UNITED STATES DEPARTMENT OF COMMERCE
Office of the Under Secretary for
Oceans and Atmosphere
Washington, D.C. 20230

NOV 10 1997

To All Interested Government Agencies and Public Groups:

Under the National Environmental Policy Act, an environmental review has been performed on the following action.

TITLE: Environmental Assessment of Amendment 49 to the Fishery Management Plan for the Groundfish Fishery of the Bering Sea and Aleutian Islands Area

LOCATION: Federal Waters of the Bering Sea and Aleutian Islands Management Area

SUMMARY: Amendment 49 will establish a regulatory program to require all vessels fishing for groundfish in the Bering Sea and Aleutian Islands Management Area to retain all pollock and Pacific cod beginning January 1, 1998, and all rock sole and yellowfin sole beginning January 1, 2003. Amendment 49 also will establish a 15-percent minimum utilization standard for all at-sea processors; for pollock and Pacific cod beginning January 1, 1998, and for rock sole and yellowfin sole beginning January 1, 2003.

RESPONSIBLE OFFICIAL: Steven Pennoyer
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The environmental review process led us to conclude that this action will not have a significant impact on the environment. Therefore, an environmental impact statement was not prepared. A copy of the finding of no significant impact, including the environmental assessment, is enclosed for your information. Also, please send one copy of your comment to me in Room 5805, PSP, U.S. Department of Commerce, Washington, D.C. 20230.

Sincerely,

Susan Fruchter

Acting NEPA Coordinator

Enclosure

ENVIRONMENTAL ASSESSMENT/REGULATORY IMPACT REVIEW/ FINAL REGULATORY FLEXIBILITY ANALYSIS

FOR

AMENDMENT 49 TO THE FISHERY MANAGEMENT PLAN FOR THE GROUNDFISH FISHERY OF THE BERING SEA AND ALEUTIAN ISLANDS AREA

TO IMPLEMENT AN
IMPROVED RETENTION - IMPROVED UTILIZATION
GROUNDFISH MANAGEMENT PROGRAM

Prepared by

National Marine Fisheries Service
Alaska Fisheries Science Center
Alaska Region

September 3, 1997

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1.0 Introduction

The groundfish fisheries in the Exclusive Economic Zone (EEZ) [3 to 200 miles offshore] off Alaska are managed under the Fishery Management Plan for the Groundfish Fisheries of the Gulf of Alaska and the Fishery Management Plan for the Groundfish Fisheries of the Bering Sea and Aleutian Islands Area. Both fishery management plans (FMP) were developed by the North Pacific Fishery Management Council (Council) under the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). The Gulf of Alaska (GOA) FMP was approved by the Secretary of Commerce and become effective in 1978 and the Bering Sea and Aleutian Islands Area (BSAI) FMP become effective in 1982.

Actions taken to amend FMPs or implement other regulations governing the groundfish fisheries must meet the requirements of Federal laws and regulations. In addition to the Magnuson Act, the most important of these are the National Environmental Policy Act (NEPA), the Endangered Species Act (ESA), the Marine Mammal Protection Act (MMPA), Executive Order (E.O.) 12866, and the Regulatory Flexibility Act (RFA).

NEPA, E.O. 12866 and the RFA require a description of the purpose and need for the proposed action as well as a description of alternative actions which may address the problem. This information is included in this document. The document also contains information on the biological and environmental impacts of the alternatives as required by NEPA, as well as a Regulatory Impact Review (RIR) which addresses the requirements of both E.O. 12866 and the RFA that economic impacts of the alternatives be considered. It also contains the Final Regulatory Flexibility Analysis (FRFA) required by the RFA which specifically addresses the impacts of the proposed action on "small entities."

This Environmental Assessment/Regulatory Impact Review/Final Regulatory Flexibility Analysis (EA/RIR/FRFA) examines a series of alternatives for an Improved Retention/Improved Utilization management regime for all BSAI groundfish fisheries, managed under that region's FMP.

1.1 Purpose of and Need for the Action

On December 9, 1994, the Council debated and then unanimously approved a motion to develop a set of regulatory options that would be used to outline the mechanics of implementing a "retention/utilization" program for the groundfish fisheries of the Bering Sea and Aleutian Islands management areas. Specifically, the Council proposed that commercial groundfish trawl fisheries be required to reduce discards by retaining species which have historically been non-retained bycatch. The Council identified two subject fisheries for initial evaluation. These were, 1) the BSAI rock sole fishery, and 2) the BSAI mid-water pollock fishery.

The objective of the Council in undertaking an examination of, what came to be referred to as, "Improved Retention/Improved Utilization" (IR/IU) regulations centers on the concern that, under present regulations, groundfish catches are "underutilized," resulting in discard levels which are perceived to be unacceptably high. An IR/IU amendment would be expected to, *"provide an incentive for fishermen to avoid unwanted catch, increase utilization of fish that are taken, and, thus, reduce discards of whole fish."*

At the request of the Council, an *Implementation Issues Assessment* was completed in March of 1995, and presented to the SSC at the April Council meeting. Council scheduling problems delayed presentation of the assessment to the AP until September 1995. The Council did not revisit the IR/IU proposal until December 1995.

In response to the contents of the Implementation Issues Assessment, advice from the SSC and AP, as well as public testimony, the Council debated and then substantially modified its original IR/IU proposal at the December 1995 meeting, before recommending that a formal EA/RIR analysis be initiated.

1.2 The Council's IR/IU Problem Statement

The Council also adopted, at its December 1995 meeting, a draft IR/IU problem statement for public review. That statement reads as follows:

> *In managing the fisheries under its jurisdiction, the North Pacific Fishery Management Council is committed to: (1) assuring the long-term health and productivity of fish stocks and other living marine resources of the North Pacific and Bering Sea ecosystem; and (2) reducing bycatch, minimizing waste, and improving utilization of fish resources in order to provide the maximum benefit to present generations of fishermen, associated fishing industry sectors, communities, consumers, and the nation as a whole. These commitments are also reflected in the Council's CRP problem statement.*
>
> *The Council's overriding concern is to maintain the health of the marine ecosystem to ensure the long-term conservation and abundance of the groundfish and crab resources. As a response to this concern, a program to promote improved utilization and effective control/reduction of bycatch and discards in the fisheries off Alaska should address the following problems:*
>
> 1. *Bycatch and discard loss of groundfish, crab, herring, salmon, and other non-target species.*
> 2. *Economic loss and waste associated with the discard mortality of target species harvested but not retained for economic reasons.*
> 3. *Inability to provide for a long-term, stable fisheries-based economy due to loss of fishery resources through wasteful fishing practices.*
> 4. *The need to promote improved retention and utilization of fish resources by reducing waste of target groundfish species to achieve long-term sustainable economic benefits to the nation."*

1.3 The Concept of Waste

"Waste" is a term that has a variety of meanings. For example, "waste" may be regarded in purely physical terms, as... *to use up without real need or purpose.* Alternatively, "waste" may be regarded as a measure of opportunity (perhaps foregone), as in... *a failure to take proper advantage.* Or "waste" may be thought of in a purely production-oriented context, as in... *the mis-allocation of scarce resources, yielding less of a good or service than could be obtained from some alternative, and less costly, combination of inputs.* Each meaning supports a slightly different view of the world.

In the context of the commercial fisheries of the North Pacific and Bering Sea, "waste" has emerged as a focus of concern. Many of these fisheries are characterized by relatively high rates of bycatch. In some cases, these bycatches are discarded without undergoing any form of processing. Some of these discards are mandated, as in the case for prohibited species catch (PSC). Other discards are periodically required by regulation when, for example, a directed fishery for a bycatch species is not open. Still other discards are prompted by economic and/or logistical considerations.

Under one or more "definitions," and in the eyes of one or another constituent group, each of these categories of discards constitutes "waste."[1] This EA/RIR/FRFA is designed to systematically assess, to the maximum extent practicable, the costs and benefits attributable to these discard practices, as they pertain to various combinations of allocated groundfish species and target fisheries, and evaluate whether or not alternative proposed regulatory actions to mandate bycatch retention and utilization in the commercial groundfish fisheries of the North Pacific and Bering Sea result in a *net benefit to the Nation*.

In the regulatory analysis that follows, an effort is made to evaluate the economic and socioeconomic implications, for the Nation as a whole, as well as for the domestic groundfish industry, on a sector-by-sector basis, of adoption of an *"Improved Retention/Improved Utilization"* requirement.

1.4 The IR/IU Amendment Proposal

On the advice of the Advisory Panel, at the December 1995 meeting, the Council appointed an industry working group to examine some of the key implementation issues raised in the assessment document. The Council asked the working group to report back to it in April and that a preliminary report be provide at the same time by the analysts on the progress of the draft EA/RIR/IRFA. At the April 1996 meeting, the IR/IU Industry Working Group and NMFS staff made their respective reports to the AP and Council. In response, again at the urging of the AP, supported by public testimony, the Council further modified the IR/IU options to be examined in the draft analysis.

The most recent modifications to the IR/IU proposal re-focus the analysis on two "Retention Alternatives," i.e., the requisite "Status Quo" alternative and a "Species-based" approach. It retains three "Utilization Options" (in addition to the no-action "Status Quo" alternative), each dictating, to a greater or lesser degree, the form and extent of processing which must be applied to the retained catch.

As under the original proposal, the IR/IU action would pertain only to Bering Sea and Aleutian Island groundfish fisheries. It would, however, extend to all gear-types, and require 100% retention of four groundfish species (two more than under the original proposal); namely, Alaska pollock, rock sole, Pacific cod, and yellowfin sole. In the case of the two flatfish species, the revised proposal would also examine the implications of either, 1) incrementally "phasing-in" 100% retention over a fixed period of time, or 2) "delaying" implementation of the 100% retention requirement until a date-certain in the future. In either case, however, 100% retention of pollock and Pacific cod would be mandated for all operations beginning as soon as possible (presumably, January 1, 1998). The specific elements of the Council's revised IR/IU proposal are described below.

1.5 Improved Retention Requirement

For purposes of analysis, the Improved Retention and Improved Utilization options (and suboptions) proposed by the Council will be contrasted with the standard Status Quo, or "no-action," alternative. Reference to the individual Council options should be understood to imply each is an alternative to the Status Quo, e.g., IU Option 1 is the first Council utilization alternative to the status quo.

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[1] Is some level of bycatch unavoidable, given existing technology and regulatory constraints? If so, then its use as an *input* to production of the primary product is not *"without real need or purpose."* Bycatch may imply *"foregone opportunity,"* although the cost of exploiting that opportunity may offset any potential benefit. Thus, scarce resources are *"mis-allocated" (i.e., wasted)*, too, if the cost of utilizing bycatch exceeds the resulting value of the output, e.g., spend a dollar to produce a dime's worth of product.

1.5.1 Improved Retention Option 1

IR Option 1 is an inclusive alternative employing a "species-based" compliance criterion for BSAI groundfish fisheries, and extending IR regulations to all gear-types. Under this proposed management regime, IR/IU would mandate the retention of 100% of all four groundfish species of concern, whenever present in the catch of any BSAI groundfish fishery. For example, if *pollock, Pacific cod, yellowfin sole, or rock sole*, is present in the catch of an Atka mackerel target operation, or a sablefish target operation, or a Greenland turbot operation (or any other BSAI groundfish fishery), then that operator would be required to retain 100% of that pollock, Pacific cod, yellowfin and/or rock sole.

The Council explicitly acknowledged the differential implications of IR for pollock and Pacific cod, and requiring 100% retention of yellowfin and rock sole. The Council, therefore, requested that the analysis examine two retention suboptions. In both cases, 100% retention of pollock and Pacific cod would be required of all groundfish targets (all gear-types) beginning in the first year of the IR/IU program.

1.5.1.1 IR Suboption A

Under suboption A, however, retention of rock sole and yellowfin sole would be "phased-in," beginning in the first year of an IR/IU program (assumed to be 1998). The "phase-in" schedule would be over either two-years or five-years, and would begin at 60% retention of each flatfish species. That is, in the case of a two-year phase-in (and assuming the IR/IU program starts in 1998) all BSAI groundfish fisheries would be required to retain at least 60% of their yellowfin and at least 60% of their rock sole in 1998; 80% in 1999; and 100% in 2000. Under a five-year phase-in, the increments would be 60% in 1998; 70% in 1999; 80% in 2000; 90% in 2001; and 100% in 2002.

1.5.1.2 IR Suboption B - [PREFERRED ALTERNATIVE]

Suboption B is a variation on a theme, taking into account the inherent difficulty of monitoring differential rates of discard below 100% (see the discussion below on monitoring "phase-in" programs). Under this suboption, 100% retention of pollock and Pacific cod would be required of all BSAI groundfish fishery participants, beginning in the first year of the IR/IU program. Retention requirements for yellowfin and rock sole would, however, be postponed for five-years, at which time the 100% retention requirement would extend to these two species, as well. That is, if the IR/IU program is adopted and implemented in 1998 (as anticipated) 100% retention of the pollock and Pacific cod catch, in all groundfish fisheries in the BSAI will be mandatory. No specific retention requirement would be applied to yellowfin or rock sole at that time. However, under the five-year delay (assuming 1998 as the starting date), beginning in 2002 and every year thereafter, 100% of the catch of yellowfin sole and rock sole in any BSAI groundfish fishery would be required to be retained.

1.6 Improved Utilization Requirement

The Council's IR/IU proposal contains a total of three Utilization Options, plus the status quo alternative. Options 2 and 3 each contain three suboptions. The family of options and suboptions is intended to define the uses which may be made of "retained" catches of *Alaska pollock, Pacific cod, yellowfin sole*, and *rock sole*, under IR/IU. As such, they pertain only to the use of these four groundfish species, allowing all other groundfish species to be used (or discarded) at the discretion of the operator.

The Secretary cannot regulate on-shore processing of fish under current provisions of the Magnuson Act.[2] The Council has, nonetheless, assumed that IR/IU regulations will extend to this sector. This assumption becomes particularly significant as it pertains to the relationship between the processing plant and the delivering vessel. Specifically, it is necessary that an IR/IU program *require* a processor to accept all pollock, Pacific cod, yellowfin, and/or rock sole offered for delivery by vessels operating in IR/IU regulated BSAI fisheries. If such a requirement does not exist, rejection of deliveries would constitute effective discarding of IR/IU regulated species by the processor. That is, for any IR/IU regime to be functionally viable, a "primary" point of delivery must be available to participating catcher vessels. (This requirement would apply equally to shoreside plants, motherships, and catcher/processors receiving deliveries from catcher vessels).

The utilization options were not directly modified by the Council at the April 1996 meeting. Adoption, by the Council, of the IR/IU Working Group position visa' vis IU Option 2 did, however, *indirectly* alter the compliance assessment criteria associated with that option. (This change is described and evaluated below).

1.6.1 Utilization Option 1 - [PREFERRED ALTERNATIVE]

Utilization Option 1 can be characterized as potentially the *least restrictive* of the three options under consideration, in as much as it provides that the retained catch of the four groundfish species of concern may be processed into any form, regardless of whether or not the resulting product is suitable for direct "human consumption."[3] The resulting product form could, therefore, be "meal," "bait," or any other "processed product."[4]

1.6.2 Utilization Option 2

Containing specific provisions governing the form of the products which may be produced from retained catches of the four species of concern, Utilization Option two is potentially the *most restrictive* of three options. It requires that all retained *pollock, Pacific cod, yellowfin sole, and rock sole* be processed into a product form for "direct human consumption," based upon a percentage of total round weight of harvest of each respective species of concern. The three suboptions under Option 2 specify the **minimum** percentage of the retained catch of the species of concern which **must** be processed for "direct human consumption," i.e., the percentage which may **not** be processed into either "meal" or "bait." The respective suboption thresholds are: Suboption A - 50%; Suboption B- 70%; and Suboption C - 90%.

1.6.3 Utilization Option 3

The final utilization option under consideration speaks directly to limits on the production of *fish meal* from the retained catch of the four species of concern, without direct reference to the issue of "direct human consumption." Specifically, Utilization Option 3 provides that reduction of *pollock, Pacific cod, yellowfin*

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[2] See discussion in section 8.0 Legal Authority

[3] At present, only "meal," "bait" and "offal" are regarded as outputs "not-for-human-consumption," with offal not qualifying as a "product" form, but rather as "processing waste."

[4] The minimum aggregate product recovery rate for all product forms, by species, which must be attained for IU compliance under Option 1, is specified as 15%. The 15 % PRR was identified as an "acceptable" *minimum* utilization standard by the IR/IU Industry Working Group and adopted as part of that group's report, for purposes of this analysis, by the Council at its April 1996 meeting.

sole, and rock sole to meal be limited to a maximum percentage of the retained catch of the species of concern. The three suboptions establish these maximum meal rates as follows: Suboption A - 50%; Suboption B - 30%; Suboption C - 10%. Thus, under the respective suboptions A through C, 50%, 70%, and 90% of the retained catch of the four species of concern could be processed into any product form, except meal.

1.7 Defining Groundfish Discards

The discarding of unprocessed groundfish from catcher vessels, processor vessels, or shoreside processing plants occur for primarily two reasons. In the first instance, a processor or vessel operator is *permitted* to retain the fish, but voluntarily *chooses* not to, for various reasons. For example, owing to the "race for fish," the operator may opt to retain only the highest value fish within his catch. Alternatively, physical limitations on the capacity and/or capability of holding and processing equipment available at the time of harvest may induce discarding of otherwise wholesome groundfish in the round. And, on occasion, the demands of the marketplace may result in unprocessed groundfish being discarded. These discards can be termed *economic discards*.

The second general reason for discards of unprocessed groundfish is associated with regulatory prohibitions on retention. In these circumstances, the processor or vessel operator is *not permitted* to retain a particular species of fish and, thus, must return it, dead or alive, to the sea. This may occur when, for example, the directed fishery for a groundfish species has closed. If the species is placed on "*bycatch-only*" status, amounts in excess of a specified ceiling must be discarded. When the TAC for a groundfish species has been reached, all additional catch of that species must be discarded, i.e., the species assumes "*prohibited*" status. These discards can be termed *regulatory discards*.[5]

Most discards of unprocessed groundfish in the BSAI groundfish fisheries are *economic* rather than *regulatory*. Historically, economic discards have been highest in association with the "roe" fishery, although regulatory changes which banned roe-stripping in the pollock fishery, and opened yellowfin sole and "other flatfish" fisheries simultaneously with rock sole, have modified this pattern somewhat. The "roe" season in both the pollock fishery and rock sole fishery occurs early in the calendar year when relatively few groundfish species are on "bycatch-only" or "prohibited" status, thus potentially reducing the role of regulatory discards in the groundfish bycatch problem in these two cases (see the discussion of this topic in Section 5.0).

1.8 Estimating Catch and Discards

The source of discard estimates depends on how total catch is estimated for a particular vessel or processor. For catcher/processors and mothership vessels with NMFS-certified observers onboard, the "blend" system is used to estimate total catch by species. Each week, NMFS compares the observer's report of total catch weight with an estimate derived from the processor's Weekly Production Report (WPR). In most cases, the "blend" process selects the higher of these two total catch weight estimates, as well as the associated observer information about species composition and the distribution between retained catch and discards. With specific reference to the retention-discard issue, if the "blend" selects the observer's report, then discard

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[5] Another source of discards of whole fish in the BSAI groundfish fisheries is associated with "prohibited species catch" (PSC). Composed of salmon, halibut, herring, and crabs, these discards are a special case of the "regulatory discard" category. PSC discards are not treated in the present analysis, because the IR/IU proposal does not directly alter the regulatory status of this group of bycatch species. Indirect effects will be cited and referenced, where appropriate.

estimates for that processor and week are based on the observer's estimate. If the "blend" selects the processor's report, discard estimates are based on the processor's WPR.

In the case of at-sea processing operations without a NMFS-certified observer onboard, the agency uses the estimates of discards provided by the processor on the WPR.

For unobserved catcher vessels delivering to shoreside processing plants, NMFS applies information about the weight and species composition of discards from observed catcher vessels operating in the same area, using the same gear-type, and participating in the same directed fishery.

For fish landed and then discarded from shoreside processing plants, NMFS uses information supplied by processors on WPRs about the weight and species composition of plant discards, regardless of whether the plant is observed or unobserved.

It is difficult to assess the accuracy of either industry or observer estimates. In the case of at-sea operators, neither source provides direct measurement of discards, and once the discards are made, estimates cannot be verified. On-shore estimates, drawn from WPRs, are no better documented, since they depend solely on the data supplied by the operation, itself, and are filed with NMFS well after the discards have been sorted and disposed of, making physical verification impossible.

2.0 NEPA Requirements: Environmental Impacts of IR/IU

An environmental assessment (EA) is required by the National Environmental Policy Act of 1969 (NEPA) to determine whether the action considered will result in significant impact on the human environment. If the action is determined not to be significant based on an analysis of relevant considerations, the EA and resulting finding of no significant impact (FONSI) would be the final environmental documents required by NEPA. An environmental impact statement (EIS) must be prepared for major Federal actions significantly affecting the human environment.

An EA must include a brief discussion of the need for the proposal, the alternatives considered, the environmental impacts of the proposed action and the alternatives, and a list of document preparers. The purpose and alternatives were discussed in Chapter 1.0, and the list of preparers is in Chapter 11.0. This section contains the discussion of the environmental impacts of the alternatives including impacts on threatened and endangered species and marine mammals.

The environmental impacts generally associated with fishery management actions are effects resulting from (1) harvest of fish stocks which may result in changes in food availability to predators and scavengers; (2) changes in the population structure of target fish stocks; (3) changes in the marine ecosystem community structure; (4) changes in the physical and biological structure of the marine environment as a result of fishing practices, e.g., effects of gear use and fish processing discards; and (5) entanglement/entrapment of non-target organisms in active or inactive fishing gear. It might be expected that any of the alternatives could have effects related to (1), (3), and (4) above.

A summary of the effects of the annual groundfish total allowable catch amounts on the biological environment and associated impacts on marine mammals, seabirds, and other threatened or endangered species are discussed in the final environmental assessment for the annual groundfish total allowable catch specifications (NMFS 1996). None of the IR/IU alternatives would affect how annual groundfish total allowable catch amounts are determined.

Possible ecological impacts of IR/IU relative to the status quo would primarily occur through the decrease in the amounts of walleye pollock, Pacific cod, yellowfin sole and rock sole that are returned to the sea. Stock assessments of pollock, cod, yellowfin sole and rock sole already assume 100% mortality of the discards of these species so no change in the population status of these species is anticipated due to any of the proposed options. However, the decrease in discards returned to the sea could result in a decrease in the amount of food available to scavengers and produce a decline in growth or reproductive output of species that rely on discards for a major portion of their food intake. Also, changes in energy flow to the detritus and local enrichment through an increase in processing waste (offal) could occur.

2.1 Consumers of Discards and Fish Processing Offal

Several years of groundfish food habits data collected by the Trophic Interactions Program at the Alaska Fisheries Science Center confirm the consumption of fish processing offal by fish in the eastern Bering Sea, Aleutian Islands, and Gulf of Alaska. Estimates of groundfish consumption of offal in the Bering Sea during the main feeding season show a level of offal consumption by several species of groundfish approaching 200,000 mt/yr (Table 2.1). Although the estimated total amount of offal consumed by pollock is fairly high at around 45,000 mt/yr, the percentage of offal in the diet is less than 1% by weight. It is the large biomass of pollock relative to other predators that brings its estimated consumption up to this level. Pacific cod consumed the most offal compared to other groundfish in 1990 and 1991. The percentage by weight of offal in the diets of Pacific cod and skates is higher than the other groundfish species sampled in the eastern Bering Sea.

An estimate of the amount of offal returned to the sea by at-sea and on-shore processors can be obtained from subtracting the total weight of groundfish products from the round weight catch of groundfish. These estimates of offal would include all fish substance (solid, liquid, and perhaps even gas) that is not part of the final product. Estimated at-sea offal production for 1994, for example, in the BSAI was 835,524 mt [= round wt of the catch (1,186,511) - product wt (350,987)] and shoreside offal production was 364,359 mt. The majority (86%) of the at-sea offal produced consisted of pollock parts. Based on the estimates in Table 2.1, it appears that groundfish in the eastern Bering Sea consume at least 20% of the at-sea offal produced. This compares to an estimate of about 11% of total discards consumed by fish and crab in a study area off Australia (Wassenburg and Hill, 1990).

Other upper-trophic level scavenger species likely to benefit from offal production include sculpins, crabs, other predatory invertebrates, marine mammals (particularly pinnipeds), and marine birds such as gulls, kittiwakes, and fulmars. Studies performed in the North Sea and Australia indicate that birds are a likely recipient of discards and offal thrown overboard during daytime and which do not immediately sink (Anon., 1994; Evans et al., 1994; Wassenburg and Hill, 1990), while crabs may be the first to arrive in areas when discards reach the bottom (Wassenburg and Hill, 1987). Offal not consumed by these predators would presumably be decomposed by bacteria and also become available as detritus for benthic filter-feeding invertebrates.

Estimates are not available for consumption of whole animal discards by groundfish, marine mammals, or birds in the BSAI and GOA areas. When analyzing stomach contents of groundfish and birds, and scats of marine mammals it is impossible to discern whether a whole animal in the stomach contents was consumed when alive or dead. Presumably, whole discards are consumed by the same scavengers that consume unground offal.

Table 2.1 Estimated amounts of offal consumed (metric tons) by groundfish on the eastern Bering Sea shelf during the main feeding season, May through September. (ns - not sampled).

	Year			
Groundfish predator	*90*	*91*	*92*	*Avg*
Pacific cod	86,789	82,577	35,067	68,144
Walleye pollock	45,117	51,851	37,023	44,664
Arrowtooth flounder	21,350	3,933	2,977	9,420
Flathead sole	28,636	7,067	32,351	22,692
Yellowfin sole	114	35,853	13,477	16,481
Pacific halibut	1,029	0	2,466	1,165
Skates	ns	ns	36,192	12,064
TOTAL	183,055	181,281	159,553	174,630

2.2 Offal and Discard Amounts

Table 2.2 provides a summary of the magnitude of offal and discard amounts relative to catch in the BSAI groundfish fisheries for 1994 under the status quo and the bounds of possible changes in those amounts under IR Option 1 and the ranges of possible product recovery rates considered under the utilization options (15% to 100%). Under the status quo option the weight of offal returned to the sea is almost four times as large as the weight of discards. About 70% of the target catch is returned as offal. About 60% of the total catch becomes offal while only 17% of the total catch is discarded whole. Obviously, when considering energy transfer in the ecosystem, offal production overshadows discard amounts. The large proportion of the total catch returned to the sea as offal and discards could reduce any potential impacts of fishing to energy loss in these areas. However, availability of the returned energy (as offal and discards) to various ecosystem components may differ from that of the undisturbed energy form (live fish).

Ecosystem level concerns about discards and offal production primarily center on the possibility that these practices might alter the regular paths of energy flow and balance and enhance the growth of scavenger populations. In the eastern Bering Sea, at least half of the discards and most of the offal produced are from pollock. Most of the remaining discards tends to be flatfish such as yellowfin sole and rock sole. All of the groundfish species found to be consumers of offal (Table 2.1) are also predators of pollock, and some of them (Pacific cod and halibut) also consume flatfish (Livingston et al., 1993). The scavenging birds (gulls, fulmars, kittiwakes), are also documented predators of pollock (Hunt et al., 1981). The annual consumptive capacity of these scavenging birds, groundfish, and crab in the eastern Bering Sea is estimated at 19 million mt, an order of magnitude larger than the total amount of offal and discards in the BSAI (Livingston, unpublished data). Since many of the main predators of pollock are consuming offal and discards, it appears that the practice of returning them to the ocean under the status quo option may not significantly disrupt regular paths of energy flow when the geographic location of the return to the sea is close to the capture location. Although fishing removes some biomass from the system, the actual amount removed in the BSAI is much less than the total catch would indicate. A large proportion of the total catch is, in fact, returned and apparently consumed by predators.

If all the newly retained fish under IR Option 1 is converted to product with the minimum 15% product recovery rate (Table 2.2), then there is a decrease in discards as a fraction of total catch from 0.14 to 0.04. However, 85% of this newly retained fish would become offal, with the corresponding increase in the amount of offal relative to total catch. There is a 2% decline in the total amount of dead organic material (offal + discard) returned to the sea, or a decline of 31,854 mt in absolute terms.

If all the newly retained fish under IR Option 1 is converted to product with the maximum possible product recover rate of 100% (Table 2.2) then there is a decrease in discards as a fraction of total catch from 0.14 to 0.04. However, there is no increase in offal production relative to total catch. There is an 11% decline in the total amount of dead organic material (offal + discard) returned to the sea, or a decline of 212,353 mt in absolute terms.

2.3 Changes in Detrital Flow

Even if offal and discards are not used by the upper trophic level scavengers that are a regular part of the energy pathway for pollock and flatfish, the total amount of dead organic material (detritus) that would reach the bottom is small relative to other natural sources of detritus. Walsh and McRoy (1986) estimate detrital flow to the middle and outer shelf of the eastern Bering Sea to be 188 $gCm^{-2}\ yr^{-1}$ and 119 $gCm^{-2}\ yr^{-1}$, respectively. When converted to biomass over the whole area[6], an estimated 506.9 million mt of naturally-occurring detritus goes to the bottom each year. Approximately 28% (142.9 million mt), is unused (Walsh and McRoy, op. cit.). The total offal and discard production in the BSAI under the status quo option as estimated for 1994 (1.49 million mt; Table 2.3) is only 1% of the estimate of unused detritus already going to the bottom and only 0.3% of the total detritus. The total amount of offal and discard produced under a 15% product recovery rate for newly retained species relative to unused detritus and total detritus is the same as for the status quo option, 1% and 0.3% respectively. The total amount of offal and discard produced under a 100% product recovery rate for newly retained species relative to unused detritus and total detritus is 0.9% and 0.25%, respectively.

A steady-state energy flow model of the eastern Bering Sea has been parameterized by Livingston (personal communication)[7] and uses much more detail regarding upper-trophic levels such as fish, mammals, and birds than used in Walsh and McRoy (op cit.). In Livingston's model, the estimated total flow to the detritus in the middle and outer shelf areas under the status quo is 619.2 million mt and the change in the flow to the detritus is less than 0.1% under either assumption about product recovery rate.

Simulation model results of discard effects on energy cycling in the Gulf of Mexico (Browder, 1983) confirmed that discards, even in that region of relatively high discard rates, tended to be a small portion of the dead organic material on the bottom. However, depending on model assumptions, changing the amount of discards through full utilization or through selective fishing methods had the potential to change populations of shrimp and its fish competitors. Uncertainty about the predation rates and assumptions about alternate prey utilization indicated a need for further research to fully understand and predict responses of populations to changes in food availability. Similar uncertainty about scavenger responses to changes in food availability and alternate prey exist for the Bering Sea. However, the small changes in total offal and discard production relative to detrital flow in the eastern Bering Sea under the proposed IR/IU options are an indication of no significant impact on flows to the detritus.

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[6] Assuming 0.4 gC/1g dry weight and 0.5 g dry weight/1g wet weight, and total middle shelf area = 4×10^5 km^2 and outer shelf area = 2.2×10^5 km^2.

[7] Patricia Livingston, Alaska Fisheries Science Center, 7600 Sand Point Way NE, Seattle, WA 98115.

Table 2.3 Summary of offal and discard amounts in the BSAI groundfish fisheries for 1994 compared to total and retained catch and hypothetical amounts under Improved Retention Option 1 (100% retention of pollock, Pacific cod, yellowfin sole, and rock sole).

Category	*Amount (mt)or fraction*	*Hypothetical amount (mt) or fraction with a 15 percent PRR for newly retained catch*	*Hypothetical amount (mt) or fraction with 100 percent PRR for newly retained catch*
Retained catch (round weight)	1,698,669	1,911,026	1,911,026
Discarded catch	285,956	73,603	73,603
Total catch (retained + discards)	1,984,625	1,984,625	1,984,625
Offal (retained rnd. wt - product wt)	1,199,883	1,380,386	1,199,883
Offal + discards	1,485,839	1,453,989	1,273,486
Discard/Retained catch	0.17	0.04	0.04
Discard/Total catch	0.14	0.04	0.04
Offal/Total catch	0.60	0.70	0.60
(Offal + discard)/Total catch	0.75	0.73	0.64
Offal/discards	4.20	18.75	16.30

2.4 Scavenger Population Response

Under the status quo rates of offal and discard production, most of the scavenger populations are not showing obvious signs of increase related to offal production. Kittiwake populations that nest on the Pribilof Islands have apparently declined from 1979 to 1989 (Hatch et al., 1993). Decline in food availability has been cited as a possible reason for the decrease in productivity for both kittiwake species. The distribution and timing of the pollock catch processing has shifted away from a predominance of fishing during summer around the outer shelf to a winter (A season) and summer (B season) fishery that occurs farther south in the outer and middle shelf areas (Fritz, 1993). This shift in fishing distribution away from summer bird foraging areas did not occur until about 1987 (Fritz et al., 1994) and cannot explain the population decline. Northern fulmar (*Fulmarus glacialis*) population size at the Pribilof Islands is showing a possible increase, particularly from 1989 to 1992. However, there is large variability around fulmar counts that makes determination of the population trend uncertain (Climo, 1993; Dragoo and Sundseth, 1993). Kittiwake population increases have been noted in Chiniak Bay, the site of offal disposal at Kodiak Island. The increases there occurred between the late 1970s and mid-1980s (Hatch et al., op cit.), apparently before offal disposal at that site began. Some of the main scavengers in the groundfish community of the eastern Bering Sea such as Pacific cod, skates, halibut and sculpins have shown a combined biomass of around 1.2 million mt in 1979 to over 1.3 million mt in 1993 (Livingston et al., 1994). The only member of that group that might be exhibiting a constant increasing trend in biomass is the skates, whose biomass has doubled between 1982 and 1993. Little is known about the skate population, such as size or age-frequency over time, that might provide clues to why this change in biomass has occurred. However, the small changes in total offal and discard production relative to total catch, Bering Sea detrital flow, and total consumptive capacity of scavenging birds, groundfish, and crab in the eastern Bering Sea under the proposed IR/IU options are an indication of no significant impact on scavenger populations.

2.5 Changes in Local Enrichment

Local enrichment and change in species composition in some areas might occur if discards or offal returns are concentrated there. There is evidence under the status quo option that such effects have previously been seen in Orca Inlet in Prince William Sound and in Dutch Harbor, Alaska. Poor water quality and undesirable species composition have been cited (Thomas, 1994) as the result of the current policy for grinding fish offal released in inshore areas and the inadequate tidal flushing in that region. However, deep water waste disposal of offal in Chiniak Bay of Kodiak Island has not shown such problems (Stevens and Haaga, 1994). No apparent species composition changes, anaerobic conditions, or large accumulations of offal occurred in Chiniak Bay where such wastes have been dumped for over a decade. Local ocean properties (water depth and flow) and amount of waste discharged per year could be important factors determining the effect of nearshore disposal on local marine habitat and communities. Recent changes to the processing plant at Dutch Harbor have dramatically reduced the amount of offal and ground discards discharged in the last two years under the status quo. The adoption of IR Option 1 could cause some increase in the amount of local enrichment due to disposal of the increased offal from shoreside processing of newly retained fish with product recovery rates less than 100%. Given the recent improvements to the Dutch Harbor plants, which may have largely reduced the discharge, the increases could be small. In 1994, the estimated amount of offal from Bering Sea shoreside processing was 364,359 mt (512,158 mt retained catch - 147,799 mt product). Increased retention of pollock, cod, yellowfin sole, and rock sole in the shoreside processing sector would be 27,178 mt, using 1994 data. If all of this newly retained fish was converted to fish meal with a minimum product recovery rate of 17%, then the increase in offal production relative to the status quo would be approximately 6%. The small estimated change in total offal production relative to current shoreside offal production in the eastern Bering Sea under the proposed IR/IU options are an indication of no significant impact due to a change in local enrichment.

2.6 Impacts on Endangered, Threatened or Candidate Species

Endangered and threatened species under the ESA that may be present in the GOA and BSAI include:

Endangered

Northern right whale	*Balaena glacialis*
Sei whale	*Balaenoptera borealis*
Blue whale	*Balaenoptera musculus*
Fin whale	*Balaenoptera physalus*
Humpback whale	*Megaptera novaeangliae*
Sperm whale	*Physeter macrocephalus*
Snake River sockeye salmon.	*Oncorhynchus nerka*
Short-tailed albatross	*Diomedea albatrus*

Threatened

Steller sea lion	*Eumetopias jubatus*
Snake R. spring and summer chinook salmon	*Oncorhynchus tshawytscha*
Snake R. fall chinook salmon	*Oncorhynchus tshawytscha*
Spectacled eider	*Somateria fischeri*
Steller's eider	*Polysticta stelleri*

The status of the ESA section 7 consultations required to assess the impact of the groundfish fisheries on endangered, threatened, or candidate species is updated annually as part of the annual groundfish specifications process.

Endangered, threatened, and candidate species of seabirds that may be found within the regions of the BSAI where the groundfish fisheries operate, and potential impacts of the groundfish fisheries on these species are discussed in the EA prepared for the 1997 TAC specifications (NMFS 1997). The U.S. Fish and Wildlife Service (USFWS), in consultation on the 1997 specifications, concluded that groundfish operations will not jeopardize the continued existence of the short-tailed albatross (letter, Rappoport to Pennoyer, February 19, 1997). None of the alternatives considered would be expected to affect threatened or endangered seabird species in any manner or extent not already addressed under previous consultations.

None of the alternatives will affect endangered and threatened species listed or critical habitat designated pursuant to the ESA in any manner not considered in prior consultations on the groundfish fisheries of the BSAI. None of the alternatives would modify the groundfish harvest thresholds that have been established for reinitiating section 7 consultation.

2.7 Impacts on Marine Mammals

Marine mammals not listed under the Endangered Species Act that may be present in the GOA and BSAI include cetaceans, [minke whale (*Balaenoptera acutorostrata*), killer whale (*Orcinus orca*), Dall's porpoise (*Phocoenoides dalli*), harbor porpoise (*Phocoena phocoena*), Pacific white-sided dolphin (*Lagenorhynchus obliquidens*), and the beaked whales (e.g., *Berardius bairdii* and *Mesoplodon spp.*)] as well as pinnipeds [northern fur seals (*Callorhinus ursinus*), and Pacific harbor seals (*Phoca vitulina*)] and the sea otter (*Enhydra lutris*).

[northern fur seals (*Callorhinus ursinus*), and Pacific harbor seals (*Phoca vitulina*)] and the sea otter (*Enhydra lutris*).

A list of marine mammal species and detailed discussion regarding life history and potential impacts of the 1995 groundfish fisheries of the BSAI and GOA on these species can be found in the EA prepared for the 1996 Total Allowable Catch Specifications for Groundfish (NMFS 1996). None of the alternatives would be expected to adversely affect marine mammals.

2.8 Coastal Zone Management Act

Implementation of 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 30(c)(1) of the Coastal Zone Management Act of 1972 and its implementing regulations.

2.9 Conclusions or Finding of No Significant Impact

None of the alternatives is likely to significantly affect the quality of the human environment, and the preparation of an environmental impact statement for the proposed action is not required by Section 102(2)(C) of the National Environmental Policy Act or its implementing regulations.

Assistant Administrator for Fisheries, NOAA

Date 10/4/97

3.0 Economic and Socioeconomic Impacts of Improved Retention

This section provides information about the economic and socioeconomic impacts of the alternatives, including identification of the individuals or groups that may be affected by the action, the nature of these impacts, quantification of the economic impacts (if possible), and discussion of the trade offs between qualitative and quantitative benefits and costs.

The requirements for all regulatory actions, specified in E.O. 12866, are summarized in the following statement from the executive order:

> In deciding whether and how to regulate, agencies should assess all costs and benefits of available regulatory alternatives, including the alternative of not regulating. Costs and benefits shall be understood to include both quantifiable measures (to the fullest extent that these can be usefully estimated) and qualitative measures of costs and benefits that are difficult to quantify, but nevertheless essential to consider. Further, in choosing among alternative regulatory approaches, agencies should select those approaches that maximize net benefits (including potential economic, environment, public health and safety, and other advantages; distributive impacts; and equity), unless a statute requires another regulatory approach.

This section also addresses the requirements of both E.O. 12866 and the Regulatory Flexibility Act to provide adequate information to determine whether an action is "significant" under E.O. 12866 or will result in "significant" impacts on small entities under the RFA.

E. O. 12866 requires that the Office of Management and Budget review proposed regulatory programs that are considered to be "significant." A "significant regulatory action" is one that is likely to:

> (1) Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or tribal governments or communities;
>
> (2) Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;
>
> (3) Materially alter the budgetary impact of entitlement, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or
>
> (4) Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in this Executive Order.

A regulatory program is "economically significant" if it is likely to result in the effects described above. The RIR is designed to provide information to determine whether the proposed regulation is likely to be "economically significant."

3.1 Catch, Bycatch, and Discards in BSAI Groundfish Fisheries: the "Status Quo" Alternative

Catch and discard data from NMFS Alaska Region Blend Estimates, and NMFS Weekly Production Reports, have been employed in describing the "Status Quo" alternative. The fishing years of 1994 and 1995 have been utilized as the base period for this analysis. The series of tables which appear in Appendix A

summarize the catch, retention, and discard performance of all groundfish target fisheries operating in the BSAI management area, during these years. By utilizing the standard NMFS Alaska Region definition of "target," and focusing on the catch and discard of the four groundfish species of concern, i.e., *pollock, Pacific cod, yellowfin*, and *rock sole*, one may assess, in general terms, the likely implications of retaining the Status Quo Alternative, with respect to bycatch discard and retention, in the absence of other regulatory changes.

3.1.1 Retaining the Status Quo Alternative

Continued management of the BSAI groundfish fisheries under the status quo alternative would, presumably, result in groundfish bycatch discards on the order of those observed in recent years in these fisheries (see Appendix A). While efforts have been made in some fisheries, by some participants, to adopt bycatch avoidance technologies or techniques, their relative contribution to bycatch reduction is likely to be limited by the continued open access "race-for-fish" in these fisheries. If bycatch discards do continue at approximately the levels observed over the period of analysis, this suggests that retention of the status quo alternative would see total *Alaska pollock* discards in the range of 98,000 mt to 109,000 mt per year (1995 and 1994 estimated aggregate discards, respectively); *Pacific cod* discards ranging from 37,000 mt to 43,000 mt per year (1994 and 1995 estimated aggregate discards, respectively); *yellowfin sole* discards continuing to be between 28,000 mt and 37,000 mt per year (1995 and 1994 estimated aggregate discards, respectively); and *rock sole* discard estimates ranging from 33,000 mt to 40,000 mt, annually (1995 and 1994 estimated aggregate discards, respectively).[8]

Because very little empirical data exist pertaining to the size frequency composition or condition of these discarded fish, except in the target fishery for each individual species, it is impossible to quantitatively estimate, with any precision, the economic impact these discards may have on the various "IR target" fisheries.[9] It is reasonable to assume, however, that many of these discarded fish are of a size, condition, and quality that would permit production of marketable products, if retained and processed. Whether the cost of retaining, processing, storing, shipping, and marketing these resulting products can be recovered through their sale, by the operations which intercept them as bycatch, is in part the subject of this analysis.

3.2 Improved Retention: Alternative One and its Suboptions

Catch and discard data from NMFS Alaska Region Blend Estimates, and NMFS Weekly Production Reports, have been employed in evaluating IR Option 1, with suboptions A & B, and contrasting each with the status quo alternative. As previously noted, the fishing years 1994 and 1995 were selected with the expectation that they most nearly reflect the current pattern of catch, utilization, and discards in the fisheries under consideration. Some preliminary 1996 data are available, but at the time of analysis they remain substantially incomplete. Their use at this point could potentially present a distorted picture of the 1996 catch, discard, and retention performance of these fisheries. For this reason they have not generally been included.

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[8] For each of these species, the presence of unusually large (or small) year classes in the harvestable biomass can result in significant variability in catch/bycatch rates over time. Historically, annual catch data clearly reveal the effects on total catch, average size in the catch, etc., of atypical year classes as they recruit into, pass through, and exit the harvestable biomass. One would expect this pattern to continue under any IR/IU program, thus making accurate predictions of numerical "improvements" in bycatch, from year-to-year, problematic.

[9] An analysis of the economic "opportunity cost" of groundfish bycatch has recently been published by the Alaska Region/Alaska Fisheries Science Center. Interested readers are referred to, L.E. Queirolo, et al., *Bycatch Utilization, and Discards in the Commercial Groundfish Fisheries of the Gulf of Alaska, Eastern Bering Sea, and Aleutian Islands*. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-58, 148 pp. November 1995.

3.2.1 IR Option 1

The provisions of Retention Option 1 are *"species-based."* This retention alternative would be applied equally to all groundfish targets (i.e., applying to all fisheries taking any amount of the four species of concern). The following analysis therefore retains the effort-apportioning criteria employed in the standard Alaska Region target definitions and contained in the NMFS Blend files.

Adoption of the "species-based" retention option would have a broad potential impact on the groundfish fisheries of the BSAI. This is so because, IR Option 1 requires that, for any groundfish fishery operating in the BSAI management area, 100% of the *pollock, Pacific cod, yellowfin sole*, and *rock sole* contained in the catch be retained. In other words, for any groundfish fishery (and any gear-type), e.g., Atka mackerel jig, sablefish pot, POP trawl, or turbot longline, this IR option would require retention of all Pacific cod, all pollock, all yellowfin sole, and all rock sole present in the catch. Any other groundfish species present in the catch could be retained or discarded at the discretion of the operator.[10]

By examining the catch and discard estimates for all groundfish fisheries (based on current Region target definitions) for the analytical base years, and assuming IR Option 1 had been in place during 1994 and 1995, the following impacts can be projected (see Appendix A).[11] The potentially affected fisheries are defined and examined below.

Alaska Pollock

Bottom Trawl

For the BSAI bottom pollock trawl fishery, NMFS Blend, ADF&G fish ticket, and NORPAC data indicate that 48 processors participated in the 1994 fishery (4 shoreside processing plants, 3 motherships, 41 catcher/processors). Nine catcher/processors operated in a "mothership" mode during some period of the fishery in 1994, i.e., receiving catch from other vessels for processing. One catcher/processor also reportedly delivered unprocessed catch to processors both at-sea and on-shore during that season. All of the motherships and catcher/processors were greater than 124 feet in length, thus indicating "100%" observer coverage.

There were 39 catcher vessels participating in this fishery in 1994. Six were reportedly greater than 124' in length (i.e., 100% observed). One catcher vessel in this size class reported deliveries at-sea, while 5 recorded deliveries in-shore. In the 60' to 124' size range (implying 30% observer coverage) 19 catcher vessels reported landings at-sea; 12 to in-shore processors. The data suggest that two other vessels participated in this fishery, one each delivering catch at-sea and on-shore, however, the vessel length is "unknown."

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[10] Subject, of course, to compliance with any other prevailing regulation or statute, e.g. EPA discharge requirements, NMFS Directed Fishing Standards.

[11] To the extent that harvesters are able to avoid bycatches of unwanted fish, these discard estimates may be further reduced by imposition of a "retention" requirement. At present, no empirical data are available with which to assess this potentiality. Presumably, adjustments to a "retention" requirement would occur over time as fishermen learn new techniques, or adjust fishing practices, patterns, and areas. It may require the observation of these operations over several seasons under a "retention" requirement before such information could be obtained, however.

Fifty processors participated in the 1995 pollock bottom trawl fishery (6 shoreside processors, 4 motherships, 40 catcher/processors). Of these, 3 motherships and 39 catcher/processors were greater than 124' in length, requiring 100% observer coverage. Nine catcher/processors in this length category also operated in a "mothership" mode during some part of the season, while one of these also delivered unprocessed catch to another vessel (i.e., also operated in a "catcher boat" mode).

One catcher/processor was in the 60' to 124' class (thus, with 30% coverage) and, according to the data files, one mothership was of "unknown" length. Three catcher vessels of over 124' (100% coverage) and 22 catcher vessels in the 60' to 124' class (30% coverage) recorded bottom pollock landings on-shore in 1995. One catcher vessel of "unknown" vessel length also reportedly landed its catch on-shore in this year. Thirty-three catcher vessels recorded deliveries at-sea in 1995. Two of these vessels were greater than 124' in length (i.e., 100% observed), 28 were 60' to 124' (i.e., 30% observed), and 3 were of "unknown" length. Five of the catcher boats in the "30% coverage" category recorded landings to both at-sea and on-shore processors during the 1995 pollock bottom trawl season.

The NMFS blend catch and discard data indicate that the bottom pollock target fishery is relatively *species selective* (see Appendix A: Table 1.1). In 1994, *pollock* accounted for just over 90% of total reported groundfish catch in this fishery. In 1995, *pollock* comprised just under 88% of its total groundfish catch. The *rate* of discards of *pollock* in this fishery has also been relatively low. In 1994, approximately 6.3% of a total pollock catch of 126,419 mt was discarded. In 1995, while the total catch of pollock was down by almost 22,000 mt to 104,026 mt, the *rate* of pollock discards was also down sharply, to 3.9% of pollock catch.

While *rates of bycatch* of the other three species of concern, i.e., *Pacific cod, yellowfin*, and *rock sole*, were low in this fishery, e.g., 4.4%, 0.8%, and 2.0% of total groundfish catch, respectively, in 1994, the associated *rates of discard* were relatively high. An estimated 6,203 mt of Pacific cod bycatch were taken in 1994, in this fishery. More than half (55.6%), or 3,434 mt, were discarded in-the-round. In 1995, Pacific cod bycatch was estimated at 9,535 mt, with 7,428 mt (78%) reportedly discarded whole. Rock sole bycatch amounts were very much smaller, estimated at 2,780 mt and 1,757 mt in 1994 and 1995, respectively. The *rate of discard* was, however, quite high at 80.5% in 1994, and 78.3% in 1995. Finally, yellowfin sole bycatches were even smaller in 1994 and 1995, with estimates of 1,060 mt and 514 mt, respectively. Discard rates for this species were 65.9% in 1994, and 82% in 1995.

IR Option 1 would have required retention of all of these discards. This would have represented an addition to reported retained groundfish catch in this fishery of 14,339 mt in 1994 and an additional 13,321 mt in 1995. These additions to retained catch represent approximately 0.7% of an assumed 2.0 million metric tons (mmt) BSAI groundfish TAC.

While the impact on any individual pollock bottom trawl operation would vary with, for example, size and configuration of the vessel, hold capacity, processing capability, markets and market access, as well as the specific composition and share of the total catch of these four species, it would appear that the impact (i.e., operational burden) attributable to adoption of IR Option 1 would not be significant for the bottom pollock target fishery, taken as a whole. Had retention requirements contained in Option 1 been in place, they would, at a maximum, have increased total retained groundfish catch in the BSAI bottom pollock trawl fishery by slightly more than 10% of total reported catch in 1994, and just over 11% in 1995. These results suggest

that, 1) vessels with the least capacity to hold catch[12], and/or 2) operations which are least operationally diversified, i.e., are significantly limited in the capacity and form(s) of processing, and/or 3) vessels which are relatively less physically mobile and independent, i.e., those with the shortest operating ranges and duration, will be most severely impacted by adoption of this IR option. In discussions with informed industry sources, these impacts were deemed not to represent a serious impediment to continued operations of the current fleet participating in this fishery (per. comm., NPFMC IR/IU Industry Working Group, March 27, 1996). This is so, principally because of the relatively small quantity of additional retained catch these operators will be required to handle under the proposed IR/IU action (as compared to historic catch levels) and the composition of the current fleet.

At-sea versus On-shore

The distinction between *at-sea* and *on-shore* operations may be characterized as follows (see Appendix A: Tables 1.1.1 and 1.1.2). No pollock bottom trawl landings were reported for the "on-shore" sector in 1994. In 1995, composition of the catch was very similar in both sectors, with at-sea reporting 87.8% pollock, 8.1% Pacific cod, 1.6% rock sole, and 0.5% yellowfin. On-shore operators reported 89.4% pollock, 7.3% Pacific cod, 0.1% rock sole, and no yellowfin in that year.

Discard rates for *pollock and Pacific cod* were higher for at-sea operators, as compared to on-shore operations in 1995. On-shore operators discarded 100% of the reported rock sole catch, although that amounted to just 5 mt, in total. At-sea operators reportedly discarded approximately 78% and 82% of their rock sole and yellowfin, respectively, that year, although the actual quantities were also relatively small.

