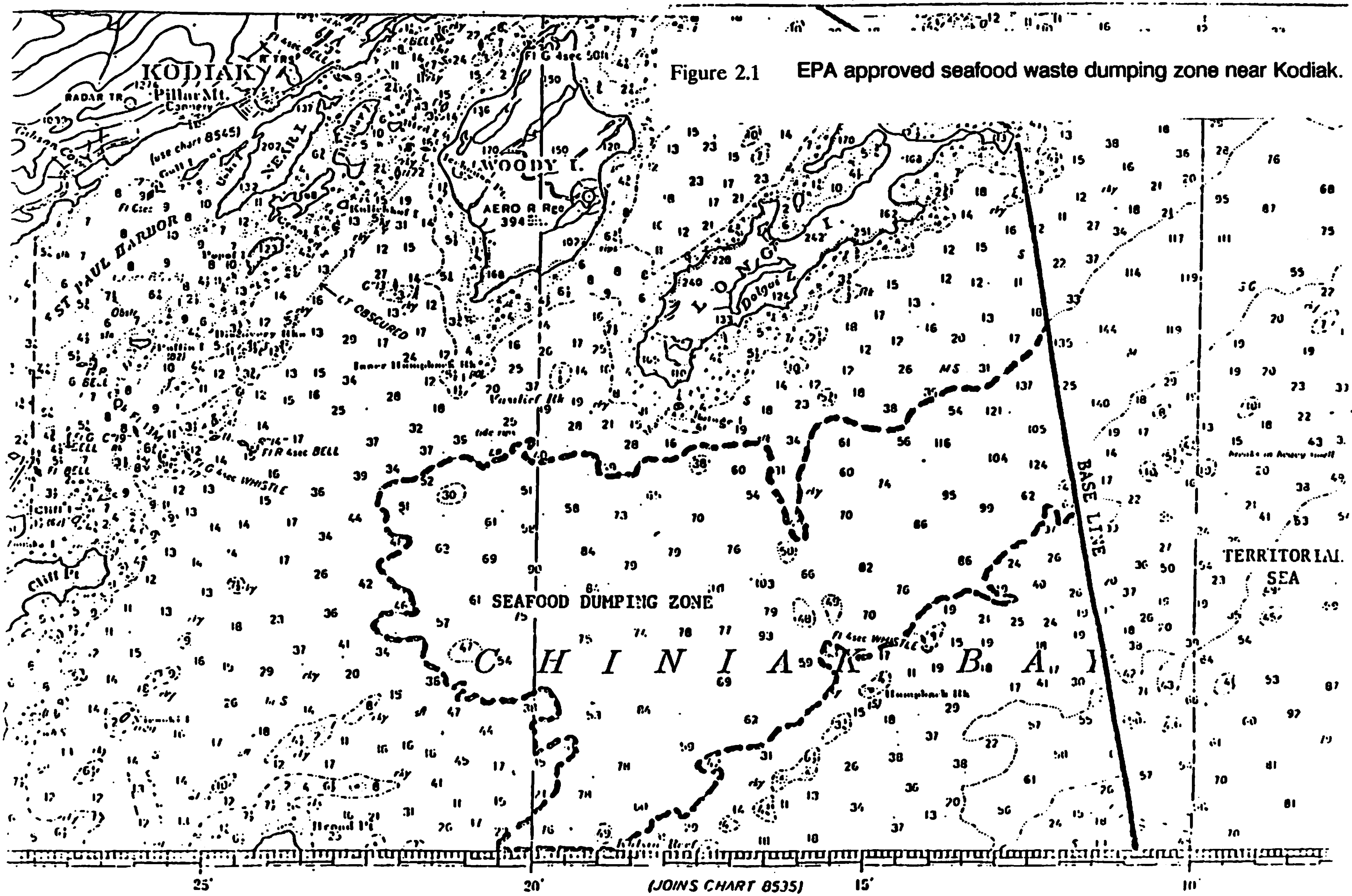



Figure 2.1 EPA approved seafood waste dumping zone near Kodiak.

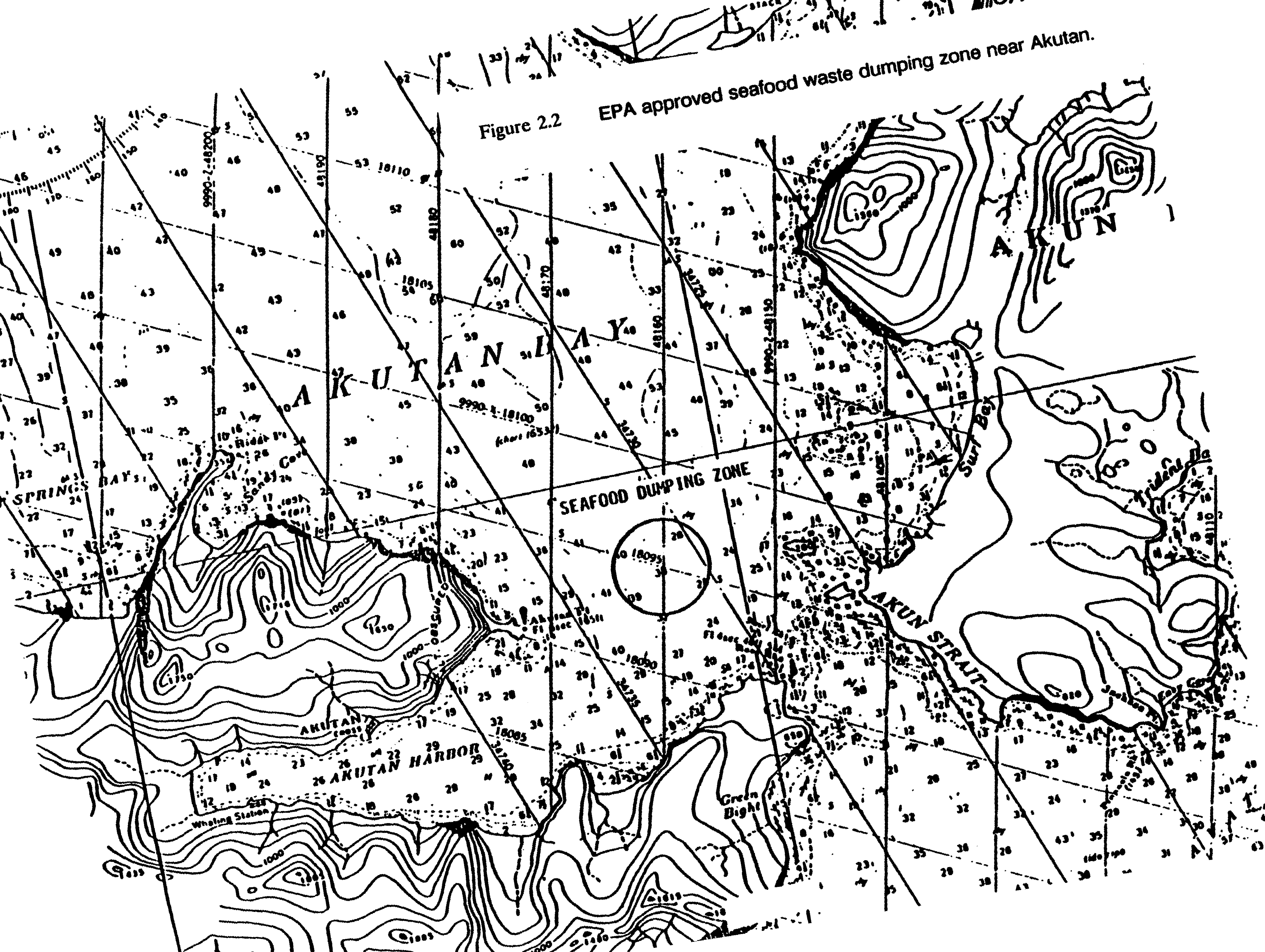



Figure 2.2 EPA approved seafood waste dumping zone near Akutan.

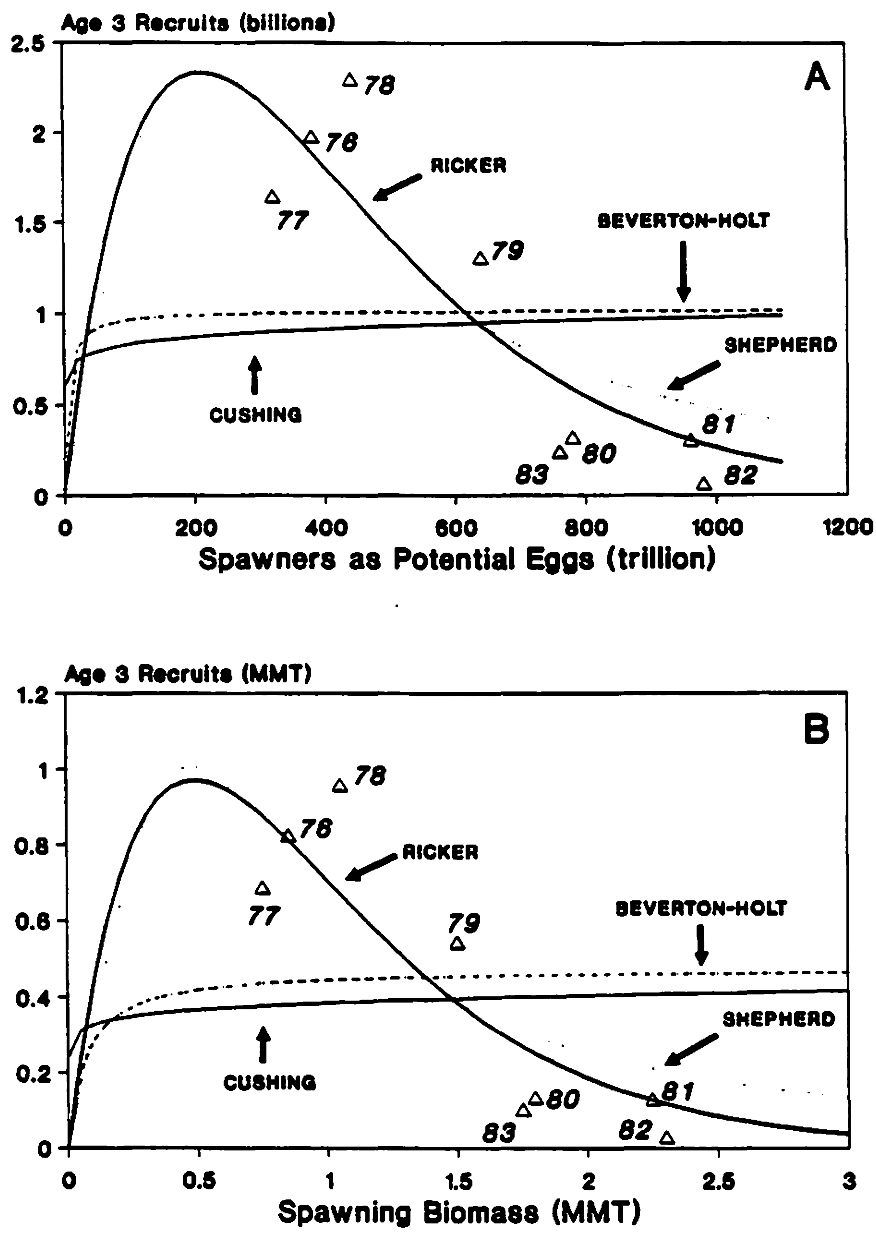



Figure 2.3 Comparison of four spawner-recruit relationships plotted against the raw data for numbers-based and biomass-based analysis. Observed data points are labeled by calendar year.

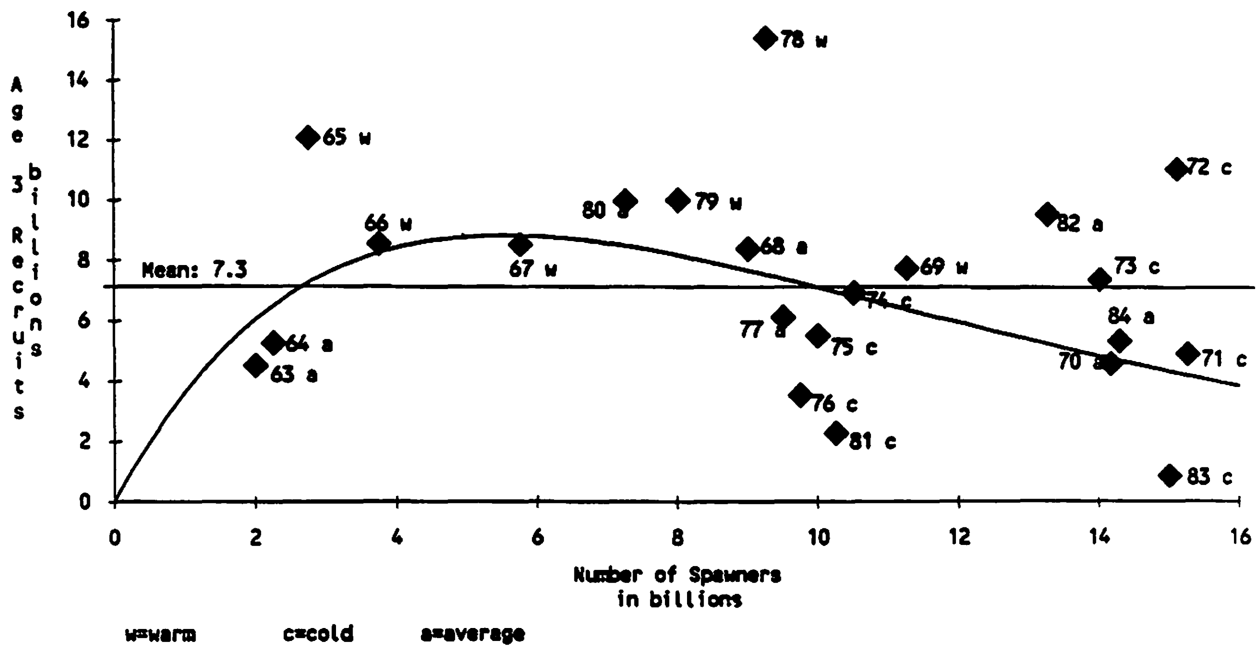



Figure 2.4 Eastern Bering Sea pollock spawner-recruit relationship.

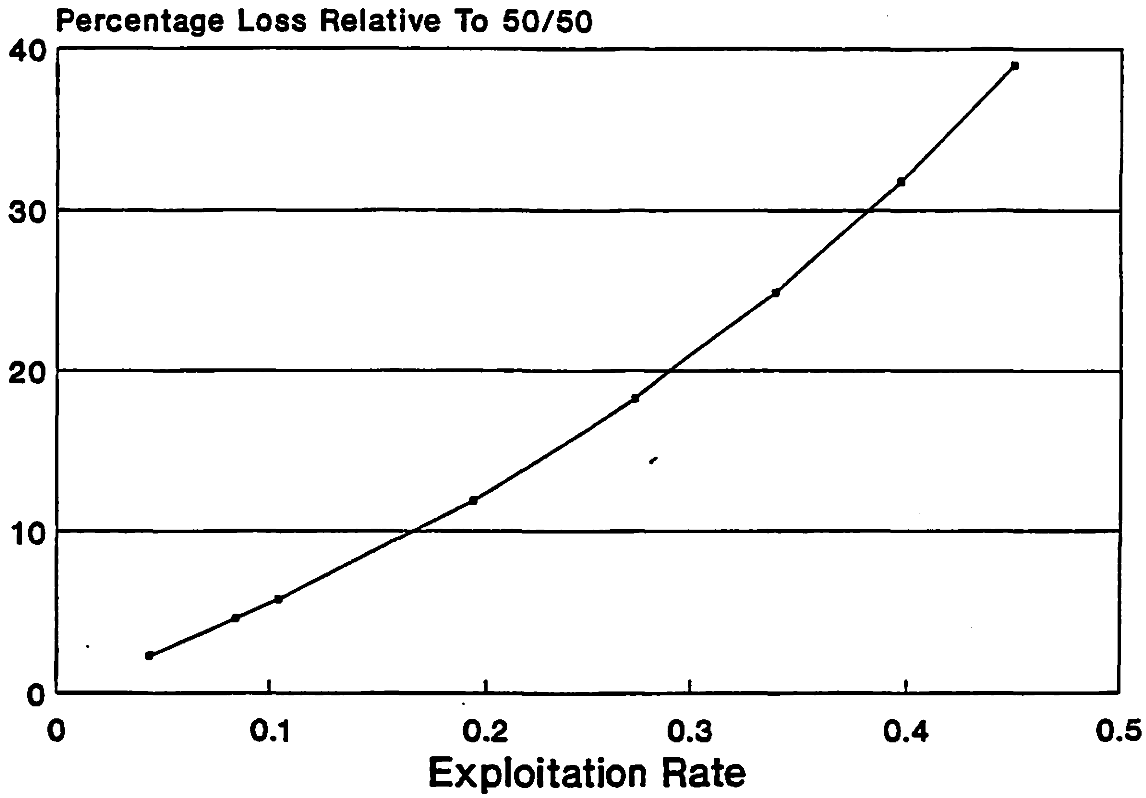
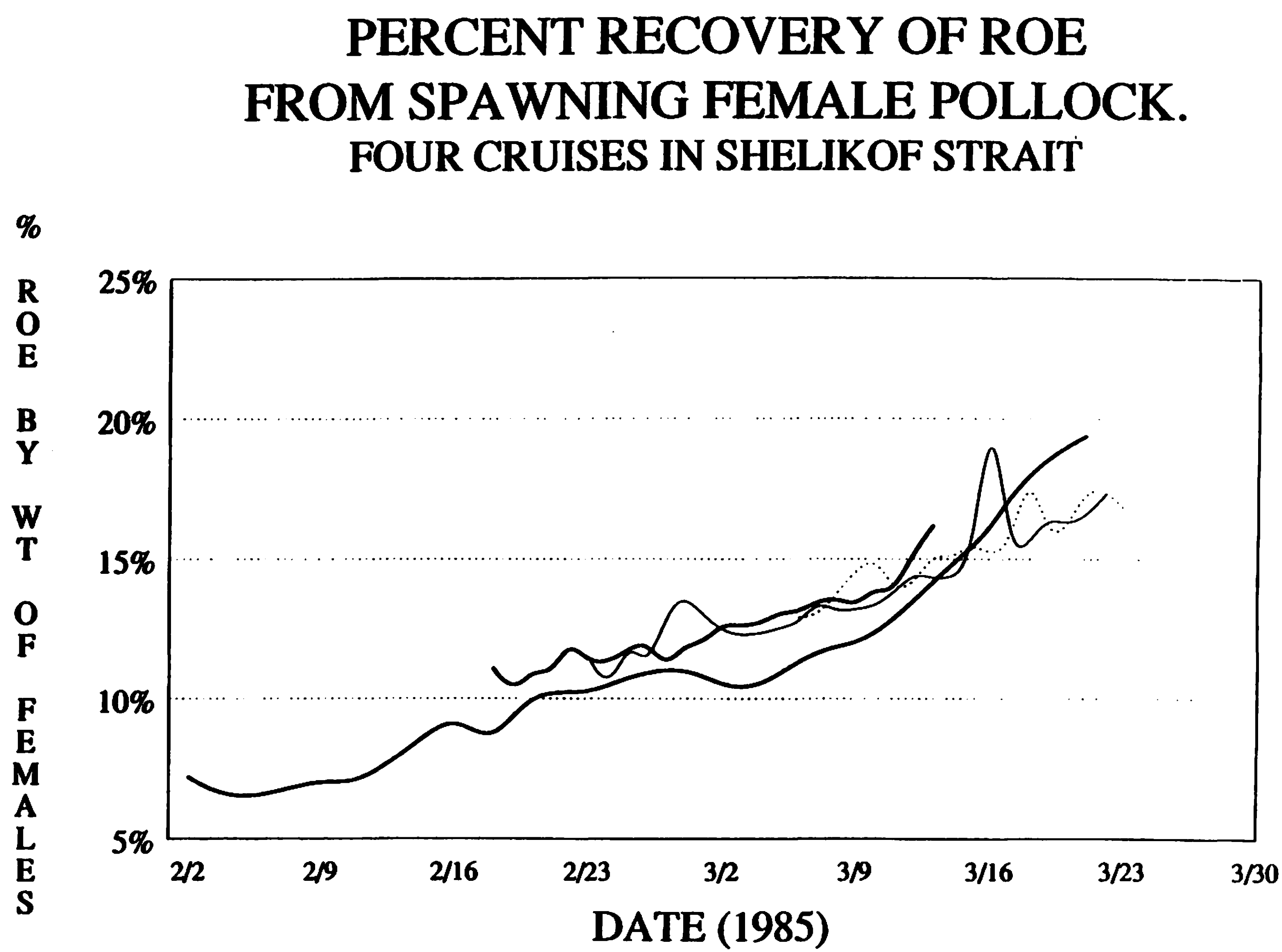



Figure 2.5 --Potential loss in egg production at various exploitation rates when 100% of the catch is assumed to consist of females, versus a 50/50 sex ratio in the catch.




