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

JUL 16 1999

To all Interested Government Agencies and Public Groups:

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

TITLE: Environmental Assessment for an Extension of an Emergency Rule to Implement Reasonable and Prudent Steller Sea Lion Protection Measures in the Pollock Fisheries of the Bering Sea and Aleutian Island Area and the Groundfish Fishery of the Gulf of Alaska

LOCATION: Federal Waters of the Bering Sea and Aleutian Islands and Gulf of Alaska

SUMMARY: This emergency rule would implement three types of management measures for the pollock fisheries of the BSAI and GOA: (1) Measures to temporally disperse fishing effort, (2) measures to spatially disperse fishing effort, and (3) pollock trawl exclusion zones around important Steller sea lion rookeries and haulouts.

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

Sincerely,

Susan Fruchter

Director of the Office of Policy and Strategic Planning

Enclosure

FINAL

Environmental Assessment

for

The Extension of an Emergency Rule to Implement Reasonable and Prudent Steller Sea Lion Protection Measures in the Pollock Fisheries of the Bering Sea and Aleutian Islands Area and the Gulf of Alaska

Date: June 28, 1999

Lead Agency: National Marine Fisheries Service
Alaska Regional Office
Juneau, Alaska
and the
Alaska Fisheries Science Center
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Abstract: In a Biological Opinion dated December 3, 1998, NMFS determined that the Alaska pollock fisheries, as proposed for the years 1999 to 2002, were likely to (1) jeopardize the continued existence of the endangered western population of Steller sea lions, and (2) adversely modify its critical habitat. In response to this jeopardy determination, NMFS published an emergency interim rule effective January 20, 1999 through July 19, 1999 that modified the Alaska pollock fisheries according to principles for reasonable and prudent alternatives set out in the Biological Opinion. *This analysis examines the extension of the emergency interim rule for the second half of 1999. A subsequent revision of this analysis will be prepared to analyze the permanent rule for the year 2000 and beyond.* These two actions are necessary to bring the Alaska pollock fisheries into compliance with Endangered Species Act after the current emergency rule expires. The proposed actions contain three categories of management measures: (1) Measures to temporally disperse the pollock fisheries, (2) measures to spatially disperse the pollock fisheries, and (3) pollock no-trawl zones. Environmental issues associated with the proposed actions include effects on Steller sea lions and other marine mammal species such as killer whales, northern fur seals, and Pacific harbor seals; seabirds, forage fish, pollock, and habitat impacts. Economic issues include: cost and earnings performance by sector and region; inter-sectoral competition; intra-sectoral and geographic distribution of catch and revenues; length and timing of fishing periods, including "stand downs" between fishing periods; CPUE , product quality and mix implications; market effects; as well as "indirect" or "spill-over" effects on dependent communities, non-profit CDQ organizations, and fishing sectors not targeting pollock.

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EXECUTIVE SUMMARY

On December 3, 1998, the Office of Protected Resources, National Marine Fisheries Service (NMFS), issued a Biological Opinion summarizing a section 7 consultation on the pollock fisheries of the Bering Sea/Aleutian Islands region (BSAI) and Gulf of Alaska (GOA), and the BSAI Atka mackerel fishery. The Biological Opinion concluded that the pollock fisheries, as proposed for 1999, were likely to jeopardize the continued existence of the western population of Steller sea lions and adversely modify its designated critical habitat. The Opinion also identified a set of management objectives or "principles" necessary to avoid the likelihood of jeopardy and adverse modification. Together, the principles (and the management measures designed to satisfy the principles) constitute the Reasonable and Prudent Alternative (RPA) to the fisheries. The principles are intended to disperse the fisheries temporally and spatially, and to ensure that these fisheries do not compete with Steller sea lions by removing prey in the waters immediately adjacent to major rookeries and haulouts.

The RPA principles were then presented to the North Pacific Fishery Management Council (Council) to allow the Council and the public to participate in the process of identifying conservation measures to satisfy the principles with the least disruption to the fisheries. On December 13, 1998, the Council voted to recommend to the Secretary of Commerce a set of conservation measures for that purpose. Many of the measures included in the Council's recommendation were consistent with the RPA principles yet varied somewhat. On December 16, 1998, NMFS revised the RPAs of the Biological Opinion to incorporate (with some modifications) the measures recommended by the Council. On January 22, 1999, NMFS published an emergency interim rule to implement those conservation measures (64 FR 3437).

The emergency rule remains in effect until July 19, 1999. Additional conservation measures are required to avoid jeopardy and adverse modification in the latter half of 1999, and for 2000 and beyond. Conservation measures for the latter half of 1999 will be implemented with a second emergency rule, and measures required for 2000 and beyond will be implemented through regulatory amendment. Using the January 22, 1999 emergency rule as a starting point, the major outstanding issues that must be in either 1999 or 2000 are requirements to:

- extend all the provisions in the current emergency rule through the second half of 1999;
- apportion B and C season total allowable catch (TAC) inside and outside of the Critical Habitat/Catcher Vessel Operational Area (CH/CVOA) conservation zone in a manner consistent with the distribution of the pollock stock;
- further reduce the A1 and A2 season percentage cap inside the CH/CVOA conservation zone; and
- either close to pollock trawling the waters around Cape Sarichef (20 nm) and eight sites identified in the GOA (10 nm), or develop alternative management measures that provide equivalent or better protection for sea lions in those regions.

This Environmental Assessment/Regulatory Impact Review/Initial Regulatory Flexibility Analysis (EA/RIR/IRFA) analyzes specific management options and alternatives (sets of options) designed to satisfy the RPA principles, and resolve these major outstanding issues. The options and alternatives analyzed are based largely on recommendations by the Council at its February 1999, April 1999, and June 1999 meetings. *At its June 1999 meeting, the Council recommended the extension of the current emergency rule with the addition of an apportionment scheme for Bering Sea B and C season catch inside and outside CH/CVOA that* *results in overall removals of 25% and 35% from the B and C seasons, respectively. This alternative is identified as Alternative 2 in the document and provides Steller sea lion protection measures for the second half of 1999 only. The Council's June 1999 motion also recommended a suite of management measures for 2000 and beyond. The specifics of the Council's recommendations for 2000 and beyond are not contained in this document but will be included in a subsequent version of this document to accompany proposed and final rulemaking for 2000 and beyond.*

SECTION 1: INTRODUCTION AND BACKGROUND

Section 1 of this document provides introductory and background information on the development of RPA principles for the pollock fisheries off Alaska. In this section, the six alternatives under analysis are presented. They are:

Alternative 1: No Action

Under the no-action alternative, the pollock fisheries off Alaska would revert to the previous management regime once the current emergency rule expires. None of the RPA elements would be implemented and the factors that led to the NMFS finding of jeopardy would remain. If this alternative is adopted, NMFS would be forced to close the pollock fishery or take independent action under authority of the Endangered Species Act to prevent the pollock fishery from jeopardizing the continued existence of the western population of Steller sea lions and adversely modify its critical habitat.

Alternative 2: (PREFERRED) January 22, 1999, Emergency Rule extended for an additional 180 days.

Under this alternative, the suite of management measures that composed the Council's December 13, 1998, emergency rule motion, as revised and adopted by NMFS, would be extended for an additional 180 days with the addition of spatial dispersion measures for the Bering Sea B and C seasons. On December 16, 1998, NMFS had determined that the spatial dispersion measures for the Bering Sea B and C seasons were inadequate to satisfy the RPA principles. As a consequence, NMFS published the January 22, 1999, emergency rule without specifying spatial dispersion measures for the second half of 1999, indicating that additional measures were necessary for the second half of 1999 before the fishery could proceed. In response to this determination by NMFS, the Council, in it's June 1999 motion included a spatial dispersion scheme for the Bering Sea B and C seasons that would achieve 1999 targets of no more than 25% of B season removals from the CH/CVOA and 35% of C season removals from the CH/CVOA. The Council's June recommendation for spatial dispersion is consistent with the RPA principles' first-year goal of no more than 25 percent removals from the CH/CVOA during the B season and no more than 35 percent removals from the CH/CVOA during the C season. The Council's motion achieved these overall limits by excluding the catcher/processor and mothership sectors from operating in the CH/CVOA during the B and C seasons and establishing limits for the inshore sector of 45 percent and 65 percent for the B and C seasons, respectively; and a combined B/C limit of 56 percent for the CDQ sector.

Alternative 3: Council's December 13, 1998, emergency rule RPA recommendations revised to cap A1/A2 season CH/CVOA catch at 50% seasonal TAC

Under Alternative 3, the complete set of management measures contained in Alternative 2 would be adopted along with specific options:

- reducing the overall A1 and A2 season CH/CVOA cap to 50% of the A1 and A2 seasonal TACs,

- splitting the TAC into winter/spring (A1 and A2 seasons) and the summer/fall (B and C seasons),
- adjusting A2 start dates,
- determining stand-down periods between seasons, and
- providing for rollovers.

Alternative 4: Council's December 13, 1998, motion revised to meet the "50% principle" as provided under Alternative 3, plus the following suboptions:

Under Alternative 4, the complete set of management measures contained in Alternative 3 would be adopted along with BSAI specific options:

- distributing B and C season catch both inside versus outside of the CH/CVOA (including measures for further dispersal of catch outside of the CH/CVOA),
- adjusting starting and ending dates for the B and C seasons,
- extending the no trawl zone around the Cape Sarichef haulout from 10 nm to 20 nm,
- analyzing the Aleutian Islands closure, and
- providing TAC rollover provisions.

and GOA specific options:

- setting tender vessel trip limits of 300,000 or 600,000 lbs,
- creating a seasonal exclusive area requirement between E/W/C GOA and BSAI,
- re-examining the Shelikof Strait critical foraging area, and
- closing eight haulout sites not included in 12/98 Emergency Action (or alternative equivalent measures),

Alternative 5: RPA example measures contained in December 3, 1998, Biological Opinion

This alternative consists of the set of measures included in the Biological Opinion as an example of measures to satisfy the RPA principles. These measures were developed by NMFS staff from the Alaska Fisheries Science Center, Alaska Region, and Office of Protected Resources.

Alternative 6: Alternative 4 plus options for eliminating stand-down periods outside the CH/CVOA, for greater separation of A1 and A2 seasons, and for incremental adjustment to catch restrictions inside and outside CH/CVOA in B and C seasons.

Alternative 6 contains all the provisions of Alternative 4, plus options to achieve the following:

- elimination of stand-down periods for individual sectors outside of the CH/CVOA if sector-specific maximum daily catch rates (daily maximum and 5-day running average maximum) are observed,
- greater separation of A1 and A2 seasons, and
- establishment of maximum allocations to the CH/CVOA and outside of the CH/CVOA both east and west of 170°W longitude.