Pelagic Trawl

For the BSAI pelagic pollock trawl fishery, NMFS Blend, ADF&G fish ticket, and NORPAC data indicate that 48 processors participated in the 1994 fishery (9 shoreside processing plants, 3 motherships, 36 catcher/processors). All of the motherships and catcher/processors were greater than 124 feet in length (indicating "100%" observer coverage). Twelve of the catcher/processors operated in a "mothership" mode at some time during the pelagic pollock season. It appears that one of these catcher/processors also fished in a "catcher vessel" mode, delivering unprocessed catch to an on-shore plant during this fishery.

A total of 117 catcher boats participated in this fishery in 1994. Twenty-six were over 124' (i.e., 100% observed), 79 were in the 60' to 124' range (i.e., 30% observed), and 12 were reportedly of "unknown" length. Five catcher vessel in the "100% coverage" category, 13 in the "30% coverage" category, and one of "unknown" length recorded deliveries both at-sea and on-shore in this fishery, in 1994. In the 60' to 124' size range (implying 30% observer coverage) 28 catcher vessels reported landings at-sea: 51 to in-shore processors. The data suggest that 12 other vessels participated in this fishery, six each delivering catch at-sea and on-shore, however, the vessel length is "unknown."

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[12] The ability to hold "round fish," e.g., pollock and cod, separately from "flatfish," e.g., rock sole, yellowfin, was reported by industry sources to be critical to an operation's ability to comply with retention requirements and simultaneously deliver a "useable" fish to a buyer. Holding round fish and flatfish together causes substantial physical damage and deterioration of quality to the softer-fleshed species, e.g., Pacific cod, pollock. Many smaller operations would not have the capability to separate catch in their holds and, as a result, could be significantly disadvantaged operationally by this requirement.

Fifty-one processors participated in the 1995 pollock pelagic trawl fishery (8 shoreside processors, 4 motherships, 39 catcher/processors). Of these, 3 motherships and 38 catcher/processors were greater than 124' in length (requiring 100% observer coverage). One catcher/processor was in the 60' to 124' class (i.e., 30% coverage) and, according to the data files, one mothership was of "unknown" length. Twenty-one of the catcher/processors (all over 124') operated in a "mothership" mode at some time during the 1995 pelagic fishery, while one also delivered unprocessed catch to another processor at-sea and one delivered unprocessed catch on-shore. The one catcher/processor in the 60' to 124' class also reportedly delivered unprocessed catch to an at-sea processor at some point during the 1995 pelagic pollock fishery.

One hundred and forty-two catcher vessels reportedly participated in this fishery in 1995. Twenty-four were greater than 124' in length (thus, 100% observed), 102 were in the "30% coverage" category (i.e., 60' to 124'), 5 were "less than 60'" in length (i.e., no observer coverage), and 11 were of "unknown" length. Seven of the greater than 124' vessels delivered at-sea, while 17 delivered on-shore. Forty-two boats in the 60' to 124' class delivered at-sea, while 60 delivered on-shore. Two boats "under 60'" delivered at-sea, three on-shore; and seven of "unknown" length reported at-sea deliveries, 4 on-shore. Five of the catcher vessels of over 124' (100% coverage), 21 of the catcher vessels in the 60' to 124' class (30% coverage), and two of "unknown" length recorded pelagic pollock landings both at-sea and on-shore in 1995.

The BSAI pelagic pollock trawl fishery has historically been *very species selective*, with 1994 and 1995 total catches consistently composed of approximately 99% *pollock* (see Appendix A: Table 1.2). The rate of discards of *pollock* in this fishery has simultaneously been very low. In 1994, just 1.7% of a total pollock catch of 1.18 mmt was discarded. In 1995, while the total catch of pollock was down by over 20,000 mt, to 1.16 mmt, the rate of pollock discards was up somewhat, to 3.2% of the pollock catch.

While *rates of bycatch* of the other three species of concern, i.e., *Pacific cod, yellowfin*, and *rock sole*, were extremely low in this fishery, e.g., 0.7%, <0.1%, and <0.1% of total groundfish catch, respectively, in 1994, the associated *rates of discard* were relatively high. An estimated 8,142 mt of Pacific cod bycatch were taken in 1994, in this fishery. Just under 60%, or 4,795 mt, were discarded in-the-round. In 1995, Pacific cod bycatch was estimated at 10,130 mt, with 6,928 mt (68.4%) reportedly discarded whole. Rock sole bycatch amounts were very much smaller, estimated at only 329 mt and 414 mt in 1994 and 1995, respectively. The *rate of discard* was, however, quite high at 87.9% in 1994, and 83.6% in 1995. Finally, yellowfin sole bycatches were even smaller in 1994 and 1995, with estimates of 147 mt and 156 mt, respectively. Reported discard rates for this species were 85.5% in 1994, and 100% in 1995.

IR Option 1 would have required retention of all of these discards. This would have represented an addition to reported retained groundfish catch of 25,557 mt in 1994 and an additional 44,557 mt in 1995. This quantity of additional retained catch represents just 2% of total reported groundfish catch in this fishery in 1994; under 4%, in 1995.

At-sea versus On-shore

The distinction between *at-sea* and *on-shore* operations may be characterized as follows (see Appendix A: Tables 1.2.1 and 1.2.2). Composition of the catch was very similar in both sectors, in both years. Discard rates for *pollock* were somewhat higher in each year for at-sea operators, as compared to on-shore operations. Total discards of this species reflect the relative share of the total catch each sector claimed. In 1994, pollock discards for the at-sea sector totaled 15,988 mt. Total pollock catch of this sector was 753,921 mt (or 64% of the aggregate pelagic pollock catch). The total discards of pollock on-shore in that year were 4,360 mt. On-shore catch of pollock was 422,740 mt (36% of the total pelagic pollock catch). At-sea discards were 31,675 mt, in 1995. On-shore discards of pollock were reported to be 5,451 mt.

In the case of *Pacific cod*, the sectoral difference in discard *rate* was substantial. In 1994, for example, on-shore operators in the pelagic fishery reportedly discarded 15.7% of its Pacific cod bycatch. In 1995, that figure was 26.4%. At-sea pelagic pollock trawlers reportedly discarded 88.3% of their Pacific cod bycatch in 1994, 93.5% in 1995. As in the case of pollock, the quantities of Pacific cod discarded reflect the relative share of total catch of the two sectors. On-shore plants reported cod discards totaling 516 mt. and 1,000 mt. in 1994 and 1995, respectively. For each of the same two years, at-sea cod discards totaled 4,279 mt and 5,928 mt.

While *rates of discard* for rock sole and yellowfin were very high (except for on-shore in 1994), the quantities involved were so small as to make any analytical interpretation meaningless, i.e., the *rates* may not present a useful frame of reference for assessment.

Under the provisions of IR Option 1, retention of all Pacific cod, pollock, yellowfin and rock sole present in the catch would be mandatory. Adoption of this suboption could be expected to increase the handling (e.g. sorting, holding/processing, transporting, and transferring) of fish which heretofore had been discarded. While the impact on any individual operation would vary inversely with, for example, size and configuration of the vessel, hold capacity, processing capability, markets and market access, and share of the total catch and bycatch of the species of concern, it would appear that the impact (i.e., operational burden) attributable to adoption of this retention option would not likely be significant for the pelagic pollock trawl fishery.

This is most probably so because the vast majority of vessels in this fishery are relatively large, operationally independent and diversified, highly mobile operations. Furthermore, while the additional quantities of *pollock* which would be required to be retained are not trivial, as a percent of total pollock catch they should not pose an operational burden (per. comm., NPFMC IR/IU Industry Working Group, March 27, 1996). Note that at present, these operators retain 97% to 98% of the total pollock catch, even without a retention requirement. Furthermore, the quantities of Pacific cod, rock sole, and yellowfin present in the catch of this fishery are so small (absolutely and as a percent of total catch) that accommodating 100% retention of these bycatches should represent nothing more than an operational inconvenience, if that, to most operators (per. comm., NPFMC IR/IU Industry Working Group, March 27, 1996). That is, any economic burden to this fishery attributable to compliance with IR Option 1 should be undetectable.

Pacific Cod

Analysis of the potential impacts of adoption of IR Option 1 in the several Pacific cod fisheries of the BSAI management area parallels that described above for the pollock directed fisheries, although because of the variety of gear-types employed in the directed fishing for cod, e.g., trawl, jigs, pots, longline, interpretation is a bit more complex. (See Appendix A: Tables 1.3 through 1.6.2)

Cod Jig

For the BSAI Pacific cod jig fishery, NMFS Blend, ADF&G fish ticket, and NORPAC indicate that no at-sea processors participated in the 1994 fishery. Six on-shore operations processed fish from this fishery in that year. One catcher vessel in the 60' to 124' size class (implying 30% observer coverage), 35 boats "less than 60'" (unobserved), and 3 boats of "unknown" length reported landings in this year.

In 1995, four at-sea catcher/processors participated in the Pacific cod jig fishery, in addition to seven on-shore processors. One was greater than 124' (100% observed), 2 were reportedly 60' to 124' (30% observed), and 1 was under 60' (unobserved). The unobserved catcher/processor reportedly operated in a "mothership"

mode at some point in the Pacific cod jig season, as well as landing unprocessed catch on-shore. One of the 60' to 124' catcher/processors also reportedly landed unprocessed catch to an on-shore plant, in a catcher boat mode. Catcher vessels numbered 2 in the 60' to 124' class, 38 in the under 60' class, and 3 on "unknown" length, in the 1995 Pacific cod jig fishery.

Clearly, the Pacific cod jig fishery was quite small during the two base years of the analysis. During that period, this fishery tended to be relatively *species selective*, in terms of catch composition. For example, in 1994 and 1995, cod made up between 87.4% and 96.9% of the total groundfish catch, in this fishery (see Appendix A: Table 1.3 through 1.3.2). Of the remaining groundfish catch, pollock accounted for about 1.7% in 1994, just 0.3% in 1995. No rock sole or yellowfin were reported in the catch in either year.

None of the reported Pacific cod catch was discarded by operations in the Pacific cod jig fishery in either 1994 or 1995. None of the pollock bycatch was retained, although the amounts were very small in both years, i.e., 14 mt and 2 mt respectively, in 1994 and 1995. Discards of pollock accounted for 13% of all groundfish discards in this fishery in 1994, and 11.5% of the total in 1995.

Had IR Option 1 been in place, an additional 14 mt of catch would have been required to be retained by these operations, out of an estimated total groundfish catch of 835 mt in 1994, and an additional 2 mt would have been required to be retained, out of a total catch of 616 mt in 1995.
On the basis of the available empirical data on the BSAI Pacific cod jig fishery, the IR Option 1 requirement that all Pacific cod, pollock, rock sole, and yellowfin sole present in the catch be retained would have little discernable impact. Only relatively small quantities of pollock, and no rock sole or yellowfin sole are present in the catch and, as noted, no discards of the target Pacific cod are reported. It would appear that the impact (i.e., operational burden) attributable to adoption of IR Option 1 would not be significant for the Pacific cod jig fishery. This conclusion was concurred in by the Council's IR/IU Industry Working Group, at its March 27, 1996 meeting.

Cod Longline

For the BSAI Pacific cod longline fishery, NMFS Blend, ADF&G fish ticket, and NORPAC indicate that 48 at-sea processors participated in the 1994 fishery (all catcher/processors). Eight on-shore processors were associated with this fishery in this year. Twenty-eight of the catcher/processors were greater than 124 feet in length, thus indicating "100%" observer coverage. Nineteen were 60' to 124' in length (30% observed), and 1 was less than 60' (unobserved). Eight catcher vessels participated in the Pacific cod longline fishery in 1994. One was in the 60' to 124' class (30% observed), six were less than 60', and 1 was of "unknown" length. All their catch was reportedly delivered on-shore, in 1994.

In 1995, these data indicate that 7 on-shore plants and 44 catcher/processors participated in the Pacific cod longline fishery. Twenty-eight of the catcher/processors were greater than 124', 14 were categorized as between 60' and 124', and 2 were less than 60'. Sixteen catcher boats participated in the BSAI Pacific cod longline fishery in this year. Three were in the "30% coverage" size class (60' to 124'), 11 were under 60' (unobserved), and two were of "unknown" length, according to the data. All of the catcher boats delivered their catch to on-shore plants.

The Pacific cod longline fishery has tended to be moderately *species selective*, in terms of catch composition. For example, in 1994 and 1995, cod made up between 84.5% and 86% of the total groundfish catch, in this fishery (see Appendix A: Table 1.4). Of the remaining catch, pollock accounted for about 2.6%, while rock sole and yellowfin were each less than a tenth of one-percent (i.e., essentially not present).

Pacific cod discards accounted for nearly 19% of all groundfish discards in this fishery in 1994, and over 22% of the total in 1995. Pollock accounted for just under 15% of the remained, while rock sole and yellowfin were, again, fractions of one-percent. The discard *rate* of Pacific cod was estimated to be 3.7% in 1994, and 3.9% in 1995. Reported *rates* for the other three species of concern are high, but really only meaningful in the case of pollock, where that figure was 89.1% in 1994 and 86.6% in 1995.[13]

Had IR Option 1 been in place in those years, an additional 5,777 mt of catch would have been required to be retained by these operations, out of an estimated total groundfish catch of 101,237 mt in 1994, and an additional 6,744 mt would have been required to be retained, out of a total catch of 117,872 mt in 1995. These additional catch retention estimates represent, respectively, 0.3% and 0.4% of the BSAI groundfish TAC.

At-sea versus On-shore

The respective performance of the *at-sea* and *on-shore* components of the Pacific cod longline fishery, as reported in the NMFS blend data, suggest that the species composition is somewhat more diverse in the at-sea catch. For example, Pacific cod made up 84.4% and 86% of the groundfish catch, respectively, in 1994 and 1995 in this sector, while on-shore catch composition was reportedly over 91% cod (see Appendix A: Tables 1.4.1 and 1.4.2). While small amounts of yellowfin and rock sole are reported in the at-sea sector, none is present in the on-shore reported catch. Similarly, while pollock has consistently represented between 2.6% and 2.7% of the at-sea catch composition, it is reportedly essentially not present in the on-shore catch. No explanation is offered for this result.

The *at-sea* component of this fishery represents the vast majority of activity in this fishery. In 1994 and 1995, at-sea operators accounted for more than 99% of total catch in the BSAI Pacific cod longline fishery. Based upon NMFS blend catch and discard data for all BSAI groundfish fisheries the combined Pacific cod longline fishery accounted for only about 5% of the total groundfish TAC, in 1994, and roughly 5.7% of the total discards. In 1995, both percentages were up, representing just over 6% of the total BSAI groundfish catch, and 6.5% of the discards, by weight. The cod longline fishery accounted, in 1994, for approximately 44% of the total Pacific cod catch and only fractions of one-percent of the total catch of the other three species of concern. It was responsible for 9.3% of the total BSAI groundfish fisheries' cod discards and 2.3% of its pollock discards. In 1995, these shares were 41.3% of total cod catch; less than a fraction of one-percent for the other species; 8.9% and 2.7%, respectively, for Pacific cod and pollock discards.

The IR Option 1 requirement that all Pacific cod, pollock, rock sole, and yellowfin sole present in the catch be retained could be expected to increase the handling (e.g. sorting, processing/storing, transporting, and transferring) of fish which heretofore had been discarded. While the impact on any individual operation would be expected to vary with the size and configuration of the vessel, hold capacity, processing capability, markets and market access, and share of the total catch of the four species of concern, it would appear that the impact (i.e., operational burden) attributable to adoption of IR Option 1 would **not be significant** for the Pacific cod longline target fishery, taken as a whole (per. comm., NPFMC IR/IU Industry Working Group, March 27, 1996).

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[13] With very limited catches of yellowfin and rock sole, 152 mt and 25 mt, respectively, in 1994; 63 mt and 43 mt, respectively, in 1995, the fact that *rates of discard* were over 90% is not particularly significant. Carried to the extreme, if a single fish, say a rock sole, had been caught and subsequently discarded, the *rate* would be 100%, while the importance to IR would be negligible.

Cod Trawl

For the BSAI Pacific cod trawl fishery, NMFS Blend, ADF&G fish ticket, and NORPAC indicate that 44 at-sea processors participated in the 1994 fishery (4 motherships, 40 catcher/processors). Nine on-shore operations were listed as cod trawl participants. Three of the motherships and 33 of the catcher/processors were greater than 124 feet in length, thus indicating "100%" observer coverage. One mothership was reported as "unknown" length. Seven catcher/processors were classified as being between 60' and 124' in length (30% observed). It appears, on the basis of these data, that four of the "100% observed" catcher/processors also operated in a "mothership" mode, receiving unprocessed fish at-sea from another vessel, at some time during the Pacific cod trawl season, in 1994.

Eight on-shore plants and seventy-six catcher vessel participated in this fishery in 1994. Eleven of these vessels were over 124' in length, with 2 delivering at-sea, 9 delivering on-shore. Fifty-seven were between 60' and 124', 4 delivering at-sea, 53 on-shore. Three were less than 60', while 5 records show "unknown" vessel length, all of which delivered on-shore, in 1994.

Forty-four at-sea processors participated in the 1995 Pacific cod trawl fishery (4 motherships, 40 catcher/processors). Of these, 3 motherships and 33 catcher/processors were greater than 124' in length, requiring 100% observer coverage. Nine of these catcher/processor vessels also operated in a "mothership" mode, receiving unprocessed catch at-sea from another vessel, during some period of this fishery. Seven catcher/processors were in the 60' to 124' class (thus with 30% coverage) and, according to the data files, one mothership was of "unknown" length.

Ninety-three catcher vessels were identified as participants in this fishery in 1995. Sixteen were over 124' (100% coverage), with six delivering at-sea and 10 on-shore. Seventy-four boats were in the 60' to 124' class (30% coverage), with 13 delivering at-sea, 61 on-shore. Three catcher boats were identified as being of "unknown" length in the 1995 data, one delivering at-sea, two on-shore. Seven catcher vessels made deliveries both at-sea and on-shore, according to the 1995 data. Four were over 124', 3 were in the 60' to 124' class.

The Pacific cod trawl fishery is, in general, relatively *species non-selective*, with between 55% and 60% of its total groundfish catch composed of the "target" species (see Appendix A: Table 1.5). In 1994 and 1995, pollock comprised 24.8% and 19.6%, respectively, of the total catch in this fishery. Rock sole was in the 8% to 12% range, with yellowfin at 3.2% and less than 1% of total reported groundfish catch in 1994 and 1995, respectively.

Pacific cod discards accounted for 13.2% of all groundfish discards in this fishery in 1994, and 16.9% of the total in 1995. Pollock was 49.6% of total discards in 1994, 42.6% in 1995. Rock sole was on the order of 17% and 24%, while yellowfin was 3.3% and 0.7%, respectively, in 1994 and 1995. The discard *rate* of Pacific cod was estimated to be 10.7% in 1994, and 11.6% in 1995. Discard *rates* for pollock were very high, consistently near 90%, over this period. Rock sole *rates* were similarly high, i.e., 93.4% in 1994, 83% in 1995. Yellowfin discard *rates* were more modest, although still between 45% and 50% for these years.

Had IR Option 1 been in place in those years, these data suggests that an additional 35,612 mt of groundfish would have been required to be retained by these operations, out of a total catch of 96,516 mt in 1994, and an additional 40,257 mt would have been required to be retained, out of a total catch of 115,154 mt in 1995. The estimated addition to total catch represents about 2% of the total BSAI groundfish TAC.

NMFS blend catch and discard data for all BSAI groundfish fisheries, utilizing the standard Alaska Region target, reveal that the *on-shore* component accounts for the majority of activity in this fishery (see Appendix A: Tables 1.4.1 and 1.4.2). In 1994, vessels delivering on-shore accounted for fully 60% of total catch in the BSAI Pacific cod trawl fishery. In 1995, catches delivered on-shore represented approximately 66% of total Pacific cod trawl catch.

The on-shore sector recorded groundfish catches composed of 60.3% Pacific cod in 1994, and 65.2% cod in 1995. Pollock made up 21.5% and 19.9% of the reported catch in those years, respectively. Rock sole was consistently over 8% of the total, while yellowfin represented from 1.7% (in 1994) to 0.8% (in 1995) of reported catch.

The at-sea sector reported Pacific cod as comprising 46.9% of the aggregate groundfish catch in 1994, 57.1% in 1995. Pollock comprised approximately 28.1% to 19.3% of the total; rock sole 7.4% to 13.9%, and yellowfin 5.6% in 1994; a fraction of one-percent of total groundfish landings in 1995.

Under the provisions of IR Option 1, retention of all Pacific cod, pollock, yellowfin and rock sole present in the catch would be mandatory. Adoption of this option could be expected to increase the handling (e.g. sorting, holding/processing, transporting, and transferring) of fish which heretofore had been discarded. While the impact on any individual operation would vary inversely with the size and configuration of the vessel, e.g., hold capacity, processing capability, and markets and market access, as well as share of the total cod catch, it would appear that the impact (i.e., operational burden) attributable to adoption of Option 1 could potentially be significant for the Pacific cod trawl target fishery.

This is so principally because of the sheer quantity of additional retained catch these operators will be required to handle, as compared to historic catch levels. Specifically, in 1994, vessels in this fishery retained a total of 53,457 mt of groundfish, out of a total estimated catch of 96,516 mt. IR Option 1 would have required that 87,961 mt have been retained (a 64.6% increase). Unless substantial excess hold capacity exists within this fleet, it is probable that compliance with Option 1 retention requirements will impose significant operational costs on this fishery, taken as a whole. Furthermore, for species for which markets are limited or undeveloped, e.g., small Pacific cod, male rock sole, 100% retention requirements under this option will impose direct operational burdens (costs) which probably cannot be offset (in whole or in part) by expected revenues generated by the sale of the additional catch. No quantitative estimate can be made, at present, of these costs. Industry sources confirm the potential differential impact adoption of Option 1 may have on various sub-sets of the fishery, however. For example, while this option is expected to have no significant effect on catcher boats (in general and as a whole) it nonetheless follows the pattern described earlier that, "the smaller the vessel, the larger the probable impact."

For catcher/processors operating in this fishery, the impact may be determined by "processing mode." That is, a vessel with the capability to fillet product will face no significant burden in complying with the IR provisions. However, a vessel limited to H&G operation will be significantly disadvantage, since the market for H&G pollock is problematic (per. comm., NPFMC IR/IU Industry Working Group, March 27, 1996). While these impacts are not amenable to measurement at the present time, the Council should be cognizant of their potential existence and disproportionate distributional effects in weighing the merits of the proposed alternative.

Cod Pot

According to NMFS Blend, ADF&G fish ticket, and NORPAC data, the Pacific cod pot fishery included just 5 at-sea processors (all catcher/processors), while 11 on-shore operations were cited in the 1994 fishery. Three of the catcher/processors were over 124' (100% observed), while 2 were 60' to 124' in length (30% coverage). Thirty-four catcher vessels participated in the 1994 Pacific cod pot fishery, 5 greater than 124', 21 in the 60' to 124' category, 6 less than 60', and 2 of "unknown" length. All delivered to on-shore processing facilities.

In 1995, 13 on-shore and 11 at-sea processors are recorded to have participated in this fishery. One mothership and 5 catcher/processors were greater than 124' in length. Five catcher/processors were classified as between 60' and 124', and 1 was less than 60' in length. Three catcher/processors in the 60' to 124' class also delivered unprocessed catch to an on-shore processor at some time during the fishery. One hundred and sixteen catcher vessels participated in the BSAI Pacific cod pot fishery during the 1995 season. Seventeen were over 124', 80 were in the 60' to 124' length range, 11 were under 60', and 2 were reported as "unknown" vessel length. All reported landings by these vessels were to on-shore processors, in this year.

The Pacific cod pot fishery has historically discarded relatively little cod, either in total or as a percent of catch (see Appendix A: Table 1.6). For example, in 1994, Pacific cod discards accounted for 1.9%, or 156 mt, of the 8,171 mt cod catch in this fishery. In 1995, the cod discard rate dropped to 1.3%, or 255 mt, of the 20,059 mt cod catch. Based upon NMFS blend estimates, this fishery is relatively *species selective* with Pacific cod accounting for 97.3% to 96.4% of total catch in 1994 and 1995, respectively. The pot fishery accounted for just 4.2% of cod catches in all BSAI fisheries in 1994, and was responsible for approximately 0.5% of cod discards. In 1995, their share of total Pacific cod catch grew to 8.2%, yet the share of total cod discards increased by only 0.1%.

Bycatches of the other three species of concern are extremely small, both as a percentage of total catch and in absolute terms. In 1994, no rock sole was reported in this fishery's catch, while 4 mt of pollock and 14 mt of yellowfin appear in the blend data. Similarly, in 1995, just 15 mt of pollock and 70 mt of yellowfin were reported (and again no rock sole) out of a total catch of 20,815 mt.

IR Option 1 requires the retention of the 100% of each of the four species of concern present in the catch. The potential reduction in discards attributable to this action in this fishery would have represented only about 2.1% of the *total* groundfish catch in this fishery in 1994; and about 1.63% in 1995. As either an absolute quantity or as a percent of the total catch of all groundfish species in this region, the pot cod discards are, at present, minuscule.

At-sea versus On-shore

The *on-shore* component of this fishery accounts for the majority of activity (see Appendix A: Tables 1.6.1 and 1.6.2). In 1994, vessels delivering on-shore accounted for 77.9% of total catch in the BSAI Pacific cod pot fishery. In 1995, catches delivered on-shore represented approximately 74% of the total. Because the quantities of bycatch of the three species of concern, other than Pacific cod, have been so small, very little additional comparison of the two sectors of this fishery are meaningful.

Adoption of IR Option 1 would require increases in the handling (e.g. sorting, holding/processing, transporting, and transferring) of fish which heretofore had been discarded. While the impact on any individual operation would vary inversely with, for example, size and configuration of the vessel, hold capacity, processing capability, markets and market access, and share of the total cod catch, it would appear

that the impact (i.e., operational burden) attributable to adoption of this option would not be significant for the Pacific cod pot fishery, taken as a whole. That is, with only relatively minor bycatches of pollock and yellowfin sole, and no recorded catch of rock sole, over the period of analysis, a mandatory "100% retention" requirement for the four species of concern represents no potential burden to this fishery. This conclusion was endorsed by the Council's IR/IU Industry Working Group, during their review of IR options, in March 1996.

Sablefish

Sablefish Longline

IR Option 1 would extend prohibition of the discarding of *pollock, Pacific cod, yellowfin*, and *rock sole* to BSAI groundfish fisheries which are not associated with the targeting of any one of the four species of concern. The sablefish longline fishery is one of these.

For the BSAI sablefish longline fishery, NMFS Blend, ADF&G fish ticket, and NORPAC indicate that 7 on-shore and 17 at-sea catcher/processors participated in the 1994 sablefish longline fishery. Four were classified as greater than 124' in length (100% observed), while 13 were in the 60' to 124' category (30% observed). One of this latter group was reported to have delivered unprocessed catch to an on-shore plant (i.e., operated in a 'catcher boat' mode) at some time during the season. Nine catcher boats participated in this fishery in 1994. One was in the 60' to 124' class, seven were under 60', and one was listed as "unknown" length. All these catcher boats delivered only on-shore.

The data for 1995 suggest that 16 on-shore and 13 catcher/processors (4 over 124' in length and 9 in the 60' to 124' class) participated in this fishery in that year. One of the vessels in the latter group is reported to have delivered unprocessed catch to an on-shore plant (i.e., operated in a catcher boat mode) at some point in the fishery. Twenty-three catcher vessels logged deliveries of sablefish in the longline target fishery in 1995, according to these data. Eleven boats were in the 60' to 124' class, seven were under 60', and 5 were of "unknown" length. All catcher boat deliveries were made on-shore.

The NMFS blend catch and discard data for 1994 and 1995 suggest, however, that this fishery is *not a significant source of bycatch* for any of the four species of concern (see Appendix A: Table 1.7). In 1994 and 1995, this fishery reported no bycatch whatsoever of rock sole or yellowfin sole, and only 4 mt of pollock (that in 1995). In 1994, 21 mt of Pacific cod bycatch was recorded, of which 11 mt (or 51.6%) was discarded. This, out of a total groundfish catch of 4,546 mt. Pacific cod thus represented just over 0.4% of total catch and roughly the same percentage of total discards in this fishery, in that year. In 1995, Pacific cod bycatch was up substantially. Reported bycatch of this species was 1,317 mt, accounting for 25.6% of total groundfish catch. The *rate* of Pacific cod discards exceeded 97%, or 1,279 mt, comprising 36.7% of total discards in this fishery.

At-sea versus On-shore

While a small part of the IR problem, the sablefish longline fishery does reveal a clear contrast between its two sectors (see Appendix A: Tables 1.7.1 and 1.7.2). The distinction between the *at-sea* and *on-shore* segments of this fishery are not great in 1994. At-sea operators recorded approximately 57% of total groundfish catch in this fishery, with the balance going to the on-shore sector. Of the 21 mt bycatch of Pacific cod, at-sea took 20 mt, using about half and discarding the balance; on-shore reported 1 mt, with none retained. In 1995, the two sectors were somewhat more distinct. For example, the at-sea sector recorded bycatches of 46 mt of Pacific cod, 4 mt of pollock. No pollock was retained, and about 29% of the Pacific

cod was discarded (or 13 mt). On-shore operators recorded Pacific cod bycatches of 1 mt, all of which was discarded in-the-round.

While the relative performance of the at-sea and on-shore sectors present some interesting operational indicators, it is clear from these data that, had IR Option 1 been in place in these two years, the impact on this fishery would have been very small. As noted, of the four species of concern, only Pacific cod is present is meaningful numbers. Had these operators been required to retain these additional fish, the effect may have been to slow the fishery slightly. But because the sablefish fishery is now managed under an Individual fishing quota (IFQ) system, the "race-for-fish" is no longer at issue, thus the marginally slower pace should not adversely impact the individual operators. This conclusion was supported by informed industry sources, who indicate that the burden to this fleet should be negligible, when taken as a whole (per. comm., NPFMC IR/IU Industry Working Group, March 27, 1996).

Sablefish Trawl

For the BSAI sablefish trawl fishery, NMFS Blend, ADF&G fish ticket, and NORPAC indicate that 1 on-shore and 7 at-sea processors participated in the 1994 sablefish trawl fishery (all the at-sea vessels were catcher/processors). Six were greater than 124' in length, one was categorized as 60' to 124'. Just 1 catcher boat was listed as participating in this fishery in 1994. It was in the 60' to 124' size range and delivered only on-shore.

Only four vessels are reported to have participated in this fishery in 1995. Two catcher/processors, one each in the over 124' category and 60' to 124' class. Two catcher vessels, both 60' to 124' in length, delivered all their catch to on-shore processors in this year.
The sablefish trawl fishery recorded almost no bycatch of any of the four species of concern during the 1994 - 1995 baseline period (see Appendix A: Table 1.8). Indeed, only in 1994 was there bycatch of any of these four species of concern reported, and that was just 7 mt of pollock. All 7 mt were discarded in-the-round.

Over these two years, sablefish trawling was a very small fishery in the BSAI management area, with total groundfish catches of just 484 mt, and 202 mt, respectively. Based upon the available historic data, one would conclude with some justification that adoption of IR Option 1 should not significantly impact operators in this fishery. A similar conclusion was offered by the NPFMC IR/IU Industry Working Group, at its March 1996 meeting.

Greenland Turbot

Greenland Turbot Longline

The BSAI longline fishery for Greenland turbot fishery is another target fishery which would be governed by the proposed IR Option 1, based upon NMFS blend data for 1994 and 1995 (see Appendix A: Table 1.9, 1.9.1, and 1.9.2).

For the BSAI Greenland turbot longline fishery, NMFS Blend, ADF&G fish ticket, and NORPAC indicate that in 1994, 4 on-shore plants. Ten catcher/processors are reported to have participated in this fishery. Five each in the over 124', and 60' to 124' categories. The data report only two catcher boats recorded turbot longline landings in that year, both only to on-shore plants. One was in the 60' to 124' class, the other listed as "unknown."

In 1995, 5 on-shore and 23 at-sea processors participated in the fishery. All the at-sea vessels were catcher/processors. Of these, 16 were classified as greater than 124' in length (100% observed), and 7 were in the 60' to 124' category (30% observed). Records indicate that just three catcher vessels participated in this fishery, in this year. One was classified as being 60' to 124' in length, 1 as under 60', and 1 of "unknown" length. All the catcher boats delivered only to on-shore plants.

Like sablefish longline, the turbot longline fishery has been responsible for only relatively small amounts of bycatch of any of the species of concern. Pacific cod bycatch totaled 40 mt, out of a total catch of 1,612 mt, in 1994; 60 mt out of 3,171 mt in 1995. Discards of Pacific cod in 1994 totaled just 2 mt (or 4.2%), while in 1995, 16 mt (25.8%) of the cod bycatch was discarded in-the-round. Almost no pollock or rock sole, and literally no yellowfin sole, bycatch was reported in either year.

Because bycatch quantities of these four species are so small, both relatively and absolutely, no significant adverse impacts would be expected in this fishery, should IR Option 1 be adopted, assuming the catch and bycatch patterns remain approximately as recorded in the base years. Individual operations may experience differential impacts, based upon the size, capacity, configuration, etc., of their operation, as well as their relative share of total catch and bycatch. However, in no case would the impacts of complying with IR Option 1 be expected to represent a significant burden. This is consistent with the advice of the Council's IR/IU Industry Working Group (per. comm., NPFMC IR/IU Industry Working Group, March 27, 1996).

Greenland Turbot Trawl

For the BSAI Greenland turbot trawl fishery, NMFS Blend, ADF&G fish ticket, and NORPAC indicate that 2 on-shore and 11 at-sea processors participated in the 1994 turbot trawl fishery (all the at-sea operations were catcher/processors). Eight were greater than 124' in length, while 3 were in the 60' to 124' category. Seven catcher boats are reported to have fished this 1994 season, with 1 being over 124', and 6 being between 60' and 124' in length. All catcher boat deliveries were made to on-shore plants in that year.

In 1995, 5 on-shore operations and 23 at-sea processors are reported to have operated in the Greenland turbot trawl fishery (2 motherships and 21 catcher/processors). Both motherships and 16 of the catcher/processors were classed as over 124' in length, with the remaining 5 catcher/processors in the 60' to 124' range. Fourteen catcher vessels are identified in the data as participants in this 1995 fishery. Four (2 over 124', 2 between 60' and 124') delivered at-sea, while 10 (2 over 124', 8 between 60' and 124') delivered catch on-shore.

The trawl fishery for Greenland turbot reported bycatches of pollock and Pacific cod in 1994; pollock, Pacific cod, rock sole, and yellowfin in 1995 (see Appendix A: Table 1.10). The quantities were, however, very small. In no case did they represent more than a fraction of one-percent of the total groundfish catch, as reported in this fishery. In 1994, for example, out of a total catch of 6,707 mt, 14 mt of pollock and 3 mt of cod bycatch were reported. All of the pollock and 54.6% of the cod were discarded in that year. In 1995, total catch in this fishery declined to 5,857 mt, while pollock bycatch increased to 47 mt and Pacific cod bycatch to 50 mt. Yellowfin appeared in the catch, totaling 5 mt, and rock sole was reported at 1 mt. All of the pollock, rock sole, and yellowfin bycatch was discarded, while 68.6% of the cod was jettisoned in-the-round.

As in the case of turbot longline, trawl bycatch quantities of any of the four species of concern are so small (both relatively and absolutely) that no significant adverse impacts would be expected in this fishery, should IR Option 1 be adopted, when the fishery is taken as a whole. Any individual participant may incur additional operating costs in complying with the retention requirements, depending upon the size, configuration, and capability of its operation, and its relative share of the total catch and bycatch. In no case,

however, are these impacts expected to be more than an operational "inconvenience" (as distinct from a significant burden). This conclusion is consistent with the advice of the Council's IR/IU Industry Working Group (per. comm., NPFMC IR/IU Industry Working Group, March 27, 1996).

Rock Sole

Rock sole Trawl

For the BSAI rock sole trawl fishery, NMFS Blend, ADF&G fish ticket, and NORPAC indicate that 33 processors participated in the 1994 rock sole fishery (3 motherships, 30 catcher/processors). All of the motherships and 27 of the catcher/processors were over 124' in length. The remaining three catcher/processors were in the 60' to 124' class. Just two catcher vessels are reported to have participated in this fishery in this year, both delivering only at-sea.

These data suggest that in 1995, 38 processors operated in the BSAI rock sole fishery (2 motherships, 36 catcher/processors). Both of the motherships and 28 of the catcher/processors were greater than 124' in length (100% observer coverage). Eight were reportedly in the 60' to 124' class. Four catcher boats were listed as participants in 1995. One was over 124' in length, 3 were categorized as 60' to 124' vessels. All the catcher boats delivered only at-sea in this year.

The NMFS blend catch and discard data indicate that the rock sole fishery is among the *least species selective* of all BSAI groundfish fisheries. In 1994, *rock sole* accounted for just under 55% of a total groundfish catch of 72,543 mt. In 1995, *rock sole* comprised just 50.7% of a total groundfish catch in this fishery of 57,227 mt (see Appendix A: Table 1.11). The *rate* of discards of rock sole in this fishery has also been relatively high. In 1994, 58.3%, or 23,141 mt, of the total rock sole catch of 39,693 mt was discarded. In 1995, the total catch of rock sole was down to 29,034 mt. Rock sole discards also fell to 13,498 mt, but as a share of total rock sole catch still represented 46.5%.

Bycatches of the other three species of concern were relatively large in these two years. In 1994, pollock bycatches were 14,922 mt (or about 21% of total catch). Of this, 13,948 mt, or 93.5% were discarded. Pacific cod catch was reportedly 5,594 mt (7.7% of total catch), with just over two-thirds discarded in-the-round, i.e., 3,710 mt. Yellowfin bycatch totaled 5,334 mt (7.4% of catch), of which 3,472 mt, or 65.1%, were discarded.

In 1995, pollock bycatches were down sharply to 7,393 mt (13.3% of total catch), with 6,396 mt, or 86.9%, discarded whole. Pacific cod bycatch was up, at 9,610 mt (16.7% of catch). Just under 53% of this was discarded in-the-round, i.e., 5,082 mt. Yellowfin was also up, with 6,599 mt, or 11.5% of total catch, while discards were down sharply to 28.1%, or 1,853 mt.

While the impact on any individual operation would be expected to vary with, for example, size and configuration of the vessel, hold capacity, processing capability, markets and market access, and share of the total bycatch of species of concern, it would appear that the impact (i.e., operational burden) attributable to adoption of IR Option 1 could be substantial for this fishery, as compared to others examined thus far, when this fishery is taken as a whole.

This may be so for several reasons. First, because of the sheer quantity of current rock sole discards, as well as the bycatch discards of especially pollock (but also Pacific cod and yellowfin) as a proportion of total catch in this fishery, adoption of IR Option 1 would essentially *increase* the amount of fish that would have

to be retained, held/processed, transported, and transferred by these operations by approximately 200%[14]. The effect of retaining this additional quantity of fish would likely result in a substantial slowing of the fishery, with each vessel finding its holding capacity filling at a much higher rate than currently. This would presumably necessitate a commensurate increase in the number of trips to port to off-load catch, thus reducing time spent fishing (i.e., reducing revenue), while imposing additional operating costs (e.g., fuel).

Second, reportedly the majority of the *rock sole* currently retained in this fishery is composed of roe-bearing females. Most of the discarded catch of *rock sole* is made up of males, or non-roe-bearing females, which command a much lower price, if and when a market can be found.[15] Concentrations of roe-bearing female *rock sole* are limited to the winter and early spring months of the fishing year (i.e., January through perhaps March). Thus anything which dramatically slowed the harvest during these months would have a disproportionately adverse impact on these operations, as compared to other periods of the fishing year.

Third, this fishery has, to-date, been almost exclusively prosecuted by relatively small H&G vessels. Furthermore, there has been effectively no "on-shore" component. The physical limitations of the current fleet of vessels which operate in this fishery could make adaptation to, and compliance with, the IR requirement effectively impossible (see discussion of DFS/VIP/LLP-Moratorium/USCG Requirements and IR/IU). The result may be that adoption of the proposed IR requirement could create such an operational barrier that the rock sole fishery would be discontinued, or alternatively the small vessel fleet which currently comprises this fishing fleet might be displaced by larger and more operationally diversified fleets of vessels, e.g., larger catcher/processors, motherships.

Finally, industry sources suggest that there are, at present, no markets for pollock bycatches for these boats, most of which can only produce an H&G product form. Retention of all Pacific cod is less a problem, but still may impose unanticipated operational impacts, including "re-targeting" some operators (see discussion of DFS/VIP/LLP-Moratorium/USCG Requirements and IR/IU).

The retention of 100% of the four species of concern in the rock sole target fishery would, in the limit, have represented a discard savings on the order of 2.2% of the *total* groundfish TAC in the BSAI groundfish fisheries, in 1994; about 1.4% in 1995. For species for which markets are limited or undeveloped, e.g., H&G pollock, male rock sole, 100% retention requirements will impose direct operational burdens which cannot be offset (in whole or in part) by expected revenues generated by the sale of the additional product. One might reasonably expect to see much of this "undersized" and/or "non-target" catch diverted into meal or other industrial product forms, depending upon the limitations imposed by the "utilization" option selected, and the capacity limitations of the operations in this fishery (see the discussion of product form under the Utilization sections).

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[14] That is, in 1994, for example, these operations retained 22,193 mt out of the 72,543 mt total catch. If they did not displace retained catch of other species not regulated by IR, under provisions of Option 1, they would have been required to retain an additional 65,543 mt (or approximately 200% more than without the retention requirement). If they had displaced other retained catch, substituting discards of, say, Atka mackerel, turbot, "O-flats," etc., the increase would have been somewhat smaller.

[15] There is some indication that new markets for male rock sole have emerged, particularly in the U.S. east coast region. It is not clear, however, that these emerging markets are large enough to fully absorb the supply of male rock sole which would be associated with 100% retention of this species in this fishery (let alone all the rock sole retained in all the other BSAI fisheries), as required under Option 1. This, of course, is an empirical question that will only be amendable to analysis with time.

Yellowfin Sole

Yellowfin sole Trawl

In the case of the BSAI yellowfin sole trawl fishery, NMFS Blend, ADF&G fish ticket, and NORPAC data indicate that 41 processors participated in the 1994 yellowfin sole fishery (4 shoreside processing plants, 2 motherships, 35 trawl catcher/processors). These data suggest that 1 catcher/processor also operated in a "mothership" mode, receiving unprocessed catch from another vessel at-sea, at some time during the fishery, in 1994. A total of twenty catcher vessels were identified as "targeting" yellowfin sole in 1994. Of these 2 delivered at-sea, while the balance delivered on-shore. The on-shore catcher boats included 4 over 124', 11 between 60' and 124', and 3 of "unknown" length. One at-sea catcher boat was classified as between 60' and 124', while the other was of "unknown" length.

In 1995, 50 processors were listed in this fishery (2 shoreside operators, 4 motherships, 44 catcher/processors). Three of these catcher/processors are also listed as having operated in a "mothership" mode at some time during the 1995 fishery. The 4 true motherships and 38 of the catcher/processors were listed as over 124' (100% observed), while 6 catcher/processors were classed as 60' to 124' in length. The catcher boats numbered 34, with 4 being over 124' and 30 classified as 60' to 124' in length. Twenty-one delivered on-shore, the balance at-sea, although two boats reportedly delivered both at-sea and on-shore at some point in the season.

The NMFS blend catch and discard data indicate that the BSAI yellowfin sole fishery is relatively *species non-selective*, with 1994 and 1995 total catches consistently composed of approximately 62% yellowfin. The rate of discards of yellowfin sole in the target fishery has been on the order of 21% to 23% (see Appendix A: Table 1.12). In 1994, of a total yellowfin catch of 126,163 mt, 27,914 mt were discarded. In 1995, the total catch of yellowfin sole was down to 101,252 mt, while discards of yellowfin declined to about 21,341 mt.

Bycatches of the other three species of concern were relatively small, comprising a consistent share of total catch in this fishery in each year. Pollock was the largest of the three, with catch totals of 32,837 mt in 1994, 25,864 mt in 1995. This represented 16.3% and 15.8% of total catch, respectively, for those years. Fully 95% (or 31,186 mt) was discarded in 1994, while 21,912 mt (or 84.7%) was discarded in 1995. Pacific cod was the next most prevalent of the four species of concern in the bycatch. Accounting for between 7% and 8% of total reported groundfish catch (i.e., 15,861 mt and 11,504 mt, respectively), Pacific cod discards were 8,682 mt (or a discard *rate* of 54.7%) in 1994; 6,483 mt (or a *rate* of 56.3%) in 1995. Rock sole comprised approximately 4% of total catch, with catches of 8,097 mt in 1994, and 7,200 mt in 1995. The *rate* of discard for this species in these two years was 68.2% in each year.

While the impact of the 100% retention requirement of IR Option 1 on any individual operation would be expected to vary with the size and configuration of the vessel, markets and market access, and share of the total catch and/or bycatch of each of these species, it would appear that the impact attributable to adoption of this retention option would be significantly greater for this fishery than for others examined thus far, except perhaps for rock sole trawl. Indeed, industry sources confirm that IR Option 1 will likely impose very substantial compliance problems for many current participants in this fishery. The burden will tend to fall most heavily upon the smallest, least diversified operations among the current fleet. As in the case of other target fisheries, the absence of well developed markets, or small markets unable to absorb total quantities of product on the scale anticipated, will pose a significant obstacle to full compliance, for some species and product forms. This burden may be particularly disruptive for this fishery, given the size and nature of its current participant fleet.

This may be so for several reasons. First, because of the size of current discards as a proportion of total catch in this fishery, adoption of IR Option 1 (requiring retention of all of these four species present in the catch) would effectively increase the amount of fish that would have to be retained, held/processed, transported, and transferred by these operations by more than two-thirds.[16] The affect of retaining this additional quantity of fish would likely result in a significant slowing of the fishery, with each vessel finding its holding capacity filling at a much faster rate than is currently the case. This would presumably necessitating a commensurate increase in the number of trips to port to off-load catch, thus reducing time spent fishing (i.e., reducing revenue), while imposing additional operating costs (e.g., fuel).

At-sea versus On-shore

The *at-sea* sector accounted for 95% of the reported activity in the yellowfin sole fishery in 1994, and 100% of the activity in 1995 (see Appendix A: Tables 1.12.1 and 1.12.2). Because the *on-shore* segment accounted for so little of the total activity, few useful comparisons of the two components can be made.

For species for which markets are limited or undeveloped, e.g., H&G pollock, male rock sole, 100% retention requirements will impose direct operational burdens which cannot be offset (in whole or in part) by expected revenues generated by the sale of the additional product. One might reasonably expect to see much of this "undersized" and/or "non-target" catch diverted into meal or other industrial product forms, depending upon the limitations imposed by the "utilization" option selected, and the capacity limitations of the operations in this fishery (see the discussion of product form under the Utilization sections).

Flathead Sole

Flathead sole Trawl

On the basis of NMFS blend catch data, IR Option 1 would be expected to extend retention requirements to the flathead sole trawl fishery. These data indicate that a "flathead sole" target did not appear as a unique fishery until 1995. Prior to that year, flathead would have been included in the "other flatfish" complex.

For the BSAI flathead sole trawl fishery, NMFS Blend, ADF&G fish ticket, and NORPAC indicate that 20 processors participated in the 1995 fishery (1 shoreside processing plants, 19 catcher/processors). Seventeen of the catcher/processors were greater than 124 feet in length, thus indicating "100%" observer coverage, while 2 were listed as 60' to 124' in length.

Bycatches of the four species of concern were relatively small in absolute terms, although as a percent of total groundfish catch in this fishery, they were not trivial (see Appendix A: Table 1.13). For example, pollock bycatch totaled 1,852 mt, comprised 17.5% of total catch and was discarded at a rate of more that 91% (or 1,694 mt). Pacific cod represented more than 10.5% of the groundfish catch in the flathead target fishery, at 1,120 mt, of which more than 50% (562 mt) was discarded in-the-round. Yellowfin bycatch was 1,307 mt in 1995 (or 12.3% of total catch), with 46.7% discarded, and rock sole was reportedly 7.4% of catch (or 788 mt), with a discard rate of 65.4%. Total groundfish catch in this fishery was 10,585 mt in this year, of which fully 55.2%, or 5,842 mt was discarded. Had Option 1 been in place, discards could have been

[16] That is, in 1994, for example, these operations retained 114,697 mt out of the 201,884 mt total catch. If they did not displace retained catch of other species not regulated by IR under provisions of Option 1, they would have been required to retain an additional 73,300 mt, or 64% more than without the retention requirement. If they had displaced other retained catch, substituting discards of, say, Atka mackerel, turbot, "O-flats," etc., the increase would have been somewhat smaller.

reduced potentially by approximately 3,382 mt, or about 58%, assuming no displacement of unregulated retained catch by regulated species.

The implication for the flathead sole fishery of adoption of IR Option 1 parallel those described for the rock sole fishery, according to informed industry sources (per. comm., NPFMC IR/IU Industry Working Group, March 27, 1996). That is, while the impact on any individual operation would be expected to vary with the size and configuration of the vessel, markets and market access, and share of the total bycatch of species of concern, it would appear that the impacts attributable to adoption of IR Option 1 could be substantial for this fishery, as compared to others examined thus far, when this target is taken as a whole. This may be so for several reasons. First, the effect of retaining the additional quantities of fish in question, while not large in an absolute sense, would likely result in a substantial slowing of the fishery, with each vessel finding its holding capacity filling at a much higher rate than currently. This would presumably necessitate a commensurate increase in the number of trips to port to off-load catch, thus reducing time spent fishing (i.e., reducing revenue), while imposing additional operating costs (e.g., fuel).

Second, physical limitations of the current fleet of vessels which operate in this fishery may make adaptation to, and compliance with, the IR requirement effectively impossible (see discussion of DFS/VIP/LLP-Moratorium/USCG REQUIREMENTS and IR/IU). The result may be that adoption of the proposed IR requirement could create such an operational barrier that the flathead sole target fishery would be discontinued, or alternatively the small vessel fleet which currently participates in this fishery might be replaced by larger and more operationally diversified fleets of vessels, e.g., larger catcher/processors, motherships.

Finally, industry sources suggest that there are, at present, no markets for pollock and small rock or yellowfin sole bycatches for these boats, most of which can only produce an H&G product form. Retention of all Pacific cod is reportedly less a problem, but still may impose unanticipated operational impacts, including "re-targeting" some operators (see discussion of DFS/VIP/LLP-Moratorium/ USCG Requirements and IR/IU).

The retention of 100% of the four species of concern in the flathead sole target fishery would, in the limit, have represented a discard savings on the order of 0.17% of the *total* groundfish TAC in the BSAI groundfish fisheries in 1995.

For species for which markets are limited or undeveloped, e.g., H&G pollock, male rock sole, 100% retention requirements will impose direct operational burdens which cannot be offset (in whole or in part) by expected revenues generated by the sale of the additional product. One might reasonably expect to see much of this "undersized" and/or "non-target" catch diverted into meal or other industrial product forms, depending upon the limitations imposed by the "utilization" option selected, and the capacity limitations of the operations in this fishery (see discussion of DFS/VIP/LLP-Moratorium/USCG Requirements and IR/IU).

"Other"- Flatfish

O-Flats Trawl

For the BSAI "O"-flats trawl fishery, NMFS Blend, ADF&G fish ticket, and NORPAC indicate that 17 processors participated in the 1994 fishery (all were catcher/processors). Thirteen of these catcher/processors were greater than 124 feet in length, thus indicating "100%" observer coverage, while the remaining 4 boats were between 60' and 124' in length. Two catcher vessel in the 60' to 124' size range (implying 30% observer coverage) reported landings to in-shore processors.

For the 1995 season, these data indicate that 23 processors participated in the "O"-flat fishery. These included 1 mothership (over 124') and 22 catcher/processors (16 over 124'; 6 between 60' and 124'). Three catcher boats, delivering only at-sea, were also present in the 1995 fishery. One was listed as over 124', while the remaining two were between 60' and 124' in length.

The O-flat target fishery would be regulated under IR Option 1, requiring 100% retention of all pollock, Pacific cod, yellowfin, and rock sole present in the catch (see Appendix A: Table 1.14). In 1994, this fishery reported total groundfish catches of 28,577 mt. In 1995, the total was 20,496 mt. The four species of concern accounted for a significant share of this total, suggesting that this fishery is relatively *species non-selective*.

