MEMORANDUM

TO: Council, SSC and AP Members

FROM: Clarence G. Pautzke
Executive Director

DATE: September 17, 1992

SUBJECT: Groundfish Plan Amendments - Initial Review

ACTION REQUIRED

(a) Initial review of the Pribilof Island trawl closure analysis.
(b) Initial review of the Pollock "B" season delay/Exclusive Registration Area analysis.
(c) Initial review of the Preferential Allocation of Pacific Cod to Gear Types analysis.

BACKGROUND

Pribilof Island trawl closure analysis

This item originally was part of Amendment 21 to the BSAI FMP. However, the Council, after a preliminary review of the document in April, requested additional analysis. The Council can review the draft amendment package (Amendment 21a) at the September meeting and release it for public review prior to final action at the December 1992 meeting.

Note that another part of Amendment 21 that the Council requested additional analysis was salmon bycatch measures. Staff from ADF&G are currently working on this analysis and will have a draft document for you prior to the December meeting.

Specific alternatives for these measures requested by the Council in April include the following:

Alternative 1: status quo -no area closures adjacent to the Pribilof Islands.

Alternative 2: close IPHC Area 4C to bottom trawling.

Alternative 3: close IPHC Area 4C to all trawling.

Alternative 4: close waters within a 25-mile zone around the islands to bottom trawling.

Alternative 5: close waters within a 25-mile zone around the islands to all trawling.

Alternative 6: close waters within IPHC Area 4C West of 169°W to bottom trawling.

Alternative 7: close waters within IPHC Area 4C West of 169°W to all trawling.

Pollock "B" season delay/Exclusive Registration Areas analysis
At its April 1992 meeting, the Council requested staff to prepare an amendment package that included: (1) alternatives to establish exclusive registration for vessels engaged in the GOA and BSAI trawl and longline groundfish fisheries; and (2) alternatives to establish a possible opening date in the BSAI "B" season pollock fishery ranging from July 1 through September 1. The draft analysis before you is the result of an analytical team's initial efforts to evaluate the potential biological and socioeconomic impacts of establishing a new starting date for the "B" season pollock fishery and exclusive registration.

"B" Season Delay. The pollock fisheries in the BS/AI are currently managed by two distinct seasons; the roe, or "A" season, which runs from January 20 until April 15 and the non-roe, or "B" season which opens on June 1 and continues until the Total Allowable Catch (TAC) is taken. The major impetus for the request for the "B" season delay lies in the following issues:

1. Maximization of the value from the pollock harvest - product recovery rates and flesh quality may be higher in the fall.

2. Allow for salmon processing opportunities - a season delay would allow pollock catcher-processors and processors the opportunity to participate in salmon processing during the early to mid summer months.

3. Increase trawl fishing opportunities- trawl fishing opportunities may be enhanced by a pollock "B" season delay by enabling those vessels to more fully participate in other fisheries during the summer months such as yellowfin sole, other flatfish, and the whiting fishery off the West coast.

4. Bycatch implications of a season delay in the pollock trawl fisheries, particularly in regards to herring and salmon.

The "B" season delay would require a regulatory amendment to the regulations implementing the BSAI fishery management plan.

For the season delay for the BSAI pollock fishery, two alternatives will be considered. Alternative 1 is the status quo (i.e., June 1 start date). Alternative 2 considers three specific season delays: July 1, August 1 and September 1 (Alternatives 2a, 2b, and 2c). Obviously, the Council may choose a seasonal opening date intermediate to these. These dates were chosen to make the analytical task more tractable.

Exclusive Registration. The exclusive registration proposal is motivated be recent relocation of pollock and cod harvesting vessels from the BSAI to the GOA upon bycatch or TAC closures which have resulted in premature closures (relative to the historical fishery) of the cod fishery in the Gulf of Alaska. Under the exclusive registration proposal, registration areas would be designated as either the Gulf of Alaska or the Bering Sea/Aleutian Islands. A vessel would have to register for that fishing year in only one of the two areas, and would be precluded from fishing in the area in which it was not registered. An exclusive registration program would require a plan amendment to both the BSAI and GOA FMPs.

For the exclusive registration analysis, four alternatives will be considered:

Alternative 1: status quo (i.e., no exclusive registration).

Alternative 2: exclusive registration for all groundfish.

Alternative 3: exclusive registration for pollock only.

Alternative 4: exclusive registration for Pacific cod only.

The Council can review the draft amendment package at the September meeting and release it for public review prior to final action at the December 1992 meeting.

Preferential Allocation of Pacific Cod

Last January the Council requested staff to proceed with an amendment analysis for preferential allocation of Pacific cod to gear types which exhibit low bycatch rates. Staff from the Alaska Fisheries Science Center have prepared a draft EA/RIR/IRFA which was sent to you on September 12, 1992.

Currently, there is no explicit allocation of the BSAI Pacific cod TAC between the trawl and non-trawl groundfish fisheries. This analysis evaluates the potential biological and socioeconomic impacts of establishing a fixed allocation of the Pacific cod TAC between the trawl and non-trawl fisheries. The Council needs to review this initial analysis and decide whether to release it for general public review and comment.

Two alternatives are considered:

Alternative 1: status quo (i.e., no explicit allocation).

Alternative 2: an explicit allocation that can only be changed by plan amendment.

The allocations considered under Alternative 2 range from only bycatch amount of cod for the trawl fisheries to only bycatch amounts of cod for the non-trawl fisheries. Based on the TAC for 1992 and historic levels of cod bycatch in trawl and non-trawl groundfish fisheries, these allocations range from approximately 16 percent to 99.8 percent of the cod TAC being available for the trawl fishery.

The Council can review the draft amendment package (Amendment 24 to the BSAI FMP) at the September meeting and release it for public review prior to final action at the December 1992 meeting.

AGENDA D-5(b)
SEPTEMBER 1992
SUPPLEMENTAL

September 17, 1992 via fax: 907 271-2817

NORTH PACIFIC FISHERIES MANAGEMENT COUNCIL

Attn: Richard Lauber

Re: Delay of Pollock B Fishery opening

Dear Mr. Lauber:

It has been brought to our attention that there is a proposal to delay the Pollock B fishery. We would like to go on record as opposing that delay. By delaying the fishery, factory trawlers would most likely then enter salmon processing, an industry that is already suffering. Factory trawlers would not create new markets for the salmon, but only continue to flood the existing markets, which is the reason for the depressed industry already.

It is understood there is significant pressure because of the situation in Prince William Sound in 1991. Had the fishery been opened on a regular schedule, there most likely would have been sufficient capacity to handle the run. We in fact waited almost 20 days to recieve fish on our processor. The 1992 P.W.S. Pink Salmon Season was a disaster for all, especially the traditional processors of pink salmon. If the factory trawl fleets enter the Bristol Bay market or the pink salmon market, as I stated earlier, the products will go to the same markets. In addition, we now have the Russian products flooding the traditional salmon markets, and most likely will also begin dumping other products on the markets.

I understand that the factory trawlers must operate as long as possible for a continuos cash flow, but processors of salmon are faced with a 3 week run that accounts for almost 100% of our operation. The shore side processors of salmon cannot pick up and move, and the floating processors are not designed or equipped to compete with the factory trawlers for bottomfish.

If the pollock season is delayed and the factory trawlers enter the salmon fishery, you will most certainly see many in the industry suffer irreparable hardship. As stated above, those of us in the Shoreside and Floating Processor Herring and Salmon Business cannot compete in the bottomfishery whatsoever.

I am available to further discuss the issues at any time.

Very truly yours,

Virginia Bussey Ferrari

\npfmc

SEP 18 1992

(Copy of Letter Sent to Council at Portland, Oregon Meeting 1992)

January 6, 1992 Via FAX (907)271-2817

NORTH PACIFIC FISHERIES MANAGEMENT COUNCIL

Attn: Richard Lauber and Other Members

Re: Delay of June 1 Pollock Fishery opening 1993 and beyond.

Dear Sirs:

To follow up my earlier fax (copy following) of November 26, 1991, I would like to reiterate the same during consideration of the issue at the September 20 meeting in Anchorage, Alaska, concerning the proposed changes in the start of the pollock "B" season.

I can only state again, that delay for economic reasons, not biological, will have long lasting datrimental effects on the already suffering salmon industry. These are not "new markets" as certain groups would have you believe, but processors supplying the traditional markets, with less than the standard quality. Due to constraints in the processing lines, most if not all of the salmon produced by factory trawlers would be round-block frozen, the softest of all salmon markets at this time. In addition, traditional salmon buyers do not have the ability to enter into competition with the factory trawlers with their existing processing facilities, both the floating processors and the shore plants that are in areas too remote to compete for bottomfish.

I am available to further discuss these matters at any time.

Very truly yours,

Virginia Busey Ferrari

vnpfmc(2)

AGENDA D-5(b)
SEPTEMBER 1992
SUPPLEMENTAL

ED PEFFERMAN
BOROUGH MANAGER

TELEPHONE
(907) 246-4224
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Bristol Bay Borough

BOX 189 • NAKNEK, ALASKA 99633

AUG 24 1992

August 18, 1992

The Honorable Richard B. Lauber, Chairperson
North Pacific Fisheries Management Council
P.O. Box 103136
Anchorage, Alaska 99570

RE: NEW START-UP DATE FOR THE POLLOCK "B" SEASON

Dear Mr. Lauber,

It is our understanding that you are currently in the process of developing the agenda for the September meeting of the North Pacific Fishery Management Council. In that regard, the Bristol Bay Borough would like to call your attention to the attached resolution reflecting our strong support for a later start-up date for the pollock "B" season and requesting that you include this matter on the agenda for Council consideration and approval in September.

The matter of the "B" season start-up date has important ramifications for our salmon industry, as you have already heard from a number of fishing organizations representing fishermen in the Bay. The issue also has an important effect on bycatch and conservation, as well as being of extreme interest to our fishermen.

The Bristol Bay Borough has not had continuous, active involvement in the council process to date. However, we look forward to working with you and the Council on this issue, and in the future, regarding other issues that affect our fisheries, our fishermen and the fishing industry in the Bay area. We believe that our new Fisheries Economic Development Commission under Chairperson Donald Nielsen will prove to be an invaluable vehicle in that regard.

We thank you for your attention to our request.

Sincerely,

Fred W. Pike

Fred W. Pike
Mayor

RESOLUTION 92-20

A RESOLUTION RECOMMENDING THAT THE NORTH PACIFIC FISHERIES MANAGEMENT COUNCIL DELAY THE START-UP FOR THE POLLOCK "B" SEASON

WHEREAS, the North Pacific Fisheries Management Council (N.P.F.M.C.) has established two seasons for the harvest of pollock, an "A" season which begins in January and a "B" season which being in June, and

WHEREAS, some of the participants in the pollock harvest have expressed interest in helping develop markets for Bristol Bay region salmon if the "B" season is delayed to August or September, and

WHEREAS, developing new markets, including pink salmon, could increase the value of the Bristol Bay fisheries and enhance revenues to the Bristol Bay Borough, and

WHEREAS, delay in the start-up of the "B" season to August or September could have favorable consequences on bycatch and conservation of other marine resources including a reduction in herring catches, and

WHEREAS, the Bristol Bay Borough Fisheries Economic Development Commission has been considering this issue for some time;

NOW THEREFORE BE IT RESOLVED that the Bristol Bay Borough Assembly supports a delay in the start-up for the pollock "B" season to August or September and recommends that the N.P.F.M.C. include this matter on the agenda for Council consideration and approval in September.

PASSED AND APPROVED by the Assembly of the Bristol Bay Borough,

Alaska this 17th day of August, 1992.

Fred W. Pike

Mayor

ATTEST:

Betty J. Bonin

Borough Clerk

NEPTUNE MARINE PRODUCTS, INC.
P.O. Box 17417
Seattle, WA 98107
5330 Ballard Ave NW
phone (206)789-3790 FAX (206)789-1795

AGENDA D-5(c)
SEPTEMBER 1992
SUPPLEMENTAL

SEP 17 1992

North Pacific Fishery Management Council
P.O. Box 103136
Anchorage, AK 99510

Sept. 17, 1992
FAX letter to
907-271-2817

RE: AGENDA ITEM D-5, PREFERENTIAL ALLOCATION OF PACIFIC COD TO GEAR TYPES WITH LOW BYCATCH.

Dear Council Members,

The above issue means many things to the gear groups involved in the Bering Sea cod fishery. As the policy making group responsible for this fishery, I would like to ask you to consider the following information in your deliberations regarding the future of this fishery. The bycatch issue will be the primary focus at this meeting, but I would also like to suggest that some of the following views represent a model for a larger sustained cod biomass, and fishery, in the Bering Sea, with a lower bycatch of halibut and crab.

The preferential allocation issue for cod, depending on low bycatch rates, could certainly be viewed as a catch allocation between the various gear types involved. I would like you to consider the following facts to realize that it should not be viewed as such:

* Most vessels in this fishery have the capability to be combination vessels using various gear types. Prior to the recent closure of the fishery for all gear types, it appeared that pot fishing would be allowed to continue due to it's extremely low bycatch rate. Numerous freezer longline vessels made contacts with pot manufacturers and ourselves in regards to developing pots that they could use with limited deck space. This pursuit to diversify a vessel's primary fishing effort has been exhibited throughout the development of the various fisheries in the Bering Sea. Whether it be a trawl vessel fishing crab with pots or longlining for cod, the capability to change the vessel's gear type is available.. Other examples include crab boats that install winches or add a longline system to become involved in these various fisheries. Longliners also have options to become involved in other fisheries such as sablefish, halibut, or, fishing pots for cod. I'm sure confirmation of these options would be difficult to get from those involved in defending their primary fishing efforts, but it should be considered. The combination capability of these vessels is a fact that should not be overlooked. The goal of a more species selective fishery for cod in the Bering Sea should not be viewed as an allocation issue between the gear groups involved. It should be viewed as establishing a policy that leads to minimal bycatch in efforts to harvest the cod resource in a responsible manner.

* Bycatch rates for the various gear types in the Bering Sea cod fishery provide the hard data to view the past. The past can provide a pattern to be considered in your deliberations, but I would like to suggest that you add current and future options into your decisions. Please consider the following information as you make your deliberations:

* In 1991, bycatch ratios in the directed trawl fishery for cod were 50 tons of cod to 1 ton of halibut mortality. In 1992, it's about 40:1.

* In the directed longline fishery, the ratio in 1991 was about 170:1. In early 1992, the longline fleet experienced a ratio of about 220:1 until early June. The entry of new vessels into the fishery, and the "Olympic system backlash", resulted in increased halibut bycatch as the impending closure approached. The annual ratio for the longline fleet was about 100 tons of cod per 1 ton of halibut mortality for 1992.

* In 1991 the ratio for the pot fishery was about 950 tons of cod caught to 1 ton of halibut mortality. The ratio through early June of 1992 was about 1280:1. This low bycatch rate resulted in the Council granting an exemption for pot gear at the June meeting in Sitka for the rest of 1992 and 1993. Over following summer months, the pot fishery expanded dramatically as catch statistics will show. The rate of halibut bycatch dropped dramatically during these summer months as cod catches increased. The final ratio for the pot fishery in 1992 will be about 1800:1.

The logical assumption of this past data would push the entire fishery towards the pot fishery due to it's existing record, but this option does not consider changes that are possible to the other gear types that would enable them to fish in a more species selective and responsible manner. The longline fishery could fish with a much better bycatch ratio if they were required to fish in a more selective manner. The options available include cutting gangions, closing certain "hot spots", or, curtailing summer fishing activities if halibut bycatch exceeds certain levels. Methods to reduce bycatch in the trawl fishery are more difficult to attain due to the inherent nature of the gear used. If the trawl fishery can not improve it's selectivity, other options exist if they want to continue to fish. In addition to trawling for other flatfish species, vessels could fish with longlines or pots if they want to continue to target cod.

Options exist to both the trawl and longline fleet involved in this fishery. I would hope that your decision will reflect the opinion that this is not a gear allocation issue. It is an issue that should encourage selective fishing methods. The best method to express this opinion is through allowing additional fishing time, and access, to those gear types that exhibit a selective capability.

The above situation dealing with species selective fishing methods is not the only selective issue that needs to be considered in the future management of this fishery. A size selective fishery provides other beneficial results to this fishery as can be seen by reading the attached report titled "EFFECTS OF TRAWLING AND LONGLINING ON THE YIELD AND BIOMASS OF COD STOCKS". This numerical simulation of the Bering Sea cod fishery by 2 very respected fishery scientists, offers a glimpse at the ability to selectively fish in such a manner that the cod biomass, and yield, will increase if fished in a size (age) selective manner.

I would like to encourage you to take actions that will acknowledge your commitment to establish a selective fishing policy in this fishery that minimizes bycatch of other species and promotes efforts to help increase the future biomass and yield of the Bering Sea cod resource.

Sincerely,

Ed Wyman

Ed Wyman

NOTES CONCERNING THE ATTACHED REPORT

The attached report written in 1990 considers the 2 primary gear types that were harvesting Pacific cod in the Bering Sea during the study period. The report shows that longline gear is more size selective than trawl gear in catching larger fish.

The pot fishery for Pacific cod did not start to develop in the Bering Sea until 1991. Commons sense should show the reader that pot fishing can also be size selective when targeting cod . Modifications to pot gear could allow the pot fishery to be even more selective than longline gear. This could easily be accomplished by requiring a certain web size for the cod pot that would allow small fish to escaped through the web prior to the pot being hauled.