Source: 1985 Foreign Observer Program
NOAA Fisheries, unpublished report.

Figure 2.6 Percent Recovery of Roe.

**Appendix I**

*THE EFFECTS OF DENSITY DEPENDENCE*

Staff of the
Alaska Department of Fish and Game
and Alaska Fisheries Science Center

Reports from the fishery indicate that pollock segregate by sex prior to spawning and that it is possible to harvest females almost exclusively. Selective removals of males or females will change the population sex ratio and may in turn affect the spawner-recruit relationship if spawners are measured in terms of the total spawning population (males and females combined). A preliminary examination of this can be made using the Bering Sea relationship as an example. This relationship is based on the total spawning population, at an assumed sex ratio of 1:1. It was assumed that the spawner-recruit relationship follows the Ricker model (Ricker 1954, 1975), which can be written

$$R = aSe^{-bS}$$

where R is the number of 3-year-old recruits in year t+3, S is the number of spawners in year t, a is a constant indicating the expected number of recruits per spawner in the absence of density dependent effects, and b is a constant incorporating the effects of two factors: the number of spawn produced by the spawners, and the number of spawners themselves. The term $e^{-bS}$ as a whole represents the reduction in recruits per spawner due to density dependent factors.

There are two extreme characterizations of density dependence: variation in the number of future recruits may depend only on the present number of spawners, or density dependence may be independent of present spawners and depend solely on the number of spawn produced. If one assumes that the number of males is not a limiting factor on spawn production (i.e., that all females are bred), then there are two models for the effects of sex ratio on spawner-recruit curves that correspond to the two extremes listed above.

The Ricker equation was modified by incorporating the proportion (p) of females in the population as follows:

$$R = 2apSe^{-2bpS}$$

This model corresponds to density dependence entirely from the number of spawn produced. In other words, density dependence is due to competition for food or interspecific predation pressure on eggs and larvae, rather than interactions with adult spawners. The relationship was calculated for p values of 1/3, 1/2 and 2/3, as shown in Figure 1a. This figure is scaled so that recruitment is shown relative to the recruitment-maximizing stock size when p = 1/2. Note that the effect of changing p is simply to contract or expand the horizontal axis. This is because the stock is being measured in terms of the total spawning population. If the horizontal axis measured only females, the curves would not change.

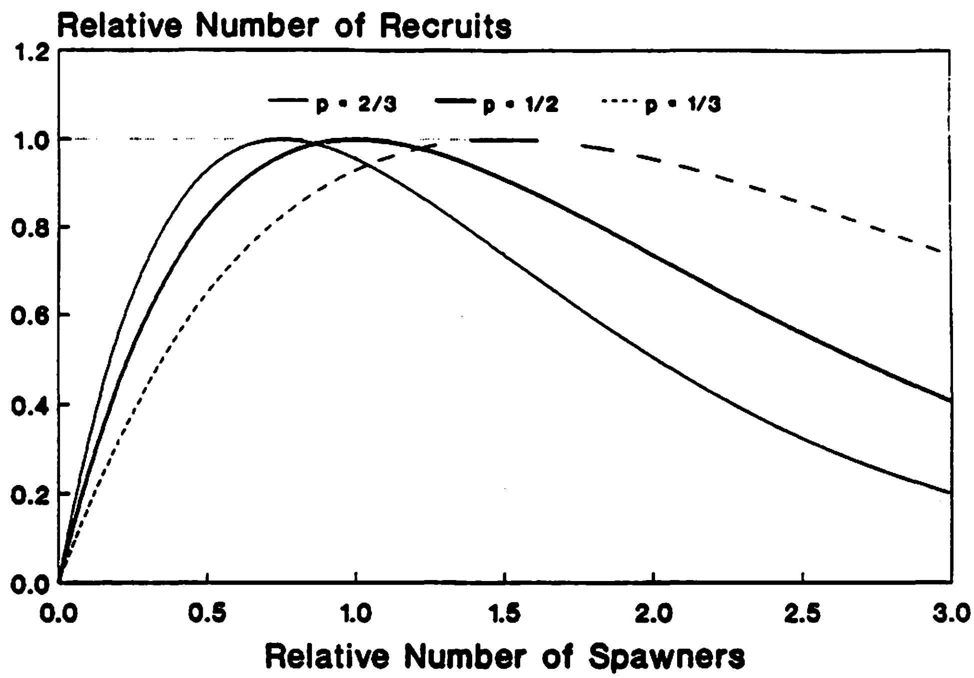
The other extreme model modifies the Ricker equation as follows:

$$R = 2apSe^{-2bS}$$

The difference between this model and the previous one is that p is left out of the exponent. It corresponds to a case in which density dependence is due only to the number of spawners through a mechanism such as cannibalism. The behavior of this model is shown in Figure 1b for the same values of p used in Figure 1a. Note that in this case, the effect of changing p is to contract or expand the vertical axis. Here, recruitment changes proportionally to p. In reality, density dependence in pollock population dynamics is likely a complex combination of both extremes described above.

## Appendix I

a. R = 2apS[exp(-2bpS)]




b. R = 2apS[exp(-2bS)]

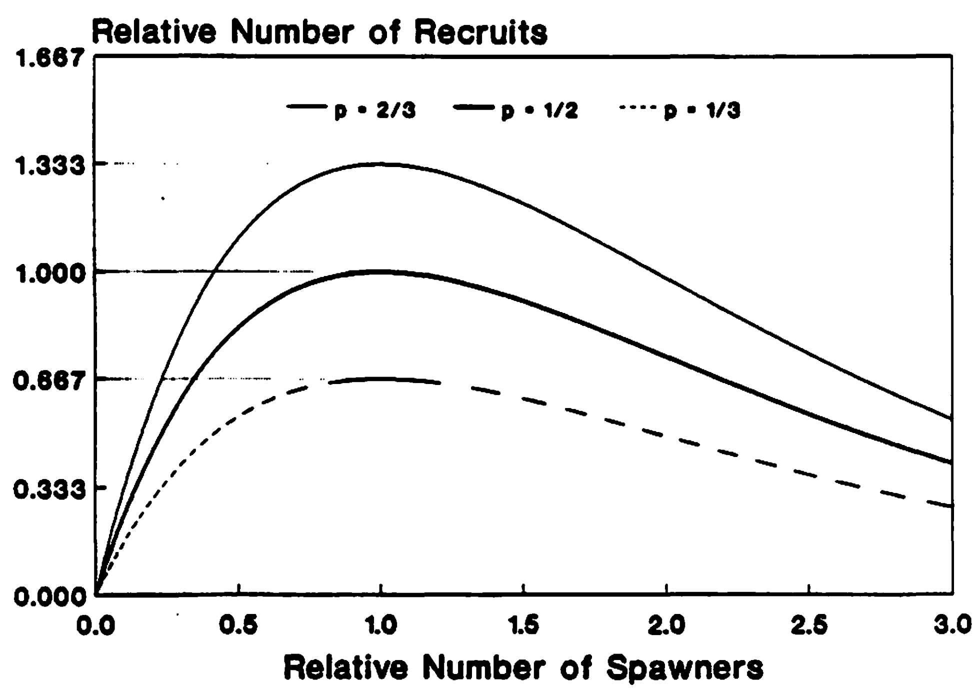



Figure 1 **Scaled spawner-recruit relationships under differnt proportions of females in the stock (p).**

## Appendix II

### SOME POSSIBLE EFFECTS OF INCREASED EARLY-SEASON EFFORT ON EQUILIBRIUM CATCH AND STOCK SIZE

Most fishery models assume that fishing effort is distributed evenly over the course of the harvest year. In practice, however, fishing effort is often concentrated during the early months. Some possible effects of such a pattern of effort distribution can be examined by means of a simple model which employs the following assumptions:

(A) Recruitment occurs instantaneously at the start of the harvest year.
(B) With the exception of the recruitment event, stock dynamics are continuous, with a constant natural mortality rate.
(C) The stock is managed on the basis of a fixed annual survival rate, applied to stock numbers.
(D) Two management options exist regarding the distribution of fishing effort: (a) effort is distributed uniformly over the harvest year, and (b) effort is distributed uniformly within a time period of length p ($0<p<1$) that begins at the start of the harvest year.
(E) Spawning takes place annually at time q, where q is expressed as a fraction of the harvest year.
(F) Recruitment is governed by the Cushing stock-recruitment relationship, with spawning stock measured in terms of numbers.

### Management Option (a)

Under Assumptions (A) and (B) and Management Option (a), equilibrium recruitment (R) can be described by the following equation:

$$R = N_0(1-e^{-F-M}), \tag{1}$$

where $N_0$ = equilibrium stock size at time 0 (the start of the harvest year), F = instantaneous rate of fishing mortality under Management Option (a), and M = instantaneous rate of natural mortality.

However, by Assumption (F), equilibrium recruitment must also conform to

$$R = aN_q^b, \tag{2}$$

where a and b are parameters ($0<b<1$) and $N_q$ = equilibrium stock size at the time of spawning.

Equilibrium spawning stock size can in turn be written as

$$N_q = N_0 e^{-(F+M)q} \, . \tag{3}$$

Substituting Equation (3) into Equation (2) and solving the resulting expression simultaneously with Equation (1) gives the following expression for equilibrium stock size at the start of the year:

$$N_0 = \left[ \frac{ae^{-(F+M)qb}}{1-e^{-F-M}} \right]^{\frac{1}{1-b}} . \tag{4}$$

Equilibrium catch (in numbers) can be estimated from Equation (4) by using Baranov's catch equation.

Management Option (b)

Note that Assumptions (D) and (E) allow the concentrated fishing season under Management Option (b) to end either before or after the time of spawning; that is, p can be greater than q (Case I) or less than q (Case II). The equations describing equilibrium catch and stock size will in general depend on which case is being considered. An exception to this is Baranov's catch equation, which, because it does not involve q, is modified in a way that does not depend on whether Case I or II is being considered. Because of Assumption (C), the fishing mortality rate under Management Option (b) is always F/p, and Baranov's catch equation is modified to read

$$\hat{C} = \frac{\hat{N}_0 (F/p)(1-e^{-F-Mp})}{(F/p)+M}, \tag{5}$$

where C = catch (in numbers), and the "^" character is used to designate stock performances under Management Option (b).

<u>Case I: p > q</u>

When p > q under Management Option (b), equilibrium spawning stock size can be written as

$$\hat{N}_q = \hat{N}_0 e^{-[(F/p)+M]q} \, . \tag{6}$$

Equation (6) can be used in the same manner as Equation (3) to derive equilibrium stock size at the start of the year under Management Option (b), giving:

$$\hat{N}_0 = \left[\frac{ae^{-[(F/p)+M]qb}}{1-e^{-F-M}}\right]^{\frac{1}{1-b}}. \tag{7}$$

Conveniently, the ratio between Equations (7) and (4) can be expressed as a simple function of b, F, p, and q:

$$\frac{\hat{N}_0}{N_0} = \exp\left[-q\left[\frac{1-p}{p}\right]F\left[\frac{b}{1-b}\right]\right]. \tag{8}$$

The ratio described by Equation (8) is always less than 1.0, implying that equilibrium stock size (and therefore equilbrium recruitment) under Management Option (b) is always less than under Management Option (a).

The ratio between equilibrium catch under Management Option (b) and equilibrium catch under Management Option (a) is given by

$$\frac{\hat{C}}{C} = \exp\left[-q\left[\frac{1-p}{p}\right]F\left[\frac{b}{1-b}\right]\right]\left[\frac{F+M}{F+Mp}\right]\left[\frac{1-e^{-F-Mp}}{1-e^{-F-M}}\right]. \tag{9}$$

Unlike the ratio of equilibrium stock sizes, the catch ratio described by Equation (9) can be greater than or less than 1.0, depending on the values of the involved parameters. The "breakeven" value of q ($q^*$, the value which sets Equation (9) equal to 1.0) is given by

$$q^* = \frac{1}{F}\left[\frac{1-b}{b}\right]\left[\frac{p}{1-p}\right]\ln\left[\left[\frac{F+M}{F+Mp}\right]\left[\frac{1-e^{-F-Mp}}{1-e^{-F-M}}\right]\right]. \tag{10}$$

<u>Case II: p < q</u>

For the case where p < q, analogues to Equations (6-10) appear as shown below:

$$\hat{N}_q = \hat{N}_0 e^{-F-Mq}, \tag{11}$$

$$\hat{N}_0 = \left[\frac{ae^{-(F+Mq)b}}{1-e^{-F-M}}\right]^{\frac{1}{1-b}}, \tag{12}$$

$$\frac{\hat{N}_0}{N_0} = \exp\left[-(1-q)F\left[\frac{b}{1-b}\right]\right], \tag{13}$$

$$\frac{\hat{C}}{C} = \exp\left[-(1-q)F\left[\frac{b}{1-b}\right]\right]\left[\frac{F+M}{F+Mp}\right]\left[\frac{1-e^{-F-Mp}}{1-e^{-F-M}}\right]. \tag{14}$$

and

$$q^* = 1 - \frac{1}{F}\left[\frac{1-b}{b}\right]\ln\left[\left[\frac{F+M}{F+Mp}\right]\left[\frac{1-e^{-F-Mp}}{1-e^{-F-M}}\right]\right]. \tag{15}$$

Note that Case II Equations (11-15) are equivalent to their Case I counterparts (Equations (6-10), respectively) when q=p. Furthermore, Case I Equations (8) and (9) give the same answers as Case II Equations (13) and (14) if the q value used in the former pair is replaced by a value equal to 1 - q(1-p)/p.

As with Case I Equations (8) and (9), Case II Equations (13) and (14) indicate that equilibrium stock size and recruitment are always reduced under Management Option (b), but that equilibrium catch may be lower or higher than would be observed under Management Option (a). The relative gain under Management Option (b) implied by Equations (9) and (14) is plotted as a function of p in Figure 1 for various levels of F. Whenever the prevailing levels of b, F, M, and q allow Equations (9) and (14) to give values less than 1.0, the relative gain is minimized at p=q. The relative gain at p=q is plotted as a function of b in Figure 2 for various levels of F.

## Figures

1) Relative gain from concentrated harvest. The vertical axis measures the relative catch increase (in numbers) resulting from early-season concentration of fishing effort. Parameter values used to generate this figure were b=0.32, M=0.3, and q=0.25.

2) Relative gain from concentrated harvest at p=q. Parameter values used were b=0.32, M=0.3, and q=0.25.

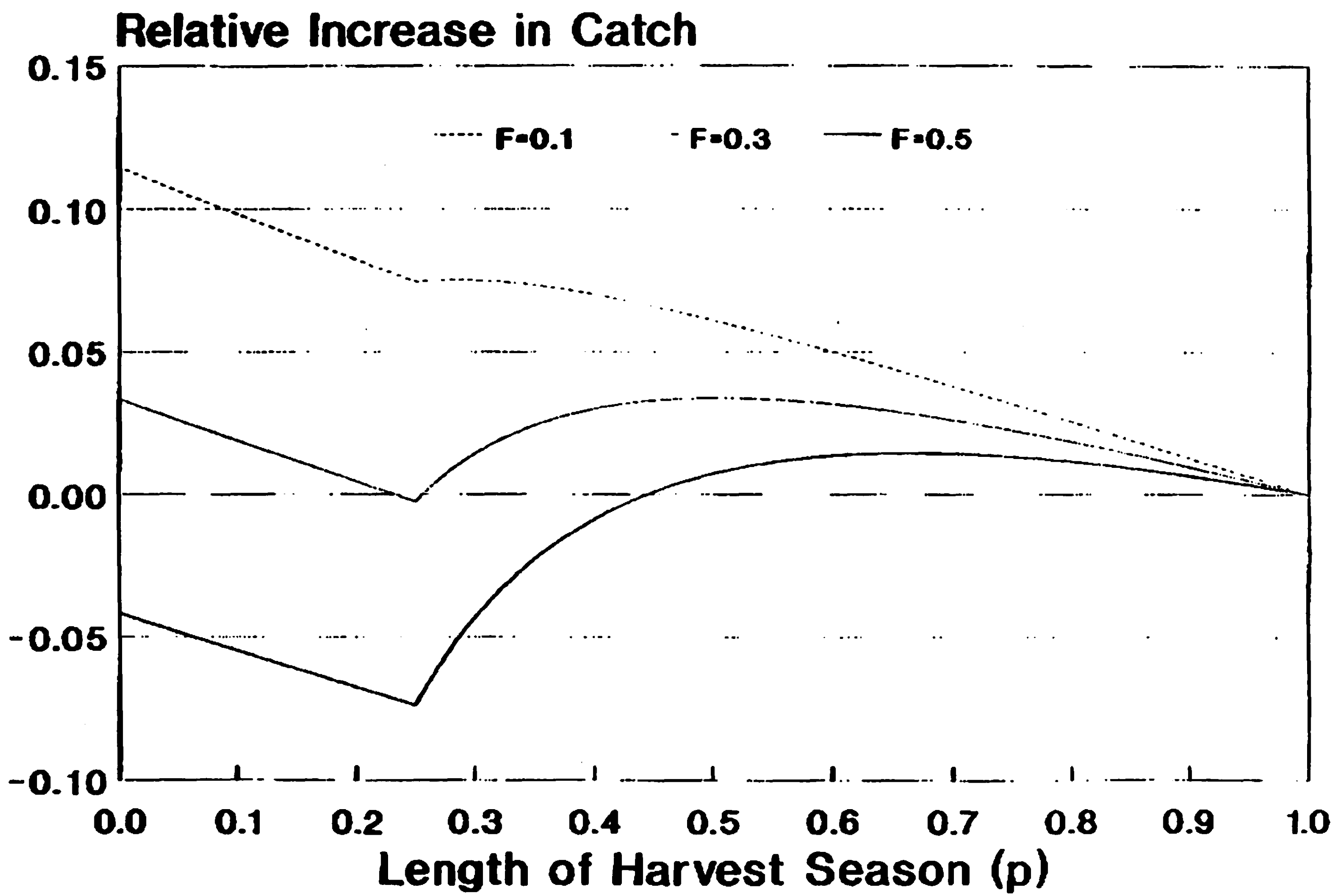
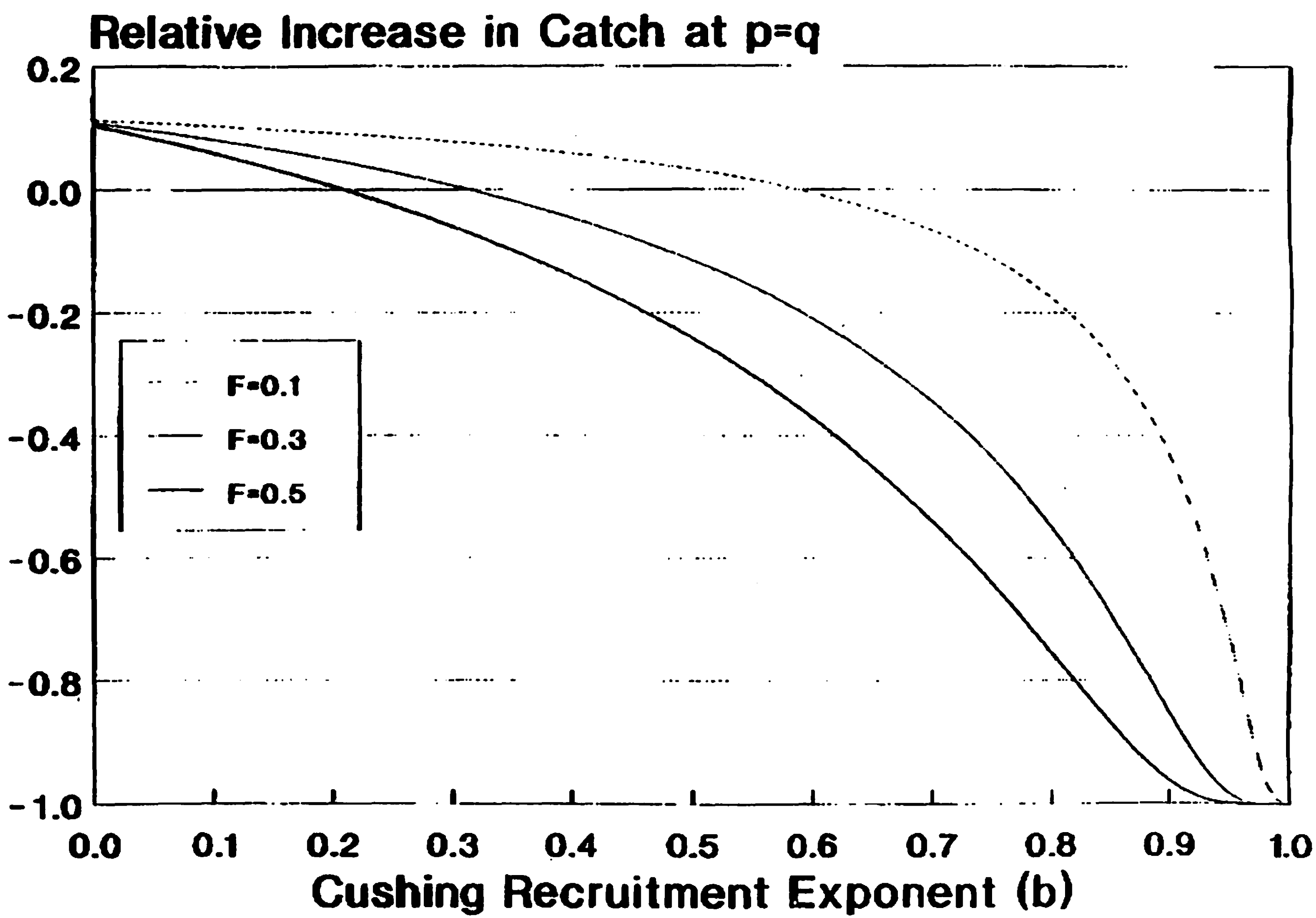



Figure 1.