The composition of bycatch was variable over these two fishing years. In 1994, nearly 27% of total catch was pollock, of which more than 99% was discarded. Yellowfin was the next most numerous species of concern in the bycatch, accounting for just over 14% of total catch. Discards of this species were relatively low, at just under 32% (or 1,301 mt out of 4,024 mt). Pacific cod made up 8.1% of the catch at 2,310 mt, of which 1,001 mt (or 43.3%) was discarded. Rock sole accounted for 3.2%, or 917 mt, of the total, of which 52% was discarded. In 1995, the pattern changed, at least with respect to pollock and yellowfin bycatch. Pollock made up only about 17.5% of total catch (of which 3,254 mt or 90.6% was discarded), while yellowfin comprised 34% of the total (with discards of just over 3,000 mt or 44.4%. Pacific cod was 9.3% of catch (1,916 mt) and rock sole was 6.8% (1,394 mt) of the total. The Pacific cod discard rate was 57% and rock sole was 60.4% in that year. All of these discards would have been prohibited under Option 1. In that case, assuming no displacement of discards of non-regulated by regulated species, this IR option could have reduced discards by up to 10,000 mt in 1994 (a 52% reduction over the status quo); and by 8,277 mt (a 41% reduction) in 1995.

For species for which markets are limited or undeveloped, e.g., H&G pollock, male rock sole, 100% retention requirements will impose direct operational burdens which cannot be offset (in whole or in part) by expected revenues generated by the sale of the additional product. One might reasonably expect to see much of this "undersized" and/or "non-target" catch diverted into meal or other industrial product forms, depending upon the limitations imposed by the "utilization" option selected, and the capacity limitations of the operations in this fishery (see the discussion of product form under the Utilization sections). For fisheries which do not target any one of the four species of concern, the nature and pattern of response to a 100% retention requirement cannot be anticipated on the basis of historic data. The analysis must, therefore, rely upon the experience and knowledge of those in the industry for guidance, and recognize that the ultimate answer as to the economic impact will await accumulation of empirical data, post-implementation.

The probable impact of adoption of IR Option 1 on this fishery would, according to the Council's IR/IU Industry Working Group, be very similar in nature to that described above for either the Flathead sole" or "Rock sole" fisheries (see those discussions for details). The impacts would, therefore, likely be significant.

Rockfish

A small BSAI rockfish longline fishery exists, but recorded no bycatches of any of the four species of interest during the 1994 and 1995 assessment period. This fishery would, therefore, not be regulated (directly impacted) by the adoption of the proposed IR/IU management program.

Rockfish Trawl

The BSAI rockfish trawl fishery is another fishery which would be effected by adoption of IR Option 1, although it does not "target" any of the four species of concern.

For the BSAI rockfish trawl fishery, NMFS Blend, ADF&G fish ticket, and NORPAC indicate that 13 at-sea processors participated in the 1994 fishery (all catcher/processors). All of these catcher/processors were greater than 124 feet in length, thus indicating "100%" observer coverage.

In 1995, 14 at-sea processors participated in the 1995 rockfish trawl fishery (again all catcher/processors). All of these vessels were greater than 124' in length, requiring 100% observer coverage.

The BSAI rockfish fishery has tended to be relatively *species selective*, based upon NMFS blend catch and discard data (see Appendix A: Table 1.15). Of the four species of concern, only pollock and Pacific cod were reported in significant numbers in the bycatch of this fishery (rock sole accounted for 0.1% and 0.2% of the total catch in 1994 and 1995, respectively. No yellowfin sole was present). Total groundfish catches in each year were, respectively, 15,102 mt and 13,498 mt. In each year pollock bycatch was under 3% of total reported catch (2.9% and 2.3%, respectively), while Pacific cod was just 3% in 1994, 1.7% in 1995. Bycatch quantities were very small, with pollock totaling 416 mt in 1994 (96.2% of which was discarded), 313 mt in 1995 (100% of which was discarded). Pacific cod totaled 447 mt in 1994 (151 mt, or 33.8%, was discarded); 234 mt (104 mt, or 44.6%, was discarded) in 1995. Adoption of this alternative would have reduced total discards in this fishery by 583 mt in 1994 (or about 20%, all else equal); and by 435 mt in 1995 (or approximately 17.7%). The aggregate discards of the four species of concern represented 0.9% of all discards of these species in the BSAI groundfish fisheries in 1994; 0.6% in 1995.

For other catch, markets are limited or undeveloped, e.g., H&G pollock, male rock sole, and thus 100% retention requirements will impose direct operational burdens which cannot be offset (in whole or in part) by expected revenues generated by the sale of the additional product. One might reasonably expect to see much of the "undersized" and/or "non-marketable" catch diverted into meal or other industrial product forms, depending upon the limitations imposed by the "utilization" option selected, and the capacity limitations of the operations in this fishery (see the discussion of product form under the Utilization sections).

Due to the size and nature of this fishery, the Council's IR/IU Industry Working Group concluded that adoption of IR Option 1 would have no significant impact on this fishery. The available data would seem to support that conclusion.

Atka Mackerel

Atka Mackerel Trawl

The BSAI Atka mackerel trawl fishery has, over the period of analysis, reported bycatches of three of the four species of concern and, therefore, would be potentially impacted by adoption of IR Option 1.

For the BSAI Atka mackerel fishery, NMFS Blend, ADF&G fish ticket, and NORPAC indicate that 15 processors participated in the 1994 fishery (all catcher/processors). Fourteen of these were greater than 124 feet in length, thus indicating "100%" observer coverage, while one was in the 60' to 124' class. All of the catch in this fishery, in this year, was processed at-sea.

In 1995, 17 catcher/processors participated in the Atka mackerel trawl harvest. All were greater than 124' in length (100% observer category). These were the only participants listed in this fishery, in this year.

NMFS blend catch and discard data suggest that, while pollock, Pacific cod, and rock sole were all present in the total catch of this fishery, only cod represented a "significant" share of the catch (see Appendix A: Table 1.16). Of the 77,168 mt total groundfish catch recorded in 1994, 6,857 mt were composed of Pacific cod (or approximately 8.9%). Of this bycatch, 2,063 mt were discarded, for a discard rate of 30%. In that same year, just 358 mt of pollock and 64 mt of rock sole were present in the catch. Discard *rates* for these two species were, respectively, 71.3% (256 mt); and 83.5% (53 mt).

In 1995, the Atka mackerel fishery reported total catches of 90,287 mt in the BSAI management area. Just 4.9% of this catch was composed of Pacific cod (for a total of 4,455 mt). Pollock bycatch was estimated to be 358 mt, or 0.4% of total groundfish catch in the fishery. Virtually all of this pollock was discarded. Rock sole bycatch totaled 138 mt (or 0.2% of catch), with 112 mt (81.1%) discarded in-the-round. Of the reported 17,313 mt total discard in this fishery in 1994, 2,522 mt was made up of the IR species of concern. Thus, had Option 1 been in place in that year, total discards in the Atka mackerel trawl fishery could potentially have been reduced by approximately 14.5%. In 1995, total reported discards in this fishery were 20,051 mt, of which 2,100 mt were pollock, cod, and rock sole. One-hundred percent retention of these species, as under IR Option 1, could have reduced discards in this fishery, in this year, by just under 10.5%.

The Council's IR/IU Industry Working Group examined this information and observed that, in general, the boats operating in this fishery are relatively larger vessels and should therefore have no serious difficulty complying with the proposed retention requirement. None of the catch or bycatch data available on this fishery, nor any other information developed in the course of the assessment, would lead to a conclusion other than there is likely to be no significant impact on this fishery from adoption of IR Option 1, *ceteris paribus*.

3.2.1.1 The Potential Aggregate Effect on Discards

Taken as a whole, the several target fisheries identified above, which would be directly impacted by IR Option 1, accounted for an estimated total groundfish catch in 1994 of approximately 1.99 mmt. In 1995, that total was estimated to be 1.92 mmt. These fisheries collectively discarded an estimated 282,574 mt of groundfish (or approximately 14.5% of total catch) in 1994, and 272,995 mt (or about 14% of total catch) in 1995. Had the retention provisions of IR Option 1 been in effect in these fisheries in these years, aggregate discards could have potentially been reduced by approximately 74% in 1994 (assuming discards of IR regulated species were not substantially offset by discards of unregulated species). This upper-bound estimate of bycatch savings would have represented about 11% of the total BSAI groundfish TAC in 1994. The effect would have been similar in 1995.

As suggested by the data on size composition for each target fishery (see Appendix B), most of the discards of *target* species are composed of fish which are, by current standards, "unmarketable" (except perhaps as meal). A share of the remaining discards are presumed to be damaged, or otherwise unsuitable for retention and processing. As a result, it seems likely that the amount of additional product deriving from IR induced reductions in discards, under Option 1, will be substantially smaller than the additional retained catch tonnage might suggest. That is, if one were to estimate the potential additional product output deriving from bycatch retention, under IR Option 1, by extrapolating average product mix and recovery rates for *target species* catch in the unregulated fisheries, the estimate would likely be substantially overstated.

While, under IR Option 1, the mandated retained bycatch may not produce commensurately large increases in product (and may actually reduce operating revenues) it may, nonetheless, have another effect consistent with the Council's stated objective for this action. By increasing operating costs, associated with meeting the retention requirements, the IR proposal may induce operators to adopt fishing techniques to avoid, to the maximum extent practicable, catching unwanted and/or undersized fish. While the magnitude of this economic inducement to "avoid" bycatch will vary from operation to operation and fishery to fishery (and therefore cannot be empirically estimated), it may represent an important potential benefit attributable to adoption of the Council's IR action.

3.2.1.2 Potentially Impacted Vessels

The potentially affected vessels, by size, operating mode, and fishery are identified in the following tables. The indicated "Significant Impact" of IR Option 1 reflects the *fleet-wide* response (i.e., assumes all vessels operate at the mean). There will be individual differences in the relative "compliance-burden" among vessels within any given target fishery. For example, in a fishery in which the "fleet-as-a-whole" will (likely) experience significant compliance impacts attributable to IR/IU, one or more *individual* vessels may not. Alternatively, in a fishery that, on-average, is not expected to incur significant impacts, there may be an individual vessel which will find compliance difficult. These preliminary findings do not reflect these potential differences within a fleet.

Trawl Vessel Count by Target, Vessel Length, and Processor Class

(Target is based on retained catch by processor, week, area, gear.1/)

	Mother ships	Catcher/ Processors		Catcher vessels				Significant impact
	greater than 124 ft	greater than 124 ft	60 ft to 124 ft	greater than 124 ft	60 ft to 124 ft	less than 60 ft	unknown length	of compliance?
1994								
Pollock								
bottom	3	41	-	6	31	-	2	N
pelagic	3	36	-	26	79	-	12	N
Sablefish	-	6	1	-	1	-	-	N
Pacific cod	4	33	7	11	57	3	5	Y1/
Rock sole	3	27	3	-	1	-	1	Y
Turbot	-	9	3	1	6	-	-	N
Yellowfin	2	32	3	4	12	-	4	Y
Flat, other	-	13	4	-	2	-	-	Y
Rockfish	-	13	-	-	-	-	-	N
Atka mack	-	14	1	-	-	-	-	N
1995								
Pollock								
bottom	4	39	1	3	22	-	1	N
pelagic	4	38	1	24	102	5	11	N
Sablefish	-	1	1	-	2	-	-	N
Pacific cod	4	33	7	16	74	-	3	Y1/
Flathead	-	17	2	-	-	-	-	Y
Rock sole	2	28	9	1	3	-	-	Y
Turbot	2	16	5	4	10	-	-	N
Yellowfin	4	38	6	4	30	-	-	Y
Flat, other	1	16	6	1	2	-	-	Y
Rockfish	-	14	-	-	-	-	-	N
Atka mack	-	17	-	-	-	-	-	N

Source: NMFS Alaska region blend, ADF&G fishtickets, and NOPFAC.
All targets calculated by AFSC staff.

1/ Catcher/processor vessels in this fishery with the capability to "fillet" product will face "no significant burden" in complying with the IR provisions (according to the Council's IR/IU Industry Working Group). Vessels limited to "H&G" operation may be "significantly disadvantaged" by the retention requirement.

Non-trawl Vessel Count by Target, Vessel Length, and Processor Class

(Target is based on retained catch by processor, week, area, gear.)1/

	Catcher/ Processors			Catcher vessels				Significant impact
	greater than 124 ft	60 ft to 124 ft	less than 60 ft	greater than 124 ft	60 ft to 124 ft	less than 60 ft	unknown length	of compliance? (Y/N)
1994								
Sable fish								
Longline	4	13	-	-	1	7	1	N
Pot	-	1	-	-	-	-	-	N
Pacific cod								
Jig	-	-	-	-	1	35	3	N
Longline	28	19	1	-	1	6	1	N
Pot	3	2	-	5	21	6	2	N
Turbot								
Longline	5	5	-	-	1	-	1	N
1995								
Sable fish								
Longline	4	9	-	-	11	7	5	N
Pacific cod								
Jig	1	2	1	-	2	33	3	N
Longline	23	14	2	-	3	11	2	N
Pot	6	5	1	17	80	11	2	N
Turbot								
Longline	16	7	-	-	1	1	1	N

Source: NMFS Alaska region blend, ADF&G fishtickets, and NORPAC.
All targets calculated by AFSC staff.

1/ Note, one mothership was reported to have participated in the 1994 Pacific cod pot fishery and was greater than 124' in length. No other motherships participated in any non-trawl BSAI groundfish fishery during 1994 or 1995, according to "blend," NORPAC, or ADF&G fishticket records.

3.2.2 Suboption A - "Phase-in"

From very early in the IR/IU development process, the concept of a "phase-in" of the retention requirement has been under consideration. The preliminary findings of the Implementation Issues Assessment, prepared for the Council in March 1995, suggested that there could be some very serious difficulties associated with monitoring and enforcing anything short of a "100% retention requirement" for any given species. Nonetheless, at it April 1996 meeting, the Council reaffirmed its desire to examine a modified "phase-in" program for improved retention in the BSAI groundfish fisheries.

Under this proposal, 100% retention of pollock and cod would be *required* in all BSAI groundfish fisheries beginning immediately upon implementation of the IR/IU program (e.g., January 1, 1998). Retention of rock sole and yellowfin sole would, however, be "phased-in," starting at 60% retention in the first year, and increasing in fixed increments until 100% retention was achieved. The rationale for this approach centers on the market limitations which currently exist for small (and/or male) rock sole and yellowfin sole. Specifically, while some progress has recently been made to develop markets for these bycaught flatfish, the demand remains relatively limited and price appears "sensitive." Price sensitivity suggest that if large quantities of small flatfishes were to suddenly enter these fledgling markets, the supply would likely not be absorbed without a severe drop in price. In the limit, of course, price could drop sufficiently below "production costs"[17] to make continued supply impossible, and the market would cease to exist. Thus, until the market(s) for these flatfish can be broadened and strengthened sufficiently to sustain a viable price, while absorbing additional supplies, large increases in deliveries of product to the marketplace could be destructive, undermining the ultimate success of the market development effort.[18] This, in turn, would impose significant (and largely unrecoverable) costs on operators required to retain bycatch for which no viable market exists. It is not clear that under such circumstances, the "benefits" of improved retention of small rock sole and yellowfin sole would off-set the attributable "costs."[19]

To accommodate these concerns, the Council has proposed two alternative "phase-in" rates for rock sole and yellowfin sole under the IR proposal. Both would begin by requiring 60% retention of each species, in any BSAI groundfish fishery in which they are present in the catch, starting with the implementation of the IR/IU program (presently assumed to be January 1, 1998). Under one regime, the retention requirement would rise to 80% in the following year, and reach 100% retention at the start of the third season.

The alternative schedule would increase the retention requirement for rock sole and yellowfin by 10% each successive year (again, beginning at 60% in the first). Thus, over a five year period, retention would arrive at 100% for each of these species, as well. (See the following table).

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[17] Including, but not limited to, harvesting, processing, transportation, storage, and marketing cost, as well as payment to fixed factors of production.

[18] The merits of this argument are largely an empirical question which can only be critically examined following a change in supply. Nonetheless, the theoretical underpinnings are consistent with demand and price responsiveness expectations.

[19] These circumstances will induce greater efforts to "avoid" unwanted bycatch, which is another of the Council's objectives for IR/IU. However, some bycatch is likely unavoidable.

A Rock sole and Yellowfin "Phase-in" Schedule [29]
(assumes 1995 catch levels)

Year	Species	Percent Required	Retention Required (mt)	Net change from status quo (mt)	(percent)
1	RS	60%	32,700	11,100	20%
	YS	60%	70,800	(19,200)	none
2	RS	70%	38,220	16,620	30%
	YS	70%	82,600	(7,400)	none
3	RS	80%	43,700	22,100	40%
	YS	80%	94,400	4,400	5%
4	RS	90%	49,100	27,540	50%
	YS	90%	106,200	16,200	18%
5	RS	100%	54,600	33,000	60%
	YS	100%	118,000	28,000	31%

Because the retention requirements will apply across all BSAI groundfish fisheries in which any of the four species of concern are present in the catch, the implications for aggregate bycatch savings in response to a variable "phase-in" schedule can be examined in the retention/discard performance under the successive annual rates. Impacts, by target-fishery, associated with the proposed "phase-in" schedules are presented in detail in Appendix C.

3.2.2.1 A Two-year "phase-in"

Using the 1995 catch and discard blend data as an example, the following conclusions can be drawn about the two "phase-in" schedules. In 1995, total discards of all groundfish species in potentially IR regulated target fisheries were approximately 273,000 mt. Pollock and Pacific cod accounted for approximately 52% of all discards of allocated groundfish species in these fisheries. Rock sole discards accounted for an estimated 12%, or 33,000 mt, while yellowfin sole made up slightly more than 10%, or 28,000 mt, of total groundfish discards.

Had the proposed IR/IU program been in place in that year, and assuming 100% retention of all pollock, Pacific cod, yellowfin, and rock sole, total groundfish discards in the BSAI groundfish fisheries could have potentially been reduced by approximately 74%, as compared to the status quo.

If a two year "phase-in" schedule on retention of rock sole and yellowfin sole had, instead, been in place, assuming approximately constant catch totals and species composition, 60% of the catch of rock sole and

[29] This implicitly assumes that all vessels operate at the "mean," e.g., they all have identical catch composition and retention rates. To the extent that this is not so, the required increase in retention is *understated*. See Appendix C for potential target-fishery specific performance requirements.

60% of the catch of yellowfin sole would have been required to be retained in the first year; 80% of the catch of each in the second year; 100% in the third year. Based upon total catch estimates for each of these species this schedule would have required retention of 32,700 mt of the 54,600 mt rock sole total catch, and 70,800 mt of the 118,000 mt yellowfin total catch in the first year. In the second year, 43,700 mt of the 54,600 mt rock sole catch, and 94,400 mt of the 118,000 mt yellowfin total catch would have been required to be retained. In the third year, all 54,600 mt of rock sole and 118,000 mt of yellowfin would have been required to be retained.

Over all, in 1995, approximately 40% of the total rock sole catch in all BSAI groundfish fisheries was "retained"(approximately 21,600 mt of the 54,600 mt total). Thus, the proposed two year "phase-in" would require an additional 20% retention of rock sole catch in the first year and an additional 40% in the second year, *ceteris paribus*.

For yellowfin sole, approximately 76% of total catch was "retained" in 1995 (90,000 mt of a 118,000 mt total catch). Therefore, assuming these catch levels prevail, the two year "phase-in" schedule would require no increase in retention of this species in the first year and only an additional 5% retention in the second, *ceteris paribus*.

3.2.2.2 A Five-year "phase-in"

Using again the 1995 catch and discard data as a basis, and referring to the table above, the five year "phase-in" schedule would suggest the following results. As in the two year schedule, the first year of the five year plan would require an additional 20% retention of rock sole catch over that observed under the status quo (or 32,700 mt of the 54,600 mt total catch). When the retention performance of the fishery is taken as a whole, it would require no additional retention of yellowfin sole. In the second year, 38,220 mt of rock sole would be required to be retained. Again, yellowfin retention would be unaffected. In the third year, rock sole retention would be required to increase by an additional 22,100 mt (to 49,100 mt), or a 40% increase in retention from the status quo. Yellowfin retention would be required to increase by approximately 4,400 mt (or 5% over the status quo). Year four would mandate rock sole retention totaling 49,100 mt (up 27,540 mt from the status quo), while yellowfin retention would be required to increase to 106,200 mt (16,200 mt above the status quo level). In year five, 100% retention is required. This suggests, in this example, that rock sole retention would rise by 33,000 mt (up by 60% over the status quo). Yellowfin retention would have been required to reach 118,000 mt, a net increase of 28,000 mt from the status quo.

These represent "aggregate" performance figures, i.e. summed across all potentially affected BSAI groundfish fisheries. The potential impacts of a "phase-in" schedule for rock sole and yellowfin on any individual sector would be expected to vary across "target" fisheries, generally in direct proportion to the relative quantities of these two species in the catch and inversely with the size and capacity of the operations effected. That is, many fisheries will not incur significant direct costs in complying with this rule (e.g., they catch relatively few rock sole or yellowfin sole and/or they have the production capacity to deal with the increase). Others, especially those with the highest rates of rock sole and yellowfin sole catches will likely be adversely impacted. However, even within this latter group, the impacts will likely be greatest for the smaller, less mobile, and least operationally diversified vessels, and least burdensome for the larger, more mobile, and most operationally diversified operations.

Acknowledging these potential distributional inequities, adoption of either "phase-in" schedule may not actually result in significantly disproportionate impacts. This is so because it appears that monitoring and enforcement of either "phase-in" program will exceed the capabilities of the available NMFS and Coast Guard resources. This proposal would require NMFS to monitor discard rates (i.e., not whether discards of

a particular species had occurred, but the *proportion* of the total catch of each species that was discarded). Regardless of whether the method used to estimate discards is based solely on observer collected data or on a combination of observer reports of total catch and industry reports of processed product, monitoring discard *rates* is much more difficult than monitoring whether *any* discards of a particular species took place. Given current levels of observer and enforcement coverage, the complexity of the observer's present task load, and the nature of monitoring *"discard rates,"* a phase-in procedure for implementation of retention standards does not appear practical. Therefore, on the advice of NMFS Observer and Enforcement Offices, and representatives of the U.S. Coast Guard, it appears that monitoring and enforcement of an IR/IU "phase-in" program would be impracticable.

Industry members have argued, nonetheless, that simply having these "phase-in" targets on the books will facilitate successful transition to a 100% retention requirement. They propose that, by explicitly specifying incrementally increasing retention targets, the industry will be able to better maintain its attention and focus on the inevitable requirement of 100% retention of all yellowfin and rock sole. Furthermore, they argue, by having the retention schedule as leverage, they may be more successful it opening or expanding markets for these fish. They identify both these aspects of a "phase-in" schedule for flatfish as clear "benefits."

No empirical data are available with which to quantitatively evaluate the merits of the industry's arguments regarding the "phase-in" schedule. Nonetheless, the industry is probably best situated to make a judgement as to the potential "benefits" of such a program. One may, however, observe that, to the extent that markets do not currently exist for much of the rock sole and yellowfin bycatch, a two year "phase-in" period may not provide the level of operational flexibility which some sectors will require in order to fully comply with IR/IU. Some may argue that the same could be said for the five year schedule. But clearly, the five-year "phase-in" would provide significantly greater opportunity to build and expand markets, develop new product forms, or adopt new techniques and technologies to "avoid" unwanted bycatches, than would the two year schedule.

3.2.3 Suboption B - "Delayed Implementation"

As an alternative to a "phase-in" program for retention of yellowfin and rock sole, it was suggested that implementation of the 100% retention requirement be *postponed* for a given period. The expectation seemed to be that by delaying implementation for these two species, the potentially impacted sectors could make the necessary adjustments to accommodate the requirement when "100% retention" was implemented. For purposes of the analysis, the Council suggested that the "delay" extend for two or five years.

A quantitative analysis of the impacts of delaying IR/IU implementation for rock sole and yellowfin is necessarily limited by the data and "response" information available. As with the "phase-in" assessment, one may project the probable "discard savings" that might, in theory, accrue from such a proposal. In this case, if the IR/IU requirement was delayed for two years, rock sole discards could potentially continue at "status quo" levels for two successive seasons after implementation of the 100% retention requirement was adopted for pollock and Pacific cod. If all else is assumed constant, this means that approximately 66,000 mt of rock sole (33,000 mt each year) could be legally discarded during the "delay." Similarly, 56,000 mt of yellowfin (approximately 28,000 mt per year) could legally be discarded during the implementation "delay."

If the postponement extended to five years, i.e., with 100% retention beginning in the fifth year, the reduction in "savings" over the immediate 100% retention requirement could be 132,000 mt (or 33,000 mt each year) for rock sole, 112,000 mt (i.e., 28,000 mt) for yellowfin sole, *ceteris paribus*.

Clearly, these are very crude estimates which do not account for possible adjustments by the industry to the eventual 100% retention requirement. However, testimony by industry sources before the Council at its April meeting suggested that if implementation of the retention requirement were simply delayed for some period, industry would not have the impetus necessary to carry out the market development, structural changes, and operational adjustments required to comply with IR/IU when adopted. That is, they reported that, "unless the Council keeps the industry's feet to the fire..." (presumably with a "phase-in" schedule) the industry will be as unprepared to comply with a 100% retention requirement following the implementation "delay" as it would be if 100% retention for rock sole and yellowfin were effective simultaneously with pollock and Pacific cod.

The industry, itself, is probably best suited to make these judgements. Certainly, there are no empirical data with which to assess the merits of these arguments. However, it seems probable, given the "common property" characteristics of the management of these resources, that spontaneous collective action by the industry to prepare for 100% retention of these two flatfish species is unlikely. As such, the predictions of industry that at the end of the "delay" period, they still will not be prepared to comply, seems plausible.

On the other hand, a "delay" in implementation, rather than a "phase-in," would accommodate the monitoring and enforcement concerns expressed by the agency and the Coast Guard, and avoid placing the Council (and Secretary) in the position of adopting regulations, i.e., a phase-in for flatfish, which they have acknowledged probably cannot be monitored or enforced.

As with the "phase-in" schedule, it seems probable that a two year delay in coming to 100% retention for these two flatfish species may not provide a sufficient window of opportunity for some sectors of the industry to adjust to IR/IU. Since it was the Council's desire to provide time for these sectors to establish and expand markets, develop new product forms, or adopt new techniques and technologies to "avoid" unwanted bycatches, the Council may wish to consider whether there is any meaningful difference in terms of "benefits" to the industry between immediate 100% retention and a two year delay. The discard savings are not great and the two year delay may not substantially alter the size or distribution of adjustment costs to the industry. While a five year delay would not assure adequate time for the industry to prepare for compliance, it would certainly increase the opportunity substantially.

4.0 Monitoring Compliance with Increased Retention Standards

4.1 Observer coverage - The Role of NMFS-Certified Observers

NMFS observers have a "primary responsibility" to estimate the weight and species composition of the total catch to provide scientifically reliable information about fishing mortality. The disposition of catch between processed product or discards is, at present, regarded as "secondary information," and is provided by the observer on the basis of the best available information. Generally, observers estimate discards by making an approximation of the percentage of fish in their samples which would have been discarded.[21] That is,

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[21] Estimation procedures and directions to observers are prescribed in the NMFS-Observer Program training manual as follows. "Percent Retained Estimation" - The percent retained by species group represents the round weight of fish that is retained by the vessel from any given tow or set that the observer samples. Observers are to make their best estimate of the weight of whole fish of each report group category that is retained (whether retained in whole or in part) on each sampled tow or set. This figure needs to be estimated and reported on the CMA form.

There is no clear scientific way for observers to arrive at the percent retained by species group figure because of the

observers only visually *approximate* the proportion of each species discarded from sampled hauls. NMFS later extrapolate this *approximation* to unobserved hauls.

4.2 Alternative means of IR Compliance Monitoring

Accumulating empirical evidence from the NMFS observer program suggests that the level of compliance with any retention regulation may be expected to vary directly with the level of observer coverage. Significant portions of the industry are, at present, either unobserved or have an observer onboard only 30%

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variability in discarding that occurs on vessels, and the many different places discard takes place. Recognizing these limitations, we want observers to make an approximation based on what they see happening on their particular vessel. Because this is an approximation, corresponding time and effort given to obtaining it should be minimized and complex mathematical approaches to this task avoided.

Because the focus is the entire tow or set, observers need to take all discard into consideration. If a trawler dumps a significant portion of any sampled haul back into the sea before sorting, then none of the species groups of that haul were 100 percent retained. For example, if 30 tons of an 80 ton net were dumped, then no more than 5/8ths or 63 percent of each species group should be reported as retained. Further, if fish are falling off the belts in the factory beyond the observer sampling station and are later washed out of the vessel, these too should be considered as discard. To provide guidance, the following are acceptable methods to determine percent retained by species group for the major gear types:

Catcher/Processor Trawlers: In most instances, this estimate will only be a visual approximation based on the observer's best judgement and observations of what is going on in the factory. For this figure, it is acceptable to make your best guess. In some cases, however, the vessel may have a rigid method for selecting a certain size or sex of fish which is applied consistently to the catch. If that is true, it is acceptable to use the composition sample to determine the weight of fish that would be sorted out by size, sex, or species in the factory. It is also acceptable to just make your best estimate. In making your approximation on a catcher/processor, if any part of a fish is retained then the entire fish is counted as retained. A cursory look at factory production figures, followed up by further investigation, might make you aware that a particular species group is sometimes utilized when you thought it was always discarded.

When making an estimate of the percentage of fish being retained, avoid basing your estimate on relative *numbers* of fish. Remember that this figure is a percentage of *weight*. If small fish are being discarded and the larger ones retained, the weight percentage of retained fish is greater than their percentage by number.

If a c/p vessel puts up product but days later discards it overboard in favor of a more valuable product (high grading), it is not necessary to try to revise earlier figures for percent retained of the discarded product. Just make a note of it in your daily log.

Catcher-only Trawlers: Observers on catcher-only vessels must consider everything that is delivered to the processor as retained, regardless of whether the processor later discards it, or gives it back to the catcher to take back out to sea for discard. With that distinction, the methods are the same as a catcher-processor trawler.

Longline Vessels: Observers on longliners normally count fish that drop off or are intentionally knocked off the line, as part of their normal sampling procedure. Count these fish as discards, apply an appropriate average weight, and calculate *by weight* what percent of each species was retained in your sample. Should drop-off's of discarded fish be so frequent that they cannot be counted separately from the sample fish, a visual approximation, as with trawlers, is acceptable. Take note also of landed target fish which are later rejected by the processing crew. If sand fleas are present, it is likely that not all the landed fish will be retained.

of the time. Even operations classified as having "*100% observer coverage*" do not, in fact, have all hauls (lifts) or deliveries monitored. Typically an observer samples the catch of only a portion of the hauls (lifts) that the vessel makes. Further, because discards can take place at various sites on a vessel and at various times, it is not reasonable to expect an "*on-duty*" observer to monitor all discards.

In the face of reduced staff and increasing workloads, the NMFS observer program is having difficulty carrying out current scientific and monitoring responsibilities. However, no additional resources are expected in the near future. Most observers onboard vessels are fully subscribed with current duties and are unable to take on any additional tasks without changing priorities, which means eliminating other duties and responsibilities. Therefore, active NMFS-observer monitoring of the Council's IR Option cannot be accomplished without additional observers and support personnel, or a significant reallocation of existing resources and priorities (although re-prioritization could undermine the observer program's ability to provide "primary" information for science and management).

Without adequate observer monitoring of discards, NMFS expects to be unable to assure strict "real-time" (field-based) compliance with the increased retention regulations, as proposed. Therefore, the Council may wish to consider alternative monitoring options which "*balance*" the level of compliance monitoring with the cost of achieving the desired discard savings.

4.2.1 Monitoring Alternative 1

Depending upon the level of monitoring which is defined as "*adequate*," the proposed IR management action could necessitate greater direct observation of fishery participants. At one extreme, the proposed IR program could require multiple observers on *all vessels, at all times*, whenever participating in any IR regulated BSAI groundfish fishery. This would include coverage onboard those vessels which are currently unobserved. Such a program would presumably require a "compliance monitor," in addition to the current scientific monitor, on each operation (and at least two such compliance monitors on each operation that fishes and/or processes more than eight to twelve hours each day) to assure that all hauls, pot lifts, and hooks are observed. Even without a quantitative estimate, it is apparent that this level of monitoring, while perhaps technically feasible, would be prohibitively costly and unnecessarily burdensome, as compared to the probable benefits, as measured in discard savings through retention compliance. This conclusion was independently confirmed by the Council's IR/IU Working Group (per. comm., IR/IU Industry Working Group, March 26, 1996).[22]

4.2.2 Monitoring Alternative 2

A relatively more modest approach to real-time, on-site monitoring of the retention requirement (proposed by the Council's IR/IU Industry Working Group) would be to effectively "*double*" observer coverage onboard vessels which currently carry observers, and at plants which are now required to have NMFS-observer coverage. That is, for example, all vessels (and presumably plants) which are currently required to have "100% observer coverage" would, under this proposal, be required to have two NMFS-certified observers present when participating in any IR regulated fishery. Likewise, any vessel (or plant) which is currently required to have an observer present 30% of the time would, under this proposal, have to have NMFS-observer coverage during 60% of its operating period, while participating in any IR regulated fishery.

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[22] The direct and indirect costs of adopting Monitoring Alternative 1 would far exceed those estimated for IR Monitoring Alternative 2.

These levels will not assure compliance with the proposed 100% retention requirement, since not all haul, lifts, (deliveries) or hooks can be monitored for observed operations, even at this level of coverage. (Furthermore, all operations which are currently "unobserved" would remain so under this proposal.) However, the increased presence of monitors can reasonably be expected to *improve* the rate of compliance by increasing the risk of detection of violations.

The NMFS Observer program estimates that adoption of IR Monitoring Alternative 2 would significantly increase the cost of providing observer services for both the fishing industry and NMFS. Specifically, by requiring two observers on every vessel 125' in length (LOA) or longer, and at every shoreside processing facility that processes 1,000 mt or more of groundfish during a calendar month, and by doubling the observer coverage on vessels that are equal to or greater than 60' but less than 125', and at shoreside processing facilities that process between 500 and 1,000 mt of groundfish during a calendar month, it is estimated that the number of "deployment days" for these vessels and plants will nearly double, from 21,861 to 42,442 days per year.[23]

Deployment days can be thought of as the days an observer contractor bills a client for observer services. This typically translates into the number of days that an observer is stationed onboard a vessel or at a shoreside plant. If a "cost per deployment day" of $201 is used, adoption of Monitoring Alternative 2 would increase annual industry costs for observer coverage in the BSAI from $4.4 million to $8.5 million.[24]

The additional observer coverage in the BSAI groundfish fisheries, outlined above, is estimated to increase the number of deployed observers by about 40% (e.g., from 567 in 1995 to 794). This increase in the number of observers and it's associated increase in the amount of data collected is estimated to raise overall NMFS Observer Program annual costs by about 33%, from $1.8 million to $2.4 million. This budgetary increase can be attributed to additional staffing and augmented spending for observer sampling equipment and data entry contracts.

Thus, initial estimates of the aggregate cost per year attributable to adoption of IR Monitoring Alternative 2, as compared to retention of the Status Quo, place the figure at approximately *$10.9 million (or an increase of $4.7 million per year above the status quo cost).*

4.2.3 Monitoring Alternative 3 - [PREFERRED ALTERNATIVE]

At the other end of the spectrum of possible monitoring programs for the proposed IR management action would be one based principally upon the examination of "secondary" data to confirm retention compliance. Under this approach, *retention* compliance would be evaluated primarily in two ways. The first involves the procedures for verifying IR compliance during random at-sea boardings by the Coast Guard and NMFS Enforcement Officers. In the case of an enforcement boarding, catch round weights reported in the vessel's fishing log would be compared to the round weight equivalent catch estimates obtained by "back casting" from primary product weights, using standard product recovery rates (PRRs), published by NMFS. That is,

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[23] Figures are based on an average of 1994 and 1995 data. In addition, since vessels operating under a CDQ quota currently carry two observers, it was assumed that increased coverage would not be required for these operations.

[24] The $201 estimate was derived from 1995 observer cost data which were compiled for Research Plan fee collection purposes and was used in the April 4, 1996 "EA/RIR for Implementation of a North Pacific Observer Program to Replace the North Pacific Fisheries Research Plan" (draft for Council review). It is considered the most current and accurate estimate of cost per deployment day for observer services.

boarding officers would physically inspect the product in the vessels hold, identifying species/product form and product weight. From this information, a "round weight equivalent" estimate of the catch would be derived using NMFS' PRRs. This estimate would be compared to the logged catch weight. If the two sources of catch estimates, for each species of concern, are within acceptable limits, to be specified by NMFS in the enabling regulations, compliance with *retention* requirements would be confirmed. In some cases, it may not be possible to compare catch round weights with the primary product weights without escorting the vessel to port to perform a case-by-case hold count.[25]

One of the most serious potential shortcomings of this approach is the reliance upon fixed PRRs. There is considerable evidence that PRRs can vary, not only between operations, but within any single operation, over the course of the season. Such factors as the size and condition of the fish, seasonality, efficiency/performance of processing equipment, and market demands (affecting product form/quality/mix), may all influence the actual realized recovery rates for any given operation. It is possible that, for example, an operator might obtain an actual PRR which is significantly higher than the published standard, for a given period of time. In this case, if boarded, use of the standard PRR to derive an estimated "round weight equivalent" catch from product onboard could lead the enforcement agent to conclude that total catch was being under-logged by the operator. This could result in issuance of a citation-of-violation and (potentially) an unjustified economic and/or legal penalty.

Alternatively, if the actual realized PRR was substantially lower than the published standard, the enforcement agent might conclude, on the basis of the "back-casting" procedure, that discarding of fish in-the-round had occurred, in violation of the retention requirement, even though it had not.

It should be noted that NMFS developed standardized PRRs for use in tracking "aggregate" fleet performance. NMFS later required their use when performing calculations for directed fishing and other formulas. The standard NMFS PRRs are approximations of the "average" product recovery rate performance observable in the fleet over a given interval of time, e.g. a fishing year, or season opening. They were never intended for use in monitoring the production performance of individual operators. These fundamental difficulties with the use of a standardized PRR may require that NMFS adopt a reasonably large degree of latitude when specifying IR compliance standards.

The second means of monitoring retention compliance under this alternative could review catch and production reports, submitted by industry to the agency, along with the associated observer catch records. Each operation participating in any BSAI groundfish fishery is required to maintain and submit regular reports to NMFS (or to the State of Alaska), on catch and/or production, e.g., Weekly Production Reports, ADF&G Fish tickets, Daily Fishing Logs, etc. On the basis of these reports, NMFS could derive estimates of total catch, by species of concern, both from catch records and by use of standard PRRs applied to reported product. These estimates could then be compared to observer catch estimates, for the same operation and period. If the two estimates agree, within some reasonable limit (to be specified in the enabling regulations), retention compliance would be assumed.

This monitoring system has several difficulties, as well. First, it relies on combining catch estimate information from different sources (observer and processor) which will lead to conflicting conclusions in

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[25] There may be some practical difficulties with relying on hold-counts at sea. Although a volumetric hold count may be sufficient for giving a general idea of the amount of product onboard a vessel, it is not exact. Bulkheads, conveyor belts, and other obstructions can undermine accuracy. If the logbook and volumetric hold count do not match, then a case-by-case count must be conducted in order to substantiate a violation. For a variety of reasons, including safety considerations, a case-by-case count will likely not be conducted at sea.

some cases. For example, an observer's estimate of the total catch of a particular species could be less than the estimate of retained catch, based on applying standard PRRs to product weight. This result could occur due to: 1) expected sampling error in procedures used by the observer [density sampling, species composition sampling, etc.]; 2) incorrect measurement of the volume of fish in a bin or the weight of fish in samples; or 3) the expected difference between individual vessel PRRs and the NMFS Standard PRR (as discussed above).

Another difficulty in this method is that observer estimates of total catch and species composition are made on a haul-by-haul basis. Production data is recorded daily and is not required to be tied to a specific haul, although record keeping and reporting requirements could be changed. Nonetheless, with existing observer coverage levels, it will be possible to apply this method *only* to the observed hauls and not to all catch of the vessel (or delivered to a plant).[26]

There are clearly other shortcomings with this aspect of the monitoring procedure, in addition to those cited above. The most obvious may be that not all participants in the IR regulated fisheries will be observed. Therefore, the independent observer estimate of catch, against which the operator's own estimate would be compared, will not be available for some (possibly significant) portion of the catch. This leads to the next potential limitation, which is the substantial reliance upon "industry supplied" catch and production reports. Indeed, unless an operator essentially *"self-reports"* a violation, by submitting catch logs which are in significant disagreement with production reports, it is highly unlikely that failure to comply with the 100% retention requirement will be detected.

In practice, the *"risk"* of detection of even relatively significant violations of the retention requirement will depend, in large part, upon random boardings and audits of the data and, thus, will vary directly with the level of resources dedicated to these enforcement functions. If, however, the objectives of the IR/IU proposal can be *substantially* achieved by, 1) providing an incentive for honest operators (which one assumes most are) to reduce bycatch discards, and 2) increasing the *risk* of detection of violations of the retention requirement, then this monitoring alternative can likely achieve this.

As proposed, this alternative would rely primarily upon existing observer, enforcement, and management staff and resources.[27] Therefore, if adopted as proposed, there would be *no significant additional cost* attributable to IR Compliance Monitoring Alternative 3.

5.0 DFS/VIP/LLP-Moratorium/USCG Requirements and IR/IU

5.1 Directed Fishing Standards (maximum retainable bycatch amounts)

NMFS annually assesses each groundfish TAC to determine how much of a species' TAC is needed as bycatch in other groundfish fisheries. The remainder is made available as a directed fishing allowance. Directed fishing is defined in regulations as "any fishing activity that results in the retention of an amount of a species or species group onboard a vessel that is greater than the maximum retainable bycatch (MRB) amount for that species or species group."

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[26] Observers sample about 60 percent of hauls on observed trawl vessels.

[27] If, however, no additional resources, e.g., FTE, are forthcoming in connection with adoption of IR/IU, diversion of staff from other functions to monitor, investigate, and prosecute IR/IU cases will mean reduced efforts being applied to those other programs.

The MRB amount is calculated as a percentage of the species closed to directed fishing relative to the amount of other species retained onboard the vessels that are open for directed fishing. The MRB percentage of a bycatch species that may be retained is established in regulations governing the groundfish fisheries. Current regulations prohibit the retention of a species closed to directed fishing in amounts that exceed the MRB percentage, and excess catch must be discarded.

The MRB percentages established in regulations serve as a management tool to slow down the rate of harvest of a species placed on *"bycatch-only"* status and to reduce the incentive to fishing vessels to target on the species. Nonetheless, vessels may "top off" their retained catch of species open to directed fishing with a species on bycatch status, up to the MRB amount. For some species such as Greenland turbot, rockfish, sablefish, and flatfish, MRB percentages are set at levels that recognize increased bycatch of these species relative to certain other species. In most cases, however, a general default of 20 percent is established to serve as a general management tool to slow the harvest rate of a species, yet avoid significant discard amounts of these species to the extent they are taken as bycatch in other open groundfish fisheries.

During the course of a fishing year, NMFS routinely closes "directed fishing" for specified groundfish species. Directed fishing closures occur because, 1) a fishery has reached a halibut, crab, salmon, or herring bycatch allowance, 2) the directed fishing allowance for a target groundfish species has been attained, or 3) because of overfishing concerns for another groundfish species taken as bycatch. When directed fishing for a species is closed for any of these reasons, bycatch amounts of the species may still be retained onboard a vessel, up to the specified MRB percentage of other species open to directed fishing that are retained onboard the vessel. NMFS attempts to manage groundfish TACs so that directed fishing closures are implemented in a timely enough manner that leave sufficient portions of the TAC to provide for bycatch in other fisheries. If TAC is reached, however, the species becomes *"prohibited,"* and all catch of the species must be discarded.

5.1.1 Interactions of MRB percentages and IR/IU

The complexity associated with monitoring and enforcing compliance with the Council's IR/IU proposal is increased if mandatory retention of pollock, Pacific cod, rock sole, or yellowfin sole is secondary to NMFS regulations that require discard of the portion of the catch of these species that exceed MRB amounts (or prohibit their retention when on *"prohibited"* status). Directed fishing for pollock (by inshore and offshore sectors) typically is closed from late-February or early March until the opening of pollock 'B' season August 15. Pollock is a prevalent bycatch species in the Pacific cod and flatfish fisheries and could comprise more than 20 percent (the MRB percentage for pollock) of the catch harvest by some vessels during the period of time directed fishing for pollock is closed. To the extent that this occurs, under the proposed IR/IU program, pollock (up to 20 percent of other retained groundfish species open for directed fishing) must be retained during a fishing trip. However, pollock bycatch amounts in excess of the 20 percent ceiling must be discarded, by regulation.

Table 5.1.1 illustrates this situation with an example of catch during a hypothetical rock sole fishing trip. Under the heading *"without increased retention,"* is the theoretical catch, retention, and discard of 100 metric tons of groundfish. Fishery status for all species in the catch is indicated as either *"open"* or *"bycatch-only."* Under the heading *"with increased retention,"* the hypothetical retained and discarded catch is redistributed to show that:

1. all catch of Pacific cod, yellowfin sole, and rock sole must be retained because the directed fisheries for these species are *open*;

2. catch of groundfish open to directed fishing, other than Pacific cod, yellowfin sole, and rock sole, may be retained or discarded subject to other regulations;

3. with the exception of pollock, catch of groundfish closed to directed fishing may be retained up to the MRB amount;

4. catch of pollock, for which the directed fishery is *closed* (i.e., on bycatch-only status) must be retained until the MRB amount is reached. At that point, *all* additional bycatch of pollock must be discarded.[25]

In Table 5.1.1, groundfish species on *bycatch-only* status are shown in the bottom-half of the table. Catch of Greenland turbot, rockfish, and Atka mackerel do not exceed MRB thresholds, so all of this catch may be retained or discarded at the discretion of the operator. However, if all of the pollock catch of 20 mt were to be retained, the MRB threshold for pollock would be exceeded. The vessel may retain pollock up to 20% of the retained catch of other groundfish species for which the directed fishery is open (in this example, [.2 x 69.2 mt = 13.8 mt]). If we assume that the vessel must retain 13.8 mt of pollock under IR requirements (an amount equal to no more than 20%, the MRB percentage for pollock), then it must discard the remainder to comply with MRB requirements (i.e., 6.2 mt).

The example in Table 5.1.1 illustrates a simple case of one species for which the vessel operator must retain a portion of the catch to meet "*increased retention*" standards, while they must simultaneously discard the remainder to stay within MRB threshold levels, under the pollock fishery closure. While the vessel operator's accounting in this example is exactly the same calculation that is currently required to maximize retention of species closed to directed fishing, the IR/IU proposal would make this process mandatory for all groundfish fishing vessels with respect to pollock, Pacific cod, yellowfin sole, and rock sole. As more fisheries are put on "*bycatch-only*" or "*prohibited*" status, it becomes more complicated for the industry, observers, and NMFS to monitor the exact quantity of bycatch species that must be retained, and that which must be discarded. Continuous accounting must be made of, 1) the status of all groundfish fisheries [open, bycatch-only, or prohibited status], 2) the vessel's retained catch composition, 3) how much of each species on *bycatch-only* status must be retained, and 4) at what point further catch of that species must be discarded to comply with MRB thresholds.

[25] In fact, to prevent retained catch from exceeding MRB, a vessel might tend to discard too much to prevent the next haul from pulling it into a violation status.

Table 5.1.1 Hypothetical distribution of 100 metric tons of groundfish catch in the BSAI rock sole fishery, without and with an increased retention requirement.

Species	Status of Fishery	Without Increased Retention[a]			With Increased Retention		
		Retained	Discarded	Total	Retained[d]	Discarded	Total
Rock sole	open	21	31	52	52	0	52
Yellowfin sole	open	2	4	6	6	0	6
Other flatfish	open	3	4	7	3	4	7
P. cod	open	3	5	8	8	0	8
Sablefish	open	0.1	0.1	0.2	0.1	0.1	0.2
Other groundfish	open	0.1	3	3.1	0.1	3	3.1
Subtotal		29.2	47.1	76.3	69.2[e]	7.1	76.3
Pollock	bye[c]	2	18	20	13.8	6.2[e]	20
Greenland turbot	bye	0.1	0.1	0.2	0.1	0.1	0.2
Rockfish	bye	0.5	0.1	0.6	0.5	0.1	0.6
Atka mackerel	bye	0.5	0.1	0.6	0.5	0.1	0.6
Arrowtooth	bye	0.3	2	2.3	0.3	2	2.3
Total		32.6	67.4	100	84.4	15.6	100

[a] Only catch exceeding MRB amounts must be discarded.

[b] All catch of pollock, Pacific cod, yellowfin sole and rock sole must be retained, except that amounts of pollock, which is closed to directed fishing, that exceed MRB amounts must be discarded.

[c] Amount of retained groundfish used to calculate retainable bycatch amounts for species on bycatch-only status.

[d] bycatch-only status

[e] amount of pollock that must be discarded because retention would violate MRB threshold. .

5.1.2 Retention Options under Directed Fishing Closures

At its April 1996 meeting, the Council expressed concern about the potential for continued regulatory discards under the IR/IU program when groundfish species are on *bycatch-only* or *prohibited* species status. The Council requested NMFS to assess several alternatives to directed fishing closures and associated MRB amounts that could potentially eliminate the current requirement for mandatory discard of catch amounts that exceed MRB percentages. Two concepts were put forward by the Council. The first would require that all bycatch of pollock, Pacific cod, rock sole, and yellowfin sole be retained, regardless of whether or not these species were on *bycatch-only* or *prohibited* status. If any of these species were on bycatch or prohibited species status, retained amounts in excess of the specified MRB amount would be required to be surrendered to NMFS and sold so that the vessel would not profit from these catch amounts.

The second concept would be similar to the first, except that NMFS would reimburse vessels for the operational cost associated with retaining bycatch species in excess of the MRB amount, when surrendered. To realize this option, NMFS would need to specify a standard cost reimbursement schedule that would be funded (presumably) from the sale of these surrendered fish. (This could require a Magnuson-Stevens Act amendment.)

The Council's options to MRB limitations give rise to several concerns. First, no legal authority exists to require vessels to surrender a portion of their catch to NMFS, unless a violation has occurred. Currently, a directed fishing closure for a species prohibits retention of that species beyond a specified MRB percentage. However, under the Council's alternative to MRB percentages, a vessel would be prohibited from *discarding* pollock, Pacific cod, rock sole, or yellowfin sole. As a result, no violation occurs on which to predicate a mandatory surrender or seizure of fish based on a vessel's retention of amounts of a species beyond the MRB threshold.

Notwithstanding legal constraints, overfishing concerns and general operational issues arise in connection with this proposal. Although BSAI bycatches of pollock, Pacific cod, rock sole, or yellowfin sole in other groundfish fisheries are unlikely to give rise to overfishing concerns, future expansion of the IR program to other species or to the GOA could result in overfishing of a species if fishing mortality and retention continued after the species was put on *prohibited* status. This would be of increased concern under the Council's second option because vessels could be provided an incentive to target species on *bycatch* status and realize a profit if their operating costs of retaining these species were less than the standard reimbursement schedule. As a result, the rate of bycatch could be higher than would otherwise occur and TAC would be reached at a more rapid rate because of the unintended incentive provided by this option to covertly target these species. Once attainment of TAC triggers *prohibited* species status, closures of other fisheries that take bycatch amounts of the species of concern also would be triggered, with perhaps significant unanticipated economic consequences. These could include both redistributional effects among segments and sectors of the industry, as well as "net" reductions to the industry (and the Nation) in revenue, employment, and product deriving from these resources.

Other practical concerns exist from an administrative perspective. NMFS would be required to monitor retained portions of catch for each species and determine what portion was in "excess" of the MRB amount and subject to surrender under option 1, or surrender and cost reimbursement under option 2. Under option 2, an incentive may exist for vessel operators to overstate the amounts retained in excess of the MBA percentage to maximize cost reimbursement. The staff resources necessary to monitor and administer a widespread surrender and/or cost reimbursement program would be significant. NMFS Enforcement's

experience with the 1995 sablefish/halibut IFQ program provides some insight into the magnitude of resources that could be required.