SECTION 2: ANALYSIS OF ALTERNATIVES RELATIVE TO THE RPA PRINCIPLES

In this section, the specific alternatives and options described in section 1 are analyzed with respect to their consistency with the RPA principles set out in the Biological Opinion. Due to the redundancy in specific management measures between the various alternatives, all proposed options pertaining to temporal dispersion, spatial dispersion, and pollock trawl exclusion zones in each management area (Bering Sea subarea, Aleutians Islands subarea, and Gulf of Alaska) are grouped together and addressed in a comparative manner. A wide range of temporal and spatial options are presented for analysis. Most of the proposed options relating to season dates, seasonal TAC apportionments, trip limits, exclusive area requirements, and TAC rollovers are consistent with the RPA principles. To be consistent with the RPA principles, the preferred alternative must, at a minimum:

- contain the basic elements of the January 22, 1999, emergency rule;
- further reduce to 50%, the A1 and A2 season percentage cap inside the CH/CVOA conservation zone;
- apportion the B and C season TAC inside and outside of the CH/CVOA conservation zone in a manner consistent with the distribution of the pollock stock,
- either close to pollock trawling the waters around Cape Sarichef (20 nm) and eight sites identified in the GOA (10 nm), or contain alternative management measures that provide equivalent or better protection for sea lions in those regions.

SECTION 3: TEMPORAL AND SPATIAL DISTRIBUTION OF THE EBS POLLOCK FISHERY

In this section, the historic and contemporary spatial and temporal distributions of the eastern Bering Sea pollock fishery are examined. Data from the foreign fishery (1982-85), joint-venture fishery (1986-88) and domestic fishery (1989-98) are analyzed to provide a picture of the evolving temporal and spatial distribution of the fishery. This section also includes preliminary data from the 1999 Bering Sea A season fishery which was conducted under emergency rule. Preliminary data from the four sectors of the Bering sea pollock fishery are summarized below:

Catcher/processor sector. The catcher/processor and inshore sectors each had their A seasons divided into A1 and A2 seasons under the emergency rule. The catcher/processor sector began the A1 season by fishing inside the CH/CVOA on January 20, but a portion of the fleet began working outside the CH/CVOA on January 28, prior to reaching their inside CH/CVOA A1 cap. Portions of the fleet continued to fish both inside and outside until the end of A1. By February 15, the catcher/processor sector had caught 96% of its inside CH/CVOA cap, but less than half its outside CH/CVOA portion, which was rolled over into the outside CH/CVOA A2 season. In the A2 season, the catcher/processor fleet worked primarily outside the CH/CVOA, where it caught 83% its A2 total of 73,000 mt. Portions of the catcher/processor fleet fished inside the CH/CVOA during the A2 only from about February 20-28, after which the majority of the fleet that was fishing was outside the CH/CVOA. In the A1 season, catcher/processor sector daily production averaged about 1,300 mt/day (max. of about 3,000 mt/day) inside the CH/CVOA by 16 vessels that had more than 10 observed sampled hauls; outside the CH/CVOA in the A1, the average was 1,000 mt/day (max. of about 2,400 mt/day) by 12 vessels with more than 10 sampled hauls. Daily production outside in the A2 peaked at about 4,600 mt/day on March 3 with 15 vessels fishing, and declined through March 18. The A1 daily production figures were considerably lower than the maximums of 8,500 and 4,500 mt/day estimated in December 1998 for the catcher/processor sector inside and outside the CH/CVOA, respectively. Because of this, the catcher/processor sector's A season was over twice as long as projected in December 1998 with lower daily removals from the CH/CVOA. Furthermore, the catcher/processor sector caught about 6,500 mt less pollock inside the CH/CVOA than they were permitted under the ER, resulting in a 36%:64% inside:outside CH/CVOA split. As of March 19, 1999, the catcher/processor sector had caught 99% of its A1 and A2 season TACs.

Inshore sector. The inshore sector began by fishing inside the CH/CVOA on January 20, and the observed portion of the fleet did not fish outside until the CH/CVOA was closed to them by NMFS for the remainder of the A1 season on February 11. Average inshore daily catch rates inside the CH/CVOA (4,500 mt/day) exceeded the maximum estimates (4,200 mt/day) made in December 1998. Consequently, the CH/CVOA was not closed to the inshore sector soon enough, resulting in approximately 21,000 mt more pollock being caught inside the CH/CVOA than the inshore sector was allocated in the A1. The resulting inside:outside CH/CVOA split for the inshore sector in A1 was 82%:18%. This overage inside in A1 was to be subtracted from the A2 CH/CVOA inshore allocation, resulting in a new A2 inside CH/CVOA allocation for the inshore sector of 16,514 mt. During A2, the inshore sector took approximately 23,300 mt inside the CH/CVOA prior to its closure on February 24. The entire A2 season for the inshore sector was closed on February 28. Consequently, for both A seasons, the inshore sector caught about 6,800 mt more inside the CH/CVOA than it was allocated, resulting in a 74%:26% inside:outside CH/CVOA split. This overage by the inshore sector was approximately balanced by the underage by the catcher/processor sector inside the CH/CVOA. Overall, the inshore sector caught 99% of it's a season TAC. Average daily catch rates by the inshore fleet were similar inside and outside the CH/CVOA in both the A1 and A2 seasons (A1: 4,500 mt/day inside, 4,400 mt/day outside; A2: 4,700 mt/day inside, 4,500 mt/day outside). Estimated maximum daily catch rates were approximately 8,000 mt/day both inside and outside the CH/CVOA.

Mothership sector. The mothership sector (allocated 10% of the non-CDQ TAC) had a single A season with 40% of its TAC, and could take no more than 50% of its allocation inside the CH/CVOA. The mothership A season began on February 1, 1999, the CH/CVOA was closed to motherships on February 9, 1999, and their A season outside of CH/CVOA ended on February 17, 1999. Based on preliminary in-season observer data, the mothership sector fished entirely within the CH/CVOA through February 8 and caught about 700 mt more inside the CH/CVOA than allocated. Motherships fished entirely outside the CH/CVOA from February 10-17, and came within approximately 2% of their projected 50%:50% inside:outside CH/CVOA split. Daily production by the mothership sector was similar inside and outside the CH/CVOA, averaging 2,127 mt/day inside the CH/CVOA (peak of 2,668 mt/day) and 2,006 mt/day outside the CH/CVOA (peak of 2,543 mt/day). These daily production estimates are slightly greater than the 1,900 mt/day estimated in December 1998 for the mothership sector in the 1999 A season.

CDQ sector. Preliminary estimates indicate that only 67% of A season CDQ fishing occurred in the CH/CVOA although, under the emergency rule, this sector was allowed to conduct 100% of it's activity within the CH/CVOA. This resulted in approximately 16,000 mt less pollock caught within the CH/CVOA than permitted by this sector. Some of the CDQ allocation was also fished while the non-CDQ fisheries were still open, a pattern different from previous years. During the A1 and A2 seasons for the inshore and catcher/processor sectors, about 32,000 mt, or 72% of the A season CDQ pollock TAC was caught; only about 9,400 mt was caught during the 5-day stand-down between the seasons. This is most likely a result of the cooperative formed by the catcher/processor fleet, some of whom fish much of the CDQ allocation. As of this analysis (through 3/19/99), there were still approximately 1,800 mt of A season CDQ pollock remaining to be harvested.

Overall results. For all sectors combined, the target of a maximum of 62.5% of the A season pollock catch from the CH/CVOA was achieved; preliminary estimates suggest that 58% of the catch was from the CH/CVOA. Approximately 15,000 mt that was projected to come from the CH/CVOA was harvested outside; this was largely due to the spatial distribution of the CDQ catch. It is estimated that all sectors combined caught over 99% of the TAC allocated to the A seasons.

Analysis of observer length frequency data for the 1999 fishery indicates that the pollock length distributions from fisheries inside and outside the CH/CVOA were similar, although pollock caught inside were slightly larger. Pollock caught inside the CH/CVOA had a modal length 1 cm larger than those outside the CH/CVOA, and there was a slightly greater percentage of fish smaller than 40 cm outside than inside. Mean length of the "inside" fish measured was 45.7 cm, while the "outside" fish averaged 43.9 cm in length.

SECTION 4: STATUS OF THE STELLER SEA LION

This section provides a summary of current information on the status of the Steller sea lion. Topics such as distribution, foraging patterns, natural predators and competitors, and population status and trends are presented. Much of this information is contained in the Biological Opinion and is repeated here for reference purposes. This section also provides background information on the designation of Steller sea lion critical habitat including a discussion of the Shelikof Strait foraging zone, as requested by the Council in its February, 1999, motion.

SECTION 5: ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES

This section provides an analysis of projected environmental effects of the alternatives. Impacts to other marine mammals, sea birds, forage species, and habitat are examined. The analysis concludes that implementation of the RPA principles outlined in the Biological Opinion will not significantly affect the quality of the human environment. Therefore, the preparation of an environmental impact statement is not required by section 102(2)(C) of NEPA or its implementing regulations.

In addition to general environmental effects, the effects of RPA measures on prohibited species bycatch in the pollock fisheries are examined. The proposed temporal and spatial changes to the pollock fishery may alter the fishery in ways different from historical patterns. Therefore, extrapolating current or historic effort to future situations is problematic.

Initial reports indicate that 1999 prohibited species catch rates in the pollock fishery are either equal to or lower than historic levels. Due to the bottom trawl ban, crab bycatch has been extremely low, about one quarter of the amount harvested by the pollock fleet last year by this time. Herring bycatch is also low, only 6% of the annual limit for the pollock fleet had been caught by the completion of the A season. It also appears that chinook salmon bycatch is down significantly. Preliminary data indicate chinook salmon to be roughly a third of what was caught last year by this time, and catch of other salmon species is roughly about one tenth of the amount caught in 1998. However, all 1999 data are preliminary; it is certain that there will be changes as A season pollock observers return from the field for debriefing and updates to the observer database are made.

SECTION 6: MANAGEMENT, MONITORING AND ENFORCEMENT

This section provides a discussion of inseason management, catch monitoring and enforcement measures that are required to implement any of the RPA-based alternatives. NMFS must have a reporting system that is able to discern pollock landings by individual catcher vessels in order to monitor on a real-time basis catch inside and outside CH/CVOA . NMFS has already developed such a system for monitoring CDQ operations and is currently developing an electronic shoreside logbook system that would provide sufficient vessel-by-vessel landing information to monitor inshore CH/CVOA activity on a vessel-by-vessel basis. Interagency discussions are also underway regarding possible merger of State and Federal reporting requirements for fish delivered by catcher vessels. A suitable system could be developed by 2000, but would require significant revisions to the existing recordkeeping and reporting program. Serious reservations exist as to whether implementing regulations could be implemented in time for the 2000 A season pollock fishery. A target implementation date for the 2000 B season likely is more reasonable.

This section also provides background information on possible Vessel Monitoring Systems (VMS) that could be used to monitor Steller sea lion RPA measures for the pollock fisheries off Alaska. At the April, 1999 Council meeting, the NMFS Office of Law Enforcement provided the Council with a separate presentation on the current status of NMFS' National VMS Program. Consequently, detailed information on possible VMS requirements are not contained in this draft EA/RIR/IRFA.

SECTION 7: ECONOMIC AND SOCIOECONOMIC IMPACTS OF THE ALTERNATIVES

The economic analysis contained in this section concludes that temporal, spatial, and/or exclusion zone management actions, as defined under the RPA principles, will likely impose direct and unavoidable costs on the participants of the eastern Bering Sea, Gulf of Alaska, and Aleutian Islands pollock target fisheries. The magnitude of such costs will likely vary by vessel (plant), depending on size, operating configuration, home (and/or operating) port, principal product forms produced, and markets supplied. Empirical data on operating costs are not readily available for the several sectors which collectively comprise the pollock industry in the GOA and BSAI management areas. Furthermore, the American Fisheries Act (AFA), enacted in 1999, has changed the pollock industry in fundamental ways, with operational and management implications which are as yet not fully understood. Disentangling the effects and impacts of the AFA from those that may appropriately be attributed to the Steller sea lion action has complicated the analysis. For example, the emergence of operational cooperative agreement (co-ops) in the Bering Sea pollock fishery (authorized by AFA) appears to have significantly affected the cost, capital, and operational structure of the domestic pollock industry.