The benefits of such a size selective fishery include an increased overall cod biomass with a subsequent increase in yield as you will see from reading the attached abstract of the report (complete copies will be available at the Council meeting). I would like to suggest that the attached report provides a blueprint for managing future cod harvests and should be seriously considered in future decisions.

ICES 1990 PAPER C.M. 1990/G:32
Ref. B

EFFECTS OF TRAWLING AND LONGLINING ON THE YIELD AND BIOMASS OF COD STOCKS - NUMERICALLY SIMULATED

by

Åsmund Bjordal 1) and Taivo Laevastu 2)
1) Institute of Fisheries Technology Research, P.O. Box 1964, N-5024 Bergen, Norway.
2) Alaska Fisheries Science Center, 7600 Sand Point Way N.E. Seattle, WA 98115, USA.

ABSTRACT

Numerical studies were conducted on the effects of trawl and longline catches on a cod stock and possible yields from it.

Five year mean age composition of Pacific cod (Gadus macrocephalus) from the Bering Sea was used as initial age composition of the stock, which was normalized to 1 ton. Age specific Z (total mortality) was computed from this distribution and natural mortality was derived by subtracting fishing mortality from Z. Age compositions of catches were either prescribed from empirical data or created with fishing mortality coefficient (F), which was assumed constant with age after the age of full recruitment. The computations were done with different catch levels for six years assuming average constant recruitment.

Essential results of this study are: a) The stock left in the sea decreases with increasing catch and reaches an equilibrium if recruitment and catches remain constant. With similar catch levels this equilibrium is reached earlier with longline and is higher than that of trawl. b) If a given level of stock in sea is desired, higher annual catches can be taken with longlines than with trawl. c) By the same catch size longlines remove more older and more piscivorous fish which is beneficial to recruitment if the latter is largely controlled by predation.

The above mentioned essential results indicate, among others that some longline fishing might be allowed to continue when TAC for trawlers has been reached.

AGENDA D-5(c)
SEPTEMBER 1992

REVISIONS TO

COUNCIL REVIEW DRAFT

ENVIRONMENTAL ASSESSMENT/REGULATORY IMPACT REVIEW/ INITIAL REGULATORY FLEXIBILITY ANALYSIS OF ALLOCATING THE PACIFIC COD TOTAL ALLOWABLE CATCH BETWEEN THE TRAWL AND NON-TRAWL FISHERIES

AMENDMENT 24 TO THE FISHERY MANAGEMENT PLAN FOR THE GROUNDFISH FISHERY OF THE BERING SEA AND ALEUTIAN ISLANDS AREA

Prepared by
National Marine Fisheries Service,
Seattle, Washington

September 21, 1992

Sections 4.1.2 and the Tables referenced in that section have been corrected. The results of the input-output model have been added to Section 4.1.3. A summary has been added (Section 4.3). Appendix B has been added and minor editorial changes were made to the text in Appendix D.

4.1.2 Gear-specific differences and their estimated effects on benefits per metric ton of cod catch

An economic model was developed to estimate benefits per metric ton of cod catch for each of three cod fisheries in terms of:

1. gross revenue at the first wholesale level (FOB Alaska),

2. net revenue (gross revenue net of variable and fixed harvesting and processing costs), and

3. net benefits (net revenue minus the opportunity cost of groundfish and PSC species bycatch).

Historical catch, discard rate, product mix, and first wholesale price data were used to estimate gross revenue per metric ton of cod catch. These estimates include the value of all groundfish that are retained. Estimates of harvesting and processing costs were included to estimate net revenue. Finally, estimates of the opportunity cost of groundfish and PSC species bycatch were included to estimate net benefits. The opportunity cost of prohibited species bycatch is based on estimates of the impact cost of bycatch where that cost is calculated as the wholesale value of foregone catch net of variable costs. The estimates are the same that were used in Amendment 21. These estimates do not include fixed costs; therefore, they overstate the bycatch impact costs by the amount of the fixed costs that should be apportioned to the crab, halibut, herring, and salmon fisheries.

Because halibut bycatch accounts for most of the bycatch impact cost and because the effect of halibut bycatch on future halibut catch has a certain component and a more speculative component, the opportunity cost of halibut bycatch is presented as a range. The lower end of the range excludes the more speculative component and the upper end includes both components.

The opportunity cost of groundfish bycatch, is based on an estimate by species of the mean net first wholesale revenue per metric ton of catch. As with the other estimates of bycatch cost, fixed costs were not included. The estimated opportunity costs per unit of bycatch are in Table 4.2.

Harvesting and processing cost data for trawl catcher/processor operations were used to estimate harvesting and processing costs for all cod trawl operations. Corresponding data for longline catcher/processors were used to estimate harvesting and processing costs for all cod longline and pot gear operations. In 1991 catcher/processors accounted for about 65% of the catch in the trawl cod fishery and about 98% of the catch in the longline cod fishery.

For vessels that participate in multiple fisheries, fixed costs were allocated to the cod fisheries based on the proportions of total groundfish catch and total groundfish fishing weeks attributable to the cod fishery. The mean of these two measures of relative participation in the cod fisheries was used for each operation. This method of allocating fixed costs to the cod fisheries will overstate substantially fixed costs in the cod pot fishery because the vessels in this fishery are principally employed in the crab fisheries, not other groundfish fisheries. In fact, it may be reasonable to allocate no fixed costs to the cod pot fishery because it is to a great extent a supplemental fishery for these vessels.

Estimates of net benefits per metric ton of cod catch are also presented for the case in which no fixed costs are allocated to the cod fishery. This was done to estimate what a vessel would be willing to pay for the right to harvest cod if its fixed costs were covered in other fisheries, if it had no other fishing opportunities, and if it were required to pay the opportunity cost of bycatch. The price and cost data used in the model are described more fully in Appendix B.

Estimates of the net benefits per metric ton of catch with longline gear were made for discard mortality rates of 8%, 12%, and 16% and for a 12-month fishery and a 9-month fishery with a June through August closure. The three discard mortality rates reflect, respectively, estimates of the rate if gangions are always cut to release halibut, if they are cut half the time, and if they are not cut. The two longline seasons are considered because, based on the high bycatch rates during this period in 1992, the longline fleet may ask for a change in its season if there is an explicit non-trawl allocation.

Historical data by vessel were used to estimate the distributions of net benefits per metric ton of catch for the three cod fisheries for each of the sets of parameter values discussed above.

These estimates of revenue and benefits per metric ton of cod catch capture many of the effects of gear-specific differences among the cod fisheries with respect to:

1. prohibited species bycatch mortality rates,

2. species selectivity and discard rates for other groundfish,

3. product quality and value, and

4. harvesting and processing costs excluding external costs.

They do not capture benefits beyond primary processing. Therefore, from the perspective of the nation, the benefits per metric ton of cod catch will tend to be understated for the trawl fishery because the trawl fishery produces a larger proportion of products for domestic markets. There are two reasons why this bias is expected to be small. First, there are substitutes for cod from the Alaska trawl fishery, such as cod from other Alaska fisheries, Alaska pollock, cod and other species from non-Alaska fisheries, and non-fish protein. Therefore, the net benefit of trawl caught cod, in terms of producer surplus beyond the primary processing level, is the difference between the surplus with that cod and the best substitute for it. Second, cod exports allow for imports that result in producer surplus associated with adding value to the imports.

The assumption that neither input nor product prices will change as a result of a change in the allocation of the cod TAC among gear groups introduces a bias that favors the gear group with the increased allocation. The reason for this is that such a reallocation will tend both to increase the prices of inputs and to decrease the prices of products for that gear group if the gear groups use different mixes of inputs and produce different mixes of products.

The following summary of the model results are for 1991. This is the last year for which 12 months of data are available and for which product mix data currently are available for the onshore processors. The estimates on which this summary is based are in Table 4.3 through 4.6. Similar types of estimates for 1990-92, but including only catch for at-sea processing, are presented in Tables 4.7 through 4.10.

For 1991 the estimates of gross wholesale value, or revenue, per metric ton of cod catch are $1,176, $1,086, and $ 1,200, respectively, for longline, pot, and trawl gear (Table 4.3). These estimates include the value of groundfish bycatch that is retained. These estimates indicate that in 1991 trawl gear had an advantage with respect to the first determinant of benefits per metric ton of cod catch.

The 1991 estimates of variable harvesting and processing cost per metric ton of cod catch are $820 for longline gear, $777 for pot gear, and $753 for trawl gear. The estimates of this component of the benefits per metric ton of cod catch also favor trawl gear.

The 1991 estimates of fixed harvesting and processing cost per metric ton of cod catch are $236 for longline gear, $241 for pot gear, and $68 for trawl gear. These estimates of this component of the benefits per metric ton of cod catch also favor trawl gear. It can be argued that these estimates understate the advantage of trawl and pot gear. For many trawlers and pot boats, fixed costs are covered by earnings in other fisheries. This means that perhaps no fixed costs should be apportioned to their cod fishing. An additional problem with the estimate of fixed costs for pot gear is that the method used to distribute fixed cost only considered activity in the groundfish fisheries, catch and weeks fished in crab fisheries are ignored.

There are several indications that the ranking of the trawl and non-trawl cod fisheries in terms of net revenue is less in doubt than the actual differences in net revenue per metric ton of cod catch. First, the modern domestic cod fishery first developed as a trawl fishery with no substantial fixed gear catch until PSC limit induced trawl closures provided an opportunity for the fixed gear fisheries. Second, the trawl vessels that have been converted to use fixed gear during trawl closures choose to use trawl gear when they are allowed to do so. Finally, information provided to the Council by the North Pacific Longline Association indicates that the apparent higher profits with trawl gear are more than offset when external costs are considered. The external costs that can be quantified are considered below. Other potential external costs are considered qualitatively in Section 4.2.

The 1991 estimates of the opportunity cost of groundfish bycatch per metric ton of cod catch are $6, $0, and $121, respectively, for longline, pot, and trawl gear. These estimates indicate that with respect to this component of the benefit per ton of cod, pot gear has the greatest advantage and trawl gear has a substantial disadvantage.

The next component of benefits per ton of cod catch is the opportunity cost of crab, herring, and chinook salmon bycatch. The opportunity cost of halibut bycatch is treated separately because of its relative importance. This component also favors longline gear. The estimates are $0, $15, and $6, respectively, for longline, pot, and trawl gear. The disadvantages of trawl and pot gear are overstated because 100% discard mortality is assumed for crab, salmon, and herring even though the mortality may be substantially lower for crab. The overstatement is greater for pot gear because crab account for much of the bycatch in the pot cod fishery. As noted above, better estimates of crab discard mortality rates are being developed.

Six estimates of the opportunity cost of halibut bycatch were made for longline gear for each year and two estimates were made each for pot and trawl gear (Table 4.4). The two estimates for the pot and trawl fisheries are based on halibut catch adjustment factors (hcaf) of 1 and 1.6. The former is the immediate and therefore certain adjustment that is made to the halibut fishery quota to adjust for halibut bycatch mortality in the groundfish fisheries. The latter is the immediate adjustment plus a series of subsequent adjustments that are made to the extent that the effects of the halibut bycatch mortality result in the predicted changes in allowable removals over a 9-year period. Although it is estimated that over time there will be a 1.6 mt reduction in the halibut quota for each 1 mt of halibut bycatch mortality, the difference between the estimated opportunity costs with the two adjustment factors is 1 to 1.32 not 1 to 1.6 because a five percent discount rate was used to estimate the present value of the predicted stream of adjustments to halibut fishery quotas.

In addition to allowing for two halibut catch adjustment factors, three discard mortality rates and two fishing seasons were considered for longline gear. The six estimates for longline gear almost bracket the range of the 24 estimates that are associated with the two catch adjustment factors, the three mortality rates, and the two seasons. The estimate for an adjustment factor of 1, a mortality rate of 8%, and a 9-month season would have a cost estimate that is lower than any of the six estimates.

With a halibut catch adjustment factor of 1.6, the 1991 estimates of the opportunity cost of halibut bycatch per ton of cod catch are $3 for pots, $64 for trawls, and range from $9 to $20 for longlines depending on the longline discard mortality rate and season. The assumption of a lower discard mortality rate naturally reduces the estimates for the cod longline fishery. The estimates indicate that a June through August longline closure would have reduced the halibut bycatch cost per metric ton of cod catch by about 10% in the cod longline fishery in 1991 and by about 43% in 1992. With a halibut catch adjustment factor of 1, the estimates are naturally reduced by almost 24% for each type of gear.

If economic profits are expected to be zero in each of the three open access cod fisheries, the net benefit per metric ton of cod catch in each fishery is expected to be negative and equal to the external cost of that fishery. The external cost that has been quantified is the opportunity cost of bycatch. With a 1.6 halibut catch adjustment factor, the cost of bycatch per ton of cod catch in 1991 was estimated to be $191 for trawls, $18 for pots, and from $15 to $26 for longlines depending on the season and halibut discard mortality rate used for the longline fishery. With a 1.0 halibut catch adjustment factor, the cost of bycatch per ton of cod catch in 1991 was estimated to be $176 for trawls, $17 for pots, and $21 for longlines. With a halibut catch adjustment factor of 1.0 and a summer closure, the estimate for longlines is $7. This case is not included in the table. As noted above, much of the cost with pots is accounted for by crab bycatch mortality which probably is overestimated. Therefore, pots may have the lowest actual bycatch cost. Although the cost of bycatch alone would tend to indicate the net benefits per metric ton of cod catch if economic profit equaled zero in each fishery, the cost and revenue data that are available indicate that currently this is not the case.

With a halibut catch adjustment factor of 1.6, the 1991 estimates of the net benefits per ton of cod catch, when fixed costs are allocated to the cod fisheries, are $72 for pots, $344 for trawls, and range from $26 to $43 for longlines depending on the longline discard mortality rate and season (Table 4.5). Note that despite the reduction in halibut bycatch cost for the longline fishery with the summer closure, the closure decreases net benefits per metric ton of cod catch. This is the result of changes in the estimates of revenue, variable cost, and fixed cost.

If it is assumed that no fixed costs should be allocated to the cod pot fishery because the pot vessels cover their fixed costs in the crab fisheries, the appropriate comparisons are among the net benefits per ton of cod catch in the pot fishery ignoring fixed costs and the benefits per ton not ignoring fixed costs in the other two fisheries. In such a comparison, the trawl fishery still has the largest estimated benefits per ton of cod catch but the pot and longline fisheries switch places with the latter having the lowest benefits per metric ton of cod catch.

The net benefits per metric ton of cod catch varies substantially among individual fishing operations within each of the three cod fisheries (Table 4.6). Therefore, reallocating the cod TAC among fishing operations based on the gear used will result in catch that is taken in some operations being replaced with catch by other operations with lower net benefits per metric ton of cod catch. To generate the maximum benefits from the cod TAC, the TAC should be allocated on the basis of the net benefits per ton of cod catch of each fishing operation, not on the basis of net benefits per ton for an aggregation of fishing operations.

As noted in Chapter 1, the cost and price data on which these estimates are based are being reviewed, the industry is preparing improved data, and the Council's review of this draft is expected to result in some of the cost and price data changing. Therefore, improved data and estimates are expected to be included in the draft before it is released for public review.

4.1.3 Gear-specific differences and their estimated effects on regional economic activity per 1,000 metric tons of cod catch

The input-output (I-O) model was used to estimate the regional economic activity associated with 1,000 of P. cod catch for each cod fishery. These estimates reflect gear-specific differences among the cod fisheries with respect to:

1. product quality and value, and

2. harvesting and processing costs excluding external costs,

The estimates in the next draft will also reflect gear-specific differences among the cod fisheries with respect to:

1. prohibited species bycatch mortality rates, and

2. species selectivity and discard rates for other groundfish.

The last two items will be accounted for by estimating the economic activity foregone due to discards in the cod fisheries and by subtracting those estimates from the estimates of the activity associated with the cod catch. The economic activity associated with retained bycatch in the cod fisheries is not part of either set of estimates because it is assumed that the economic activity associated with this catch would be the same in the cod fishery or alternative groundfish fisheries.

The I-O model does not attempt to estimate the economic activity associated with processing and marketing groundfish products beyond primary processing. Therefore, from the perspective of the nation, the economic activity per metric ton of cod catch will tend to be understated for the trawl fishery because the trawl fishery produces a larger proportion of products for domestic markets. This bias is expected to be small for the same reason the corresponding bias in the estimate of net benefits is expected to be small (see Section 4.1.2). The I-O model, including estimated parameter values, is discussed in Appendix B.

The results of the I-O model are in Table 4.11. They indicate that the local economic activity associate with 1,000 mt of cod catch ranges from $64,731 for catch by factory/trawlers to $220,963 for catch by trawlers delivering to onshore processors in Dutch Harbor. Using 1991 data from the weekly processor reports to estimate the weighted average for all longline catch and all trawl catch, the local economic activity associated with 1,000 mt of cod catch is $92,757 for longline gear and $119,256 for trawl gear. Comparable estimates for Alaska and the Pacific Northwest combined are about $1.7 million for longline gear and $2.1 million for trawl gear. This suggests that in terms of regional economic activity, the cod trawl fishery has a 23% advantage compared to the cod longline fishery.