In 1995, about 1,000 quota share overages were identified in the sablefish/halibut IFQ program. Each overage episode involved about 24 man-hours to assess and document. This activity includes, 1) a determination of "where the fish was caught" [directed fishing closures may be area specific], 2) a determination of "how many pounds of overage occurred," 3) coordinating the off- loading of surrendered fish, and 4) finding/finalizing an agreement with a buyer for the seized fish or initiating a donation to a food-bank organization.[29] The time scale involved likely would be increased under the IR/IU program given that the volume of each vessel's retained catch could be several orders of magnitude higher than that experienced under the sablefish/halibut IFQ fisheries. Additional operational costs also could accrue to the vessel, because it would be required to cease fishing operations until documentation of catch and off loading occurred.

Finally, the administration of a cost reimbursement program under the Council's second option would require additional staff resources, documentation, and an administrative infrastructure that currently does not exist. Industry disputes over the amount of bycatch retained above MBA amounts likely would occur and would frustrate the agency's ability to effectively administer such a program.

Perhaps the only alternative to directed fishing closures that would still allow for full retention under the proposed IR/IU program would be a program that required full retention of designated species, without triggering a directed fishing closure, as TAC is approached. Such a program would, however, also require that once a species' TAC is reached, all gear/area fishing operations that would be expected to take any additional amounts of that species would be prohibited, i.e., complete fishery closures. This option could be expected to result in significant foregone harvesting opportunities, with substantial economic and socioeconomic consequences for affected sectors, dependent communities, and the Nation, as a whole.

5.2 Fishery Definitions for Purposes of Specific Fishery Management Programs

Currently, regulations implementing the groundfish observer program (50 CFR part 677), the BSAI Vessel Incentive Program (50 CFR part 675.26), and fishery-specific accountability for prohibited species bycatch (50 CFR parts 672.20(f) and 675.21) set out fishery "target" definitions based on the species composition of *retained* catch (except in the case of *pelagic* pollock). These definitions are necessary because different fisheries have different observer coverage requirements, bycatch rate standards, and fishery specific PSC allowances. The assumption in developing these fishery definitions is that the groundfish species retained in amounts greater than any other retained groundfish species generally reflects the "target" species or fishery the vessel was participating in.

Compliance with the Council's proposed IR/IU program, mandating 100% retention of pollock, Pacific cod, rock sole, and yellowfin sole in any BSAI groundfish fishery, could alter the retained catch composition onboard a vessel to the extent that the vessel would be assigned to a fishery that is not the vessel's *"intended"* operational target. This situation would likely occur in the most *"species non-selective"* fisheries in the BSAI, e.g., rock sole, and to a lesser extent in relatively *"species non-selective"* fisheries such as trawl

[29] Note, if the surrendered fish were ultimately donated to food-banks, e.g., for lack of a buyer, the anticipated revenue to compensate the fisherman for the "recoverable costs" of retaining the surrendered catch, under option 2, would not be available, thus requiring some alternative funding source.

Pacific cod and yellowfin sole. Fishery definitions for *"species-selective"* fisheries, e.g., pelagic pollock, or virtually all non-trawl groundfish fisheries, would likely not be significantly affected by mandatory retention provisions under IR/IU.

To address the potential effect of the IR/IU program on existing fishery definitions, a separate regulatory amendment could be developed for species non-selective fisheries that redefines fishery units based on the total species composition of retained catch, rather than the retention of a single species relative to all others. This approach may require that some fisheries that currently are defined separately in regulations be combined with other fisheries that have similar catch composition profiles. The effectiveness of these revised fishery definitions, from a management perspective, would be proportional to the effectiveness of the monitoring and enforcement of mandatory retention requirements.

A second option would be to require vessels to notify NMFS when they "check-in or out" of a fishery, and then be held accountable for any fishery-specific management measures that may apply to the fishery they are checked-in to. This option poses both administrative and enforcement difficulties and would require further assessment to fully gauge its practicality. For example, the Council would need to consider how vessels would be prevented from "checking-in to" a fishery to avoid certain management measures that are required for another fishery the vessels actually intends to pursue. Furthermore, as was pointed out in the IR/IU Implementation Assessment, a vessel may not always know with certainty which fishery it is participating in, given the way "targets" are designated by NMFS, post-delivery. This is especially true for catcher-boats (see the detailed discussion in, *An Improved Retention Program for the BSAI Groundfish Fisheries*. Report to the NPFMC, NMFS, December 1995).

5.3 VIP Bycatch Rates

Under the IR/IU proposal, vessels would have greater incentive to undertake action to be more selective in what they catch, so that they do not incur the costs of retaining and/or processing unwanted pollock, Pacific cod, rock sole, or yellowfin sole taken as bycatch. Various options likely are available to vessel operators that could affect species or size selection of catch, including avoidance of certain fishing grounds or fishing depths. Gear modifications also are an obvious tool to increase selectivity of catch. Some gear modifications, such as increased codend mesh size, could increase bycatch *rates* of prohibited species such as halibut or crab. This could occur because small-sized fish escape through the trawl/codend mesh, thus reducing the absolute amount of groundfish harvested per unit of time; yet the bycatch amount of halibut or crab would remain relatively unchanged.

Concerns about increased bycatch rates of halibut and crab have been voiced by trawl industry members as the industry continues to pursue voluntary measures to reduce bycatch discard amounts via the use of large mesh codends in the pollock, Pacific cod, and rock sole fisheries. This concern is particularly highlighted in view of the vessel incentive program (VIP) bycatch rate standards. Under the VIP, bycatch rate standards are based on the composition of catch, not on what is retained. These bycatch rate standards are specified by NMFS for the BSAI and GOA midwater pollock and "other trawl" fisheries and for the BSAI bottom pollock and yellowfin sole fisheries. Vessels that exceed these standards are subject to prosecution.

Regulations governing VIP set out procedures to collect observer data and calculate bycatch rates to provide the highest quality bycatch rate information available on an individual vessel basis because these data would be used to enforce penalties on individual vessel owners and operators for exceeding bycatch rate standards.

Once observer data are submitted to NMFS, VIP bycatch rates are calculated using the following procedures:

1. The vessel is assigned to one or more "target" fisheries each month based on industry reported retained catch composition (weekly production reports or ADF&G fish tickets);
2. A bycatch rate is calculated only if an observer sampled at least 50 percent of the hauls in that target fishery and month;
3. The bycatch rate for a target fishery during a month is calculated by summing the weight of halibut (or numbers of crab) in all samples and dividing by the sum of the weight of all groundfish in all samples.

Total catch, not retained catch, is considered the basis for the bycatch rate because the denominator of the calculation described above is the weight of all groundfish in the sample. Data collected through random sampling of catch is used as the basis for the VIP bycatch rate to provide confidence intervals, or statistical measures of the reliability of these estimates. The confidence intervals provide a measure of how well the bycatch rate in the sample reflects the overall performance of the vessel in a particular target fishery and month.

Vessels that undertake action to be more "selective," in terms of their groundfish catch composition, under the IR/IU program could increase their vulnerability to higher bycatch rates of halibut and crab, and thus of prosecution under the VIP.

The most obvious response to this concern would be to increase bycatch rate standards to provide trawl vessel operators greater latitude to explore gear modifications to increase species or size selectivity. Alternatively, trawl industry representatives have asked NMFS to explore the option of specifying increased VIP bycatch rate standards in terms of *retained* catch, to respond to concerns about increased bycatch rates that could ensue from the use of large mesh trawl gear. This option may become less responsive to industry concerns, however, if the IR/IU proposal essentially moves toward the practice of retaining all catch. Nonetheless, the issue of potentially increased bycatch *rates* of halibut and crab remain.

Preliminary analyses by NMFS on 1994/95 individual vessel bycatch rates, relative to specified VIP bycatch rate standards,[30] did not indicate a discernable increase in the number of vessels that exceed the standard relative to past years. Although the analysis was not extensive, it seemed to indicate that current bycatch rate standards are sufficiently lenient to accommodate voluntary use of large mesh codends in the trawl fisheries. This may not always be the case, however, as stronger incentives are posed to the industry to fish more selectively. In this situation, the VIP bycatch rate standards could be adjusted upward as the need arose to accommodate IR/IU objectives for the management of the groundfish trawl fleet.

The option of redesigning the VIP using bycatch rate standards based on retained catch rather than total catch poses prohibitive difficulties, unless all groundfish catch is retained. When the VIP was established, the option of basing the bycatch rate on retained catch, rather than on total catch, was discussed. However, observers are unable to determine with certainty the amount of catch from a particular sample that will be retained. Therefore, while the numerator (bycatch) would be weighed or counted with a high degree of accuracy, the denominator (retained catch) would have to be estimated from some other source. Although

[30] September 19, 1995, letter to the North Pacific Fishery Management Council addressing VIP bycatch rates for the first half of 1996. A copy of this letter and attached analysis is available from the Council, 605 W. 4th Ave., Suite 306, Anchorage, AK 99501-2252

observers do provide rough estimates of the proportion of catch by species that is retained or discarded, this information is not sufficiently accurate to enforce retention or discard rate standards for the catch as a whole, let alone to provide estimates of the weight of retained versus discarded catch in a particular basket sample.

If observers cannot accurately determine the weight of retained groundfish in a particular sample, statistical measures of reliability, such as confident intervals, cannot be calculated for bycatch rate estimates in the same manner as currently is done. In other words, the calculation of a useful confidence interval requires that both the numerator and the denominator in each sample be known with certainty. Basing the VIP on retained catch, rather than total catch, will eliminate the possibility of calculating a meaningful confidence interval because deviating from the actual measurement of the bycatch associated with a particular catch amount introduces a level of uncertainty that cannot be estimated. The error associated with estimating the proportion of retained catch in the sample based on the observer's general knowledge of vessel operations cannot be incorporated into the confidence interval calculation process or would make the resulting confidence interval so wide as to be useless.

Even if lack of a confidence interval around a bycatch rate is not viewed as critical, difficulties arise in estimating both the numerator (bycatch) and denominator (retained catch) at any level. Although some kind of estimate can be made of any catch or bycatch amount, the relevant question is whether NMFS can estimate the bycatch amounts with enough qualitative "confidence" to enforce the VIP. In other words, is the data sufficient to convince an administrative law judge that the vessel did, in fact, exceed the bycatch rate standard. Based on NMFS' experience to date with prosecuting VIP violations, bycatch rate standards must be based on total catch, rather than retained catch, until such time that either all catch is retained or that retained and discarded catch amounts of each species may be accurately measured.

5.4 At-sea Weighing as a Tool to Monitor Retention or Utilizations Standards

The Council requested that NMFS include information in the IR/IU analysis about measures such as weighing or volumetric measurement, as possible tools to monitor retention and/or utilization standards.

Status of at-sea weighing regulations: The Council recommended that NMFS develop regulations to require processor vessels participating in the BSAI *pollock* fishery to weigh all catch.[31] NMFS published an advance notice of proposed rulemaking (ANPR) in February, 1996 that outlined a three-part scale testing and certification program for at-sea scales. During the summer of 1996, a contracted technical advisor will work with NMFS staff to further develop the scales testing and certification program. Once regulations governing at-sea weighing have been developed, NMFS also will have to determine who will be authorized to inspect and certify at sea scales, and possibly fund the development of the certification program within a state weights and measures agency.

Role of scales in monitoring retention and utilization standards: Current methods for estimating discards and options for monitoring retention and utilization standards are discussed in Section 1.8 (Estimating Catch and Discards), Section 4.0 (Monitoring Compliance with Increased Retention Standards), and Section 6.0 (Increased Utilization). The use of scales would not alleviate most of the monitoring and enforcement difficulties identified in these sections. For example, while scales may provide a more accurate estimate of

[31] Note, the analytical and regulatory work done so far on the issue of "total enumeration" of catch in BSAI groundfish fisheries has been limited to pollock target trawl fisheries. That is, no equivalent preparatory work has been undertaken with respect to this issue as it pertains to fisheries other than pollock trawl, that take one or more of the four IR/IU species of concern, i.e., Pacific cod, yellowfin, pollock, or rock sole.

total catch weight, current procedures for using observer data to determine species composition and the proportion of a particular species retained or discarded would not change with a requirement to weigh total catch. Scales would not provide direct measurement of discards, nor would they alleviate the uncertainty associated with verifying compliance with retention requirements by comparing observers' total catch weight estimates with the round weight equivalent of processed product (see Section 4.2.3).
Furthermore, it is not possible to assess the potential cost of acquiring, installing, maintaining, and operating scales (or certified bins) on all potentially affected vessels, at this time. It is, however, reasonable to assume that these costs would be significant. Because, it appears, total enumeration of catch will not substantially enhance monitoring and enforcement of IR/IU, there would be no commensurate off-setting benefit from requiring use of these technologies, under this action.

5.5 Moratorium on Entry

A temporary moratorium on the entry of new vessels into the groundfish and crab fisheries under Federal jurisdiction was implemented January 1, 1996, and will remain in effect through December 31, 1998, unless it is superseded by the license limitation program (see Section 5.6). The moratorium limits access to the groundfish and the Bering Sea and Aleutian Islands Area crab resources off Alaska to vessels whose owners have been issued a moratorium permit for the vessel by NMFS or that are within a vessel category specified as exempt from the moratorium on entry (Federal Register, Vol. 60, p. 40763, August 10, 1995, corrected p. 47312, September 12, 1995). Owners, at the time of application, of moratorium qualified vessels are eligible to receive a moratorium permit. Moratorium qualified vessels are those on which a legal landing of a moratorium species was made during the qualification period of January 1, 1988 through February 9, 1992.

Moratorium qualified vessels are issued a *"maximum length overall"* (MLOA). The MLOA of a moratorium qualified vessel is based on the length overall (LOA) of the original qualifying vessel on June 24, 1992. The reconstruction or replacement of a moratorium qualified vessel is then limited by its issued MLOA. The MLOA of a vessel with an original qualifying LOA of 125' or less is 1.2 times the original qualifying LOA, or 125', which ever is less. The MLOA of a vessel with an original qualifying LOA of more than 125' is equal to its original qualifying LOA. This provision, known as the "20% rule," allows smaller vessels to be reconstructed or replaced by slightly larger vessels (e.g., to increase safety margins), but prevents larger vessels from increasing in length, precluding significant increases in the fishing capacity of the overall fleet.

A vessel that exceeds its MLOA is no longer moratorium qualified. Also, a replacement vessel that exceeds the MLOA cannot receive the moratorium qualification by transfer. The owner of such a vessel would not be eligible for a moratorium permit, unless the owner obtained a new moratorium qualification with a MLOA greater than or equal to the LOA of the original or replacement vessel.

5.5.1 Interaction with IR/IU

The requirements of IR/IU, i.e., retention and utilization of 100% of specific groundfish species, can potentially impact vessels currently under the moratorium on entry. Vessel upgrades, which may become necessary because of the requirements of IR/IU, are limited by the 20% rule. The limitation due to length restrictions can adversely impact vessels that lack sufficient size to meet the new retention and utilization requirements.

Vessels unable to upgrade because of the moratorium length restrictions necessarily would have to curtail or cease operations. This consequence, however, may further the goal of the moratorium by preventing any

increase in fishing effort. This result may not, however, have been fully anticipated by the Council as a probable impact of adopting IR/IU. It now clearly must be.
Like pieces of a puzzle, management programs like the moratorium on entry and IR/IU and the future license limitation program (discussed in Section 5.6), were designed to fit together in an overall scheme intended to rationalize the fisheries by reducing excess effort and capital, and reducing inappropriate fishing and processing practices.

The primary impact of the Entry Moratorium on Improved Retention Option 1 is related to size. Requiring increased retention of species normally discarded will mean, 1) that more hold space will be necessary to store retained catch [whether in-the-round for delivery to a processor, or in product-form for catcher/processors and mothership], 2) that more plant space will be needed to accommodate processing of additional volumes, species, and/or product-forms, or 3) that much shorter trips, with more frequent off loading, must be made to ensure necessary hold [and/or plant] space for retained species. Each of these will impose different, and perhaps significant, economic and operational costs on affected operators. These impacts, while not amenable to quantification at this time, will likely fall disproportionately across target fisheries and sectors. Those fisheries with, 1) the highest bycatch of one or more of the species of concern as a proportion of total catch, and 2) the smallest, least mobile, and least operationally diversified vessels, will incur the largest proportional cost. In fisheries with both large-vessel and small-vessel segments, these impacts could also have a re-distributional effect, shifting shares of the total catch from smaller operations to larger ones. The size of such a re-distribution will vary from fishery to fishery, but should be regarded as a probable outcome of the interaction of IR/IU and Entry Moratorium requirements.

The impact of the Moratorium on Entry on suboption A and suboption B to IR Option 1 only varies in a temporal degree. Under suboption A, the necessary capacity accommodation for some species (yellowfin sole and rock sole) could be phased-in during a two- or five-year period. Under suboption B, the necessary capacity accommodation for the above species would not be required until the end of the two- or five-year period. Under either suboption, however, 100% retention of pollock and Pacific cod will be required as of the implementation date of IR/IU, and thus will impose operational impacts.

As explained earlier, the moratorium on entry limits the expansion of vessels by establishing length parameters. These parameters may hamper a person's ability to upgrade a vessel for the new retention and utilization requirements of the above options, thereby affecting the behavior of the person by either reducing or eliminating the viability of the fishing operation because of the inability to upgrade. This impact, however, is somewhat ameliorated by the fact that a person could upgrade by obtaining a moratorium qualification of sufficient length by transfer.

5.6 License Limitation Program

The license limitation program (LLP) has been proposed by the Council as another step in developing a comprehensive and rational management program for the fisheries in the U.S. EEZ off Alaska. The LLP is designed to address the problems of overcapacity and overcapitalization, i.e., that the domestic harvesting fleet has expanded beyond the size necessary to efficiently harvest the optimum yield of the fisheries within the EEZ. Further, it is intended to fulfill the commitment to the long-term health and productivity of the fisheries and other living marine resources in North Pacific and Bering Sea ecosystem.

Like the moratorium on entry, LLP would establish a MLOA for a qualified vessel that will be based on the length overall (LOA) of that vessel on June 24, 1992. The same 20% rule also would apply, except that the LLP would also require that a vessel remain within a specified vessel length class based on its June 24, 1992

LOA. This added limitation would exacerbate the problem of upgrading a vessel to meet the requirements of IR/IU, cited above.

Also, the LLP would classify a vessel as either a catcher vessel or a catcher/processor vessel based on past performance of the qualified vessel. Vessels that never processed in the past would be prevented from processing in the future under the LLP, unless a new license with a catcher/processor classification was obtained (or unless the LLP is amended).

5.6.1 Interaction with IR/IU

The requirements of IR/IU, i.e., retention and utilization of 100% of specific groundfish species, can potentially impact vessels that would be under the future LLP, if it is approved. The LLP currently is scheduled for implementation in 1998. Vessel upgrades, which may become necessary because of the requirements of IR/IU, are limited by the length restrictions and the specific vessel classes of the LLP. These restrictions can adversely impact vessels that lack sufficient size to meet the new retention and utilization requirements.

Vessels unable to upgrade because of the length restrictions will necessarily curtail or cease operations. This consequence, however, was anticipated in the LLP amendment proposal. It may not have been fully anticipated, however, as the IR/IU proposal evolved. This could be problematic since management programs like the LLP and IR/IU and the Moratorium on Entry (discussed in Section 5.5.2), must be designed to fit together in an overall scheme that is capable of rationalizing the fisheries by reducing excess effort and capital, and reducing inappropriate fishing and processing practices.

The Environmental Assessment/Regulatory Impact Review for the LLP addressed the intended effects of this interaction. When addressing the problem of harvesting capacity in excess of that required to harvest the available resource, the analysis provides that the LLP could address the excess harvest capacity issue by capping the number of vessels, however, in tandem with a improved retention/utilization program, the LLP could effectively reduce harvest capacity. The harvesting capacity would be reduced because some of the effort (and space) currently used for harvesting would have to be shifted to retention and utilization.

The issues addressed under the 'Moratorium on Entry' apply as well to the proposed License Limitation Program (see the discussion in Section 5.5). Like the moratorium on entry, the primary impact of the LLP on IR Option 1 is directly correlated with the size of the operation.

The impact of the LLP on suboption A and suboption B to IR Option 1 only varies in a temporal degree. Under suboption A, the necessary capacity accommodation for some species (yellowfin sole and rock sole) could be phased-in during a two- or five-year period. Under suboption B, the necessary increase in space requirements would not accrue until the end of the two- or five-year period. Under either suboption, however, 100% retention of pollock and Pacific cod will be required as of the implementation date of IR/IU, impose direct operational impacts.

The impact of size restrictions of the LLP on Utilization Options 1, 2, and 3 also only varies by degree. Utilization Option 1, considered the least restrictive option, would require that the retained species be processed in any form. This could be meal, bait, or any other processed product, and would not have to be suitable for direct human consumption. Although the rigorous standards of processing product for direct human consumption would be averted under this option, any requirement to process retained species will add to the need for more space or require more trips.

The impacts of the LLP on Utilization Options 2 and 3 are exacerbated by the specialization of processing required. Hence, requiring that a certain amount of processed product to be suitable for direct human consumption (or be limited to "authorized product" forms), as in Utilization Option 2, or requiring a maximum amount of processing into meal, as in Utilization Option 3, can only increase the need for space for equipment necessary for these processing techniques.

Unlike the moratorium on entry, however, a vessel under the LLP must be specifically classified as a catcher/processor to process. This requirement could cause a direct conflict with any utilization option that requires processing, further limiting an operator's ability to adjust optimally to the IR/IU requirements. Vessels classified as catcher vessels would be prohibited from processing under the LLP. This conflict could potentially be resolved through, for example, an exemption to the utilization requirements, or by allowing catcher vessels limited processing capabilities. However, each would reduce the efficacy, i.e., attainment of the objectives, of the original management actions.

The vessel length and processing limitations of the LLP may hamper a person's ability to upgrade a vessel in order to comply with the new retention and utilization requirements of the above options, thereby affecting the behavior of the person, either by reducing or eliminating the viability of the fishing operation because of the inability to upgrade. This impact, however, is potentially somewhat ameliorated by the fact that a person can upgrade by obtaining a license of sufficient length and processing capability by transfer. The number of such licenses is, however, limited.

5.7 Loadline and Vessel Classification

NMFS regulations, e.g., "moratorium/license limitation," will directly constrain the ability of some in the BSAI groundfish fishing sectors regulated by the proposed IR/IU to modify their operations to comply with retention and utilization requirements. Beyond the limitations imposed by NMFS regulations, there are other federal requirements which may impose equal or greater adverse economic impacts on some segments of the industry, as a direct consequence of retention and utilization mandates. The most obvious of these are the regulations pertaining to "vessel safety, stability, and operation," monitored and enforced by the U.S. Coast Guard.

Three principal requirements may impose significant barriers to IR/IU compliance for some (primarily the smallest) operations currently participating in the BSAI groundfish fisheries. These include, 1) "Certificate of Compliance" [46 CFR 28.710]; 2) "Loadline Certification" [46 CFR 41-47]; and 3) "Survey and Class" certification [46 CFR sec.28.720].[32] Not every vessel would be required to acquire each of these certifications. However, each of these certifications have the potential to impose significant costs on any operation which finds it necessary to obtain one or more of these.

The American Bureau of Shipping (ABS) is one of a relatively few sources worldwide which can issue these certifications. When contacted about the cost and complexity of obtaining each of these certifications, assuming a "typical" existing vessel operating in the Bering Sea fisheries, ABS provided the following information.[33]

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[32] Per. comm., Lt. Cmd. Mike Gardiner, U.S. Coast Guard, Juneau, AK., April 1996.

[33] Per. comm., Michael Macri, Vessel Surveyor, American Bureau of Shipping, Seattle, WA., April 1996.

For fishing vessels that wish to do *any* "processing" onboard (as defined by the USCG), the operation *must* be both "loadlined" and "classed." Loadline certification is the less complex and costly of these two requirements (although neither is easy or inexpensive). In addition, the vessel must obtain a "Certificate of Compliance," verifying adherence to all vessel "safety" requirements.

The Loadline Certification concerns itself with "water-tightness" and "*stability*" of the vessel. "Class" certification concerns itself with *all* the components and every aspect of a vessel, i.e., structural, electrical, plumbing, machinery, propulsion, etc. The ABS estimates that the cost of obtaining "loadline" certification for a vessel of the type cited above would be, at a *minimum*, $35,000, plus $500 per year for the required annual inspection (assuming the vessel is currently capable of meeting the loadline standards. If not, add to this estimate the cost of any structural changes which are required to meet these minimums. For some existing vessels, it may not be possible, short of rebuilding the boat from the keel up, to meet these minimum requirements).

"Class" certification could be expected to cost, at a *minimum*, an additional $70,000 to obtain (again assuming the vessel currently meets the "classification" threshold standards. If not, add to this the cost of bringing all systems up to those minimums).

For the type of vessel in question, "Certificate of Compliance" costs could be expected to be between $500 and $1,000, assuming the vessel meets the required standards (otherwise, add the cost of upgrading to these *minimums*).

While the direct costs, cited above, to acquire the necessary certifications can be roughly approximated, the economic impacts of "down-time,"[34] as well as the re-fitting costs associated with extensive structural, technical, and/or mechanical modification, have not been accounted for in these estimates, since they would vary from case to case. Nonetheless, the forgoing should be regarded as the "lower bound" estimate of the cost of obtaining these mandatory certifications, for vessels wishing, or required, to add capacity to their current operations to comply with the proposed IR/IU action.

5.8 Economic Versus Regulatory Discards

The two general categories of groundfish discards, "economic" and "regulatory," are discussed above under Section 1.7. A preliminary determination of the proportions of each category relative to the total amount of recorded discards in 1994 and 1995, however, produced questionable results due to a simplifying assumption used to speed the analysis. The NMFS inseason management staff are reviewing recent years' catch data and will provide further information on the relative proportions of 'economic' and 'regulatory' discards at the Council's meeting in September 1996.

6.0 Economic and Socioeconomic Impacts of Improved Utilization

At it April 1996 meeting, the Council reaffirmed it commitment to examine three "utilization" options (each alternative to the Status Quo). The three address the objective of obtaining more complete use of retained bycatch, each in a different way. Several confounding problems were identified in the course of the Implementation Issues Assessment with some aspects of the IU proposals. The Council asked for advice

[34] These could include, potentially, loss of fishing time, resulting in foregone revenues, lost employment of crew, etc., as well as transit time and expense to and from a shipyard, among others.

from its working group, and at the April Council meeting, tentatively adopted that advice, modifying two of the three original IU Options to facilitate analysis (and potential future implementation). The revised options are treated, in order, below.

In estimating the additional product values produced from retention "discard savings," four different data sources were used, 1994 processor price survey, the 1994-95 finished product data, the 1994-95 observer length frequency data, and the blend data files. The following explanation provides an overview of the methodology used, as well as its shortcomings.

For purposes of the *"utilization" portion* of this analysis, it is assumed that the 100% "retention" requirement is met by all operations. This is a necessary simplifying assumption, but one which may not actually be achievable under the proposed IR/IU action (see Section 3.0). Some operations may not be able to comply with this absolute retention requirement and may be forced to leave the fishery. Others may continue to discard amounts of the four species of concern, despite the prohibition. And some "leakage" is to be expected in any case. Therefore, the estimated "discard savings," cited below, must be regarded as *upper-bound estimates* of the potential reduction in discards and resulting product output.

Price data - The price data used to calculate value for both 1994 and 1995 were a subset of the 1994 processor price survey. No 1995 processor price data are *currently available*.

Observer length frequency data - These data contain observer length frequency estimates for a given species in a given target fishery by year, month, day, species, gear and three digit statistical area. For instance, the pollock length data in this file are generally from the pollock target fishery only. These length frequencies were assumed to be constant, for each species, across all target fisheries. Using this information, as well as weight to length ratios from the 1995 BSAI SAFE document, and discussions with industry members as to the marketable size thresholds for each species, a marketable/non-marketable weight ratio was calculated for the four species of concern. The marketable length thresholds used in this analysis are as follows:

Pacific cod> 46 cm; Rock sole>28 cm; Yellowfin sole>27 cm; Pollock>32 cm (see Appendix B).[35]

Finished product data - These data provide finished product weights by processor designation, shoreside or mothership and catcher/processor, gear and species. The price data were matched to this file to provide finished product values for BSAI processors, as well as a ratio of authorized primary products, meal, and all other products.

Methodology - The *marketable/non-marketable* weight ratios, as well as product values and product ratios from the finished product data files, were matched to the blend data. With the combination of these data, it is possible to apportion currently discarded catch between "marketable" and "non-marketable," as well as provide estimates of currently discarded tons going to "meal," "authorized primary products," and "all other products." Using the price data discussed above, it is possible to provide estimates of the corresponding *"gross"* values of these three product categories.[36]

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[35] Industry sources suggested that, while using 'length' as a marketable/non-marketable indicator may be an acceptable analytical simplification, it does not reflect the complex mechanisms at work in the actual marketplace.

[36] Production costs should be deducted from these "gross" value estimates to obtain the appropriate "net" measure of product value deriving from these retained catches. Unfortunately, these cost data are not available.

For IU Option 1, this product value was obtained by summing the value of marketable and non-marketable catch. The incremental value of the marketable catch was found by multiplying the estimate of marketable catch, less the actual retained catch, times a weighted average price for all products. The non-marketable catch estimate was assumed to be used for meal and was multiplied by the price for meal.

For IU Option 2, the process of valuation was identical to option 1, except the price used to estimate the incremental marketable value was a weighted price of only those products identified as "authorized primary products"(see Section 6.2.1). In addition, the percentage of round tons used for authorized products was calculated, to allow comparisons of the three sub-options.

IU Option 3 values were calculated using the same prices as in option 1, and like option 2, the percentage of round tons used in "meal" production was calculated, to allow comparisons of the three sub-options.

There are several shortcomings with the data utilized throughout this IU modeling exercise that should be noted. One complication with these data is the reporting of "gear" and "areas" across various input files. For shoreside processors, no gear-type is reported in the finished product file, while the normal range of gear designations is present in the blend data. Similarly, shoreside processors report only large areas, i.e., BSAI, GOA, in the finished product file, while 3 digit statistical areas are used in the blend data. It should also be noted that this model looks annually at an entire sector of the industry, e.g., processor mode and gear-type, and not at individual processors on a weekly basis. This is particularly important when considering the series of sub-options. The percentage "meal" or "authorized primary product" is estimated annually for the entire fleet. *While annually a given sector of the industry may not be constrained by the sub-option thresholds being considered, during any given week, individual processors may be unable to meet these limits.*

Finally, the effect of Directed Fishing Standards on retention and utilization may be potentially very substantial. Unfortunately, it has not been possible to complete a detailed analysis of "regulatory" discards in time for their inclusion in this draft analysis. Therefore, the following estimated "discard savings" and "product values" should be regarded as preliminary *upper-bound estimates* of the potential increase in output attributable to adoption of the competing IU options. In fact, the actual savings may be substantially lower if "regulatory" discards account for a significant portion of total discards. Preliminary findings suggest that, at least in the aggregate, "regulatory" discards probably do not represent more than 25% of the total discards of groundfish. That is, at least 75% of the BSAI groundfish discard can be attributed to "economic" decisions[17]. The complete analysis is expected to be available by the September 1996 Council meeting (see Section 5.8).

Within the limits of these constraints, and under the assumptions cited above, the following preliminary impacts can be projected for the IU options under consideration.

6.1 Improved Utilization Option 1

Utilization Option 1 can be characterized as potentially the *least* restrictive of the three options under consideration, in as much as it provides that the retained catch of the four groundfish species of concern may be processed into *any* form, regardless of whether or not the resulting product is suitable for direct "human consumption." The resulting product form could, therefore, be "meal," "bait," or any other "processed

[17] "Regulatory" discards may represent greater or lesser shares of total discards in any given fishery. The detailed "regulatory" discard analysis, by target fishery, will be available to the Council in September 1996.

product."[38] Compliance with the "improved utilization" requirement under this option would require only that no whole fish of the four species of concern be discarded in-the-round, i.e., some form of processing must be applied to each fish taken.

Monitoring of "utilization"compliance under this option would require that the sum of the product weights of all primary and ancillary product forms, prepared from the retained catch, by species, be at least 15% of the logged catch weight of that species. In other words, if an operation recorded catches of, say, Pacific cod in a given reporting week of 100 mt, IU Option 1 would require that the *aggregate* product weight for all primary and ancillary products made from that 100 mt of cod equal at least 15 mt. This means that the "minimum" aggregate product recovery rate,
by species, when all output is taken as a whole, must be at least 15% to confirm compliance with the *utilization* standard.[39] [40]

[38] At present, only "meal," "bait" and "offal" are regarded as outputs "not-for-human-consumption," with the latter not qualifying as a "product" form, but rather as "processing waste."

[39] The 15% PRR was identified as an "acceptable" *minimum* utilization standard by the IR/IU Industry Working Group and adopted as part of that group's report, for purposes of this analysis, by the Council at its April 1996 meeting.

[40] Note that an operator must *simultaneously* meet the "retention" standard, discussed above under IR Option 1, and the "utilization" standard to be judged "in compliance" with the requirements of IR/IU, i.e., compliance with either standard, in the absence of the other, is not sufficient.

6.1.1 An Estimate of IU Option 1 Impact on Production and Gross Value

On the basis of this IU compliance criterion, and employing the *estimated increase* in "retained" catch, by species of concern, the following *"preliminary"* conclusions can be drawn with respect to the potential impacts of adopting IU Option 1.[41]

Assuming 100% retention of each of the four species of concern, and assuming IU Option 1 had been in place in the 1994 fishing season, the aggregate incremental increase in product value, deriving from IR/IU discard savings from all BSAI groundfish fisheries, would have totaled approximately $143.4 million. Add to this the "retained product value" ($692.6 million in 1994) from the species/quantities historically retained and the total output value under IU Option 1 would have been approximately $836.0 million in 1994. In 1995, the same estimates are $137.5 million in gross product value deriving from "discard savings," $728.2 million in "retained product value, for a total of $865.7 million, all else equal (see Table 6A). These figures must be regarded as an "upper-bound" estimate, since preliminary analysis of the impact of "regulatory" discards on the actual IR/IU "discard savings" suggests totals may be significantly smaller than predicted by the raw data (see Section 5.8). Furthermore, these reflect "gross" product value estimates which do not account for the cost of production. As a result, they "overstate" the potential value which may accrue from discard savings to an unknown, but perhaps significant, extent.[42]

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[41] These estimates are subject to change following completion of the Direct Fishing Standards analysis.

[42] Note that it is implicit in these estimates that no operational adjustments are made in response to the IU requirements. That is, we have not attempted to predict the response of the industry, at the advice of the IR/IU industry working group.

Table 6A - IU Option 1 "Gross" Values (by year, processing mode, gear, fishery, species)

	Retained Product Value	Discard Savings Value
1994		
MS & C/P		
Longline		
P. cod		
Pacific cod	$66,909,782	$2,417,577
Sablefish		
Pacific cod	8,375	8,176
G. turbot		
Pacific cod	50,937	1,089
Unknown		
Pacific cod	0	2,609
Other		
P. cod		
Rock sole	1,219	17,465
Yellowfin	160	85,983
Pollock	107,532	1,096,376
Rockfish		
Pollock	0	1
Sablefish		
Rock sole	862	0
Yellowfin	0	11
Pollock	0	84
G. turbot		
Rock sole	0	27
Pollock	0	555
Unknown		
Rock sole	0	5
Pollock	328,076	13,593
Pot		
Atka Mackerel		
Pacific cod	0	5,704
P. cod		
Pacific cod	1,459,763	3,641
Trawl		
Atka Mackerel		
Pacific cod	4,173,134	1,445,994
Rock sole	26,925	105,157
Yellowfin	0	78
Pollock	18,227	113,033

Table 6A - (cont.)

Bot. pollock		
Pacific cod	2,171,616	2,789,665
Rock sole	1,452,406	3,936,531
Yellowfin	170,911	366,336
Pollock	50,633,748	3,278,109
P. cod		
Pacific cod	12,832,023	1,263,803
Rock sole	1,228,721	4,468,065
Yellowfin	30,632	71,422
Pollock	250,878	3,024,777
O. flats		
Pacific cod	926,756	523,500
Rock sole	1,091,748	517,654
Yellowfin	272,125	200,576
Pollock	22,601	1,077,089
Rockfish		
Pacific cod	257,700	109,015
Rock sole	3,489	32,277
Yellowfin	14,979	12,481
Pollock	5,567	184,144
Other groundfish		
Pacific cod	34,509	16,828
Rock sole	773	10,567
Yellowfin	67,054	47,530
Pollock	0	52,508
Pel. pollock		
Pacific cod	467,415	3,332,215
Rock sole	12,214	616,025
Yellowfin	1,733	65,522
Pollock	238,959,112	6,285,931
Rock sole		
Pacific cod	1,641,371	2,938,634
Rock sole	42,331,780	39,742,773
Yellowfin	1,213,951	1,837,484
Pollock	328,446	6,159,560
Sablefish		
Pacific cod	1,342	1,228
Pollock	0	2,974
G. turbot		
Pacific cod	1,233	1,323
Rock sole	0	2,142
Pollock	0	6,144

Table 6A - (cont.)

Yellowfin		
Pacific cod	6,627,916	7,124,050
Rock sole	6,293,679	10,843,361
Yellowfin	61,550,152	9,346,559
Pollock	559,145	16,490,407
Discard		
Pacific cod	0	18,115
Rock sole	0	2,942
Yellowfin	0	6,918
Pollock	0	575
Shoreside		
All gears		
Bot. pollock		
Pacific cod	65,923	33,329
Rock sole	2,721	23
Yellowfin	115	7
Pollock	788,288	102,527
P. cod		
Pacific cod	32,260,499	1,715,983
Rock sole	3,288	1,536,495
Yellowfin	308,126	185,547
Pollock	143,836	5,455,006
Rockfish		
Pacific cod	0	17
Pel. pollock		
Pacific cod	2,213,190	326,196
Rock sole	5,509	114
Yellowfin	9,482	73
Pollock	147,849,580	1,639,367
Sablefish		
Pacific cod	0	1,347
Yellowfin	0	53
Pollock	0	50
G. turbot		
Pacific cod	33,460	34
Rock sole	23	11
Yellowfin	15	26
Pollock	32	2,483
Yellowfin		
Pacific cod	446,369	59,738
Rock sole	69,981	1,366
Yellowfin	3,695,992	9,171
Pollock	128,566	173,134

Table 6A - (cont.)

Discard		
Pacific cod	0	4,490
Pollock	0	19,011
1994 total	$692,567,718	$143,351,136
1995		
MS & C/P		
Longline		
P. cod		
Pacific cod	$79,948,619	$3,123,936
Rockfish		
Pacific cod	50	0
Other gf		
Pacific cod	0	20,423
Sablefish		
Pacific cod	26,854	11,200
G. turbot		
Pacific cod	33,208	13,277
Discard		
Pacific cod	0	60,004
Other		
P. cod		
Rock sole	10,807	84,510
Yellowfin	233	40,111
Pollock	173,757	2,385,231
Rockfish		
Pollock	0	43
Other gf		
Pollock	0	1,564
Sablefish		
Rock sole	0	949
Pollock	0	4,050
G. turbot		
Rock sole	5,615	644
Pollock	0	1,131
Discard		
Rock sole	0	23
Pollock	0	171

Table 6A - (cont.)

Pot		
P. cod		
Pacific cod	4,386,180	68,686
Trawl		
Atka Mackerel		
Pacific cod	2,680,807	1,467,374
Rock sole	55,559	179,618
Yellowfin	1,246	912
Pollock	28	185,540
Bot. pollock		
Pacific cod	2,065,325	6,630,722
Rock sole	812,826	2,059,186
Yellowfin	164,554	293,240
Pollock	41,837,119	2,582,269
P. cod		
Pacific cod	30,589,317	3,833,124
Rock sole	4,686,978	10,770,737
Yellowfin	25,822	143,486
Pollock	619,494	5,594,384
O. flats		
Pacific cod	760,527	944,435
Rock sole	1,072,524	1,174,009
Yellowfin	2,374,279	1,487,174
Pollock	122,177	1,665,633
Rockfish		
Pacific cod	123,324	94,733
Rock sole	8,341	28,599
Pollock	17,988	161,925
Flathead		
Pacific cod	524,674	508,903
Rock sole	550,695	768,209
Yellowfin	432,636	301,432
Pollock	57,083	847,930
Pel. pollock		
Pacific cod	404,933	5,548,757
Rock sole	147,629	687,669
Yellowfin	1,401	76,138
Pollock	258,205,248	14,444,202
Rock sole		
Pacific cod	4,329,819	4,729,151
Rock sole	33,336,183	16,470,898
Yellowfin	2,959,067	802,764
Pollock	355,647	3,477,724

Table 6A - (cont.)

Sablefish		
Pacific cod	0	229
Pollock	0	1,537
G. turbot		
Pacific cod	5,250	32,245
Rock sole	0	1,279
Yellowfin	8,198	1,654
Pollock	0	18,242
Arrowtooth		
Pacific cod	452	853
Rock sole	1,126	0
Pollock	0	2,473
Yellowfin		
Pacific cod	4,689,840	5,946,567
Rock sole	4,803,493	7,316,240
Yellowfin	49,538,949	7,160,922
Pollock	1,481,294	11,237,251
Discard		
Pacific cod	0	10,635
Rock sole	0	9,413
Yellowfin	0	1,987
Pollock	0	1,129
Shoreside		
All gears		
Bot. pollock		
Pacific cod	113,014	235,719
Rock sole	205	930
Yellowfin	0	31
Pollock	1,919,696	163,803
P. cod		
Pacific cod	37,837,892	1,708,265
Rock sole	53,253	872,954
Yellowfin	178,653	60,934
Pollock	141,595	4,412,982
Rockfish		
Pacific cod	0	4,771
Other gf		
Pacific cod	193	0

Table 6A - (cont.)

Pel. pollock		
Pacific cod	2,337,278	736,875
Rock sole	5,191	1,275
Yellowfin	1,539	977
Pollock	145,434,489	2,311,017
Sablefish		
Pacific cod	4,751	1,043,017
Rock sole	0	1
Pollock	0	24
G. turbot		
Pacific cod	11,532	5
Rock sole	178	0
Yellowfin	6	102
Pollock	937	5,305
Unknown		
Pacific cod	478	0
Rock sole	4	0
Pollock	1,930	0
Yellowfin		
Pacific cod	1,339,281	26,673
Rock sole	102,864	1,155
Yellowfin	3,959,116	4,087
Pollock	322,741	147,442
Discard		
Pacific cod	0	4,186
Pollock	0	23,316
1995 total	$728,209,991	$137,517,553

NOTE: The foregoing are "gross" value estimates, i.e., they do not account for associated production costs. They must, therefore, be regarded as "upper-bound" estimates which likely overstate (perhaps significantly) the "net" value attributable to products deriving from historically retained catch or "discard savings" under this IU option.

6.2 Improved Utilization Option 2

IU Option 2 may be regarded as the *most* restrictive of the three "utilization" options under consideration. Containing specific provisions governing the form of the products which may be produced from retained catches of the four species of concern, as originally proposed, Utilization Option 2 would require that a fixed percentage of all retained *pollock, Pacific cod, yellowfin sole, and/or rock sole* be processed into a product form for "direct human consumption," based upon a percentage of total round weight of harvest of each respective species of concern. The three suboptions, under Option 2, specify the **minimum** percentage of the retained catch of the species of concern which must be processed for "direct human consumption," i.e., the percentage which may not be processed into either "meal" or "bait." The respective suboption thresholds are: Suboption A - 50%; Suboption B- 70%; and Suboption C - 90%.

There has been considerable difficulty and extensive debate surrounding the meaning of "for human consumption," as contained in this option (see, for example, the discussion in, *Increased Retention/Increased Utilization Implementation Issues Associated with the BSAI Mid-water Pollock and BSAI Rock Sole Fisheries*, NMFS Alaska Fisheries Science Center, September 1995). When the Council's IR/IU Industry Working Group addressed this "utilization" proposal, they too were unable to satisfactorily resolve this definitional issue. Instead, this group moved to modify IU Option 2, deleting specific reference to "products-for-human-consumption" and substituting instead a list of specific "primary product forms" which would be *deemed to meet the intended Council objectives for this option.*

At its April 1996 meeting, the Council adopted the IR/IU Working Group's report, and in so doing, amended the compliance criteria for this option. Thus, IU Option 2 would now require that a **minimum** of 50%, or 70%, or 90% (depending upon the threshold selected) of the total catch of each of the four species of concern would be required to be processed into one or more of the "authorized" primary product forms. If a processor does so, it is deemed to be in compliance with the IU requirement, under this option.[43]

6.2.1 Authorized Primary Product Forms

Groundfish harvested in the commercial fisheries of the BSAI are utilized in a wide variety of ways. The range of product forms extend from relatively "high unit value" products (e.g., individually-quick-frozen fillets), to industrial products (oils and meals) and bait. New product forms continue to emerge in response to market opportunities. *Indeed, many products which are economically very important to the U.S. industry today, were not regarded as products in which U.S. fishermen and processors were interested, nor suited to produce, only a few years ago (e.g., surimi or pollock roe).* Thus, the list of groundfish products, included as an approved product under IU Option 2, should not be regarded as exhaustive or final. Instead, the list reflects the best current information on the variety of products which are presently being prepared by U.S. processors from groundfish harvested in the BSAI.

The list would, however, constitute the basis for judging utilization compliance following the "initial" implementation of IU Option 2. This table also presents the PRRs (in some cases a range of PRRs) for each general product form reported to NMFS in 1994 (the last year of complete data). At the recommendation of the Working Group, however, the Council adopted the "Official NMFS Product Recovery Rates," as the basis for judging utilization, by product-form and species. Those standardized rates appear in the IU Option 2 - PRR table.

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[43] Ibid.

The IU Option 2 - "Processed Product for Groundfish Retained and Processed Table" lists all product forms reported to NMFS from 1994 groundfish harvests off Alaska (the most recent year for which complete data are available). Products are divided among "primary," "ancillary" and "industrial" product forms, based on current regulatory definitions. Only the items listed as *"primary"* would meet the IU criteria, under this proposal.

The list of primary products includes outputs such as whole fish, headed-and-gutted product, fillets of various forms, surimi, and minced fish. In commercial practice in these fisheries, the proportion of the whole fish utilized in the production of these products reportedly range from 13 percent to 100 percent.

Products defined as principally "ancillary," such as roe, heads, cheeks, etc., are assumed to be produced in addition to a primary product, and thus would not be appropriate output forms for assessing IU compliance. Their production would not be prohibited or limited under this proposal, once the requisite percentage of "primary" product was attained.

Economic, logistic, regulatory, and biological considerations could be expected to dictate the specific mix of "primary" (and for that matter, "ancillary") products which would be derived from the retained catch under IR/IU. At present, the specific output form and product mix in BSAI groundfish fisheries is highly variable. Production characteristics (i.e., form, grade, and product mix) may vary in response to, among other factors, the type of processing operation (e.g., in-shore or at-sea); the season of the year (e.g., the presence or absence of roe); regulatory restrictions (e.g., roe-stripping prohibition); and the nature of the market (e.g., surimi prices have been low relative to fillets). Influenced by these biological, technological, and economic factors, performance may diverge from operation to operation between and within each category, and even within any given operation, from season to season, and fishery to fishery.

IU Option 2 - Processed Product for Groundfish Retained and Processed.
(Note: Only *"primary"* product forms on this list would be used to assess IU Compliance)

Product Form	PRR
IU Acceptable "Primary" Products	
Whole fish	1.0
Bled only	0.98
Gutted only	.80 - .90
Gutted only	.80 - .90
H&G w/roe	.55 - .80
H&G western	.50 - .78
H&G eastern	.52 - .65
H&G tail removed	.44 - .62
Kirimi	0.48
Salted/split	0.45
Wings	0.32
Fillets w/skin, ribs	.32 - .45
Fillets w/skin, no ribs	.27 - .38
Fillets, no skin, ribs	.21 - .25
Fillets w/ribs, no skin	.25 - .35
Fillets, no skin, ribs	.21 - .25
Fillets, deep-skin	0.13
Surimi	.15 - .18
Minced	.22 - .50
Mantles	.75 - .85
Butterfly, no backbone	0.43
"Ancillary" products	
Roe	0.08
Pectoral girdle	0.05
Heads	.15 - .20
Chins	0.05
Belly	.01 - .10
Fish oil	na
Stomachs	na
Milt	na
Bones	na
"Industrial" products	
Bait (primary)	1.0
Fish meal (ancillary)	.17 - .22

IU Option 2 - NMFS Approved Product Recovery Rates

PRODUCT CODE / FMP SPECIES	Species code	1 WHOLE FOOD FISH	2 WHOLE BAIT FISH	3 BLED	4 GUTTED	6 HEADED & GUTTED WITH ROE	7 HEADED & GUTTED WESTERN CUT	8 HEADED & GUTTED EASTERN CUT	10 HEADED & GUTTED W/O TAIL	11 KIRIMI	12 SALTED & SPLIT	13 WINGS	14 ROE
PACIFIC COD	110	1.00	1.00	0.98	0.85	0.63	0.57	0.47	0.44	....	0.45	....	0.05
POLLOCK	270	1.00	1.00	0.98	0.80	0.70	0.65	0.56	0.50	....	....	....	0.04
ROCK SOLE	123	1.00	1.00	0.98	0.90	0.80	0.72	0.65	0.62	0.48	....	....	0.00
YELLOWFIN SOLE	127	1.00	1.00	0.98	0.90	0.80	0.72	0.65	0.62	0.48	....	....	0.00

		PRODUCT CODE											
	Species code	15 PECTORAL GIRDLE	16 HEADS	17 CHEEKS	18 CHINS	19 BELLY	20 FILLETS: WITH SKIN & RIBS	21 FILLETS: SKIN ON NO RIBS	22 FILLETS: WITH RIBS NO SKIN	23 FILLETS: SKINLESS/ BONELESS	24 FILLETS: DEEP SKIN	30 SURIMI	31 MINCE	32 MEAL
PACIFIC COD	110	0.05	....	0.05	....	0.01	0.45	0.35	0.25	0.25	....	0.15	0.50	0.17
POLLOCK	270	....	0.15	....	....	....	0.35	0.30	0.30	0.21	0.16	0.16 1/	0.22	0.17
ROCK SOLE	123	....	....	....	....	....	0.32	0.27	0.27	0.22	....	....	....	0.17
YELLOWFIN SOLE	127	....	....	....	....	....	0.32	0.27	0.27	0.22	....	0.18	....	0.17

	Species code	33 OIL	34 MILT	35 STOMACHS	36 BAFFLES	37 BUTTERFLY BACKBONE REMOVED	96 DECOMPOSED FISH	98 AT-SEA DISCARDS
PACIFIC COD	110	....	....	....	....	0.43	0.00	1.00
POLLOCK	270	....	....	....	....	0.43	0.00	1.00
ROCK SOLE	123	....	....	....	....	....	0.00	1.00
YELLOWFIN SOLE	127	....	....	....	....	....	0.00	1.00

6.2.2 Implications of an IU Qualifying Products List

Reliance on a "prescribed" list of acceptable products, with a single standard PRR for each, as the basis for judging IU compliance has several potential difficulties. Because technology and markets change over time, flexibility and responsiveness to such changes will be important to avoid imposing unanticipated, and unwarranted, economic costs on the domestic industry. It seems probable that some formal mechanism will have to be designed for monitoring, reviewing, and updating the "qualifying list."[44]

Furthermore, since the list of "approved" products represents the foundation upon which "regulatory compliance" will be judged, it may be appropriate to make provisions for arbitration of disputes as to whether a particular product form, manufactured by a specific operator, meets the Council's definition. Because denial of inclusion of some specific product form could impose penalties, and thus economic costs, on some operators, it seems that some mechanism for appeals of this kind may be required. An appeals process could be designed and incorporated into the enabling IR/IU regulations. There would be some administrative cost associated with any such procedure, although these costs cannot be estimated at present.

In addition, some regular, periodic review of the "approved products" list would be necessary. One solution could be for the enabling regulations for IR/IU to specify that the Council review and approve the list of IU "acceptable" product forms annually, perhaps at its December meeting immediately prior to the fishing year to which the list will apply. There would be very little direct cost to adoption of this procedure, although the lead-time for operators to adjust to the prescribed list would be short.