While operational details of the 1999 catcher/processor co-op are not available for analysis, anecdotal evidence suggests that the existence of the co-op has allowed its members to function in a substantially more "efficient" manner, and that RPA-attributable costs to the "co-oping" sector are almost certainly lower than they would have been in the absence of a co-op. In 2000, both the inshore and motherships sectors will be permitted to enter into operational co-ops, under provisions of the AFA. Whether they will or not, and if so, how this will effect their respective operational performance, especially with respect to RPA-attributable constraints, can only be guessed at. But such a decision would appear to have the potential to significantly alter the scope and magnitude of any attributable impacts deriving from the Steller sea lion actions.

Preliminary data from the 1999 GOA and Bering Sea A seasons (conducted under RPA-mandated emergency rule) suggest that the costs resulting from the temporal and spatial RPA measures may be less significant than previously projected by industry and NMFS. Under the emergency rule, all four sectors of the pollock industry demonstrated marked success in adapting to the emergency rule measures as indicated by the daily production, CPUE, and length frequency data presented in section 3. In every case, and for each sector, the apportioned share of the pollock TAC was (essentially) attained, suggesting that complying with RPA requirements was not the operational burden some had anticipated.

Nonetheless, there will be costs imposed by this action. It is probable that these costs will be disproportionately distributed, with the smallest, least mobile, and least operationally diversified operations facing the greatest adjustment burden. It is the case that actions which relocate the fishery farther from traditional operating ports, or to periods of more severe sea and weather conditions, tend to disadvantage some elements of the industry more than others. Larger and more physically mobile operations will have a natural advantage in such circumstances. Several specific actions have been proposed by the Council and NMFS, however, to mitigate some of these adverse economic and operational impacts (e.g., trip limits, exclusive registration areas), while provisions of the AFA provide others.

Changes in the product mix or the amounts of individual product forms supplied to a given market, resulting directly from the RPA-based alternatives, are difficult to anticipate or value. For example, if the adopted RPA actions result in harvests of smaller fish, product mix could be affected (e.g., fewer 'deep-skin' fillets produced). However, as suggested, the AFA has imposed large-scale changes in the BSAI pollock fishery, including a substantial allocation shift from the catcher/processor sector (which has historically produced the bulk of fillet products) to the inshore sector (which has historically dedicated the bulk of its production to surimi products). This AFA action alone could swamp any effect that might be attributable to the Steller RPAs, in this regard. In addition, most of the nine catcher/processors that were declared ineligible under the AFA were smaller and older catcher/processors that were primarily dedicated to fillet production. It appears that, in response to AFA, industry chose to retire smaller fillet-producing catcher/processors, rather than larger, more operationally diversified, and more expensive surimi-producing catcher/processors. If this interpretation is correct, many of the product mix and supply impacts would more appropriately accrue to the AFA, and would not largely be the result of the proposed Steller action.

This demonstrates again that disentangling effects that are primarily and appropriately attributable to Steller sea lion related actions from those that are more appropriately assigned to the AFA is an analytical complication which only time and empirical experience will resolve.

SECTION 8: INITIAL REGULATORY FLEXIBILITY ANALYSIS

This section fulfills the requirements of the Regulatory Flexibility Act to prepare an Initial Regulatory Flexibility Analysis (IRFA) for all actions that may have a significant economic effect on a substantial number of small entities. Several conclusions may be drawn concerning the potential differential impacts of this suite of RPA actions on "small entities"in the Bering Sea, Aleutian Islands, and Gulf of Alaska management areas. The only small businesses that participate directly in the BSAI pollock fishery are independent catcher boats. All other business entities (catcher/processors, motherships, shoreside processors, and processor affiliated catcher boats) participating in the BSAI pollock fishery are categorized as "large" entities, on the basis of the RFA criteria.

The IRFA concludes that except for the segment of the catcher vessel fleet which, absent the proposed action, would have participated in the Aleutian Islands area pollock target fishery (assuming the final Steller RPA action completely closes that fishery), the adverse economic impacts attributable to the proposed action are likely to be small, indirect, and limited to the types of operational effects discussed in the RIR, e.g., increased variable operating costs, greater running time/reduced fishing time, potentially higher physical risk for the smaller segments of the fleet, CPUE implications. Operational, logistical, and variable costs data are not available with which to quantitatively estimate the possible magnitudes of these impacts for the potentially effected small entities.

The determination that any adverse economic effects will be of this indirect nature stems from the conclusion in the EA that all three processing sectors will harvest and process their full pollock TAC-apportionments, following adoption and implementation of the Steller RPA action. That is, while there may be some, as yet unmeasurable, impacts from the proposed action, none are expected to significantly adversely impact a substantial number of small entities, as those terms are defined for RFA purposes. Unfortunately, while that is the expectation, given the information currently available, it is not possible to quantitatively certify this outcome.

Under the proposed action, specific provisions have been included which provide ameliorative relief for small catcher vessels in the GOA management area. These provisions specifically provide for restrictive catch trip limits and seasonal exclusive registration for vessels operating in the eastern/western/central Gulf fisheries and those fishing the Bering Sea. Similarly, the action contains an option which would provide a limited "exemption" from the CH/CVOA closure, for catcher vessels delivering inshore, which are 99' (LOA) or smaller, and which have historically participated in the BSAI management area pollock trawl fishery.

Each of these alternative provisions (if adopted) would be expected to reduce or eliminate the natural advantage that large, operationally diversified, and technologically sophisticated vessels enjoy when compared to smaller operations, competing in the same fishery. Because operating cost data are not available for either group, a quantitative estimate of the net effects of these ameliorative actions cannot be made. Nonetheless, if adopted, each of these actions would be expected to reduce the burden that may accrue to small catcher vessels from implementation of the RPAs.

1.0 INTRODUCTION AND BACKGROUND

The groundfish fisheries in the exclusive economic zone (EEZ) off Alaska are managed by the NMFS under the authority of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). The mission of the NMFS is the stewardship of living marine resources for the benefit of the nation through their science-based conservation and management and promotion of the health of their environment. The goals for accomplishing this mission are sustainable fisheries, recovered protected species, and healthy living marine resource habitat. Guidance for achieving these goals is taken from relevant Federal legislation.

Actions taken to amend fishery management plans or implement other regulations governing the groundfish fisheries must meet the requirements of Federal laws and regulations. In addition to the Magnuson-Stevens Act, the most important of these are the National Environmental Policy Act (NEPA), the Endangered Species Act (ESA), the Marine Mammal Protection Act (MMPA), Executive Order (E.O.) 12866, and the Regulatory Flexibility Act (RFA). This action is necessary to bring the Alaska pollock fisheries into compliance with the ESA.

On December 3, 1998, NMFS issued a Biological Opinion (for Steller sea lion) on the pollock fisheries of the Bering Sea and Aleutian Islands Management Area (BSAI) and Gulf of Alaska (GOA), and the Atka mackerel fishery of the Aleutian Islands subarea under Section 7 of the Endangered Species Act (NMFS 1998a). The Biological Opinion concluded that the BSAI and GOA pollock trawl fisheries, as proposed for the years 1999 to 2002, were likely to jeopardize the continued existence of the western population of Steller sea lions, and adversely modify its critical habitat. The pollock trawl fisheries in the BSAI, and GOA management areas had to be modified to accomplish temporal and spatial dispersion of the fisheries. Mitigation objectives were conveyed in the reasonable and prudent alternatives attached to the Biological Opinion with specifics of fishery modifications to be determined by the North Pacific Fishery Management Council (Council). At its December 1998 meeting, the Council passed a motion which largely met the reasonable and prudent alternatives outlined in the December 3, 1998, Biological Opinion (Appendix A). NMFS then amended the December 3, 1998 Biological Opinion to incorporate most of the Council's motion as reasonable and prudent alternatives that would constitute removal from jeopardy (NMFS 1998b).

On January 22, 1999, NMFS published an emergency rule (64 FR 3437 and correction 64 FR 7814) to implement the reasonable and prudent alternatives recommended by the Council as revised by the amended Biological Opinion. The emergency rule implemented three types of management measures for the BSAI and GOA pollock fisheries: (1) temporal dispersion of the pollock fishery, (2) spatial dispersion of the pollock fishery, and (3) pollock trawl exclusion zones. The environmental analysis prepared for the emergency rule (NMFS 1999) concluded that the emergency rule was not likely to significantly affect the quality of the human environment. Therefore, an environmental impact statement was not prepared. The emergency rule, FR 64 3437, (Appendix B) is in effect for up to 180 days which is January 20, 1999, through July 19, 1999.

This Environmental Assessment/Regulatory Impact Review/Initial Regulatory Flexibility Analysis (EA/RIR/IRFA) analyzes specific management options and alternatives (sets of options) designed to satisfy the RPA principles, and resolve these major outstanding issues. The options and alternatives analyzed are based largely on recommendations by the Council at its February 1999, April 1999, and June 1999 meetings. *At it's June, 1999, meeting, the Council recommended the extension of the current emergency rule with the addition of an apportionment scheme for Bering Sea B and C season catch inside and outside CH/CVOA that results in overall removals of 25% and 35% from the B and C seasons, respectively. This alternative is identified as Alternative 2 in the document and provides Steller sea lion protection measures for the second half of 1999 only. The Council's June 1999 motion also recommended a suite of management measures for*

2000 and beyond. The specifics of the Council's recommendations for 2000 and beyond are not contained in this document but will be included in a subsequent version of this document to accompany proposed and final rulemaking for 2000 and beyond.

1.1 Purpose and Need

Fisheries in these management areas are conducted annually. The emergency interim rule implementing the reasonable and prudent alternatives is applicable only for fisheries occurring between January 20, 1999 and July 19, 1999. *The purpose of this proposed action is promulgation of a second emergency interim rule for the latter half of calendar year 1999 (i.e., after July 19, 1999).* A subsequent revision of this analysis will accompany the proposed and final rulemaking to establish RPA measures for 2000 and beyond. Promulgation of these rules is, therefore, necessary to avoid a return to the former fishery management regime (referred to as status quo) which was found not to be in compliance with the Endangered Species Act.

This Environmental Assessment/Regulatory Impact Review/Initial Regulatory Flexibility Analysis (EA/RIR/IRFA) assesses management alternatives for the BSAI and GOA pollock fisheries to determine, in part, if they comply with the ESA requirement for a reasonable and prudent alternative (RPAs) to these fisheries, as originally proposed. It also evaluates other environmental and economic issues associated with implementation of the measures. Other environmental issues include: marine mammal species other than Steller sea lions such as killer whales, northern fur seals, and Pacific harbor seals; seabirds, forage fish, pollock, and habitat impacts. Economic issues include: cost and earnings performance by sector and region; inter-sectoral competition; intra-sectoral and geographic distribution of catch and revenues; length and timing of fishing periods, including "stand downs" between fishing periods; CPUE , product quality and mix implications; market effects; as well as "indirect" or "spill-over" effects on dependent communities, non-profit CDQ organizations, and fishing sectors not targeting pollock.