4.3 Summary

As with most of the issues currently facing fishery managers, there are many diverse impacts to be weighed and considered. This chapter has presented a number of issues that potentially could influence the decision to allocate cod between trawl and fixed gear.

Although it is important to understand the qualifications and assumptions of the analysis that has lead to the numerical or qualitative results given in each section, an attempt has been made to summarize the main points in this section. Brief summary statements for a number of issues are followed by a tabular summary.

The biological model, that has been used for several years to assist the Council in establishing ABCs and TACs for cod, indicates that a decrease in the percent of the cod TAC taken with trawl gear would decrease the cod MSY. Based on gear-specific differences both in size selectivity and in the seasonality of catch, it was estimated that eliminating the cod trawl fishery would decrease the MSY by 1.8%. Qualifications concerning the model's estimates are discussed in Section 4.1.1.

The economic model estimates indicate that trawl gear generates the highest gross returns per mt of cod allocated, and also has the lowest variable and fixed costs. However, it is also trawl gear which has the highest costs in terms of the bycatch of other groundfish, crab, halibut, herring, and salmon combined. The estimates of net benefits per metric ton of cod catch, which take all of these measures into account, are highest for trawl gear and lowest for longline gear and there are substantial differences among the estimates. However, as noted previously, these are initial estimates and are expected to change as improved price and cost data are provided by the industry and as this draft is reviewed by the AP, SSC, and Council prior to release for public review.

Considerations of parties beyond the direct commercial users of cod and other stocks were handled by an updated version of the input-output model that has been used in prior Council deliberations. When looking at the total impacts of the aggregate economy, additional allocations of cod to the trawl fleet resulted in higher total impacts than to the longline fleet. Pot vessels were not included in that modeling exercise.

Catch in the cod trawl fishery is significantly more concentrated during the yearly part of the year when the cod stocks are in prespawning and spawning aggregations. The potential for such a fishery to have adverse effects on either yield per recruit or recruitment was summarized as follows. Harvest frontloading does have the potential for reducing stock sizes and catches, which is certainly a valid concern for management. The extent (if any) to which this potential is realized at present or under any likely future scenario, however, is unknown. In any case, should frontloading become an established pattern, stock assessments should be able to incorporate this factor into the process of estimating ABC so that it does not pose a long-term conservation problem. The difference between trawl and fixed gear cod fisheries in the percent of catch that would be taken during the yearly part of the year would be reduced measurably both by the summer longline closure that has been proposed and by the continued expansion of cod fixed gear effort.

The section dealing with the gear-specific differences on the effects on habitat and its productivity has not been completed. However, if a decrease in catch and effort in the cod trawl fishery results in the redeployment of trawl effort to other BSAI fisheries, the expected net effect on the productivity of BSAI habitat would be zero unless the adverse and beneficial effects of trawling are target specific.

This allocation issue would not appear to have a very significant impact on the viability of any marine mammal stock, but given the level of concern about the recovery of these mammals and the need for protection as dictated by various federal laws, it should be noted that trawl gear may have the greatest negative impact overall. However, as with the effects on habitat, a redeployment of trawl effort to other fisheries probably would offset any such benefit in the cod fisheries alone.

Given the current halibut PSC limit for the trawl fisheries and bycatch mortality rates in the cod trawl and fixed gear fisheries and in other trawl fisheries, decreasing the percent of the cod TAC taken with trawl gear will increase the percent of the BSAI OY that can be taken. However, it is not expected to allow the full OY to be taken, the net value of the trawl catch would be expected to decrease even though trawl catch could increase, and there probably would not be a net reduction in halibut bycatch mortality if trawl effort were redeployed to harvest the full TACs for the species that are not targeted with fixed gear.

Gear-specific differences in the following probably are not significant and in combination probably do not justify a reallocation of cod from trawl to fixed gear: (1) quantity and quality of biological data from the cod fisheries; (2) management and enforcement costs; (3) mobility among fisheries and alternative use opportunities; and (4) gear conflicts and vessel safety.

The other issues that were discussed in Section 4.2 were addressed by the results of the economic model. The model results were summarized above.

TABULAR SUMMARY OF IMPACTS ON THE DIFFERENT GEAR TYPES

ISSUES	TRAWL	LONGLINE	POT
MSY (age selectivity)	+	0	N/A
Gross wholesale value	+	0	-
Variable cost per mt	+	-	0
Cost of groundfish bycatch	-	0	+
Cost of halibut bycatch	-	0	+
Cost of other PSC bycatch	0	+	-
Net benefits/mt of cod	+	-	0
Regional Economic Activity	+	-	N/A
Marine Mammals	-/0	0	0

IMPACTS OF INCREASING THE PERCENT OF CATCH TAKEN WITH FIXED GEAR

Habitat productivity:	Unknown direction and magnitude, but probably not significant, particularly with a redeployment of trawl effort to other fisheries
PSC limits and OY:	Groundfish catch could be increased, but probably not to OY; therefore, PSC limits would still limit catch and it would be difficult to reduce PSC limits without imposing additional costs on the trawl fishery.
Recruitment and Y-P-R:	Unknown magnitude for each. Effect on Y-P-R could be + or -, effect on recruitment may be +.
Quantity and quality of data:	Advantages and disadvantages for each gear type, net effect not significant, adequate data can be obtained with all gear.
Mgmt. and enforcement costs:	Direction and magnitude unknown but change in costs are not expected to be significant.
Fairness/Equity:	The magnitude and direction depend on your perspective or method of defining equity.
Mobility and options:	The greater mobility and options for trawlers does not justify increasing fixed gear cod catch.
Fuel efficiency:	Considered by net benefit model.

Public opinion on discards:	Considered by net benefit model.
Gear conflict and safety:	Insignificant effects expected.
Market considerations:	Potential negative effects of unknown magnitude, but not expected to be substantial.

Table 4.1 Projected eastern Bering Sea Pacific cod ABCs (TACs) for various percentages of the catch taken with trawl gear, 1992-2011.

ABC (TAC) in thousand metric tons

Year	62%	0%	20%	40%	60%	80%	100%
1992	162	159	159	160	162	163	166
1993	155	154	154	154	156	155	156
1994	138	132	134	136	138	139	140
1995	128	124	126	127	128	127	127
1996	121	121	121	122	121	120	119
1997	118	119	119	119	118	117	117
1998	117	117	118	117	117	117	117
1999	117	116	117	117	117	117	117
2000	117	115	116	116	117	117	117
2001	116	114	115	116	116	117	117
2002	116	114	114	115	116	116	116
2003	115	113	114	115	115	115	116
2004	115	112	113	114	115	115	115
2005	114	112	113	114	114	115	115
2006	114	111	112	113	114	114	115
2007	114	111	112	113	114	114	114
2008	114	111	112	113	113	114	114
2009	113	110	112	113	113	114	114
2010	113	110	111	112	113	114	114
2011	113	110	111	112	113	114	114

Approximately 62% of the catch was taken with trawl gear in 1991.

Table 4.2 Estimated opportunity cost per unit of bycatch.

Prohibited species	$ Value
Pacific Halibut	$2,900 or $ 2,200 per metric ton
Pacific Herring	742.08 per metric ton
Chinook Salmon	20.50 per animal
Red King Crab	9.96 per animal
Bairdi Tanner Crab	.68 per animal

Groundfish species	$ Value
Pollock	340.19 per metric ton
Sablefish	1,996.30
Arrowtooth Flounder	35.62
Rock Sole	427.57
Yellowfin Sole	275.22
Greenland Turbot	735.34
Other Rockfish	491.91
Atka Mackerel	419.08
Other Flatfish	78.79
Other Groundfish	17.97

Note: For each species the opportunity cost is an estimate of the gross wholesale value in other fisheries net of variable harvesting and processing costs. Figures for non-prohibited species are a mean of 1990 to 1992 values. Halibut value per metric ton depends on the halibut catch adjustment factor; 1.6 ($2,900) or 1.0 ($2,200).

Table 4.3 Estimated revenue, variable cost, fixed cost, groundfish bycatch cost, and other bycatch cost, excluding halibut, per metric ton of cod catch for each of three domestic BSAI cod fisheries, 1990-91.

Year	Gear	Revenue per mt	Var.Cst per mt	Fxd.Cst per mt	Gf.Cst per mt	Bycatch cost/mt
1990	Longline	1,135	820	236	7	0
	Pot	1,086	777	241	5	80
	Trawl	1,200	753	68	110	6
1991	Longline	1,176	871	245	6	0
	Pot	1,103	780	233	0	15
	Trawl	1,306	736	34	121	6

Note: Bycatch cost per metric ton includes red king crab, bairdi Tanner crab, chinook salmon, and herring.

Table 4.4 Estimated halibut bycatch cost per metric ton of cod catch for each of three domestic BSAI cod fisheries and for six cases, 1990-91.

Year Gear	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
HCAF:	1.6	1.0	1.6	1.6	1.6	1.6
LLmort:	.16	.16	.12	.08	.16	.08
LL Closure:	No	No	No	No	Yes	Yes
1990						
Longline	17	13	12	8	13	6
Pot	4	3				
Trawl	32	24				
1991						
Longline	20	15	15	10	18	9
Pot	3	2				
Trawl	64	49				

Note: Each case is defined by the values of HCAF, LLmort, and LL Closure. HCAF is the halibut catch adjustment factor that is used to estimate how halibut bycatch reduces catch in the commercial halibut fisheries. LLmort is the discard mortality rate in the cod longline fishery. LL Closure denotes a June-August closure of the cod longline fishery.

Table 4.5 Estimated net benefit per metric ton of cod catch for each of three domestic BSAI cod fisheries and for six cases, 1990-91.

Net benefits excluding fixed costs

Year	Gear	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
HCAF:		1.6	1.0	1.6	1.6	1.6	1.6
LLmort:		.16	.16	.12	.08	.16	.08
LL Closure:		No	No	No	No	Yes	Yes
1990	Longline	291	295	295	300	279	285
	Pot	220	221				
	Trawl	299	307				
1991	Longline	278	283	283	288	271	280
	Pot	305	306				
	Trawl	378	394				

Net benefits including fixed costs

Year	Gear	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
HCAF:		1.6	1.0	1.6	1.6	1.6	1.6
LLmort:		.16	.16	.12	.08	.16	.08
LL Closure:		No	No	No	No	Yes	Yes
1990	Longline	55	59	60	64	43	49
	Pot	-22	-20				
	Trawl	231	239				
1991	Longline	33	38	38	43	26	35
	Pot	72	73				
	Trawl	344	360				

Note: Each case is defined by the values of HCAF, LLmort, and LL Closure. HCAF is the halibut catch adjustment factor that is used to estimate how halibut bycatch reduces catch in the commercial halibut fisheries. LLmort is the discard mortality rate in the cod longline fishery. LL Closure denotes a June-August closure of the cod longline fishery. The mean apportionment of fixed costs is based on the percent of groundfish weeks and tonnage accounted for by the cod fishery.

Table 4.6 Variability in net benefits per metric ton of cod catch among individual fishing operations, 1990-91.

Net benefits for the six cases, under the assumption of zero fixed costs:

	Wt.mean	Mean	Stddev	Min	Max	Count
1990						
Longline						
Case 1	291	387	365	60	1,718	31
Case 2	295	394	368	68	1,744	31
Case 3	295	395	368	68	1,745	31
Case 4	300	402	371	77	1,772	31
Case 5	279	285	387	-993	1,718	31
Case 6	285	300	392	-993	1,772	31
Pot						
Case 1	220	9	848	-2,245	440	9
Case 2	221	10	848	-2,243	443	9
Trawl						
Case 1	299	146	573	-2,187	1,069	56
Case 2	307	155	569	-2,151	1,075	56
1991						
Longline						
Case 1	278	324	182	8	927	43
Case 2	283	335	182	36	948	43
Case 3	283	336	182	37	949	43
Case 4	288	347	183	66	970	43
Case 5	271	222	274	-798	749	43
Case 6	280	242	276	-798	758	43
Pot						
Case 1	305	345	220	13	772	14
Case 2	306	346	220	13	773	14
Trawl						
Case 1	378	75	739	-2,642	1,642	77
Case 2	394	93	730	-2,625	1,643	77
1990 and 1991 combined						
Longline						
Case 1		235	399	-3,080	1,718	129
Case 2		244	399	-3,064	1,744	129
Case 3		245	399	-3,064	1,745	129
Case 4		254	400	-3,048	1,772	129
Case 5		130	455	-3,090	1,718	129
Case 6		145	457	-3,052	1,772	129
Pot						
Case 1		211	453	-2,245	816	44
Case 2		211	453	-2,243	816	44
Trawl						
Case 1		-19	1,234	-11,248	1,937	191
Case 2		-3	1,226	-11,137	1,977	191

Table 4.6 Continued.

Net benefits for the six cases, under the assumption of mean fixed costs:

	Wt.mean	Mean	Stddev	Min	Max	Count
1990						
Longline						
Case 1	55	387	365	60	1,718	31
Case 2	59	394	368	68	1,744	31
Case 3	60	395	368	68	1,745	31
Case 4	64	402	371	77	1,772	31
Case 5	43	285	387	-993	1,718	31
Case 6	49	300	392	-993	1,772	31
Pot						
Case 1	-22	9	848	-2,245	440	9
Case 2	-20	10	848	-2,243	443	9
Trawl						
Case 1	231	146	573	-2,187	1,069	56
Case 2	239	155	569	-2,151	1,075	56
1991						
Longline						
Case 1	33	324	182	8	927	43
Case 2	38	335	182	36	948	43
Case 3	38	336	182	37	949	43
Case 4	43	347	183	66	970	43
Case 5	26	222	274	-798	749	43
Case 6	35	242	276	-798	758	43
Pot						
Case 1	72	345	220	13	772	14
Case 2	73	346	220	13	773	14
Trawl						
Case 1	344	75	739	-2,642	1,642	77
Case 2	360	93	730	-2,625	1,643	77
1990 and 1991 combined						
Longline						
Case 1		235	399	-3,080	1,718	129
Case 2		244	399	-3,064	1,744	129
Case 3		245	399	-3,064	1,745	129
Case 4		254	400	-3,048	1,772	129
Case 5		130	455	-3,090	1,718	129
Case 6		145	457	-3,052	1,772	129
Pot						
Case 1		211	453	-2,245	816	44
Case 2		211	453	-2,243	816	44
Trawl						
Case 1		-19	1,234	-11,248	1,937	191
Case 2		-3	1,226	-11,137	1,977	191

Note: The six cases are defined in Tables 4.4 and 4.5.

Table 4.7 Estimated catcher/processor revenue, variable cost, fixed cost, groundfish bycatch cost, and other bycatch cost, excluding halibut, per metric ton of cod catch for each of three domestic BSAI cod fisheries, 1990-92.

Year	Gear	Revenue per mt	Var.Cst per mt	Fxd.Cst per mt	Gf.Cst per mt	Bycatch cost/mt
1990	Longline	1,108	820	236	6	0
	Pot	788	777	241	5	21
	Trawl	793	753	68	106	5
1991	Longline	1,146	871	245	6	0
	Pot	844	780	233	0	13
	Trawl	929	736	34	110	5
1992	Longline	989	934	273	4	1
	Pot	754	794	237	0	1
	Trawl	1,057	800	31	124	5

Note: Bycatch cost per metric ton includes red king crab, bairdi Tanner crab, chinook salmon, and herring. For cases 5 and 6 (longline season summer closures), the longline bycatch cost is zero in 1992.

Table 4.8 Estimated catcher/processor halibut bycatch cost per metric ton of cod catch for each of three domestic BSAI cod fisheries and for six cases, 1990-92.

Year	Gear	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
HCAF:		1.6	1.0	1.6	1.6	1.6	1.6
LLmort:		.16	.16	.12	.08	.16	.08
LL Closure:		No	No	No	No	Yes	Yes
1990	Longline	15	12	12	8	11	6
	Pot	2	1				
	Trawl	23	18				
1991	Longline	18	14	14	9	16	8
	Pot	2	1				
	Trawl	43	32				
1992	Longline	30	23	23	15	17	9
	Pot	1	1				
	Trawl	60	46				

Note: Each case is defined by the values of HCAF, LLmort, and LL Closure. HCAF is the halibut catch adjustment factor that is used to estimate how halibut bycatch reduces catch in the commercial halibut fisheries. LLmort is the discard mortality rate in the cod longline fishery. LL Closure denotes a June-August closure of the cod longline fishery.

Table 4.9 Estimated catcher/processor net benefit per metric ton of cod catch for each of three domestic BSAI cod fisheries and for six cases, 1990-92.