Appendix II



Relative Increase in Catch at p=q
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
F=0.1
F=0.3
F=0.5
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Cushing Recruitment Exponent (b)


Figure 2.

## Appendix III

### THE RELATIONSHIP BETWEEN SEX RATIOS IN THE CATCH AND IN THE STOCK

When market conditions place a premium on roe, there is an incentive for fishermen to harvest females in a disproportionate fashion. In general, the proportions of females in the catch ($P_C$) and in the stock ($P_S$) would be expected to vary in an inverse manner. For the equilibrium case, the relationship between $P_C$ and $P_S$ can be stated explicitly, given the following assumptions:

(A) Recruitment occurs instantaneously at the start of the harvest year.
(B) All fish above the age of recruitment are fully vulnerable.
(C) With the exception of the recruitment event, stock dynamics are continuous.
(D) Males are harvested at an instantaneous rate $F_M$, and females are harvested at an instantaneous rate $F_F$.
(E) Harvesting occurs continuously throughout the year.
(F) All fish are subject to the same natural mortality rate M.
(G) The sex ratio at the age of recruitment is 1:1.
(H) The age structure of the stock is in equilibrium.
(I) The total (male and female combined) fishing mortality rate $F_T$ is determined by a target survival rate applied to the total recruited stock.

Given Assumptions (A-H), $P_S$ can be computed as follows:

$$P_S = \frac{\dfrac{N_0/2}{1-e^{-M-F_F}}}{\dfrac{N_0/2}{1-e^{-M-F_F}} + \dfrac{N_0/2}{1-e^{-M-F_M}}} = \frac{1-e^{-M-F_M}}{2-e^{-M-F_M}-e^{-M-F_F}}, \qquad (1)$$

where $N_0$ = total number of recruits (male and female).

Equation (1) can be used to derive $P_C$ from the sex-specific exploitation rates as shown below:

$$P_C = \frac{\dfrac{P_S F_F(1-e^{-M-F_F})}{M+F_F}}{\dfrac{P_S F_F(1-e^{-M-F_F})}{M+F_F} + \dfrac{(1-P_S) F_M(1-e^{-M-F_M})}{M+F_M}} = \frac{F_F(M+F_M)}{F_F(M+F_M) + F_M(M+F_F)}. \qquad (2)$$

By Assumption (I), the total survival rate serves as a constraint on $F_M$ and $F_F$, as defined by the following weighted average of sex-specific survival rates:

$$e^{-M-F_T} = P_S e^{-M-F_F} + (1-P_S) e^{-M-F_M}. \tag{3}$$

Rearranging terms gives $F_F$ as a function of the variable $F_M$ and the constant $F_T$:

$$F_F = \ln\left[\frac{1 + e^{-M-F_T} - 2e^{-M-F_M}}{2e^{-M-F_T} - (1+e^{-M-F_T})e^{-M-F_M}}\right] - M. \tag{4}$$

Figure 1 shows $F_F$ as a function of $F_M$ for three values of $F_T$. Note that for high values of $F_T$, extreme values of the sex-specific fishing mortality rates become permissible.

Because $F_F$ can be written as a function of $F_M$ (for given $F_T$), $P_S$ and $P_C$ can also be written as functions of $F_M$ alone by substituting Equation (4) into Equations (1) and (2). Then, for a given value of $F_T$, $P_S$ can be plotted as a function of $P_C$ with $F_M$ implicit, as shown in Figure 2. Note that the tradeoff between $P_S$ and $P_C$ is generally less than 1:1, i.e., an increase in $P_C$ generally does not imply an equal decrease in $P_S$. Also, note that limiting values of $P_S$ and $P_C$ exist for sufficiently high values of $F_T$.

<u>Figures</u>

1) Female fishing mortality rate as a function of male fishing mortality rate for given values of the total fishing mortality rate. The natural mortality rate was set at 0.3.

2) The proportion of females in the stock as a function of the proportion of females in the catch. The dashed curves indicate tradeoffs between the two proportions for given values of the total fishing mortality rate. The solid curves define the universe of possible combinations. The natural mortality rate was set to 0.3.

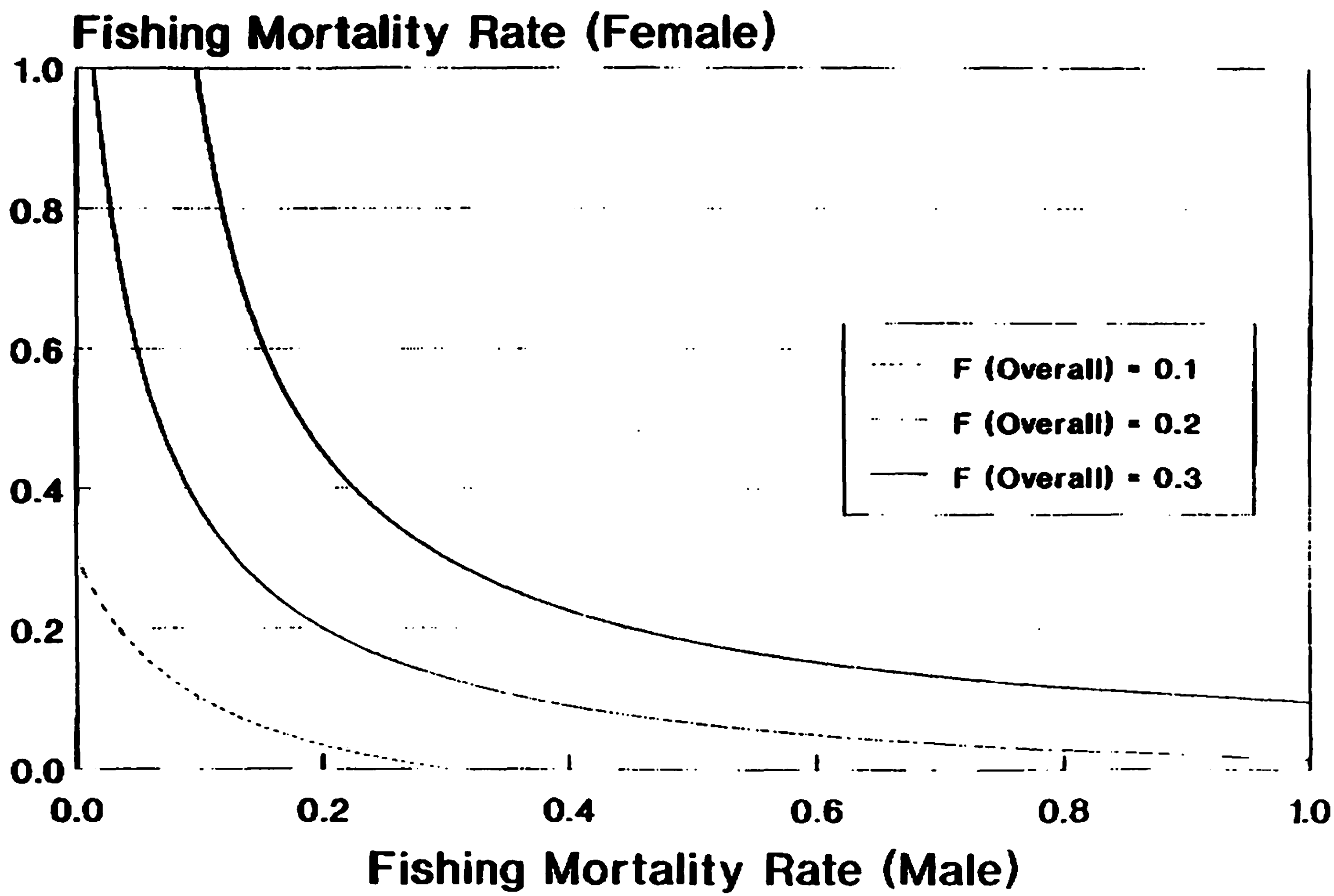
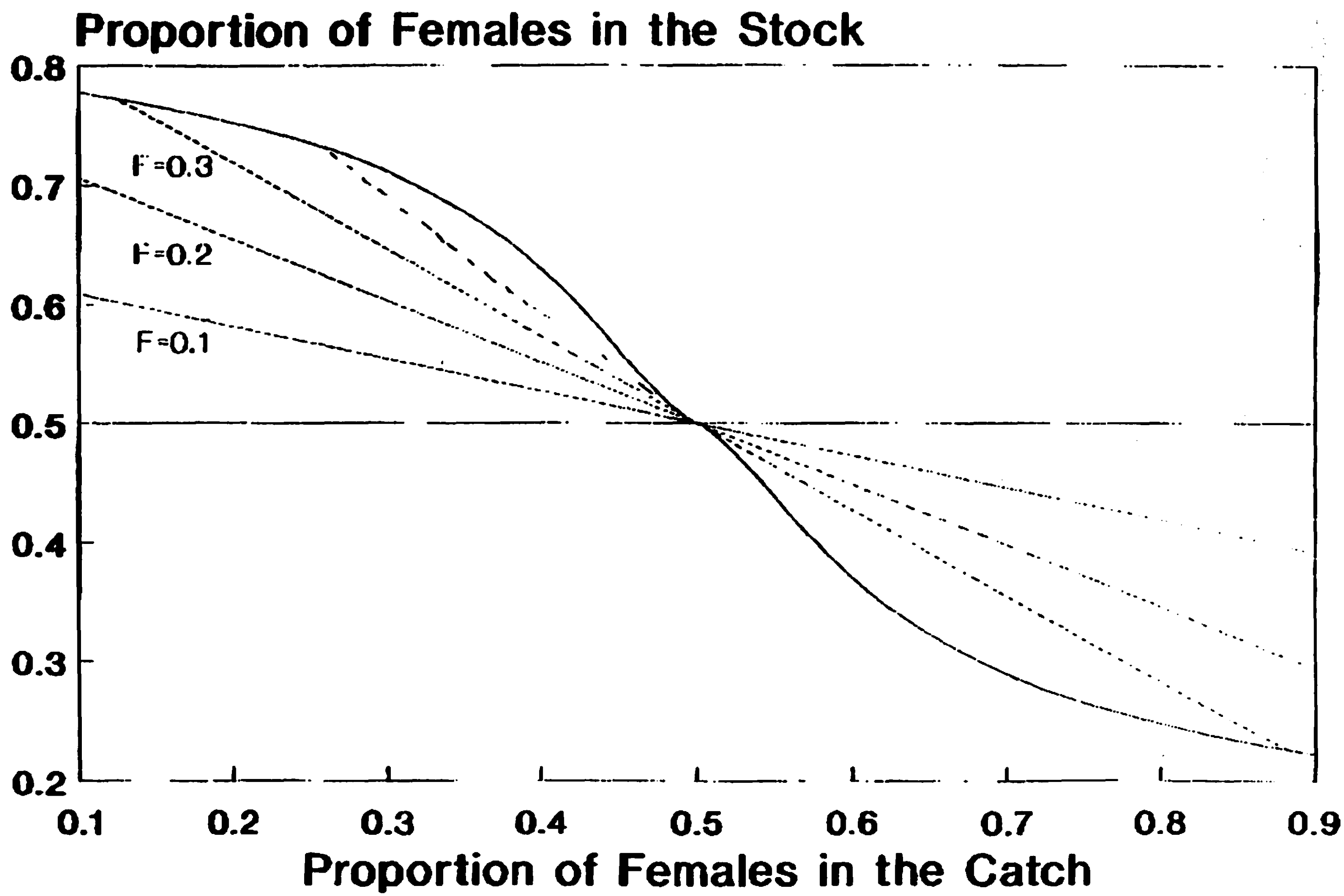

Fishing Mortality Rate (Female)
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.2
0.4
0.6
0.8
1.0
Fishing Mortality Rate (Male)
F (Overall) = 0.1
F (Overall) = 0.2
F (Overall) = 0.3

Figure 1.



Proportion of Females in the Stock
0.8
0.7
0.6
0.5
0.4
0.3
0.2
F=0.3
F=0.2
F=0.1
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Proportion of Females in the Catch


Figure 2.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Washington, D.C. 20230

OFFICE OF THE GENERAL COUNSEL

December 1, 1989

MEMORANDUM FOR: North Pacific Fishery Management Council

FROM: Margaret H. Frailey
Margaret H. Frailey
Assistant General Counsel for Fisheries

Craig R. O'Connor, for
Alaska Regional Attorney

SUBJECT: Limitations on Roe Stripping

## BACKGROUND

Practices that could be labeled "wasteful" occur in many, perhaps in most, marine fisheries. Some of these practices are dictated by the economics of the fishery, such as the discard of unmarketable fish in trawl fisheries. Others are mandated by regulators for management and enforcement reasons, such as the discard of undersized fish or "prohibited species."

Recent events in the groundfish trawl fisheries in the Gulf of Alaska and Bering Sea stimulated discussion by the North Pacific Council of measures that would ban or restrict one "wasteful" practice, that of roe stripping in the pollock fisheries. These fisheries are currently managed through annual quotas with no seasonal breakdowns; trawling proceeds until the quotas are reached. The Fishery Management Plans for Groundfish of the Gulf of Alaska and for Groundfish of the Bering Sea and Aleutian Islands (FMPs) identify no biological problem with allowing all or most of the harvest to occur in the first few months of the year, during the spawning season.

Because pollock roe has a commercial value many times that of any product produced from the flesh of the fish, some at-sea processors have opted to increase the amount of roe they can handle and store by "stripping" roe from female fish while discarding male pollock and female carcasses. The North Pacific Council at its September meeting postponed action on a roe-stripping amendment, but stated clearly its intent to prohibit the practice and to promote fuller utilization of the pollock resource. The Executive Director of the Council requested an opinion on the legal parameters of the issue before the December 5 Council meeting.

## SUMMARY

(1) There is authority under the Magnuson Fishery Conservation and Management Act to limit wasteful practices. Controlling wasteful practices is as legitimate a purpose as conserving a stock of fish or allocating fishing privileges. Requiring fuller utilization of a fishery resource should be justified as a means of achieving optimum yield.

(2) There are a multitude of conservation and management measures, directed at harvesting activities, available to eliminate or restrict practices such as roe stripping. These include seasons, quotas, gear requirements, discard restrictions, and catch limits.

(3) There is also authority under the Act to limit wasteful practices by requiring at-sea processors to retain harvested fish rather than discarding them. At-sea processing is "fishing" subject to regulation under the Act.

(4) There is authority -- though not as clear-cut -- to limit wasteful practices by requiring at-sea processors to utilize fish flesh for food products and fish meal. There have been no instances thus far of directly mandating what a processor does with legally possessed fish for purposes of full utilization.

(5) There is no authority to limit wasteful practices by regulating on-shore processors, because on-shore processors can be regulated only indirectly as an incidence of managing "fishing."

## CAVEAT

This memorandum does not address the adequacy of any record developed by any Council to support any of the management measures discussed. The analysis is completely theoretical; Secretarial approval and legal defense of any measure affecting roe stripping or other fish processing practices would depend on the existence of a record justifying the measure and demonstrating the net benefits to be derived from its implementation.

## DISCUSSION

We will first explore the purposes cognizable under the Magnuson Act for restricting roe stripping and other wasteful practices, and then examine the means authorized by the Act to accomplish such restrictions.

## 1. Acceptable Purposes

### A. Biology

It goes without saying that biological reasons for limiting or banning roe stripping would be valid; they would implement the paramount purpose of the Magnuson Act, to conserve a stock of fish. The first and fourth purposes of the Act, 16 U.S.C. 1801(b)(1) and (4), are to conserve and manage the fishery resources of the United States and to achieve and maintain, on a continuing basis, the optimum yield from each fishery. National standard 1, 16 U.S.C. 1851(a)(1), reiterates the requirement of achieving optimum yield. Fishery management plans (FMPs) must contain measures necessary and appropriate for the conservation and management of the fishery, 16 U.S.C. 1853(a); the definition of "conservation and management", 16 U.S.C. 1802(2), emphasizes the rebuilding, restoration, and maintenance of fishery resources.

If it can be established that harvesting before or during spawning season adversely affects recruitment by breaking up schools of fish before spawning occurs, or by concentrating harvest of the quota on pre-spawning fish, a Council would have adequate rationale to adopt restrictions on the practice.

### B. Economic and Ecological

Likewise, allocation of fishing privileges is a traditional purpose of management measures under the Act. Some of the concern over roe stripping stems from fishermen and shore-based processors whose opportunity to participate in the pollock fishery was curtailed by the rapid harvest of the quota by factory-trawlers early in the year. The need to deal with increasing demand for a shrinking public resource was recognized in the Act as one of the Councils' tasks. This is recognized in national standard 4, 16 U.S.C. 1851(a)(4), which addresses the allocation of fishing privileges, and in the section listing discretionary provisions of FMPs, 16 U.S.C. 1853(b), which includes limits on types of fishing vessels and gear, quotas and catch limits, and systems of limiting access to a fishery.

If it can be established that the net benefits to the Nation would be increased by allocating the opportunity to harvest pollock among the various participants, or by distributing the effort on the annual quota more evenly, a Council would have adequate rationale to adopt measures that would affect roe stripping. A particularly analogous FMP is the Mid-Atlantic Council's surf clam plan, which uses quarterly quotas, controlled hours of fishing, and a moratorium on entry to provide a steady stream of clams to processors throughout the year. Socioeconomic factors such as dependence on employment in processing plants could also enter into the equation.[1] Of course, any allocation would have to meet the criteria of national standards 4 and 5, 16 U.S.C. 1851(a)(4) and (5), for fairness and equity and promotion of conservation.

Another economic/ecological reason for banning discards is that decaying fish might "sour" a particular fishing ground. In 1982 the National Marine Fisheries Service added a condition to the permits of foreign vessels in the Pacific whiting fishery, prohibiting discards of fish and offal (except prohibited species) within 12 miles of shore. Domestic fishermen in Humboldt Bay were complaining not only about the ecological consequences of dumping, but about the time consumed in the nasty job of cleaning refuse from their trawls. The permit condition is still in place.

C. Full Utilization

Because the record developed by NMFS and Council staff before the September meeting of the North Pacific Council apparently did not adequately establish biological, ecological, or economic reasons for roe stripping restrictions,[2] the debate turned to limiting the practice for reasons of "full[er] utilization" or prevention of "wastage."[3] The transcript shows some unease among Council members with this purpose. As mentioned above, wasteful practices are tolerated or mandated in many fisheries under Magnuson Act regulation. Avoidance of waste has not been a commonly expressed purpose for FMP measures. Defining what is

---

1 Pot gear was phased out of the Gulf of Alaska sablefish fishery beginning in 1986 by Amendment 14 to the Groundfish FMP. One justification was the dependence on the fishery of hook and line fishermen and the shore-based processors to whom they delivered. 50 FR 43193, 43196 (Oct. 24, 1985).

2 Statement of Steve Pennoyer, NMFS Alaska Regional Director, at page 3 of transcript of North Pacific Council discussion of Agenda D-3(a), September 28, 1989.

3 One proponent argued, "...I think there's probably a third issue here and that would be a moral issue. Last year during the time this took place the whole industry was in headlines day after day about the thousands of pounds of usable fish that were discarded and thus removed from access to the rest of the public. Fish that any other time of year would have been usable, marketable, and desirable fish but because of seeking only the high valued roe, they were removed from accessibility and there must be some consideration for this and the wisest use of a product." Statement of Council member Ron Hegge at page 17 of transcript of North Pacific Council discussion of Agenda D-3(a), September 29, 1989.