Presumably, any changes to the list, following its initial adoption, would come primarily from requests, made to the Council, by industry sources wishing to add a specific product(s) to the authorized list. The proposed initial list, cited in the preceding section and endorsed by the IR/IU Industry Working Group in its report to the Council, includes all of the primary product forms currently reported to NMFS by operators participating in the BSAI (and GOA) groundfish fisheries (except for fishmeal), and thus should impose no significant barrier or burden if adopted (assuming some systematic means of reviewing and up-dating the list is instituted when IR/IU is adopted).

Once a "qualifying list" has been established in regulation, the next element in the regulatory program under IU Option 2 will involve provisions for tracking of production output, monitoring, and enforcement. At present, these functions rely primarily upon "back casting" from product weight to round weight using NMFS Standard PRRs. As was found in the Pollock Roe Stripping Amendment and the Inshore/Offshore Amendment, PRR's can be controversial, subject to manipulation and interpretation, and variable within and between operations, over time and species. These complexities may confound efforts to monitor compliance with the proposed utilization requirement, and in combination with the diversity of "IU approved product," undermine the intent to significantly increase mandatory utilization of retained groundfish catch.
Reliance on an approved products list, as proposed under IU Option 2, will impose costs on and reduce operational flexibility for some. It may reduce the U.S. industry's ability to meet existing demand, retain market-share, or exploit new market opportunities. And finally, it may be disproportionately burdensome to some segments of the industry as compared with others, e.g., smaller, less diversified operations. While

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[44] Many products which are economically very important to the U.S. industry today, were not regarded as "primary products", as defined in IU Option 2, only a few years ago. Had strict prohibitions on their production been imposed, market opportunities could have been foregone, with very substantial economic consequences for domestic producers.

principally an empirical question, alternatives to a strict reliance on an "approved list" and PRR's for all outputs may be less restrictive and, therefore, less costly, both to the industry and to the agency.

6.2.3 An Estimate of IU Option 2 Impact on Production and Gross Value

On the basis of the foregoing primary products list, and associated NMFS Standard PRRs, *and* assuming, 1). that future catches will be approximately equivalent, in amount and species composition, to those observed in the base years, 2) that product mix and market prices are essentially constant over time, and 3) the IR option selected requires 100% retention of each of the four species of concern, then one may draw the following conclusions about the probable economic impacts of adoption IU Option 2 (see Table 6B).[45]

Note that these figures reflect "gross" product value estimates which do not account for the cost of production. As a result, they "overstate" the potential value which may accrue from discard savings to an unknown, but perhaps significant, extent. Furthermore, these figures must be regarded as an "upper-bound" estimate, since preliminary analysis of the impact of "regulatory" discards on the actual IR/IU "discard savings" suggests totals may be significantly smaller than predicted by the raw data (see Section 5.8).

[45] These estimates are subject to change following the Directed Fishing Standards analysis.

Table 6B - Option 2 "Gross" Values and Percentage of round weight catch to authorized primary product production (by year, processing mode, gear, fishery, species)

	Retained Product Value	Discard Savings Value	Percent Primary
1994			
MS & C/P			
Longline			
P. cod			
Pacific cod	$66,909,782	$2,332,343	99.1%
Sablefish			
Pacific cod	8,375	7,837	99.1%
G. turbot			
Pacific cod	50,937	1,055	99.1%
Unknown			
Pacific cod	0	2,500	99.1%
Other			
P. cod			
Rock sole	1,219	17,465	79.1%
Yellowfin	160	35,988	89.0%
Pollock	107,532	836,597	100.0%
Rockfish			
Pollock	0	1	100.0%
Sablefish			
Rock sole	862	3	100.0%
Yellowfin	0	11	89.0%
Pollock	0	66	100.0%
G. turbot			
Rock sole	0	27	79.1%
Pollock	0	433	100.0%
Unknown			
Rock sole	0	5	79.1%
Pollock	323,076	10,622	99.6%
Pot			
Atka Mackerel			
Pacific cod	0	5,740	99.8%
P. cod			
Pacific cod	1,459,763	3,652	97.8%

Table 6B - (cont.)

Trawl			
Atka Mackerel			
Pacific cod	4,173,134	1,453,591	91.2%
Rock sole	26,925	107,996	79.8%
Yellowfin	0	80	86.1%
Pollock	18,227	85,681	99.4%
Bot. pollock			
Pacific cod	2,171,616	2,804,556	92.1%
Rock sole	1,452,406	4,042,698	79.7%
Yellowfin	170,911	375,071	85.3%
Pollock	50,633,748	2,494,460	98.4%
P. cod			
Pacific cod	12,832,023	1,270,074	90.7%
Rock sole	1,228,721	4,538,661	79.8%
Yellowfin	30,632	73,117	85.4%
Pollock	250,878	2,292,690	99.5%
O. flats			
Pacific cod	926,756	526,274	91.5%
Rock sole	1,091,748	531,415	78.8%
Yellowfin	272,125	205,245	84.7%
Pollock	22,601	816,388	99.6%
Rockfish			
Pacific cod	257,700	109,590	91.4%
Rock sole	3,489	33,149	80.0%
Yellowfin	14,979	12,772	84.8%
Pollock	5,567	139,574	99.6%
Other gf			
Pacific cod	34,609	16,917	91.4%
Rock sole	773	10,853	80.1%
Yellowfin	67,054	48,635	84.7%
Pollock	0	39,799	99.7%
Pel. pollock			
Pacific cod	467,415	3,350,087	93.1%
Rock sole	12,214	632,686	80.2%
Yellowfin	1,733	67,088	86.0%
Pollock	238,959,112	4,810,719	98.3%
Rock sole			
Pacific cod	1,641,371	2,954,397	92.4%
Rock sole	42,331,780	40,808,481	79.1%
Yellowfin	1,213,951	1,880,869	85.1%
Pollock	323,446	4,668,727	99.6%

Table 6B - (cont.)

Sablefish			
Pacific cod	1,342	1,234	91.9%
Pollock	0	2,284	99.7%
G. turbot			
Pacific cod	1,233	1,331	92.0%
Rock sole	0	2,200	80.3%
Pollock	0	4,657	99.7%
Yellowfin			
Pacific cod	6,627,916	7,162,035	92.0%
Rock sole	6,293,679	11,135,294	79.5%
Yellowfin	61,550,152	9,540,781	84.0%
Pollock	659,145	12,499,077	99.6%
Discard			
Pacific cod	0	18,212	93.5%
Rock sole	0	3,021	80.3%
Yellowfin	0	7,083	86.1%
Pollock	0	436	99.7%
Shoreside			
All gears			
Bot. pollock			
Pacific cod	65,923	35,769	90.7%
Rock sole	2,721	23	35.2%
Yellowfin	115	7	32.7%
Pollock	788,288	37,760	99.5%
P. cod			
Pacific cod	32,260,499	1,810,054	97.8%
Rock sole	3,288	1,648,691	62.0%
Yellowfin	308,126	199,469	85.4%
Pollock	140,836	4,668,798	99.9%
Rockfish			
Pacific cod	0	17	97.4%
Pel. pollock			
Pacific cod	2,213,190	344,669	88.6%
Rock sole	5,509	114	80.5%
Yellowfin	9,432	73	86.3%
Pollock	147,849,580	1,404,929	99.5%
Sablefish			
Pacific cod	0	1,425	97.4%
Yellowfin	0	57	90.6%
Pollock	0	43	100.0%

Table 6B - (cont.)

G. turbot			
Pacific cod	33,460	34	88.7%
Rock sole	23	11	57.6%
Yellowfin	15	23	97.5%
Pollock	32	2,125	100.0%
Yellowfin			
Pacific cod	446,369	63,115	88.5%
Rock sole	69,981	1,366	81.0%
Yellowfin	3,695,992	9,171	99.4%
Pollock	128,566	148,182	99.7%
Discard			
Pacific cod	0	4,749	97.4%
Pollock	0	16,271	100.0%
1994 Option 2A total	$692,567,718	$135,401,755	
Option 2B total	692,564,407	133,753,052	
Option 2C total	537,754,296	57,114,229	
1995			
MS & C/P			
Longline			
P. cod			
Pacific cod	$79,948,619	$2,999,430	99.2%
Rockfish			
Pacific cod	50	0	99.7%
Other gf			
Pacific cod	0	19,522	99.4%
Sablefish			
Pacific cod	26,854	10,710	99.2%
G. turbot			
Pacific cod	33,208	12,697	99.2%
Discard			
Pacific cod	0	57,357	99.4%
Other			
P. cod			
Rock sole	10,807	62,013	74.6%
Yellowfin	233	40,111	86.5%
Pollock	173,757	1,133,036	100.0%
Rockfish			
Pollock	0	19	100.0%
Other gf			
Pollock	0	699	100.0%

Table 6B - (cont.)

Sablefish			
Rock sole	0	698	80.2%
Pollock	0	1,809	100.0%
G. turbot			
Rock sole	5,615	548	38.4%
Pollock	0	505	100.0%
Discard			
Rock sole	0	17	80.2%
Pollock	0	76	100.0%
Pot			
P. cod			
Pacific cod	4,386,180	68,360	99.9%
Trawl			
Atka Mackerel			
Pacific cod	2,680,807	1,442,933	95.5%
Rock sole	55,559	183,605	78.7%
Yellowfin	1,246	966	85.6%
Pollock	29	128,532	99.6%
Bot. pollock			
Pacific cod	2,065,325	6,614,442	96.4%
Rock sole	812,826	2,104,856	78.6%
Yellowfin	164,554	310,635	86.9%
Pollock	41,837,119	1,301,514	98.5%
P. cod			
Pacific cod	30,539,317	3,795,994	94.9%
Rock sole	4,686,978	11,309,515	78.6%
Yellowfin	25,322	152,251	88.1%
Pollock	619,494	3,875,671	99.4%
O. flats			
Pacific cod	760,527	935,080	95.9%
Rock sole	1,072,524	1,199,904	78.3%
Yellowfin	2,374,276	1,870,920	85.4%
Pollock	122,177	1,183,935	99.5%
Rockfish			
Pacific cod	123,324	93,796	95.6%
Rock sole	8,341	29,234	78.7%
Pollock	17,938	112,178	99.4%
Flathead			
Pacific cod	524,874	503,865	95.8%
Rock sole	550,695	785,189	78.4%
Yellowfin	432,836	319,061	85.6%
Pollock	57,080	537,417	99.5%

Table 6B - (cont.)

Pel. pollock			
Pacific cod	404,933	5,493,669	96.3%
Rock sole	147,629	702,950	78.8%
Yellowfin	1,401	80,694	98.3%
Pollock	268,205,248	10,034,278	98.5%
Rock sole			
Pacific cod	4,329,819	4,682,320	95.8%
Rock sole	33,336,183	16,829,897	77.9%
Yellowfin	2,959,067	347,981	94.3%
Pollock	355,647	2,409,285	99.4%
Sablefish			
Pacific cod	0	226	96.9%
Pollock	0	1,065	99.6%
G. turbot			
Pacific cod	6,250	31,925	96.6%
Rock sole	0	1,307	79.2%
Yellowfin	8,198	1,746	84.1%
Pollock	0	12,637	99.6%
Arrowtooth			
Pacific cod	452	846	96.1%
Rock sole	1,126	0	97.7%
Pollock	0	1,713	99.6%
Yellowfin			
Pacific cod	4,689,840	5,887,756	95.9%
Rock sole	4,803,493	7,478,054	78.4%
Yellowfin	49,539,949	7,531,491	83.8%
Pollock	1,481,294	7,785,002	99.4%
Discard			
Pacific cod	0	10,830	96.9%
Rock sole	0	9,623	79.2%
Yellowfin	0	4,226	89.0%
Pollock	0	782	99.6%
Shoreside			
All gears			
Bot. pollock			
Pacific cod	113,014	227,248	95.0%
Rock sole	205	1,148	37.5%
Yellowfin	0	32	90.0%
Pollock	1,919,696	132,842	99.3%
P. cod			
Pacific cod	37,837,392	1,681,044	91.5%
Rock sole	53,258	1,087,014	39.3%
Yellowfin	178,653	82,638	87.4%
Pollock	141,596	3,604,266	99.9%

Table 6B - (cont.)

Rockfish			
Pacific cod	0	4,599	96.8%
Other gf			
Pacific cod	193	0	94.3%
Pel. pollock			
Pacific cod	2,337,279	710,618	92.6%
Rock sole	5,191	1,275	31.7%
Yellowfin	1,539	1,004	87.8%
Pollock	145,434,439	1,391,644	99.2%
Sablefish			
Pacific cod	4,751	1,005,480	96.8%
Rock sole	0	1	40.2%
Pollock	0	20	99.9%
G. turbot			
Pacific cod	11,532	5	93.8%
Rock sole	178	0	71.3%
Yellowfin	6	105	98.8%
Pollock	937	4,333	99.8%
Unknown			
Pacific cod	479	0	94.3%
Rock sole	4	0	71.3%
Pollock	1,930	0	99.3%
Yellowfin			
Pacific cod	1,339,281	25,863	91.3%
Rock sole	102,864	1,165	67.4%
Yellowfin	3,959,116	4,087	95.4%
Pollock	328,741	120,434	99.4%
Discard			
Pacific cod	0	4,034	96.8%
Pollock	0	19,044	99.9%
1995 Option 2A total	$728,145,722	$122,504,996	
Option 2B total	728,042,858	122,503,830	
Option 2C total	626,871,060	71,180,312	

NOTE: The foregoing are "gross" value estimates, i.e., they do not account for associated production costs. They must, therefore, be regarded as "upper-bound" estimates which likely overstate (perhaps significantly) the "net" value attributable to products deriving from historically retained catch or "discard savings" under this IU option.

6.3 Improved Utilization Option 3

The final utilization option under consideration speaks directly to limits on the production of *fishmeal* from the retained catch of the four species of concern, without direct reference to the issue of "direct human consumption." Specifically, Utilization Option 3 provides that reduction of *pollock, Pacific cod, yellowfin sole, and rock sole* to meal be limited to a maximum percentage of the retained catch of the species of concern. The three suboptions establish these maximum meal rates as follows: Suboption A - 50%; Suboption B - 30%; Suboption C - 10%. Expressed another way, under the respective suboptions A through C, 50%, 70%, and 90% of the retained catch of each of the four species of concern could be processed into any product form, except meal.

6.3.1 An Estimate of IU Option 3 Impact on Production and Gross Value

On the basis of this IU compliance criterion, and employing the estimated increase in retained catch attributable to "discard savings," by species of concern, the following "*preliminary*" conclusions can be drawn with respect to the potential impacts of adopting IU Option 3.[46]

IU Option 3 is intermediate between 1 and 2 with respect to the potential impact it may have on utilization compliance. Like IU Option 2, as the threshold level is increased, fewer fisheries are able to successfully comply, and thus the *risk* of imposing a significant economic burdens increases. For example, if the compliance threshold is set at 50%, i.e., up to 50% of the retained catch of each species of concern may be converted to meal, the estimated discard savings value is $143.4 million (incidently, the same as under IU Option 1). The "retained product" value was $692.6 million, for a total product value of $836.0 million. Referring to the last column in Table 6C, "*Percent Meal*," it appears that no target fishery would have a problem meeting the 50% threshold (on the basis of the 1994 example).

If the threshold were, instead 30% maximum meal production, and assuming no other operator increased catch proportionately and no other adjustment is made, the value of the "discard savings" would decline to $141.9 million. (Incidently, the "retained catch" value also declined slightly, indicating, in this case, two target fisheries, 'shoreside' Pacific cod and turbot could *potentially* find compliance a problem.) At a 10% maximum meal threshold the discard savings value estimate would decline even further, and many more of the target fisheries would be *potentially* at risk due to an inability to meet this standard (see Table 6C, any meal percentage greater than 10% would fail this compliance test).

These value figures must be regarded as an "upper-bound" estimate, since preliminary analysis of the impact of "regulatory" discards on the actual IR/IU "discard savings" suggests totals may be significantly smaller than predicted by the raw data (see Section 5.8). Furthermore, these product values reflect "gross" estimates which do not account for the cost of production. As a result, they "overstate" the potential value which may accrue from discard savings to an unknown, but likely very significant, extent.[47]

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[46] These estimates are subject to change following completion of the Direct Fishing Standards analysis.

[47] Note that it is implicit in these estimates that no operational adjustments are made in response to the IU requirements. That is, we have not attempted to predict the response of the industry, at the advice of the IR/IU industry working group.

Table 6C - Option 3 "Gross" values and percentage of round weight catch to meal production

	Retained Product Value	Discard Savings Value	Percent Meal
1994			
MS & C/P			
Longline			
P. cod			
Pacific cod	$66,446,544	$1,978,239	0.9%
Pacific cod	66,909,732	2,417,577	0.9%
Sablefish			
Pacific cod	8,375	3,176	0.9%
G. turbot			
Pacific cod	50,937	1,089	0.9%
Unknown			
Pacific cod	0	2,609	0.9%
Other			
P. cod			
Rock sole	1,219	17,465	20.9%
Yellowfin	160	85,938	11.0%
Pollock	107,532	1,096,376	0.0%
Rockfish			
Pollock	0	1	0.0%
Sablefish			
Rock sole	862	0	0.0%
Yellowfin	0	11	11.0%
Pollock	0	84	0.0%
G. turbot			
Rock sole	0	27	20.9%
Pollock	0	555	0.0%
Unknown			
Rock sole	0	5	20.9%
Pollock	328,076	13,593	0.0%
Pot			
Atka Mackerel			
Pacific cod	0	5,704	0.2%
P. cod			
Pacific cod	1,459,768	3,641	0.2%

Table 6C - (cont.)

Trawl			
Atka Mackerel			
Pacific cod	4,173,134	1,445,994	8.2%
Rock sole	26,925	135,157	20.2%
Yellowfin	0	78	13.9%
Pollock	13,227	113,033	0.5%
Bot. pollock			
Pacific cod	2,171,616	2,789,668	7.5%
Rock sole	1,462,406	3,936,531	20.3%
Yellowfin	170,911	366,386	14.7%
Pollock	50,633,748	3,278,109	1.5%
P. cod			
Pacific cod	12,832,023	1,263,803	8.5%
Rock sole	1,229,721	4,468,065	20.2%
Yellowfin	30,632	71,422	14.6%
Pollock	250,878	3,024,777	0.4%
O. flats			
Pacific cod	926,756	523,500	7.9%
Rock sole	1,091,748	517,684	21.2%
Yellowfin	272,125	200,576	15.3%
Pollock	22,601	1,077,089	0.4%
Rockfish			
Pacific cod	257,700	109,016	8.1%
Rock sole	3,489	32,277	20.0%
Yellowfin	14,979	12,481	15.2%
Pollock	5,567	184,144	0.4%
Other gf			
Pacific cod	34,509	16,828	8.0%
Rock sole	773	10,567	19.9%
Yellowfin	67,054	47,530	15.3%
Pollock	0	52,508	0.3%
Pel. pollock			
Pacific cod	467,415	3,332,215	6.8%
Rock sole	12,214	616,035	19.8%
Yellowfin	1,733	65,522	14.0%
Pollock	238,959,112	6,285,931	1.5%
Rock sole			
Pacific cod	1,641,371	2,938,684	7.3%
Rock sole	42,331,780	39,742,773	20.9%
Yellowfin	1,213,951	1,837,484	14.9%
Pollock	328,446	6,159,560	0.4%

Table 6C - (cont.)

Sablefish			
Pacific cod	1,342	1,223	7.7%
Pollock	0	2,974	0.3%
G. turbot			
Pacific cod	1,233	1,323	7.6%
Rock sole	0	2,142	19.7%
Pollock	0	6,144	0.3%
Yellowfin			
Pacific cod	6,627,916	7,124,050	7.6%
Rock sole	6,293,679	10,843,361	20.5%
Yellowfin	61,350,152	9,346,559	16.0%
Pollock	559,145	16,490,407	0.4%
Discard			
Pacific cod	0	13,115	6.5%
Rock sole	0	2,942	19.7%
Yellowfin	0	6,919	13.9%
Pollock	0	575	0.3%
Shoreside			
All gears			
Bot. pollock			
Pacific cod	65,923	33,829	5.8%
Rock sole	2,721	23	14.3%
Yellowfin	115	7	17.3%
Pollock	783,283	102,527	0.4%
P. cod			
Pacific cod	32,260,499	1,715,933	7.2%
Rock sole	3,238	1,336,495	33.0%
Yellowfin	308,126	135,547	14.6%
Pollock	143,336	5,455,006	0.1%
Rockfish			
Pacific cod	0	17	2.6%
Pel. pollock			
Pacific cod	2,213,190	326,196	6.8%
Rock sole	5,509	114	19.5%
Yellowfin	9,432	73	13.7%
Pollock	147,849,580	1,639,367	0.5%
Sablefish			
Pacific cod	0	1,347	2.6%
Yellowfin	0	53	9.4%
Pollock	0	50	0.0%

Table 6C - (cont.)

	G. turbot			
	Pacific cod	33,460	34	4.0%
	Rock sole	23	11	42.4%
	Yellowfin	15	26	12.5%
	Pollock	32	2,433	3.0%
	Yellowfin			
	Pacific cod	446,369	59,738	5.9%
	Rock sole	69,931	1,366	19.0%
	Yellowfin	3,695,992	9,171	10.6%
	Pollock	128,566	173,134	0.3%
	Discard			
	Pacific cod	0	4,490	2.6%
	Pollock	0	19,011	0.0%
1994	Option 3A total	$692,567,718	143,391,136	
	Option 3B total	692,564,407	141,854,630	
	Option 3C total	572,707,814	59,322,350	
1995				
	MS & C/P			
	Longline			
	P. cod			
	Pacific cod	$79,948,619	$3,123,936	0.6%
	Rockfish			
	Pacific cod	50	0	0.0%
	Other gf			
	Pacific cod	0	20,423	0.6%
	Sablefish			
	Pacific cod	26,954	11,200	0.6%
	G. turbot			
	Pacific cod	33,208	13,277	0.6%
	Discard			
	Pacific cod	0	60,004	0.6%
	Other			
	P. cod			
	Rock sole	10,307	84,510	19.8%
	Yellowfin	233	40,111	10.5%
	Pollock	173,757	2,595,231	0.0%

Table 6C - (cont.)

Rockfish			
Pollock	0	43	0.0%
Other gf			
Pollock	0	1,564	0.0%
Sablefish			
Rock sole	0	949	19.8%
Pollock	0	4,050	0.0%
G. turbot			
Rock sole	5,615	644	19.8%
Pollock	0	1,131	0.0%
Discard			
Rock sole	0	23	19.8%
Pollock	0	171	0.0%
Pot			
P. cod			
Pacific cod	4,386,180	68,686	0.1%
Trawl			
Atka Mackerel			
Pacific cod	2,680,807	1,457,374	4.3%
Rock sole	55,559	179,618	21.3%
Yellowfin	1,246	912	14.4%
Pollock	28	185,540	0.4%
Bot. pollock			
Pacific cod	2,065,325	6,680,722	3.5%
Rock sole	312,826	2,059,186	21.4%
Yellowfin	164,554	293,240	13.1%
Pollock	41,837,119	2,582,269	1.3%
P. cod			
Pacific cod	30,539,317	3,833,124	4.7%
Rock sole	4,686,979	10,770,737	21.4%
Yellowfin	25,822	143,486	11.9%
Pollock	619,494	5,594,384	0.5%
O. flats			
Pacific cod	760,527	944,435	3.9%
Rock sole	1,072,524	1,174,009	21.7%
Yellowfin	2,374,275	1,487,174	14.6%
Pollock	122,177	1,665,688	0.5%

Table 6C - (cont.)

Rockfish			
Pacific cod	123,324	94,733	4.1%
Rock sole	8,341	26,699	21.3%
Pollock	17,966	161,926	0.5%
Flathead			
Pacific cod	524,674	508,903	4.0%
Rock sole	550,695	768,209	21.6%
Yellowfin	432,636	301,432	14.5%
Pollock	57,083	847,930	0.5%
Pel. pollock			
Pacific cod	404,833	5,648,757	3.2%
Rock sole	147,629	687,669	21.2%
Yellowfin	1,401	76,138	11.1%
Pollock	258,205,248	14,444,202	1.3%
Rock sole			
Pacific cod	4,329,819	4,729,151	4.0%
Rock sole	33,336,183	16,470,998	22.1%
Yellowfin	2,959,067	802,764	15.7%
Pollock	355,647	3,477,724	0.5%
Sablefish			
Pacific cod	0	229	3.1%
Pollock	0	1,537	0.4%
G. turbot			
Pacific cod	6,250	32,245	3.4%
Rock sole	0	1,279	20.3%
Yellowfin	8,198	1,654	15.9%
Pollock	0	13,242	0.4%
Arrowtooth			
Pacific cod	452	353	3.7%
Rock sole	1,126	0	2.3%
Pollock	0	2,473	0.4%
Yellowfin			
Pacific cod	4,639,340	5,946,667	3.9%
Rock sole	4,803,493	7,316,240	21.6%
Yellowfin	49,538,949	7,150,922	16.2%
Pollock	1,481,294	11,237,251	0.6%
Discard			
Pacific cod	0	10,635	3.1%
Rock sole	0	9,413	20.8%
Yellowfin	0	3,937	11.0%
Pollock	0	1,129	0.4%

Table 6C - (cont.)

Shoreside			
All gears			
Bot. pollock			
Pacific cod	113,014	235,719	4.3%
Rock sole	205	930	62.5%
Yellowfin	0	31	10.0%
Pollock	1,919,696	163,803	0.7%
P. cod			
Pacific cod	37,837,892	1,708,265	6.5%
Rock sole	53,258	872,954	60.7%
Yellowfin	178,653	60,984	12.6%
Pollock	141,596	4,412,982	0.1%
Rockfish			
Pacific cod	0	4,771	3.2%
Other gf			
Pacific cod	193	0	3.6%
Pel. pollock			
Pacific cod	2,337,278	736,875	5.8%
Rock sole	5,191	1,275	69.3%
Yellowfin	1,539	977	12.2%
Pollock	145,434,439	2,311,017	0.8%
Sablefish			
Pacific cod	4,751	1,043,017	3.2%
Rock sole	0	1	59.8%
Pollock	0	24	0.1%
C. turbot			
Pacific cod	11,532	5	4.0%
Rock sole	178	0	28.7%
Yellowfin	6	102	10.2%
Pollock	937	5,305	0.2%
Unknown			
Pacific cod	478	0	3.6%
Rock sole	4	0	28.7%
Pollock	1,930	0	0.7%
Yellowfin			
Pacific cod	1,339,231	26,673	6.6%
Rock sole	102,864	1,165	32.6%
Yellowfin	3,959,116	4,037	4.6%
Pollock	322,741	147,442	0.6%

Table 6C - (cont.)

Discard			
Pacific cod	0	4,133	3.2%
Pollock	0	23,316	0.1%
1995 Option 3A total	$728,151,337	136,642,393	
Option 3B total	728,048,473	136,641,227	
Option 3C total	626,871,060	86,725,328	

NOTE: The foregoing are "gross" value estimates, i.e., they do not account for associated production costs. They must, therefore, be regarded as "upper-bound" estimates which likely overstate (perhaps significantly) the "net" value attributable to products deriving from historically retained catch or "discard savings" under this IU option.

6.4 Contrasting the IU Options

Based upon the forgoing analyses of the expected value deriving from "discard savings" under each of the three proposed IU options, and within the limits of the simplifying assumptions cited above, the following general conclusions may be made[48]. IU Option 1 is, as anticipated, the *least burdensome* of the three options in as much as it does not specify, or otherwise constrain, the manner in which an operator may comply with the utilization requirement. That is, by providing the maximum flexibility and latitude to the operator to "optimize" production within the constraints of its own physical plant, while achieving the objectives of utilizing all retained catch, this option is the least costly of the three solutions under consideration. IU Option 1 also happens to produce the largest total value from the additional retained and processed product, e.g. $143.4 million based on 1994 catch estimates.

IU Option 2, on the other hand, is confirmed to be the *most restrictive* of the three options, imposing strict product-form requirements on all retained catch of the four species of concern, including "discard savings" output. In 1994, for example, under "suboption A" with 50% primary product requirement, no fisheries appear to be in jeopardy, and the total value of all product deriving from retained bycatch savings is estimated at $135.4 million.[49] Under this scenario, the value of the traditionally retained product was estimated at $692.6 million.

Under "suboption B," using the 1994 example, two fisheries would have been below the minimum 70% primary product threshold. These two fisheries were 'shoreside' Pacific cod, which failed to meet the requirement on rock sole bycatch, and 'shoreside' Greenland turbot, which also failed on rock sole. If these two fisheries cannot adjust (and no other operations increase their catch proportionally) the potential loss to discard savings output is $1.6 million, bringing the total to $133.8 million.[50] As a result, the value of the total production of these two fisheries is potentially put in jeopardy (but not necessarily completely foregone). These results do not imply that these target fisheries will necessarily be closed down if IU Option 2 is adopted. Only that, at the 70% threshold compliance level, these two fisheries would have been in "non-compliance," all else equal, and could have faced a range of economic, logistical, and legal difficulties. The correct interpretation of these results would be that a "red flag" should be raised, alerting one to a *potential* problem here.

"Suboption C," which sets the primary product compliance threshold at 90%, obviously puts significantly more target fisheries at jeopardy due to "non-compliance" (see suboption C total in Table 6B).

IU Option 3 is intermediate between 1 and 2 with respect to the potential impact it may have on utilization compliance. Like IU Option 2, as the threshold level is increased, fewer fisheries are able to successfully comply, and thus the risk of imposing a significant economic burdens increases. For example, if the compliance threshold is set at 50% (suboption C), i.e., up to 50% of the retained catch of each species of

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[48] Note that it is implicit in these estimates that no operational adjustments are made in response to the IU requirements. That is, we have not attempted to predict the response of the industry, at the advice of the IR/IU industry working group.

[49] This assumes no physical constraints on processing and hold capacity.

[50] It is important to emphasize that these are "fishery-wide" estimates. Within any given target fishery some individual operations may be expected to have little or no difficulty meeting the threshold, even though in the aggregate their "target" appears to be in jeopardy, while others may be unable to achieve the compliance minimum.

concern can be converted to meal, the estimated discard savings value is $143.4 million (incidently, the same as under IU Option 1), for a total product value of $836.0 million. Referring to the last column in Table 6C, "Percent Meal," it appears that no target fishery would have a problem meeting the 50% threshold (on the basis of the 1994 example). If the threshold were, instead 30% maximum meal production (suboption B), and assuming no other operator increased catch proportionately and no other adjustment is made, the value of the discard savings would decline to $141.9 million, and two target fisheries ('shoreside' Pacific cod and turbot, the same two cited as 'at risk' under option 2) could *potentially* find compliance a problem. At a 10% maximum meal threshold the discard savings value would decline even further, and many of the target fisheries would be *potentially* at risk due to an inability to meet this standard (see Table 6C, any meal percentage greater than 10% would fail this compliance test).
Clearly, these are crude, highly simplified estimates of the potential impacts that adoption of one of the IU options could impose on the several target groundfish fisheries that will be regulated by and IR/IU amendment. For example, it is *assumed* that, 1) no adjustments in product mix will be made, 2) no other sector increases catch to absorb the foregone catch of the potentially non-compliant sectors, and 3) product and hold capacity are not constraining. The first two assumptions may overstate impacts, the third may overstate the total product yield.

One could expect that, in the face of constraints on utilization of retained catch, some adjustments would be made to lessen these projected impacts. But it is unlikely, given the capacity and nature of the existing industry, that all of these adverse impacts can be ameliorated, at least in the short run.

On the basis of the foregoing preliminary analysis (and within the limitations of the simplifying assumptions made), it appears that, of the three IU options under consideration, IU Option 1 imposes the least economic and operational burden on the industry, may produce the largest "discard savings value," and retains the maximum possible flexibility for the industry to respond to changing markets, while achieving the Council's basic objectives of reducing discards and more fully utilizing retained catch. IU Option 1 also provides each operation the opportunity to "optimally" utilize its existing physical plant to comply with the IR/IU requirements, thus reducing potential short term adjustment costs. Since these adjustment cost could be expected to be most burdensome for the smallest, least mobile, and least operationally diversified participants in the fishery, the distributional effects of IU Option 1 are also likely smallest among the three IU options.

6.5 Fishmeal Reduction Capability

At present, meal capacity does not exist to any significant extent in many sectors of the BSAI groundfish industry. Available data do not permit a detailed examination of the probable response of individual vessels (or even individual target fisheries) to limitations on meal production. However, if one makes several simplifying assumptions, a general assessment may be possible.

It is assumed for purposes of the following discussion that, if an operator had fish meal production capacity, that operator would have produced *some* quantity of meal at *some time* during the fishing year. It need not have been pollock meal in the pollock fishery, or rock sole meal in the rock sole fishery, etc., but if an operator produced *any* meal, from *any* source, it is assumed the operation has meal capacity; otherwise not.

Because IU Option 3 could potentially have differential impacts on each IR/IU regulated target fishery, it may be appropriate to summarize the available information on "fishmeal capability" by individual BSAI target, recognizing that there is, undoubtedly, some overlap of vessels and plants listed as "participants" in

each. This implies that there is some inevitable double-counting, if operations "with" meal capability are totaled across all fisheries. Therefore, no such "aggregation" is attempted.

Unfortunately, no fishmeal "capacity" (as distinct from "capability") information is available for the existing plants, which would clearly bear on the ability of an operation (or sector) to convert retained bycatch into meal. Instead, only the "absence" or "presence" of meal production can be identified, at this time. This limits the conclusions one may draw about probable sectoral response to IR/IU requirements, or the cost and need for additional capacity. These data are, nonetheless, presented as a crude proxy for capacity, by target fishery and sector. Based upon NMFS Weekly Production Reports, for both on-shore and at-sea processors, and the target fisheries of concern, the following results emerge:

Alaska Pollock

Bottom Trawl

Forty-eight processors reportedly participated in the 1994 BSAI bottom pollock trawl fishery. Based upon NMFS Weekly Production Reports, for both on-shore and at-sea processors, it appears that approximately 52% of the operations had fish meal capacity. These included, eight "motherships" (including five catcher/processors operating in a "mothership" mode during some period of the fishery in 1994); ten catcher/processors; and seven shoreside plants. In 1995, a total of 50 processors were identified as participants in this fishery. Of these, 32 processors recorded meal output, or 64% of those participating in the bottom pollock fishery.

Pelagic Trawl

Forty-eight processors participated in the 1994 pelagic pollock fishery. Approximately 65% of these reported some quantity of fishmeal production during the 1994 season. These included nine "motherships" (including six catcher/processors operating in a "mothership" mode during some period of the fishery in 1994); thirteen catcher/processors; and nine shoreside plants. In 1995, fifty-one processors operated in this fishery. Of these, 35 processors recorded meal production, or approximately 69%.

Pacific Cod

Cod Jig

For the 1994 BSAI Pacific cod jig fishery, no at-sea processors participated in the fishery. The total number of on-shore plants listed as "participating" in the Pacific cod fishery in this year was 6. Two of these reported fishmeal production.

In 1995, four catcher/processors also reportedly participated in the BSAI Pacific cod jig fishery. None recorded fishmeal production. Seven on-shore operators were identified with this fishery, and 4 produced meal at some point during the 1995 fishing year. Thus, approximately 36% of the processors in this fishery had meal capacity, in 1995.

Cod Longline

Forty-eight at-sea processors (all catcher/processors) and 8 on-shore plants participated in the 1994 fishery. None of the at-sea operators reported meal production. Four on-shore plants which were identified with the Pacific cod longline fishery did produce fishmeal at some time during the 1994 fishing year, or about 7%.

In 1995, NMFS data indicate that 44 catcher/processors participated in the Pacific cod longline fishery. Again, none recorded fish meal production. Seven on-shore plants were identified with this fishery, of which three on-shore operations recorded meal production in 1995, or just under 6%.

Cod Trawl

For the BSAI Pacific cod trawl fishery, 44 at-sea processors and 9 on-shore plants participated in the 1994 fishery. Three motherships participated, all reporting fishmeal production at some time during the year. Of the 41 catcher/processors, six recorded meal production. Six of the on-shore facilities produced meal. This suggests that approximately 27% of the participants had meal capacity of some kind in 1994.

Forty-four at-sea processors participated in the 1995 Pacific cod trawl fishery (4 motherships, 40 catcher/processors). Eight on-shore plants were identified, as well. Of these, 4 on-shore plants, 4 motherships and 6 catcher/processors recorded meal production during the fishing year, representing about 27% of the sector.

Cod Pot

According to NMFS data, the Pacific cod pot fishery included just 3 at-sea processors in the 1994 fishery (all catcher/processors), while 11 on-shore operations were identified. Six of the on-shore plants produced meal, while none of the at-sea processors did. This suggests that approximately 37% of this fishery's processors had fishmeal capacity in that year.

In 1995, eleven at-sea processors are recorded to have participated in this fishery. Thirteen on-shore plants processed pot-caught cod. Only four on-shore operations, out of all participating processors, recorded meal output. Thus, just under 17% had this capability, in 1995.

Sablefish

Sablefish Longline

IR Option 1 would extend regulate the discarding of *pollock, Pacific cod, yellowfin*, and *rock sole* to BSAI groundfish fisheries which are not associated with the targeting of any one of the four species of concern. The sablefish longline fishery is one of these.

For the BSAI sablefish longline fishery, 17 at-sea processors participated in the 1994 sablefish longline fishery (all catcher/processors), while 7 on-shore processors are listed. Three of the on-shore plants reported meal production, while none of the at-sea operators did. The result is that approximately 12.5% of this sector had meal capacity in 1994.

The data for 1995 suggest that 13 catcher/processors and 16 shoreside operations participated in this fishery. Of these, only 3 operations, all on-shore, reported meal production in 1995, or about 10%.

Sablefish Trawl

For the BSAI sablefish trawl fishery, 7 at-sea processors participated in the 1994 sablefish trawl fishery (all were trawl catcher/processors). Just 1 on-shore plant was identified, but that operator was the only one that did fishmeal in that year, i.e., 12.5% capacity for this fishery.

Only four vessels are reported to have participated in this fishery in 1995. No one recorded a output of meal in this fishery, in 1995.

Greenland Turbot

Greenland Turbot Longline

For the BSAI Greenland turbot longline fishery, 10 catcher/processors are reported to have participated in this fishery, in 1994. Four on-shore plants are also identified. Two of these did fishmeal, approximately 14% of the fishery with meal capacity in this year.

In 1995, 23 at-sea processors participated in the fishery (all were catcher/processors). Five shoreside plants also participated, three producing fishmeal, or just under 11% of the sector with meal reduction capacity.

Greenland Turbot Trawl

For the BSAI Greenland turbot trawl fishery, NMFS Blend, ADF&G fish ticket, and NORPAC indicate that 11 at-sea processors participated in the 1994 turbot trawl fishery (all catcher/processors). Two shoreside plants also participated, both producing meal. The net result is 15% of this sector had meal reduction capacity in 1994.

In 1995, 23 at-sea processors are reported to have operated in the Greenland turbot trawl fishery (2 motherships and 21 catcher/processors). Five on-shore operators were also cited. Just 1 of the at-sea operators recorded meal production, while 4 of the operators on-shore did so. This yields an estimate that approximately 18% of this fishery had meal capacity in that year.

Rock Sole

For the BSAI rock sole trawl fishery, 33 processors participated in the 1994 rock sole fishery (3 motherships, 30 catcher/processors). Only two operations recorded meal output in that year, suggesting that just over 6% of the fleet had access to this technology, in that year.

In 1995, 38 processors operated in the BSAI rock sole fishery (2 motherships, 36 catcher/processors). Five had reported production of fish meal, or 13% of the fleet.

Yellowfin Sole

The BSAI yellowfin sole trawl fishery had 41 processors participate in 1994, (4 shoreside processing plants, 2 motherships, 35 trawl catcher/processors). Of these, 4 catcher/processors and 3 shoreside plants produced meal, implying 17% of the sector had reduction capacity.

In 1995, 50 processors were listed in this fishery (2 shoreside operators, 4 motherships, 44 catcher/processors). One mothership, six catcher/processors, and two shoreside operations did fishmeal, that year. This suggests that only about 18% of the processors in this fishery had fishmeal capacity.

Flathead Sole

For the BSAI flathead sole trawl fishery, the data indicate that 20 processors participated in the 1995 fishery (1 shoreside processing plants, 19 catcher/processors). None had fishmeal capacity, on the basis of the criteria employed herein.

"Other"-Flatfish

For the BSAI "O"-flats trawl fishery, 17 processors participated in the 1994 fishery (all were catcher/processors). None recorded meal production, i.e., this fishery had no reduction capacity in this year.

For the 1995 season, these data indicate that 23 processors participated in the "O"-flat fishery and, once again, there was no meal reduction capacity represented.

Rockfish

For the BSAI rockfish trawl fishery, the data indicate 13 at-sea processors participated in the 1994 fishery (all catcher/processors). None had meal output.

In 1995, 14 at-sea processors participated in the 1995 rockfish trawl fishery (again all catcher/processors) and, again, there was no fishmeal reduction capacity represented in this fishery.

Atka Mackerel

For the BSAI Atka mackerel fishery, NMFS data indicate that 15 processors participated in the 1994 fishery (all catcher/processors). One reported production of meal, 6.7% of the fleet.

In 1995, 17 catcher/processors participated in the Atka mackerel trawl harvest. Two produced fishmeal that year, or 11.8% of the fleet had this capability.

6.5.1 Interpreting the Effects of Fishmeal Capacity

Clearly, the foregoing discussion indicates that fishmeal reduction capability is limited within many of the potentially impacted "target" fisheries (in some cases extremely so). While "through-put" (i.e., raw material input/meal output) information for the existing reduction capacity is not currently available, it would appear that significant reliance on meal production to absorb increases in retained bycatch is, in general, not feasible for most fisheries which would come under IR/IU regulation. This may be so, not only because of the limited number of meal plants in a sector, but also due to physical and logistical considerations of operators without plants, e.g., the ability of a vessel without its own meal capacity to hold and transport bycatch to some operator with a meal plant.

Even for sectors which have relatively high aggregate percentages of the affected operations with meal capability, this conclusion may hold. For example, in the pelagic pollock fishery, 69% of the participating processing operations are assumed to have fishmeal reduction capability (based upon 1995 performance

indicators). However, anecdotal information suggests that this capacity is concentrated in specific segments and absent in others. Virtually all *surimi* operations (catcher/processors, motherships, and on-shore plants) identified as participating in this target fishery have reduction capability. Reportedly, none of the *fillet* operations have meal capacity. This latter group is reported to be composed of the smaller and less operationally diversified vessels in this fishery. Thus, the ability to respond to IR/IU requirements by diverting unwanted or unusable bycatch into meal will be available to one segment and unavailable to another (perhaps not surprising).

However, this result could shift the relative share of, in this case, the pelagic pollock catch taken by each segment (surimi operations divert bycatch to meal, fillet operations must hold and deliver whole fish on-shore for reduction, or otherwise utilize bycatch). Since these two "product-differentiated" segments of the pelagic pollock fishery serve different markets, supplies of product into each may change in response to IR/IU. Precisely how prices (and consumers) will be effected cannot be anticipated, although generally one would anticipate prices for surimi to fall in response to increases in supply (potentially benefiting consumers of surimi), while fillet prices should rise as supplies shrink (potentially disadvantaging consumers of fillets).

This pattern holds true, to a greater or lesser extent, for the other "target" fisheries cited above. Certainly, fisheries with the least current meal capacity could rely least on meal as a production response to IR/IU.[51] Some suggestion has been made that existing on-shore fishmeal reduction capacity is sufficient to accommodate the demands from operations without meal plants, although no empirical evidence has been offered to verify this assertion. Even if this were assumed to be so, there are several concerns which emerge in assessing such a plan. The simple physical and logistics limits of such a scheme have already been mentioned. In addition, it is likely that deliveries of "whole fish," expressly for reduction, would not produce revenues for the delivering vessel. Indeed, some propose that on-shore plants would "charge" vessels for such a service. The "fee" would, presumably, be whatever the market would bear (depending upon such factors as area, season, available reduction capacity, storage and holding costs, meal prices, etc.).

In some fisheries, these additional operating costs for IR/IU compliance could force marginally profitable operations into unprofitability, resulting in removal of capacity from the industry. The most potentially vulnerable would be expected to include those operations with the smallest capacity to hold and transport bycatch, those most constrained in mobility, and least operationally diverse. Thus, as with other aspects of the proposed IR/IU action, the potential operational and economic burden attributable to adoption of an improved retention and utilization requirement may be expected to fall disproportionately on this latter segment of the industry, while the larger, more mobile, most operationally diversified will assume a greater share of the catch and production.[52] The extent to which these outcomes will emerge following adoption and implementation of an IR/IU management regime remain an empirical question. It is, however, useful to acknowledge these potentialities in weighing the competing options.

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[51] This result may be regarded as entirely consistent with the expectations for IR/IU. One purpose of the proposal is to provide economic disincentives to catch unwanted fish, which this may be interpreted to provide. Another aspect of IR/IU focuses on the desire to see "meals" not "meal" produced from retained catch. This result may support that objective. Finally, some have accepted the possibility that one indirect outcome of IR/IU will be displacement of some current capacity, perhaps even loss of some "target" fisheries. This too may be consistent with the outcome cited here.

[52] Assuming any operation remains "profitable" in a given fishery. An alternative outcome could be that a "target" fishery simply ceases to exist following adoption of, in this instance, IR/IU regulations.

6.5.2 The Cost of Adding Fishmeal Capacity

Reliance upon meal production capacity to achieve compliance with improved utilization, under any of the three IU options, may be problematic for most operations which do not already have this capability. This is so for several reasons. First, for most vessels currently operating in the fishery, the cost (including design, installation, and operation of a meal plant) may be prohibitive. Estimates for installing a fishmeal plant on an existing *vessel* are hard to acquire, since the cost would vary literally from operation to operation, depending upon the existing physical plant. However, sources familiar with such installations suggest that the cost of adding a fish meal plant to an existing vessel would vary with the size of the vessel and expected output of the plant. Assuming the plant was suited for production of a high quality fishmeal, i.e., product was derived from whole fish and fresh offal, the cost of a "small" plant (approximate capacity 50 tons of raw material per 24 hours) would be between $1 million and $1.3 million. A "medium" size plant (approximately 150 mt of raw material per 24 hours) could cost between $2.85 million and $3.25 million, while a "large" plant (350 mt of raw material per 24 hours) could cost $4 million to $4.3 million.

There are, of course, several other limiting factors in this calculation. One of the most confounding could be the regulatory limitations imposed on retro-fitting a commercial fishing vessel with such additional capacity. U.S. Coast Guard regulations pertaining to "load line" and "vessel stability" requirements present one such set, while the Council's own Moratorium and License Limitation represent another (see the discussion under 5.0 DFS/VIP/LLP-Moratorium/USCG Requirements and IR/IU). Another consideration is that, even if a meal plant could be installed, most existing vessels without such capacity at present would not have the hold or storage capacity to retain the meal once it was produced. Without such holding capabilities, the ability to make meal would not provide a viable means of remaining operationally competitive in the fishery.

6.6 An Alternative to Meal

It seems likely that many vessels which do not have meal capacity would seek an alternative means of complying with the IR/IU requirements, whichever IU Option is selected. There may be several unanticipated and potentially undesirable consequences associated with this outcome.

First, if substantial quantities of heretofore discarded bycatch are, instead, exported to another country for re-processing, much of the potential value-added benefit deriving from the retention of this catch, including processing jobs, will be transferred overseas. Noting that the United States has historically been the largest single importer of groundfish products in the world, one objective of "Americanizing" the fisheries of the U.S. EEZ, under provisions of the Magnuson-Stevens Act, was to increase the opportunity for U.S. fishermen, processors, and marketers to supply this domestic market (as well as compete in international markets). Any action which tends to induce the export of groundfish "in-the-round," or only partially processed, will reduce the opportunity for domestic value-added production, reduce domestic employment, increase the share of domestic consumer markets for groundfish products supplied by imported product, and thus undermine this objective of the Magnuson-Stevens Act.

Second, if these "products," produced from whole bycatch in the BSAI groundfish fisheries, are transferred on-shore or to another vessel and subsequently dumped at sea, or otherwise unutilized, the IR/IU program will have achieved very little. Even if ostensibly exported to another country for subsequent reprocessing, there could be no assurance that much of this output would not simply exacerbate solid-waste and pollution problems in another part of the world.

Third, regulatory requirements for improved retention and improved utilization in a fishery implicitly raise questions about monitoring the disposition of production output. To paraphrase an old adage, *"you may require that a product be produced from a given quantity of catch, but you can't always assure somebody will buy it."*, and certainly not for a price that will cover all the production costs. Expressed another way, while imposing retention and utilization requirements on BSAI groundfish harvesters and processors may reduce discards of fish in-the-round and, by extension, impose some costs associated with handling, processing, and storage (all of which may, it is hoped, induce harvesters to modify their behavior to avoid unwanted catches), it will be true that some products will not find markets.

There may be several reasons for this. Some product may be "unsalable" as a result of inferior handling, processing, and storage. Certainly, some of the raw catch will be of the wrong size (too small or too large), given the operators "primary" mode of production. Some will be the wrong species, and thus not amenable to existing processing procedures or plant configuration. And still others will have attributes which do not meet "primary" product requirements, e.g., wrong sex, parasite infestation, or physically damaged.

6.6.1 A "Least-cost" Response Strategy

It is probable then that operators, confronted with specific retention and utilization requirements, will assess their options, given the physical limitations of their plant, and the cost (both in handling, processing, storing, and marketing these "secondary" products, and the associated loss in "primary" product output), and then seek the least cost means of "optimizing" production, subject to these constraints.

In some cases, at least in the short run, this may mean processing these products in the quickest, least costly way available, and then disposing of the "product" as efficiently as possible, while meeting the technical letter of all applicable laws and regulations. For example, an operation confronted with the proposed IR/IU

requirements, and limited by physical, technical, or logistical constraints, could use previously discarded bycatch to produce mixed catch blocks frozen "in-the-round," sometimes referred to as "ocean run" block. Having, by definition, "retained" the bycatch, and now having "utilized" it, i.e., processed it by freezing, the least cost means of disposing of this output might be to simply dump the blocks into the sea.[53]

At present, there does not appear to be any legal or regulatory barrier preventing this or similar activity within the EEZ, i.e., between 3 and 200 miles. That is, while the U.S. EPA "encourages" proper disposal of waste, so long as the dumping is not conducted in nearshore waters, e.g., within three miles of shore or near a reef, this practice would not, apparently, be prohibited under the Marine Dumping Act or the Clean Water Act (per. comm., Burney Hill, U.S. EPA, 1995).[54] Provisions of the EPA permit governing disposal of waste, for fish processing vessels, specify "grinding of processing waste," although authority to require such actions beyond 3 miles (some suggest 12 miles) has not been tested, and enforcement is extremely limited (per. comm., Florence Carroll, U.S. EPA, 1995). Disposal beyond 3 miles of surplus "product," e.g., frozen ocean-run block, fish meal, etc., as distinct from processing waste is not, however, regulated by existing law (per. comm., Greg Kellog, U.S. EPA, 1995). Therefore, apparently, so long as packaging materials, e.g., plastic, cardboard, etc., is not also discharged, no prohibition on this activity within the 3-200 mile EEZ is currently provided for in Federal law.

Even if "surplus product" were subsequently to be redefined as "processing waste," the Marine Dumping Act explicitly exempts fish processing from its controls, and provisions of the Clean Water Act, which might be interpreted to govern disposal in the EEZ, would only require grinding prior to discharge. While the added handling associated with grinding before discharging of surplus product would impose some level of deterrence, it may be insufficient to eliminate such practices, at least in the short run. While technically in compliance with the Council's IR/IU requirement as proposed, the actions described above would presumably place in doubt both the improvement in bycatch utilization, and the net benefit to the Nation, deriving from the regulatory action under consideration.

6.7 Mandatory Product Retention

On the other extreme, however, requiring that all products be retained until sold is impractical, and could have other unanticipated negative impacts. First, such a requirement might exceed monitoring and enforcement capabilities and authority, since all production would have to be tracked beyond primary production, e.g., at least through cold storage inventorying. In addition, the volumes of groundfish product which might be associated with proposed IR/IU regulations could "plug" available cold storage capacity with relatively low-value/high-volume products. Limited cold storage capacity (particularly in Alaska) occupied by surplus groundfish production would not be available to other users and uses, e.g., halibut, salmon, sablefish, crab, herring, etc. This could impose substantial unanticipated logistical and economic costs on these fisheries and the communities which depend upon them.