Net benefits excluding fixed costs

Year	Gear	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
HCAF:		1.6	1.0	1.6	1.6	1.6	1.6
LLmort:		.16	.16	.12	.08	.16	.08
LL Closure :		No	No	No	No	Yes	Yes
1990	Longline	283	286	286	290	277	283
	Pot	182	182				
	Trawl	94	100				
1991	Longline	270	274	274	279	271	279
	Pot	195	195				
	Trawl	247	257				
1992	Longline	25	33	33	40	32	40
	Pot	172	172				
	Trawl	232	246				

Net benefits including fixed costs

Year	Gear	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
HCAF:		1.6	1.0	1.6	1.6	1.6	1.6
LLmort:		.16	.16	.12	.08	.16	.08
LL Closure :		No	No	No	No	Yes	Yes
1990	Longline	51	55	55	59	46	51
	Pot	2	2				
	Trawl	43	48				
1991	Longline	30	34	34	39	30	38
	Pot	5	5				
	Trawl	222	233				
1992	Longline	-246	-239	-239	-231	-240	-231
	Pot	-2	-1				
	Trawl	207	221				

Note: Each case is defined by the values of HCAF, LLmort, and LL Closure. HCAF is the halibut catch adjustment factor that is used to estimate how halibut bycatch reduces catch in the commercial halibut fisheries. LLmort is the discard mortality rate in the cod longline fishery. LL Closure denotes a June-August closure of the cod longline fishery. The mean apportionment of fixed costs is based on the percent of groundfish weeks and tonnage accounted for by the cod fishery.

Table 4.10 Variability in net benefits per metric ton of cod catch among individual catcher/processors, 1990-92.

Net benefits for the six cases, under the assumption of zero fixed costs:

	Wt.mean	Mean	Stddev	Min	Max	Count
1990						
Longline						
Case 1	283	354	311	60	1,718	31
Case 2	286	361	315	68	1,744	31
Case 3	286	361	315	68	1,745	31
Case 4	290	367	319	77	1,772	31
Case 5	277	311	408	-993	1,718	31
Case 6	283	322	416	-993	1,772	31
Pot						
Case 1	182	271	64	212	367	9
Case 2	182	272	65	213	368	9
Trawl						
Case 1	94	59	590	-2,199	1,069	56
Case 2	100	68	586	-2,163	1,075	56
1991						
Longline						
Case 1	270	301	145	8	767	43
Case 2	274	310	144	36	772	43
Case 3	274	310	144	37	772	43
Case 4	279	320	144	66	776	43
Case 5	271	243	279	-798	749	43
Case 6	279	260	282	-798	758	43
Pot						
Case 1	195	225	131	13	360	14
Case 2	195	225	131	13	361	14
Trawl						
Case 1	247	13	802	-2,716	1,642	77
Case 2	257	32	792	-2,699	1,643	77
1992						
Longline						
Case 1	25	65	488	-3,080	753	55
Case 2	33	73	487	-3,064	757	55
Case 3	33	74	487	-3,064	757	55
Case 4	40	83	486	-3,048	760	55
Case 5	32	-41	556	-3,090	753	55
Case 6	40	-31	555	-3,052	760	55
Pot						
Case 1	172	206	208	-121	816	21
Case 2	172	207	208	-121	816	21
Trawl						
Case 1	232	-337	2,044	-11,248	1,937	58
Case 2	246	-314	2,034	-11,137	1,977	58

Table 4.10 Continued.

Net benefits for the six cases, under the assumption of zero fixed costs:

	Wt.mean	Mean	Stddev	Min	Max	Count
1990-92 combined						
Longline						
Case 1		211	385	-3,080	1,718	129
Case 2		219	385	-3,064	1,744	129
Case 3		219	385	-3,064	1,745	129
Case 4		228	385	-3,048	1,772	129
Case 5		134	471	-3,090	1,718	129
Case 6		147	473	-3,052	1,772	129
Pot						
Case 1		223	166	-121	816	44
Case 2		224	166	-121	816	44
Trawl						
Case 1		-86	1,305	-11,248	1,937	191
Case 2		-69	1,297	-11,137	1,977	191

Net benefits for the six Cases, under the assumption of mean fixed costs:

	Wt.mean	Mean	Stddev	Min	Max	Count
1990						
Longline						
Case 1	51	354	311	60	1,718	31
Case 2	55	361	315	68	1,744	31
Case 3	55	361	315	68	1,745	31
Case 4	59	367	319	77	1,772	31
Case 5	46	311	408	-993	1,718	31
Case 6	51	322	416	-993	1,772	31
Pot						
Case 1	2	271	64	212	367	9
Case 2	2	272	65	213	368	9
Trawl						
Case 1	43	59	590	-2,199	1,069	56
Case 2	48	68	586	-2,163	1,075	56

Table 4.10 Continued.

Net benefits for the six Cases, under the assumption of mean fixed costs:

	Wt.mean	Mean	Stddev	Min	Max	Count
1991						
Longline						
Case 1	30	301	145	8	767	43
Case 2	34	310	144	36	772	43
Case 3	34	310	144	37	772	43
Case 4	39	320	144	66	776	43
Case 5	30	243	279	-798	749	43
Case 6	38	260	282	-798	758	43
Pot						
Case 1	5	225	131	13	360	14
Case 2	5	225	131	13	361	14
Trawl						
Case 1	222	13	802	-2,716	1,642	77
Case 2	233	32	792	-2,699	1,643	77
1992						
Longline						
Case 1	-246	65	488	-3,080	753	55
Case 2	-239	73	487	-3,064	757	55
Case 3	-239	74	487	-3,064	757	55
Case 4	-231	83	486	-3,048	760	55
Case 5	-240	-41	556	-3,090	753	55
Case 6	-231	-31	555	-3,052	760	55
Pot						
Case 1	-2	206	208	-121	816	21
Case 2	-1	207	208	-121	816	21
Trawl						
Case 1	207	-337	2,044	-11,248	1,937	58
Case 2	221	-314	2,034	-11,137	1,977	58
1990-92 combined						
Longline						
Case 1		211	385	-3,080	1,718	129
Case 2		219	385	-3,064	1,744	129
Case 3		219	385	-3,064	1,745	129
Case 4		228	385	-3,048	1,772	129
Case 5		134	471	-3,090	1,718	129
Case 6		147	473	-3,052	1,772	129
Pot						
Case 1		223	166	-121	816	44
Case 2		224	166	-121	816	44
Trawl						
Case 1		-86	1,305	-11,248	1,937	191
Case 2		-69	1,297	-11,137	1,977	191

Note: The cases are defined in Tables 4.8 and 4.9.

Table 4.11 Input-output model estimates of economic activity associated with an additional 1,000 mt of Pacific Cod catch by the onshore longline and trawl fisheries and the at-sea longline and trawl fisheries.

	Local	Rest of Alaska	Pacific NW	Total
Onshore case				
Longline	$184,708	$141,399	$1,442,623	$1,768,730
Trawl	$220,963	$168,158	$1,809,791	$2,198,912
At-sea case				
Longline	$90,976	$101,181	$1,474,287	$1,666,444
Trawl	$64,731	$119,968	$1,790,375	$1,975,074
Weighted case				
Longline	$92,757	$101,945	$1,473,685	$1,668,387
Trawl	$119,256	$136,786	$1,797,151	$2,053,193

Note: These results are based on the Jensen-Radtke Input-Output Model for catcher boats delivering to Dutch Harbor and catcher/processors.

APPENDIX B

CATCH AND BYCATCH DATA AND ECONOMIC MODELS

Table B.1 Cod bycatch as a percentage of other groundfish catch for various domestic BSAI trawl fisheries by month, 1990-92.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1990													
Atka mack	.0	8.5	3.1	7.0	10.6	12.7	.	.	.	.	.	.	11.2
Bot plck	17.1	8.2	9.7	10.5	12.2	11.2	4.1	4.5	8.8	5.5	.0	7.6	9.5
Flatfish	21.8	.	.	.0	9.1	.	.	6.1	2.7	.	4.0	.	4.4
Rockfish	.	.	1.8	3.8	1.1	5.3	6.0	3.2	3.6	5.3	14.8	5.9	5.0
Other	.	6.1	.0	45.5	59.6	.0	14.1	32.1	23.8	38.5	.	44.2	17.5
Pollock	.3	.1	.5	.8	.8	.4	.4	.5	.6	.3	.1	.0	.5
Rocksole	8.0	11.6	11.1	.	.	.	.	1.9	4.5	6.0	2.3	.	9.2
Sable	2.1	.	.0	.	2.0	2.3	.0	.	.3	.	.	.	.8
Turbot	.9	.0	.3	1.8	.	2.3	27.3	.4	.	.	.	.	.9
Arth	.	.	.	.	.	.	.	.0	1.4	1.5	4.1	.	2.7
Yel sole	.	.	.	.	.	.	.	2.6	4.0	3.1	2.1	.	3.0
Total	3.8	1.7	2.3	3.2	3.0	3.0	1.1	1.0	1.8	1.1	1.0	2.9	2.1
1991													
Atka mack	5.1	8.1	6.8	.	.	.	.	.	.	.	.	.	6.6
Bot plck	15.4	13.2	14.7	15.0	20.0	5.7	5.6	4.7	4.5	.	.	.	8.5
Flatfish	5.7	7.4	.0	5.6	14.6	4.4	7.3	3.7	5.4	2.9	.	.	6.3
Rockfish	.	.	12.1	13.8	4.0	4.2	.	.0	.	1.2	.6	.	10.3
Other	4.2	.0	.0	.0	1.7	10.4	.0	.	6.2	.0	.	.	2.0
Pollock	.4	.2	.0	1.4	.	.4	.5	.5	.9	.	.	.	.4
Rocksole	4.6	6.3	7.3	15.8	7.2	5.6	3.8	6.5	6.9	.	.	.	6.5
Sable	.0	20.0	.0	.2	.0	.	.	.	.	.2	.0	.	1.9
Turbot	.	.	.	.	1.4	.	.	.	.	.	.	.	1.4
Arth	.	.	33.0	6.3	.5	.0	12.4	.	.	.1	.	.	1.1
Yel sole	.	.	.	.	1.0	.4	3.1	3.5	4.2	6.1	.	.	2.7
Total	2.1	2.6	2.9	13.3	3.2	.7	1.2	1.2	2.6	4.8	.4	.	1.9
1992													
Atka mack	1.4	3.9	4.4	9.8	.	.	.	.	.	.	.	.	6.5
Bot plck	14.7	9.8	4.3	13.4	26.8	3.7	2.8	2.9	.	.	.	.	6.3
Flatfish	7.4	9.3	4.6	.	5.4	6.8	8.4	5.0	.	.	.	.	7.0
Rockfish	.	2.6	8.0	6.8	24.2	.	3.1	.	.	.	.	.	5.8
Other	.0	.0	.3	.0	3.2	3.3	3.8	.	.	.	.	.	.9
Pollock	1.6	.9	.5	.0	.	.5	.4	.1	.	.	.	.	.6
Rocksole	3.9	8.8	12.5	.	4.1	6.4	10.5	7.1	.	.	.	.	8.1
Sable	.	.	.	.0	.	.	.	.	.	.	.	.	.
Arth	.	.	.	18.0	.	.	.	.	.	.	.	.	18.0
Yel sole	.	.	.	.	1.4	1.2	2.3	4.9	.	.	.	.	1.6
Total	4.2	3.1	1.6	6.6	1.5	1.1	.9	.8	.	.	.	.	2.0

Table B.2 Catch, retained catch, and halibut bycatch and bycatch mortality rates for each of three domestic BSAI cod fisheries by month and area, 1990-92.

BSAI Longline Fishery

YR	MONTH	TTONS	RTONS	HALMT	HALMORT	THALPCT	RHALPCT	THALMORT	RHALMORT
90	1	1,847	1,832	25	4	1.33%	1.34%	.21%	.21%
90	2	3,568	3,553	53	9	1.50%	1.51%	.24%	.24%
90	3	2,812	2,734	37	6	1.30%	1.34%	.21%	.21%
90	4	1,887	1,690	9	1	.46%	.52%	.07%	.08%
90	5	2,806	2,660	36	6	1.29%	1.36%	.21%	.22%
90	6	5,440	5,193	353	56	6.49%	6.80%	1.04%	1.09%
90	7	5,880	5,544	314	50	5.35%	5.67%	.86%	.91%
90	8	6,241	5,855	247	40	3.97%	4.23%	.63%	.68%
90	9	7,283	6,880	176	28	2.42%	2.56%	.39%	.41%
90	10	5,341	4,969	175	28	3.28%	3.53%	.53%	.56%
90	11	4,176	3,868	95	15	2.28%	2.46%	.36%	.39%
90	12	3,931	3,645	174	28	4.42%	4.77%	.71%	.76%

YR	MONTH	TTONS	RTONS	HALMT	HALMORT	THALPCT	RHALPCT	THALMORT	RHALMORT
91	1	2,778	2,618	55	9	1.99%	2.11%	.32%	.34%
91	2	4,408	4,121	95	15	2.15%	2.30%	.34%	.37%
91	3	5,776	5,546	90	14	1.55%	1.62%	.25%	.26%
91	4	6,393	5,886	54	9	.85%	.92%	.14%	.15%
91	5	5,333	4,952	81	13	1.53%	1.64%	.24%	.26%
91	6	7,645	6,835	299	48	3.91%	4.37%	.63%	.70%
91	7	6,191	5,321	396	63	6.40%	7.44%	1.02%	1.19%
91	8	7,036	6,175	328	52	4.66%	5.31%	.75%	.85%
91	9	8,118	7,001	224	36	2.76%	3.20%	.44%	.51%
91	10	5,976	5,091	344	55	5.76%	6.76%	.92%	1.08%
91	11	5,198	4,528	323	52	6.21%	7.13%	.99%	1.14%
91	12	5,235	4,668	325	52	6.22%	6.97%	.99%	1.12%

YR	MONTH	TTONS	RTONS	HALMT	HALMORT	THALPCT	RHALPCT	THALMORT	RHALMORT
92	1	6,320	5,648	191	31	3.03%	3.39%	.48%	.54%
92	2	8,952	8,066	175	28	1.95%	2.17%	.31%	.35%
92	3	13,720	12,335	249	40	1.82%	2.02%	.29%	.32%
92	4	13,735	12,376	450	72	3.28%	3.64%	.52%	.58%
92	5	21,317	13,033	767	123	3.60%	5.89%	.58%	.94%
92	6	10,904	9,198	1,320	211	12.11%	14.35%	1.94%	2.30%
92	7	12,023	10,599	1,378	220	11.46%	13.00%	1.83%	2.08%
92	8	2,103	1,911	212	34	10.07%	11.08%	1.61%	1.77%

BSAI Pot fishery

YR	MONTH	TTONS	RTONS	HALMT	HALMORT	THALPCT	RHALPCT	THALMORT	RHALMORT
90	5	0	0	0	0	.00%	.00%	.00%	.00%
90	7	376	355	5	1	1.33%	1.41%	.13%	.14%
90	8	576	568	5	1	.88%	.90%	.09%	.09%
90	9	269	266	3	0	1.16%	1.17%	.12%	.12%
90	10	173	170	7	1	4.27%	4.35%	.43%	.44%
90	11	24	24	1	0	2.30%	2.30%	.23%	.23%

YR	MONTH	TTONS	RTONS	HALMT	HALMORT	THALPCT	RHALPCT	THALMORT	RHALMORT
91	2	1	1	0	0	1.01%	1.01%	.10%	.10%
91	3	18	18	0	0	1.01%	1.01%	.10%	.10%
91	4	34	34	0	0	1.01%	1.01%	.10%	.10%
91	7	665	652	14	1	2.11%	2.16%	.21%	.22%
91	8	798	782	11	1	1.36%	1.39%	.14%	.14%
91	9	1,357	1,161	5	1	.40%	.47%	.04%	.05%
91	10	969	787	5	0	.48%	.59%	.05%	.06%
91	11	191	188	1	0	.28%	.28%	.03%	.03%
91	12	328	321	2	0	.63%	.64%	.06%	.06%

Table B.2 Continued.