"waste" and what is the unavoidable incidence of rational economic decisions by the fishing industry is a gnarly question.

The Magnuson Act, however, does suggest that prevention of waste is a legitimate goal for fishery management measures. The role of our fishery resources in contributing to the world's food supply is specifically mentioned twice in the "findings" section, 16 U.S.C. 1801(a)(1) and (7), once in general terms and later in terms of developing a fishery for underutilized species. The interests of consumer groups in participating in the Council process are recognized in the "purposes" section, 16 U.S.C. 1801(b)(5). The policy expressed in 16 U.S.C. 1801(c)(3) of promoting efficiency has been interpreted to encompass measures that discourage waste.[4]

The central concept of fishery management under the Act, "optimum yield" (OY), emphasizes food production in considering what amount of fish will provide the greatest overall benefit to the Nation, 16 U.S.C. 1802(13). The national standard guidelines say food production encompasses "the goals of providing seafood to consumers, maintaining an economically viable fishery, and utilizing the capacity of U.S. fishery resources to meet nutritional needs." 50 C.F.R. 602.11(f)(2)(i). Social factors that may be considered in setting OY include "world-wide nutritional needs." 50 C.F.R. 602.11(f) (3)(ii).

The required provisions of FMPs include specification of OY and the conservation and management measures "necessary and appropriate" for achieving OY, 16 U.S.C. 1853(a)(1) and (3). This is the case because all conservation and management measures must be consistent with the national standards, which include the requirement to achieve optimum yield on a continuing basis, 16 U.S.C. 1851(a)(1).

The only textual argument against measures with waste avoidance as their purpose is that FMPs are to contain measures necessary and appropriate for the "conservation and management" of the fishery, but the term "conservation and management" is defined very narrowly in 16 U.S.C. 1802(2):

> The term "conservation and management" refers to all of the rules, regulations, conditions, methods, and other measures (A) which are required to rebuild, restore, or maintain, and which are useful in rebuilding, restoring, or maintaining, any fishery resource and the marine environment; and (B) which are designed to assure that--
> (i) a supply of food and other products may be taken, and that recreational benefits may be obtained, on a continuing basis;

---

[4] General Counsel Opinion No. 80 (1979).

(ii) irreversible or long-term adverse effects on fishery resources and the marine environment are avoided; and
(iii) there will be a multiplicity of options available with respect to future uses of these resources.[5]

Even if one follows the definitional chain from "fishery resources" to "fishery" to "fishing" to broaden the object affected by the described measures, the verbs "rebuild, restore, or maintain" indicate that the first meaning of "fishery" ("(A) one or more stocks of fish...") is the one intended. The purposes for which these measures are to be designed under (B) of the definition all speak to preservation of fishery resources. Therefore the definition of "conservation and management" seems -- at first reading -- limited to measures with biological purposes, those directed at protecting the natural resource.

The definition of "conservation and management" has a peculiar legislative history. It began, almost word for word, as a definition of "conservation" in section 3 of S.961. (The Commerce Committee Report described "conservation" as "interchangeable with the term 'management.' This definition serves to outline several of the goals of the national fishery management program.") There was no direct connection between the term "conservation" and the contents of fishery management plans under section 203(a) of that bill, which directed each Council to submit "recommended management regulations," except for the basket clause in the discretionary provisions section (203(b)(7) of the bill). <u>A Legislative History of the Fishery Conservation and Management Act of 1976</u> at 674, 701, 711-12 (1976). The final legislation required FMPs to contain "conservation and management measures" and revised the definition of "conservation and management" in an apparent

---

[5] This is one of the provisions that was narrowly interpreted in General Counsel Opinion No. 61 (1978), which concluded that the Act did not authorize the Secretary to deny applications for joint-venture permits on the basis that U.S. processors could process the fish. This ruling resulted in the processor-preference amendment, P.L. 95-354. The implication of Opinion No. 61, that "conservation and management" does not encompass consideration of the economic interests of on-shore processors, is inconsistent with Opinion No. 80 and subsequent practice of the agency (see discussion on page 7).

attempt at conformity.[6]

Not since 1978 has the definition of "conservation and management" stood in the way of Secretarial action under the Magnuson Act (see footnote 5). In fact, the definition was broadly construed in General Counsel Opinion No. 80 (1979), which addressed public health and safety measures, to allow any purpose that can be inferred from the Act as the basis for an FMP provision. Strict application of a narrow interpretation of the term would eliminate probably half the FMP measures currently in place. Regulations allocating fishing privileges, setting minimum size limits for the convenience of processors, spreading effort over an entire season, separating mobile from fixed gear, allowing experimental fishing contrary to conservation regimes, permitting the harvest of "prohibited species," forbidding one fisherman from pulling another's traps -- all these and other measures would be suspect as conservation-neutral or even as counter to conservation purposes.

We believe a strict reading of the definition of "conservation and management" is inconsistent with the Act's many expressions of permissible economic and social goals. Optimum yield cannot be achieved if FMPs can address only the restoration or maintenance of stocks of fish. Many purposes of the Act cannot be fulfilled if the Councils and the Secretary are so limited.

---

[6] Another peculiarity about the definition is that it includes measures to "restore...the marine environment," while section 303 restricts conservation and management measures to those "applicable to foreign fishing and fishing by vessels of the United States." The legislative history is clear that threats to the marine environment such as oil spills and navigation could not be regulated under the Act. Councils wishing to control activities harmful to the marine environment and citing the definition of "conservation and management" as authority have been told that Congress gave them no tools to affect activities other than "fishing." Memorandum by Joel MacDonald, August 7, 1979, "Council Authority to Prescribe Conservation and Management Measures Respecting the Marine Environment and Fishery Habitats." Even an activity that literally comes within the definition of "fishing" (anchoring on coral, by which a fishery resource might be "taken") has been excluded from coverage by the Act. Memorandum by Gaylin Soponis (1982?), "Fishery Management Plan for Coral and Coral Reefs of the Gulf of Mexico and South Atlantic." A prohibition in the FMP against anchoring by vessels over a certain length in "habitat areas of particular concern" was disapproved because it would have regulated navigation of vessels not even remotely connected with the fishing industry.

Several examples can be cited of management measures that have waste avoidance as at least one of their purposes:

- The purpose of the Texas closure in the Gulf of Mexico Shrimp FMP was described by a federal district court as "to protect shrimp until they reach a more valuable size and thereby eliminate the wasteful practice of discarding undersized brown shrimp." Louisiana v. Baldridge (sic), 538 F.Supp. 625, 627 (E.D.La. 1982). The court upheld this management measure.

- The Red Drum FMP identified wastage as a problem, citing instances where purse seines overloaded with red drum were held until transfer vessels arrived. If the fish were held too long, they were released intentionally. In at least one case the fish were lost during the transfer due to a torn net. The regulations banned at-sea transfers and added an admonishment (now at 50 C.F.R. 653.22(b)): "A person or vessel must conduct fishing operations in a way that minimizes wastage of red drum."

- The New England Groundfish FMP, for a few months, contained a no-discard rule to prevent the waste of valuable protein. 44 FR 885, 889 (January 3, 1979).[7]

---

[7] The provision was rescinded by Amendment 5, with the following explanation:

> The early stages of groundfish management under the FCMA brought the imposition of low trip limit levels for all the regulated species. Fishing under this restrictive system led to the practice of vessels discarding groundfish in order that they might bring in the largest and most highly valued permitted catch possible. For example, if a vessel had caught all of its trip allocation of codfish but not haddock, any additional codfish caught on subsequent tows might be discarded until the haddock limit was filled out.
>
> The Council attempted to regulate a solution to this problem prohibiting discarding at sea, and establishing weekly trip limits in mid-1978. The intent at this time was to create the incentive to conduct as clean and species specific a fishing operation as possible, and thereby eliminate needless wastage of groundfish. It was envisioned that if wastage could be minimized, the OYs could be increased accordingly. However, experience has shown that generally this is not possible. The common habitat preferences of codfish, haddock, and

o The Tanner crab FMP, no longer in effect, tailored seasons to avoid harvest of molting crabs, which suffered high mortality rates during transport to on-shore processors. The season could be shortened if molting began sooner than anticipated. 44 FR 30688.

o The Secretarial Shark FMP, now being developed, would require landing of the entire shark to eliminate the wasteful practice of "finning."

We conclude that the Act most certainly allows the Councils to adopt, and the Secretary to approve, management measures aimed at avoidance of waste or promotion of fuller utilization of fish. The most defensible approach would be amending the definition of optimum yield, to add an overlay of full utilization to the numbers set for biological and economic reasons.

## 2. Acceptable Management Measures

### A. Quotas

Establishing waste avoidance as a legitimate purpose for an FMP measure is only the beginning. What means may a Council employ to accomplish such a purpose? The North Pacific Council discussed a number of traditional measures, of the sort enumerated in 16 U.S.C. 1853(b), that are undoubtedly available.[8] One approach would set semi-annual or quarterly quotas to limit the amount of pollock that could be taken during the spawning season.[9] Cf. 1853(b)(3). While such quotas would distribute fishing opportunity over the year, they would probably not eliminate roe stripping entirely; the rush to harvest the

---

yellowtail, the restrictive management system imposed under the FCMA, and undoubtedly, the escalating vessel operating costs all have defeated the "no-discard" concept. Therefore, in recognition of this disparity between the intent of the no-discard regulation and the factors that determine the way in which the fishery operates, FMP refinement is necessary.

[8] For each of these suggestions, the Regional Attorney verified their acceptability under the Act. Pages 15-17, 21 of transcript of North Pacific Council discussion of Agenda D-3(a), September 28-29, 1989.

[9] The Council in fact recommended that the Regional Director allocate pollock in the Gulf of Alaska on a quarterly basis in 1990.

allowable periodic quota would still operate during the first quarter or half-year.

### B. Seasons

Another option would simply ban a directed pollock fishery during the spawning season. Cf. 1853(b)(2). While biological or waste-avoidance concerns might argue for a ban, the economic loss of the profitable roe fishery might be difficult to justify. Indeed, timing the fishery to avoid the roe season might itself be considered wasteful, since the value of each female fish harvested is appreciably less without the roe.

### C. Catch limits, etc.

One measure the Council did not discuss, but certainly could consider, would be a per-vessel limit on pollock harvest. Cf. 1853(b)(3). A daily or weekly limit would slow down the harvest, even during spawning season, so that a catcher/processor would have no economic incentive to discard usable flesh. Other undiscussed possibilities include limiting the number of vessels in the fishery (cf. 1853(b)(6)); requiring operable fish-meal equipment to be installed on processing vessels, or prohibiting the use of mechanical roe extractors (cf. 1853(b)(4)); and forbidding processing vessels from operating in the fishery (cf. 1853(b)(4)).

### D. Limits on use of fish

One Council member suggested prohibiting the discard of male fish and roe-stripped females. Several amendments to the motion were offered, specifying that in a directed pollock fishery undersized fish, heads, frames, guts, and "unmarketable flesh, based on industry-wide marketability" could be discarded. Applying a no-discard rule to harvesters raises no legal problems of authority under the Act and has precedents in the New England Groundfish FMP[10] and the yet-to-be-adopted Secretarial Shark FMP.[11] (As another Council member noted, such

---

[10] The regulations made it unlawful for "any person" to "discard, at sea" any groundfish. The definition of "discard" required the retention of any live fish once on board a vessel, or any dead fish that had been caught. Because there was no at-sea processing in the fishery, the regulations in effect imposed a landing requirement on harvesters, but had no application to processors.

[11] The October 20, 1989, draft of the FMP, besides setting commercial quotas and recreational bag limits, requires the landing of carcasses in proportion to the number of fins retained. The discussion of finning focuses on the waste issue,

a rule might present enforcement problems and raise difficult issues as to what constitutes "unmarketable flesh.")

The Regional Attorney proposed a variation on this motion, a ban on harvesting fish that would be used for roe stripping. An analogy for this approach is found in the Northern Anchovy FMP, which created a "formula OY" dependent on size of the spawning biomass. It gives highest priority to the importance of anchovy as forage for marine birds and other fish, and to the live bait fishery, for which no quota is set. The middle priority is for the nonreduction fishery (for dead bait or human consumption), which has a small quota no matter what the biomass size. Lowest priority is the reduction fishery ("fishing for northern anchovies for the purposes of conversion to fish flour, fish meal, fish scrap, fertilizer, fish oil, or other fishery products or byproducts for purposes other than direct human consumption"). Only if the biomass is above a certain level is the reduction fishery allowed. See 50 C.F.R. 662.20.

Back in 1978, when the Northern Anchovy FMP was approved, there was no discussion of the authority to regulate the purposes for which fishing was allowed. (Attention was focused on the novelty of a "formula OY.") The regulations authorize a type of purse seine for use only in the reduction fishery, but contain no direct prohibition on fishing for reduction purposes during a closure of the reduction fishery. Perhaps the practical explanation for this omission is that no one fishing with other gear would harvest amounts useful in a reduction operation. It would nonetheless be a violation of the Magnuson Act for someone to buy or possess for "purposes of conversion" anchovies harvested without a reduction quota in effect. 16 U.S.C. 1857(1)(G)).

Some North Pacific Council members were apparently uncomfortable with restricting fishing "for the purpose of" roe stripping, because the fisherman delivering pollock to a processor would be responsible for a practice over which he had no control. (This would not be a problem, of course, with a catcher/processor.) The Council seemed more interested in the question whether a no-discard rule or a flesh-utilization requirement could be applied

---

although there might be some unstated conservation benefits from the ban (by slowing the harvest by requiring landing or by identifying the species killed from the carcass). The impacts analysis discusses possible economic loss to the fishermen, but projects social benefits from elimination of waste. Again, there is no at-sea processing in the shark fishery. The draft FMP does not specify what may be done with landed carcasses; presumably, they may be discarded.

directly to processors.[12]

FMPs may contain only conservation and management measures "applicable to foreign fishing and fishing by vessels of the United States." 16 U.S.C. 1853(a)(1). "Fishing" is defined at 1802(10)(D) as "any operations at sea in support of, or in preparation for" the harvesting of fish. While the definition of "fishing vessel" at 1801(11)(B) specifically includes "processing" as "any activity relating to fishing," a narrow focus on the "fishing" definition raises an issue of whether at-sea processing is "in support of" the harvesting of fish. If it is not, arguably the Magnuson Act does not authorize the direct regulation of at-sea processing activities.[13]

One answer is that at-sea processing does support harvesting, particularly in the roe-stripping circumstance where discarding carcasses frees the processing crew and equipment to handle more pollock than "full utilization" practices would allow.

Another answer is that the definition of "fishing" should not be read so narrowly. During development of the processor-preference amendment, both the House and Senate bills revised definitions to include at-sea processing as "fishing." As one sponsor explained, "In the end, we decided to leave the FCMA definitions unchanged on this point while, at the same time, making clear the act was intended to benefit the entire fishing industry. I want to emphasize that, even though the final bill does not include the House clarification, it is the understanding of the House that 'fishing' in section 3 of the FCMA

---

[12] It should be noted that this approach would not resolve the allocation issue between factory trawlers and vessels that deliver to on-shore processors. Factory trawlers operating on an undivided annual quota, even though slowed by full-utilization requirements or a no-discard rule, could still harvest the lion's share of the quota early in the season.

[13] Indirect regulation of both at-sea and on-shore processors has long been accepted under the Magnuson Act as a necessary concomitant of the regulation of harvesting activities. Examples are reporting requirements such as those challenged in National Food Processors v. Klutznick, No. 81-1239 (D.C.Cir. June 30, 1981), and access to loading docks for inspection purposes, enforced in Lovgren v. Byrne, 787 F.2d 857 (3rd Cir. 1986). Another indirect regulation currently under litigation is the prohibition against sale in the Atlantic Billfish FMP (National Fisheries Institute v. Mosbacher, No. 88-3103 (D.D.C., filed October 26, 1988)). The purpose of the prohibition is to implement the plan's allocation of billfish to the recreational fishery and to prevent creation of a market for billfish incidentally caught in a commercial fishery.

does include "processing" and that, for that reason, the proposed clarification is unnecessary." 124 Cong. Rec. H8265-66 (August 10, 1978) (statement of Rep. Murphy).

The legislative history of the Act and its amendments manifests no clear intent by Congress whether FMPs may address what processors do with legally harvested fish. We acknowledge there is no exact precedent for the full-utilization proposal.[14] Examples cited in this memorandum--no at-sea transfer of red drum, no discard of New England groundfish or sharks, no sale of Atlantic billfish, no quota for an anchovy reduction fishery--may be characterized as directed at harvesters.[15] Nevertheless, we find no persuasive analytical distinction between measures aimed at harvesting activities and those aimed at processing activities occurring at sea. Instructing a "fishing vessel" to retain or land fish is--practically or conceptually--no different from requiring it to use the fish for some nutritional or other economic purpose.

The risk in mandating particular uses of harvested fish is that a court, in reviewing the statute, its history, and the agency practice in implementing it, may conclude that direct regulation of processors is a new venture, outside the original intent of Congress. A court might discern a limited authority over anyone beyond the harvester, since the Magnuson Act is so elaborately focused on harvesting activities. Even the processor-preference amendment stopped short of requiring harvesters to deliver fish to U.S. processors or interfering in the business arrangements between processors and harvesters.

One statutory objection to the direct regulation of at-sea processors might be the unfairness involved in requiring full utilization of pollock by floating processors, but not by on-shore processors. National standard 4 addresses the fair and equitable allocation of fishing privileges among fishermen, but does not cover treatment of other participants in the fishing industry. This may be an indication that Congress did not intend direct regulation of processors. On the other hand, many management measures affect different users in different ways without running afoul of the Act (see 50 C.F.R. 602.14).

---

[14] This lack of precedent was the source of the Regional Attorney's doubts expressed at the September Council meeting on the validity of direct regulation of processors.

[15] The permit condition on the Pacific whiting fishery, however, tells processors as well as harvesters they may not discard fish within 12 miles of shore. This restriction is not aimed at the method of harvest or any allocation of fishing privileges. Rather, it is directed at an aspect of usage of legally possessed fish.

Persons beyond the fisheries jurisdiction of the United States (foreigners who fish only on the high seas or U.S. citizens who fish only in State waters) may enjoy advantages vis-a-vis those subject to Magnuson Act jurisdiction but fishing on the same stock of fish. The fact the Secretary cannot regulate the former does not mean he should not regulate the latter.

Another objection might be that national standard 5 requires measures "where practicable, [to] promote efficiency in the utilization of fishery resources." From one viewpoint, roe stripping is the most efficient practice imaginable: given the time constraints in a quota-driven fishery, the discard of low-value fish maximizes the vessel's economic return by allowing available labor, equipment, and storage capacity to be devoted to production of the high-value roe. The guidelines for standard 5, however, take a broader view of "efficiency." The Appendix to the guidelines states:

> NOAA believes that, for purposes of standard 5, efficiency can be defined as the ability to produce a desired effect or product [or achieve an objective] with a minimum of effort, costs, or <u>misuse of valuable biological resources.</u> In other words, Councils should choose management measures that achieve the FMP's objectives with minimum cost and burdens on society....NOAA believes that an FMP should not restrict the use of productive and cost-effective techniques of harvesting, processing or marketing, unless such restriction is necessary to achieve the conservation or social objectives of the FMP (emphasis added).

A measure directed at achieving fuller utilization of pollock flesh could be justified either as a restriction on cost-effective processing techniques that is nonetheless required to achieve a conservation or social objective, or as a means of achieving efficient utilization of fishery resources without wasting protein.

Yet another objection is that national standard 7 requires management measures to minimize costs, including costs to the industry of complying with the measures. The guidelines for national standard 7, 50 C.F.R. 602.17(d)(1), state that management measures "should be designed to give fishermen the greatest possible freedom of action in conducting business... that [is] consistent with ensuring wise use of the resources...." Again, this balancing of economic burdens (loss of roe harvest) against social objectives (fuller utilization of protein) is the sort of policy decision the Act mandates the Council to make.

### 3. Conclusion

As long as a measure applies to fishing (including at-sea processing), has a purpose cognizable under the Act, furthers the achievement of optimum yield, and is consistent with the national standards, one can argue it is authorized by 16 U.S.C. 1853. We conclude that we could defend direct regulation of harvesting and at-sea processing (but not on-shore processing) to prevent roe stripping as coming within the purview of the Act. The safer approach, however, is to control roe stripping by traditional harvesting restrictions or by banning discards by vessels at sea. Telling processors how much fish meal and how many fillets they must produce risks a judicial challenge to our statutory authority.

We reiterate the need for a record justifying any limitation on roe stripping.[16] We also note the existence of policy arguments against embarking on the "slippery slope" of regulating the economic decisions of processors.[17] Since the legal and policy questions are not free from doubt, and since the national standard guidelines do not address equity among fishery participants other than fishermen, amendment to the Act to clarify the extent to which processors should be regulated would be welcome.