1.2 Related NEPA documents

This EA tiers off the Alaska Groundfish FSEIS (NMFS 1998c) which analyzed the effects of groundfish fisheries in the EEZ off Alaska and displayed fishery induced impacts on all aspects of the ecosystem. This EA also tiers off the Steller sea lion emergency rule EA (NMFS 1999), which analyzed (for the short-term) the impacts of implementing the reasonable and prudent alternatives to avoid the likelihood of the pollock fisheries off Alaska jeopardizing the continued existence of the western population of Steller sea lions, or adversely modifying its critical habitat. This EA also tiers off the 1999 Groundfish Total Allowable Catch Specifications EA (NMFS 1998d).

Fishery management measures being developed concurrently with this proposed action which affect the trawl pollock fisheries throughout some or all of these management areas include: (1) Amendment 57 to the FMP for the Groundfish Fishery of the Bering Sea and Aleutian Islands area to prohibit the use of nonpelagic trawl gear in directed pollock fisheries, and, (2) American Fisheries Act implementation. These actions are explained further below:

In June 1998, the Council adopted a fishery management plan amendment (Amendment 57) to the FMP for the Groundfish Fishery of the Bering Sea and Aleutian Islands that will prohibit the use of nonpelagic trawl gear in the BSAI pollock fishery. A draft EA/RIR/IRFA for this action was prepared and submitted for Secretarial review June 23, 1998. Final action on the proposed amendment is expected in the spring of 1999 and the regulation banning nonpelagic gear would be effective by the B season in the Bering Sea. In the meantime, the same results are being achieved in the directed pollock fisheries by Council action taken during the 1999 TAC specification process. None of the 1999 pollock TAC in the BSAI pollock fishery was allocated to vessels using nonpelagic trawl gear. Prohibiting nonpelagic gear from directed pollock fisheries affects amounts of crab and halibut bycatch and rates of benthic substrate disturbance.

On October 21, 1998, the President signed into law the American Fisheries Act (AFA), which imposed major structural changes on the BSAI pollock fishery including: (1) The buyout of nine pollock factory trawlers, (2) major shifts in pollock allocations from the offshore to the inshore and CDQ sectors of the industry, (3) a prohibition on entry of new vessels and processors into the BSAI pollock fishery, (4) authorization of harvester cooperatives in the inshore, mothership, and offshore sectors, and (5) establishment of protections for other fisheries. The changes wrought by the AFA have the potential to interact greatly with the proposed RPA measures, in both positive and negative ways. Formation of fishery cooperatives under the AFA may reduce pressure on vessels participating in co-ops to race with each other to harvest available pollock quotas in Bering Sea management areas. However, the AFA-mandated shift in pollock allocations from the offshore sector to the less-mobile inshore sector could intensify fishing effort in nearshore areas critical to Steller sea lions, in the absence of mitigating measures. The Council is currently developing management measures to implement the provisions of the AFA, and an EA/RIR/IRFA for these potential regulations is being prepared.

1.3 Principles of a Reasonable and Prudent Alternative

The December 3, 1998, Biological Opinion on the BSAI and GOA pollock fisheries and the BSAI Atka mackerel fishery concluded that the pollock fisheries are "likely to jeopardize the continued existence of the western population of Steller sea lions and adversely modify its critical habitat." The clause "jeopardize the continued existence of" means "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). The clause "adversely modify its critical habitat" means "a direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species. Such alterations include, but are not limited to, alterations adversely modifying any of those physical or biological features that were the basis for determining the habitat to be critical" (50 CFR 402.02).

The statutory language of the ESA requires that if jeopardy and adverse modification are found, then "the Secretary shall suggest those reasonable and prudent alternatives which he believes would not violate subsection (a)(2) and can be taken by the Federal agency or applicant in implementing the agency action." More specifically, ESA regulations (50 CFR 402.02) define "reasonable and prudent alternatives" as

> *". . . alternative actions identified during formal consultation that can be implemented consistent with the scope of the Federal agency's legal authority and jurisdiction, that is economically and technologically feasible, and that the director believes would avoid the likelihood of jeopardizing the continued existence of listed species or resulting in the destruction or adverse modification of critical habitat."*

This EA/RIR/IRFA assesses management alternatives for the BSAI and GOA pollock fisheries to determine, in part, if they comply with the ESA requirement for a reasonable and prudent alternative (RPA) to these fisheries, as originally proposed. The alternatives fall into three categories related to temporal dispersion of the fisheries, spatial dispersion, and no trawl zones for the pollock fisheries. In the following sections, we review previous management measures taken pertinent to temporal and spatial dispersion of the fisheries and trawl exclusion zones, development of RPAs to date, the RPA principles as listed in the December 3, 1998, Biological Opinion, the Council's motion of December 13, 1998, the NMFS response to that motion, and remaining requirements for satisfaction of the RPA principles.

1.3.1 Previous temporal, spatial, and trawl exclusion measures for Steller sea lion conservation

The Steller sea lion was listed as threatened under the Endangered Species Act in 1990. From 1990 to the present, a range of management measures were implemented to halt the decline and facilitate the recovery of sea lions (see pages 87 to 95 in the December 3, 1998 Biological Opinion). The following management measures were implemented to address issues related to temporal and spatial dispersion of the pollock fisheries and the need to exclude trawling in the vicinity of Steller sea lion rookeries and haulouts.

1990 — Three nautical mile (nm) "no-entry" zones were established around the principle Steller sea lion rookeries west of 150°W long. These no entry zones were implemented for the purpose of "... restricting the opportunities for individuals to shoot at sea lions and facilitating enforcement of this restriction; reducing the likelihood of interactions with sea lions, such as accidents or incidental takings in these areas where concentrations of these animals are expected to be high; minimizing disturbances and interference with sea lion behavior, especially at pupping and breeding sites; and, avoiding or minimizing other related adverse effects."

1991 — On January 7, 1991, NMFS issued a final rule to implement regulations for Amendments 14/19 to the BSAI and GOA FMPs that limited pollock roe-stripping and seasonally apportioned the pollock TAC in the BSAI and GOA (56 FR 492). For BSAI fisheries, the pollock TAC was divided between an A (roe) season and a B (summer-fall) season. In the GOA fisheries, the pollock TAC for the Western and Central (W/C) Regulatory Areas was divided into 4 equal seasons. NMFS noted in the proposed rule (55 FR 37907, September 14, 1990) that "shifting fishing effort to later in the year may reduce competition for pollock between the fishery and Steller sea lions whose populations have been declining in recent years."

On June 5, 1991, NMFS issued a biological opinion that focused on the potential effects of the GOA pollock fishery, as specified in the 1991 TAC specification, on food availability to Steller sea lions. Although the opinion concluded that the GOA 1991 pollock TAC specification was not likely to jeopardize the continued existence of any endangered or threatened species under NMFS' jurisdiction, the opinion noted that changes in the temporal and spatial distribution of the pollock fishery may have contributed to the Steller sea lion decline. Specifically, the fishery operated more in fall and winter, caught the quota in less time, and fished more often in areas later designated (in 1993) as Steller sea lion critical habitat under the ESA (Fritz et al. 1995).

On June 19, 1991, NMFS issued an emergency interim rule (effective through September 17, 1991) to ensure that pollock fishing did not jeopardize the continued existence or recovery of the threatened Steller sea lion (56 FR 28112). The rule contained measures to protect the Steller sea lion by:

1. allocating the pollock TAC for the combined W/C Regulatory Areas equally between two subareas located east and west of 154°W,

2. limiting the amount of unharvested pollock TAC that may be rolled over to subsequent quarters in a fishing year, and

3. prohibiting fishing with trawl gear in the EEZ within 10 nm of 14 Steller sea lion rookeries.

With respect to the third measure, prohibition of trawl gear within 10 nm of rookeries, NMFS considered similar prohibitions for other gear types. The pollock and Atka mackerel fisheries use trawl gear almost exclusively. Trawls alone were excluded because (1) the risk of lethal incidental take of sea lions in non-trawl fisheries is low, (2) groundfish harvest with trawl gear results in greater amounts of bycatch of other important sea lion prey species, such as juvenile pollock, squid and herring, than non-trawl gear, (3) the trawl fishery harvests the majority of the catch, and (4) the likelihood of creating localized depletions of sea lion prey, both commercially exploited and non-target species, is greater with trawl gear than with hook-and-line or pot gear.

On September 19, 1991, NMFS extended the above measures through December 16, 1991 (56 FR 47425).

In 1991, NMFS also proposed closing statistical area 518, the area surrounding Bogoslof Island (where 30% and 60% of the BSAI pollock A season TAC was caught in 1990 and 1991, respectively), to directed pollock fishing. This closure was prompted by concerns about the decline in size of the Aleutian Basin pollock stock, possibly due to heavy exploitation from 1986 to 1990 in the international portion of the Bering Sea. However, this closure of the Bogoslof Island district had implications for sea lion recovery because of a predicted large redistribution of pollock fishery effort to areas soon to be designated as critical habitat. Because the size of the proposed 1992 BSAI A season pollock TAC was similar to that released in 1991 and area 518 was to be closed, the fleet would have to fish elsewhere to achieve its 1992 TAC. The only other large assemblage of spawning pollock available to the domestic fleet was on the continental shelf north of Unimak Island, an area used by sea lions from the eastern Aleutian Islands for foraging.

1992 — On January 23, 1992, NMFS issued a final rule to implement Amendments 20/25 to the BSAI and GOA FMPs (57 FR 2683). The amendments authorized regulations to protect marine mammal populations by:

1. prohibiting trawling year-round within 10 nm of 37 Steller sea lion rookeries in the GOA and BSAI;

2. expanding the prohibited zone to 20 nm for 5 of these rookeries from January 1 through April 15 each year;

3. establishing 3 GOA pollock management districts; and

4. imposing a limit on the amount of an excess pollock seasonal harvest that may be taken in a quarter in each district.

1993 — On March 12, 1993, NMFS issued a final rule to implement an expanded no-trawl zone around the Ugamak Island Steller sea lion rookery in the eastern Aleutian Islands during the pollock roe fishery season in the BSAI (58 FR 13561). The expanded zone was expected to better encompass Steller sea lion winter habitats and juvenile foraging areas in this portion of the southeastern Bering Sea shelf during the BSAI winter pollock fishery.

On July 13, 1993, NMFS issued a final rule to implement regulations (BSAI FMP amendment 28) that subdivided the Aleutian Islands subdistrict into three subareas (areas 541, 542, 543) (58 FR 37660). This rule was implemented because of concerns that the concentration of fishery removals, particularly Atka mackerel, in the eastern Aleutian Islands could cause localized depletion of groundfish stocks. While dispersal of the Atka mackerel TAC was initiated to conserve fish, it was also consistent with the objectives of the fishery management measures enacted for Steller sea lion recovery.

On August 27, 1993, NMFS designated critical habitat for the Steller sea lion (58 FR 45269) as required by the ESA. The primary benefit of the designation is that it provides notice to Federal agencies that a listed species is dependent on these areas (and their features) for its continued existence and that any Federal action that may affect these areas (and their features) is subject to the consultation requirements of section 7 of the ESA.