Each day that groundfish products remain in inventory, increasingly greater cold storage costs are incurred by groundfish processors, diminishing the potential for recovering production costs (or realizing an economic profit). At some point, perhaps relatively quickly, the total cost of production and storage would exceed the

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[53] Alternative processing, other than freezing, could be undertaken with equivalent results. For example, "salting" or "drying" constitutes processing, under current regulation.

[54] Reference is made to the Marine Protection, Research, and Sanctuaries Act of 1972 (a.k.a Marine Dumping Act), part 102(d).

value of the product. Then, the product would become a financial liability which would either have to be liquidated, i.e., disposed of,[55] or abandoned by the owner. Neither action is without cost. Furthermore, the net effect on society, as compared to simply retaining the status quo, would be negative, since substantial costs, in the form of productive resource inputs, would have been invested, e.g., handling, processing, transporting, cold storing, and disposing of the product, with no apparent benefit accruing from the investment.[56]

The implications for product disposition once IU compliance is confirmed is largely beyond the scope of Council authority and agency resources to monitor or enforce, and will, by necessity, largely be left to economic forces to determine.[57]

6.8 Monitoring IU Compliance

The ability of NMFS to monitor any utilization requirement will be quite limited. Thus, "leakage"[58] will be unavoidable. This is so for several reasons. First, some fish are inevitably damaged beyond use in both the fishing and processing activities of any operation and, therefore, will not be utilized, in the sense of producing a final product.

Second, use of PRRs to monitor compliance on an individual operation basis is expected to present serious difficulties (see the discussion of PRRs, above). Adoption of PRRs for fish management purposes was based on the expectation that they would reflect the "aggregate" fleet-wide performance within a fishery, season, or area. Their usefulness at the individual operator level is, as previously noted, doubtful.

Third, no monitoring is possible beyond the "primary" processing level, constraining further the ability to assure IU compliance. NMFS-certified observers are not generally able to provide a level of coverage of the processing operation of a vessel that could be said to represent a systematic monitoring program, given their other duties and priorities. Establishing a corps of "utilization monitors" was contemplated by the Council's IR/IU Industry Working Group, but rejected as too costly and burdensome for the improvement in compliance that might reasonably be expected.

The method of assessing IU compliance, endorsed by the Council's IR/IU Working Group, would (as in the case of IR Monitoring Alternative 3) rely primarily upon auditing of catch and production records

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[55] Would at-sea disposal of "surplus product" be authorized, or would landfill disposal be required? If at-sea dumping is permitted, what has been achieved, beyond imposing perhaps substantial costs on the industry? If at-sea disposal is not permitted, there may be serious legal and technical problems with landfilling surplus products, e.g., regulatory authority; site availability and capacity; as well as, economic and ecological costs.

[56] Clearly, it is the expectation of the Council that imposition of additional costs of retaining and utilizing bycatch will induce changes in fishing practices and operational behavior. Over time, these changes should yield the desired "benefits," although in the short run, adjustment costs may be very high in some fisheries, or for some sectors.

[57] Subject, of course, to prevailing domestic and foreign laws and regulations governing, for example, landfilling, dumping at-sea, etc.

[58] Leakage, in this context, is defined as whole fish which are not processed, as required under IU.

periodically submitted to NMFS. In addition, it would employ random boardings of processing vessels (and presumably plants) by U.S. Coast Guard and/or NMFS Enforcement agents as an inducement to compliance.

An example may help to clarify the proposed monitoring procedure. NMFS Alaska Region would, as it currently does, monitor and audit the catch and production records submitted to it by participating groundfish processing operations. These records would be scrutinized on the basis of the required "minimum" performance criteria specified in the IU option adopted by the Council, i.e., "minimum" 15% PRR, "authorized primary product" list and standard PRR, or "maximum" percent meal production. If substantial inconsistencies appear to exist between reported catch and product output, on the basis of the adopted IU performance criteria, NMFS Enforcement would be notified and (if warranted) an enforcement investigation initiated.

In the case of random boardings, the logged catch of the four species of concern would be compared to the product weights, by species and statistical reporting area, of all products onboard (or appearing in production logs). Depending upon the prevailing IU criteria (cited above) a judgment as to *"utilization"* compliance would be made by the boarding officer, on the basis of criteria specified in the IR/IU enabling regulations, and (if necessary) an enforcement action initiated.

Leakages will occur, and should be anticipated, under this IU compliance monitoring system. However, the *risk* of detection of violations of the IU requirement is expected to provide a sufficient disincentive to achieve an acceptable level of compliance, while recognizing the limitations of a program based on "secondary" data and existing monitoring and enforcement capabilities.

No provisions for increased observer or enforcement resources are contained in the proposed IU action. Therefore, as proposed, adoption would impose no significant additional administrative, monitoring, or enforcement costs, as compared to the status quo (emphasizing, once again, that the ability of NMFS to monitor any utilization requirement will be quite limited).

It is important to point out that policing of retention and utilization standards will not be strictly confined to the staff and resources expressly dedicated to IR/IU monitoring and enforcement. It was noted by Captain William Anderson, of the U.S. Coast Guard, at the April 1996 Council meeting, that,

> "If you have an observer onboard a vessels (or at a plant), while perhaps not officially tied to this (IR/IU) program, he or she is present and walking around. If that person sees a large amount of pollock, rock sole, yellowfin, and/or Pacific cod continuously going over the side, when those fisheries are in open status, you don't need to have a specific number tied to a specific standard to say that that operation is in violation, because it can't be discarding those species; it's 100% retention. So, you have observers, you have all the crew members, you have other boats in the area, a lot of opportunities to have enough of a framework there that brings that 750 million pound (ADF&G projected discard) figure down. So I don't want to get too hung up on how well we can back calculate (round weight from product weight using PRRs) and get into arguments over the numbers, because there are other methods out there that are going to help achieve the Council's goal of dramatically reducing discards."

6.9 Technical and Market Limits on Production

Provisions of the Council's revised IR/IU proposal will necessarily require the retention and utilization of a substantial range of sizes of fish for each of the four species of concern, many of which have, heretofore,

been primarily treated as discards. While some of these discards have been forced by regulations, and others have clearly been due to economic considerations, e.g., lack of markets or lower values than the primary target species, etc., still others may have occurred for "technical" reasons. That is, existing mechanical processing technology imposes both *effective* and *absolute* limits on the size (and to perhaps a lesser extent, species) of fish which can be efficiently converted into a product form (excluding, of course, meal reduction and freezing in-the-round).

From the standpoint of economic effects on the industry, attributable to adoption of IR/IU, existing production capacity and technology are "fixed" in the short run, and only marginally malleable in the intermediate-run. It will, undoubtedly, take time and perhaps significant capital investment, before the majority of prevailing production capacities can be "optimally" adjusted, within the current fish processing sectors, to meet IR/IU mandates. It may be useful, therefore, to consider existing technical limits which will confront the industry as it attempts to adjust to the proposed IR/IU provisions.

While each operation in these fisheries is, to a greater or lesser extent, unique in terms of configuration, capacity, and technology, all are confronted by similar limitations on what can be produced from the raw catch. As the Council assesses regulatory options in connection with the IR/IU proposal, these limitations may be useful indicators of the probable impact on, and response of, the industry to changes in retention and utilization requirements.

Information on size frequencies and species composition appear in Appendix B. These data suggest that size composition for each of the four species of concern present in the catch can vary significantly.

6.9.1 Size Composition

Species size composition data are drawn from NMFS observer samples of catch in the BSAI groundfish fisheries for 1994 and 1995. Because of the way in which catch composition sampling is conducted, in general, size frequency data are limited to the species which is of "primary abundance" in the catch, while no size data are compiled for the other groundfish species present. That is, the pollock size frequency data reported here are associated with samples taken during "pollock"fisheries, the Pacific cod size frequency are taken from sample data obtained during "cod" fisheries, etc. Because no equivalent data on size composition is available for the "other species of concern" in a given fisheries catch, it has been assumed that, for example, the size of pollock in a Pacific cod fishery is distributed as in a pollock fishery; and the size frequency of rock sole in a yellowfin fishery is distributed as in a rock sole fishery; and so forth for all possible combinations of the four species of concern under IR/IU.

In the base year 1994, pollock ranging in size from 9 cm (about 7 grams) to over 100 cm (more than 6,000 grams) are reported in the catch. In 1995, pollock ranged in size from 9 cm to over 105 cm (7,500 grams). For the same two year period, approximately 25% of the catch is equal to or less than 40 cm (approximately 465 grams) in size, approximately 25% is between 41 cm and 45 cm (up to 650 grams), 25% is between 46 cm and 49 cm (up to 830 grams), and roughly the final 25% is greater than 50 cm (beginning at about 3,800 grams).

In the case of Pacific cod, 1994 observer size "comp" statistics indicate that the lower end of the range was about 13 cm (20 grams), while the upper-bound was 147 cm (44 kilograms). The 1995 catch data suggest that this range narrowed slightly, with the lower-end being 16 cm (38 grams) and the upper-end reportedly 128 cm in length (just over 30 kilograms).

Rock sole composition data for the 1994 BSAI rock sole fishery place the size frequency range at between 9 cm (7 grams) and 58 cm (2.5 kilograms). The range was very slightly narrower in 1995, with the lower-bound being 10 cm (10 grams) and the upper at 57 cm (2.2 kilograms). Rock sole vary somewhat in size by season and sex. For example, male rock sole in the traditional roe fishery range from 15 cm to over 45 cm in length. Females in the same season are somewhat larger, ranging from 18 cm to over 50 cm. In the non-roe season, the lower end of the range declines, with both males and females showing up in the catch as small as 9 cm, while the upper-end of the size frequency range remains about the same.

Yellowfin sole sampled by NMFS observers in the yellowfin fishery in 1994 were as small as 5 cm (1 gram) and as large as 52 cm (1.7 kilograms). In 1995, the low-end of the range rose to 8 cm (6 grams), while the upper-bound was unchanged from 1994.

6.9.2 Technological Limits

In many of the groundfish fisheries of the BSAI harvesting primarily "round fish," e.g., pollock, Pacific cod, industry sources and others knowledgeable about the processing sector, report that, at the present time, at-sea fillet and surimi production relies heavily on Baader processing technology, including the Baader 182, 190, and 212 filleting machines. Shorebased operators rely upon the same technology, although additional Toyo processing capacity exists in this sector.

The BSAI "flatfish" fisheries, e.g., rock sole, yellowfin sole, have historically been dominated by relatively small catcher/processor vessels. Industry sources (and others knowledgeable about this sector) report that, at the present time, technology does not exist to permit mechanical flatfish fillet production at-sea. While Baader manufactures the 176 flatfish fillet machine, reports suggest that at-sea operations on the size vessel currently operating in this fishery have not been successful. Therefore, mechanical processing technology, at least in the short run, is limited to H&G machines, e.g., the Baader 417 and 427, the Tokai, and Ryan headers, for this segment of the industry.

6.9.2.1 Fillet and Surimi Production from "Round Fish"

Technical information, provided by Baader Fish Processing Machinery, suggest that each of their "round fish" filleting machines have absolute limits on the size of pollock, Pacific cod, etc., which can be processed. For the 190, the limits range from 33 cm to 66 cm. For the 212, which also allows the extraction of roe, the bounds are 35 cm to 55 cm. The 182 machine, in its standard configuration, can process pollock in the range of 27 cm to 42 cm, although in its alternative configuration, with mechanical modifications, the machine can process fish of 35 cm to 52 cm. These mechanical limits define the boundaries of possible production without substantial modification to the machines.

Utilizing these "technical" limits, in combination with the size composition data for the BSAI fisheries, it appears that the proportion of catch of pollock and Pacific cod in IR/IU regulated fisheries which is "too small" to be processed by the available filleting technology is highly variable by fishery (see appendix C). For example, in the pelagic pollock target fishery, on average, approximately 1.75% of the catch will be below the minimum size for mechanical processing for operations employing the factory configured Baader 182 machines. With modification to utilize 35 cm to 55 cm fish, 7.4% of the pollock catch would be below machine limits for the 182. Just over 5% of total pollock catch will be too small to process using Baader 190's and 7.4% will be below the lower size limit for use of the Baader 212 machine. Reportedly, Toyo machines will process pollock as small as 27 cm in length, equivalent to the lower bound of the standard Baader 182 configuration.

At the lower end of the size range then, technology, currently available to the industry, does not provide a means to "utilize" a relatively small, but non-trivial, portion of the pollock catch for anything but reduction purposes (or perhaps freezing in-the-round). One on-shore operator contacted suggested that, "you put the really small fish into the system and they just fall through the grates in the machines." At that stage, they are destined for the meal plant.

At the upper-limits, using the standard factory configuration of the Baader 182 would mean that nearly 59.5% of total pollock catch in the example pelagic fishery would be too large for these machines. In the modified configuration which accommodates fish as large as 52 cm, just over 10% of the pollock catch would be too large for the machines. For operators with Baader 190 machines, less than 0.25% of the catch could not be processed by machine. The Baader 212, with an upper bound of 55 cm, could handle all but about 4.4% of the pollock caught. Toyo machines reportedly have an upper-bound limit of 2,000 grams or about 66 cm. This is equivalent to the Baader 190 limit.

Very large fish, which cannot be mechanically processed, could perhaps be processed by hand. The issue becomes whether physical limitations, e.g., adequate space for labor intensive processing, and the economics of the fishery will accommodate such practices. Some operators will clearly have an advantage over others in this way. That is, physical space is not typically a limiting factor for on-shore operations. It may not be for some of the largest motherships and C/P. Space will be a binding constraint for smaller operations, however.

Similar characterizations can be made for the mandatorily retained Pacific cod bycatch, as well. The interested reader should refer to the frequency data presented in Appendix B. There, by target fishery and "species of concern," the percentages of catch in each size frequency category are listed.

6.9.2.2 H&G Processing

Technical information, provided by Baader Fish Processing Machinery, suggest that each of these V-cut heading machines have absolute limits on the size of fish which can be processed. For the Baader 417, the limits range from 30 cm to 70 cm. For the 427, the bounds are 50 cm to 100 cm. These mechanical limits define the boundaries of possible production without substantial modification to the machines. Equivalent data were not obtained on the Tokai or Ryan machines, but industry sources suggest that the Tokai machines can process small to medium sized fish, while the Ryan's range is from the medium to large fish. In the case of operations which "hand process" catch, these limits clearly do not apply. However, the issues of scale and cost per unit output are of concern in such cases.

As with Pacific cod, the interested reader should refer to the detailed statistical data presented, by target, by species of concern, in Appendix B, to examine the implications of technical limits on flatfish catches (or H&G roundfish operations, as well).

At the lower end of the size range then, technology, currently available to the industry, does not provide a means to "utilize" a relatively small, but non-trivial, portion of the flatfish catch in the BSAI groundfish fishery for anything but reduction purposes (or freezing in-the-round).

Very large fish, which cannot be mechanically processed, could be processed by hand. The issue, as before, is whether physical limitations, e.g., adequate space for labor intensive processing, and the economics of the fishery will accommodate such practices.

While the foregoing discussion identifies the limits "technology" currently imposes on groundfish processors in the BSAI, the actual "binding constraint" on these operations is imposed by the marketplace.

6.9.3 Market Limitations

In a sense, the technological limits describe what "*can*" be processed, while markets define what "*should*" be processed, at least in the short run, in a straight-forward economic sense.

Despite the industry's best efforts, it is probable that unwanted bycatch will continue to occur in the BSAI groundfish fisheries, even with the incentives provided by an IR/IU program, given the nature of the technology employed. And, while industry may be expected to investigate opportunities to develop new products or markets to utilize previously discarded fish, these opportunities will take time and resources. Some may eventually yield results for the industry and benefits to the Nation. In the short run, at least, the industry will have to deal with existing markets and product demand.

Clearly, if a profit maximizing firm expends scarce productive resources, e.g., labor, capital, etc., to produce a product for which there is no market, that firm will not remain in business for long. Similarly, if it costs $1.00 to produce $0.10 worth of output, society has "wasted" $0.90. Therefore, in order to assess the likely impact on, and response of, the industry to the proposed IR/IU requirements, it is important to consider what "*market limitations*," in addition to the "technological limitation," may confront the industry (at least in the short run).

Industry sources consulted in the course of preparing this analysis suggest that current markets dictate the following limits. For pollock, the assumed "minimum" size fish that can currently be used to produce a marketable product is approximately 33 cm, although some minor variability exists among product forms.[59] For example, fillets generally require at least a 36 cm fish. For surimi production, the lower limit is about 300 grams (approximately 33 cm). Reportedly, pollock H&G requires a fish of no less than 350 grams. Another industry source reported that his operation did not buy pollock of less than 450 grams (approximately 40 cm), although fish of as little as 400 grams (or about 38 cm) would be the lower limit for that operator's surimi production. Deep-skin blocks and individually quick frozen fillets required fish of at least 600 grams (or roughly 44 cm). Small fish, i.e., under the identified "minimum," could not be utilized to produce a "saleable" product (other than meal) in existing markets.

The market imposed limits on Pacific cod were somewhat higher. For purposes of assessing the implications of the retention requirement, a 47 cm "minimum" length has been employed. Smaller fish than this minimum would generally be assumed to be reduced to meal (or perhaps frozen in-the-round for export), under the proposed IR/IU action. Depending, again, on product form and market, some variation is present for this species. For example, minimum round weight for cod destined for the domestic H&G market was estimated to be approximately 900 g (about 2 pounds), while for the Japanese H&G market a "minimum" round weight of 1,360 g (about 3 pounds) was required.

Rock sole which are smaller than 29 cm in length have been assumed to be below "marketable" size, for purposes of this analysis and, as in the case of the other three species of concern under IR/IU, fish smaller than this threshold have been assumed to be destined for fishmeal reduction (or perhaps freezing in-the-round for export). Industry sources suggest that some size variability is associated with differences in product form,

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[59] The "marketable" determination implies that a final primary product, other than industrial forms, e.g., meal, bait, can be made and sold from the raw material.

For example, current markets dictate the following limits. For rock sole H&G with roe, the "minimum" size fish that can be used to produce a marketable product is about 280-300 grams. For H&G without roe, the lower limit is about 250 grams. Rock sole in-the-round requires a fish of no less than 300 grams. While these are "minimums," industry sources report that the "optimum" size is somewhat larger for each product form. A fish of 385 grams would be "optimum" for H&G with roe. For H&G without roe, 330 grams, and for rock sole in-the-round 400 grams is ideal.

The "marketable" limit defined for yellowfin sole is currently assumed to be 28 cm. That is, any yellowfin present in the catch of IR/IU regulated fisheries would be assumed to be usable only for meal production (or perhaps freezing in-the-round for export), under prevailing market conditions. One source reported that yellowfin sole weighing no less than 260 g (round weight) were marketable domestically for re-processing, while fish as small as 150 g (round) had historically been sold into the Japanese market, although nothing smaller. For the H&G market the minimum marketable size was slightly larger, 300 g round, yielding a product weight of about 180 g.

The variability of the proportion of discards composed of "marketable-size" fish between "target" fisheries is considerable. While there are too many combinations of "year, gear-type, target, and retained species" to treat in the text, it may be helpful to examine these relationships as they pertain to the respective "target" fisheries for the four species of concern, e.g., pollock in the pollock targets, Pacific cod in the cod targets, etc. (For a comprehensive statistical listing, see Appendix B).

The NMFS observer size frequency data suggest the following about *discarded* catch:

Pollock Bycatch in Pollock Target Fisheries

For the at-sea segment, in 1994, pollock discarded in the "bottom pollock" fishery was composed of 91.4% "marketable" sized fish, while 8.6% were below the "minimum" size threshold. In 1995 in this fishery, the pollock discard division was 92.8% "marketable" size, 7.2% "unmarketable."

In the at-sea pelagic pollock fishery, for 1994, pollock discards were composed of 80.8% "marketable" sized fish, 19.2% undersized. In 1995, these figures were 92.2% "marketable," 7.8% "unmarketable."

On-shore, bottom pollock discards of pollock were made up of 99.3% "marketable" sized fish (just 0.7% under market size). The numbers were virtually the same in 1995, for the on-shore sector.

On-shore pelagic discards were composed of 92.8% "marketable" sized fish, the remaining 7.2% being below the minimum size limit, in 1994. The following year, 97.2% and 2.8% of the discarded pollock were "marketable" and "unmarketable"size, respectively, in the on-shore pelagic sector.

Pacific cod Bycatch in Pacific cod Target Fisheries

The at-sea cod longline discards of Pacific cod, in 1994, were comprised of 84.3% "marketable" sized fish, with 15.7% being too small to sell. The same comparison in 1995 indicate that 77.3% of the cod discards were "marketable" size, with 22.7% below the limit.

For the on-shore sector, cod longliners' discards were 35.8% of "marketable" size and 64.2% were too small, in 1994. The pattern changed dramatically in 1995, when 87.2% of their discards were "marketable' size fish, with the remaining 12.8% below market limits.

For pot caught cod, the 1994 at-sea discards were composed of 57% "marketable," 43% small sized fish. In 1995, 88.3% of cod discards were "marketable" sized, 11.7% below market size.

Shoreside cod pot data reveal that 81.2% of the cod discarded in 1994 were of "marketable" size, while 18.8% were not. The 1995 figures were, 70.9% and 29.1%, respectively.

Trawl Pacific cod fisheries at-sea had cod discards composed of 78.6% "marketable" sized fish, 21.4% were not, in 1994. Only 51.2% of the cod discards in 1995 in this fishery were large enough to market, with the remaining 48.8% being too small.

On-shore Pacific cod trawlers' discards of cod were 52.3% "marketable" size, 47.7% below the minimum, in 1994. The pattern was reversed in 1995, with 49% being large enough to sell, 51% being too small.

Rock Sole Bycatch in Rock Sole Target Fisheries

The 1994 rock sole trawl fishery discards of rock sole were made up of 64.2% "marketable" size fish, with the balance (35.8%) not of salable size. In 1995, 57.5% of the discarded rock sole met the market size standard, while 48.8% did not.

Yellowfin Sole Bycatch in Yellowfin Target Fisheries

Yellowfin sole discards, by the at-sea yellowfin trawl fishery in 1994, were composed of 53.7% "marketable" sized fish, with the remaining 46.3% being too small for sale. The same set of numbers in 1995 were 33.6% "marketable" size, 66.4% not.

For the on-shore yellowfin trawl fishery, yellowfin discards in both 1994 and 1995 were reportedly comprised solely (no pun intended) as "under" the marketable size limit.

As noted above, the preceding summarizes only the "direct" relationships between "marketable" size, discards, and "target fishery," for a given species. Many additional interactions between bycatch and market constraints are associated with adoption of an IR/IU requirement, since in every BSAI groundfish target there is the potential for mandatory retention of all four species of concern (e.g., pollock, cod, rock sole and yellowfin in the Atka trawl fishery, and the Greenland turbot longline fishery, and the sablefish pot fishery, etc.). Those interactions are listed in Appendix B.

While some of the discards of the four species of concern can be seen to be composed of "marketable" sized fish, varying from fishery to fishery, very significant portions are too small to market (at present). To the extent that the industry is unable, 1) to substantially reduce the bycatch of, in this case, under-sized fish, and/or 2) to develop new product forms and markets through which to utilize under-sized fish, substantial quantities of small pollock, Pacific cod, yellowfin and rock sole may be diverted into ancillary byproducts, exported in-the-round, or reduced to meal, at least in the short run, in response to the proposed IR/IU regulatory action. Furthermore, the potential costs of IR/IU compliance can be expected to be distributed "unevenly" across the several fisheries which will be required to meet the retention standards. That is, some fisheries will be significantly burdened by 100% retention requirements, while others face a much less difficult challenge in complying. Likely, this differential impact will extend to segments within many of the potentially affected fisheries, once again with the greatest potential impacts accruing to the smallest, least mobile, and least operationally diversified participants.

Clearly, compliance will impose costs on the industry, in the form of refitting of physical plant, re-capitalization of some operations, the displacement of some capacity, and potentially slowing of the fishery, with accompanying reductions in revenues and increases in operating costs. Quantitative estimates of these impacts cannot be made, given available information, at this time. They nonetheless should be recognized as likely outcomes of adoption of the proposed action and weighed in the decision.

7.0 Improved Utilization and the Marketplace

Markets are dynamic organizations which respond to numerous and varied forces. Unfortunately, very little analysis is presently available regarding market characteristics for most of the principal groundfish products derived from the BSAI fisheries. These analytical limitations cannot be quickly or easily overcome. Therefore, such key economic aspects as price elasticities, inventory holdings, substitutional relationships, and market trends cannot be quantitatively treated in the present EA/RIR.

Notwithstanding these limitations, several qualitative observations concerning the probable response of the market to IR/IU can be made. Some products of interest from the BSAI fisheries represent only a small part of the total supply within a global market, e.g., fishmeal or mince. In these cases, changes in output which might reasonably be anticipated in response to IR/IU requirements may have very little discernable impact on the market, as a whole, although they may affect U.S. market-share[50].

Other product forms produced from these fisheries may represent a very substantial share of the total supply entering the market, e.g., deep-skin fillets, certain grades of pollock surimi. As a result, significant changes in supply may induce equivalently large responses in price and even market structure (e.g., substitution effects). In general, the more generic the product form and the larger the range of potential substitutes available in the marketplace, the smaller will be the expected market response to changes in supply. The more specialized the product form and more narrow the market, the greater the probable market response to supply changes, all else equal.

The ability of the U.S. fishing and processing sectors to remain competitive in the world seafood marketplace will largely depend upon its capacity to respond "optimally" to dynamic international market forces. Without such flexibility, market opportunities may be foreclosed, to the detriment of the individual U.S. fisherman/processor, the domestic fishing and processing sector, and the Nation, as a whole.[51]

These conclusions tend to support the position of the Council's IR/IU Industry Working Group which advocated providing the "maximum" opportunity for flexibility on the part of the individual operator to respond quickly and efficiently to market signals, while adhering to the spirit of the IR/IU proposal to reduce discards of whole fish and improve recovery of useable products from bycatch species.

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[50] If the entire quantity of discards of the four species of concern in all potentially impacted fisheries were converted into any single product form, e.g., fishmeal, the market for that product would clearly be expected to react, perhaps dramatically. However, given the capacity limitations which prevail in the BSAI domestic groundfish fishing and processing sectors, this extreme response to IR/IU is not feasible (and, thus, the attributable market effect unlikely).

[51] The United States benefits from export trade. The U.S. is also a major importer of groundfish products. Any reduction in "market-share" within the world seafood market could adversely impact the Nation by negatively impacting its relative balance-of-trade.

7.1 Price/Market Response

As noted, while regulations can require that product be produced, they cannot guarantee how the marketplace will respond to increased production. By requiring the individual operators to retain and utilize species for which they are ill-equipped, or with which they are unfamiliar, a further complication, in the form of a price/demand response to *quality* variation, may arise, at least in the short run. As U.S. groundfish operations seek to adjust their production procedures and capacity to accommodate the new retention and utilization requirements, "aggregate" product quality could be expected to fall among all U.S. seafood producers, taken as a group.

Consider the following scenario. Assume a catcher/processor vessel, participating in, say, the BSAI bottom pollock fishery, is equipped and configured to produce, for example, pollock fillets from a relatively narrow size range of fish, using existing mechanical filleting technology. Assuming adoption of IR Option 1, this vessel must now convert all "IR/IU designated" bycatch, e.g., all pollock (including those which are undersized both on the basis of "technology" and "market" criteria), P. cod, yellowfin and rock sole, into products, with perhaps a requisite percentage constraint on product composition and form (depending on the IU option selected). It is not unreasonable to conclude that the resulting output of products, produced from fish of unfamiliar and/or previously undesirable species or characteristics (size, sex, condition) will be of a lower average quality than equivalent product forms produced from the same species, but by a different operator which is properly configured to process flatfish, or Pacific cod, or smaller pollock, etc.

The output of both U.S. producers will enter the same "market," competing with one another, but also being judged against "substitute" products from other sources, e.g., Icelandic cod, Canadian Atlantic haddock, New Zealand orange roughy. It is possible, therefore, that regulations in the BSAI groundfish fisheries requiring retention and utilization could (at least in the short run) lower the aggregate level of product quality within the U.S. seafood processing industry in the North Pacific, as greater quantities of what might be characterized as "sub-standard" product (as compared to current output) is forced onto the market. This could have an adverse effect on the U.S. industry's reputation for quality, impacting prices, and reducing U.S. market share, in world seafood trade. While ultimately an empirical question, a recognition of the potential for such adverse economic impacts is appropriate as the Council reviews its IR/IU options.

7.2 U.S. Exports of Alaska Groundfish Products

While empirical analysis of the specific markets for individual species/product forms is currently beyond the capability of this document, some basic export information is available with which to examine the contribution of groundfish from the U.S. EEZ off Alaska to American export trade and world seafood supply. Presumably, the majority of the increase in groundfish products deriving from adoption of an IR/IU regime for the BSAI would enter these same markets. In light of the qualitative discussion above, these statistics may provide some indication of the nature of the principal markets for BSAI groundfish products.

The majority of the groundfish harvested in the U.S. EEZ off Alaska finds its way into export markets. Many of the principal groundfish products are exported after undergoing only primary processing in the U.S., e.g., "whole or dressed" fish, or as intermediate product-forms, e.g., surimi, which will be reprocessed into final products, by secondary processors, outside the U.S.

Groundfish from the U.S. EEZ off Alaska are exported to a wide variety of countries. While the list of individual countries receiving export shipments of these products has varied over time, the "principal" export markets can be summarized as including Japan, the Republic of Korea, Canada, the Peoples Republic of

China, and the European community.[62] Numerous "other" countries also purchase U.S.groundfish products from North Pacific fisheries, but in much smaller quantities and/or on a less consistent basis.

The following tables summarizes the reported quantities and values of these groundfish products, by primary product form and species category, exported to each of the principal markets, for 1991 through 1995. These data are drawn from U.S. Department of Commerce, Bureau of the Census sources for customs districts in Alaska and Washington state. To the maximum extent practicable, only products deriving from groundfish harvested off Alaska are included in the reported export quantities (it is not possible to isolate just products from BSAI, however).

Export product categories have changed over time. These changes have been made ostensibly to provide greater detail by species and product form. However, as a result, not all products appear as distinct export categories in each year, although the product may have been present in substantial quantities. For example, "surimi" was not a separate product category until 1992. Prior to that time, export quantities of surimi may have been recorded under product categories, "fish, meat/minced," "fish, minced," or "fish balls, cake, pudding."

Despite these difficulties, these export data reveal the wide variety of product forms which derive from the utilization of groundfish harvested in the U.S. EEZ off Alaska.[63] They also demonstrate the important contribution these groundfish resources make to U.S. seafood export trade, and by extension to the economic well-being of the region, the Nation, and the world's supply of seafood products.

Groundfish exports from fisheries in the U.S. EEZ off Alaska varied between 1991 and 1995, both in terms of specific product categories and total quantity. As these export data illustrate, 1994 saw total edible groundfish exports of 362,010 mt of product from these fisheries. This total increased by only slightly over 1 percent in 1995, to 366,374 mt.

While export quantities were nearly unchanged between 1994 and 1995, the *value* of seafood exports from these fisheries was strongly higher. In 1994, the estimated value of these products (in nominal dollars) was $813.4 million. The 1995 estimate placed the value at more than $939.7 million, or an increase of approximately 16 percent. A portion of this increase can be attributed to a general increase in the world price for groundfish products. Additional factors influencing this solid increase in total export value may have included growth in U.S. processing capacity and capability to produce outputs with higher "value-added" characteristics, as well as the changing structural relationship in seafood trade between, in particular, the U.S. and Japan, its principal market (see, Sproul and Queirolo, 1994).

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[62] The European community, in this case, includes Denmark, Sweden, Norway, Germany, United Kingdom, Netherlands, Portugal, Spain, France, Italy, and Ireland; not to be confused with the formal EC confederation.

[63] These statistics do not include exports of "non-edible" products.

Principal Alaska groundfish product exports, 1991-95 (in metric tons).

Product	1991	1992	1993	1994	1995
			"Whole or dressed"		
Flatfish					
Canada	123	59	113	222	155
Europe	1,059	553	67	199	200
Japan	50,087	23,397	21,983	39,282	27,866
P.R. China	2,269	1,571	1,353	14,723	27,290
Rep. Korea	15,437	20,309	30,127	20,932	20,942
Other	2,551	5,680	6,332	1,960	1,149
Cod					
Canada	976	981	511	1,035	2,874
Europe	30,700	16,689	4,086	2,346	2,617
Japan	32,221	27,415	18,359	32,876	29,600
P.R. China	.	.	31	249	3
Rep. Korea	16,479	11,580	9,866	2,402	2,583
Other	11	29	112	46	84
Pollock					
Europe	192	193	6	7	.
Japan	26	182	192	144	113
P.R. China	16	.	.	.	.
Rep. Korea	.	689	754	1,149	2,397
Other	50	.	20	58	54
Mackerel (Atka)					
Canada	53	74	39	31	77
Japan	1,741	2,751	8,191	12,233	23,339
Rep. Korea	20	2,751	10,212	5,341	6,453
Sablefish					
Europe	15	137	19	.	37
Japan	17,503	14,273	13,503	14,943	15,581
P.R. China	.	.	.	16	40
Rep. Korea	424	291	.	29	110
Other	34	127	132	221	351
Other, nspf					
Canada	860	746	933	1,743	759
Europe	4,803	611	1,272	338	159
Japan	26,495	64,136	45,227	27,120	20,563
P.R. China	.	20	83	280	1,665
Rep. Korea	9,803	19,923	9,495	5,239	5,436
Other	135	781	313	280	566

(Continued).

Product	1991	1992	1993	1994	1995
			Roe products		
Pollock roe					
Europe	83	4	.	.	339
Japan	15,041	15,847	10,490	7,976	13,489
P.R. China	.	41	17	.	.
Rep. Korea	2,947	1,659	307	937	1,102
Other	.	.	2	.	40
Fish roe, other, nspf					
Canada	13	116	51	59	128
Europe	28	183	88	161	96
Japan	3,920	3,104	3,819	2,597	2,639
P.R. China	.	.	.	.	61
Rep. Korea	524	178	41	831	81
Other	11	.	1	42	39
			"Fillets"		
Cod					
Canada	247	183	327	545	113
Europe	399	316	85	197	113
Japan	161	186	338	524	265
Rep. Korea	172	551	14	92	95
Other	26	.	6	35	90
Pollock					
Canada	440	412	41	16	12
Europe	5,221	883	1,390	3,091	.
Japan	147	1,080	228	1,037	5,495
P.R. China	34	.	.	.	.
Rep. Korea	524	740	231	186	22
Other	1	14	260	41	193
Other, nspf					
Canada	1,164	1,653	2,009	1,463	1,234
Europe	2,912	1,593	236	342	67
Japan	935	238	1,783	471	198
P.R. China	.	.	19	10	.
Rep. Korea	121	.	.	4	118
Other	103	90	34	43	120

(Continued).

Product	1991	1992	1993	1994	1995
			"Other products"		
Surimi					
Canada	.	101	63	61	62
Europe	.	802	695	1,195	1,425
Japan	.	94,379	120,173	119,635	117,630
P.R. China	.	.	335	161	439
Rep. Korea	.	9,586	23,063	12,909	10,754
Other	.	277	3,739	5,480	3,413
Fish, minced					
Canada	.	6	359	39	868
Europe	3,566	263	14	218	1
Japan	61,233	3,059	2,796	1,233	1,742
P.R. China	.	.	.	.	60
Rep. Korea	9,252	1,614	.	173	131
Other	379	43	90	.	270
Fish, meat					
Canada	1,001	659	537	690	779
Europe	1,578	728	490	366	58
Japan	18,467	5,486	3,006	9,923	3,372
P.R. China	.	.	113	.	.
Rep. Korea	3,990	905	1,143	3,654	3,478
Other	.	155	1,182	1,059	221
Fish balls, cake, pudding					
Canada	1	13	22	.	3
Europe	53	49	.	.	9
Japan	11,390	19,893	12	75	228
P.R. China	.	23	21	.	.
Rep. Korea	4,468	3,603	574	100	.
Other	250	300	23	9	98
Fish sticks, minced					
Canada	2,729	3,043	3,287	3,837	3,725
Europe	.	.	100	.	20
Japan	7,182	4,237	6,530	2,872	4,454
P.R. China	.	.	.	.	.
Rep. Korea	4,219	365	160	39	441
Other	156	578	581	569	105
Fish meal for human consumption					
Canada	10	.	.	3	
Europe	.	1	.	.	
Japan	3,348	2,487	2,370	4,273	
P.R. China	.	.	.	392	
Rep. Korea	368	.	80	.	
Other	251	15	.	400	

(Continued).

Product	1991	1992	1993	1994	1995
Cod, salted, dried					
Canada	1	60	72	85	1,179
Europe	6,796	669	870	933	166
Japan	.	.	33	.	2
Rep. Korea	.	.	.	17	70
Other	.	32	.	.	.
Fish liver oils					
Canada	6	3	11	5	
Rep. Korea	147	79	25	129	
Fish oils					
Canada	990	4,886	4,237	5,944	
Japan	290	270	1,080	.	
Other	54	50	260	409	
Fish meal					
Canada	6,582	4,621	1,381	712	
Europe	.	73	.	.	
Japan	27,778	22,156	17,279	12,492	
P.R. China	1,131	2,690	4,857	3,482	
Rep. Korea	2,390	1,501	1,184	1,701	
Other	39,685	47,507	40,154	33,147	

Sources: U.S. Dep. Commer., Bur. of the Census; database from Natl. Mar. Fish. Serv., Fish. Stat. Div., Silver Spring, MD 20910; and Alaska Fish. Sci. Cent., 7600 Sand Point Way NE, BIN C15700, Seattle, WA 98115-0070.

Value of principal Alaska groundfish product exports, 1991-95 (in $1,000).

Product	1991	1992	1993	1994	1995
			"Whole or dressed"		
Flatfish					
Canada	529	255	432	892	548
Europe	755	576	126	218	258
Japan	84,025	32,196	36,603	72,011	58,161
P.R. China	1,596	934	946	12,653	25,369
Rep. Korea	11,308	17,690	18,521	15,273	16,298
Other	2,366	4,716	5,773	1,996	1,571
Cod					
Canada	2,335	2,920	2,005	2,587	5,523
Europe	35,376	26,683	6,547	4,923	5,170
Japan	66,042	50,864	33,971	62,812	65,641
P.R. China	.	.	14	132	4
Rep. Korea	20,614	13,949	11,950	5,335	6,640
Other	22	206	527	256	697
Pollock					
Europe	183	393	14	24	.
Japan	26	439	374	166	420
P.R. China	12	.	.	.	.
Rep. Korea	.	462	560	878	2,175
Other	238	.	50	147	146
Mackerel (Atka)					
Canada	70	138	61	50	93
Japan	3,372	5,168	11,329	12,053	27,357
Rep. Korea	17	3,131	6,967	4,221	5,311
Sablefish					
Europe	17	431	43	.	182
Japan	92,772	75,732	87,389	85,384	92,991
P.R. China	.	.	.	69	180
Rep. Korea	1,252	129	.	83	231
Other	171	694	1,058	1,626	2,096
Other, nspf					
Canada	2,417	2,233	3,534	5,127	2,555
Europe	10,013	1,549	1,914	492	329
Japan	52,393	114,083	83,309	48,092	44,409
P.R. China	.	26	67	67	969
Rep. Korea	13,855	21,968	8,827	3,959	4,555
Other	379	1,089	521	736	1,313

(Continued).

Product	1991	1992	1993	1994	1995
			"Roe products"		
Pollock roe					
Europe	317	111	.	.	664
Japan	129,335	160,979	100,384	79,924	134,599
P.R. China	.	473	79	.	.
Rep. Korea	22,921	16,470	3,326	8,503	8,378
Other	.	.	4	.	44
Fish roe, other, nspf					
Canada	197	588	336	639	862
Europe	178	3,436	2,426	2,693	1,793
Japan	29,501	19,540	17,891	13,643	17,113
P.R. China	.	.	.	.	141
Rep. Korea	3,775	772	284	3,621	124
Other	90	.	9	117	610
			"Fillets"		
Cod					
Canada	888	588	1,318	1,455	394
Europe	837	1,190	108	226	275
Japan	416	627	1,632	1,331	969
Rep. Korea	382	750	34	213	361
Other	83	.	14	86	200
Pollock					
Canada	1,413	395	95	37	34
Europe	9,882	1,208	2,837	5,377	.
Japan	420	2,049	1,136	2,663	15,859
P.R. China	89	.	.	.	.
Rep. Korea	1,345	530	115	283	80
Other	5	57	157	143	201
Other, nspf					
Canada	4,902	5,764	7,649	5,546	5,035
Europe	6,746	5,244	816	1,412	192
Japan	2,520	862	5,955	1,619	1,278
P.R. China	.	.	34	31	.
Rep. Korea	36	.	.	57	145
Other	134	421	202	139	495
			"Other products"		
Surimi					
Canada	.	273	159	147	166
Europe	.	1,438	1,362	2,747	3,242
Japan	.	328,560	253,102	273,742	310,823
P.R. China	.	.	612	324	1,015
Rep. Korea	.	29,285	36,265	25,577	25,444
Other	.	656	4,804	10,346	8,314

(Continued).

Product	1991	1992	1993	1994	1995
Fish, minced					
Canada	.	24	668	63	994
Europe	9,736	303	17	291	3
Japan	190,227	7,415	3,595	2,064	3,731
P.R. China	.	.	.	.	188
Rep. Korea	23,207	4,296	.	380	317
Other	816	77	164	.	661
Fish, meat					
Canada	4,346	2,347	2,137	3,212	2,251
Europe	3,530	1,552	1,038	1,047	174
Japan	48,596	9,365	6,977	17,090	9,372
P.R. China	.	.	496	.	.
Rep. Korea	9,062	1,542	2,021	6,168	5,179
Other	.	685	1,737	1,623	347
Fish balls, cake, pudding					
Canada	3	62	95	.	11
Europe	195	130	.	.	24
Japan	34,507	57,039	71	370	862
P.R. China	.	112	51	.	.
Rep. Korea	16,881	5,396	635	187	.
Other	331	673	42	42	261
Fish sticks, minced					
Canada	8,689	9,930	9,766	11,308	11,002
Europe	.	.	162	.	64
Japan	18,420	16,230	14,876	6,968	15,367
P.R. China	.	.	.	.	.
Rep. Korea	8,385	916	254	134	916
Other	340	996	445	633	316
Fish meal for human consumption					
Canada	13	.	.	3	
Europe	.	27	.	.	
Japan	3,139	1,566	1,232	3,136	
P.R. China	.	.	.	263	
Rep. Korea	279	.	43	.	
Other	190	30	.	236	
Cod, salted, dried					
Canada	4	129	144	263	2,816
Europe	22,319	3,066	1,979	2,782	479
Japan	.	.	191	.	14
Rep. Korea	.	.	.	29	113
Other	.	72	.	.	.

(Continued).

Product	1991	1992	1993	1994	1995
Fish liver oils					
Canada	27	14	23	22	
Rep. Korea	465	239	137	506	
Fish oils					
Canada	543	1,805	1,730	2,367	
Japan	117	308	240	.	
Other	27	29	186	558	
Fish meal					
Canada	4,209	2,670	627	322	
Europe	.	703	.	.	
Japan	12,212	10,013	8,598	5,555	
P.R. China	559	1,822	2,077	1,164	
Rep. Korea	3,871	837	951	588	
Other	22,923	23,125	18,513	17,071	

Sources: U.S. Dep. Commer., Bur. of the Census: database from Natl. Mar. Fish. Serv., Fish. Stat. Div., Silver Spring, MD 20910: and Alaska Fish. Sci. Cent., 7600 Sand Point Way NE, BIN C15700, Seattle, WA 98115-0090.

All values are reported in "nominal" U.S. dollars.

8.0 Legal Authority

A December 1, 1989, memorandum from the NOAA Office of General Counsel to the North Pacific Fishery Management Council summarized the Council's authority to prohibit roe-stripping and increase retention and utilization of pollock:

> (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 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."

9.0 Final Regulatory Flexibility Analysis

The objective of the Regulatory Flexibility Act is to require consideration of the capacity of those affected by regulations to bear the direct and indirect costs of regulation. If an action will have a significant impact on a substantial number of small entities an Initial Regulatory Flexibility Analysis (IRFA) must be prepared to identify the need for the action, alternatives, potential costs and benefits of the action, the distribution of these impacts, and a determination of net benefits.

NMFS has defined all fish-harvesting or hatchery businesses that are independently owned and operated, not dominant in their field of operation, with annual receipts not in excess of $2,000,000 as small businesses. In addition, seafood processors with 500 employees or fewer, wholesale industry members with 100 employees or fewer, not-for-profit enterprises, and government jurisdictions with a population of 50,000 or less are considered small entities. A "substantial number" of small entities would generally be 20% of the total universe of small entities affected by the regulation. A regulation would have a "significant impact" on these small entities if it reduced annual gross revenues by more than 5 percent, increased total costs of production by more than 5 percent, or resulted in compliance costs for small entities that are at least 10 percent higher than compliance costs as a percent of sales for large entities.

If an action is determined to affect a substantial number of small entities, the analysis must include:

1. a description and estimate of the number of small entities and total number of entities in a particular affected sector, and total number of small entities affected; and

2. analysis of economic impact on small entities, including direct and indirect compliance costs, burden of completing paperwork or record keeping requirements, effect on the competitive position of small entities, effect on the small entity's cash flow and liquidity, and ability of small entities to remain in the market.

9.1 Alternatives Considered for the Purpose of the FRFA

9.1.1 Improved Retention Alternatives

The Council's IR proposal contains two retention options in addition to the requisite status quo option. IR Option 1 is an inclusive alternative employing a "species-based" compliance criterion for BSAI groundfish fisheries, and extending IR regulations to all gear-types. Under this proposed management regime, IR/IU would mandate the retention of 100% of all four groundfish species of concern, whenever present in the catch of any BSAI groundfish fishery. For example, if pollock, Pacific cod, yellowfin sole, or rock sole, is present in the catch of an Atka mackerel target operation, or a sablefish target operation, or a Greenland turbot operation (or any other BSAI groundfish fishery), then that operator would be required to retain 100% of that pollock, Pacific cod, yellowfin and/or rock sole.

The Council explicitly acknowledged the differential implications of IR for pollock and Pacific cod, and requiring 100% retention of yellowfin and rock sole. The Council, therefore, requested that the analysis examine two retention suboptions. In both cases, 100% retention of pollock and Pacific cod would be required of all groundfish targets (all gear-types) beginning in the first year of the IR/IU program.

IR Suboption A. Under suboption A, however, retention of rock sole and yellowfin sole would be "phased-in," beginning in the first year of an IR/IU program (assumed to be 1998). The "phase-in" schedule would be over either two-years or five-years, and would begin at 60% retention of each flatfish species. That is, in the case of a two-year phase-in (and assuming the IR/IU program starts in 1998) all BSAI groundfish

fisheries would be required to retain at least 60% of their yellowfin and at least 60% of their rock sole in 1998; 80% in 1999; and 100% in 2000. Under a five-year phase-in, the increments would be 60% in 1998; 70% in 1999; 80% in 2000; 90% in 2001; and 100% in 2002.

IR Suboption B - [PREFERRED ALTERNATIVE]. Suboption B is a variation on a theme, taking into account the inherent difficulty of monitoring differential rates of discard below 100% as discussed in section 4.0. Under this suboption, 100% retention of pollock and Pacific cod would be required of all BSAI groundfish fishery participants, beginning in the first year of the IR/IU program. Retention requirements for yellowfin and rock sole would, however, be postponed for five-years, at which time the 100% retention requirement would extend to these two species, as well. That is, if the IR/IU program is adopted and implemented in 1998 (as anticipated) 100% retention of the pollock and Pacific cod catch, in all groundfish fisheries in the BSAI will be mandatory. No specific retention requirement would be applied to yellowfin or rock sole at that time. However, under the five-year delay (assuming 1998 as the starting date), beginning in 2002 and every year thereafter, 100% of the catch of yellowfin sole and rock sole in any BSAI groundfish fishery would be required to be retained.

9.1.2 Improved Utilization Alternatives

The Council's IR/IU proposal contains a total of three Utilization Options, plus the status quo alternative. Options 2 and 3 each contain three suboptions. The family of options and suboptions is intended to define the uses which may be made of retained catches of Alaska pollock, Pacific cod, yellowfin sole, and rock sole, under IR/IU. As such, they pertain only to the use of these four groundfish species, allowing all other groundfish species to be used (or discarded) at the discretion of the operator.

Utilization Option 1 - [PREFERRED ALTERNATIVE]. Utilization Option 1 can be characterized as potentially the least restrictive of the three options under consideration, in as much as it provides that the retained catch of the four groundfish species of concern may be processed into any form, regardless of whether or not the resulting product is suitable for direct "human consumption." The resulting product form could, therefore, be "meal," "bait," or any other "processed product."

Utilization Option 2. Containing specific provisions governing the form of the products which may be produced from retained catches of the four species of concern, Utilization Option two is potentially the *most restrictive* of three options. It requires that all retained pollock, Pacific cod, yellowfin sole, and rock sole be processed into a product form for "direct human consumption," based upon a percentage of total round weight of harvest of each respective species of concern. The three suboptions under Option 2 specify the minimum percentage of the retained catch of the species of concern which must be processed for "direct human consumption," i.e., the percentage which may not be processed into either "meal" or "bait." The respective suboption thresholds are: Suboption A - 50%; Suboption B- 70%; and Suboption C - 90%.

Utilization Option 3. The final utilization option under consideration speaks directly to limits on the production of fish meal from the retained catch of the four species of concern, without direct reference to the issue of "direct human consumption." Specifically, Utilization Option 3 provides that reduction of pollock, Pacific cod, yellowfin sole, and rock sole to meal be limited to a maximum percentage of the retained catch of the species of concern. The three suboptions establish these maximum meal rates as follows: Suboption A - 50%; Suboption B - 30%; Suboption C - 10%. Thus, under the respective suboptions A through C, 50%, 70%, and 90% of the retained catch of the four species of concern could be processed into any product form, except meal.

9.1.3 Other Alternatives Considered and Rejected by the Council

During the development of the IR/IU program, the Council considered a number of other alternatives to address the problem of discards in the groundfish fisheries off Alaska. In addition to the IR/IU program alternative programs under analysis included individual fishing quotas for groundfish species and a "Harvest Priority" program, which would provide for quota set-asides for vessels exhibiting low bycatch rates of non-target species. These alternative programs were rejected in favor of retention and utilization requirements because the IR/IU program was seen as the most expeditious way of reducing groundfish discards. The Council also considered exemptions and phase-in periods based on vessel size. However, these proposals were rejected because they would have diluted the expected reductions in bycatch and discards and were thought to provide an unfair competitive advantage to a certain sector of the industry.

In addition, the Council considered and rejected various voluntary programs to reduce bycatch and discards because it was believed that voluntary efforts would not meet the statutory requirements of the Magnuson-Stevens Act. Section 303(a)(11) of the Magnuson-Stevens Act requires the Council to "establish a standardized reporting methodology to assess the amount and type of bycatch occurring in the fishery, and include conservation and management measures that, to the extent practicable and in the following priority--(A) minimize bycatch; and (B) minimize the mortality of bycatch which cannot be avoided." In implementing this provision of the Act, the Council is further required under section 313(f) to "submit conservation and management measures to lower, on an annual basis for a period of not less than 4 years, the total amount of economic discards occurring in the fisheries under its jurisdiction." The proposed IR/IU program, submitted by the Council, is intended to meet these statutory requirements.

9.2 Economic Impact on Small Entities

Most of the vessels participating in the groundfish fisheries off Alaska which will be regulated under the proposed IR/IU action meet the definition of a small entity under the RFA. IR Option 1, in combination with any of the three IU Options under consideration, could result in a significant economic impact on a substantial number of small entities, as that concept is defined for purposes of the RFA.

The specific economic impacts of the proposed action on small entities in each sector of the groundfish industry are addressed in detail in sections 3.0 and 6.0 of this document and are summarized below. Sections 3.0 and 6.0 of the analysis examined the economic effects of this proposed rule by fishery and gear type and made the following conclusions: (1) The economic effects of the proposed rule on vessels using longline, jig and pot gear would not be significant, (2) The economic effects of the proposed rule on trawl catcher vessels and shore-based processors would not be significant, (3) The economic effects of the proposed rule on trawl catcher/processor operations may or may not be significant depending upon the fishery as well as the size and processing capacity of the vessel in question.