---

[16] Another caveat: Requirements for utilization of fish must avoid creation of export restrictions that would present problems under the General Agreement on Tariffs and Trade.

[17] Councils concerned about "wastage" or nutritional needs might propose that a certain amount of fish be sold to underdeveloped countries, that salmon be canned instead of marketed fresh, or that recreational fishermen be forced to eat their trophies.

**Appendix V**

INFORMATION FROM THE INDUSTRY

**March 1990**

**ACKNOWLEDGEMENT**

The staff of the North Pacific Fishery Management Council wishes to acknowledge the help and cooperation received from various segments of the industry during this entire project.

Without the willingness of individuals from many companies and the support of industry groups, such as Alaska Factory Trawlers Association and Alaska Groundfish Data Bank, access to data of this level of detail would not have been possible.

## Introduction

At its September 1989 meeting, the North Pacific Fishery Management Council (Council) instructed staff to revise its analysis on the pollock roe-stripping issue for the Gulf of Alaska (GOA) and the Bering Sea/Aleutian Islands (BS/AI). In order to respond to the type of concerns raised by the Council, information provided by the industry concerning the operations involved in the 1989 pollock fisheries was incorporated into the analysis. At its December meeting, the Council examined the revised analysis and some modifications were suggested.

The data provided by the industry was used: (1) to acquire a clearer picture of what happened during the 1989 pollock fisheries; (2) to improve the cost and revenue estimates used in the EA/RIR analysis for floating processors, shoreside processors, and catcher boats delivering to shoreside plants; and (3) to gather information on the range of recovery rates for various product forms under the different operations.

Thirty one companies, operating 52 vessels, were identified as having been involved in the 1989 pollock fishery in either the Bering Sea or the Gulf of Alaska. In addition, shoreside plants, from both regions, that were active in the pollock fisheries provided detailed information. Eight boats delivering to shoreside plants in the GOA also provided the staff with details of their 1989 operations.

## Format

In general, industry provided three types of information: (1) data about the operation's actual activities, with regards to where and when they fished pollock in 1989; (2) details of the operating costs, labor force, and gross returns associated with their pollock fisheries; and (3) information about their operating characteristics and how their operations might be impacted by either a roe-stripping ban or seasonal allocation requirement.

These data were then grouped into categories to reflect the type of processing operation, processing behavior, and area of activity. Catcher processors are considered to be a heterogenous group and were subdivided into head-and-gutted (H&G) operations, vessels that only stripped and an other category. The performance of the two groups were compared to shoreside plants.

Data from the catcher boats delivering to shoreside plants was harder to obtain due to the timing of the analysis and the fact that many of these vessels were out to sea engaged in other fisheries.

This project was initiated in mid-October and the majority of the information was given to the staff by late November. However, data refinement and clarification continued into February of 1990. Upon receipt, the information was entered into a database in order to allow for computational ease of calculating the range and weighted mean of the responses. Some measures of performance could be calculated by more than one method from the variety of data provided. Once the data was summarized and interpreted, contact was again made with industry to ensure that the estimates were reasonable interpretations of their performance.

## Interpretation of the Data

Clearly, the range of responses indicated that there is a fair amount of variability in performances and structures, both within and among the different categories of operations. Therefore, care must be taken in extrapolating from estimates of an average or representative performer to actual impacts on the existing fleet.

However, several companies representing all segments of the industry (catcher/processors, catcher boats, and shoreside plants) did provided detailed information on many facets of their operations and these summarized estimates probably reflect the best available data to use, without invoking confidentiality concerns.

APPENDIX VI

# SUMMARY RESPONSE TO COMMENTS
# on
# DRAFT EA/RIR/IRFA for AMENDMENT 19/14

## Pollock Roe-Stripping and Seasonal Apportionments

Background

The North Pacific Fishery Management Council reviewed a draft pollock roe-stripping and seasonal allowances analysis at their April 1990 meeting and requested further clarification. Council members were invited to submit their comments directly to the analysts for consideration before the June meeting. This short paper responds to those comments to aid the Council in its consideration of the five main alternatives:

1. Status Quo.

2. Prohibit roe-stripping in the pollock fisheries in the Gulf of Alaska and Bering Sea/Aleutian Islands or portions thereof.

3. Require full utilization of all pollock in the pollock fisheries in the Gulf of Alaska and Bering Sea/Aleutian Islands or portions thereof.

4. Implement a seasonal allowance schedule for pollock to place limits on the winter-early spring harvest in the Gulf of Alaska and Bering Sea/Aleutian Islands or portions thereof and perhaps restrict the Gulf pollock trawl fishery to midwater gear.

5. Prohibit roe-stripping and implement a seasonal allowance schedule for pollock in the Gulf of Alaska and Bering Sea/Aleutian Islands or portions thereof (a combination of Alternatives 2 and 4), and perhaps restrict the Gulf pollock trawl fishery to midwater gear.

Alternatives 4 and 5 include the options to: prohibit pollock fishing during the roe season in either the Gulf of Alaska or Bering Sea/Aleutian Islands, establish separate TACs for the roe seasons in both areas, and restrict all Gulf of Alaska pollock trawl fisheries to the use of mid-water gear.

The alternatives are discussed in terms of the seven major impacts considered in the original analysis:

Biological Impacts

1. effects on the ecosystem of discards in roe-stripping operations;

2. effects of fishing on spawning concentrations on pollock stock productivity;

3. effects on sea lion and other marine mammal populations of a large or intensive roe fishery; and

4. effects on the bycatch rates for crab, halibut, herring, salmon, and other species as the result of roe-stripping or a large roe fishery.

Socioeconomic Impacts

5. roe-stripping as a wasteful practice; and

6. effects of fishing on spawning concentrations on the economic productivity of pollock stocks; and

7. effects on both how much pollock is available for onshore processing and when it is available.

This paper clarifies the conclusions of the original draft analysis for the issues on which the public and Council commented. The analysts have had time only to respond to specific comments from Council members, Alaska Groundfish Data Bank, and Greenpeace; however, all comments have been considered. If the Council chooses an alternative other than status quo, there will be opportunity for additional comment during the Secretarial public review period.

Consideration of Four Biological Issues

1. Roe-stripping discards and their impact on the ecosystem.

Seafood processing discard is an environmental concern. Hundreds of thousands of tons of discard result from the processing of pollock and other groundfish fisheries. Substantial discards also result from the non-retention of incidental catch of prohibited species, undersized individuals of commercial species or otherwise undesirable species. Current indications are that the amount and type of processing discharge are not negatively impacting the environment, though there is the possibility that problems may occur in areas of low mixing. The probability of adverse effects would be reduced if EPA requirements were followed, specifically, if all discards were ground into particles less than 0.5 inch.

Alternatives 2, 3, and 5 would reduce or eliminate the amount of discard associated with the pollock fishery. The amount of discard under Alternative 4 may be more or less than under the status quo.

The discard from roe-stripping operations probably does not have significant additional impacts over those caused by discard from fisheries as a whole. However, this may change if roe-stripping increases substantially.

2. Spawning stock fisheries and impacts on stock productivity.

With the exception of waste production, the biological impacts of a roe-stripping operation are similar to any fishing on a spawning stock.

Potentially, a roe harvest could alter the reproductive capacity of the stock by its effect on either spawning success or the sex composition. The effect of fishery removals on future recruitment depends on the relationship between the spawning population and recruits. Without a well-defined stock recruitment relationship and an understanding of all the factors affecting recruitment, the effects cannot be determined.

Another potential impact of concentrating fishing activities on spawning concentrations of pollock is the localized depletion of discrete stocks. There is insufficient information to define localized stock boundaries. There is some evidence, however, to suggest that Gulf of Alaska and Bering Sea pollock are separate stocks, but there is little evidence to distinguish pollock stocks in the Central and Western Gulf. In the 1989 pollock assessment it was noted that pollock in the Shumagin area tended to be larger at age than pollock harvested in the Kodiak and Chirikof areas. While this could be due to stock separation, migratory behavior could also be an explanation. Since stock boundaries cannot be defined, it can only be brought to the Council's attention that localized depletion may occur.

It also is possible that fishing in the spring could result in a loss of yield per individual, since growth accrued during the year would be foregone. However, an increase in the net yield to the fishery would not necessarily be realized if the fishery took place later in the year, due to natural mortality. A simulation showed that growth exceeds mortality in the early years but falls behind at age 5. As ages 5 and older are typically a large part of the catch, there would not necessarily be an increase in yield if harvesting occurred late in the year versus early in the year.

The stocks are not thought to be directly affected by the length of the fishing season, but a compressed season could increase the potential for exceeding the TAC. The domestic observer program and improved inseason monitoring are helping to reduce that potential.

With respect to the stock productivity issue, Alternatives 4 and 5 will change the timing of the pollock fishery directly and Alternatives 2 and 3 could change it indirectly. There is adequate capacity to take the entire GOA pollock TACs during the first quarter, so banning roe-stripping alone under Alternative 2 may not change the timing of the Gulf fishery. This would also hold true in the Bering Sea and Aleutians so long as DAP roe-stripping remains minimal. However, banning roe-stripping or making seasonal allocations in the Bering Sea could forestall the expected intensification of the pollock DAP fishery toward the early part of the year that was witnessed in the joint venture and foreign fisheries. That intensification occurred as competition increased for limited quantities of fish. The same could occur with DAP fisheries as fishing effort and technology increase and if the stocks decline as projected in the near future.

3. <u>Effects of roe fisheries on sea lion and marine mammal populations.</u>

National Marine Mammal Laboratory research indicates that the recent declines in northern sea lion abundance in Alaska may be linked, in part, to changes in either the quality or quantity of prey available. It has been hypothesized that pollock roe fisheries and other pollock fisheries may be contributing to these declines. This hypothesis has not been tested and there is insufficient evidence either to link population declines of northern sea lions to declines in prey availability or to link the size of the roe fishery as opposed to the size of the pollock fishery to prey availability. Data are also lacking at this time regarding the interactions of the pollock roe fisheries on other marine mammals. Considering that the northern sea lion has recently been listed as "threatened," a conservative course of action would be prudent.

4. <u>Impacts of a roe fishery or roe-stripping on bycatch rates.</u>

A shift in effort and catch from the pollock roe fishery which has very low bycatch rates to other fisheries which have higher bycatch rates will increase bycatch rates for the pollock fishery as a whole or for the groundfish fishery as a whole. Such increases in bycatch rates can increase bycatch or decrease groundfish catch. The bycatch management measures influence the effects and costs of increased bycatch rates.

A ban on roe-stripping can increase bycatch rates by causing some vessels to switch to other groundfish fisheries. In 1990, some heading and gutting (H&G) boats switched to the turbot fishery and had high halibut bycatch rates.

A shift in pollock fishing from the mid-water roe fishery to later in the year will tend to increase crab and halibut bycatch rates unless the latter are also mid-water fisheries. Equal quarterly allowances in the Gulf would permit a substantial shift to other than mid-water fisheries. A shift in catch to later in the year may also increase herring and salmon bycatch rates in the BSAI or Gulf.

Consideration of Three Socioeconomic Issues

5. Roe-stripping as a wasteful practice.

Benefits and costs must be examined and compared to determine if a use of a resource is wasteful. Roe-stripping, or any other use of pollock, may not be wasteful even if it results in a lower total product recovery rate.

One argument is that a use that does not maximize the amount of protein produced per metric ton of catch is wasteful and wrongfully deprives people of food they desperately need. This argument neglects the fact that alternative uses result in different amounts of other resources being used and, therefore, impose different costs as well as different benefits. If it costs $1 to provide an additional pound of protein and the price of a pound of protein is $0.90, there are less costly sources of protein and, all else being equal, using $1 worth of resources to produce an additional pound of protein is economically wasteful.

The original draft attempted to examine the costs and benefits of requiring fuller utilization. One of the costs of roe-stripping is the foregone protein associated with roe-stripping.

There were three kinds of roe-stripping operations in the first quarter of 1989, harvesting the following amounts of pollock:

| | | | | |
|---|---|---|---|---|
| i. Headed and gutted at-sea processors | BSAI | 15,700 mt | | |
| | | | GOA | 9,150 mt |
| ii. At-sea processors who roe-stripped | BSAI | 14,000 mt | | |
| | | | GOA | 11,600 mt |
| iii. Shoreside processors | GOA | 3,000 mt | | |
| | TOTAL | | 53,450 mt | |

The original draft analysis used a roe-recovery rate of 4% for the BSAI and 7.5% for the Gulf of Alaska. To simplify, assume 7% is representative. This was the recovery rate used in the emergency regulations and is also proposed in the draft regulations accompanying this amendment package.

A 7% recovery rate results in 93% or 49,708 mt of discard from 53,450 mt of roe-stripping operations in 1989. If the 53,450 mt of pollock had been used for surimi, fillets, or minced products, with a recovery rate of 17% only 83% of catch would have been discarded. If these products had been produced in addition to roe, discards would only be 76%. Thus discards would have been reduced to either 44,363 mt or 40,622 mt.

The difference, 5,300 mt to 9,000 mt, in quantity of edible flesh between recovering only roe and recovering other products, or roe and other products, could be viewed as either significant or insignificant depending on one's perspective. From a nutritional point of view this represents a potential of 12 to 20 million pounds of food.

From a discard perspective, DAP operations take over 1.1 million mt of pollock from the BSAI and GOA annually, and discard could be 76% to 83% or 840,000 mt to 910,000 mt without roe-stripping. In either case, additional discard due to roe-stripping is about 1% of the total.

An analysis of the fuller utilization approach also requires an examination of the benefits of alternative uses of pollock. Four economic measures of the benefits of alternative levels of utilization were used. They are: (1) gross wholesale value (GWV); (2) net wholesale value (NWV) which is gross wholesale value minus variable costs; (3) employee days, a measure of the amount of labor used; and (4) employee costs, a measure of the payment for labor which can be viewed as a cost or benefit depending on one's perspective, i.e., are you receiving a paycheck?, or are you paying the company's bills?

The estimates of the four measures of benefits for individual types of operations and groups of operations are based on information from the 1989 DAP pollock fishery. Comparisons were made between roe-stripping operations and all other operations.

The comparison for the Gulf of Alaska shows that gross wholesale value, net wholesale value, and employee costs would decrease significantly if roe-stripping was replaced by other uses in 1989. Only one economic indicator, employee days, would have been increased by a ban on roe-stripping. The direction of the economic indicators are the same for the Gulf whether compared for the entire fishery or just for the first quarter.

If roe-stripping had been replaced by other uses of pollock in the Bering Sea and Aleutians, there would have been no significant differences between indicators. This is because in 1989 roe-stripping accounted for only about 3% of the DAP pollock catch. Therefore, a comparison of benefits on a per metric tons basis was made. If roe-stripping were replaced with other uses, gross wholesale value, employment days and employment costs would decline; however, net wholesale value increases substantially. Although the net wholesale value per ton is estimated to be less for roe-stripping operations as a whole compared to all other operations as a whole, one group of roe-stripping operations (factory trawlers other than H&G boats) had the second highest value per ton of the six groups of operations.

A ban on roe-stripping will have an economic impact, especially for headed and gutted operations that have heavily depended on those practices. However, the segments of the industry not involved in roe-stripping may benefit.

6. Effects of fishing on spawning concentrations on the economic productivity of pollock stocks.

The ability of the pollock fishery to be an ongoing source of employment, income, and profits is in part determined by the effects of a roe fishery on sustainable yield and on the benefits per metric ton of catch.

Three of the four estimates of benefits were larger for the roe fishery than for later fisheries. The estimates indicate that a shift to a fishery that occurs later in the year would reduce 3 of the 4 measures including profitability. It is not known what conclusions could be drawn if additional measures of benefits per unit of catch were used or if data from a year other than 1989 had been used. Overall, the indicators reflect what industry has been saying: the roe fishery is profitable.

A separate measure of the economic importance of the roe fishery is the $57 million value of Japanese imports of pollock roe from the U.S. With the exception of roe-stripping operations, roe is primarily a byproduct of the pollock fishery. Therefore, the cost associated with utilizing the roe is low compared to the revenue it provides. As a result, roe contributes disproportionately to the profitability of pollock operations.

The measures used do not account for the benefits of utilizing pollock any time during the year when more lucrative opportunities are not available. It is in the interest of each operation to be able to do so. However, because the demand for pollock exceeds the TACs such an ability cannot be provided to all participants. If, for example, there is sufficient harvesting and processing to use all of a TAC in 60 days, quarterly or monthly allowances will not be able to provide full employment of that capacity throughout the year. With quarterly allowances, the fishery could be concentrated during the first 15 days of each quarter. With monthly allowances, it could be concentrated during the first 5 days of each month. The net benefits of a larger number of more intensive fisheries could be less than those of one 60-day fishery. For some operations, the disadvantages of a larger number of more intensive fisheries would be offset by the fact that others would leave the fishery. To the extent that this happens, more pollock would be available to those who remain in the fishery.

7. Effects on both how much pollock is available for onshore processing and when it is available

This issue is addressed by considering the answers to two questions: (1) will a ban on roe-stripping increase the amount of pollock available for onshore processing and will it affect when it is available? (2) will seasonal allowances increase the amount available for onshore processing? The answers differ by area.

In the BSAI, a ban on roe-stripping is not expected either to produce a substantial increase in the amount of pollock available for onshore processing or to have a significant effect on when it is available. Roe-stripping accounts for a small percentage of the total pollock harvest in the BSAI (about 3% in 1989) and, all else being equal, the percentage may decrease because most of the newer vessels and shoreside processing plants are staged for full utilization. If increased competition for fish during the first quarter increases the amount of roe-stripping, a ban on roe-stripping could result in an increase in the amount of pollock available for onshore processing.

Seasonal allowances in the BSAI could increase the competition for fish during the first quarter. Such competition could increase the amount of roe-stripping that occurs, with the possibility of fewer fish being available for onshore processing.

In the Gulf, a ban on roe-stripping is not expected either to prevent much of the TAC from being taken for at-sea processing or to have a significant effect on when pollock is available for onshore processing. Some at-sea processors that would be eliminated by a ban on roe-stripping (i.e., the H&G boats) account for a relatively small part of the total at-sea processing capacity. Therefore, much of the Gulf TAC could be taken for at-sea processing whether or not roe-stripping is prohibited. A ban will not assure that pollock are available for onshore processing throughout the year because the onshore and at-sea processing capacity are large enough to allow all of the TAC to be taken during the first quarter. In 1990, the onshore processing capacity alone was so great that the first quarter allowance was taken during January without much catch being taken for at-sea processing.

In the Gulf, quarterly allowances may be to the advantage of onshore processors because at-sea processors have shown much more interest in participating in the first quarter fishery than later in the year. However, the magnitude of that advantage will be reduced as capacity increases or fisheries are restricted in other areas.

The inability of seasonal allowances or a ban on roe-stripping to assure a specific change in the distribution of catch makes it difficult to estimate what the distributional effect of either would be with respect to these two sectors of the groundfish industry or with respect to the communities associated with each.

Closing Comments

The responses above have summarized information on seven problems addressed in the original draft analysis of a restriction on roe-stripping and/or seasonal allowances of the pollock TAC. An attempt was made to provide a balanced discussion of biological and economic issues. It is difficult to reach more definitive conclusions because of data limitations.

Scientists in other parts of the world have experienced the same dilemma. The Canadian Northern Cod Panel reported in February 1990 to the Canadian Minister of Fisheries, their independent review of the state of the northern cod stock. They emphasized:

> For cod there is no recorded evidence that fishing during spawning periods affects the spawning habitat in a negative manner or that fishing in other periods of the year will result in better survival of the spawned eggs. Thus, there is little if any substantiated evidence supporting the claim that fishing by trawls during the spawning season damages survival of the spawning products or that such removal are more damaging than taking fish during other periods of the year.

However, the panel added:

> Nevertheless, we cannot leave this subject without injecting a cautionary note. The state of our current knowledge is such that we cannot easily answer the question whether intense fishing on spawning cod populations disturbs either the mating behavior or the spawning success of the aggregate. Nor can we be sure that fishing on large spawning aggregates will not lead to localized depletions so that overfishing of particular spawning groups may lead directly, in the short term, to shortages of fish in particular inshore areas. The longer term impacts are, however, speculative because we are not sure of the year-to-year integrity of spawning aggregates or of the relative contribution such spawning groups may have to the northern cod recruitment. That is to say, we cannot give anything like a definitive answer until we know a great deal more about the nature of the spawning subgroups, their aggregational patterns from year to year, the manner in which recruitment to such groups is affected, and the nature of their feeding and spawning migrations. Once again, further study is indicated and, in light of the strongly held public perceptions, should be treated as a matter of some urgency.