BSAI Pot Fishery

YR	MONTH	TTONS	RTONS	HALMT	HALMORT	THALPCT	RHALPCT	THALMORT	RHALMORT
92	1	49	49	0	0	.00%	.00%	.00%	.00%
92	2	1	1	0	0	.00%	.00%	.00%	.00%
92	4	126	125	0	0	.00%	.00%	.00%	.00%
92	5	2,902	2,799	26	3	.91%	.95%	.09%	.09%
92	6	2,135	2,085	9	1	.42%	.43%	.04%	.04%
92	7	2,060	1,932	7	1	.34%	.36%	.03%	.04%
92	8	338	333	1	0	.43%	.44%	.04%	.04%

BSAI Trawl Fishery

YR	MONTH	TTONS	RTONS	HALMT	HALMORT	THALPCT	RHALPCT	THALMORT	RHALMORT
90	1	12,607	9,830	131	98	1.04%	1.33%	.78%	1.00%
90	2	23,060	17,433	155	117	.67%	.89%	.51%	.67%
90	3	37,715	26,515	398	298	1.06%	1.50%	.79%	1.13%
90	4	21,057	13,433	190	142	.90%	1.41%	.68%	1.06%
90	5	19,684	10,835	254	191	1.29%	2.35%	.97%	1.76%
90	6	14,280	8,939	58	44	.41%	.65%	.31%	.49%
90	7	322	248	1	1	.35%	.45%	.26%	.34%
90	8	51	38	0	0	.04%	.05%	.03%	.04%
90	9	150	93	0	0	.32%	.52%	.24%	.39%
90	10	256	203	0	0	.06%	.08%	.05%	.06%
90	11	2,299	1,723	37	28	1.62%	2.16%	1.21%	1.62%
90	12	3,712	3,122	59	44	1.59%	1.89%	1.19%	1.42%

YR	MONTH	TTONS	RTONS	HALMT	HALMORT	THALPCT	RHALPCT	THALMORT	RHALMORT
91	1	13,993	10,012	368	276	2.63%	3.68%	1.97%	2.76%
91	2	14,982	11,795	349	262	2.33%	2.96%	1.75%	2.22%
91	3	21,800	16,172	477	358	2.19%	2.95%	1.64%	2.21%
91	4	58,845	40,898	856	642	1.46%	2.09%	1.09%	1.57%
91	5	7,268	4,344	232	174	3.19%	5.34%	2.40%	4.01%
91	6	211	96	3	2	1.42%	3.13%	1.07%	2.35%
91	7	643	324	5	4	.80%	1.58%	.60%	1.19%
91	8	9	2	0	0	.00%	.02%	.00%	.01%
91	10	41	21	1	1	1.78%	3.51%	1.33%	2.64%

YR	MONTH	TTONS	RTONS	HALMT	HALMORT	THALPCT	RHALPCT	THALMORT	RHALMORT
92	1	256	193	8	6	3.08%	4.09%	2.31%	3.06%
92	2	8,618	6,068	214	160	2.48%	3.52%	1.86%	2.64%
92	3	20,253	13,613	330	247	1.63%	2.42%	1.22%	1.82%
92	4	26,139	16,923	635	476	2.43%	3.75%	1.82%	2.81%
92	5	9,662	5,156	342	256	3.54%	6.63%	2.65%	4.97%
92	6	248	247	3	2	1.16%	1.17%	.87%	.88%

Table B.2 Continued

EBS Longline Fishery

YR	MONTH	TTONS	RTONS	HALMT	HALMORT	THALPCT	RHALPCT	THALMORT	RHALMORT
90	1	1,847	1,832	25	4	1.33%	1.34%	.21%	.21%
90	2	3,568	3,553	53	9	1.50%	1.51%	.24%	.24%
90	3	2,770	2,692	32	5	1.14%	1.17%	.18%	.19%
90	4	1,887	1,690	9	1	.46%	.52%	.07%	.08%
90	5	2,801	2,656	36	6	1.27%	1.34%	.20%	.21%
90	6	5,420	5,174	353	56	6.51%	6.81%	1.04%	1.09%
90	7	5,825	5,489	313	50	5.38%	5.70%	.86%	.91%
90	8	6,234	5,848	247	40	3.97%	4.23%	.63%	.68%
90	9	7,176	6,773	172	28	2.40%	2.55%	.38%	.41%
90	10	5,177	4,806	172	27	3.32%	3.57%	.53%	.57%
90	11	3,998	3,691	89	14	2.23%	2.42%	.36%	.39%
90	12	3,931	3,645	174	28	4.42%	4.77%	.71%	.76%

YR	MONTH	TTONS	RTONS	HALMT	HALMORT	THALPCT	RHALPCT	THALMORT	RHALMORT
91	1	2,717	2,557	53	8	1.94%	2.06%	.31%	.33%
91	2	4,200	3,975	71	11	1.68%	1.78%	.27%	.28%
91	3	5,351	5,165	43	7	.81%	.84%	.13%	.13%
91	4	6,125	5,717	35	6	.57%	.61%	.09%	.10%
91	5	5,314	4,935	79	13	1.49%	1.60%	.24%	.26%
91	6	7,642	6,832	299	48	3.91%	4.37%	.63%	.70%
91	7	6,100	5,251	380	61	6.22%	7.23%	1.00%	1.16%
91	8	6,807	5,973	311	50	4.57%	5.21%	.73%	.83%
91	9	8,090	6,975	222	35	2.74%	3.18%	.44%	.51%
91	10	5,835	4,973	318	51	5.45%	6.40%	.87%	1.02%
91	11	4,522	3,875	271	43	6.00%	7.01%	.96%	1.12%
91	12	4,825	4,279	304	49	6.31%	7.11%	1.01%	1.14%

YR	MONTH	TTONS	RTONS	HALMT	HALMORT	THALPCT	RHALPCT	THALMORT	RHALMORT
92	1	5,761	5,107	186	30	3.23%	3.65%	.52%	.58%
92	2	8,517	7,636	159	25	1.86%	2.08%	.30%	.33%
92	3	12,188	10,822	201	32	1.65%	1.85%	.26%	.30%
92	4	10,609	9,505	278	44	2.62%	2.93%	.42%	.47%
92	5	20,011	11,837	689	110	3.44%	5.82%	.55%	.93%
92	6	7,030	5,734	1,071	171	15.23%	18.68%	2.44%	2.99%
92	7	7,400	6,392	1,104	177	14.92%	17.27%	2.39%	2.76%
92	8	1,419	1,261	153	24	10.75%	12.09%	1.72%	1.93%

EBS Pot Fishery

YR	MONTH	TTONS	RTONS	HALMT	HALMORT	THALPCT	RHALPCT	THALMORT	RHALMORT
90	7	376	355	5	1	1.33%	1.41%	.13%	.14%
90	8	576	568	5	1	.88%	.90%	.09%	.09%
90	9	269	266	3	0	1.16%	1.17%	.12%	.12%
90	10	173	170	7	1	4.27%	4.35%	.43%	.44%
90	11	24	24	1	0	2.30%	2.30%	.23%	.23%

YR	MONTH	TTONS	RTONS	HALMT	HALMORT	THALPCT	RHALPCT	THALMORT	RHALMORT
91	2	1	1	0	0	1.01%	1.01%	.10%	.10%
91	3	10	10	0	0	1.01%	1.01%	.10%	.10%
91	4	2	2	0	0	1.01%	1.01%	.10%	.10%
91	7	401	388	13	1	3.33%	3.44%	.33%	.34%
91	8	319	311	10	1	3.27%	3.35%	.33%	.33%
91	9	521	516	4	0	.71%	.72%	.07%	.07%
91	10	444	414	2	0	.55%	.59%	.05%	.06%
91	11	191	188	1	0	.28%	.28%	.03%	.03%
91	12	328	321	2	0	.63%	.64%	.06%	.06%

Table B.2 Continued

EBS Pot Fishery

YR	MONTH	TTONS	RTONS	HALMT	HALMORT	THALPCT	RHALPCT	THALMORT	RHALMORT
92	1	49	49	0	0	.00%	.00%	.00%	.00%
92	2	1	1	0	0	.00%	.00%	.00%	.00%
92	4	126	125	0	0	.00%	.00%	.00%	.00%
92	5	2,188	2,110	26	3	1.20%	1.24%	.12%	.12%
92	6	868	858	6	1	.74%	.75%	.07%	.08%
92	7	863	847	2	0	.20%	.20%	.02%	.02%
92	8	154	152	0	0	.22%	.22%	.02%	.02%

EBS Trawl Fishery

YR	MONTH	TTONS	RTONS	HALMT	HALMORT	THALPCT	RHALPCT	THALMORT	RHALMORT
90	1	12,607	9,830	131	98	1.04%	1.33%	.78%	1.00%
90	2	23,060	17,433	155	117	.67%	.89%	.51%	.67%
90	3	37,715	26,515	398	298	1.06%	1.50%	.79%	1.13%
90	4	21,057	13,433	190	142	.90%	1.41%	.68%	1.06%
90	5	19,196	10,503	254	190	1.32%	2.41%	.99%	1.81%
90	6	11,043	6,749	39	30	.36%	.58%	.27%	.44%
90	7	174	106	0	0	.12%	.20%	.09%	.15%
90	8	51	38	0	0	.04%	.05%	.03%	.04%
90	9	60	17	0	0	.05%	.19%	.04%	.14%
90	10	161	119	0	0	.06%	.07%	.04%	.06%
90	11	2,299	1,723	37	28	1.62%	2.16%	1.21%	1.62%
90	12	3,696	3,113	59	44	1.60%	1.90%	1.20%	1.42%

YR	MONTH	TTONS	RTONS	HALMT	HALMORT	THALPCT	RHALPCT	THALMORT	RHALMORT
91	1	13,993	10,012	368	276	2.63%	3.68%	1.97%	2.76%
91	2	14,958	11,774	349	262	2.34%	2.97%	1.75%	2.23%
91	3	21,799	16,172	477	358	2.19%	2.95%	1.64%	2.21%
91	4	58,434	40,654	853	640	1.46%	2.10%	1.09%	1.57%
91	5	7,214	4,291	232	174	3.21%	5.40%	2.41%	4.05%
91	6	67	52	1	0	.84%	1.08%	.63%	.81%
91	7	416	113	3	2	.60%	2.23%	.45%	1.67%
91	8	9	2	0	0	.00%	.02%	.00%	.01%
91	10	41	21	1	1	1.78%	3.51%	1.33%	2.64%

YR	MONTH	TTONS	RTONS	HALMT	HALMORT	THALPCT	RHALPCT	THALMORT	RHALMORT
92	1	256	193	8	6	3.08%	4.09%	2.31%	3.06%
92	2	8,618	6,068	214	160	2.48%	3.52%	1.86%	2.64%
92	3	16,469	10,232	321	240	1.95%	3.13%	1.46%	2.35%
92	4	21,682	13,890	610	457	2.81%	4.39%	2.11%	3.29%
92	5	6,429	2,964	309	231	4.80%	10.41%	3.60%	7.81%
92	6	248	247	3	2	1.16%	1.17%	.87%	.88%

AI Longline Fishery

YR	MONTH	TTONS	RTONS	HALMT	HALMORT	THALPCT	RHALPCT	THALMORT	RHALMORT
90	3	42	42	5	1	11.71%	11.71%	1.87%	1.87%
90	5	4	4	0	0	11.51%	11.51%	1.84%	1.84%
90	6	20	20	1	0	2.58%	2.58%	.41%	.41%
90	7	55	55	1	0	2.30%	2.32%	.37%	.37%
90	8	7	7	0	0	2.97%	2.97%	.48%	.48%
90	9	107	107	4	1	3.66%	3.66%	.59%	.59%
90	10	164	164	4	1	2.18%	2.18%	.35%	.35%
90	11	177	177	6	1	3.26%	3.27%	.52%	.52%

Table B.2 Continued

AI Longline Fishery

YR	MONTH	TTONS	RTONS	HALMT	HALMORT	THALPCT	RHALPCT	THALMORT	RHALMORT
91	1	60	60	3	0	4.47%	4.47%	.71%	.71%
91	2	208	146	24	4	11.55%	16.47%	1.85%	2.63%
91	3	425	381	46	7	10.89%	12.13%	1.74%	1.94%
91	4	268	168	19	3	7.24%	11.53%	1.16%	1.84%
91	5	19	17	2	0	12.30%	13.49%	1.97%	2.16%
91	6	3	3	0	0	5.54%	5.54%	.89%	.89%
91	7	91	70	16	3	18.11%	23.40%	2.90%	3.74%
91	8	229	202	17	3	7.44%	8.43%	1.19%	1.35%
91	9	28	27	3	0	9.59%	9.88%	1.53%	1.58%
91	10	141	118	26	4	18.31%	21.80%	2.93%	3.49%
91	11	676	653	51	8	7.60%	7.87%	1.22%	1.26%
91	12	409	388	21	3	5.15%	5.43%	.82%	.87%

YR	MONTH	TTONS	RTONS	HALMT	HALMORT	THALPCT	RHALPCT	THALMORT	RHALMORT
92	1	559	541	5	1	.91%	.94%	.15%	.15%
92	2	435	430	16	3	3.72%	3.76%	.59%	.60%
92	3	1,531	1,513	49	8	3.18%	3.22%	.51%	.51%
92	4	3,126	2,870	172	28	5.50%	5.99%	.88%	.96%
92	5	1,306	1,196	79	13	6.04%	6.59%	.97%	1.05%
92	6	3,875	3,464	249	40	6.44%	7.20%	1.03%	1.15%
92	7	4,623	4,207	274	44	5.92%	6.51%	.95%	1.04%
92	8	684	650	59	9	8.66%	9.11%	1.39%	1.46%

AI Pot Fishery

YR	MONTH	TTONS	RTONS	HALMT	HALMORT	THALPCT	RHALPCT	THALMORT	RHALMORT
90	5	0	0	0	0	.00%	.00%	.00%	.00%

YR	MONTH	TTONS	RTONS	HALMT	HALMORT	THALPCT	RHALPCT	THALMORT	RHALMORT
91	3	8	8	0	0	1.01%	1.01%	.10%	.10%
91	4	32	32	0	0	1.01%	1.01%	.10%	.10%
91	7	264	264	1	0	.26%	.26%	.03%	.03%
91	8	479	471	0	0	.09%	.09%	.01%	.01%
91	9	837	645	2	0	.21%	.28%	.02%	.03%
91	10	525	374	2	0	.42%	.59%	.04%	.06%

YR	MONTH	TTONS	RTONS	HALMT	HALMORT	THALPCT	RHALPCT	THALMORT	RHALMORT
92	5	714	688	0	0	.04%	.04%	.00%	.00%
92	6	1,267	1,228	2	0	.19%	.20%	.02%	.02%
92	7	1,197	1,085	5	1	.44%	.49%	.04%	.05%
92	8	184	181	1	0	.62%	.62%	.06%	.06%

AI Trawl Fishery

YR	MONTH	TTONS	RTONS	HALMT	HALMORT	THALPCT	RHALPCT	THALMORT	RHALMORT
90	5	488	331	1	1	.17%	.25%	.13%	.19%
90	6	3,237	2,190	19	14	.58%	.86%	.43%	.64%
90	7	149	142	1	1	.62%	.65%	.46%	.48%
90	9	90	75	0	0	.50%	.60%	.38%	.45%
90	10	94	84	0	0	.07%	.08%	.05%	.06%
90	12	16	9	0	0	.42%	.75%	.32%	.57%

YR	MONTH	TTONS	RTONS	HALMT	HALMORT	THALPCT	RHALPCT	THALMORT	RHALMORT
91	2	24	21	0	0	.00%	.00%	.00%	.00%
91	3	0	0	0	0	.05%	.06%	.03%	.05%
91	4	411	244	3	3	.85%	1.43%	.64%	1.07%
91	5	54	54	0	0	.57%	.57%	.42%	.43%
91	6	144	44	2	2	1.69%	5.60%	1.27%	4.20%
91	7	228	212	3	2	1.15%	1.24%	.86%	.93%

YR	MONTH	TTONS	RTONS	HALMT	HALMORT	THALPCT	RHALPCT	THALMORT	RHALMORT
92	3	3,784	3,382	9	7	.24%	.27%	.18%	.20%
92	4	4,456	3,034	25	19	.57%	.83%	.42%	.62%
92	5	3,233	2,192	33	25	1.03%	1.52%	.77%	1.14%

Table B.3 Wholesale prices (FOB Alaska)

A completed table will be available at the September Council meeting.

Table B.4 Cost models.

By definition:

FCB = fixed cost in the base year

GFCB = groundfish catch per vessel year in the base year

CC/GFC = cod catch divided by groundfish catch

VC/GFC = variable cost per metric ton of groundfish catch

VC/CC = variable cost per metric ton of cod catch

CVW = vessel weeks in a cod fishery

GFVW = vessel weeks in a groundfish fishery

therefore,

VC/CC = (VCB/GFCB) / (CC/GFC)

and VC/CC will vary over time and among vessels as CC/GFC varies.

Assumptions for a factory longliner:

FCB = $481,000

GFCB = 2,042 mt

VCB = $1,550,000 and therefore

VCB/GFCB = $759.

Assumptions for a factory trawler:

FCB = $2,660,000

GFCB =14,300 mt

VCB = $6,900,000 and therefore

VCB/GFCB = $483.

Fixed cost is apportioned to each fishing operations based on the average of CVW/GFVW and CC/GFC.

Table B.5 Inputs for the input-output model.

In shore cod pounds (from 1991 WPR) status quo for Dutch Harbor:

	Longline	Trawl	Total
H&G	724,747	8,911,647	9,636,394
Fillets	381,730	13,320,160	13,701,890
Salted/split	663,745	34,574,813	35,238,558

After giving longline gear 2,204,620 pounds (1,000 mt):

	Longline increase	Total
H&G	902,594	10,538,988
Fillets	475,403	14,177,293
Salted/split	826,623	36,065,181

New % Splits	Longline	Trawl
% H&G	100%	100%
% Fillets	6%	94%
% Salted/split	4%	96%

After giving trawl gear 2,204,620 pounds (1,000 mt):

	Trawl increase	Total
H&G	345,854	9,982,248
Fillets	516,945	14,218,835
Salted/split	1,341,821	36,580,379

New % Splits	Longline	Trawl
% H&G	100%	100%
% Fillets	3%	97%
% Salted/split	2%	98%

Off shore cod pounds (from 1991 WPR) status quo:

	Longline	Trawl	Total
H&G	131,169,599	51,812,384	182,981,983
Fillets	0	66,996,241	66,996,241

After giving longline gear 2,204,620 pounds (1,000 mt):

	Longline increase	Total
H&G	2,204,620	185,186,603
Fillets	0	66,996,241

New % splits	Longline	Trawl
% H&G	100%	100%
% Fillets	0%	100%

After giving trawl gear 2,204,620 pounds (1,000 mt):

	Trawl increase	Total
H&G	961,434	183,943,417
Fillets	1,243,186	68,239,428

New % splits	Longline	Trawl
% H&G	100%	100%
% Fillets	0%	100%

APPENDIX D

ANALYSIS OF BSAI COD ALLOCATION FOR TRAWL AND FIXED GEAR WITH RESPECT TO MAINE MAMMALS

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The issue of allocating BSAI cod TAC between trawls and fixed (longline and pot) gear and how this may relate to marine mammals was investigated in the following ways:

1) Rates of recent (1991) incidental take by both gear types;

2) Locations fished by both gear types, especially with respect to Steller sea lion rookeries;

3) Temporal distribution of catch by both gear types; and

4) Bycatch and cod length-frequencies of both gear types.