1996 — On March 12, 1996, NMFS issued a final rule to implement Amendment 45 to the GOA FMP that combined the 3rd and 4th quarterly allowances for pollock in the 3 statistical areas of the combined W/C Regulatory Area into single seasonal allowances that became available on September 1 of each fishing year (61 FR 9972).

1998 — On June 11, 1998, NMFS issued a final rule to change the seasonal apportionment of the pollock TAC in the W/C Regulatory Areas of the GOA by moving 10% of the TAC from the 3rd fishing season (starting September 1) to the 2nd fishing season (starting June 1; 63 FR 31939). This seasonal shift of TAC was a precautionary measure intended to reduce the potential impacts of pollock fishing on Steller sea lions by reducing the percentage of the pollock TAC that is available to the fishery during the fall and winter months.

In June, the Council recommended to the Secretary of Commerce a regulatory amendment to impose an A/B season apportionment (50:50) of Atka mackerel TAC in each of the three management areas, and to incrementally shift the fishery catch in areas 542 and 543 until a target split of 40% inside and 60% outside was reached in 2002. Additional components of the Council motion included a year-round 20-nautical-mile no-trawl zone around Seguam rookery in area 541, exemption of the Community Development Quota (CDQ) fisheries from the A/B season split, A/B seasons corresponding to A/B season dates for the pollock fishery, annual review of the amendment, and a recommendation for cooperative research by NMFS and other parties (including industry) to determine the effects of these management measures. NMFS implemented these Atka mackerel measures on January 22, 1999 (64 FR 3446).

1.3.2 RPA development to date

During the section 7 consultation on the subject fisheries, both the "action" and "consulting" divisions of NMFS were confronted with a practical problem posed by the timing of the consultation relative to the anticipated start of these fisheries. The consultation was not expected to be completed before December 1998 and the fisheries were scheduled to begin on January 1, 1999 (non-trawl fisheries) and January 20, 1999 (trawl fisheries). The intervening period was not sufficient to consider and implement RPA measures. Therefore, recognizing that the consultation could conclude jeopardy or adverse modification, NMFS began consideration of possible RPAs prior to the conclusion of the consultation to expedite the implementation of any required adjustments to the fisheries prior to their initiation. The potential for a conclusion of jeopardy and/or adverse modification was discussed at several public workshops and at several Council meetings to allow the public and the Council opportunity to contribute ideas for avoiding jeopardy and adverse modification, should such conclusions be reached in the Biological Opinion.

At the conclusion of the section 7 consultation, NMFS determined that the most effective way to avoid jeopardy and adverse modification of critical habitat was (1) to define explicit objectives or principles (hereafter referred to as the "RPA principles" or just "principles") to be achieved by new conservation-oriented management measures, and then (2) to return to the Council for additional input from both the Council and public regarding possible measures that would satisfy those principles with the least amount of disruption to the fisheries. On December 13, 1998, the Council passed a motion recommending a suite of management measures intended to satisfy the RPA principles for the first half of 1999. On December 16, 1998, NMFS 1) determined that much of the Council's motion was consistent with the RPA principles established in the Biological Opinion and 2) revised the Biological Opinion accordingly. On January 22, 1999, the Council's motion, with some modification by NMFS, was published as an emergency interim rule in effect through July 19, 1999 (64 FR 14, January 22, 1999). This EA/RIR/IRFA pertains to a second emergency interim rule for the latter half of 1999 (i.e., after July 19, 1999), and to a permanent rule to be considered for the year 2000 and beyond, or until modified by subsequent management action. The following paragraphs contain a more detailed review of the RPA principles as incorporated into the Biological Opinion, the Council's motion of December 13, 1999, and NMFS's revisions to the RPA section of the Biological Opinion in response to the Council's motion, and a discussion of RPA principles not yet satisfied by management measures recommended by the Council.

1.3.3 RPA principles established in the December 3, 1998, Biological Opinion

The RPA principles of the Biological Opinion were intended to avoid the likelihood of jeopardizing the continued existence of the western population of Steller sea lions or adversely modifying its critical habitat. To achieve this intended purpose, management of the fisheries must comply with each of the RPA principles listed below. That is, the anticipated benefit of these principles is based on the understanding that the principles comprise a set of objectives that must be satisfied, in total, to achieve the intended purpose. Therefore, any resulting measure should be evaluated for its separate effects, as well as its effects when combined with other measures. The principles were designed to disperse the BSAI and GOA pollock fisheries temporally and spatially, and to preclude the possibility of sea lion/fisheries competition for prey in the areas surrounding sea lion rookeries and haulouts.

1.3.3.1 Temporal dispersion

Principle A: Continue current prohibition on all pollock trawling fisheries in the period from November 1 through January 19 and extend to the Gulf of Alaska.

The intent of *Principle A* was to eliminate competition between Steller sea lions and pollock fisheries during part of the winter period, when sea lions may be particularly sensitive to the availability of prey. This sensitivity may result from seasonal changes in behavior, foraging patterns and distribution, prey distribution, reproductive status, and metabolic/physiologic requirements. Steller sea lions, at least adult females and immature animals, are not like some marine mammals that store large amounts of fat to allow periods of fasting. They need more or less continuous access to food resources throughout the year. Nevertheless, the sensitivity of sea lions to competition from fisheries may be exaggerated during the winter. Harsh winter conditions (e.g., lower temperatures, rougher sea states) may not only confound the ability of sea lions to gain energy and nutrients, but may also increase the daily metabolic requirements, thereby reducing the chance for successful foraging as measured by net gain in energy and nutrients.[1] The metabolic demands on adult females may already be high if they are either pregnant or lactating, or both. Nursing pups may be attempting to make the transition from nutritional dependence on the mother to nutritional independence. Their small size and poorly developed foraging skills may make them particularly vulnerable to harsh winter conditions. Similarly, weaned pups and juveniles must be able to forage independently, but are compromised by their small size and lack of foraging skills. Their ability to forage successfully may be compromised in winter months.

Changes in condition, availability, and behavior of prey may also be essential to successful foraging by all sea lions in winter. Pollock in reproductive condition (i.e., bearing roe—toward the end of the winter) are

[1] This hypothesis is supported by observations of captive sea lions on unrestricted diets (Kastelein et al. 1990). This study indicated that animals naturally increased their food intake in fall and winter months.

presumably of greater nutritional value to sea lions (for the same reasons that the fisheries would rather take roe-bearing pollock than pollock spent after the spawning season). Also, the relative value of any prey type must also depend on the energetic costs of capturing, consuming, and digesting the prey. The winter aggregation of roe-bearing pollock may lead to a reduction in sea lion energetic costs associated with foraging on this species. Pollock aggregations appear to be relatively predictable in, for example, Shelikof Strait or the southeastern Bering Sea, which supports the idea that these are important foraging areas for sea lions. Undisturbed access to such prey aggregations may be essential for sea lions attempting to survive the winter period and recover in time for the spring/summer reproductive period.

Principle B: Distribute the pollock trawl harvest into at least four seasons (two in the period from January through May and two in the period from June through October).

The intent of *Principle B* was to better disperse both the BSAI and GOA pollock fisheries through the remainder of the year (January 20 to October 31) to reduce the potential for temporary localized depletion of prey for sea lions. In both regions, the fisheries have become concentrated in time, leading to "derby" fisheries which increase the potential for prey depletion relative to the needs of Steller sea lions or other predators. For example, in the BSAI, the 1990 fishery occurred over a period of about 10 months, but had become concentrated into a period of less than 3 months in 1998. If adverse effects occurred only as a result of removal of prey (i.e., exploitative competition), then the catch would be best dispersed evenly throughout January 20 to October 31 period. However, adverse effects might also occur as a result of long-term presence of fishing vessels and fishing activity in areas where sea lions would otherwise forage (i.e., interactive competition). Therefore, rather than attempt to distribute the fishery catch evenly throughout the January-October period, the intent of *Principle B* was to increase the number of seasons from two (BSAI) or three (GOA) to four in both regions. To avoid clumping of the seasons, two of the four seasons were to occur in the period from January through May, and two in the period from June through October.

Principle C: Limit combined TAC in the winter and spring periods to a maximum of 45% of the annual TAC (the current limit on the existing winter season).

The intent of *Principle C* was to ensure that the pollock catch in the winter and spring period did not exceed 45% of the annual TAC. Pollock aggregate in winter and spring for spawning, and the value of the fish during that period is greater for the fishery because of the value of the roe. However, spawning and the associated changes in physiological condition (i.e., roe-bearing) and behavior (i.e., formation of large spawning aggregations) are likely important to sea lions and other predators, as well. Spawning occurs in the later part of the winter and spring when sea lions may still be nursing their pups, or weaned pups may be facing the transition to nutritional independence. Similarly, all sea lions may depend on aggregations of roe-bearing pollock to both recover their condition after the winter period and prepare for the upcoming reproductive period in spring and early summer.

The winter/spring fisheries target the reproductive portion of the stocks just prior to spawning. Therefore, the restriction of TAC in the winter/spring periods may also have important implications for the status of the pollock stocks.

Principle D: Allocate single-season TACs to be no more than 30% of the annual TAC.

The intent of *Principle D* was to maintain the integrity of the four-season system by ensuring that the annual fishing effort would be relatively evenly dispersed throughout the period from January 20 to October 31. That is, this principle was included to ensure that the effort was not effectively concentrated into three or fewer seasons by apportioning more than 30% of the TAC to selected seasons. (For example, a seasonal limit of 35% could have reduced the year to three seasons: 35% + 35% + 30%.) A cap of 30% was chosen to allow some flexibility relative to an even fixed distribution of 25% in each of four seasons.

Principle E: Prevent concentration of pollock catch at the end of one season and the beginning of the next season which, in effect, could result in a single pulse of fishing. Mechanisms for limiting such concentration might include inter-seasonal no-fishing periods, or limits on the proportion of a seasonal TAC that can be taken in the latter part of a season. Other measures to spread or reduce effort may be necessary.

The intent of *Principle E* was to prevent the effective collapse of two consecutive seasons into one single intense pulse by concentration of fishing effort at the end of the first period and the beginning of the second period. That is, the intent of *Principle E* was to maintain the integrity and purpose of the four-season system (i.e., distribute the catch to avoid the potential for localized depletion). Possible mechanisms for preventing such a concentration include no-fishing periods between seasons and mechanisms to distribute catch within each season.

Principle F: Limit rollover of portions of seasonal TACs to situations only where necessary to account for premature fisheries closure resulting from inaccuracies associated with monitoring of seasonal catches.

The intent of *Principle F* was to prevent fisheries from concentrating catch in a season by lowering the catch well below the TAC in one season and then rolling over the uncaught portion of that season's TAC to the next season. Again, the goal was to maintain the integrity of the four-season approach and distribute the catch throughout the period from January 20 to October 31.

1.3.3.2 Spatial dispersion

Principle A: Allocate percentage of TAC to areas defined by critical habitat (CH) and broad management districts (see item c) based on the pollock biomass distribution.

The intent of *Principle A* was to prevent excessive harvesting of pollock in localized areas; i.e., to prevent localized depletion by distributing the catch according to the distribution of the pollock stock.