THE FOLLOWING ARE RESPONSES TO SPECIFIC COMMENTS
Page and section numbers reference the draft EA/RIR/IRFA dated March 9, 1990

COMMENTS AND RESPONSES

A number of comments concerning the biological and economic analyses in the EA/RIR were received. Some of the comments reflect deficiencies in the EA/RIR and others reflect a misunderstanding of what is presented in the EA/RIR.

Biological Analyses

**Oscar Dyson's comments:**

Comment p. iii, last paragraph Since the current FMPs provide only for setting the quota, not for distributing the catch over time or area, they do not provide considerable authority to protect the stocks and alter the rules of the race.

Response: Based on available data, we are unable to find evidence that pollock roe fisheries have had negative impacts on pollock populations. We believe that the annual quotas by management area specified in the FMPs and approved through the Council process have provided protection to the stocks. The FMPs allow for the establishment of seasonal fisheries which could be used by the Council to change the pace of the fisheries. The Council has not used this mechanism to alter the rules of the race in the pollock fisheries.

Comment p. v - 2. Fishing on aggregated stocks combined with roe-stripping allows for unusually high discards in a small area and thus has a greater potential for affecting the environment, than a fishery conducted over a larger area and time frame.

Since existing EPA requirements apparently are not adhered to, concluding that roe-stripping does not adversely affect the environment is not justifiable.

Response: We feel that this is a valid comment and that it should be noted that the possibility of substantial discards increases in confined areas, when the stocks being fished are highly aggregated as with the roe fishery. However, we still maintain that substantial discards are currently being put into the system from the processing of other groundfish, the non-retention of prohibited species, unmarketable species, and unmarketable sizes. Therefore, we conclude that the incremental increase in discards relative to other operations may not be significant, and that it cannot be shown that roe-stripping adversely affects the ecosystem. Suggested modification of the section follows:

Comment p. v - 2. Does roe-stripping adversely affect the ecosystem as the result of additional discards?

Seafood processing discard is a major environmental concern. All discards other than live fish are considered a pollutant, and as such may not be dumped into the marine environment of the United States (including all EEZ waters) unless approved by the Environmental Protection Agency (EPA).

Currently, there are hundreds of thousands of metric tons of discard resulting from the processing of pollock for surimi and other accepted product forms, and other groundfish fisheries. Substantial additional discards result from the non-retention of incidental catch of prohibited species, undersized individuals of commercial species and otherwise undesirable fish or other species. Consequently, it appears that the incremental discard of pollock from roe-stripping operations may not be significant relative to other practices common to the groundfish fisheries in the Bering Sea and the Gulf of Alaska. Fish processing wastes are currently dumped at approved sites off of Kodiak and Akutan; current indications are that the amount and type of processing discharge are not negatively impacting the environment, except possibly in confined areas.

However, the likelihood of substantial discards in confined areas increases when the stocks being fished are highly aggregated, as with roe-bearing pollock. Such occurrences and other adverse effects of additional discharges of processing waste would be reduced if existing EPA requirements were more closely followed and enforced, specifically if all discards were ground into particles less than 0.5 inch. Therefore, it cannot be shown that roe-stripping by itself adversely affects the ecosystem through additional discards.

Comment p. v - 3.1 The section fails to discuss the effects of taking the quota based on a total population from only a few spawning aggregations or few areas. In the Gulf of Alaska there is some suggestion that there is a stock separation between the Western and Central Gulf stocks.

Response: This gets into the issue of localized depletion (See Section 2.3.3.1.5). At this time there is insufficient evidence to define localized stock boundaries. There is some evidence however, to suggest that Gulf of Alaska and Bering Sea pollock are separate stocks. There is not really any evidence at this time to suggest that there are separate pollock stocks in the Central and Western Gulf. In the 1989 pollock assessment it was noted that pollock in the Shumagin area tended to be larger at age than pollock harvested in the Kodiak and Chirikof areas. While this could be due to stock separation, migratory behavior could also be an explanation. Since localized stock boundaries cannot be defined, we can only bring to the Council's attention that localized depletion is a potential impact.

Comment p. v - 3.1.1 Historically the greatest number of fish harvested are ages 3, 4, and 5. Depending on year class strength any of these year classes may make up a large percentage of the harvest. Therefore, the conclusion that there is no advantage to harvesting late in the year is true only for those years in which age 5 fish are the predominant year class.

Response: It is possible that fishing in the spring could result in a loss of yield per individual, since growth accrued during the year would be foregone. However, an increase in the net yield to the fishery would not necessarily be realized if the fishery took place later in the year, due to natural mortality. A simulation showed that growth exceeds mortality in the early years but falls behind at age 5. As ages 5 and older are typically a large part of the catch, there would be no increase in yield if harvesting occurs late in the year versus early in the year.

Comment p. vi - 3.1.6 1. The EA/RIR does note that deleterious effects are possible by fishing during the spawning season and by targeting females. Under the current management regime, overfishing is possible in short intense fisheries. Possibility of localized depletion is unknown -- do we risk the stocks to find out or proceed cautiously? 2. There have not been dominant pollock roe fisheries for many years. 3. There has not been research conducted on the effect of fishing spawning stocks, because there has been relatively little fishing solely on spawning stocks. Since there is little data to draw on it is not logical to conclude there is not a problem.

Response: 1. Appendix II describes conditions under which equilibrium stock size could decrease due to fishing during the spawning season. However, we are careful to note that the model only presents an example of conditions under which this could happen, and is not necessarily representative of current pollock stock dynamics (See Section 3.1.3). Therefore, we cannot conclude that fishing during the spawning season under current conditions is deleterious, only that it is possible that there could be adverse affects under certain conditions. Appendix III suggests that targeting on females could unbalance the sex ratio under high exploitation rates. This could be a concern in the eastern Bering Sea which has high exploitation rates, but is probably not an issue in the Gulf where exploitation is less than 10% (See Section 3.1.4). Therefore, we cannot conclude that targeting on females is deleterious under current conditions, but do note (in the text) conditions under which there could be adverse affects. Section 3.1.2 discusses the potential for exceeding the TAC, but we cannot conclude overfishing is occurring and attribute it to the roe fishery. Currently there is insufficient information to define localized stock boundaries. Therefore, we can only bring to the Council's attention that localized depletion is a potential impact (See Section 3.1.5).

2. We agree that references to large dominant pollock roe fisheries be deleted from the text.

3. We acknowledge that our understanding of pollock stock dynamics and the effects of fishing on spawning stocks is limited, which prevents us from making conclusive statements about the biological effects. We suggest the text be modified to state that we cannot establish significant adverse impacts, as opposed to suggesting that there are no significant adverse impacts. The following is suggested modification of the text:

3.1.6. Conclusions Current understanding of pollock stock dynamics does not permit clear-cut conclusions about the biological impacts of a roe-fishery. The research that has been conducted does not provide conclusive evidence of significant adverse impacts. While it is not possible to establish that intensive fisheries during the spawning season will lead to stock declines or conservation problems, alternatives which limit or constrain roe fisheries would tend to mitigate any such effects.

Comment p. vii - 4. Pollock are off bottom both the first three and last four months of the year. Thus, management measures which seek to limit the spring pollock fishery and apportion quota to the latter part of the year will have no effect on bycatch.

Deferring part of the pollock catch to later in the year would encourage the harvest of Pacific cod early in the year when (halibut) bycatch is lowest. Therefore, bycatch would actually be reduced.

Response: We acknowledge that we cannot conclusively state that pollock are on the bottom later in the year. There is, however, the additional factor that older fish tend to be more demersal. There was a strong component of older fish in the Gulf population in 1988 and 1989. In these years, according to observers, several boats fished mid-water gear just off the bottom or fished with bottom gear, supposedly to maximize the number of older and larger fish in the catch. Therefore, depending on the age structure of the population and the desired size composition, fishing practices may change which could affect bycatch rates.

The bulk of the Gulf of Alaska Pacific cod catch is already harvested early in the year (76% in the first half of 1989). The 1990 Gulf bottom trawl fishery was shut down May 29 as it had reached the halibut PSC cap for the first half of the year. There is already a problem with halibut bycatch early in the year. Therefore, we disagree that deferring the pollock catch to later in the year would necessarily have the net effect of reducing bycatch and increasing the overall groundfish harvest.

Suggested modification of the text follows:

vii - 4. The late winter/early spring fishery which targets on roe-bearing pollock is primarily an off-bottom trawl fishery with low bycatch rates. This may change at times depending on the age structure of the population. In the Gulf of Alaska, there was a strong component of older fish in the population in 1988 and 1989. In these years, according to observers, several boats fished mid-water gear just off-bottom or fished on the bottom with bottom trawl gear. The probable explanation for this change is that the fleet was trying to maximize the number of older and larger fish that tend to be more demersal. Therefore, it is possible that fishing practices change to account for changes in the age-structure of the stock.

The timing of the fishery can also have an effect on bycatch rates. Following the spawning season, pollock tend to be found on or near bottom. The target gear, bottom trawls, can encounter significantly greater numbers of halibut and crab if fished "hard on bottom". Late in the year, it has been suggested that pollock re-establish off bottom aggregations in advance of spawning early the following year.

Any management measures which divert fishing effort from mid-water to bottom trawling will tend to result in higher bycatch rates for crab and halibut. This would result in greater crab and halibut mortality in the pollock fishery and/or decreased groundfish catch depending on when the bycatch caps would be taken. Total bycatch would remain constrained by the PSC limits.

**Larry Cotter's Comments**

Comment p. v. This comment was the same as Oscar Dyson's second comment addressed above.

Comment p. vi. The following statements should be deleted: "The possibility of adverse impacts occurring has not been considered sufficiently high by the Council, NMFS, ADF&G, or the industry for them to fund research projects that might provide more definitive results. Although there have been large or dominant pollock roe fisheries for many years, the issue of adverse biological impacts has apparently not warranted such research."

Response: We concur that these statements should be deleted from the text.

Comment p. viii. Should be more on possible marine mammal interactions.

Response: We have no more information at this time on marine mammal interactions with the pollock fishery.

Comment p. 21 Section 2.3.3.1.5. The localized depletion issue is much broader than separate stocks issues. Some discussion should be devoted to both sides of the issue, ...

Response: From a biological perspective, the issue of localized depletion is based on the issue of discrete stocks. If it can be established that there are localized stocks, then localized depletion could be a problem. At the current time there is insufficient information to define localized stock boundaries.

Comment. p. 31. 3rd para, last sentence. Is there a current basis to suggest it will have a biological impact on the stocks?
The implication from the way this sentence is framed suggests there is.

Response: The sentence referred to reads, "There is no current basis to suggest that this will have a biological impact on the stock". We feel this sentence clearly states that there is no expected biological impact.

Comment p. 36. 2nd para. 1) I have a problem with the following three sentences: "Appendices I-III provide examples of conditions under which roe-stripping can effect changes in the spawning stock, but these examples are simplified and do not necessarily represent current stock dynamics. Current understanding of pollock stock dynamics and the interactions of marine mammals with pollock do not permit clear-cut conclusions about the biological impacts of a roe fishery. The research that has been conducted does not indicate that there are significant adverse impacts." 2) The last two sentences [of the para.] are objectionable and should be deleted.

Response: We suggest the following rewording:

Appendices II-III provide examples of conditions under which equilibrium stock size could decrease due to fishing during the spawning season, and targeting on females could unbalance the sex ratio of the population under high exploitation rates. These models do not necessarily represent current pollock stock dynamics, but are useful in showing some conditions under which adverse affects are possible. Current understanding of pollock stock dynamics does not permit clear-cut conclusions about all the biological impacts of a roe fishery. The research that has been conducted has not established that there are significant adverse impacts under current conditions. While it is not possible to establish that intensive fisheries during the spawning season will lead to stock declines or conservation problems, alternatives which limit or constrain roe fisheries would tend to mitigate any such effects.

**Alaska Groundfish Data Bank Comments**

Comment - If, as some of the data cited suggests, there are localized pollock populations, taking the whole quota in a short time period presents a serious potential for overfishing selected components of the stock and damaging the entire stock a component at a time.

Response: At this time there is insufficient evidence to define localized stock boundaries. There is some evidence however, to suggest that Gulf of Alaska and Bering Sea pollock are separate stocks. There is no conclusive evidence at this time to define separate pollock stocks in the Central and Western Gulf. In the 1989 pollock assessment, it was noted that pollock in the Shumagin area tended to be larger at age than pollock harvested in the Kodiak and Chirikof areas. While this could be due to stock separation, migratory behavior could also be an explanation. Since localized stock boundaries cannot be defined, we can only bring to the Council's attention that localized depletion is a potential impact.

Comment - It should be noted that there is no data to suggest that the size of a spawning aggregation relates to the success of that aggregation's recruitment.

Response: We agree that we do not have a well-defined stock-recruitment relationship. As is noted in the executive summary and in the text, "Without a well-defined stock-recruitment relationship and an understanding of all the factors affecting recruitment, definite conclusions regarding the impacts of targeting on spawning pollock cannot be made." Section 2.3.3.1.3 discusses the tenuous nature of the stock-recruitment relationships suggested for pollock, which prevents us from forecasting the impacts of a roe fishery on future recruitment.

Comment - It is inappropriate to state the stocks are not affected by fishing mortality occurring over a short time period. The effect is actually unknown.

Response: The major biological concern is not the length of the fishing season but its timing which coincides with the peak spawning period. Several other fisheries have compressed fishing seasons, such as Gulf of Alaska halibut and sablefish. These stocks are not thought to be affected by fishing mortality occurring over a short time period. Our biological concerns over a compressed fishing season relate to the timing of the season and are discussed in Sections 2.3.3.1.1 and 2.3.3.1.3.

Comment - There is no more danger of PSC bycatch in the fall than in the late-winter spring. There may be a decrease in PSC bycatch as a fall pollock fishery could encourage targeting on Pacific cod early in the year when bycatch is lowest.

Response: We suggest modification of the text to state that bycatch rates would be expected to increase when bottom trawl gear is used. The bulk of the Gulf of Alaska Pacific cod catch is already harvested early in the year (76% in the first half of 1989). The 1990 Gulf bottom trawl fishery was shut down May 29 as it had reached the halibut PSC cap for the first half of the year. There is already a problem with halibut bycatch early in the year. Therefore, we disagree that deferring the pollock catch until later in the year would necessarily have the net effect of reducing bycatch and increasing the overall groundfish harvest.

Comment - There have not been dominant pollock roe fisheries anywhere but in the Gulf of Alaska 1984-86. The probability of adverse impacts of a roe only fishery has been considered sufficiently high for the Council, NMFS, ADF&G and the industry to limit the Shelikof Strait quota.

Response: We concur that statements referring to large dominant roe fisheries and lack of concern by the Council etc. should be deleted from the text.

**Greenpeace Comments**

Comment 2 pp. 10-11

a) In recognition of the fact that roe-stripping may have both adverse and beneficial effects, the question "Does roe-stripping adversely affect the ecosystem as the result of additional waste?", should be changed to "What effects does roe-stripping have on the ecosystem due to additional discards?"

Response: Although the question was posed to look at adverse effects, the analysis within the section does note both the adverse and beneficial impacts (See Section 2.3.2).

b) The question of the effect of the timing of the fishery on bycatch should be extended to include other groundfish and non-utilized species.

Response: The discussion regarding the effects on bycatch focuses on crab and halibut as these are prohibited species which can constrain the groundfish fisheries. We acknowledge that there is bycatch of other groundfish and non-utilized species in every fishery, but we have no data as to the magnitude or composition of this bycatch in the domestic fisheries. With the implementation of the observer program, we should get better data on the magnitude and composition of bycatch. At this time, we do know that bycatch rates for halibut and crab could increase when bottom trawl gear is employed as opposed to mid-water gear but we have no data to support any statements regarding most other species.

Comment 10 p. 17, para 1 - What is known about seasonal variability in natural mortality? Since the seasonal timing of harvest is being discussed here, a discussion of annual net differences between mortality and growth is inappropriate.

Response: Natural mortality is a very difficult parameter to track. We have no data on seasonal variation of this parameter. The simulation provided by Collie assumed constant natural mortality over the course of a year. There is the possibility that deferring the pollock harvest later in the year could increase yield per individual due to the extra time allowed for growth. However, an increase in the net yield to the fishery would not necessarily be realized due to natural mortality. The biological impacts on the productivity of pollock due to the timing of the season depend on growth and mortality, therefore a discussion of the net differences between growth and mortality is pertinent to this section.

Comment 22 p. 28, para. 7 A slower paced fishery would reduce the potential for exceeding the TAC, provide more pollock for bycatch in other fisheries, and make more food available for predators such as marine mammals.

Response: We acknowledge that the biological effects of a slower paced fishery should be discussed in greater detail. The biological impacts would be similar to those discussed under Alternative 2 (prohibit roe-stripping), but they would be present to a greater extent. However, we note that due to the current pace of the fishery (particularly in the Gulf of Alaska) and the anticipated increases in harvesting and processing capacity, we cannot state that more pollock will necessarily be available for other fisheries. It is also difficult to anticipate that more food would necessarily be available to predators. Under the status quo, a fast paced fishery was occurring due to the large harvesting and processing capacity, and the fact that roe was being stripped from females (with the carcasses and males being discarded). Under Alternative 3 (full utilization), the pace of the fishery would be slower, and there would initially be a decrease in total catch until meal reduction capacity becomes available unless the joint venture apportionments were increased. There would also be a substantial reduction in the discard of solid pollock processing waste into the ecosystem.

Suggested additional text (to replace para. 7, p 28):

The size of the roe season fishery would initially decrease in both the BSAI and the GOA unless joint venture apportionments were temporarily increased. The biological impacts of a slower paced fishery would be similar to those discussed under Alternative 2, but they would be present to a greater extent.

Comment 24 p. 29, para. 1 - The statement that no adverse effects of current discards on stock productivity and components of the ecosystem should be reworded to say the magnitudes of the effects of the current levels of discard on the pollock stock productivity and on food web dynamics as a whole are not known, except in confined areas.

Response: The paragraph states: "Furthermore, the biological effects of a decrease in the amount of catch that is discarded as solid waste are not known. There is no indication, however, that the current levels of discards have adversely affected the productivity of the pollock stocks or other components of the ecosystem." We feel these statements are appropriate, and note that a more detailed discussion of effects of discards is contained in Section 2.3.2, where we discuss both potential negative and beneficial impacts.

Comment 28 p. 31, para. 1 - The assessment on environmental factors affecting egg and larval survival is not clear.

Response: The statements in this paragraph regarding egg and larval survival were an attempt to summarize the discussion in Section 2.3.3.1.3, and do need some clarification. Suggested rewording follows:

The information presented ... Constraining the harvest of female pollock during the roe season could increase egg and larval production. If density-independent (environmental) factors play a significant role in regulating pollock abundance, the eggs and larvae that survive are (1) those spawned during a window of time when environmental conditions were favorable to survival, or (2) those spawned in a location favorable to survival. In this context, it would be important to ensure that a significant number of females escaped the fishing fleet throughout the spawning season. However, the factor of natural mortality ...

Comment 29 p. 31, para 6 - Bycatch can further be reduced by requiring off-bottom trawl fishing, rather than hard on the bottom.

Response: We agree that there is less bycatch in the mid-water trawl pollock fishery, compared to a pollock fishery conducted with bottom trawls or mid-water trawls fished hard on bottom. The reality is that in the Gulf of Alaska, the halibut PSC caps are expected to be taken by other fisheries. Therefore, restricting the pollock fishery to mid-water trawls will not have the intended net effect of reducing halibut bycatch in the Gulf of Alaska trawl fisheries. However, it would allow more groundfish to be taken prior to the attainment of the PSC caps.

## Economic Analyses

The comments that address the economic analyses have been placed into five categories. They address: 1) the discussion of the allocation problem, 2) the distribution of benefits, 3) the measures of benefits that are used, 4) the estimates for those measures and the conclusions drawn based on the estimates, and 5) other issues. Each of the following five sections paraphrases the comments within a category and presents a response to each comment or set of comments.

### The Allocation Problem

Comment 1 Whether allocating TACs among competing uses is "efficient" is a matter of debate and not an appropriate statement and the sentence should be deleted (p. iii).

Response This comment is in response to the following statement. "The alternatives do not include the use of the market mechanism to solve the allocation problem, that is to efficiently allocate the TACs among competing uses.". The statement is correct in that: 1) the alternatives being considered do not use a market mechanism to solve the allocation problem and 2) the allocation problem can be defined as the lack of an efficient allocation of TACs among competing uses. The statement does not address the issue as to whether an efficient allocation can occur with the alternatives being considered.