This analysis was done without any knowledge of the proposed allocation alternatives; therefore, it should be considered a "qualitative" analysis of where, when, and how each gear type is fished, and in general, what are the interactions of each gear with marine mammals.

The primary conclusion of this analysis is that fixed gear tends to have less overlap with marine mammals than trawl gear, both in terms of what is caught but also where, when and how it is fished. However, there is no firm evidence that allocating cod TAC to trawls would, in and of itself, have measurable deleterious effects on marine mammals. But allocating cod to trawls, especially if it is combined with an inshore allocation in the BSAI, could affect those marine mammals (particularly pinnipeds) that forage in the southeastern Bering Sea from Amak to Unalaska Islands. This is a similar conclusion to one that was reached with respect to establishment of the Catcher Vessel Operational Area for pollock by Amendment 18.

1. Rates of Incidental Take

Both gear types have a low (or zero) rate of incidental take of marine mammals when used in the cod fishery. In 1991, there were no observed takes of marine mammals by pot or longline gear fishing for cod in the BSAI or GOA regions. Trawl gear had a total of 45 observed takes of marine mammals in the two regions, 41 of which occurred in the BSAI. The BSAI cod fishery had a total of 2 observed takes; an unidentified whale and an unidentified phocid in subarea 521.

NMFS lists (Federal Register 12 May 1992; 57:92) commercial fisheries according to frequency of takes of marine mammals; BSAI longline fisheries are in Category II (occasional incidental take of killer whales), while BSAI trawl and pot fisheries are in Category III (remote likelihood of incidental take). Placement of longline fisheries in Category II is due to the documented interaction between killer whales and the longline fishery for sablefish and turbot. Despite their inclusion in Category III, BSAI trawl fisheries have had documented interactions with 14 marine mammal species, including pinnipeds, cetaceans and otters. Pots have had no documented taking of any marine mammal.

Neither gear as currently fished in the cod fishery is likely to present a problem with respect to incidental takes of marine mammals. However, increased cod-fishing effort with longlines in the BSAI could increase the interaction potential with killer whales. But due to the documented (although at low rates) takes of a wide variety of marine mammals by trawl gear, fixed gear may have a slight edge here with respect to lower potential impact on marine mammals.

2. Locations fished by both gear types

Attached are charts showing cod pot, longline and trawl fishing locations in the BSAI for 1990-91 by 3, 4-month periods. Fishing locations for the three gear types are similar, but trawls tend to be fished more in the southeastern Bering Sea (north of Unimak Pass and Unimak Island) than do longlines. Effort is concentrated near the edge of the continental shelf up to 60°N latitude in the Bering Sea, and along the northern edge of the Aleutian Islands, especially Akun, Akutan, Unalaska, Umnak, Seguam, Amlia, Atka, Adak, and Attu Islands.

In 1990-91, trawls caught 14.5 and 12.7%, respectively, of their total cod catch within 20 miles of Steller sea lion rookeries in the BSAI, and most of this occurred in either the 1st (1991) or 2nd (1990) quarters. By contrast, between 1-2% of the longline-caught cod was captured within 20 miles of Steller sea lion rookeries in the BSAI in 1990 and 1991. The small amount of data available for pots for 1990 and 1991 yield different patterns: in 1990, 10% of the pot-caught cod were caught within 20 miles of rookeries, while in 1991 this increased to 69%.

Based on where cod is caught by each gear type, fixed gear again is given a slight edge over trawl gear for lower interaction potential with marine mammals. This is especially true when viewed in light of any potential inshore/offshore cod allocation (as was done in the GOA). Inshore cod trawlers out of Dutch Harbor rely heavily on areas north of Akun, Akutan, Unimak Island and within Unimak Pass for catches, especially early in the year. This group was particularly affected by the 20 mile trawl closures around Akun and Akutan during the A season 1992. If an inshore cod allocation is granted in the BSAI or if the trawl allocation in this proposal is high, then conflict between cod trawling and marine mammals (particularly Steller sea lions) in this area will likely intensify.

3. Temporal distribution of catch

Trawl catch of cod has occurred primarily in the first half of both 1990-1991, with approximately 80% of the annual total harvested in the first two quarters (observer data).

This may be due to the quarterly allocation schedule of halibut bycatch to the cod trawl fishery: 60% in quarter 1, 30% in quarter 2 and 10% in quarter 3.

By contrast, longline fishing for cod is spread more evenly throughout the year. Based on observer data, the quarterly percentage catch distribution of longline-caught cod in 1990-91 was:

	1990	1991
Quarter 1	9.5%	20.1%
Quarter 2	24.3%	27.1%
Quarter 3	36.3%	29.0%
Quarter 4	29.9%	23.8%

No records of cod pot deployments in Jan-Apr of 1990 or 1991 exist in NORPAC, suggesting that it is primarily a summer/fall fishery.

Based on the temporal distributions of the fisheries, again the slight edge goes to fixed gear. Winter is thought to be a more critical time period for foraging problems, especially for juvenile sea lions. While juvenile sea lions are unlikely to eat large cod, trawl fishing in the winter would more likely negatively affect foraging sea lions (fish school disruption, bycatch of other prey) than if fixed gear deployments were concentrated in winter.

4. Bycatch and cod length-frequencies

Cod generally comprise only a modest proportion of the sea lion diet, and less of the harbor seal's and Northern fur seal's. In the 1970s and 1980s, cod was found in 12.4% and 6.8% of the sea lion stomachs examined from the GOA (Calkins and Goodwin 1988), but was ranked second in order of importance (behind pollock) in a 1981 collection of sea lions from the Bering Sea (principally northwest of the Pribilofs; Calkins, unpubl.). Cod was found in 6-8% of the harbor seal stomachs examined from the GOA (Pitcher 1980a;b), and is a minor component of the fur seal diet (Kajimura 1984). All three pinnipeds tend to prefer smaller prey than adult cod, but 60-80 cm fish are not uncommon prey of sea lions. The average length of fish ingested by sea lions in several studies, though, has been under 30 cm.

Other important prey items of Steller sea lions, harbor seals, and Northern fur seals include pollock, herring, squid, octopus, Atka mackerel, capelin, sand lance and salmon. Bycatch rates of the two gear types for these species would also affect the degree of interaction with these pinnipeds.

Bycatch

Of the eight pinniped prey items listed above, pollock and Atka mackerel are caught almost exclusively by trawls in directed fisheries. Furthermore, bycatch rates of pollock, particularly small pollock, are much lower with fixed gear than with trawls. Bycatch rates of capelin and sand lance are very low in groundfish fisheries regardless of gear type. Table 1 (below) summarizes the 1991 bycatch rates of cod-directed trawls and fixed gear for squid, herring, octopus, salmon and prohibited species. Directed cod fishing for each gear type was defined as follows:

Trawls: Cod ≥ 40% of retained catch after midwater pollock (pollock ≥ 95% of total catch) and Greenland turbot (turbot ≥ 35% of retained catch) trawl fisheries had been assigned. Retained catch was the total catch of all species with assigned TACs.

Fixed gear: Cod ≥ 40% of retained catch of all species with assigned TACs.

Table 1. Observed bycatch rates of squid, herring, octopus, salmon and prohibited species by trawls and fixed gear fishing for cod in the BSAI in 1991.

Catch	Trawl	Fixed
Total (mt)	56,103	70,025
Retained (mt)	52,939	61,823
Cod (mt)	40,066	57,967
Squid (kg)	2,931	0
rate (kg/mt cod)	0.073	0
Herring (kg)	1,316	0
rate (kg/mt cod)	0.033	0
Octopus (kg)	57,722	92,710
rate (kg/mt cod)	1.441	1.599
Salmon (kg)	11,212	295
rate (kg/mt cod)	0.280	0.005
Halibut (kg)	922,495	2,430,055
rate (kg/mt cod)	23.024	41.922
King crab (#)	2,105	4,202
rate (#/mt/cod)	0.052	0.072
Tanner crab (#)	380,023	99,433
rate (#/mt cod)	9.485	1.715

Bycatch rates of squid and herring by cod trawls and fixed gear were low, but fixed gear had no observed bycatch of either species. Octopus bycatch rates for both gear types were the highest of the four species, with fixed gear having slightly higher bycatch rates than trawls for octopus. As expected, salmon bycatch rates were considerably higher (56 times higher) for trawls than for fixed gear.

Fixed-gear bycatch rates of halibut are nearly double those of trawls, but discard mortality rates of halibut are much lower from fixed gear (13-18% for longlines and 6-10% from pots) than from trawls (75%). Using the observed bycatch rates of halibut by both gear types above, discard mortality of halibut would be approximately 17.3 kg/mt of trawl-caught cod, and range between 2.5 - 7.5 kg/mt of fixed gear-caught cod.

King crab bycatch rates were approximately the same by both gear types in 1991, while the trawl bycatch rate for Tanner crab was 5.5 times that of fixed gear.

In summary, with respect to bycatch rates of pinniped prey and prohibited species, fixed gear would be favored over trawl gear due to its zero bycatch of some important pinniped prey items (particularly squid, herring and small pollock) and lower discard mortality of prohibited species. Both gear types have relatively high bycatch rate of octopus, which could be a concern given the potential for an directed octopus fishery.

Cod Length-Frequency

Length-frequencies of cod collected by all trawls, cod-directed trawls and fixed gear in 1991 are shown on accompanying figures. Mean and median lengths of cod caught by both trawls and fixed gear were all greater than 65 cm, but were between 5-7 and 3-5 cm lower, respectively, for trawls than for fixed gear. More importantly, between 14-20% of the cod caught by trawls were 50 cm in length or less, while only 3% of the cod caught by fixed gear were in this size category in 1991. Fixed gear may have less potential for interaction with pinnipeds than trawls based on the length-frequency of cod captured.

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AGEDNDA D-5(a)
Supplemental

ENVIRONMENTAL ASSESSMENT/REGULATORY IMPACT REVIEW/

INITIAL REGULATORY FLEXIBILITY ANALYSIS

FOR

AMENDMENT 21 (Chapter 4)

TO THE FISHERY MANAGEMENT PLAN FOR

THE GROUNDFISH FISHERY OF THE

BERING SEA AND ALEUTIAN ISLANDS

Prepared by staff of

National Marine Fisheries Service
Alaska Department of Fish and Game
Alaska Commercial Fisheries Entry Commission
Juneau, Alaska

September 21, 1992

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4.0 CLOSE AREAS AROUND THE PRIBILOF ISLANDS TO TRAWLING

4.1 Management Background

In October, 1989, and again in August, 1991, the Central Bering Sea Fishermen's Association (CBSFA) proposed a prohibition on bottom trawl fishing in International Pacific Halibut Commission (IPHC) Area 4C. At it's September, 1991 meeting, the North Pacific Fishery Management Council (NPFMC) requested the State of Alaska to prepare an analysis of the proposal. At its April, 1992 meeting the NPFMC reviewed a draft analysis of the proposal, and expanded the scope of the proposal to include different areas of closure.

4.2 Purpose of and Need for the Proposed Action

The IPHC Area 4C lies between 56°20'N and 58°N latitude and 168°W and 171°W longitude, enclosing about 8,100 square nautical miles (28,000 square kilometers) and including the Pribilof Islands with St. George near the southern boundary and St. Paul near the center of the area (see Figure 1). According to the CBSFA, the Pribilof Islands and surrounding waters encompassed by IPHC Area 4C represent important habitat for marine mammals, seabirds, blue king crab and Korean hair crab. Bottom trawling is alleged to be destructive to the habitat of these animals including their prey species, as well as to the animals themselves including their juvenile stages. In addition, bottom trawling is acknowledged to have relatively high bycatch of prohibited species such as halibut and red king crab.

The stated purpose of the proposed action is to eliminate bottom trawl activities in IPHC Area 4C in order that blue king crab and Korean hair crab stocks may build to exploitable levels, and seabird and marine mammal populations may increase to levels sustainable by a habitat undisturbed by bottom trawl activities. In addition, the CBSFA contends that elimination of bottom trawl activities in IPHC Area 4C will reduce bycatch of juvenile halibut and crab.

4.3 Alternatives for Pribilof Islands Area Trawl Activities

The range of alternatives considered always includes taking no action - status quo. The alternative encompassing the proposal is to close IPHC Area 4C to bottom trawling. However, since pelagic trawls in the area often fish on or near the bottom, a reasonable alternative to address the effects of trawling would be to close the area to all trawling. After a review of the preliminary analysis of the proposal, the NPFMC added alternatives encompassing closures for two different areas, namely an area from the beach out to 25 nautical miles (nm) around St. George and St. Paul Islands, and an area encompassing only that part of IPHC area 4C west of 169°W longitude. Figure 1 shows these areas in relation to IPHC Area 4C. Thus, the alternatives considered are:

Alternative 1: Status quo, allow trawling around the Pribilof Islands.

Alternative 2: Close IPHC Area 4C to bottom trawling.

Alternative 3: Close IPHC Area 4C to all trawling.

Alternative 4: Close the area within 25 nm of the beach around the Pribilof Islands to bottom trawling.

Alternative 5: Close the area within 25 nm of the beach around the Pribilof Islands to all trawling.

Alternative 6: Close IPHC Area 4C west of 169°W to bottom trawling.

Alternative 7: Close IPHC Area 4C west of 169°W to all trawling.

4.4 Analyses of The Alternatives

Operation of the BSAI groundfish trawl fisheries under each of the alternatives would have direct and indirect effects on the groundfish stocks and economically important bycatch species as well as marine mammal and bird populations. The direct effects result from fishing operations and can be quantitatively estimated for groundfish and bycatch catches in the BSAI. Quantitative estimates of the likely effects on mammal and bird populations in the areas around the Pribilof Islands resulting from the effects of fishing under each alternative were not available. Information on blue king crab near the Pribilof Islands was available from NMFS' trawl surveys in the Bering Sea and the NMFS' groundfish observer data base.

A fishery simulation model developed by Smith (1989) and Funk (1990) and modified for use in analyzing earlier amendments (Anonymous, 1991b) was modified and used by Mr. Dave Ackley of the Alaska Department of Fish and Game to make quantitative estimates of the likely consequences of alternatives in this document on groundfish catch and bycatch in the BSAI. Dr. Ben Muse of the Alaska Commercial Fisheries Entry Commission developed relative cost and return parameters for directed fishery species and bycatch, and produced estimates of value for the alternatives considered here. Model parameters were based on 1990 and 1991 data. Detailed discussion of the methods for making catch and value estimates is found in Section 1.8 above and in Appendix 1.

The data the bycatch model uses is summarized into monthly totals for each fishery and subarea. The model simulates fishing activity by dividing the monthly data into prespecified time segments (such as a week) and accumulating catch a portion at a time. For instance, in simulating a weekly fishery, the monthly data is divided by four and the fishery is allowed to prosecute one quarter of the monthly data in each iteration. The data from each iteration is accumulated and compared against the TAC. In this way if a TAC is exceeded, it is not exceeded by the entire catch from a month, but by only a portion of the monthly total. This partitioning of the data has been adequate in determining the effects of closures over large area units. The current analysis, however, requires a finer scale of resolution to detect meaningful differences.

Model runs presented to the SSC in April were often counterintuitive. The reason for the counterintuitive results was because of the means in which the model tracks fisheries and accumulates their respective catches. As mentioned above, a portion of the monthly catch, in this case a week's catch, is compared to the TAC, and if the TAC is exceeded the fishery is halted. No further catch from the closed zone is allowed to accumulate. Often, however, the closed zone includes several management subareas for which there is catch remaining in the week. The model does not allow the catch from the remaining subareas to accumulate. The data is sorted in month, fishery and subarea order. If, for instance, the TAC is attained in the first of 4 subareas within a zone, the catch from the first subarea is accumulated, but the catch from the remaining subareas is not.

The model was therefore modified for the present analysis to simulate a daily fishery within each month. Each iteration of the model only accumulated 1/30 of the monthly catch, and each iteration was compared to the TAC. This allowed the affects produced by not accumulating catch from (effectively closed) remaining management areas within a closed zone to be minimal. Subsequent results indicated no discernible differences among alternatives in groundfish catch and bycatch levels as shown in Tables 4.1 and 4.2, and Figure 4.2. Remaining differences could still be attributed to the method of accumulating catches used in the model, however, the scale of model specific differences have been reduced to the smallest level possible.

For these analyses of alternatives, population levels for directed fishery species and bycatch species under quota were assumed to be optimized by the respective quotas established for the BSAI, and were not affected by the alternatives considered for the areas around the Pribilof Islands trawl activities. Direct effects of the alternatives were measured by changes in catch levels and associated values for directed fishery and bycatch species in the BSAI as a whole. The effects of the alternatives were estimated under two different scenarios with respect to the effectiveness of the vessel incentive program. Scenario 1 assumes the vessel incentive program to be completely effective. Scenario 2 assumes there is no effective vessel incentive program, which results in higher bycatch rates and lower groundfish catch levels than Scenarios 1. Alternatives were compared within a given scenario.