The assertion that the pollock fisheries are managed in a conservative manner is based largely on a single-species approach which relies on stock-wide measures of stock status and fisheries effects (e.g., total biomass and overall harvest rate). However, this single-species approach and these stock-wide measures may not be consistent with ecosystem management and may have serious ecosystem effects. The distribution of the pollock stocks, particularly in the BSAI region, has played a minor role in the management of the pollock fisheries. Consequently, local harvest rates may exceed overall harvest rates by significant amounts. Analyses of stock distribution, catch, and harvest rates in the BSAI regions in 1991, 1994, 1996, and 1997 indicate that from less than 5% to 20% of the stock was in the CVOA during the summer survey, but data from 1992 to 1997 indicate that 36% to 50% of the B-season catch came from this region in the years 1992 to 1997. Thus, harvest rates in the CVOA appear to have been significantly greater than harvest rates observed in other regions, and approached 50% in 1997. The concentration of catch relative to stock distribution is also a significant concern during the A season; from 1992 to 1997, 53% to 89% of the catch has been taken from critical habitat. The harvest rate within critical habitat cannot be estimated at present because the distribution of the stock is poorly known during this period. On an annual basis, the catch from critical habitat has ranged from about 45% to nearly 70% of the total catch since 1987 (with the exception of 1990). All of this information suggests that the overall harvest rate for the eastern Bering Sea (i.e., 15-20%) is not a good indicator of (1) the harvest rate on smaller geographic scales, (2) possible ecosystem effects, and (3) possible effects on Steller sea lions, in particular.

Principle B: Absent good scientific estimates of pollock biomass distribution, place a maximum limit on the percentage of TAC allocations from CH areas for each season. A cap of 50%, for example, is consistent with past fishing practices, but still leads to meaningful reduction in the percentage of TAC from CH.

The intent of *Principle B* was to limit the catch in designated Steller sea lion critical habitat for periods when the fishing occurs in the absence of reliable information on the distribution of the pollock stock. Specifically, this principle was developed to limit catch in critical habitat during the winter/spring period when the pollock distribution is not well known. A cap of 50% was chosen to reduce the current levels of catch in critical habitat without a major disruption of the fishery.

Principle C: Allow for the possibility of further reduction of percentage of TAC in specific critical habitat areas.

The intent of *Principle C* was to provide a mechanism for further reduction of catch in specific critical habitat areas. "Further reduction" was intended to mean reduction below the harvest level that would occur if the catch were distributed according to the distribution of the stock. Pollock trawl exclusion zones around important rookeries and haulouts are one example of such reduction, but similar reduction may be required in other areas of critical habitat. This principle was included because harvesting of sea lion prey at a level consistent with the overall harvest rate may still be detrimental for sea lions under some circumstances, in which case further reduction in the catch would be required.

Principle D: Prevent redistribution of TAC from areas outside of critical habitat to areas inside of critical habitat.

The intent of *Principle D* was to prevent concentration of catch in critical habitat by shifting apportionments of TAC from outside of critical habitat to inside of critical habitat. Such redistribution might be considered, for example, if ice formation limited the geographic region of fishing (and foraging by sea lions) to a relatively small area that consisted largely of Steller sea lion critical habitat. In such a case, the TAC that was apportioned to regions outside of critical habitat could not be taken from within critical habitat. The reason for this principle was that sea lions might be effectively limited to the same geographic restrictions, and prey resources within critical habitat would be excessively reduced with such redistribution of catch.

Principle E: Base spatial distribution of the TAC on existing study or management areas. In addition, in the Bering Sea subarea, the CVOA and southeastern Bering Sea foraging area should be combined to form one CH/CVOA complex. Additional or alternative areas may be suggested but should not lead to further spatial concentration of catch. Alternative areas must distribute TAC in a manner that is equivalent to or better (for sea lions) than would be accomplished by the following set of management areas.

Bering Sea subarea
Winter: CH/CVOA, and outside CH/CVOA
Summer: CH/CVOA, outside of CH/CVOA east of 170°W, and west of 170°W

Aleutian Islands subarea
All areas: 541, 542, and 543

Gulf of Alaska
Winter: Shelikof Strait (621 and 631 combined), 610, 620, 630
Summer: 610, 620, and 630

The intent of *Principle E* was to provide a minimum standard for distribution of catch according to the distribution of the stock. Alternative areas for distributing catch should be considered, but must ensure that catch is distributed in a manner commensurate with the overall distribution of pollock in the BSAI and GOA regions. The areas chosen were based on current study and management areas.

In the Bering Sea subarea during summer, the use of three areas CH/CVOA, outside of CH/CVOA east of 170°W long., and west of 170°W long. to distribute catch was considered essential to ensure that excessive catch was not concentrated just outside of critical habitat. Pollock stocks are thought to be relatively mobile, and the abundance (or biomass) of pollock in Steller sea lion critical habitat is, therefore, determined by factors both inside and outside of critical habitat. If the catch were divided into just two areas, then fishing vessels could concentrate effort in critical habitat until that portion of the TAC was taken, and then simply move to just outside critical habitat and take the remainder of the catch. This kind of border concentration of catch could (and likely would) affect the availability of prey within critical habitat and would fail to distribute catch in a manner consistent with stock distribution. Further dispersal of fishing effort and catch is deemed necessary to prevent detrimental ecosystem effects and, specifically, to prevent detrimental effects on Steller sea lions.

1.3.3.3 Pollock trawl exclusion zones

Principle A: Spatial separation of pollock trawl fishing and Steller sea lion foraging areas adjacent to terrestrial haulouts and rookeries.

The intent of *Principle A* was to effectively eliminate the possibility of competition for prey resources between the fishery and sea lions within the vicinity of selected, important rookeries and haulouts. During the reproductive season, rookeries may be particularly important land bases for adult females nursing pups and for young pups and juveniles learning to forage independently. Adults, both female and male, rarely wander far from the breeding areas. Outside the breeding season, sea lions are much more mobile and far-ranging; animals of both sexes and all age groups tend to disperse widely across the range. Juveniles tend to move the most, but all age groups wander significant distances from late July to the next May. Not only do the animals move great distances, but they also move from location to location, rarely staying at specific sites for long periods. Haulout sites in winter have been likened to a "Howard Johnson's restaurant" near a major highway, where many sea lions may occupy a site, but over time the individuals there change even though the number may not.

Principle B: Protection of all rookeries and haulouts used by significant numbers of animals since the beginning of the decline in the 1970s.

The intent of *Principle B* was to provide protection consistent with that required for a healthy, recovered western population of sea lions. Given the 80% decline in abundance of sea lions, it is not surprising that certain areas are no longer used or are used less frequently and by smaller numbers of sea lions. The decrease in use, however, does not necessarily indicate that these areas are no longer important, but rather, the decrease in use should be expected based on the decline alone. The alteration or modification of those habitats through repetitive, intense removal of prey reduces the likelihood that those areas will be optimal for sea lion use. NMFS must insure that resources in those areas, especially those areas determined to be critical habitat, can sustain the growing needs of Steller sea lions as the population recovers. Failure to protect these areas would likely preclude their contribution to the recovery of the population. The best indicator of the population in a recovered and reasonably healthy state is from the 1970s.

Principle C: Protection zones in the Bering Sea subarea must have a minimum radius of 20 nm, and 10 nm in the GOA and Aleutian Islands.

The intent of *Principle C* was to provide a minimum level of protection for the areas around rookeries and haulouts. The no-trawl zones were designed to protect feeding areas used by females with dependent nursing pups.

1.3.3.4 Additional RPA elements

In addition to the principles aimed at temporal and spatial dispersion and protection around rookeries and haulouts, the RPA, as described in the Biological Opinion, contained three other important elements.

Incremental or phased approach

The RPA described in the Biological Opinion allowed for the incremental imposition of conservation measures if the incremental approach does not jeopardize the continued existence of the western population of Steller sea lions. The phase in of any measures must not be drawn out, and 2 years was suggested as a guideline, with a significant portion of any new measure imposed in the first year.

Review of fishery practices and fish/sea lion biology subsequent to establishment of RPA measures

This element was intended to ensure that fishery practices were, in fact, consistent with expectations based on the intent of the RPA principles.

Long-term management of the potential interactions between sea lions and fisheries

The RPA principles recommended formation of a committee consisting of Federal and State managers, sea lion researchers, and industry and environmental representatives to develop recommendations for long-term management of the potential interactions between sea lions and fisheries.

1.3.4 Council's motion of December 13, 1998

At its December, 1999, meeting, after consideration of the information pertaining to the competition between Steller sea lions and the BSAI and GOA pollock fisheries, the Council adopted a motion recommending that NMFS proceed with an emergency rule to implement specific RPAs prior to the 1999 pollock fishing season. The complete text of the Council's December 13 motion is contained in Appendix A.

1.3.5 NMFS revisions to Council motion, emergency interim rule, and outstanding requirements

After review of the Council's motion, the Office of Sustainable Fisheries (NMFS) informed the Office of Protected Resources (also NMFS) that the Council's motion, with some modifications, should be accepted as alternative RPAs for the BSAI and GOA pollock fisheries (Memorandum from G. Matlock to H. Diaz-Soltero; December 16, 1998) (Appendix B). The Office of Protected Resources concurred.

Based on the Council motion, and the above modifications, NMFS published an emergency interim rule to implement RPAs for the pollock fisheries on January 22, 1999 (64 FR:3437-3446, Appendix C). The rule remains in effect until July 19, 1999. In February, 1999, NMFS presented a summary of these modifications to the Council, along with information pertaining to remaining outstanding requirements of the RPA principles:

- the need to extend all the provisions in the current emergency rule,
- the need for TAC allocation methods for inside and outside of the CH/CVOA complex and E/W of 170°W long. in the B and C seasons in the BSAI region,
- the need for continued reduction of the percentage cap inside of the CH/CVOA complex in the A1 and A2 seasons,
- the need for further equivalent management measures for Cape Sarichef or the eight planned closures in the GOA if those areas are to remain open.

These requirements pertain to the emergency rule for the latter half of 1999 and the permanent rule for 2000 and beyond (or until modified). The Council responded by passing a motion describing a range of options to be included in this EA/RIR/IRFA (Appendix D).

1.4 Alternatives developed for analysis

Based on the Council's February 1999 motion, NMFS has developed the following alternatives for analysis. Rather than proposing several distinct alternatives, the Council has requested analysis of a set of overlapping alternatives that contain numerous specific options and suboptions under each management measure. To clarify the distinction between "alternatives" and "options, the term "alternative" is used to describe a complete suite of management measures that could be adopted by the Council as RPAs and the term "option" is used when describing specific management measures. Due to the overlapping nature of the Council's proposed alternatives, a comprehensive discussion of the range of options pertaining to each RPA principle is contained in section 2.

ALTERNATIVE 1: No Action

Under the no-action alternative, the pollock fisheries off Alaska would revert to the previous management regime once the current emergency rule expires. None of the RPA elements would be implemented and the factors that led to the NMFS determination of jeopardy would remain. If this alternative is adopted, NMFS would be forced to close the pollock fishery or take independent action under authority of the ESA to prevent the pollock fishery from jeopardizing the continued existence of the western population of Steller sea lions and adversely modify its critical habitat.

ALTERNATIVE 2: (PREFERRED) January 22, 1999, emergency rule extended for an additional 180 days.