Under the category of trawl catcher/processors, the economic effects on vessels participating in the pollock, sablefish, Greenland turbot, rockfish, and Atka mackerel fisheries would not be significant. However, the economic effects on vessels participating in the Pacific cod, rock sole, yellowfin sole, flathead sole and "other" flatfish fishery would be significant. This is because the bycatch of IR/IU species in these fisheries is substantial. The quantity of additional retained catch that operators in these fisheries would be required to handle under the proposed rule would impose significant operational costs on these fisheries, taken as a whole. This is especially true for products for which markets are limited or undeveloped, e.g., small Pacific cod, male rock sole and head-and-gut (H&G) pollock. Current prices for these products may be insufficient to cover the costs of their production.

In general, the impacts on any individual factory trawler operation would vary inversely with the size and configuration of the vessel, hold capacity, processing capability, markets and market access, as well as the specific composition and share of the total catch of the four IR/IU species. The burden will tend to fall most heavily upon the smallest, least diversified operations among the current fleet. In addition, the groundfish vessel moratorium, proposed license limitation program, and U.S. Coast Guard load-line requirements severely limit reconstruction to increase vessel size and/or processing capacity. These restrictions are expected to further limit the ability of smaller catcher/processors to adapt to the proposed IR/IU program.

NMFS data indicate that in 1995, 44 at-sea processors participated in the BSAI Pacific cod trawl fishery (4 motherships and 40 catcher/processors); 38 at-sea processors participated in the BSAI rock sole fishery (2 motherships and 36 catcher/processors); 48 at-sea processors participated in the BSAI yellowfin sole fishery (4 motherships and 44 catcher/processors); 19 catcher/processors participated in the flathead sole fishery; and 23 at-sea processors participated in the "other" flatfish fishery (1 mothership and 22 catcher/processors).

Catcher/processors participating in the Pacific cod fishery with the capability to fillet product will not face a significant burden in complying with the proposed IR/IU program. Catcher/processors in the Pacific cod fishery that are limited to H&G product will be significantly disadvantaged because viable markets for H&G pollock do not exist. For this reason, catcher/processors limited to H&G product will be significantly disadvantaged in every fishery where substantial quantities of pollock bycatch occurs.

The physical limitations of the current fleet of catcher/processors that operate in the rock sole, yellowfin sole, flathead sole, and "other" flatfish fisheries could make adaptation to, and compliance with, the proposed IR/IU program effectively impossible. The result may be that adoption of the proposed rule would create such an operational barrier that the rock sole fishery would be discontinued, or alternatively the small-vessel fleet which currently comprises this fishing fleet might be displaced by larger and more operationally diversified fleets of vessels, e.g., larger catcher/processors and motherships.

NMFS is currently undertaking a number of efforts to reduce the impact of the proposed IR/IU program on small entities, including ongoing research on fishing gear and fishing techniques. NMFS is supporting and providing technical assistance to industry-based gear research efforts, and has authorized a large-scale experimental fishing permit proposal to systematically test the effects of a open-top intermediate trawl configuration on bycatch of pollock and Pacific cod in the flatfish fisheries. NMFS is also funding university-based gear research through the Saltonstall-Kennedy Grant Program including a study to examine the effects of various mesh size configurations on bycatch of undersize pollock in pelagic trawl fisheries. The objective of these efforts is to provide industry with information that will assist in the development of more selective fishing gear and fishing techniques in the groundfish fisheries off Alaska.

9.3 Response to Comments on the IRFA

The following is a summary of the comments received on the IRFA with responses by NMFS.

Comment 1. The IR/IU program will severely disadvantage small entities to the benefit of large at-sea and shoreside processors. These impacts will be highly allocative and are an inappropriate result of an FMP amendment that has no conservation purpose but is intended solely to respond to the socioeconomic needs of the fishing industry.

Response. The EA/RIR/FRFA prepared for Amendment 49 concluded that the action could impose significant economic impacts on a substantial number of small entities. The extent of the impact for a particular operation will be directly proportional to level of unwanted bycatch of the four IR/IU species. Vessels or fisheries that currently discard IR/IU species at high rates will face substantially greater burden

than vessels or fisheries with lower bycatch and discard rates of IR/IU species. The impact on a particular operation also is expected to vary inversely with the size and configuration of the operation, with larger processors more likely to have the space and infrastructure necessary to retain and process IR/IU species. Because catcher/processors face greater space constraints than onshore processors, and are limited in their ability to expand due to vessel moratorium, licence limitation and U.S. Coast Guard load line requirements, the impacts of the IR/IU program are expected to fall most heavily on catcher/processors, especially smaller factory trawlers that lack the capacity to produce fishmeal.

During development of Amendment 49, the Council considered and rejected alternatives that might have mitigated impacts on smaller factory trawlers. For example, an alternative that would have allowed exemptions or phase-in periods based on vessel size was rejected because it would have diluted the reductions in bycatch and discards, and was thought to favor sectors of the industry with high discard rates. The Council believed that an inevitable and appropriate consequence of any discard reduction program is that the compliance burden would be proportionate to the current bycatch and discard rate of a particular operation.

NMFS is currently assisting with industry efforts to develop more selective fishing gear and fishing techniques to reduce the impacts of Amendment 49. NMFS approved a large-scale fishing experiment in the BSAI during August 1997 to test experimental trawl gear designed to reduce pollock bycatch in flatfish trawls. Initial results from the experiment have been promising and will be made available to the public. These and other efforts may assist the industry in significantly reducing the effects Amendment 49 on certain trawl fisheries. NMFS believes that Amendment 49 will provide incentives for the Alaska groundfish industry to develop innovative solutions for reducing bycatch, and that such solutions also could be applicable to other fisheries throughout the United States and the world.

Comment 2. The EA/RIR/IRFA does not calculate net economic benefits or contain a cost benefit analysis as required under E.O. 12866.

Response. The Magnuson-Stevens Act, NEPA, E.O. 12286 and other applicable regulations require that, to the extent practicable, the RIR contain a complete examination of the costs and benefits attributable to the proposed action. To the extent that these costs and benefits can be quantified, they should be. Those which cannot be treated quantitatively are to be included in a qualitative way. On the basis of both the quantifiable benefits and costs, and the qualitative benefits and costs, a judgement should be rendered as to whether or not that the action will result in a net benefit to the nation.

NMFS has noted repeatedly during the four years of analysis for Amendment 49 that the cost data necessary to conduct a rigorous, quantitative net benefit analysis are not available. When the industry has been invited to provide such data, they have declined to do so. Therefore, NMFS has prepared an analysis on the basis of the "best available scientific information" (as required under the Magnuson-Stevens Act), then supplemented that (largely gross revenue analysis) with qualitative assessments of the probable response of the effected sectors, the probable environmental response, as well as the potential price and market response, to the proposed action (again, as required by the Magnuson-Stevens Act). Review and advice was sought from the Council's Advisory Panel and Scientific and Statistical Committee (SSC)) as well as numerous other numerous experts, both within the industry and outside the industry, in an effort to test the conclusions of the analysis against their respective experience and expertise. These experts consistently affirmed the analytical approach (given the limitations on data), as well as the findings of the analysis. The EA/RIR/FRFA meets the rigor with which benefits and costs of Council FMP amendments have been analyzed, historically.

Comment 3. The IRFA was flawed in that several reasonable traditional alternatives, currently used by NMFS and the State, were summarily rejected without discussion by the Council and were not analyzed in the IRFA. The Regulatory Flexibility Act (RFA) requires a description of "any significant alternatives...which minimize any significant economic impact (5 U.S.C. 603(c)). The IRFA doesn't even mention an industry proposal to exempt unmarketable undersize fish from the proposed rule. Minimum size limits are currently used in the halibut, crab, herring, and salmon fisheries. The Council has refused to consider industry proposals to only require retention of fish greater than 1.0 or 1.5 lbs citing enforcement concerns. A minimum size standard applied to the IR/IU program would make this an effective program for reducing waste. The EA/RIR/IRFA itself bases its cost/benefit calculations on a set of minimum marketable sizes. Amendment 49, as proposed, should not be approved by the Secretary, but should instead be returned to the Council for serious consideration of a viable alternative to mitigate the impact on the small H&G catcher/processors. The fact that, in effect, only one alternative was considered for improved retention is a serious defect in the analysis, and the fact that improved retention was considered a different option than improved utilization is a disturbing attempt at arguing that three options were considered rather than one option and the status quo. Because the option of using traditional size restrictions is available, this alternative should be considered as viable for the purposes of analysis even if the Council did not intend to select that alternative.

Response. A wide variety of alternatives were considered during development of the IR/IU program. These alternatives were analyzed in a serious of Council documents beginning with an Implementation Issues Analysis dated September 11, 1995. These documents were incorporated by reference into the final EA/RIR/FRFA. The council considered and rejected minimum size limits for retention of IR/IU species because an exemption allowing the discard of undersize fish would have diluted the incentives for vessel operators to avoid the bycatch of juvenile fish in the first place. See also response to comment 13.

10.0 NEPA and E.O. 12866 Conclusions

None of the IR/IU Options (or suboptions) would result in a "significant regulatory action," as defined in E.O. 12866.

None of the IR/IU Options (or suboptions) are likely to significantly affect the quality of the human environment and, therefore, the preparation of an environmental impact statement for the proposed action is not required by Section 102(2)(C) of the National Environmental Policy Act or its implementing regulations.

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Appendix A: Catch and Discard Performance, by Target Fishery

Table 1.1 Catch and discards of all groundfish in the BSAI bottom pollock trawl fishery, 1994-95

	Catch metric tons	Species percent of catch	Discards metric tons	Species percent of discards	Discard rate
1994					
Pollock	126,419	90.4%	7,969	46.4%	6.3%
Pacific cod	6,203	4.4%	3,434	20.0%	55.4%
Rock sole	2,780	2.0%	2,237	13.0%	80.5%
Yellowfin	1,050	.8%	699	4.1%	65.9%
Turbot	12	.0%	12	.1%	100.0%
Arrowtooth	1,015	.7%	959	5.6%	94.5%
Flat other	1,479	1.1%	1,066	6.2%	72.1%
Rockfish	92	.1%	92	.5%	100.0%
Atka mack	1	.0%	1	.0%	100.0%
Oth/unk	721	.5%	701	4.1%	97.2%
Groundfish total	139,731	100.0%	17,171	100.0%	12.3%
1995					
Pollock	104,026	87.8%	4,097	26.5%	3.9%
Pacific cod	9,535	8.1%	7,428	48.0%	77.9%
Rock sole	1,757	1.5%	1,375	8.9%	78.3%
Yellowfin	514	.4%	421	2.7%	82.0%
Sablefish	2	.0%	2	.0%	100.0%
Turbot	37	.0%	37	.2%	100.0%
Arrowtooth	622	.5%	570	3.7%	91.6%
Flat other	1,347	1.1%	971	6.3%	72.1%
Rockfish	26	.0%	26	.2%	100.0%
Atka mack	124	.1%	124	.8%	100.0%
Oth/unk	450	.4%	431	2.8%	95.8%
Groundfish total	118,440	100.0%	15,482	100.0%	13.1%

Table 1.1.1 Catch and discards of groundfish in the bottom pollock at-sea processing trawl fishery, BSAI 1994-95.

	Catch metric tons	Species percent of catch	Discards metric tons	Species percent of discards	Discard rate
1994					
Pollock	126,419	90.4%	7,969	46.4%	6.3%
Pacific cod	6,203	4.4%	3,434	20.0%	55.4%
Rock sole	2,780	2.0%	2,237	13.0%	80.5%
Yellowfin	1,060	.8%	699	4.1%	65.9%
Turbot	12	.0%	12	.1%	100.0%
Arrowtooth	1,015	.7%	959	5.6%	94.5%
Flat other	1,479	1.1%	1,066	6.2%	72.1%
Rockfish	92	.1%	92	.5%	100.0%
Atka mack	1	.0%	1	.0%	100.0%
Oth/unk	721	.5%	701	4.1%	97.2%
Groundfish total	139,781	100.0%	17,171	100.0%	12.3%
1995					
Pollock	99,129	87.8%	3,926	26.4%	4.0%
Pacific cod	9,134	8.1%	7,155	48.2%	78.3%
Rock sole	1,752	1.6%	1,370	9.2%	78.2%
Yellowfin	514	.5%	421	2.8%	82.0%
Turbot	21	.0%	21	.1%	100.0%
Arrowtooth	603	.5%	551	3.7%	91.4%
Flat other	1,330	1.2%	954	6.4%	71.7%
Rockfish	14	.0%	14	.1%	100.0%
Atka mack	33	.0%	33	.2%	100.0%
Oth/unk	431	.4%	414	2.8%	96.1%
Groundfish total	112,962	100.0%	14,860	100.0%	13.2%

Table 1.1.2 Catch and discards of groundfish in the bottom pollock on-shore processing trawl fishery, BSAI 1994-95.

	Catch metric tons	Species percent of catch	Discards metric tons	Species percent of discards	Discard rate
1995					
Pollock	4,897	89.4%	171	27.5%	3.5%
Pacific cod	401	7.3%	273	43.8%	68.0%
Rock sole	5	.1%	5	.8%	100.0%
Sablefish	2	.0%	2	.3%	100.0%
Turbot	15	.3%	15	2.5%	100.0%
Arrowtooth	19	.3%	19	3.0%	100.0%
Flat other	17	.3%	17	2.7%	100.0%
Rockfish	12	.2%	12	2.0%	100.0%
Atka mack	91	1.7%	91	14.6%	100.0%
Oth/unk	19	.4%	17	2.8%	90.0%
Groundfish total	5,478	100.0%	622	100.0%	11.4%

Table 1.2 Catch and discards of groundfish in the pelagic pollock trawl fishery, BSAI 1994-95.

	Catch metric tons	Species percent of catch	Discards metric tons	Species percent of discards	Discard rate
1994					
Pollock	1,176,661	99.0%	20,348	72.7%	1.7%
Pacific cod	8,142	.7%	4,795	17.1%	58.9%
Rock sole	329	.0%	289	1.0%	87.9%
Yellowfin	147	.0%	125	.4%	85.5%
Sablefish	2	.0%	1	.0%	33.8%
Turbot	49	.0%	48	.2%	97.1%
Arrowtooth	972	.1%	847	3.0%	87.1%
Flat other	1,471	.1%	876	3.1%	59.5%
Rockfish	95	.0%	58	.2%	61.8%
Atka mack	43	.0%	32	.1%	73.9%
Oth/unk	718	.1%	562	2.0%	78.3%
Groundfish total	1,183,630	100.0%	27,981	100.0%	2.4%
1995					
Pollock	1,156,587	98.8%	37,126	78.4%	3.2%
Pacific cod	10,130	.9%	6,928	14.6%	68.4%
Rock sole	414	.0%	347	.7%	83.6%
Yellowfin	156	.0%	156	.3%	100.0%
Sablefish	7	.0%	7	.0%	100.0%
Turbot	58	.0%	57	.1%	99.3%
Arrowtooth	560	.0%	525	1.1%	93.8%
Flat other	1,352	.1%	1,189	2.5%	87.9%
Rockfish	227	.0%	167	.4%	73.3%
Atka mack	120	.0%	111	.2%	92.2%
Oth/unk	893	.1%	755	1.6%	84.6%
Groundfish total	1,170,504	100.0%	47,367	100.0%	4.0%

Table 1.2.1 Catch and discards of groundfish in the pelagic pollock at-sea processing trawl fishery, BSAI 1994-95.

	Catch metric tons	Species percent of catch	Discards metric tons	Species percent of discards	Discard rate
1994					
Pollock	753,921	99.0%	15,988	70.1%	2.1%
Pacific cod	4,846	.6%	4,279	18.7%	88.3%
Rock sole	316	.0%	288	1.3%	91.2%
Yellowfin	128	.0%	125	.5%	97.9%
Sablefish	T	.0%	0	.0%	100.0%
Turbot	23	.0%	23	.1%	100.0%
Arrowtooth	819	.1%	814	3.6%	99.4%
Flat other	964	.1%	798	3.5%	82.8%
Rockfish	22	.0%	20	.1%	91.5%
Atka mack	1	.0%	1	.0%	100.0%
Oth/unk	492	.1%	484	2.1%	98.2%
Groundfish total	761,532	100.0%	22,819	100.0%	3.0%
1995					
Pollock	764,124	98.8%	31,675	78.3%	4.1%
Pacific cod	5,339	.8%	5,928	14.7%	93.5%
Rock sole	397	.1%	329	.8%	82.9%
Yellowfin	154	.0%	154	.4%	100.0%
Sablefish	3	.0%	3	.0%	100.0%
Turbot	32	.0%	31	.1%	98.6%
Arrowtooth	473	.1%	470	1.2%	99.3%
Flat other	1,092	.1%	1,075	2.7%	98.5%
Rockfish	121	.0%	107	.3%	88.9%
Atka mack	81	.0%	78	.2%	96.3%
Oth/unk	611	.1%	602	1.5%	98.5%
Groundfish total	773,426	100.0%	40,452	100.0%	5.2%

"T" - Trace amounts (less than 1 mt)

Table 1.2.2 Catch and discards of groundfish in the pelagic pollock on-shore processing trawl fishery, BSAI 1994-95.

	Catch metric tons	Species percent of catch	Discards metric tons	Species percent of discards	Discard rate
1994					
Pollock	422,740	99.0%	4,360	84.5%	1.0%
Pacific cod	3,297	.8%	516	10.0%	15.7%
Rock sole	14	.0%	2	.0%	11.0%
Yellowfin	19	.0%	.	.	.
Sablefish	1	.0%	0	.0%	27.8%
Turbot	26	.0%	24	.5%	94.5%
Arrowtooth	153	.0%	33	.6%	21.3%
Flat other	507	.1%	78	1.5%	15.4%
Rockfish	73	.0%	38	.7%	52.3%
Atka mack	43	.0%	31	.6%	73.5%
Oth/unk	225	.1%	78	1.5%	34.6%
Groundfish total	427,098	100.0%	5,161	100.0%	1.2%
1995					
Pollock	392,463	98.8%	5,451	78.8%	1.4%
Pacific cod	3,791	1.0%	1,000	14.5%	26.4%
Rock sole	17	.0%	17	.2%	100.0%
Yellowfin	2	.0%	2	.0%	100.0%
Sablefish	4	.0%	4	.1%	100.0%
Turbot	26	.0%	26	.4%	100.0%
Arrowtooth	87	.0%	55	.8%	63.5%
Flat other	261	.1%	115	1.7%	43.9%
Rockfish	107	.0%	59	.9%	55.7%
Atka mack	39	.0%	33	.5%	83.7%
Oth/unk	282	.1%	153	2.2%	54.5%
Groundfish total	397,073	100.0%	6,915	100.0%	1.7%

Table 1.3 Catch and discards of groundfish in the Pacific cod jig fishery, BSAI 1994-95.

	Catch metric tons	Species percent of catch	Discards metric tons	Species percent of discards	Discard rate
1994					
Pollock	14	1.7%	14	13.2%	100.0%
Pacific cod	730	87.4%	.	.	.
Flat other	13	1.6%	13	12.4%	100.0%
Rockfish	9	1.1%	9	8.5%	100.0%
Atka mack	69	8.2%	69	65.8%	100.0%
Oth/unk	T	.0%	0	.0%	3.6%
Groundfish total	835	100.0%	105	100.0%	12.5%
1995					
Pollock	2	.3%	2	11.5%	100.0%
Pacific cod	597	96.9%	.	.	.
Arrowtooth	T	.0%	0	.9%	100.0%
Atka mack	13	2.1%	13	68.6%	100.0%
Oth/unk	4	.6%	4	19.0%	91.6%
Groundfish total	616	100.0%	19	100.0%	3.0%

"T" - Trace amounts (less than 1 mt)

Table 1.3.1 Catch and discards of groundfish in the Pacific cod at-sea processing jig fishery, BSAI 1994-95.

	Catch metric tons	Species percent of catch	Discards metric tons	Species percent of discards	Discard rate
1995					
Pacific cod	30	97.3%	.	.	.
Oth/unk	1	2.7%	1	100.0%	100.0%
Groundfish total	31	100.0%	1	100.0%	2.7%

Table 1.3.2 Catch and discards of groundfish in the Pacific cod on-shore processing jig fishery, BSAI 1994-95.

	Catch metric tons	Species percent of catch	Discards metric tons	Species percent of discards	Discard rate
1994					
Pollock	14	1.7%	14	13.2%	100.0%
Pacific cod	730	87.4%	.	.	.
Flat other	13	1.6%	13	12.4%	100.0%
Rockfish	9	1.1%	9	8.5%	100.0%
Atka mack	69	8.2%	69	65.8%	100.0%
Oth/unk	T	.0%	0	.0%	3.6%
Groundfish total	835	100.0%	105	100.0%	12.5%
1995					
Pollock	2	.4%	2	12.0%	100.0%
Pacific cod	567	96.9%	.	.	.
Arrowtooth	T	.0%	0	1.0%	100.0%
Atka mack	13	2.2%	13	71.8%	100.0%
Oth/unk	3	.5%	3	15.2%	89.4%
Groundfish total	585	100.0%	18	100.0%	3.0%

"T" - Trace amounts (less than 1 mt)

Table 1.4 Catch and discards of groundfish in the Pacific cod longline fishery, BSAI 1994-95.

	Catch metric tons	Species percent of catch	Discards metric tons	Species percent of discards	Discard rate
1994					
Pollock	2,777	2.7%	2,475	14.8%	89.1%
Pacific cod	85,508	84.5%	3,128	18.7%	3.7%
Rock sole	25	.0%	23	.1%	94.0%
Yellowfin	152	.1%	151	.9%	99.8%
Sablefish	112	.1%	8	.0%	7.0%
Turbot	295	.3%	167	1.0%	56.6%
Arrowtooth	1,456	1.4%	1,246	7.5%	85.6%
Flat other	213	.2%	189	1.1%	89.0%
Rockfish	180	.2%	86	.5%	47.7%
Atka mack	41	.0%	38	.2%	94.0%
Oth/unk	10,479	10.4%	9,206	55.1%	87.9%
Groundfish total	101,237	100.0%	16,718	100.0%	16.5%
1995					
Pollock	3,064	2.6%	2,654	14.7%	86.6%
Pacific cod	101,428	86.0%	3,990	22.1%	3.9%
Rock sole	43	.0%	38	.2%	89.9%
Yellowfin	63	.1%	62	.3%	99.4%
Sablefish	48	.0%	16	.1%	34.0%
Turbot	335	.3%	198	1.1%	59.0%
Arrowtooth	1,765	1.5%	1,573	8.7%	89.2%
Flat other	281	.2%	271	1.5%	96.6%
Rockfish	68	.1%	47	.3%	70.3%
Atka mack	45	.0%	44	.2%	98.5%
Oth/unk	10,733	9.1%	9,153	50.7%	85.3%
Groundfish total	117,872	100.0%	18,048	100.0%	15.3%

Table 1.4.1 Catch and discards of groundfish in the Pacific cod at-sea processing longline fishery, BSAI 1994-95.

	Catch metric tons	Species percent of catch	Discards metric tons	Species percent of discards	Discard rate
1994					
Pollock	2,776	2.7%	2,475	14.8%	89.1%
Pacific cod	85,263	84.4%	3,119	18.7%	3.7%
Rock sole	25	.0%	23	.1%	94.0%
Yellowfin	152	.2%	151	.9%	99.8%
Sablefish	106	.1%	8	.0%	7.4%
Turbot	295	.3%	167	1.0%	56.6%
Arrowtooth	1,456	1.4%	1,246	7.5%	85.6%
Flat other	213	.2%	199	1.1%	89.0%
Rockfish	178	.2%	84	.5%	47.1%
Atka mack	41	.0%	38	.2%	94.0%
Oth/unk	10,466	10.4%	9,202	55.1%	87.9%
Groundfish total	100,970	100.0%	16,703	100.0%	16.5%
1995					
Pollock	3,062	2.6%	2,651	14.8%	86.6%
Pacific cod	100,690	86.0%	3,857	21.6%	3.8%
Rock sole	43	.0%	38	.2%	89.9%
Yellowfin	63	.1%	62	.3%	99.4%
Sablefish	48	.0%	16	.1%	34.0%
Turbot	335	.3%	198	1.1%	58.9%
Arrowtooth	1,756	1.5%	1,565	8.8%	89.1%
Flat other	281	.2%	271	1.5%	96.6%
Rockfish	68	.1%	47	.3%	70.0%
Atka mack	45	.0%	44	.2%	98.5%
Oth/unk	10,685	9.1%	9,115	51.0%	85.2%
Groundfish total	117,034	100.0%	17,866	100.0%	15.3%

Table 1.4.2 Catch and discards of groundfish in the Pacific cod on-shore processing longline fishery, BSAI 1994-95.

	Catch metric tons	Species percent of catch	Discards metric tons	Species percent of discards	Discard rate
1994					
Pollock	T	.0%	0	.5%	100.0%
Pacific cod	245	91.9%	9	59.0%	3.6%
Sablefish	7	2.5%	.	.	.
Arrowtooth	T	.0%	0	.3%	100.0%
Rockfish	2	.8%	2	14.3%	100.0%
Oth/unk	13	4.7%	4	25.3%	29.8%
Groundfish total	267	100.0%	15	100.0%	5.6%
1995					
Pollock	2	.3%	2	1.3%	100.0%
Pacific cod	739	93.7%	133	73.2%	18.0%
Turbot	T	.0%	0	.2%	100.0%
Arrowtooth	8	1.1%	8	4.7%	100.0%
Oth/unk	39	4.9%	38	20.7%	97.3%
Groundfish total	788	100.0%	182	100.0%	23.0%

"T" - Trace amounts (less than 1 mt)

Table 1.5 Catch and discards of groundfish in the Pacific cod trawl fishery, BSAI 1994-95.

	Catch metric tons	Species percent of catch	Discards metric tons	Species percent of discards	Discard rate
1994					
Pollock	23,968	24.8%	21,338	49.6%	89.0%
Pacific cod	53,223	55.1%	5,689	13.2%	10.7%
Rock sole	7,676	8.0%	7,169	16.6%	93.4%
Yellowfin	3,094	3.2%	1,416	3.3%	45.8%
Sablefish	4	.0%	1	.0%	15.9%
Turbot	61	.1%	44	.1%	71.8%
Arrowtooth	2,038	2.1%	2,033	4.7%	99.7%
Flat other	3,252	3.4%	2,527	5.9%	77.7%
Rockfish	356	.4%	298	.7%	83.6%
Atka mack	241	.2%	180	.4%	74.7%
Oth/unk	2,604	2.7%	2,365	5.5%	90.8%
Groundfish total	96,616	100.0%	43,059	100.0%	44.6%
1995					
Pollock	22,530	19.6%	20,394	42.6%	90.5%
Pacific cod	69,801	60.6%	8,085	16.9%	11.6%
Rock sole	13,769	12.0%	11,430	23.9%	83.0%
Yellowfin	699	.6%	347	.7%	49.6%
Sablefish	T	.0%	.	.	.
Turbot	91	.1%	86	.2%	95.3%
Arrowtooth	1,604	1.4%	1,577	3.3%	98.3%
Flat other	3,707	3.2%	3,042	6.4%	82.1%
Rockfish	200	.2%	193	.4%	96.3%
Atka mack	126	.1%	126	.3%	100.0%
Oth/unk	2,626	2.3%	2,566	5.4%	97.7%
Groundfish total	115,154	100.0%	47,848	100.0%	41.6%

"T" - Trace amounts (less than 1 mt)

Table 1.5.1 Catch and discards of groundfish in the Pacific cod at-sea processing trawl fishery, BSAI 1994-95.

	Catch metric tons	Species percent of catch	Discards metric tons	Species percent of discards	Discard rate
1994					
Pollock	10,435	28.1%	8,211	46.8%	78.7%
Pacific cod	17,386	46.9%	2,719	15.5%	15.6%
Rock sole	2,741	7.4%	2,242	12.8%	81.8%
Yellowfin	2,071	5.6%	989	5.6%	47.8%
Sablefish	3	.0%	0	.0%	9.2%
Turbot	58	.2%	41	.2%	70.6%
Arrowtooth	1,186	3.2%	1,186	6.8%	100.0%
Flat other	1,653	4.5%	957	5.4%	57.9%
Rockfish	296	.8%	238	1.4%	80.3%
Atka mack	240	.6%	179	1.0%	74.6%
Oth/unk	1,028	2.8%	794	4.5%	77.3%
Groundfish total	37,099	100.0%	17,557	100.0%	47.3%
1995					
Pollock	12,634	19.3%	10,875	38.3%	86.1%
Pacific cod	37,357	57.1%	4,979	17.5%	13.3%
Rock sole	9,078	13.9%	6,879	24.2%	75.8%
Yellowfin	301	.5%	260	.9%	86.2%
Sablefish	T	.0%	.	.	.
Turbot	69	.1%	64	.2%	93.3%
Arrowtooth	1,285	2.0%	1,259	4.4%	97.9%
Flat other	2,509	3.8%	1,960	6.9%	78.1%
Rockfish	195	.3%	188	.7%	96.4%
Atka mack	124	.2%	124	.4%	100.0%
Oth/unk	1,844	2.8%	1,802	6.3%	97.7%
Groundfish total	65,397	100.0%	28,389	100.0%	43.4%

"T" - Trace amounts (less than 1 mt)

Table 1.5.2 Catch and discards of groundfish in the Pacific cod on-shore processing trawl fishery, BSAI 1994-95.

	Catch metric tons	Species percent of catch	Discards metric tons	Species percent of discards	Discard rate
1994					
Pollock	13,533	22.8%	13,127	51.5%	97.0%
Pacific cod	35,836	60.3%	2,970	11.6%	8.3%
Rock sole	4,935	8.3%	4,927	19.3%	99.9%
Yellowfin	1,023	1.7%	427	1.7%	41.7%
Sablefish	T	.0%	0	.0%	100.0%
Turbot	3	.0%	3	.0%	100.0%
Arrowtooth	852	1.4%	847	3.3%	99.4%
Flat other	1,599	2.7%	1,570	6.2%	98.2%
Rockfish	60	.1%	60	.2%	100.0%
Atka mack	T	.0%	0	.0%	100.0%
Oth/unk	1,576	2.7%	1,571	6.2%	99.7%
Groundfish total	59,418	100.0%	25,503	100.0%	42.9%
1995					
Pollock	9,895	19.9%	9,519	48.9%	96.2%
Pacific cod	32,444	65.2%	3,107	16.0%	9.6%
Rock sole	4,691	9.4%	4,551	23.4%	97.0%
Yellowfin	398	.8%	87	.4%	21.9%
Turbot	22	.0%	22	.1%	100.0%
Arrowtooth	319	.6%	319	1.6%	100.0%
Flat other	1,199	2.4%	1,082	5.6%	90.4%
Rockfish	5	.0%	5	.0%	100.0%
Atka mack	2	.0%	2	.0%	100.0%
Oth/unk	782	1.6%	764	3.9%	97.7%
Groundfish total	49,756	100.0%	19,459	100.0%	39.1%

"T" = Trace amounts (less than 1 mt)

Table 1.6 Catch and discards of groundfish in the Pacific cod pot fishery, BSAI 1994-95.

	Catch metric tons	Species percent of catch	Discards metric tons	Species percent of discards	Discard rate
1994					
Pollock	4	.0%	4	.9%	100.0%
Pacific cod	8,171	97.3%	156	41.5%	1.9%
Rock sole	T	.0%	0	.1%	100.0%
Yellowfin	14	.2%	14	3.9%	100.0%
Arrowtooth	T	.0%	0	.1%	100.0%
Flat other	T	.0%	0	.1%	100.0%
Rockfish	T	.0%	0	.1%	100.0%
Atka mack	6	.1%	6	1.7%	100.0%
Oth/unk	201	2.4%	193	51.5%	96.0%
Groundfish total	8,398	100.0%	375	100.0%	4.5%
1995					
Pollock	15	.1%	15	1.5%	100.0%
Pacific cod	20,059	96.4%	255	26.1%	1.3%
Rock sole	T	.0%	0	.0%	100.0%
Yellowfin	70	.3%	70	7.2%	100.0%
Sablefish	1	.0%	1	.1%	100.0%
Turbot	1	.0%	1	.1%	100.0%
Arrowtooth	16	.1%	16	1.7%	100.0%
Flat other	1	.0%	1	.1%	100.0%
Rockfish	5	.0%	5	.5%	100.0%
Atka mack	77	.4%	77	7.9%	100.0%
Oth/unk	571	2.7%	537	54.9%	94.1%
Groundfish total	20,815	100.0%	978	100.0%	4.7%

"T" - Trace amounts (less than 1 mt)

Table 1.6.1 Catch and discards of groundfish in the Pacific cod at-sea processing pot fishery, BSAI 1994-95.

	Catch metric tons	Species percent of catch	Discards metric tons	Species percent of discards	Discard rate
1994					
Pollock	T	.0%	0	.6%	100.0%
Pacific cod	1,795	97.1%	.	.	.
Rockfish	T	.0%	0	.1%	100.0%
Atka mack	1	.1%	1	2.7%	100.0%
Oth/unk	52	2.8%	50	96.7%	96.2%
Groundfish total	1,849	100.0%	52	100.0%	2.8%
1995					
Pollock	1	.0%	1	.7%	100.0%
Pacific cod	5,316	97.8%	84	43.6%	1.6%
Rock sole	T	.0%	0	.0%	100.0%
Yellowfin	9	.2%	9	4.6%	100.0%
Sablefish	T	.0%	0	.0%	100.0%
Turbot	T	.0%	0	.3%	100.0%
Arrowtooth	1	.0%	1	.8%	100.0%
Rockfish	1	.0%	1	.4%	100.0%
Atka mack	4	.1%	4	2.2%	100.0%
Oth/unk	105	1.9%	91	47.4%	87.2%
Groundfish total	5,438	100.0%	193	100.0%	3.3%

"T" - Trace amounts (less than 1 mt)

Table 1.6.2 Catch and discards of groundfish in the Pacific cod on-shore processing pot fishery, BSAI 1994-95.

	Catch metric tons	Species percent of catch	Discards metric tons	Species percent of discards	Discard rate
1994					
Pollock	3	.0%	3	1.0%	100.0%
Pacific cod	6,376	97.3%	156	48.2%	2.4%
Rock sole	T	.0%	0	.1%	100.0%
Yellowfin	14	.2%	14	4.5%	100.0%
Arrowtooth	T	.0%	0	.1%	100.0%
Flat other	T	.0%	0	.1%	100.0%
Rockfish	T	.0%	0	.1%	100.0%
Atka mack	5	.1%	5	1.5%	100.0%
Oth/unk	149	2.3%	143	44.3%	95.9%
Groundfish total	6,549	100.0%	323	100.0%	4.9%
1995					
Pollock	13	.1%	13	1.7%	100.0%
Pacific cod	14,744	95.9%	171	21.8%	1.2%
Yellowfin	61	.4%	61	7.8%	100.0%
Sablefish	1	.0%	1	.1%	100.0%
Turbot	1	.0%	1	.1%	100.0%
Arrowtooth	15	.1%	15	1.9%	100.0%
Flat other	1	.0%	1	.1%	100.0%
Rockfish	4	.0%	4	.5%	100.0%
Atka mack	73	.5%	73	9.3%	100.0%
Oth/unk	466	3.0%	446	56.8%	95.7%
Groundfish total	15,378	100.0%	785	100.0%	5.1%

"T" - Trace amounts (less than 1 mt)

Table 1.7 Catch and discards of groundfish in the sablefish longline fishery, 1994-1995

	Catch metric tons	Species percent of catch	Discards metric tons	Species percent of discards	Discard rate
1994					
Pollock	T	.0%	0	.0%	100.0%
Pacific cod	21	.5%	11	.4%	51.6%
Sablefish	1,599	35.2%	23	.9%	1.4%
Turbot	2,305	50.7%	2,122	83.2%	92.1%
Arrowtooth	231	5.1%	231	9.1%	100.0%
Flat other	1	.0%	1	.0%	100.0%
Rockfish	253	5.6%	29	1.1%	11.4%
Oth/unk	136	3.0%	135	5.3%	99.2%
Groundfish total	4,546	100.0%	2,551	100.0%	56.1%
1995					
Pollock	4	.1%	4	.1%	100.0%
Pacific cod	1,317	25.6%	1,279	36.7%	97.1%
Rock sole	T	.0%	0	.0%	100.0%
Sablefish	1,319	25.7%	12	.4%	.9%
Turbot	1,633	31.8%	1,483	42.6%	90.5%
Arrowtooth	287	5.6%	287	8.2%	100.0%
Flat other	T	.0%	0	.0%	100.0%
Rockfish	248	4.8%	84	2.4%	34.1%
Oth/unk	330	6.4%	330	9.5%	99.9%
Groundfish total	5,143	100.0%	3,479	100.0%	67.6%

"T" - Trace amounts (less than 1 mt)

Table 1.7.1 Catch and discards of groundfish in the sablefish at-sea processing longline fishery, 1994-1995

	Catch metric tons	Species percent of catch	Discards metric tons	Species percent of discards	Discard rate
1994					
Pollock	T	.0%	0	.0%	100.0%
Pacific cod	20	.8%	10	1.0%	48.5%
Sablefish	1,264	49.1%	11	1.1%	.9%
Turbot	802	31.2%	657	67.3%	81.9%
Arrowtooth	204	7.9%	204	20.9%	100.0%
Flat other	1	.0%	1	.1%	100.0%
Rockfish	206	8.0%	19	2.0%	9.4%
Oth/unk	76	2.9%	75	7.6%	98.6%
Groundfish total	2,573	100.0%	977	100.0%	38.0%
1995					
Pollock	4	.2%	4	.5%	100.0%
Pacific cod	46	2.7%	13	1.7%	28.8%
Rock sole	T	.0%	0	.1%	100.0%
Sablefish	686	40.6%	6	.7%	.8%
Turbot	581	34.4%	466	60.5%	80.2%
Arrowtooth	154	9.1%	154	20.0%	100.0%
Flat other	T	.0%	0	.0%	100.0%
Rockfish	127	7.5%	37	4.8%	29.0%
Oth/unk	90	5.3%	90	11.6%	99.5%
Groundfish total	1,689	100.0%	770	100.0%	45.6%

"T" = Trace amounts (less than 1 mt)

Table 1.7.2 Catch and discards of groundfish in the sablefish on-shore processing longline fishery, 1994-1995

	Catch metric tons	Species percent of catch	Discards metric tons	Species percent of discards	Discard rate
1994					
Pacific cod	1	.1%	1	.1%	100.0%
Sablefish	335	17.0%	11	.7%	3.4%
Turbot	1,502	76.2%	1,465	93.0%	97.5%
Arrowtooth	27	1.4%	27	1.7%	100.0%
Flat other	T	.0%	0	.0%	100.0%
Rockfish	46	2.4%	9	.6%	20.4%
Oth/unk	60	3.1%	60	3.8%	99.9%
Groundfish total	1,973	100.0%	1,575	100.0%	79.8%
1995					
Pollock	T	.0%	0	.0%	100.0%
Pacific cod	1,271	36.8%	1,265	46.7%	99.6%
Sablefish	633	18.3%	7	.2%	1.1%
Turbot	1,057	30.6%	1,017	37.5%	96.2%
Arrowtooth	132	3.8%	132	4.9%	100.0%
Flat other	T	.0%	0	.0%	100.0%
Rockfish	120	3.5%	47	1.8%	39.4%
Oth/unk	240	6.9%	240	8.9%	100.0%
Groundfish total	3,455	100.0%	2,709	100.0%	78.4%

"T" - Trace amounts (less than 1 mt)

Table 1.8 Catch and discards of groundfish in the sablefish at-sea processing trawl fishery, 1994-1995

	Catch metric tons	Species percent of catch	Discards metric tons	Species percent of discards	Discard rate
1994					
Pollock	7	1.4%	7	1.7%	100.0%
Sablefish	61	12.6%	.	.	.
Turbot	192	39.6%	180	46.0%	94.0%
Arrowtooth	157	32.4%	157	40.1%	100.0%
Flat other	15	3.0%	8	2.0%	53.4%
Rockfish	21	4.4%	13	3.4%	61.7%
Oth/unk	31	6.5%	27	6.9%	85.4%
Groundfish total	484	100.0%	392	100.0%	80.9%
1995					
Sablefish	41	20.5%	.	.	.
Turbot	71	35.4%	71	49.7%	100.0%
Arrowtooth	58	28.8%	58	40.5%	100.0%
Flat other	5	2.5%	5	3.6%	100.0%
Rockfish	5	2.3%	3	1.9%	57.9%
Oth/unk	21	10.4%	6	4.3%	29.4%
Groundfish total	202	100.0%	144	100.0%	71.1%

Table 1.9 Catch and discards of groundfish in the Greenland turbot longline fishery, 1994-1995

	Catch metric tons	Species percent of catch	Discards metric tons	Species percent of discards	Discard rate
1994					
Pollock	T	.0%	0	.0%	100.0%
Pacific cod	40	2.5%	2	.7%	4.2%
Sablefish	146	9.1%	3	1.2%	2.1%
Turbot	1,228	76.2%	85	34.1%	6.9%
Arrowtooth	86	5.4%	86	34.7%	100.0%
Flat other	T	.0%	0	.2%	100.0%
Rockfish	42	2.6%	3	1.3%	7.9%
Oth/unk	69	4.3%	69	27.8%	100.0%
Groundfish total	1,612	100.0%	250	100.0%	15.5%
1995					
Pollock	1	.0%	1	.1%	100.0%
Pacific cod	60	1.9%	16	1.9%	25.8%
Rock sole	1	.0%	1	.1%	100.0%
Sablefish	245	7.7%	122	15.1%	49.9%
Turbot	2,229	70.3%	103	12.7%	4.6%
Arrowtooth	150	4.7%	135	16.7%	90.0%
Flat other	3	.1%	3	.3%	92.1%
Rockfish	45	1.4%	2	.2%	3.8%
Oth/unk	437	13.8%	428	52.8%	98.0%
Groundfish total	3,171	100.0%	811	100.0%	25.6%

"T" - Trace amounts (less than 1 mt)

Table 1.9.1 Catch and discards of groundfish in the Greenland turbot at-sea processing longline fishery, 1994-1995

	Catch metric tons	Species percent of catch	Discards metric tons	Species percent of discards	Discard rate
1994					
Pollock	T	.0%	0	.0%	100.0%
Pacific cod	40	3.7%	1	.7%	3.1%
Sablefish	105	9.7%	3	1.5%	2.6%
Turbot	778	72.0%	52	28.9%	6.6%
Arrowtooth	58	5.4%	58	32.7%	100.0%
Flat other	T	.0%	0	.3%	100.0%
Rockfish	38	3.5%	3	1.7%	8.1%
Oth/unk	61	5.7%	61	34.2%	100.0%
Groundfish total	1,080	100.0%	179	100.0%	16.6%
1995					
Pollock	1	.0%	1	.1%	100.0%
Pacific cod	56	1.9%	16	2.0%	27.9%
Rock sole	1	.0%	1	.1%	100.0%
Sablefish	203	6.8%	120	15.2%	59.0%
Turbot	2,105	70.6%	96	12.2%	4.6%
Arrowtooth	140	4.7%	125	15.9%	89.3%
Flat other	3	.1%	3	.3%	92.1%
Rockfish	40	1.4%	2	.2%	4.0%
Oth/unk	432	14.5%	423	53.9%	98.0%
Groundfish total	2,981	100.0%	736	100.0%	26.4%

"T" - Trace amounts (less than 1 mt)

Table 1.9.2 Catch and discards of groundfish in the Greenland turbot on-shore processing longline fishery, 1994-1995

	Catch metric tons	Species percent of catch	Discards metric tons	Species percent of discards	Discard rate
1994					
Pollock	T	.0%	0	.1%	100.0%
Pacific cod	T	.1%	0	.6%	100.0%
Sablefish	41	7.8%	0	.5%	.9%
Turbot	450	84.6%	33	47.2%	7.4%
Arrowtooth	28	5.3%	28	39.6%	100.0%
Rockfish	4	.8%	0	.3%	5.7%
Oth/unk	8	1.6%	8	11.7%	100.0%
Groundfish total	532	100.0%	71	100.0%	13.3%
1995					
Pacific cod	5	2.4%	.	.	.
Sablefish	42	21.9%	2	9.1%	5.4%
Turbot	124	65.3%	7	28.6%	5.8%
Arrowtooth	10	5.5%	10	41.9%	100.0%
Rockfish	4	2.3%	0	.3%	1.5%
Oth/unk	5	2.6%	5	20.0%	100.0%
Groundfish total	190	100.0%	25	100.0%	13.1%

"T" - Trace amounts (less than 1 mt)

Table 1.10 Catch and discards of groundfish in the Greenland turbot trawl fishery, 1994-1995

	Catch metric tons	Species percent of catch	Discards metric tons	Species percent of discards	Discard rate
1994					
Pollock	14	.2%	14	.9%	100.0%
Pacific cod	3	.0%	2	.1%	54.6%
Sablefish	307	4.6%	44	2.8%	14.4%
Turbot	4,988	74.4%	283	17.7%	5.7%
Arrowtooth	1,157	17.3%	1,104	69.2%	95.4%
Flat other	45	.7%	21	1.3%	47.0%
Rockfish	84	1.2%	19	1.2%	22.8%
Oth/unk	109	1.6%	108	6.8%	99.2%
Groundfish total	6,707	100.0%	1,595	100.0%	23.8%
1995					
Pollock	47	.8%	47	2.0%	100.0%
Pacific cod	50	.9%	35	1.5%	68.6%
Rock sole	1	.0%	1	.0%	100.0%
Yellowfin	5	.1%	5	.2%	100.0%
Sablefish	308	5.3%	23	1.0%	7.5%
Turbot	3,175	54.2%	213	9.2%	6.7%
Arrowtooth	1,826	31.2%	1,756	75.8%	96.2%
Flat other	110	1.9%	71	3.1%	64.7%
Rockfish	161	2.8%	46	2.0%	28.6%
Oth/unk	174	3.0%	120	5.2%	68.8%
Groundfish total	5,857	100.0%	2,317	100.0%	39.6%

Table 1.10.1 Catch and discards of groundfish in the Greenland turbot at-sea processing trawl fishery, 1994-1995

	Catch metric tons	Species percent of catch	Discards metric tons	Species percent of discards	Discard rate
1994					
Pollock	14	.2%	14	.9%	100.0%
Pacific cod	3	.0%	2	.1%	54.6%
Sablefish	307	4.6%	44	2.8%	14.4%
Turbot	4,988	74.4%	283	17.7%	5.7%
Arrowtooth	1,157	17.3%	1,104	69.2%	95.4%
Flat other	45	.7%	21	1.3%	47.0%
Rockfish	84	1.2%	19	1.2%	22.8%
Oth/unk	109	1.6%	108	6.8%	99.2%
Groundfish total	6,707	100.0%	1,595	100.0%	23.8%
1995					
Pollock	35	.8%	35	2.0%	100.0%
Pacific cod	41	.9%	34	2.0%	84.0%
Rock sole	1	.0%	1	.0%	100.0%
Yellowfin	4	.1%	4	.2%	100.0%
Sablefish	234	5.1%	22	1.3%	9.6%
Turbot	2,617	56.6%	178	10.2%	6.8%
Arrowtooth	1,382	29.9%	1,312	75.4%	94.9%
Flat other	73	1.7%	39	2.2%	50.1%
Rockfish	136	2.9%	34	2.0%	25.3%
Oth/unk	94	2.0%	30	1.6%	35.5%
Groundfish total	4,623	100.0%	1,741	100.0%	37.7%

Table 1.10.2 Catch and discards of groundfish in the Greenland turbot on-shore processing trawl fishery, 1994-1995

	Catch metric tons	Species percent of catch	Discards metric tons	Species percent of discards	Discard rate
1995					
Pollock	11	.9%	11	2.0%	100.0%
Pacific cod	9	.8%	0	.0%	.7%
Yellowfin	T	.0%	0	.0%	100.0%
Sablefish	74	6.0%	1	.1%	.3%
Turbot	558	45.2%	35	6.1%	6.3%
Arrowtooth	444	36.0%	444	77.2%	100.0%
Flat other	32	2.6%	32	5.6%	100.0%
Rockfish	25	2.0%	12	2.0%	46.8%
Oth/unk	80	6.5%	40	6.9%	49.3%
Groundfish total	1,234	100.0%	575	100.0%	46.6%

"T" - Trace amounts (less than 1 mt)

Table 1.11 Catch and discards of groundfish in the rock sole at-sea processing trawl fishery, BSAI 1994-95.

	Catch metric tons	Species percent of catch	Discards metric tons	Species percent of discards	Discard rate
1994					
Pollock	14,922	20.6%	13,948	27.7%	93.5%
Pacific cod	5,594	7.7%	3,710	7.4%	66.3%
Rock sole	39,693	54.7%	23,141	46.0%	58.3%
Yellowfin	5,334	7.4%	3,472	6.9%	65.1%
Turbot	9	.0%	9	.0%	100.0%
Arrowtooth	619	.9%	619	1.2%	100.0%
Flat other	3,606	5.0%	2,759	5.5%	76.5%
Rockfish	1	.0%	1	.0%	100.0%
Oth/unk	2,765	3.8%	2,691	5.3%	97.3%
Groundfish total	72,543	100.0%	50,350	100.0%	69.4%
1995					
Pollock	7,593	13.3%	6,596	21.8%	86.9%
Pacific cod	9,610	16.8%	5,082	16.8%	52.9%
Rock sole	29,034	50.7%	13,498	44.5%	46.5%
Yellowfin	6,599	11.5%	1,853	6.1%	28.1%
Turbot	3	.0%	3	.0%	100.0%
Arrowtooth	200	.3%	196	.6%	98.1%
Flat other	2,646	4.6%	1,579	5.2%	59.7%
Oth/unk	1,543	2.7%	1,513	5.0%	98.1%
Groundfish total	57,227	100.0%	30,318	100.0%	53.0%

Table 1.12 Catch and discards of groundfish in the yellowfin sole trawl fishery, BSAI 1994-95.

	Catch metric tons	Species percent of catch	Discards metric tons	Species percent of discards	Discard rate
1994					
Pollock	32,837	16.3%	31,186	35.8%	95.0%
Pacific cod	15,861	7.9%	8,682	10.0%	54.7%
Rock sole	8,097	4.0%	5,518	6.3%	68.2%
Yellowfin	126,163	62.5%	27,914	32.0%	22.1%
Turbot	5	.0%	5	.0%	100.0%
Arrowtooth	1,568	.8%	1,525	1.7%	97.3%
Flat other	12,423	6.2%	8,502	9.8%	68.4%
Oth/unk	4,932	2.4%	3,856	4.4%	78.2%
Groundfish total	201,884	100.0%	87,187	100.0%	43.2%
1995					
Pollock	25,864	15.8%	21,912	32.8%	84.7%
Pacific cod	11,504	7.0%	6,483	9.7%	56.3%
Rock sole	7,200	4.4%	4,910	7.4%	68.2%
Yellowfin	101,252	61.7%	21,341	32.0%	21.1%
Turbot	64	.0%	64	.1%	100.0%
Arrowtooth	306	.2%	291	.4%	95.1%
Flat other	15,056	9.2%	9,087	13.6%	60.4%
Rockfish	3	.0%	3	.0%	100.0%
Oth/unk	2,819	1.7%	2,617	3.9%	92.9%
Groundfish total	164,063	100.0%	66,707	100.0%	40.7%

Table 1.12.1 Catch and discards of groundfish in the yellowfin sole at-sea processing trawl fishery, BSAI 1994-95.