There were a relatively large number of alternatives with negligible differences among alternatives in terms of directed groundfish catch and bycatch levels in the BSAI. In addition, it was not possible to quantify likely effects of the alternatives on marine mammal and bird populations. Therefore the analysis is presented in terms of the status quo (Alternative 1) followed by descriptions of categories of effect (e.g. likely effect on blue king crabs or enforcement costs) across alternatives.

4.4.1 Alternative 1: Status quo, allow trawling in the areas around the Pribilof Islands

At present, directed trawl fisheries for groundfish occur in the areas around the Pribilof Islands under the general regulations for the Bering Sea and Aleutian Islands. The first columns of Table 4.1 and Table 4.2 present the expected catch and value of directed groundfish fisheries and bycatch under Alternative 1 for the BSAI as a whole, under Scenarios 1 and 2, respectively.

Under status quo conditions, directed bottom trawl catch represented 18 percent of the total groundfish catch for IPHC Area 4C and 24 percent of the gross value, whereas all trawling represented virtually all of the catch and value for the area. Compared to directed fisheries in the BSAI, bottom trawling in IPHC Area 4C represented less than 2 percent of the catch and value, while all trawling in IPHC Area 4C accounted for 9 percent of the catch and 7 percent of the value of groundfish in the BSAI.

In the absence of changes in regulations, a pattern of trawl fishing reflecting Scenario 1 or 2, or some intermediate situation, would be expected to continue into the future, with variation in directed catch and bycatch due to shifts in resource locations, weather and market factors. The penultimate rows of Tables 4.1 and 4.2 represent the expected annual gross revenues from directed groundfish fisheries adjusted (reduced) by the foregone present gross values of the associated bycatch under Scenarios 1 and 2, respectively. The final rows of Tables 4.1 and 4.2 represent the expected annual net revenues (i.e. adjusted for costs) from groundfish fisheries adjusted by the foregone net values of the associated bycatch under Scenarios 1 and 2, respectively.

The first reported blue king crab catches in the Pribilof Islands area were 544 metric tons in 1973. Catches peaked in 1980 and 1981 at 4,900 and 4,100 metric tons, respectively. Thereafter, landings dropped to an average 200 metric tons per year from 1984 through 1987. The Pribilof Islands blue king crab fishery has not been conducted since 1987. Although 1990 and 1991 survey information indicated potentially fishable populations, the error associated with the survey estimates, the expected large amounts of effort and the difficulties inherent in managing a remote, derby-type fishery resulted in decisions not to open the fishery.

Table 4.3 contains estimates of the density of blue king crab (males and females of all sizes) in the areas around the Pribilof Islands that make up the alternative closure areas. These estimates were based on the NMFS' trawl surveys around the Pribilof Islands in 1989-1991. The area of highest crab density appeared to be the IPHC Area 4C west of 169°W longitude outside 25 NM around the islands. The next highest area of crab density appeared to be within 25 NM of the islands. The area in IPHC Area 4C east of 169°W appeared to have the lowest density of crab during the periods of the NMFS' trawl surveys (June to mid-August).

Table 4.4 provides estimates of blue king crab bycatch rates by trawl vessels in IPHC Area 4C and subareas during 1989-1991 based on groundfish observer data. For bottom trawls, estimated bycatch rates for blue king crab were slightly higher in IPHC Area 4C west of 169°W than in IPHC Area 4C as a whole. For pelagic trawls, the situation was reversed, primarily due to some extraordinarily high blue king crab bycatches in pelagic trawls in 1991. Bycatch rates for the area within 25 NM of the islands appeared to be considerably lower (one-half to one-third) than rates for the larger areas.

Seabird density in the BSAI fluctuates seasonally and assessments for Amendments 18/23 (1991a) did not postulate a trend for the area. The assessment did note (p. 2-46) that about 88 percent of the world population of red-legged kittiwakes and 92 percent of the Alaskan thick-billed murre population breed on the Pribilof Islands. These birds include pollock in their diet in the Pribilofs (2-20 percent for red-legged kittiwakes and 25-50 percent for thick-billed murres). The assessment states that kittiwakes and murres have exhibited poor reproductive success in recent years and their populations appear to have declined. In the absence of changes in regulations, populations could continue to decline, stabilize at some lowered level, or the trend may reverse (Sue Mello, NMFS, personal communication, May, 1992).

Of the marine mammals inhabiting the BSAI, the assessment for Amendments 18/23 (1991a) discussed three species in some depth that were important in the Pribilof Islands: Steller sea lions (Eumetopias jubatus), northern fur seals (Callorhinus ursinus) and Pacific harbor seals (Phoca vitulina). The populations of these species were below historical levels and the Steller sea lion is listed as threatened under the Endangered Species Act (ESA). About two-thirds of the world population of northern fur seals is associated with the Pribilof Islands and, although the population is currently stable, it is listed as depleted under the MMPA. Pacific harbor seals have declined similar to Steller sea lions, although the assessment does not evaluate the current population status. Pollock were important in the diets of these three pinnipeds, and the Pribilof Islands were particularly important habitat for the northern fur seal. A 10 nautical mile (19 kilometer) radius "no trawling" zone is in effect around the Walrus Island Steller sea lion rookery near St. Paul Island in the Pribilofs. Given the available information and the existing regulations for the areas around the Pribilof Islands, the fishery there was judged to meet the "no jeopardy" standard of the ESA. The MMPA only applies to incidental takes of marine mammals. However, it is possible that additional information on the ecosystem requirements of marine mammals may indicate that the existing regulations need to be modified in order to optimize marine mammal populations (Sue Mello, NMFS, personal communication, May, 1992).

Under the status quo, management strategies and enforcement practices would not change. Therefore management and enforcement costs would not be expected.

4.4.2 Effects of Alternatives 2 through 7: Close Various Areas Around the Pribilof Islands to Bottom Trawling or All Trawling

4.4.2.1 Effects on Directed Groundfish Catch and Prohibited Species Bycatch in the BSAI

Tables 4.1 and 4.2 present the expected catch and value of directed groundfish fisheries and bycatch under Alternatives 2 through 7 for Scenarios 1 and 2. As noted above and shown in Figure 4.2, there were no discernible changes in directed and bycatch amounts and values in the BSAI as a result of these alternatives. There would likely be local effects on the groundfish fisheries of prohibiting either bottom or pelagic trawling, or both, in the alternative areas around the islands. For example, the 25 NM area south of St. George Island includes an area near the 100 fathom curve (that lies outside IPHC Area 4C) that reportedly has good fishing. Similarly, the part of IPHC Area 4C east of 169°W reportedly contains good fishing grounds. Prohibiting trawling in these areas would tend to transfer the effort to other areas of, perhaps, lower productivity and higher costs. If groundfish CDQs were utilized by processing plants on the Pribilof Islands, then a prohibition on trawling around the islands could raise costs to these operations. However, there was no information available on the likely amount of possible cost increases.

4.4.2.2 Effects on Blue King Crab

Data from NMFS' trawl surveys in 1989-1991, summarized in Table 4.3, indicate that Alternatives 6 and 7 closing the IPHC Area 4C west of 169°W appear to protect the areas of highest blue king crab density. The area 25 NM around the islands had a lower density of crab, while that part of IPHC Area 4C east of 169°W had the lowest density in the 1989-1991 surveys. Data on distribution from surveys conducted in 1979 and 1980 (Otto memorandum, 1992) indicate that crab were distributed somewhat further to the east of 169°W during that era of relatively high abundance (and catches) of blue king crab near the Pribilof Islands.

Information from NMFS' groundfish observer data base for 1989-1991 indicated that relatively high bycatches of blue king crab occurred in IPHC Area 4C northeast of the Pribilof Islands (outside 25 NM) on both sides of 169°W. A second area of concentrated bycatch occurred in IPHC Area 4C within 25 NM of St George Island around 169°W. Table 4.4 indicates that pelagic trawling produced higher bycatch rates for blue king crab than did bottom trawling. This counter-intuitive result is explained by the definition of pelagic trawl that included trawls capable of fishing on or near the bottom, and by the occurrence of several extraordinarily high bycatches of blue king crab (up to 672 crab/hour) by pelagic trawls in 1991. A minimal amount of bycatch was attributable to non-trawl gears. Table 4.5 (in the row labelled "Blue King Crab Bycatch Savings. . .") presents estimates of the bycatch in numbers of blue king crab that would have been avoided by the boats carrying observers under each alternative during the period 1989-1991. Based on the projected blue king crab savings in Table 4.5, Alternative 3 closing IPHC Area 4C to all trawling would result in avoiding the largest amount of blue king crab bycatch while Alternative 4 closing 25 NM around the islands to bottom trawling would result in the smallest bycatch saving, compared to the status quo.

4.4.2.3 Effects on Seabirds and Marine Mammals

The NMFS has concluded that existing fishery exploitation levels are not a problem for birds and mammals in the BSAI. The impact of closing part or all of IPHC Area 4C to trawling on populations of birds and mammals in the BSAI is not clear. Since there is no increase in overall exploitation rates of the fish stocks, the alternatives are not likely to have any adverse effects on seabirds and marine mammals. There may be some local positive effects on marine mammals and seabirds that are linked to land during the breeding season. However, the relationship between fishing and birds and mammals is unclear. Although it may be intuitively reasonable that less fishing is better for bird and mammal populations, this is not presently supported by any data. Bird species are not eating fish of the same size that are harvested by the fishery. Since fish stocks and birds and mammals are mobile, local closures may not have any real effects since fish and mammals don't necessarily stay within the closed areas. (Sue Mello, NMFS, personal communication, May, 1992.)

4.4.2.4 Effects on Management and Enforcement Costs

All of the alternatives 2 through 7 are likely to require an increase in management and enforcement costs. Increases in management costs for establishing rules and evaluating effectiveness would be similar among the alternatives. Alternatives 3, 5 and 7 that close areas to all trawling are likely to require similar increases in enforcement costs as increased at-sea surveillance would be required to enforce the ban on trawling. However, since all trawling would be forbidden in the area, at-sea boardings would not be required so that cost increases should be less than under Alternatives 2, 4 and 6 which involve closing areas to bottom trawling only. Since trawling would still be allowed in the areas so long as fisheries were open under Alternatives 2, 4 and 6, some further increased surveillance and perhaps at-sea boardings could be necessary to effectively enforce the prohibition only on fishing with bottom trawls.

4.5 Summary of Analyses

Table 4.5 provides a summary of the effects of the alternatives in terms of changes from the status quo. The first two rows of numbers in Table 4.5 were derived from the penultimate and last rows in Tables 4.1 and 4.2 by subtracting the values for Alternative 1 from the entries for Alternatives 1 through 7. The groundfish adjusted gross and net values incorporate changes in bycatch as well as directed catch among alternatives. There are no discernible differences among the alternatives in terms of their effects on the groundfish adjusted gross and net values in the BSAI. The relatively small, non-zero numbers in the first 4 rows of Table 4.5 may be artifacts of the model rather than significant results.

The effects of the alternatives on blue king crab are presented in Table 4.5 in terms of the blue king crab bycatch during 1989-1991 by vessels carrying observers that would have been avoided under each alternative. Alternative 3 would have yielded the largest savings in blue king crab bycatch during this period, while Alternative 4 would have produced the smallest savings.

The effects of the alternatives on bird and marine mammal populations in the BSAI were unknown.

All of the alternatives to the status quo were likely to occasion increased management and enforcement costs. Increases in management and enforcement costs were reckoned to be highest under Alternatives 2, 4 and 6 which involve prohibiting bottom trawls only and likely require at-sea boardings. However, estimates of differences in cost increases among alternatives were not made.

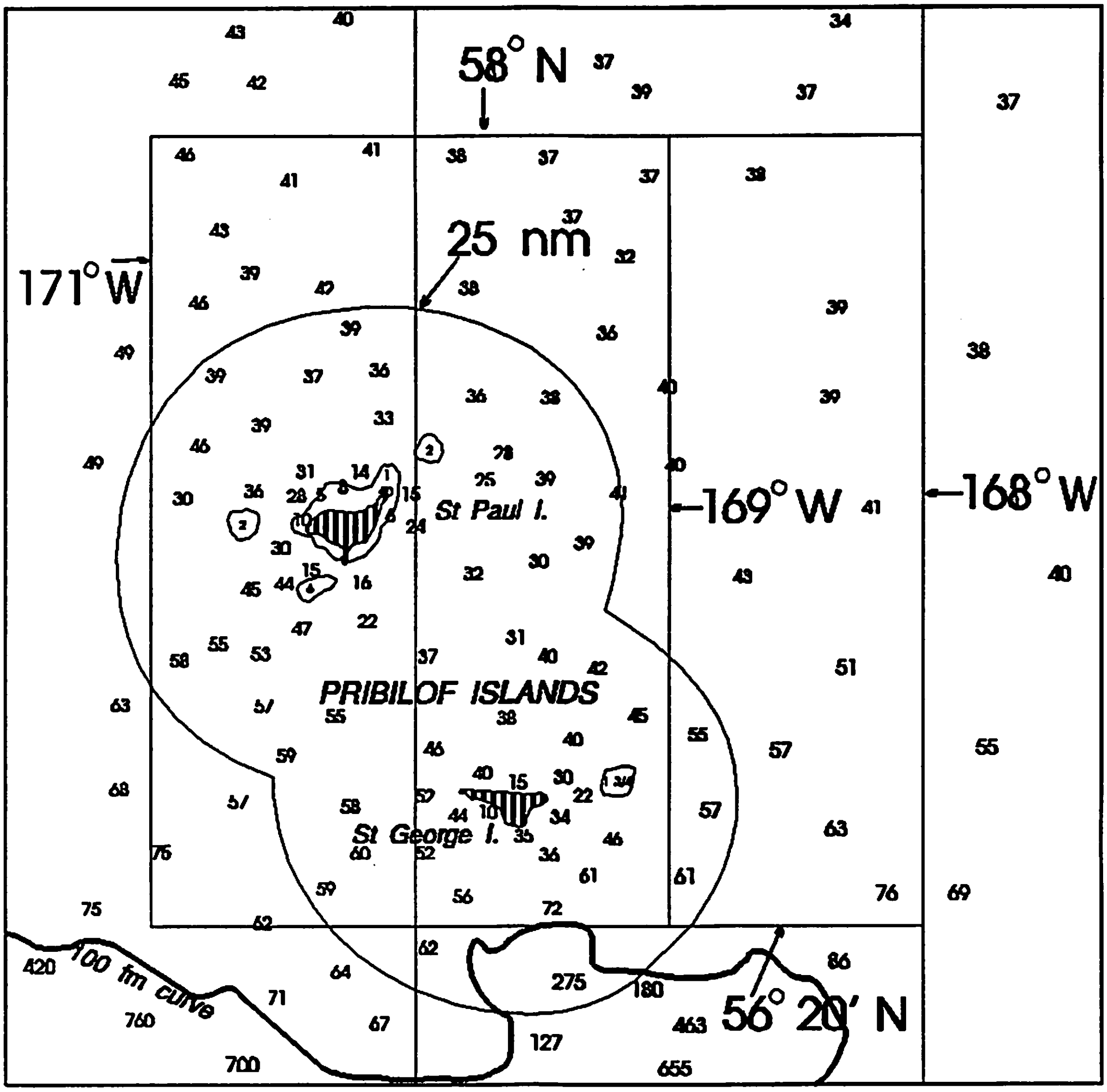

Figure 4.1. Depth soundings (in fathoms) and 100 fathom contour of proposed trawl closure alternatives around the Pribilof Islands. Alternative closure areas include IPHC Area 4C bounded by 56°20'N, 58°N, 168°W and 171°W; IPHC Area 4C west of 169°W; and the area out to 25 NM around the islands.

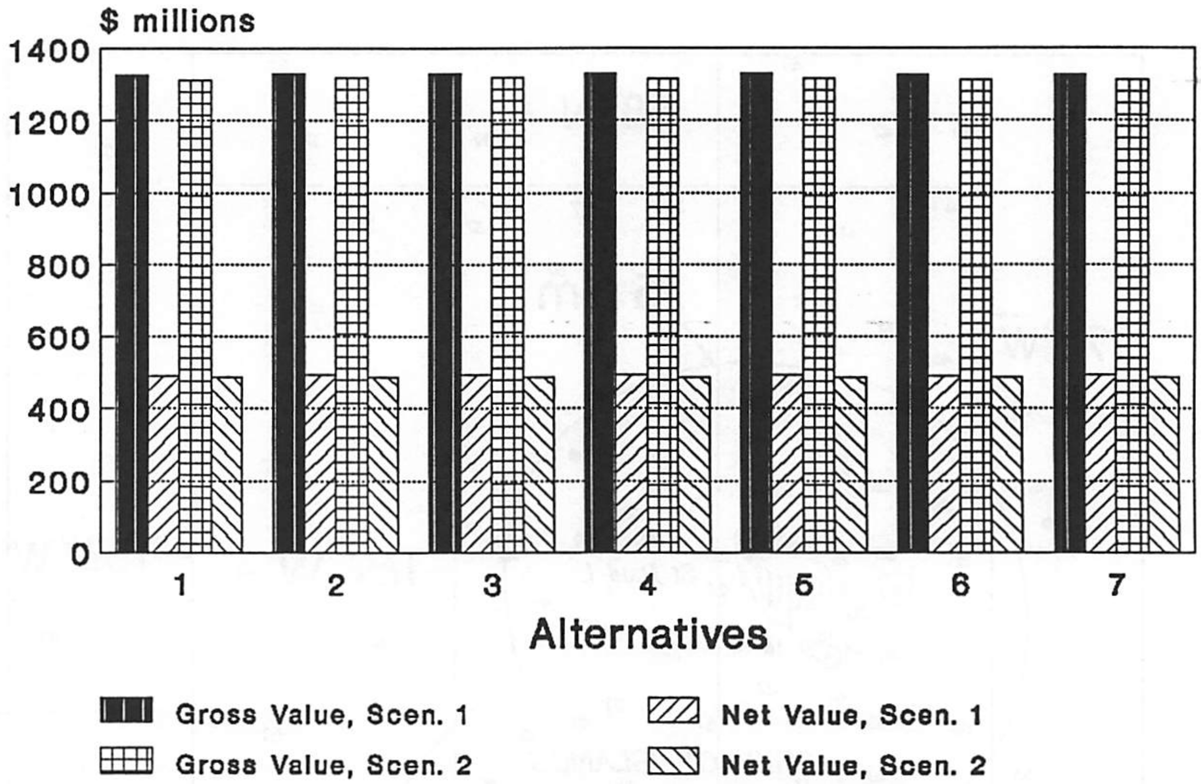

Figure 4.2. Comparison of Groundfish Adjusted Gross and Net Values Among Alternatives and Scenarios. Alternatives and Scenarios Defined in Text and Tables 4.1 and 4.2.