The determination of whether an allocation is efficient is not based on value judgements. It is a matter of debate only to the extent that the values of all the variables used in calculating both the profitability of producing a product and the demand for the product are not known. An efficient allocation is not necessarily a "socially optimal" allocation or what some would consider a "fair" allocation. The latter two are in part determined by value judgements. The statement should have used the term "appropriate" instead of "efficient" because, the issue being addressed is the appropriate or socially optimal allocation of pollock among competing uses.

Comment 2 Most people don't define the problem as "allocation". Allocation is part of the problem but so are concerns for waste and adverse biological effects. The statement suggests a personal bias (p xii).

Response The statement reflects a definition of "allocation" that is much broader than reflected in the often arbitrary and misleading distinction between "allocation and conservation issues". The issue being addressed by the EA/RIR is the appropriate use (i.e., allocation) of pollock. The competing uses include different types of fishing operations harvesting pollock to produce different combinations of products at different times during the year. They also include non-harvest uses. The determination of the appropriate allocation requires both biological and economic information, where the latter is as broadly defined as is appropriate given the groundfish FMP objectives, the Magnuson Act, and other applicable Federal regulations and directives. The merits of alternative uses are jointly determined by their effects on the future productivity of the pollock stocks and other components of the ecosystem and by other effects on the net benefits of harvesting pollock.

Comment 3 "The first problem is allocational in nature.... The second perceived problem...." This suggests that one problem has greater legitimacy than the other. The allocational theme is common throughout the document and suggests a personal bias.

Response As noted in the previous response, the EA/RIR presents a broad definition of "allocation". Within that context, the problem is correctly identified to be that of determining the appropriate use or allocation of pollock. The first part of the statement reflects the fact that in 1989 the Gulf pollock TACs did not meet the demands for pollock of the DAP fishery and that this was expected to be the situation in the BSAI and Gulf in 1990 and beyond. That is, there was clearly a problem in that the plans of all participants in the DAP fishery to use pollock could not be met. The second part of the statements reflects the fact that it is less clear that roe-stripping is an inappropriate use of pollock. Whether it is depends on a number of economic and biological factors. Rather than presenting these as separate problems, the potential biological and economic effects of roe-stripping should have been presented as factors that in part determine the appropriate use of pollock.

Comment 4 It is much more than an allocation issue. Other issues are the concerns with respect to the waste of food, biological impacts, and social and economic disruption and impacts caused by roe-stripping (p. 36).

Response As noted above and on page 36, the appropriate use (i.e., allocation) of pollock depends on a variety of biological and economic factors. These factors certainly include what are referred to as "other issues" in the comment. Unfortunately, our ability to estimate accurately the variables that determine the appropriate allocation of pollock is quite limited.

Distribution of Benefits and Costs

Comment 1 Whether the Council does or does not take action, the increased capacity will eliminate some operations from the pollock fishery and increase the cost of the fishery to some or all operations.

Response This statement is correct and accurately identifies the nature and source of a major problem for the DAP pollock fishery in the Gulf beginning in 1989 and a problem that may appear in the BSAI by 1990 or 1991. The alternatives being considered do not directly address or eliminate this problem. Alternatives 2, 3, and 5 would tend to eliminate one class of vessels (H&G boats) from the pollock fishery unless these vessels can either find more profitable markets for the products they are capable of producing or profitably invest in additional processing equipment. These alternatives would also tend to decrease the processing capacity of other operations. These two effects would tend to decrease processing capacity; however, in the case of the Gulf, the decrease is not expected to be sufficient either to prevent the demand for pollock from greatly exceeding the pollock TACs or to assure that the entire TACs are not taken during the first quarter.

A major difference between the status quo and Alternatives 2-5 is that with the former the ability of the different operations to compete for the limited TACs will determine which operations are eliminated from the fishery. With the latter, a group may be eliminated because regulations would limit its ability to compete.

Comment 2 The quarterly allowances may benefit at-sea processors.

Until recently, the potential for the BSAI PSC caps to result in the closure of all bottom trawl fisheries in the BSAI was not fully recognized. Therefore, when the Gulf quarterly allowances were first discussed and when the EA/RIR was written, generally it was assumed that such a closure would either not occur or certainly not occur early enough to result in a large influx of factory trawlers from the BSAI into the Gulf during the third and fourth quarters. The Gulf quarterly allowances are certainly one of the factors that resulted in at-sea trawl operations taking less than 1,500 mt of pollock in the Central and Western Gulf by late May. The expected closure of the bottom trawl fisheries in the BSAI clearly decrease the expected effect of the quarterly allowances in the Gulf with respect to redistributing catch from at-sea to shoreside processors. For the percentage of the Gulf catch taken for at-sea processing in 1990 to exceed that of 1989, the percentage of catch for at-sea processing during the remainder of the year would have to be greater than it was during the first quarter of 1989. This may not be a reasonable expectation if the mid-water pollock fisheries in the BSAI continue to provide a profitable fishing opportunity for a large part of the catcher/processor and mothership fleet.

Comment 3 Compared to 1988, no action resulted in a transfer from onshore to off-shore processors. This will continue if no action is taken.

Response The EA/RIR states that there was a very large increase in the percentage of the Gulf pollock TAC taken for at-sea processing in 1989 compared to 1988. That percentage may well increase if no action is taken with respect to quarterly allowances. Given the combination of increased at-sea processing capacity and potential closures in the BSAI it may increase even with quarterly allowances. Public testimony indicates that one of the objectives of the quarterly allowances was not only to prevent an increase in that percentage but to result in a decrease compared to 1989.

Comment 4 In 1989, the offshore sector could have been fully employed in the BSAI.

The EA/RIR contains a similar statement. However, the same is not expected to be true beyond 1990 or perhaps in 1990. Even if it were expected to be true, it would not necessarily be a sufficient justification for reallocating catch to the onshore sector.

Comment 5 Gulf of Alaska processors prefer a year-round fishery to a short intensive roe fishery.

Response It may be correct to state that shorebased Gulf of Alaska processors prefer a year-round fishery; however, it is not clear that this preference is shared by at-sea processors that have or could operate in the Gulf. It would appear that given the current shorebased processing capacity and pollock TAC in the Gulf, a year-round pollock fishery is not expected to occur even with no catch for at-sea processing. In 1990, the first quarter allowance was taken during January.

Comment 6 There are no expansion plans for GOA processors nor are any new catcher boats being built for the Gulf.

Response The reference in the text to increasing capacity for both the at-sea and shorebased sectors of the fishery may be incorrect with respect to the latter for the Gulf. The text should have emphasized increases or potential increases in the demand for pollock by each sector. The demand for pollock by the shorebased sector can increase as the result of increased capacity, fuller utilization of existing capacity, or producing more pollock and less of other products. The comment does not indicate whether both capacity and demand for pollock are thought to be fixed in the Gulf. The ability of a floating processor to become permanently moored in protected waters and effectively become part of the shorebased sector greatly increases the potential for the demand for pollock from the shoreside processors to increase in the Gulf. Due to the mobility of most catcher boats, the comment that no boats are being built for the Gulf does not indicate that the pollock fishing power available to Gulf shoreside processors is fixed.

Measures of Benefits

Comment 1 The economic analysis does not go far enough with respect to downstream benefits and costs and shoreside impacts.

Response There are three reasons that the EA/RIR does not attempt to quantify the effects on local or regional economies of a change in the distribution of catch for onshore and at-sea processing. The regional economic models that were required to estimate the effects were not available, there was not sufficient time to develop such models, and the use of such models would require estimates of how the alternatives would affect the distribution of catch and such estimates are not available. As noted above, none of the alternatives being considered assures, for example, that a fixed percentage of the Gulf pollock TAC will be made available to shoreside processing plants.

The regional economic model that is being developed for the Inshore/Offshore Amendment will be used prior to the June Council meeting to provide estimates of the community impacts per 10,000 mt of pollock catch. A table summarizing the estimated impacts will be presented during the June meeting if the economists who are developing the model determine that the estimates from the preliminary model are meaningful.

Comment 2 The measures of the value of alternative uses are not adequate. They do not address the following:

1. the benefits of maintaining market position or the cost of maintaining markets when supply is not steady;

2. adverse effects on long range planning;

3. the costs of closing down and reopening operations;

4. a processor's profit on a 12-month basis;

5. the costs associated with shutting down and laying off part of a local or non-local labor force;

6. the cost of gearing up for a one quarter "race for fish";

7. the cost of reassembling and retraining a work force;.

8. the long term advantage of providing a variety of product forms;

9. the costs communities bear when a decline in base sector activity results in the closure of support businesses and property values;

10. reduced prices due to seasonal market gluts; and

11. increased cold storage costs due to seasonal gluts.

Response The statement is correct, not all the net benefits of the competing uses of pollock are captured by the four measures of benefit per metric ton of pollock catch used in the analysis.

The RIR indicates that the measures presented are useful but not all-inclusive measures of benefits and that in some cases the estimates of these four measures are based on very small samples.

It is naturally desirable to be able to utilize pollock throughout the year or when other more lucrative opportunities are not available. Not being able to do so decreases the profitability of operations. However, particularly in the Gulf, none of the alternatives being considered decreases processing capacity sufficiently to assure such an ideal situation. As noted in the RIR, there is more than sufficient processing capacity to take all of the current Gulf pollock TAC during the first quarter or to assure that quarterly allowances will not result in processors being able to operate throughout each quarter. For example, the first quarter fishery was closed on January 26 in 1990.

Significant seasonal fluctuations in the availability of pollock can impose costs on fishermen, processors, processing plant employees, the support sector of local communities, and communities that benefit from the pollock fishery. However, as noted above, there are two reasons why none of the alternatives being considered is expected to assure that such fluctuations will not occur in the Gulf. First, the first quarter allowance was taken in January with only an insignificant part being taken for at-sea processing. Therefore, the shoreside plants were not provided with a continuous supply of pollock during the first quarter and much of the catch occurred before the roe quality was at its peak. The importance of the latter of course depends on the extent to which processors would have taken advantage of higher quality roe later that quarter. Second, the projected closure of the BSAI bottom trawl fisheries by the end of June is expected to result in a substantial increase in the amount of Gulf pollock taken for at-sea processing during the second half of 1990. This could prevent the quarterly allowances from providing shoreside processors with the amount of pollock they have planned for. It is not clear whether the bycatch measures for 1991 will prevent a reoccurrence of the BSAI closure and the associated problem for shoreside processors in the Gulf.

The adverse effects of a highly seasonal pollock fishery in terms of maintaining markets, higher cold storage costs, and reduced product prices are expected to be much less in the Gulf than they would be in the BSAI for similar levels of seasonal concentrations because the Gulf accounts for such a small part of the world supply of pollock. For example, in the first quarter of 1989, the 58,000 mt catch in the Gulf was less than 20% of the BSAI catch of 304,000 mt catch. This does not necessarily mean that these adverse effects will be insignificant.

With respect to the benefits of providing a variety of product forms, it should be noted that: 1) the benefits of this diversity is probably less in the Gulf due to the level of the TACs and 2) a first quarter allowance that results in much of the allowance being taken prior to what would have been the peak of a roe fishery may actually decrease product diversity by reducing the options of participating in the roe market.

The use of the four measures of benefits was first presented in December of 1989 and the results of their use was contained in the EA/RIR released for public comment March 9, 1990. Neither data to provide a basis for estimating alternative measures of benefits nor data to increase the accuracy of the estimates of the four measures of benefits have been provided by the proponents of specific alternatives. Although the potential existence of alternative measures of benefits that would support one alternative over another may suggest that more analysis is necessary prior to taking action, this potential probably cannot be used to justify any particular action.

Comment 3 The text indicates that employment is not in the best interest of the nation.

The EA/RIR includes employee days and employment costs per metric ton of pollock as two of the four measures of the benefits of the alternative uses of pollock. The comment is no doubt the result of the fact that the EA/RIR includes a discussion of whether or not employment is a benefit or a cost. The conclusions presented are that: 1) if the opportunity cost of labor is greater than zero, there are both costs and benefits associated with a particular use of labor; 2) if the opportunity cost of labor equals the payment for labor, the benefit and cost of that use of labor are also equal and that use does not provide a net benefit to the nation; and 3) if the opportunity cost is greater than the payment for labor, that use decreases the net benefits to the nation. The opportunity cost of using labor, or any other resource, is what it is worth in its best alternative use.

Comment 4 Define employee days and employment costs. Discuss and justify the difference between shoreside and at-sea. Clarify the source of the estimates and how they are used (p. 12-13).

Response Employee days and employment costs per metric ton of pollock catch are, respectively, measures of the amount of labor and the payments for that labor per metric ton of pollock catch. For catcher/processors and catcher boats their values were estimated using estimates of average daily labor force, average daily labor costs, and average daily catch. For shoreside processors, estimates of average daily round weight of pollock used for processing were used instead of average daily catch. These estimates were provided by individual operations by area, time of year, and operation mode. Typically, the estimates for a type of operation, area, and time of year were calculated as the weighted averages of the information provided by individual operations. The total catches for the individual observations were used as the weights. The estimates of average value per metric ton of catch and total catch by area, season, and type of operation were used to estimate total benefits by area, season, and type of operation for 1989.

Estimates were made of what the totals of each of the four measures of benefits would have been in 1989 had there been no roe-stripping or if there had been no pollock fishery during the first quarter. In making these "what if" estimates, the level of catch in all the types of operations or seasons that were not excluded were increased proportionately to maintain total catch at the actual 1989 level.

The differences in the estimates of employee or employment cost per metric ton of catch are determined by differences in output per employee day and cost per employee day, respectively. As noted in the EA/RIR, the validity of the estimates is limited by the amount and quality of the information provided by individual operations.

Comment 5 What is an employee day worth? Are at-sea and shoreside days the same? If not what is the difference? Are ancillary jobs considered? Why or why not? What is that value?

The estimate of employee days per metric ton of catch is used as a measure of the relative benefits of alternative uses of pollock. The measure is in terms of the employment generated in the harvesting and processing sectors per metric ton of catch. What a unit of employment is worth depends to a great extent on your perspective. As noted above, if labor is highly mobile and if the opportunity cost of labor equals the price of labor, a unit of labor in that use does not provide a net benefit because it would be equally beneficial in an alternative use. From a regional perspective, there can be a net benefit if the alternative employment opportunity is elsewhere and does provide secondary benefits to the regional economy. If a region is actively trying to increase employment, it can be assumed that additional employment is thought to provide regional benefits. Community impact models are often used to provide a measure of the benefits of additional employment. Such models are being developed and if reasonable estimates of these impacts can be made, they will be presented at the June meeting.

Units of labor and employment are not perfectly homogeneous for an operation or between different operations of the same type or of different types. The information provided by the industry was not intended to provide sufficient detail to evaluate the degree to which the units are homogeneous. It was only intended to provide an approximation of the units of labor directly associated with different uses of pollock.

For the purposes of the analysis it is assumed that at-sea and shoreside days are the same. As explained above, similar methods were used to estimate each.

Ancillary jobs were not considered. The principal reason for this is that the time and information necessary to do it were not available. The effect on the estimates of not considering them depends on the extent to which the number of ancillary jobs per unit of direct employment differs among the alternative uses of pollock. Although there may be significant differences on a regional basis, the differences may be quite small on a national basis. To the extent that at-sea employment includes services that normally would be provided to processing plants or their employees by employees in the service sector of a local economy, the estimates overstate labor and labor costs for at-sea operations relative to shoreside operations. For example, a mothership may employ more people to maintain its processing equipment than a shoreside processor because the latter may make use of a maintenance service rather than hiring someone. It is not known how important this difference is.

Comment 6 How can you estimate the benefits if you can't estimate the effects on shoreside processing? This suggests that the impacts on shoreside processors and communities were not considered.

As noted above, our ability to estimate the effect of each alternative on shoreside processing and the associated communities is limited by both the difficulty in determining whether and how each would alter the distribution of catch for shoreside and at-sea processing and the lack of a model to estimate the community impacts per unit of catch. The latter problem is being resolved.

The impacts on shoreside processors and communities were only considered to the extent that statements were made about the expected direction of change in the distribution of catch. To the extent that none of the alternatives assures a specific change or direction of change in the distribution, this may not be a significant deficiency.

Comment 7 The use of short-term profit as a measure of the appropriate use of pollock is inappropriate. Jobs and long-term profitability are more important.

Response The EA/RIR does use an estimate of employment or jobs as a measure of benefits. The measures of benefits used were not intended to be nor were they reported to be all-inclusive. Placing an emphasis on jobs and down-playing the importance of short-term or long-term profits can be counterproductive. It is the profitable operations that provide ongoing employment opportunities. Actions that decrease profitability will tend to decrease the level and stability of employment and income.

Ideally, estimates of both the short-term and long-term profitability of the alternative uses of pollock would be available. However, the latter require significantly more information and are much more speculative. Short-term profits provide useful information concerning potential directions of change.

Comment 8 The potential social benefits of meal plant expansion in terms of the levels and stability of employment is ignored.

Response The increased use of meal plants will increase employment if the meal plants are profitable. If they are not profitable, and are principally the result of EPA or fishery regulations, their use could actually decrease the level and stability of employment.

Estimates and Conclusions

Comment 1 The most profitable use of pollock differs among operations.

Response The information presented in the EA/RIR confirms this. Based on this, one of the important conclusions is that banning a particular use of pollock can result in the transfer of pollock from some operations that use it very profitably to some that do not, as well as the transfer of pollock from some operations that do not use it productively to some that do. That is, banning a specific use and ignoring that within each type of use there can be significant differences in how productively pollock is used can result in highly productive operations being eliminated as well as those that cannot be justified. Ideally, less productive operations would be eliminated regardless of their use of pollock.

Comment 2 Fishing and processing jobs are more important in some communities than others. Can't the relative value of 1,000 jobs in Kodiak compared to 1,000 jobs in Seattle be quantified and the downstream effects quantified, particularly if factory trawlers can operate elsewhere?

Response The relative importance of a job in one community compared to another depends very much on the perspective taken. For an individual, it is more important to have a viable employment opportunity that allows him to live in his preferred location. For the nation as a whole, it is more important to have the employment opportunity where the labor that is used can be used most productively in conjunction with other resources, where productivity is broadly defined. For a community with few employment opportunities, one more job is certainly more important in percentage terms but not necessarily in absolute terms. It can be argued that a critical mass of employment opportunities is necessary to develop or maintain the infrastructure necessary for a community to prosper. But it can also be argued that the cost of developing and maintaining such an infrastructure in each community may be excessive.

The argument that a job is necessarily more important in a small community than a large community suggests that it should be public policy to relocate industries and employment opportunities from larger communities to smaller communities. This would mean, for example, that it would be advantageous to transfer jobs from the largest fishing communities in Alaska to the smallest. Such an action can be justified in some instances, but not in others because there are advantages in having large communities. The lower cost of providing support services for industry and individuals in larger communities is one of the advantages.

The determination of the relative value of employment opportunities in alternative communities is certainly in part dependent on value judgements rather than economic analysis. For example, some people may place a higher value on jobs in one community because that community is more important to them for a variety of reasons. This is done for each RIR in that a national perspective is taken and the focus is on the net benefits to the nation, not to the world.

As mentioned above, there were other, presumably less profitable, places for factory trawlers to operate in 1989 without displacing others. However, due to increased capacity, this is not expected to be the case in 1990 or beyond.

Comment 3 With a ban on roe-stripping, H&G boats may find a market for pollock roe frozen in the round as with herring.

When a type of fishing operation is prohibited, those who had been involved in such operations will typically respond by increasing their participation in other types of fishing operations. As noted in the RIR, the H&G vessels that would be prevented from continuing roe-stripping operations will at least partially offset the benefits they received from roe-stripping by switching to other types of operations. These could include freezing roe-bearing pollock in the round or participating in other groundfish fisheries. Although these other activities could be more lucrative than roe-stripping, this is not the expectation of those who chose roe-stripping.

Comment 4 The use of 1989 as the reference year distorts the conclusions. The analysis is based on only 1989 data and does not consider the effects under alternative scenarios concerning harvest levels or relative product prices.

Response The economic and biological factors that determine the relative value of alternative uses of pollock can change substantially from year to year. As a result, a use such as roe-stripping may be a very high-valued use in some years and a relatively low-valued use in other years. Due to the difficulty of predicting how these factors will change over time, proposed management alternatives are typically analyzed in terms of what their effect would have been had they been in place during the most recent year for which data are available. There is no question that conducting the same type of analysis for several years would provide more information concerning the alternatives. However, time and budget limits typically prevent such extensions of the analysis. There are few aspects of the analysis of any management action that could not be improved if more resources were available.

Comment 5 Explain the basis of the conclusion (3) in the second paragraph on page vii.