	Catch metric tons	Species percent of catch	Discards metric tons	Species percent of discards	Discard rate
1994					
Pollock	32,420	16.8%	30,769	35.6%	94.9%
Pacific cod	15,772	8.2%	8,593	9.9%	54.5%
Rock sole	7,924	4.1%	5,500	6.4%	69.4%
Yellowfin	118,880	61.8%	27,788	32.2%	23.4%
Turbot	5	.0%	5	.0%	100.0%
Arrowtooth	1,568	.8%	1,525	1.8%	97.3%
Flat other	11,986	6.2%	8,376	9.7%	69.9%
Oth/unk	3,901	2.0%	3,812	4.4%	97.7%
Groundfish total	192,455	100.0%	86,367	100.0%	44.9%
1995					
Pollock	25,864	15.8%	21,912	32.8%	84.7%
Pacific cod	11,504	7.0%	6,483	9.7%	56.3%
Rock sole	7,200	4.4%	4,910	7.4%	68.2%
Yellowfin	101,252	61.7%	21,341	32.0%	21.1%
Turbot	64	.0%	64	.1%	100.0%
Arrowtooth	306	.2%	291	.4%	95.1%
Flat other	15,056	9.2%	9,087	13.6%	60.4%
Rockfish	3	.0%	3	.0%	100.0%
Oth/unk	2,819	1.7%	2,617	3.9%	92.9%
Groundfish total	164,068	100.0%	66,707	100.0%	40.7%

Table 1.12.2 Catch and discards of groundfish in the yellowfin sole on-shore processing trawl fishery, BSAI 1994-95.

	Catch metric tons	Species percent of catch	Discards metric tons	Species percent of discards	Discard rate
1994					
Pollock	417	4.4%	417	50.9%	100.0%
Pacific cod	89	.9%	89	10.9%	100.0%
Rock sole	172	1.8%	18	2.2%	10.6%
Yellowfin	7,283	77.2%	126	15.4%	1.7%
Flat other	437	4.6%	126	15.3%	28.8%
Oth/unk	1,032	10.9%	44	5.3%	4.2%
Groundfish total	9,429	100.0%	820	100.0%	8.7%

Table 1.13 Catch and discards of groundfish in the flathead sole at-sea processing trawl fishery, BSAI 1994-95.

	Catch metric tons	Species percent of catch	Discards metric tons	Species percent of discards	Discard rate
1995					
Pollock	1,852	17.5%	1,694	29.0%	91.5%
Pacific cod	1,120	10.6%	562	9.6%	50.2%
Rock sole	788	7.4%	515	8.8%	65.4%
Yellowfin	1,307	12.3%	611	10.5%	46.7%
Turbot	22	.2%	20	.3%	93.2%
Arrowtooth	774	7.3%	771	13.2%	99.6%
Flat other	3,920	37.0%	870	14.9%	22.2%
Rockfish	54	.5%	53	.9%	98.9%
Oth/unk	749	7.1%	746	12.8%	99.7%
Groundfish total	10,585	100.0%	5,842	100.0%	55.2%

Table 1.14 Catch and discards of groundfish in the other flat at-sea processing trawl fishery, BSAI 1994-95.

	Catch metric tons	Species percent of catch	Discards metric tons	Species percent of discards	Discard rate
1994					
Pollock	7,614	26.6%	7,547	38.5%	99.1%
Pacific cod	2,310	8.1%	1,001	5.1%	43.3%
Rock sole	917	3.2%	474	2.4%	51.7%
Yellowfin	4,024	14.1%	1,301	6.6%	32.3%
Sablefish	31	.1%	16	.1%	51.3%
Turbot	246	.9%	222	1.1%	90.2%
Arrowtooth	4,035	14.1%	4,035	20.6%	100.0%
Flat other	6,356	22.3%	2,211	11.3%	33.7%
Rockfish	279	1.0%	254	1.3%	91.1%
Oth/unk	2,565	9.0%	2,560	13.0%	99.8%
Groundfish total	28,577	100.0%	19,621	100.0%	68.7%
1995					
Pollock	3,594	17.5%	3,254	29.2%	90.6%
Pacific cod	1,916	9.3%	1,091	9.8%	57.0%
Rock sole	1,394	6.8%	842	7.6%	60.4%
Yellowfin	6,956	33.9%	3,090	27.8%	44.4%
Sablefish	4	.0%	.	.	.
Turbot	11	.1%	11	.1%	100.0%
Arrowtooth	462	2.3%	462	4.1%	100.0%
Flat other	5,350	26.1%	1,577	14.2%	29.5%
Rockfish	12	.1%	6	.1%	53.1%
Oth/unk	798	3.9%	798	7.2%	100.0%
Groundfish total	20,496	100.0%	11,131	100.0%	54.3%

Table 1.15 Catch and discards of groundfish in the rockfish at-sea processing trawl fishery, BSAI 1994-95.

	Catch metric tons	Species percent of catch	Discards metric tons	Species percent of discards	Discard rate
1994					
Pollock	433	2.9%	416	14.1%	96.2%
Pacific cod	447	3.0%	151	5.1%	33.8%
Rock sole	17	.1%	16	.5%	92.1%
Sablefish	75	.5%	10	.3%	12.8%
Turbot	348	2.3%	33	1.1%	9.6%
Arrowtooth	601	4.0%	543	18.4%	90.4%
Flat other	39	.3%	37	1.3%	96.0%
Rockfish	11,606	76.8%	1,169	39.7%	10.1%
Atka mack	1,339	8.9%	394	13.4%	29.4%
Oth/unk	198	1.3%	174	5.9%	88.1%
Groundfish total	15,102	100.0%	2,943	100.0%	19.5%
1995					
Pollock	313	2.3%	313	12.8%	100.0%
Pacific cod	234	1.7%	104	4.3%	44.6%
Rock sole	22	.2%	18	.7%	81.9%
Sablefish	24	.2%	1	.0%	4.0%
Turbot	384	2.8%	25	1.0%	6.5%
Arrowtooth	387	2.9%	367	15.0%	94.7%
Flat other	10	.1%	5	.2%	47.8%
Rockfish	10,791	80.0%	831	33.9%	7.7%
Atka mack	1,180	8.7%	691	28.2%	58.5%
Oth/unk	151	1.1%	98	4.0%	65.2%
Groundfish total	13,493	100.0%	2,453	100.0%	18.2%

Table 1.16 Catch and discards of groundfish in the Atka mackerel at-sea processing trawl fishery, BSAI 1994-95.

	Catch metric tons	Species percent of catch	Discards metric tons	Species percent of discards	Discard rate
1994					
Pollock	358	.5%	256	1.6%	71.3%
Pacific cod	6,857	8.9%	2,063	13.2%	30.1%
Rock sole	64	.1%	53	.3%	83.5%
Sablefish	1	.0%	.	.	.
Turbot	46	.1%	13	.1%	29.7%
Arrowtooth	139	.2%	139	.9%	100.0%
Flat other	21	.0%	21	.1%	100.0%
Rockfish	5,649	7.3%	4,127	26.4%	73.1%
Atka mack	63,612	82.4%	8,587	54.8%	13.5%
Oth/unk	421	.5%	398	2.5%	94.5%
Groundfish total	77,168	100.0%	15,653	100.0%	20.3%
1995					
Pollock	358	.4%	358	1.8%	100.0%
Pacific cod	4,455	4.9%	1,630	8.1%	36.6%
Rock sole	138	.2%	112	.6%	81.1%
Sablefish	3	.0%	.	.	.
Turbot	37	.0%	10	.1%	28.0%
Arrowtooth	118	.1%	118	.6%	100.0%
Flat other	18	.0%	18	.1%	100.0%
Rockfish	4,856	5.4%	3,662	18.3%	75.4%
Atka mack	79,323	88.4%	13,669	68.2%	17.1%
Oth/unk	431	.5%	472	2.4%	98.2%
Groundfish total	90,287	100.0%	20,051	100.0%	22.2%

Appendix B: Size Composition of Bycatch in IR/IU Fisheries

The following table identifies the "size composition" of discarded Alaska pollock, Pacific cod, yellowfin sole, and rock sole whenever present in BSAI groundfish fisheries, using a binary qualifying criterion. Specifically, based upon prevailing "minimum" marketable size (as expressed in round-weight-equivalent terms and reported by industry sources), the percentage of bycatch discards of each species of concern, composed of fish above and below the market threshold, was calculated.

NMFS Observer "length frequency" data, for 1994 and 1995, were employed in this calculation. Only BSAI groundfish target fisheries potentially impacted by the proposed IR/IU action were included. Length frequency data are generally collected only for the "predominant" groundfish species in the catch, e.g., Pacific cod in a cod target, yellowfin in a yellowfin target. Thus, for purposes of the analysis, it was assumed that the frequency distribution of any given species of concern was approximately constant across all targets.

Percent of "marketable" and "non-marketable" discards, by species, were computed on the basis of the following "minimum" length thresholds: Pacific cod - 47 cm; Pollock - 33 cm; Rock sole - 29 cm; Yellowfin - sole 28 cm. Length/weight ratios were based upon BSAI Alaska Fisheries Science Center's Stock Assessment and Fishery Evaluation (SAFE) documents, by species.

Estimated Pacific cod, pollock, rock sole and yellowfin sole discards (mt), percentage of discards of marketable size and smaller than marketable size fish in the BSAI, by processor type, gear, HR/HU species and target fishery ,1994-95.

	1994			1995		
	Discard	marketable	non-marketable	Discard	marketable	non-marketable
Mothership & C/P						
Jig						
(Pollock Bycatch)						
Pacific cod	.0	.0	.0	.3	99.8	.2
Longline						
(Pacific cod Bycatch)						
Pacific cod	3,118.8	84.3	15.7	3,857.1	77.3	22.7
Other gf	3.1	99.4	.6	93.9	99.1	.9
Sablefish	9.7	98.8	1.2	13.2	97.0	3.0
G. turbot	1.5	75.2	24.8	15.6	96.9	3.1
(Rock sole Bycatch)						
Pacific cod	23.3	77.8	22.2	38.3	78.0	22.0
Sablefish	.0	.0	.0	.4	80.2	19.8
G. turbot	.0	.0	.0	.7	18.3	81.7
(Yellowfin Bycatch)						
Pacific cod	151.4	89.0	11.0	62.1	86.4	13.6
(Pollock Bycatch)						
Pacific cod	2,473.9	99.9	.1	2,651.4	100.0	.0
Other gf	30.7	98.6	1.4	1.8	100.0	.0
Sablefish	.2	100.0	.0	4.2	100.0	.0
G. turbot	1.3	100.0	.0	1.2	100.0	.0
Pot						
(Pacific cod Bycatch)						
Atka mackerel	7.0	99.9	.1	.0	.0	.0
Pacific cod	5.6	57.0	43.0	84.1	88.3	11.7

	1994			1995		
	Discard	marketable	non-marketable	Discard	marketable	non-marketable
Mothership & C/P						
Pot (cont.)						
(Yellowfin Bycatch)						
Pacific cod	.2	89.0	11.0	8.9	86.5	13.5
(Pollock Bycatch)						
Pacific cod	.3	100.0	.0	1.4	100.0	.0
Trawl						
(Pacific cod Bycatch)						
Atka mackerel	2,062.5	89.8	10.2	1,630.2	82.1	17.9
Bottom pollock	3,559.1	94.8	5.2	7,166.4	91.5	8.5
Pacific cod	2,458.6	78.6	21.4	4,993.7	51.2	48.8
Other flats	705.0	92.3	7.7	1,027.1	88.3	11.7
Rockfish	151.4	91.0	9.0	104.4	85.3	14.7
Flathead sole	.0	.0	.0	556.9	86.9	13.1
Other gf	45.1	94.3	5.7	12.2	93.2	6.8
Pelagic pollock	4,099.4	96.5	3.5	5,912.8	93.0	7.0
Rock sole	3,703.0	95.4	4.6	5,159.0	87.7	12.3
Sablefish	1.6	94.0	6.0	.2	93.5	6.5
G. turbot	1.7	94.4	5.6	34.5	92.2	7.8
Yellowfin	9,166.2	94.4	5.6	6,464.5	88.4	11.6
(Rock sole Bycatch)						
Atka mackerel	53.3	75.0	25.0	111.8	75.7	24.3
Bottom pollock	2,035.5	73.3	26.7	1,302.9	74.5	25.5
Pacific cod	2,271.7	74.7	25.3	6,865.9	73.9	26.1
Other flats	350.7	53.8	46.2	814.3	68.1	31.9
Rockfish	15.9	77.4	22.6	17.7	75.9	24.1
Flathead sole	.0	.0	.0	515.1	70.4	29.6
Other gf	6.6	78.2	21.8	5.5	78.4	21.6
Pelagic pollock	298.7	78.8	21.2	420.6	77.0	23.0
Rock sole	23,100.0	64.2	35.8	13,570.8	57.5	42.5
G. turbot	1.0	79.2	20.8	.7	80.3	19.7
Yellowfin	5,818.2	70.3	29.7	4,853.9	71.1	28.9

	1994			1995		
	Discard	marketable	non-marketable	Discard	marketable	non-marketable
Mothership & C/P						
Trawl [cont.]						
(Yellowfin Bycatch)						
Atka mackerel	.1	89.0	11.0	1.8	70.8	29.2
Bottom pollock	676.8	84.7	15.3	550.3	79.4	20.6
Pacific cod	131.4	85.1	14.9	259.9	83.8	16.2
Other flats	408.6	77.7	22.3	3,053.4	68.6	31.4
Rockfish	25.0	78.9	21.1	.0	.0	.0
Flathead sole	.0	.0	.0	610.6	70.2	29.8
Other gf	109.5	78.7	21.3	7.1	86.1	13.9
Pelagic pollock	114.9	88.7	11.3	135.8	85.8	14.2
Rock sole	3,470.5	83.1	16.9	1,934.4	51.7	48.3
G. turbot	.0	.0	.0	4.3	43.7	56.3
Yellowfin	29,474.9	53.7	46.3	21,186.6	33.6	66.4
(Pollock Bycatch)						
Atka mackerel	255.6	99.5	.5	358.3	99.7	.3
Bottom pollock	7,798.2	91.4	8.6	5,398.9	92.8	7.2
Pacific cod	6,838.2	99.5	.5	10,809.2	99.6	.4
Other flats	2,434.5	99.6	.4	3,217.8	99.6	.4
Rockfish	416.2	99.6	.4	312.9	99.6	.4
Flathead sole	.0	.0	.0	1,638.0	99.6	.4
Other gf	120.0	99.6	.4	7.0	99.7	.3
Pelagic pollock	16,044.6	80.8	19.2	30,437.6	92.2	7.8
Rock sole	13,923.6	99.5	.5	6,719.2	99.6	.4
Sablefish	6.7	99.6	.4	3.0	99.7	.3
G. turbot	13.9	99.6	.4	35.2	99.7	.3
Yellowfin	37,273.9	99.6	.4	21,714.5	99.6	.4

Shoreside processor	1994 Discard	1994 marketable	1994 non-marketable	1995 Discard	1995 marketable	1995 non-marketable
Jig						
(Pacific cod Bycatch)						
Pacific cod	.0	.0	.0	2.7	100.0	.0
(Pollock Bycatch)						
Pacific cod	13.8	99.7	.3	2.1	99.8	.2
Longline						
(Pacific cod Bycatch)						
Pacific cod	8.8	35.8	64.2	132.9	87.2	12.8
Rockfish	.0	.0	.0	5.8	97.7	2.3
Sablefish	1.3	97.7	2.3	1,265.4	97.7	2.3
G. turbot	.4	97.7	2.3	.0	.0	.0
(Yellowfin Bycatch)						
Sablefish	.1	89.0	11.0	.0	.0	.0
(Pollock Bycatch)						
Pacific cod	.1	100.0	.0	2.3	100.0	.0
Sablefish	.0	.0	.0	.1	100.0	.0
Pot						
(Pacific cod Bycatch)						
Pacific cod	155.8	81.2	18.8	171.0	70.9	29.1
Sablefish	.0	.0	.0	.8	99.7	.3
(Rock sole Bycatch)						
Pacific cod	.2	79.1	20.9	.0	.0	.0
(Yellowfin Bycatch)						
Pacific cod	14.5	89.0	11.0	61.1	85.1	14.9
(Pollock Bycatch)						
Pacific cod	3.2	100.0	.0	13.2	100.0	.0

Shoreside processor	1994 Discard	1994 marketable	1994 non-marketable	1995 Discard	1995 marketable	1995 non-marketable
Trawl (cont.)						
(Pacific cod Bycatch)						
Bottom pollock	45.0	88.8	11.2	290.1	92.8	7.2
Pacific cod	2,970.2	52.3	47.7	3,107.4	49.0	51.0
Other gf	5.7	96.0	4.0	5.1	95.1	4.9
Pelagic pollock	480.1	73.4	26.6	977.2	81.2	18.8
Sablefish	.4	96.0	4.0	.0	.0	.0
G. turbot	.0	.0	.0	.1	.0	100.0
Yellowfin	89.1	71.4	28.6	79.8	.0	100.0
(Rock sole Bycatch)						
Bottom pollock	.4	.0	100.0	5.2	58.0	42.0
Pacific cod	4,927.5	40.1	59.9	4,551.0	60.8	39.2
Pelagic pollock	1.5	.0	100.0	17.0	31.5	68.5
G. turbot	.1	.0	100.0	.0	.0	.0
Yellowfin	18.2	.0	100.0	15.6	.0	100.0
(Yellowfin Bycatch)						
Bottom pollock	.0	.0	.0	.1	90.6	9.4
Pacific cod	426.6	76.0	24.0	87.2	56.9	43.1
Pelagic pollock	1.0	.0	100.0	2.2	78.6	21.4
G. turbot	.1	84.8	15.2	.2	90.1	9.9
Yellowfin	126.1	.0	100.0	56.2	.0	100.0
(Pollock Bycatch)						
Bottom pollock	247.7	99.3	.7	356.9	99.4	.6
Pacific cod	13,126.6	99.9	.1	9,519.2	100.0	.0
Other gf	45.8	99.9	.1	50.4	100.0	.0
Pelagic pollock	4,073.1	92.8	7.2	5,215.2	97.2	2.8
Sablefish	.1	99.9	.1	.0	.0	.0
G. turbot	5.9	99.9	.1	11.5	100.0	.0
Yellowfin	417.3	99.9	.1	319.1	99.9	.1

Appendix C: IR/IU "Phase-in" Schedule Impacts, By Target Fishery

The following series of tables describe the incremental increase in retention of rock sole (Tables C-1.1 and C-2.1) and yellowfin sole (Tables C-1.2 and C-2.2) which would have been required under IR suboption A, by target fishery, mode of operation, and (for catcher/processors) vessel size category.[34] The performance estimates are based upon 1994 and 1995 groundfish catch, retention, and discard data. The "two-year" schedule would begin at 60% retention in year one, increase to 80% in year two, with 100% retention required in year three. The "five-year" schedule would begin at 60%, then increase by 10% per year, until reaching 100% retention in the fifth year.

[34] All motherships are, by assumption, larger than 124' in length.

Table C-1.1 Rock Sole "Phase-in" Schedule (1994 Base Year Catch).

			[Additional retention required, mt]				
	Retain	Discard	60%	70%	80%	90%	100%
Motherships							
Bottom pollock	7.3	23.1	11.0	14.0	17.0	20.1	23.1
Pacific cod	.0	46.6	27.9	32.6	37.3	41.9	46.6
Pelagic pollock	.5	76.7	45.8	53.5	61.2	69.0	76.7
Rock sole	110.0	33.1	.0	.0	4.5	18.8	33.1
Yellowfin sole	59.4	2.0	.0	.0	.0	.0	2.0
Catcher/Processors							
[60°-124°]							
Atka Mackerel	.0	.1	.0	.1	.1	.1	.1
Bottom pollock	.0	.0	.0	.0	.0	.0	.0
Pacific cod	140.6	323.5	137.9	184.1	230.7	277.1	323.5
O. flats	28.1	10.3	.0	.0	2.6	6.5	10.3
Rock sole	1,310.3	1,848.8	585.2	901.1	1,217.0	1,532.9	1,848.8
Sablefish	1.1	.0	.0	.0	.0	.0	.0
Greenland turbot	.0	.0	.0	.0	.0	.0	.0
Yellowfin sole	82.8	327.2	163.2	204.2	245.2	286.2	327.2
[greater than 124°]							
Atka Mackerel	10.5	53.2	27.7	34.1	40.5	46.8	53.2
Bottom pollock	535.3	2,213.9	1,114.3	1,389.2	1,664.1	1,939.0	2,213.9
Pacific cod	360.0	1,895.0	993.0	1,218.5	1,444.0	1,669.5	1,895.1
O. flats	112.2	320.5	147.4	190.7	234.0	277.3	320.5
Rockfish	1.4	15.9	9.0	10.7	12.5	14.2	15.9
Pelagic pollock	27.2	211.1	115.8	139.6	163.5	187.3	211.1
Rock sole	15,434.4	21,402.1	6,667.5	10,351.1	14,034.8	17,718.4	21,402.1
Greenland turbot	.0	1.0	.6	.7	.8	.9	1.0
Yellowfin sole	2,262.5	5,170.1	2,189.2	2,934.5	3,679.8	4,425.1	5,170.1
Discards	.0	.1	.1	.1	.1	.1	.1
Shore plants							
Bottom pollock	5.9	.4	.0	.0	.0	.0	.4
Pacific cod	7.2	4,927.7	2,953.8	3,447.2	3,940.7	4,434.2	4,927.7
Pelagic pollock	12.2	1.5	.0	.0	.0	.1	1.5
Greenland turbot	.1	.1	.0	.0	.0	.0	.1
Yellowfin sole	153.9	18.2	.0	.0	.0	1.0	18.2

Table C-1.2 Yellowfin Sole "Phase-in" Schedule (1994 Base Year Catch).

			[Additional retention required, mt]				
	Retain	Discard	60%	70%	80%	90%	100%
Motherships							
Bottom pollock	.1	4.9	2.9	3.4	3.9	4.4	4.9
Pacific cod	.0	15.4	9.3	10.8	12.4	13.9	15.4
Pelagic pollock	.2	10.2	6.0	7.1	8.1	9.1	10.2
Rock sole	199.9	48.9	.0	.0	.0	24.0	48.9
Yellowfin sole	1,387.6	307.2	.0	.0	.0	137.7	307.2
Catcher/Processors							
[60-124']							
Pacific cod	.0	31.9	19.1	22.3	25.5	28.7	31.9
Rock sole	110.3	586.8	308.0	377.9	447.4	517.1	586.8
Sablefish	.0	.0	.0	.0	.0	.0	.0
Yellowfin sole	1,153.1	1,718.2	569.7	856.8	1,143.9	1,431.0	1,718.2
[greater than 124']							
Atka Mackerel	.0	.1	.1	.1	.1	.1	.1
Bottom pollock	360.9	694.1	272.1	377.6	483.1	588.6	694.1
Pacific cod	1,081.8	1,093.4	223.1	440.8	658.3	875.9	1,093.4
O. flats	2,544.5	1,124.2	.0	23.6	390.5	757.4	1,124.2
Rockfish	23.0	25.0	5.8	10.6	15.4	20.2	25.0
Pelagic pollock	2.4	115.2	68.1	79.9	91.6	103.4	115.2
Rock sole	1,710.8	3,013.2	1,115.6	1,590.0	2,064.4	2,538.8	3,013.2
Yellowfin sole	88,551.4	25,762.5	.0	.0	2,899.7	14,331.1	25,762.5
Discards	.0	12.0	7.2	8.4	9.6	10.8	12.0
Shore plants							
Bottom pollock	.0	.0	.0	.0	.0	.0	.0
Pacific cod	596.6	441.1	26.0	129.8	233.5	337.3	441.1
Pelagic pollock	18.5	1.0	.0	.0	.0	.0	1.0
Sablefish	.0	.1	.1	.1	.1	.1	.1
Greenland turbot	.0	.1	.0	.0	.0	.0	.1
Yellowfin sole	7,156.4	126.1	.0	.0	.0	.0	126.1

Note: Catcher/processors who also act as motherships during a year are counted separately.

Table C-2.1 Rock Sole "Phase-in" Schedule (1995 Base Year Catch).

			[Additional retention required, mt]				
	Retain	Discard	60%	70%	80%	90%	100%
Motherships							
Bottom pollock	77.9	37.4	.0	2.8	14.3	25.9	37.4
Pacific cod	176.2	1,611.2	909.4	1,090.4	1,271.3	1,452.3	1,633.2
O. flats	3.1	54.2	11.3	17.0	42.7	48.4	54.2
Pelagic pollock	66.6	40.4	.0	8.3	19.0	29.7	40.4
Rock sole	781.6	385.5	.0	35.4	152.1	268.8	385.5
Greenland turbot	.0	.7	.4	.5	.5	.6	.7
Yellowfin sole	116.0	125.8	29.1	53.2	77.4	101.6	125.8
Discards	.0	.2	.1	.1	.1	.1	.2
Catcher/Processors							
[60-124']							
Bottom pollock	.0	.9	.5	.6	.7	.8	.9
Pacific cod	363.9	610.0	220.5	317.8	415.2	512.6	610.0
O. flats	15.4	40.8	18.3	24.0	29.6	35.2	40.8
Flathead sole	64.0	172.2	77.7	101.3	124.9	148.6	172.2
Rock sole	1,909.1	1,983.5	426.4	815.7	1,205.0	1,594.2	1,983.5
Yellowfin sole	57.3	287.4	149.5	184.0	218.4	252.9	287.4
Discards	.0	5.5	1.1	3.9	4.4	5.0	5.5
[greater than 124']							
Atka Mackerel	26.1	111.8	56.7	70.5	84.3	98.1	111.8
Bottom pollock	304.1	1,331.2	677.1	840.6	1,004.2	1,167.7	1,331.2
Pacific cod	1,662.6	4,674.8	2,139.9	2,773.6	3,407.3	4,041.1	4,674.8
O. flats	430.0	705.8	251.5	365.1	478.6	592.2	705.8
Rockfish	3.9	17.7	9.1	11.3	13.4	15.6	17.7
Flathead sole	208.8	342.9	122.2	177.4	232.6	287.7	342.9
Pelagic pollock	1.1	289.1	173.0	202.0	231.1	260.1	289.1
Rock sole	12,948.7	11,170.2	1,522.7	3,934.5	6,346.4	8,758.3	11,170.2
Sablefish	.0	.4	.2	.3	.3	.4	.4
Greenland turbot	2.2	.8	.0	.0	.2	.5	.8
Yellowfin sole	2,116.8	4,496.6	1,851.2	2,512.6	3,171.9	3,835.3	4,496.6
Shore plants							
Bottom pollock	.6	5.2	2.9	3.5	4.1	4.6	5.2
Pacific cod	140.3	4,551.0	2,674.5	3,143.6	3,612.7	4,081.8	4,551.0
Pelagic pollock	13.7	17.0	4.8	7.8	10.9	14.0	17.0
Greenland turbot	.5	.0	.0	.0	.0	.0	.0
Yellowfin sole	270.9	15.6	.0	.0	.0	.0	15.6

Table C-2.2 Yellowfin Sole "Phase-in" Schedule (1995 Base Year Catch).

			[Additional retention required, mt]				
	Retain	Discard	60%	70%	80%	90%	100%
Motherships							
Bottom pollock	23.6	12.9	.0	1.9	5.6	9.2	12.9
Pacific cod	22.4	35.7	12.4	18.3	24.1	29.9	35.7
O. flats	40.8	91.2	38.4	51.6	64.8	78.0	91.2
Pelagic pollock	.3	34.7	20.7	24.2	27.7	31.2	34.7
Rock sole	248.1	142.1	.0	25.0	64.0	103.0	142.1
Greenland turbot	13.2	2.3	.0	.0	.0	.7	2.3
Yellowfin sole	6,592.5	564.5	.0	.0	.0	.0	564.5
Discards	.0	1.9	1.1	1.3	1.5	1.7	1.9
Catcher/Processors							
[60-124']							
Bottom pollock	5.4	4.5	.6	1.6	2.6	3.5	4.5
Pacific cod	5.5	181.8	106.9	125.6	144.4	163.1	181.8
O. flats	611.9	456.0	20.8	135.6	242.4	349.2	456.0
Flathead sole	244.0	274.1	66.9	118.7	170.5	222.3	274.1
Rock sole	459.5	462.2	93.6	185.7	277.9	370.1	462.2
Greenland turbot	.0	1.9	1.1	1.3	1.5	1.7	1.9
Yellowfin sole	2,116.7	1,690.0	167.3	548.0	928.7	1,309.3	1,690.0
Discards	.0	7.1	4.3	5.0	5.7	6.4	7.1
[greater than 124']							
Atka Mackerel	2.0	1.8	.3	.7	1.1	1.5	1.8
Bottom pollock	63.6	404.0	216.9	263.7	310.4	357.2	404.0
Pacific cod	14.1	105.4	57.6	69.6	81.5	93.5	105.4
O. flats	1,085.0	2,391.5	202.7	750.7	1,298.6	1,846.6	2,394.5
Flathead sole	452.6	336.5	20.9	99.8	178.7	257.6	336.5
Pelagic pollock	2.9	118.9	70.2	82.4	94.6	106.7	118.9
Rock sole	4,166.4	1,397.2	.0	.0	281.4	840.8	1,397.2
Greenland turbot	.0	.2	.1	.1	.1	.2	.2
Yellowfin sole	71,202.1	19,086.2	.0	.0	1,028.5	10,057.4	19,086.2
[Unknown length]							
Pacific cod	.0	7.7	4.6	5.4	6.1	6.9	7.7
Shore plants							
Bottom pollock	.0	.1	.0	.0	.0	.1	.1
Pacific cod	317.0	148.4	.0	8.8	55.4	101.9	148.4
Pelagic pollock	2.7	2.2	.2	.7	1.2	1.7	2.1
Greenland turbot	.0	.2	.1	.1	.2	.2	.2
Yellowfin sole	7,025.2	56.2	.0	.0	.0	.0	56.2

Appendix D: Target Switching Attributable to IR/IU

One significant, but perhaps not fully anticipated, impact of IR/IU concerns the resulting "target switching" that would accompany adoption of the IR/IU management action. BSAI groundfish fisheries are largely managed, monitored, and defined on the basis of retained catch composition (the only exception, at present, being pelagic pollock). Therefore, anything which changes the retained catch composition of an operation could shift it (and its performance indicators, e.g., PSC bycatch rates) into or out of a given "target" fishery category. The requirement that any operator catching any amount of pollock, Pacific cod, yellowfin, and/or rock sole must retain that catch, means that the species composition upon which the "target" is assigned could (and in many cases would) be altered.

On the basis of 1994 and 1995 catch data, and assuming 100% retention of each of the four species of concern, the following patterns of "target switching" would have been predicted as a result of mandatory changes in "retained" catch composition.

Table D-1.0 shows, by year and processing mode, the number of *'unique BSAI processors'* designated (at least once during the fishing year) as participating in each target fishery, on the basis of actual retained catch under the *Status Quo* alternative, and on the basis of projected retained catch under the *Improved Retention* alternative. In addition, the table shows the number of processors which retain the same target, i.e., *'duplicates'*, under either management regime, as well as the number which *'exit'* and *'enter'* a given target with the introduction of the improved retention requirements.

Table D-1.1 presents target switching information similar to that contained in Table D-1.0, but gives number of potentially impacted *'blend data target records'*, instead of unique processors. A target record is a unique combination of *'year, weekending date, processor identification, processor mode, statistical area, gear and CDQ number'*.

Table D-1.2 summarizes information on *'tons of groundfish catch'*, by target fishery, which would have potentially been the subject of "target switching," as a result of adoption of the proposed IR/IU action.

Tables D-2.0 and D-2.1 track the relationship between the *Regional Office* (i.e., status quo) blend target records and target records under the Improved Retention requirements. Specifically, these tables answer the question, when a record *'exits'* a given target, where did it go? Table D-2.0 presents the number of Regional Office target records, while Table D-2.1 shows metric tons of groundfish catch, by year, processing type, Regional Office target and corresponding Improved Retention target records.

Table D-1.0 Target Switching -- Number of BSAI processors, (w/o IR/IU) and (w/ IR/IU), by processing mode and target, 1994.

	w/o IR/IU	w/ IR/IU	Duplicates	Exited	Entered
Motherships					
Bottom pollock	9	12	9	0	3
Pacific cod	6	5	5	1	0
Pelagic pollock	15	15	15	0	0
Rock sole	3	4	3	0	1
Yellowfin sole	3	3	3	0	0
Catcher/Processors					
Atka Mackerel	16	15	15	1	0
Bottom pollock	42	57	38	4	19
Pacific cod	90	86	80	10	6
O. flats	21	13	10	11	3
Rockfish	14	14	14	0	0
Pelagic pollock	36	36	36	0	0
Rock sole	32	30	28	4	2
Sablefish	24	24	24	0	0
Greenland turbot	21	21	21	0	0
Yellowfin sole	35	35	35	0	0
Discards	6	0	0	6	0
Shore plants					
Bottom pollock	2	7	2	0	5
Pacific cod	16	17	16	0	1
Rockfish	2	2	2	0	0
Pelagic pollock	9	9	9	0	0
Sablefish	6	6	6	0	0
Greenland turbot	5	5	5	0	0
Yellowfin sole	4	4	4	0	0

Note: Catcher/processors who also act as motherships during a year are counted as two vessels.

Table D-1.0 (cont.) Target Switching -- Number of BSAI processors, (w/o IR/IU) and (w/ IR/IU), by processing mode and target, 1995.

	w/o IR/IU	w/ IR/IU	Duplicate	Exited	Entered
Motherships					
Bottom pollock	16	17	13	3	4
Pacific cod	15	15	15	0	0
O. flats	1	1	1	0	0
Pelagic pollock	26	26	26	0	0
Rock sole	3	3	2	1	1
Greenland turbot	3	3	3	0	0
Yellowfin sole	7	7	7	0	0
Discards	2	0	0	2	0
Catcher/Processors					
Atka Mackerel	17	17	17	0	0
Bottom pollock	39	55	37	2	18
Pacific cod	92	90	88	4	2
O. flats	21	19	16	5	3
Rockfish	16	16	16	0	0
Flathead sole	20	0	0	20	0
Other	1	0	0	1	0
Pelagic pollock	39	39	39	0	0
Rock sole	36	36	35	1	1
Sablefish	15	15	15	0	0
Greenland turbot	44	42	42	2	0
Arrowtooth	3	2	2	1	0
Yellowfin sole	44	44	44	0	0
Discards	7	0	0	7	0
Shore plants					
Bottom pollock	5	7	5	0	2
Pacific cod	16	16	16	0	0
Rockfish	1	0	0	1	0
Other	1	1	1	0	0
Pelagic pollock	8	8	8	0	0
Rock sole	0	1	0	0	1
Sablefish	14	14	14	0	0
Greenland turbot	6	6	6	0	0
Yellowfin sole	2	2	2	0	0

Note: Catcher/processors who also act as motherships during a year are counted as two vessels.

Table D-1.1 Target Switching -- Number of BSAI processor target records, (w/o IR/IU) and (w/ IR/IU), by processing mode and target, 1994.

	w/o IR/IU	w/ IR/IU	Duplicate	Exited	Entered
Motherships					
Bottom pollock	20	42	19	1	23
Pacific cod	14	10	10	4	0
Pelagic pollock	196	176	176	20	0
Rock sole	5	6	5	0	1
Yellowfin sole	8	8	8	0	0
Catcher/Processors					
Atka Mackerel	152	150	150	2	0
Bottom pollock	212	357	173	39	184
Pacific cod	1,378	1,319	1,301	77	18
O. flats	55	47	26	29	21
Rockfish	54	54	54	0	0
Pelagic pollock	780	729	702	78	27
Rock sole	286	280	236	50	44
Sablefish	48	47	47	1	0
Greenland turbot	36	36	36	0	0
Yellowfin sole	441	420	404	37	16
Discards	7	0	0	7	0
Shore plants					
Bottom pollock	15	37	13	2	24
Pacific cod	396	386	383	13	3
Rockfish	2	2	2	0	0
Pelagic pollock	245	233	231	14	2
Sablefish	13	13	13	0	0
Greenland turbot	12	12	12	0	0
Yellowfin sole	15	15	15	0	0

Note: A target record is defined on the basis of year, weekending date, processor id, processor mode, statistical area, gear and CDQ number.

Table D-1.1 (cont.) Target Switching -- Number of BSAI processor target records, (w/o IR/IU) and (w/ IR/IU), by processing mode and target, 1995.

	w/o IR/IU	w/ IR/IU	Duplicate	Exited	Entered
Motherships					
Bottom pollock	54	50	31	23	19
Pacific cod	110	108	104	6	4
O. flats	2	1	1	1	0
Pelagic pollock	304	307	289	15	18
Rock sole	13	13	11	2	2
Greenland turbot	3	3	3	0	0
Yellowfin sole	28	27	27	1	0
Discards	2	0	0	2	0
Catcher/Processors					
Atka Mackerel	169	168	168	1	0
Bottom pollock	231	280	198	33	82
Pacific cod	1,575	1,551	1,533	42	18
O. flats	84	84	46	38	38
Rockfish	51	50	50	1	0
Flathead sole	52	0	0	52	0
Other	1	0	0	1	0
Pelagic pollock	841	765	758	83	7
Rock sole	194	233	168	26	65
Sablefish	41	41	41	0	0
Greenland turbot	65	62	62	3	0
Arrowtooth	3	2	2	1	0
Yellowfin sole	436	419	384	52	35
Discards	7	0	0	7	0
Shore plants					
Bottom pollock	10	21	10	0	11
Pacific cod	518	522	512	6	10
Rockfish	1	0	0	1	0
Other	1	1	1	0	0
Pelagic pollock	208	202	202	6	0
Rock sole	0	1	0	0	1
Sablefish	83	74	74	9	0
Greenland turbot	13	13	13	0	0
Yellowfin sole	13	13	13	0	0

Note: A target record is defined on the basis of year, weekending date, processor id, processor mode, statistical area, gear and CDQ number.

Table D-1.2 Target Switching -- Metric Tons of Catch of BSAI processors. (w/o IR/IU) and (w/ IR/IU), by processing mode and target, 1994.

	w/o IR/IU	w/ IR/IU	Duplicate	Exited	Entered
Motherships					
Bottom pollock	14,971	20,022	14,799	173	5,223
Pacific cod	2,426	2,317	2,317	109	0
Pelagic pollock	135,235	130,284	130,111	5,123	173
Rock sole	507	515	507	0	8
Yellowfin sole	1,942	1,942	1,942	0	0
Catcher/Processors					
Atka Mackerel	77,109	77,034	77,034	75	0
Bottom pollock	125,017	182,823	86,921	38,096	95,902
Pacific cod	137,492	121,835	119,721	17,771	2,115
O. flats	22,281	12,738	8,208	14,073	4,530
Rockfish	14,933	14,933	14,933	0	0
Pelagic pollock	627,078	601,314	564,368	62,710	36,946
Rock sole	78,299	77,418	67,459	10,840	9,959
Sablefish	1,240	1,232	1,232	8	0
Greenland turbot	3,762	3,792	3,762	0	29
Yellowfin sole	190,513	184,626	178,706	11,807	5,919
Discards	21	0	0	21	0
Shore plants					
Bottom pollock	1,309	8,529	1,191	118	7,338
Pacific cod	67,069	61,253	61,244	5,824	8
Rockfish	2	2	2	0	0
Pelagic pollock	427,098	425,693	425,575	1,522	118
Sablefish	336	336	336	0	0
Greenland turbot	987	987	987	0	0
Yellowfin sole	9,429	9,429	9,429	0	0

Table D-1.2 (cont.) Target Switching -- Metric Tons of Catch of BSAI processors, (w/o IR/IU) and (w/ IR/IU), by processing mode and target, 1995.

	w/o IR/IU	w/ IR/IU	Duplicate	Exited	Entered
Motherships					
Bottom pollock	14,326	15,157	10,671	3,656	4,487
Pacific cod	15,064	13,900	13,504	1,561	396
O. flats	349	186	186	163	0
Pelagic pollock	181,869	181,435	178,089	3,780	3,346
Rock sole	2,856	3,669	2,651	204	1,017
Greenland turbot	318	318	318	0	0
Yellowfin sole	10,547	10,681	10,469	79	212
Discards	16	0	0	16	0
Catcher/Processors					
Atka Mackerel	90,287	90,272	90,272	15	0
Bottom pollock	98,635	129,660	88,850	9,785	40,810
Pacific cod	172,918	164,533	163,897	9,021	636
O. flats	18,619	17,187	8,186	10,434	9,001
Rockfish	13,380	13,359	13,359	21	0
Flathead sole	10,585	0	0	10,585	0
Other	28	0	0	28	0
Pelagic pollock	591,557	571,263	561,976	29,581	9,288
Rock sole	55,899	72,910	52,061	3,838	20,849
Sablefish	875	875	875	0	0
Greenland turbot	4,373	4,347	4,347	26	0
Arrowtooth	69	65	65	4	0
Yellowfin sole	153,521	146,381	138,307	15,214	8,074
Discards	105	0	0	105	0
Shore plants					
Bottom pollock	5,484	8,188	5,484	0	2,704
Pacific cod	68,009	67,258	65,653	2,356	1,605
Rockfish	11	0	0	11	0
Other	2	2	2	0	0
Pelagic pollock	397,437	396,780	396,780	657	0
Rock sole	0	309	0	0	309
Sablefish	3,088	1,494	1,494	1,594	0
Greenland turbot	1,304	1,304	1,304	0	0
Yellowfin sole	11,443	11,443	11,443	0	0

Table D-2.0 Target Switching -- Number of BSAI processor target records by processing mode, w/o IR/IU and w/ IR/IU, 1994.

count

	w/o IR/IU	w/ IR/IU
Motherships		
Bottom pollock	20	
Bottom pollock		19
Pelagic pollock		1
Pacific cod	14	
Bottom pollock		3
Pacific cod		10
Rock sole		1
Pel. pollock	196	
Bottom pollock		20
Pelagic pollock		176
Rock sole	5	
Rock sole		5
Yellowfin sole	8	
Yellowfin sole		8
Shore plants		
Bottom pollock	15	
Bottom pollock		13
Pelagic pollock		2
Pacific cod	396	
Bottom pollock		13
Pacific cod		383
Rockfish	2	
Rockfish		2
Pelagic pollock	245	
Bottom pollock		11
Pacific cod		3
Pelagic pollock		231
Sablefish	18	
Sablefish		18
Greenland turbot	12	
Greenland turbot		12
Yellowfin sole	15	
Yellowfin sole		15

Table D-2.0 (cont.) Target Switching -- Number of BSAI processor target records by processing mode, w/o IR/IU and w/ IR/IU, 1994.

count

	w/o IR/IU	w/ IR/IU
Catcher/Processors		
Atka Mackerel	152	
Atka Mackerel		150
Bottom pollock		1
Pacific cod		1
Bottom pollock	212	
Bottom pollock		173
Pacific cod		3
Pelagic pollock		29
Rock sole		6
Yellowfin sole		1
Pacific cod	1,378	
Bottom pollock		54
Pacific cod		1,301
Pelagic pollock		1
Rock sole		12
Greenland turbot		1
Yellowfin sole		9
O. flats	55	
Bottom pollock		21
Pacific cod		3
O. flats		26
Rock sole		2
Yellowfin sole		3
Rockfish	54	
Rockfish		54
Pelagic pollock	780	
Bottom pollock		74
Pacific cod		4
Pelagic pollock		702
Rock sole	285	
Bottom pollock		22
Pacific cod		3
O. flats		21
Rock sole		236
Yellowfin sole		4

Table D-2.0 (cont.) Target Switching -- Number of BSAI processor target records by processing mode, w/o IR/IU and w/ IR/IU, 1994.

	count	
	w/o IR/IU	w/ IR/IU
Sablefish	48	
Pacific cod		1
Sablefish		47
Greenland turbot	36	
Greenland turbot		36
Yellowfin sole	441	
Bottom pollock		13
Rock sole		24
Yellowfin sole		404
Discards	7	
Bottom pollock		1
Pacific cod		5
Yellowfin sole		1

Note: A target record is defined on the basis of year, weekending date, processor id, processor mode, statistical area, gear and CDQ number.

Table D-2.0 (cont.) Target Switching -- Number of BSAI processor target records by processing mode, w/o IR/IU and w/ IR/IU, 1995.

	count	
	w/o IR/IU	w/ IR/IU
Motherships		
Bottom pollock	54	
Bottom pollock		31
Pacific cod		2
Pelagic pollock		21
Pacific cod	110	
Bottom pollock		5
Pacific cod		104
Rock sole		1
O. flats	2	
O. flats		1
Rock sole		1
Pelagic pollock	304	
Bottom pollock		15
Pelagic pollock		289
Rock sole	13	
Rock sole		11
Yellowfin sole		2
Greenland turbot	3	
Greenland turbot		3
Yellowfin sole	28	
Pacific cod		1
Yellowfin sole		27
Discards	2	
Pacific cod		1
Yellowfin sole		1

Table D-2.0 (cont.) Target Switching -- Number of BSAI processor target records by processing mode, w/o IR/IU and w/ IR/IU, 1995.

count

	w/o IR/IU	w/ IR/IU
Shore plants		
Bottom pollock	10	
Bottom pollock		10
Pacific cod	518	
Bottom pollock		5
Pacific cod		512
Rock sole		1
Rockfish	1	
Pacific cod		1
Other	1	
Other		1
Pelagic pollock	208	
Bottom pollock		6
Pelagic pollock		202
Sablefish	83	
Pacific cod		9
Sablefish		74
Greenland turbot	13	
Greenland turbot		13
Yellowfin sole	13	
Yellowfin sole		13

Table D-2.0 (cont.) Target Switching -- Number of BSAI processor target records by processing mode, w/o IR/IU and w/ IR/IU, 1995.

count

	w/o IR/IU	w/ IR/IU
Catcher/Processors		
Atka Mackerel	169	
Atka Mackerel		168
Pacific cod		1
Bottom pollock	231	
Bottom pollock		198
Pacific cod		1
Pelagic pollock		31
Rock sole		1
Pacific cod	1,575	
Bottom pollock		24
Pacific cod		1,533
Pelagic pollock		1
Rock sole		15
Yellowfin sole		2
O. flats	84	
Bottom pollock		4
O. flats		46
Rock sole		12
Yellowfin sole		22
Rockfish	51	
Bottom pollock		1
Rockfish		50
Flathead sole	52	
Bottom pollock		8
Pacific cod		3
O. flats		32
Rock sole		4
Yellowfin sole		5
Other	1	
Pacific cod		1
Pelagic pollock	841	
Bottom pollock		83
Pelagic pollock		758

Table D-2.0 (cont.) Target Switching -- Number of BSAI processor target records by processing mode, w/o IR/IU and w/ IR/IU, 1995.

	count	
	w/o IR/IU	w/ IR/IU
Rock sole	194	
Bottom pollock		10
Pacific cod		3
O. flats		6
Rock sole		168
Yellowfin sole		7
Sablefish	41	
Sablefish		41
Greenland turbot	65	
Pacific cod		3
Greenland turbot		62
Arrowtooth	3	
Pacific cod		1
Arrowtooth		2
Yellowfin sole	436	
Bottom pollock		20
Rock sole		32
Yellowfin sole		384
Discards	7	
Pacific cod		6
Rock sole		1

Note: A target record is defined on the basis of year, weekending date, processor id, processor mode, statistical area, gear and CDQ number.

Table D-2.1 Target Switching -- Catch of BSAI processors by processing mode, w/o IR/IU and w/ IR/IU, 1994.

Metric tons

	w/o IR/IU	w/ IR/IU
Motherships		
Bottom pollock	15,408	
Bottom pollock		14,799
Pelagic pollock		173
Pacific cod	2,425	
Bottom pollock		100
Pacific cod		2,317
Rock sole		8
Pel. pollock	135,234	
Bottom pollock		5,123
Pelagic pollock		130,111
Rock sole	507	
Rock sole		507
Yellowfin sole	1,942	
Yellowfin sole		1,942
Shore plants		
Bottom pollock	1,309	
Bottom pollock		1,191
Pelagic pollock		118
Pacific cod	67,068	
Bottom pollock		5,824
Pacific cod		61,244
Rockfish	2	
Rockfish		2
Pel. pollock	427,097	
Bottom pollock		1,514
Pacific cod		8
Pelagic pollock		425,575
Sablefish	336	
Sablefish		336
Greenland turbot	937	
Greenland turbot		937
Yellowfin sole	9,429	
Yellowfin sole		9,429

Table D-2.1 Target Switching -- 1994, (cont.)

Metric tons

	w/o IR/IU	w/ IR/IU
Catcher/Processors		
Atka Mackerel	77,109	
Atka Mackerel		77,034
Bottom pollock		68
Pacific cod		7
Bottom pollock	125,017	
Bottom pollock		86,921
Pacific cod		596
Pelagic pollock		35,529
Rock sole		1,668
Yellowfin sole		303
Pacific cod	137,492	
Bottom pollock		10,605
Pacific cod		119,721
Pelagic pollock		1,418
Rock sole		1,495
Greenland turbot		29
Yellowfin sole		4,224
O. flats	22,281	
Bottom pollock		12,041
Pacific cod		938
O. flats		8,208
Rock sole		167
Yellowfin sole		927
Rockfish	14,933	
Rockfish		14,933
Pel. pollock	627,077	
Bottom pollock		62,683
Pacific cod		26
Pelagic pollock		564,368
Rock sole	78,299	
Bottom pollock		5,320
Pacific cod		537
O. flats		4,530
Rock sole		67,459
Yellowfin sole		453
Sablefish	1,240	
Pacific cod		8
Sablefish		1,232

Table D-2.1 Target Switching -- 1994, (cont.)

	Metric tons w/o IR/IU	Metric tons w/ IR/IU
Greenland turbot	3,762	
Greenland turbot		3,762
Yellowfin sole	190,513	
Bottom pollock		5,178
Rock sole		6,629
Yellowfin sole		178,706
Discards	21	
Bottom pollock		7
Pacific cod		2
Yellowfin sole		12

Table D-2.1 Target Switching -- Catch of BSAI processors by processing mode, w/o IR/IU and w/ IR/IU, 1995.

	Metric tons w/o IR/IU	Metric tons w/ IR/IU
Motherships		
Bottom pollock	14,326	
Bottom pollock		10,671
Pacific cod		309
Pelagic pollock		3,346
Pacific cod	15,054	
Bottom pollock		706
Pacific cod		13,504
Rock sole		854
O. flats	349	
O. flats		186
Rock sole		163
Pel. pollock	181,869	
Bottom pollock		3,780
Pelagic pollock		178,089
Rock sole	2,855	
Rock sole		2,651
Yellowfin sole		204
Greenland turbot	318	
Greenland turbot		318

Table D-2.1 Target Switching -- 1995, (cont.)

	Metric tons w/o IR/IU	w/ IR/IU
Yellowfin sole	10,548	
Pacific cod		79
Yellowfin sole		10,469
Discards	16	
Pacific cod		8
Yellowfin sole		8
Shore plants		
Bottom pollock	5,434	
Bottom pollock		5,434
Pacific cod	68,009	
Bottom pollock		2,047
Pacific cod		65,653
Rock sole		309
Rockfish	11	
Pacific cod		11
Other	2	
Other		2
Pel. pollock	397,437	
Bottom pollock		657
Pelagic pollock		396,780
Sablefish	3,088	
Pacific cod		1,594
Sablefish		1,494
Greenland turbot	1,304	
Greenland turbot		1,304
Yellowfin sole	11,443	
Yellowfin sole		11,443

Table D-2.1 Target Switching -- 1995, (cont.)

	Metric tons	
	w/o IR/IU	w/ IR/IU
Catcher/Processors		
Atka Mackerel	90,287	
Atka Mackerel		90,272
Pacific cod		15
Bottom pollock	98,635	
Bottom pollock		88,850
Pacific cod		123
Pelagic pollock		9,297
Rock sole		375
Pacific cod	172,918	
Bottom pollock		4,905
Pacific cod		163,897
Rock sole		4,060
Yellowfin sole		56
O. flats	18,620	
Bottom pollock		756
O. flats		8,186
Rock sole		3,428
Yellowfin sole		6,250
Rockfish	13,380	
Bottom pollock		21
Rockfish		13,359
Flathead sole	10,585	
Bottom pollock		885
Pacific cod		15
O. flats		8,100
Rock sole		733
Yellowfin sole		852
Other	28	
Pacific cod		28
Pel. pollock	591,557	
Bottom pollock		29,581
Pelagic pollock		561,976
Rock sole	55,899	
Bottom pollock		1,677
Pacific cod		343
O. flats		901
Rock sole		52,061
Yellowfin sole		917

Table D-2.1 Target Switching -- 1995, (cont.)

	Metric tons w/o IR/IU	w/ IR/IU
Sablefish	875	
Sablefish		875
Greenland turbot	4,373	
Pacific cod		26
Greenland turbot		4,347
Arrowtooth	69	
Pacific cod		4
Arrowtooth		65
Yellowfin sole	153,521	
Bottom pollock		2,985
Rock sole		12,229
Yellowfin sole		138,307
Discards	106	
Pacific cod		81
Rock sole		25