Table 4.1. Catch and value for directed groundfish and bycatch species in the BSAI fisheries under Alternatives 1 through 7 under Scenario 1 for closing areas around the Pribilof Islands.[1]

	Alternative						
	1	2	3	4	5	6	7
Groundfish Catch (1000 mt)							
Fixed Gear Cod & Sablefish	65	65	65	65	65	65	65
Pollock Surimi	1,333	1,335	1,333	1,334	1,334	1,333	1,333
Cod & Atka Mackerel Fillets	166	166	166	166	166	166	166
All Other Headed & Gutted	193	192	192	192	192	192	192
TOTAL	1,758	1,759	1,757	1,758	1,757	1,757	1,757
Groundfish Gross Revenue ($1,000,000)							
TOTAL	1,354	1,357	1,357	1,356	1,355	1,354	1,355
Groundfish Net Revenue (Gross Revenue - Variable Cost, $1,000,000)							
TOTAL	505	506	506	506	506	505	506
Bycatch Amounts							
Halibut (mt)	3,552	3,599	3,558	3,584	3,582	3,597	3,597
Herring (mt)	1,523	1,573	1,558	1,544	1,545	1,539	1,544
Red King Crab (no)	74,272	78,229	78,886	76,614	76,902	76,331	76,252
Tanner Crab (1,000 no)	1,982	1,957	1,913	1,985	1,941	1,981	1,936
Chinook (no)	21,764	21,996	22,447	21,767	21,661	21,814	21,897
Bycatch Present Gross Value (All fisheries, $1,000,000)							
TOTAL	28	28	28	28	28	28	28
Bycatch Present Net Value (All fisheries, $1,000,000)							
TOTAL	14	14	14	14	14	14	14
Groundfish Adjusted Gross Value (Groundfish Gross Revenue Total - Bycatch Present Gross Value Total, $1,000,000)							
TOTAL	1,326	1,329	1,329	1,328	1,328	1,326	1,327
Groundfish Adjusted Net Value (Groundfish Net Revenue Total - Bycatch Present Net Value Total, $1,000,000)							
TOTAL	491	492	492	492	492	491	492

[1] Alternative 1 - Status quo. Alternative 2 - Close IPHC Area 4C to bottom trawling. Alternative 3 - Close IPHC Area 4C to all trawling. Alternative 4 - Close 25 nm around islands to bottom trawling. Alternative 5 - Close 25 nm around islands to all trawling. Alternative 6 - Close IPHC Area 4C west of 169°W to bottom trawling. Alternative 7 - Close IPHC Area 4C west of 169°W to all trawling. Scenario 1 - Effective vessel incentive program.

Table 4.2. Catch and value for directed groundfish and bycatch species in the BSAI fisheries under Alternatives 1 through 7 under Scenario 2 for closing areas around the Pribilof Islands.[1]

	Alternative						
	1	2	3	4	5	6	7
Groundfish Catch (1000 mt)							
Fixed Gear Cod & Sablefish	65	65	65	65	65	65	65
Pollock Surimi	1,335	1,336	1,336	1,338	1,336	1,336	1,334
Cod & Atka Mackerel Fillets	166	166	166	166	166	166	166
All Other Headed & Gutted	173	176	176	172	172	172	172
TOTAL	1,740	1,743	1,743	1,741	1,739	1,739	1,737
Groundfish Gross Revenue ($1,000,000)							
TOTAL	1,343	1,347	1,349	1,346	1,345	1,343	1,343
Groundfish Net Revenue (Gross Revenue - Variable Cost, $1,000,000)							
TOTAL	501	503	504	502	502	501	501
Bycatch Amounts							
Halibut (mt)	3,884	3,909	3,911	3,900	3,897	3,904	3,902
Herring (mt)	1,628	1,663	1,660	1,649	1,643	1,639	1,636
Red King Crab (no)	92,123	89,000	89,648	86,839	87,130	86,472	86,368
Tanner Crab (1,000 no)	1,792	1,856	1,816	1,813	1,770	1,808	1,763
Chinook (no)	21,527	21,781	22,240	21,555	21,438	21,597	21,669
Bycatch Present Gross Value (All fisheries, $1,000,000)							
TOTAL	30	30	30	30	30	30	30
Bycatch Present Net Value (All fisheries, $1,000,000)							
TOTAL	15	15	15	15	15	14	15
Groundfish Adjusted Gross Value (Groundfish Gross Revenue Total - Bycatch Present Gross Value Total, $1,000,000)							
TOTAL	1,313	1,317	1,319	1,316	1,315	1,313	1,313
Groundfish Adjusted Net Value (Groundfish Net Revenue Total - Bycatch Present Net Value Total, $1,000,000)							
TOTAL	486	487	488	487	487	487	486

[1] Alternative 1 - Status quo. Alternative 2 - Close IPHC Area 4C to bottom trawling. Alternative 3 - Close IPHC Area 4C to all trawling. Alternative 4 - Close 25 nm around islands to bottom trawling. Alternative 5 - Close 25 nm around islands to all trawling. Alternative 6 - Close IPHC Area 4C west of 169°W to bottom trawling. Alternative 7 - Close IPHC Area 4C west of 169°W to all trawling. Scenario 2 - No effective vessel incentive program.

Table 4.3. Estimated Blue King Crab Density in the Pribilof Islands Area During 1989-1991 in Number of Crab per Square Mile.[1]

Year	Item	Area		
		IPHC Area 4C East of 169°W Outside 25 NM of Islands	IPHC Area 4C West of 169°W Outside 25 NM of Islands	Within 25 NM of Islands[2]
1991	Number of Stations	7	6	11
	Average Estimated Crab/mi^2	783	2,561	1,102
1990	Number of Stations	4	8	12
	Average Estimated Crab/mi^2	676	3,705	1,760
1989	Number of Stations	1	4	9
	Average Estimated Crab/mi^2	233	2,459	2,424
1989-1991	Number of Stations	12	18	32
	Average Estimated Crab/mi^2	701	3,067	1,721

[1] Source: Calculated from data in NMFS Alaska Fisheries Science Center reports to industry on the 1989, 1990 and 1991 eastern Bering Sea crab surveys. Males and females of all sizes were included.

[2] There were no stations south of 58° 20' N and within 25 NM of the islands, i.e. outside IPHC Area 4C and within 25 NM of the islands.

Table 4.4. Estimated Blue King Crab Bycatch Rates and Hours Fished by Observed Vessels in the Pribilof Islands Area During 1989-1991 in Number of Crab by Groundfish Gear Type and Alternative Area.[1]

Year	Gear Type	Area					
		IPHC Area 4C		Within 25 NM of Islands		IPHC Area 4C West of 169°W	
		Crab/Hr	Hours	Crab/Hr	Hours	Crab/Hr	Hours
1991	Bottom Trawl	28.0	255	4.1	115	29.6	159
	Pelagic Trawl	37.5	198	10.9	38	32.5	38
	All Gear	31.8	459	5.8	153	30.2	197
1990	Bottom Trawl	2.9	419	0.8	25	2.3	281
	Pelagic Trawl	1.3	3	-[2]	-[2]	-[2]	-[2]
	All Gear	2.9	422	0.8	25	2.3	281
1989	Bottom Trawl	11.9	26	16.3	15	14.5	21
	Pelagic Trawl	-[2]	-[2]	-[2]	-[2]	-[2]	-[2]
	All Gear	11.9	26	16.3	15	14.5	21
1989-1991	Bottom Trawl	11.9	700	4.7	155	12.3	461
	Pelagic Trawl	37.0	201	10.9	38	32.5	38
	All Gear	17.8	907	5.9	193	13.8	499

1 Source: Calculated from data in NMFS Alaska Fisheries Science Center's groundfish observer data base by Ms. Karma Black. September, 1992.

2 No vessels observed.

Table 4.5. Summary of likely direct and indirect effects of Alternatives 1 through 7 under Scenarios 1 and 2.[1]

	Alternative						
	1	2	3	4	5	6	7
Apparent Change in Groundfish Adjusted Gross Value from Alternative 1 ($ millions).[2]							
Scenario 1	0	3	3	2	2	0	1
Scenario 2	0	4	6	3	2	0	0
Apparent Change in Groundfish Adjusted Net Value from Alternative 1 ($ millions).[2]							
Scenario 1	0	1	1	1	1	0	1
Scenario 2	0	1	2	1	1	1	0
Projected Blue King Crab Bycatch Savings on Observed Vessels during 1989-1991 based on Groundfish Observer Data.							
	0	8,694	16,132	731	1,147	5,637	6,893
IPHC Area 4C Bird Populations[3].							
	?	?	?	?	?	?	?
IPHC Area 4C Marine Mammal Populations[3].							
	?	?	?	?	?	?	?
Enforcement Costs[3].							
	0	+	+	+	+	+	+

[1] Alternative 1 - Status quo. Alternative 2 - Close IPHC Area 4C to bottom trawling. Alternative 3 - Close IPHC Area 4C to all trawling. Alternative 4 - Close 25 nm around islands to bottom trawling. Alternative 5 - Close 25 nm around islands to all trawling. Alternative 6 - Close IPHC Area 4C west of 169°W to bottom trawling. Alternative 7 - Close IPHC Area 4C west of 169°W to all trawling. Scenario 1 - Effective vessel incentive program Scenario 2 - No effective vessel incentive program.

[2] Non-zero numbers probably due to model performance, as explained in text, and should be considered artifacts of the model rather than significant results.

[3] Increase (+), decrease (-), no change (0) or unknown (?).

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AGENDA D-5(b)
SEPT 1992
SUPPLEMENTAL

PRINCE WILLIAM SOUND AQUACULTURE CORPORATION

SEP 21 1992

September 16, 1992

Clarence G. Pautzke, Executive Director
North Pacific Fishery Management Council
P. O. Box 103136
Anchorage, AK 99510

Dear Sir:

The North Pacific Fisheries Management Council (the Council) is scheduled to meet during the week of September 20, during which time it will consider the dates of the Bering Sea pollock "B" season. As a major salmon producer, Prince William Sound Aquaculture Corporation (PWSAC) is very interested in the Council's action on this issue. Please let me explain.

PWSAC is involved in a fishery which is not managed by the Council, and therefore is probably of secondary importance to the Council. However, the fishing companies which you do regulate in the pollock fishery are important to the full development and maintenance of the Alaska salmon industry.

Prices paid to fishermen and producers for Alaska pink salmon in 1991 and 1992 have not sustained those business ventures. In fact, traditional salmon processors in the upper Gulf of Alaska advertised months prior to the 1991 season that they would not buy pink salmon from PWSAC, the major producer of pinks in this region. The resultant and well publicized wastage of pink salmon in Prince William Sound prompted PWSAC to undertake an extensive effort to pre-sell its cost recovery fish in 1992. This was accomplished, due in part to the availability of factory trawlers which processed pinks into products for new and developing markets.

PWSAC is fully aware of its supporting role in the Alaska salmon industry. However, our role is also one which provides opportunity for the various segments of the industry, as would be provided by the Council if the dates of the Alaska pollock and salmon fisheries did not overlap.

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The production of major numbers of pink and chum salmon in Pacific Russia is about to be channeled through new processing facilities to world markets. I am told that several countries are involved in the development of those salmon resources and that representatives of the U.S. processing industry have been investigating business opportunities there.

What this means to me is that now is the time to promote Alaska salmon in as many product forms as possible and in as many markets as possible. New processing and distribution ventures must be given the opportunity to establish markets for Alaska salmon prior to the time that salmon from other sources fill those niches.

By establishing September 1 or 15 as the opening date for the Bering Sea pollock "B" season, the Council can, in addition to achieving improved utilization of the pollock resource, allow the salmon industry to diversify, which is necessary to secure the future of Alaska salmon in world markets.

Thank you for your consideration of these statements.

Sincerely,

John McMullen
President

CC: NPFMC Council Members

AGENDA D-5(c)
SEPT 1992
SUPPLEMENTAL

ALASKA
CRAB
COALITION

3901 Leary Way (Bldg.) N.W., Suite #6 • Seattle, WA 98107 • (206) 547-7560 • FAX (206) 547-0130

SEP 18 1992

September 15, 1992

TO: Clarence Pautzke, Executive Director
North Pacific Fishery Management Council
P.O. Box 103136
Anchorage, Alaska 99501

FROM: Arni Thomson, Executive Director *Arni Thomson*

RE: COMMENT ON AGENDA ITEM D-5, PREFERENTIAL ALLOCATION OF PACIFIC COD TO GEAR TYPES WITH LOW BYCATCH

- Rationale for priority preferential allocation/seasonal apportionment of cod to pot gear:

  - **Pot gear has demonstrated lowest bycatch mortality of halibut. Ratios of cod production to halibut mortality, by metric ton, based on 1992 BSAI fishing season statistics:**

    - **Pot gear--1800:1**
    - **Longline gear--100:1**
    - **Bottom trawl gear--40:1**

  - Pot gear modifications to improve cod production, while reducing bycatch of halibut and other species, including:

    - Cod triggers that hold target fish in the pots.
    - Mandatory exclusion devices that keep halibut, crab, and other species out of the pots (rigid vertical spacers at no less than 9-inch intervals in the entrance tunnels).
    - Mandatory escape mechanisms (exit devices, 18 inches in length no more than 6 inches from the bottom of the pot, constructed of #30 biodegradable cotton twine in all groundfish pots).

  - Prohibition on use of longline/pot gear, thus reducing gear conflicts and consequent incidental catch and mortality.

- Other comments:

  - Crab fishermen have traditionally harvested cod incidentally in the crab fisheries for use as bait. Crab boats normally use 10-20 pots to target on cod in the course of the tanner crab fisheries, and rely on cod for fresh bait. This greatly improves productivity of the crab fisheries, as fresh bait is more effective than frozen bait. This also improves the economics of the crab fishery, by saving crab fishermen the cost of purchasing bait (approximately $.50 per pound).

  - **The pot gear directed catch of cod in the Bering Sea has increased by 300% from 1991 to 1992, and should have been much greater. In 1991, pot boats caught 4,000 metric tons of cod, but in 1992 the catch has been 12,000 metric tons. However, the cod catch to halibut bycatch mortality ratio for this fishery significantly improved from 948:1 in 1991 to 1800:1 in 1992.**

    The 1992 harvest would likely have gone to 20,000 metric tons, if the 750 mt longline cap for halibut mortality had been implemented on September 1, when it was approved in Department of Commerce. An estimated 40 crab boats were planning to enter the cod fishery the week of September 7, after the 60-hour St. Matthew Island king crab fishery and to continue cod fishing until November 1, when the Bristol Bay king crab fishery opens.

  - **Current 1992 catch and bycatch reports for the BSAI longline cod fishery show a dramatic increase in halibut bycatch mortality and an increase in the bycatch rate that are attributable to the new fleet of freezer longlingers. The cod catch to halibut bycatch mortality ratio in 1991 was 170:1. In 1992 this decreased to 100:1. The increase in halibut bycatch mortality is noted in the September 1992 IPHC discard mortality report.**

    Certain on deck mechanized equipment on freezer longliners, such as "crucifiers/hookstrippers", must be regarded as a major source of the increased halibut mortality in BSAI longline fisheries. This should be evaluated closely, along with the analysis of gangion cutting, in the process of attempting to minimize halibut bycatch mortality.

  - Fluctuations in halibut bycatch mortality in the BSAI cod trawl fisheries from 1991 to 1992 have been statistically inconsequential.

  - There is a need to restrict the first quarter cod apportionment, which coincides with the spawning roe season. This would parallel the pollock roe quota restriction, and would respond to the expectation of a decline in the cod stocks next year.

  - Time and area closures, such as are being recommended for the summer months, should be carefully evaluated to determine the problem areas. These restrictions should apply only to the specific gear types that experience the higher bycatches as has been the policy of the NPFMC in the development of similar management measures.