Response The conclusion is with respect to how average benefits per metric ton of pollock catch would change if catch is transferred from the first quarter to later in the year. Four measures of benefits were estimated and compared for: 1) the actual first quarter 1989 pollock fisheries and 2) the actual pollock fisheries for the rest of 1989. In each case the estimates were the weighted averages of the types of pollock operations that occurred during each period. For the GOA, the comparison in terms of estimated benefits per metric ton of catch for the first quarter as opposed to later in the year is as follows: gross wholesale value is $77 higher, net wholesale value is $91 higher, employee days are 0.09 lower, and employment costs are $5 higher. The last difference is not significant. For the BSAI, the results of similar comparisons are as follows; gross wholesale value is $120 higher, net wholesale value is $111 higher, employee days are 0.04 higher, and employee costs are $1 lower. As in the GOA, the last difference is not significant. The last part of the conclusion was that a shift to a later pollock fishery would substantially reduce the economic viability of the pollock fishery. This statement was based on the estimated reduction in net wholesale value per metric ton of catch of 47% and 26% respectively for the GOA and BSAI.

These conclusions are based on four measures of the benefits per metric ton of catch and do not address the biological effects of the seasonal distribution of catch. Those effects are discussed in a separate section. As noted in the EA/RIR, the overall merits of alternative seasonal distributions are jointly determined by the expected biological effects and the benefits per unit of catch.

Comment 6 What is the economic value of foregone product?

Response The foregone net value is the difference between the foregone total value and the foregone total cost. The net wholesale value of a foregone product would provide a measure that is consistent with the measures of benefit per metric ton of catch used in the EA/RIR. Such measures ignore benefits beyond the wholesaler.

Comment 7 Why isn't net wholesale value known (p. 27)?

Response The comment is in reference to 3,000 mt of pollock that were used for roe-stripping by a shoreside plant. The net value of this production is not known because the industry did not provide cost information for this roe-stripping operation. Only limited information concerning this operation became available after much of the analysis had been conducted and additional information has not been requested by staff.

Comment 8 The economic analysis is based on one year and gives highest points to short-term profits.

Response The merits of using data for only one year were discussed above. Although four measures of benefits per metric ton of catch are reported, the estimates of net wholesale value are at times emphasized more than the other measures. From a national perspective, this measure may provide a better measure of benefits than do the other three measures.

Comment 9 The logical conclusion is that the TACs should be sold to foreign vessels so there are only profits because jobs don't matter. An alternative conclusion is that all management should be dropped and let the fleet go for the maximum short-term profit without regard to the effects on stocks.

Response These conclusions are not supported by the EA/RIR. Two measures of jobs are presented as measures of benefits. However, the need to account for the cost of labor is discussed. The conclusion was that with few exceptions, the opportunity cost of labor is not zero. That is, labor is mobile and one use of labor precludes another. What matters is that resources, including labor, be used as productively as possible so that the total amount of goods and services that are available is not unnecessarily reduced.

The EA/RIR also notes that the appropriate use of pollock depends on both the biological effects of the uses and the economic benefits per unit of catch. It suggests that short-term profits should be considered. It does not suggest that the biological effects should be ignored.

Comment 10 If the intent is to promote a healthy long-term U.S. industry, the health of the resource is the primary concern and long-term strategies which create employment, preserve market position, preserve a company's ability to respond to changing market conditions, and attempt to allow adjustment of product flow to meet market demands would be the major economic concerns.

Response The EA/RIR presents information concerning a number of types of effects that the alternatives may have. The information is not all-inclusive and is often not definitive. In many instances actions that are taken to "create employment, preserve market position and a company's ability to respond to changing market conditions, and attempt to allow adjustment of product flow to meet market demands" for one group of participants in the fishery will have the opposite effect on other participants. Given the time and resources that are available and the number of issues being evaluated, typically only rough approximations can be made of the actual tradeoffs. This is certainly the case with the EA/RIR for Amendments 19/14.

Comment 11 The lower employment with roe-stripping is not considered a cost.

Response The comment is incorrect. Two measures of employment are included among the four measures of benefits per metric ton of catch reported for each type of fishing operation.

Comment 12 The statement that some roe-stripping operations were more profitable than some operations that did not participate in roe-stripping is inappropriate and indicates a desire to show that roe-stripping is not wasteful (p. 13).

Response Estimates of net wholesale value per metric ton and the other three measures of benefits presented in the EA/RIR were presented for two types of roe-stripping operations and four other types of operations. The estimates of the net wholesale value per ton are $132 and $393 for the two categories of roe-stripping operations (Table 2.7 in the EA/RIR or Table 3 in this report). They are $572, $378, $96, and $117 for the four categories of non roe-stripping operations. Therefore, if these alternatives uses were ranked solely on the basis of this one measure of benefit, the second category of roe-stripping operations would rank second and the first category would rank fourth. The point that was being made in the statement was that banning a particular type of activity, such as roe-stripping, can result in the elimination of some categories of operations that use pollock very productively as well as some that do not. The author was not predisposed to show that roe-stripping is not wasteful.

Comment 13 There is some confusion about where there will be competition (p. 14 and 22).

Response The harvesting and processing capacity in the domestic fishery is not sufficient to take the entire BSAI pollock TAC during the first quarter nor is it expected to be in the next year or two. This means that the first quarter uses of pollock will not compete with each other. However, if seasonal allowances are imposed and if the first quarter demands for pollock exceed the allowance, these uses will compete with each other. Without seasonal allowances, the first quarter uses are expected to compete with other uses later in the year only.

Comment 14 Given the quality of the estimates of benefits per metric ton of catch and the lack of confidence intervals, differences of less than 5% are probably insignificant. Therefore, the real differences between the benefits for a roe fishery compared to other uses are less than stated (p. 22 and 27).

Response It is certainly the case that when the estimates are similar for different uses that those uses should be given the same rank. However, the conclusions presented on page 22 were not distorted by the failure to note whether or not differences were significant. When comparing first quarter values to the values for GOA fisheries after the first quarter, gross wholesale value is 18% higher, net wholesale value is 89% higher, employee days are 12% lower, and employee costs are less than 4% higher (Table 2.15). Therefore, two are probably higher, one lower, and one is the same. For the BSAI the comparison is as follows: gross value is 22% higher, net value is 35% higher, employee days are 11% higher, and employee costs are 1% lower. Therefore, three are probably higher and one is the same.

When comparing the values for roe-stripping operations to the values for all other uses of pollock in the GOA, gross wholesale value is 74% higher, net wholesale value is 139% higher, employee days are 41% lower, and employee costs are 71% higher (Table 2.12). Therefore, three are probably higher and one is lower. For the BSAI the comparison is as follows: gross value is 11% higher, net value is 27% lower, employee days are 13% higher, and employee costs are 31% higher. Therefore, three are probably higher and one is lower.

Comment 15 Over time a variety of factors that determine the relative benefits of a roe fishery can change. The effects of such changes were not considered.

Response Such changes could increase or decrease the relative merits of a roe fishery. As already noted, it is difficult to estimate what the relative values of alternative uses of pollock were in 1989. It would be more difficult to estimate what they will be in the future. A previous response also addressed the merits or problems with having the analysis based on data for only one year.

Comment 16 Technological progress should be considered. A ban on roe-stripping operations may force the H&G boats to change in ways that will make them more profitable.

Response Technical progress can occur in ways that can increase or decrease the benefits and costs of roe-stripping relative to other uses of pollock. This comment suggests that the H&G vessels need to be told they cannot continue roe-stripping in order for them to find the most productive way to operate. This is highly speculative, particularly given that these vessels currently operate in a number of fisheries due to the seasonality of the roe fishery.

Other Comments

Comment 1 The second sentence in 2.3.3 is presumptuous and suggests a bias (p. 16). It is inappropriate to define waste in strictly economic terms. The social definition of waste is ignored. Downstream social and economic costs to communities that wish to utilize pollock throughout the year are ignored.

Response The paragraph containing the referenced sentence is as follows.

> The productivity of a fishery can be measured biologically and economically, that is, in terms of catch, product weight, and net benefits over time. In terms of the wise use of the resources, net benefit is the most comprehensive measure of productivity for the same reasons that foregone net benefit is a better measure of waste than is foregone product weight. However, because catch over time is a critical factor in determining net benefits, the first part of this section focuses on the potential effects of a roe fishery on future productivity measured in terms of catch, that is, biological productivity.

The comment may be based on a narrow definition of net benefits that excludes biological and social implications of alternative uses of pollock. However, the EA/RIR defines net benefits very broadly. The last part of the paragraph indicates that the biological impacts, at least with respect to future pollock catch, are included. The section in which the two measures of waste are discussed states that net benefits should be defined as broadly as is appropriate given the groundfish FMP objectives, the Magnuson Act, and other applicable Federal regulations and directives. Such a definition would clearly include all the appropriate effects of a use of pollock within the net benefits of that use. As noted in the EA/RIR and elsewhere in this document, the principal problem in terms of applying this rule is being able to measure accurately each type of effect that should be included in the calculation of net benefits.

Comment 2 An appropriate conclusion is that though the proposed regulatory changes may not address the overcapitalization problem, they do address what are felt to be potential biological problems (p. iii, last paragraph).

Response It is not necessary to hedge on the inability of the alternatives to address the overcapitalization problem, particularly in the Gulf. However, the intent of the paragraph in question was to define differences among the nature of the alternatives and not to summarize their relative merits.

Comment 3 There is a limited ability to prevent overharvest in an intensive fishery given the current management budget.

Response The domestic fishery observer program can provide timely information. This information combined with improved methods of projecting catch are probably capable of preventing overharvest during the roe season from exceeding the overharvest that could occur during the fall pollock fishery. Pollock aggregations and the use of mid-water gear during the fall fishery reportedly result in catch per unit of effort that is similar to that during the roe fishery.

Comment 4 Why isn't the 3,000 mt of onshore roe-stripping considered throughout the analysis?

Response As noted above, the fact that this roe-stripping took place was not made known to staff until after the industry had provided information on the extent of the various types of pollock operations that had occurred by late 1989. The processor associated with the 3,000 mt did not provide economic information concerning this production. Staff become aware of this when it was mentioned during the AP meeting in December. This 3,000 mt was not included in the calculations of additional at-sea discards resulting from roe-stripping because it was assumed that the resulting discards were sent to a reduction plant.

Comment 5 If recovery rates for surimi and fillets differ, why wasn't this taken into account since H&G boats took about 50% of the pollock for roe-stripping (p. 15)?

Response Recovery rates for fillets are typically higher than those for surimi. A surimi recovery rate of 16% is used in the EA/RIR. The comparable rate for fillets is about 20%. If the estimates of the increase in at-sea pollock discards due to roe-stripping had been made using fillet production as the alternative to roe-stripping, the results would have been the same as those given with roe and surimi as the products for the BSAI and less than that for the GOA. This is because the combined recovery rate for roe and surimi is about 20% in the BSAI and 23.5% in the Gulf. The estimated increase in discards would have been higher if the alternative products had been assumed to be roe and fillets. However, during the roe season, the reported lower quality of fillets reduces the probability that this would be the dominant alternative.

Comment 6 Was the economic analysis totally focused on the at-sea sector? What are the impacts on the shoreside sector? How can conclusions be drawn without such information (p. 28)?

Response The economic analysis was not totally focused on the at-sea sector. The estimates of the four measures of benefit per metric ton of pollock catch for the alternative uses of pollock were based on information provided by a variety of types of operations including shoreside processing and catcher boats delivering to them (Tables 2.6 - 2.10). The estimated catch of each type of operation was used to estimate the weighted average benefits per ton for different aggregations of operations such as all roe-stripping operations, all first quarter operations, and all second through fourth quarter operations (Tables 2.12 and 2.14 in the EA/RIR and Table 3 in this report). Responses to the other two questions are included in the response to Comment 6 in the "Measures of Benefits" section.

Comment 7 The analysis in section 2.3.1 only addresses whether roe-stripping is an economically wasteful practice. It should also address whether roe-stripping is biologically wasteful. The potential effects of roe-stripping on pollock stocks and the ecosystem should be considered in section 2.3.1 and the associated tables.

Response As noted in the introduction to section 2.3.1, the potential biological effects of roe-stripping are discussed in separate sections. These sections address the effects of the additional discards that may result from roe-stripping and the effects of a roe fishery on the productivity of pollock stocks and marine mammals. It is not clear from the comment what if any additional effects should be considered. An attempt to consider the joint effects of differences in benefits per unit of catch and differences in stock productivity is included in section 2.3.3. Our inability to quantify the biological effects of alternative uses of pollock prevents the tabular estimates of benefits per metric ton of catch from including estimates adjusted for the expected biological effects.

Comment 8 The comparison of the discards between roe-stripping and surimi operations is misleading because the other alternatives to roe-stripping tend to have less discard than surimi operations. For example, if in 1989 the roe-stripping operations replaced H&G operations, the estimated total pollock discards would have been 149% and 49% more in the GOA and BSAI, respectively, due to the roe-stripping that is estimated to have occurred.

Response It is obvious that the additional discards that occur due to roe-stripping depend on what products are replaced by roe-stripping. During the roe season, surimi or surimi and roe are likely alternatives to roe-only production and there has been little to suggest that these alternatives to roe-stripping generate unacceptably high levels of discards. Later in the year, the production of only fillets or only surimi is considered the most likely alternative to roe-stripping earlier in the year. As noted in a previous response, the estimates of increased discards with roe-stripping compared to roe and surimi production are similar to or exceed the increases that would occur if the comparison is with fillets only. Another possibility is that roe-stripping would be replaced with operations that include meal and oil as products and result in no solid waste being discharged. The resulting differences in discards between such operations and roe-stripping operations is implicit in section 2.3.2 and explicit in section 2.3.6.2. The possibility that roe-stripping replaces H&G operations is not considered because such operations were thought to account for an insignificant part of the pollock catch. However, the increase in discards that would occur if roe-stripping operations replace H&G operations is within the range of estimates considered.

Comment 9 Due to the size of the pollock fishery in the BSAI, if a substantial portion of the TAC were taken for roe-stripping as occurred in the GOA, the amount of discards would be substantially more than considered in the text.

Response The comment is correct. If over 33% of the BSAI pollock TAC were taken for roe-stripping, the increase in discards would be beyond the range considered in the EA/RIR. There are several reasons why such a high level of catch was not considered. In 1989, roe-stripping operations accounted for about 12.6% of the first quarter BSAI catch or about 3% of the annual DAP catch. Although the DAP fishery is probably capable of taking more than 33% of the BSAI pollock TAC during the first quarter, this amount could be taken for roe-stripping only if few operations produced other products. The demand for pollock roe and alternative sources of supply of pollock roe also limit the probability that this amount of roe-stripping would occur in the BSAI.

Comment 10 Limiting the pollock fishery to off-bottom trawling in the GOA and BSAI would reduce bycatch of a variety of species (on-bottom, off-bottom, and mid-water trawling should be considered).

Response Benefits and costs of prohibiting the use of on-bottom trawl gear in the GOA pollock fishery are presented in the EA/RIR. A similar prohibition for the BSAI was not considered because it was not included among the alternatives developed prior to the preparation of the EA/RIR.

Comment 11 The analysis is vague with respect to the amount of protection onshore processors want.

Response The comment is correct. The point that was being made is that, in the GOA, much of the approximately 20,750 mt of pollock taken for at-sea roe-stripping in 1989 could have been taken by other types of at-sea operations had roe-stripping been prohibited in 1989. It is probably true that the onshore processors would have preferred access to the entire GOA pollock TAC and that they didn't expect at-sea processors to use significantly more than the 8,000 mt of pollock they used in 1988.

Comment 12 There is a need to justify the 20% recovery rate used given that fillet and H&G rates are higher (p. 29) .

Response As noted above, a product recovery rate of 20% is appropriate for roe and surimi combined in the BSAI or for only fillets in the BSAI and Gulf. Surimi only operations would have a rate of about 16%. H&G pollock operations would have a much higher rate but account for an insignificant part of the pollock catch. This suggests that an overall recovery rate of 20% prior to reduction to meal is a reasonable estimate. The expanded observer program and reporting requirements for 1990 will permit much better estimates of product mixes and recovery rates to be made. An attempt will be made to summarize such data prior to the June Council meeting.

Comment 13 The planned expansions of meal plants indicate that meal is expected to be profitable. Given the planned expansions, the additional requirement of full utilization could be met with much less of an effect on meal markets and capacity than suggested. Efforts to increase the demand for meal may be appropriate if meal production at these high levels would otherwise be unprofitable.

Response The expected profitability of meal plants is in part determined by expectations concerning EPA regulations for the disposal of processing waste and the price of meal. A processor may find it more profitable to use a meal plant than other EPA approved waste disposal methods. However, this does not imply that a meal plant will be profitable for a different processor faced with different EPA rules and, therefore, a different set of alternatives for disposing of processing waste. The other reason that the planned expansions do not necessarily imply the profitability of meal plant expansion is that often individual expansion plans are made based on the assumption that world prices will not be significantly affected because each planned expansion by itself will not substantially affect the world supply of meal. What is often ignored is that the simultaneous expansion of meal production by several processors or communities can decrease meal prices. Also note that a substantial part of the planned expansion is to meet increasingly stringent EPA disposal requirements for species other than pollock. For example, Kodiak processors expect to lose the option of barging waste to at-sea dump sites.

Increased marketing efforts can probably increase the demand for meal and offset some of the price reductions that would otherwise occur. However, increased marketing efforts could also increase demand in the absence of increased supply. Therefore, the benefits of marketing should not be confused with the potentially adverse effects on profitability of a substantial increase in the supply of meal. If meal reduction is or becomes profitable and if management measures do not decrease the profitability of meal reduction, it is difficult to argue that regulations that require meal reduction are either burdensome or necessary. Conversely, if they are not profitable given the existing fishery management measures, it cannot be argued that full utilization will not impose costs on the industry.

Comment 14 Monthly allowances could be used to prevent multi-season fisheries from developing.

Response If, for example, there is sufficient harvesting and processing to use all of a TAC in 60 days, quarterly or monthly allowances will not be able to provide full employment of that capacity throughout the year. With quarterly allowances, the fishery could be concentrated during the first 15 days of each quarter. With monthly allowances, it could be concentrated during the first 5 days of each month. There is little assurance that the daily pace of the fishery would decrease. In fact, it may actually increase since higher fishing rates can be sustained for a short period of time. The net benefits of a larger number of more intensive fisheries could be less than those of one 60-day fishery.

For some operations, the disadvantages of a larger number of more intensive fisheries would be offset, at least in part, by the fact that this would result in others leaving the fishery. To the extent that this happens, more pollock would be available to those who remain in the fishery. This may not be an efficient method of decreasing participation in the pollock fisheries.

Comment 15 There have not been "large or dominant roe fisheries for several years". The lack of large roe fisheries explains why there has not been much research concerning the effects of a roe fishery.

Response The definitions of "large" and "several" are the key issues for this comment. Table 4 presents catch data for 1981-90 by quarter. For the purposes of the EA/RIR, the first quarter was used as a proxy for the roe season.

Comment 16 In the GOA, pollock are off bottom the first 3 and last 4 months of the year; therefore, shifting the fishery to later in the year will not increase bycatch rates. An early pollock fishery will delay the cod fishery and increase bycatch rates.

Response This response is an addition to the one included above in the Biological Analysis section. Clearly if the seasonal allowances replace one low bycatch rate pollock fishery with another, bycatch rates would not increase. This may well be the case if a pollock fishery in the last 4 months replaces one in the first 3 months. However, the equal quarterly allowances would not do this unless most of the allowances for the second and third quarters are taken in the last 4 months. The previously referenced data in Table 2 summarize the Alaska Region's projections of the DAP desired use of pollock by quarter for 1990.

Concluding Remark A fact that is often ignored in considering proposed solutions to management problems is that the mythical beast Hydra is alive and well in the North Pacific. The Hydra is a 9-headed monster with the troublesome ability to replace each head that is cutoff with two more. Unfortunately the same is true of many management problems. When one problem is eliminated one or more new ones appear. The beast that confronts managers may be even more difficult to deal with than the Hydra for two reasons. First, even an attempt to solve one problem may create new ones without eliminating the initial problem. Second, it is difficult to predict what the new problem will be.

Consider, for example, the ban on roe-stripping for 1990 and the quarterly allowances of pollock in the GOA that were intended to, among other things, assure that adequate pollock would be available to onshore processors in the Gulf during the last 4 months of 1990. One unexpected problem emerged as a result of these actions that displaced H&G boats completely from the Gulf pollock fishery during the first quarter and from the BSAI pollock fishery once the roe-stripping ban became effective. It was that the H&G boats entered the turbot fishery earlier than they had in the past and, in part, as a result had much higher halibut bycatch rates than they were expected to have. The high bycatch rates in the turbot fishery have contributed to the projected early closures of all BSAI bottom trawl pollock and Pacific cod fisheries which in turn may result in an

**unprecedented influx of at-sea operations into the Gulf during the second half of the year. Neither staff nor the proponents of the management actions for 1990 expected these results.**