Under this alternative, the suite of management measures that composed the Council's December 13, 1998, emergency rule motion, as revised and adopted by NMFS, would be extended for an additional 180 days with the addition of spatial dispersion measures for the Bering Sea B and C seasons. On December 16, 1998, NMFS had determined that the spatial dispersion measures for the Bering Sea B and C seasons were inadequate to satisfy the RPA principles. As a consequence, NMFS published the January 22, 1999, emergency rule without specifying spatial dispersion measures for the second half of 1999, indicating that additional measures were necessary for the second half of 1999 before the fishery could proceed. In response to this determination by NMFS, the Council, in it's June 1999 motion included a spatial dispersion scheme for the Bering Sea B and C seasons that would achieve 1999 targets of no more than 25% of B season removals from the CH/CVOA and 35% of C season removals from the CH/CVOA. The Council's June recommendation for spatial dispersion is consistent with the RPA principles' first-year goal of no more than

25 percent removals from the CH/CVOA during the B season and no more than 35 percent removals from the CH/CVOA during the C season. The Council's motion achieved these overall limits by excluding the catcher/processor and mothership sectors from operating in the CH/CVOA during the B and C seasons and establishing limits for the inshore sector of 45 percent and 65 percent for the B and C seasons, respectively; and a combined B/C limit of 56 percent for the CDQ sector.

The complete text of the Council's December 13, 1998, motion is contained in Appendix A. The January 22, 1999, emergency rule is contained in Appendix B, and the Council's June 13, 1999 motion is contained in Appendix G. The primary elements of the preferred alternative are outlined below:

Bering Sea Temporal Dispersion. Alternative 2 would accomplish temporal dispersion by establishing new fishing seasons for the four sectors of the Bering Sea pollock fishery that are established in the AFA. The pollock TAC allocated to each industry sector would be apportioned to the fishing seasons according to the following table:

Fishing Season	Season Dates and Seasonal TAC Apportionment Percentages					
	Inshore and catcher/processor		Mothership		CDQ	
A1 Season	1/20 - 2/15	(27.5%)	2/1 - 4/15	(40%)	1/20 - 4/15	(45%)
A2 Season	2/20 - 4/15	(12.5%)				
B Season	8/1 - 9/15	(30.0%)	9/1 - 11/1	(60%)	4/15 - 12/31	(55%)
C Season	9/15 - 11/1	(30.0%)				

Bering Sea Spatial Dispersion: CH/CVOA Conservation Zone. Alternative 2 would establish a Critical Habitat/Catcher Vessel Operational Area (CH/CVOA) conservation zone for the purpose of regulating total removals of pollock. This CH/CVOA conservation zone would include the portion of Bering Sea critical habitat known as the Bogoslof foraging area, and the portion of the CVOA that extends eastward from the Bogoslof foraging area.

Pollock harvests within the CH/CVOA conservation zone during each season would be restricted to a percentage of each sector's seasonal TAC apportionment according to the percentages displayed below:

Fishing Season	Percentage of catch within CH/CVOA			
	Inshore	Catcher/ processor	Mothership	CDQ
A1 Season	70%	40%	50%	100%
A2 Season				
B Season	45%	0%	0%	56%
C Season	63%			

NMFS would monitor catch by each industry sector and close the CH/CVOA conservation zone to directed fishing for pollock by a sector when NMFS determines that the specified CH/CVOA limit has been reached. Catcher vessels less than or equal to 99 ft length overall (LOA) would be exempt from CH/CVOA closures from September 1 through March 31 unless the percentage cap for the inshore sector has been reached. To accomplish this objective, NMFS would announce the closure of the CH/CVOA conservation zone to catcher/vessels over 99 ft LOA before the inshore sector percentage limit is reached and in a manner intended to leave remaining quota within CH/CVOA sufficient to support fishing by vessels less than or equal to 99 ft LOA for the duration of the current inshore sector opening.

Aleutian Islands Closure. The Aleutian Islands subarea would be closed to directed fishing for pollock.

Gulf of Alaska Temporal Dispersion. Alternative 2 would accomplish temporal dispersion of the GOA pollock fishery through implementation of new fishing seasons and TAC apportionments. These new fishing seasons are summarized below. The pollock fishing season in the Eastern Regulatory Area would be unchanged.

Fishing season and TAC apportionment	From:	To:
A Season: 30%	January 20	April 1
B Season: 20%	June 1	July 1
C Season: 25%	September 1	The date of closure of a statistical area (610, 620, 630) to directed fishing, or October 1, whichever comes first.
D Season: 25%	Five days after the date of closure of a statistical area (610, 620, 630) to directed fishing in the C season.	November 1.

W/C GOA Trip limits. As an additional spatial dispersion measure, a 300,000 lb (136 mt) pollock trip limit would be established for catcher vessels harvesting pollock in the directed pollock fisheries of the W/C GOA.

GOA Spatial Dispersion. The TAC for pollock in the combined W/C Regulatory Areas would continue to be apportioned among Statistical Areas 610, 620, and 630 in proportion to the distribution of the pollock biomass as determined by the most recent NMFS surveys. To prevent localized depletions of pollock within Shelikof Strait, an important winter foraging area for Steller sea lions, the emergency rule limits removals from within a designated Shelikof Strait conservation zone during the A season. The Shelikof strait limit is determined by calculating the ratio of the most recent estimate of pollock biomass in Shelikof Strait divided by the most recent estimate of total pollock biomass in the GOA. This ratio will then be multiplied by the overall pollock TAC for the GOA and multiplied by the A season apportionment of 30%. When NMFS determines that A season pollock removals from within the Shelikof Strait conservation zone have reached this specified limit, directed fishing for pollock would be prohibited in the Shelikof Strait conservation zone. Note that for the year 2000 and beyond, NMFS recommends a separate TAC for Shelikof strait rather than a cap for the reasons discussed in section 2.5.

Pollock Trawl Exclusion Zones. Under Alternative 2, directed fishing for pollock would be prohibited within 10 or 20 nm of rookeries and significant haulouts in the Bering Sea subarea and GOA. In its December 13, 1998, motion, the Council recommended closure of all of the pollock exclusion zones recommended by NMFS in the Biological Opinion with one exception in the Bering Sea subarea and eight exceptions in the GOA. In the Bering Sea subarea, the Council recommended no closure for a proposed 20 nm exclusion zone around the Cape Sarichef haulout. However, in the emergency rule, NMFS determined that this site warranted protection and implemented a 10 nm closure around Cape Sarichef for 1999 with the intent that this closure be extended to 20 nm for 2000 and beyond. In the GOA, the Council recommended no closures around Cape Barnabas, Gull Point, Rugged Island, Point Elrington, Cape Ikolik, Needles, Mitrofania, and Sea Lion Rocks. The January 22, 1999, emergency rule did not close this sites for the 1999 fishing year and the preferred alternative to extend the emergency rule for an additional 180 days also would not close these eight sites for the remainder of 1999.

ALTERNATIVE 3: Council's December 13, 1998, emergency rule RPA recommendations revised to cap A1/A2 season CH/CVOA catch at 50%

Under Alternative 3, the complete set of management measures contained in Alternative 2 would be adopted along with a reduction in the overall A1 and A2 season CH/CVOA catch limit to 50% of the A1 and A2 seasonal TACs. The method for reducing the A1/A2 season CH/CVOA catch from 62.5% to 50% would be determined by one of the following options:

(a) using an equal proportional reduction across the Inshore, Mothership, and Catcher/processor sectors
(b) using a constant percentage point reduction across the Inshore, Mothership, and Catcher/processor sectors
(c) Using equal percentages (equal access) for inshore and mothership sectors.

Additional suboptions for season dates, seasonal TAC apportionments and stand-down periods include:

(a) 45/55 A/(B/C) Split
(b) A2 start dates of February 20, March 1, or March 15
(c) 5, 7, or 10 day stand-down periods between seasons
(d) revised rollover provisions identified by NMFS

ALTERNATIVE 4: Council's December 13, 1998, motion revised to meet the "50% principle" as provided under Alternative 3, plus the following suboptions:

GOA Specific
(a) tender trip limits of 136mt and 272 mt.
(b) seasonal exclusive registration between E/W/C GOA and BSAI
(c) re-examine Shelikof Strait critical foraging area
(d) pollock trawl closures not included in 12/98 Emergency Action

BSAI Specific
(a) Spatial distribution of catch:
  Option 1: Inside CH/CVOA and outside CH/CVOA
  Option 2: Inside CH/CVOA and outside CH/CVOA with outside CH/CVOA split east/west of 170°
    Suboption: Range of +/- 30% of sector percentage
  Option 3: Inside CH/CVOA and outside CH/CVOA, with 10-mile buffer around CH

(b) B/C Season start dates:
  1. B Season start date: June 1
    a. with differential application by sector keyed to co-op.
    b. end Aug 15
    c. end Aug 30

  2. C Season start dates:

a. Sept 1
b. Sept 15

3. C Season end dates:
a. Oct 31
b. Nov 30

4. Combine B/C season with early start date, and with cap on monthly catch. No month to exceed 20-30% of annual harvest on a sector-by-sector basis.

(c) Pollock trawl closures not included in December 13, 1998, motion.
(d) Analysis of Aleutian closure and long-term management options.
(e) Rollovers:
1. Repeal restriction that doesn't allow harvest of uncaught CH fish.
2. Rollover restrictions evaluated on a sector-by-sector basis.

ALTERNATIVE 5: RPA example measures contained in December 3, 1998, Biological Opinion

The following set of recommended measures were developed by NMFS staff from the Alaska Fisheries Science Center and the Alaska Regions in the December 3, 1999, Biological Opinion as an example which implements the above principles of the reasonable and prudent alternatives. While analysis of this option was not specifically requested by the Council, it is included here for comparison purposes.

Temporal dispersion

In both the Bering Sea subarea and the Gulf of Alaska, TAC would be distributed among four seasons. In the Aleutian Islands subarea, seasonal allocation is not considered necessary. Rollover of seasonal TACs to subsequent seasons must be limited to the amount of TAC remaining after premature fisheries closure resulting from inaccuracies associated with monitoring of seasonal catches.

Bering Sea subarea season dates and apportionments

Season	Start Date	Apportionment
A1	January 20	20%
A2	March 1	25%
B	August 15	25%
C	September 15	30%

Western/Central GOA season dates and apportionments

Season	Start Date	Apportionment
A1	January 20	15%
A2	March 1	30%
B	June 1	25%
C	September 15	30%

Spatial dispersion

In the Bering Sea subarea, pollock TAC would be split between two areas during the A1 and A2 seasons, and among three areas during the B and C seasons.

Bering Sea subarea spatial dispersion

Season	Areas	Apportionment
A1 & A2	1) Inside CH/CVOA 2) Outside CH/CVOA	(See below)
B & C	1) CH/CVOA 2) East of 170°W outside of CH/CVOA 3) West of 170°W, north of 56 °N	(See below)

For A1 and A2 seasons, apportionment of pollock TAC to the CH/CVOA would be reduced in two increments. In 1999, no more than 62.5% of each season's TAC could be taken in the combined area; in 2000, no more than 50%.

For B and C seasons, the Bering Sea subarea TAC would be allocated to three areas based on the distribution of exploitable pollock (age 3+) biomass as best determined by summer bottom trawl and hydroacoustic surveys. The TAC apportioned to critical habitat may require further reduction, although no reduction in presently included in this alternative.

In the GOA, pollock TAC would be split among four areas in the A1 and A2 seasons and three areas in the B and C seasons.

Western/Central GOA spatial dispersion

Season	Areas	Apportionment
A1 & A2	1) Shelikof (combined areas 621 and 631) 2) Area 610 3) Area 620 (outside of 621) 4) Area 630 (outside of 631)	(See below)
B & C	1) Area 610 2) Area 620 3) Area 630	(See below)

For A1 and A2 seasons, the Shelikof Strait TAC would be determined by first calculating the ratio of the most recent estimate of biomass in the strait (from hydroacoustic surveys) divided by the most recent estimate of total biomass in the GOA (model estimate). The ratio will then be multiplied by each seasonal TAC to determine what portion of that TAC will be apportioned to the strait. The remainder would be distributed among the other areas according to the results from the most recent summer bottom trawl survey. The TAC apportioned to the strait may require further reduction, although no reduction is presently included in this alternative.

For B and C seasons, the TAC will be apportioned among the areas according to the most recent bottom trawl survey data.

No spatial apportionment of pollock TAC is proposed for the AI.

Pollock trawl exclusion zones

Exclusion zones would be established around haulouts in the Bering Sea subarea, Aleutian Islands subarea, and GOA. The size of the exclusion zones in each fishery area reflects the relative widths of the continental shelf. The shelf is broader in the Bering Sea subarea (zones with a radii of 20 nm) than in the Aleutian Islands subarea, or most of the GOA (zones with radii of 10 nm). Existing zones, which prohibit all trawling around rookeries, would not be affected by this alternative. New zones would prohibit trawling for pollock only, and only around haulout sites used by the western population (i.e., west of 144°W long.). These sites were selected on the basis of counts conducted since 1979 during the reproductive season (summer) and non-reproductive season (winter). The following criteria were used to identify sites that require protection zones.

1. Rookeries: 10 or 20 nm (depending on location) all-trawl exclusion zones, year-round.
2. Haulouts:

    a. Sites with greater than 200 sea lions during a summer survey would have 10 or 20 nm pollock no-trawl zones during the summer/fall period (B and C seasons).

    b. Sites with greater than 75 sea lions during a winter survey would have 10 or 20 nm pollock no-trawl zones during the winter period (A1 and A2 seasons).

    c. Sites meeting both of the above criteria would have 10 or 20 nm pollock no-trawl zones during all seasons.

ALTERNATIVE 6: Alternative 4 plus options for eliminating stand-down periods outside the CH/CVOA, for greater separation of A1 and A2 seasons, and for incremental adjustment to catch restrictions inside and outside CH/CVOA in B and C seasons.

Alternative 6 includes April Council meeting alternatives intended to provide for more flexible and continuous fishing opportunities in the A1/A2 seasons for 2000 and beyond, and in the B and C seasons for 1999 and beyond. These alternatives are combined in such a way as to balance them with the requirements of the 1998 BO RPA principles. In general, the rules affecting fishing patterns outside the CH/CVOA would be relaxed in both the A1/A2 seasons compared to 1999 A1/A2 seasons, and the B/C seasons compared to the example RPAs in the BO. Inside the CH/CVOA, however, the rules would increase temporal dispersion of fishing effort. The provisions would be phased in over two year periods; 2000 - 2001 for A1/A2 and 1999-2000 for B and C. The dates listed in the accompanying tables illustrate one set that satisfies the requirements of the BO RPA principles. These example dates are not fixed, but any other proposed set of season starting and ending dates must also satisfy other BO RPA requirements (e.g., separation of seasons inside CH/CVOA).

A1 and A2 Seasons

The changes to the A1 and A2 seasons would include three new provisions. These changes, as well as proposed season dates and stand-down periods (where applicable), are listed in Tables 1-1 and 1-2 below for 2000 and 2001.

Table 1-1 Proposed A1/A2 season structure for 2000 EBS pollock fishery.

	Inside CH/CVOA 50% STAC[1]					Outside CH/CVOA 50% STAC[1]				
	A1 Dates		A2 Dates		Stand-down	A1 Dates		A2 Dates		Stand-down
	Start	End	Start	End		Start	End	Start	End	
CPs	1/20	3/15	4/1	5/15	15 d	1/20	NA	NA	5/15	NONE[2]
MS	1/20	3/15	4/1	5/15	15 d	1/20	3/15	4/1	5/15	15 d
Inshore	1/20	3/15	4/1	5/15	15 d	1/20	3/15	4/1	5/15	15 d
CDQ	1/20	3/15	4/1	5/15	15 d	1/20	NA	NA	5/15	NONE[2]

[1] STAC=Seasonal TAC

[2] Exemption from inter-season stand-down provision outside CH/CVOA is premised on each sector's ability to limit daily catch rates (and 5-day running average catch rates) to pre-determined levels established in cooperation with industry.

Table 1-2 Proposed A1/A2 season structure for 2001 EBS pollock fishery, assuming each sector can establish MCRs.

	Inside CH/CVOA 50% STAC[1]					Outside CH/CVOA 50% STAC[1]				
	A1 Dates		A2 Dates		Stand-down	A1 Dates		A2 Dates		Stand-down
	Start	End	Start	End		Start	End	Start	End	
CPs	1/20	3/15	4/1	5/15	15 d	1/20	NA	NA	5/15	NONE[2]
MS	1/20	3/15	4/1	5/15	15 d	1/20	NA	NA	5/15	NONE[2]
Inshore	1/20	3/15	4/1	5/15	15 d	1/20	NA	NA	5/15	NONE[2]
CDQ	1/20	3/15	4/1	5/15	15 d	1/20	NA	NA	5/15	NONE[2]

[1] STAC=Seasonal TAC

[2] Exemption from inter-season stand-down provision outside CH/CVOA is premised on each sector's ability to limit daily catch rates (and 5-day running average catch rates) to pre-determined levels established in cooperation with industry.

1) Stand-down requirements between the A1 and A2 seasons outside the CH/CVOA will be eliminated where sector-specific maximum catch rates (MCR) can be maintained. Catch limits would take the form of a daily maximum and 5-day running average maximum for each sector, principally facilitated by the establishment of sector cooperatives. Note that only the CP and CDQ sectors are expected to be ready to establish these limits for 2000; however, other sectors also would be eligible for outside stand-down exemptions if they too could implement MCRs. By 2001 MCRs for inside the CVOA would also be required in order for a sector to operate outside with no stand-down provision.

2) The A2 season will start later in 2000 and beyond than in 1999, representing a completely separate seasonal TAC release from the A1 season inside the CH/CVOA. In an effort to ease the transition from the continuous A1/A2 fishery that resulted in 1999 to a fully separate A2 season, the single season allocation limit of 30% would be increased (for the 2000 A1 season only), such that the A1 and A2 TAC release percentages would be 35% and 5%, respectively, given a combined A1/A2 allocation of 40% (or 40% A1 and 5% A2 given a combined A1/A2 allocation of 45%).

3) All sectors (CPs, Inshore, MS, and CDQ) would be required to adhere to the same seasonal and spatial apportionment rules.

B and C Seasons

The changes to the B and C seasons would also include three new provisions. Items 1 and 2 below, effecting proposed season dates and stand-down periods (where applicable) are listed in Table 1-3 for 2000 and Table 1-4 for 2001. Item 3, which refers to spatial allocation rules, is reflected in Tables 1-3 and 1-4 below for 1999 and 2000, respectively.

Table 1-3 Proposed B and C season structure for 2000 EBS pollock fishery.

1999 Dates	Inside CH/CVOA					Outside CH/CVOA				
	B Dates		C Dates		Stand-down	B Dates		C Dates		Stand-down
	Start	End	Start	End		Start	End	Start	End	
CPs	NA	NA	NA	NA	NA	8/1	NA	NA	10/31	NONE[1]
MS	NA	NA	NA	NA	NA	8/1	9/7	9/22	10/31	15 d
Inshore	8/1	9/7	9/22	10/31	15 d	8/1	9/7	9/22	10/31	15 d
CDQ	8/1	9/7	9/22	10/31	15 d	8/1	NA	NA	NA	NONE[1]

[1] Exemption from inter-season stand-down provision outside CH/CVOA is premised on each sector's ability to limit daily catch rates (and 5-day running average catch rates) to pre-determined levels established in cooperation with industry.

Table 1-4 Proposed B and C season structure for 2001 EBS pollock fishery, assuming each sector can establish MCRs.

2000 Dates	Inside CH/CVOA					Outside CH/CVOA				
	B Dates		C Dates		Stand-down	B Dates		C Dates		Stand-down
	Start	End	Start	End		Start	End	Start	End	
CPs	NA	NA	NA	NA	NA	8/1	NA	NA	10/31	NONE[1]
MS	NA	NA	NA	NA	NA	8/1	NA	NA	10/31	NONE[1]
Inshore	6/1	9/1	9/15	10/31	15 d	8/1	NA	NA	10/31	NONE[1]
CDQ	6/1	9/1	9/15	10/31	15 d	8/1	NA	NA	10/31	NONE[1]

[1] Exemption from inter-season stand-down provision outside CH/CVOA is premised on each sector's ability to limit daily catch rates (and 5-day running average catch rates) to pre-determined levels established in cooperation with industry.

1) Stand-down requirements between the B and C seasons outside the CH/CVOA will be eliminated where sector-specific maximum catch rates (MCR) could be maintained. Catch limits would take the form of a daily maximum and 5-day running average maximum for each sector, principally facilitated by the establishment of sector cooperatives. Note that only the CP and CDQ sectors are expected to be ready to establish these limits for 2000; however, other sectors also would be eligible for outside stand-down exemptions if they too could implement MCRs. By 2001, MCRs for inside the CVOA would also be required in order for a sector to operate outside with no stand-down provision.

2) By 2001, all sectors (CPs, Inshore, MS, and CDQ) would be required to adhere to the same seasonal and spatial apportionment rules. In 1999, however, the CDQ may operate after the 10/31 C season closure date.

3) The target spatial allocations in the B and C seasons would be phased in during 1999, allowing the fisheries flexibility in adjusting to the area specific TAC guidelines. The overall guideline target spatial distribution would be as follows, based on analyses of available pollock distribution data in the EBS:

B season: 15% CH/CVOA
30% East of 170E
55% West of 170E (2 standard deviations = 20%)

C season: 25% CH/CVOA
25% East of 170E
50% West of 170E

The B-season target distribution is based on the average 1991-98 biomass distributions in each of the three areas shown in Table 3-5. The C-season target distribution is based on Figure 3-19, which shows various pollock seasonal migration scenarios into and out of the CH/CVOA based on winter and summer survey data.

This target distribution would be modified for 1999 and 2000 according to the protocol in the Table below. This approach phases in the limits on removals inside CH/CVOA while establishing a gradual increase in removals west of 170E, with the minimum set at 2 standard deviations below the average biomass fraction (i.e., 55% - 20% = 35%) for that area to account for inter-annual variability.

Proposed B and C season spatial allocations for 1999 EBS pollock fishery.

1999 Allocations	B	C
CH/CVOA	25% Max	35% Max
Outside CH/CVOA	Max. 60% of STAC1 from E of 170°W longitude	Max. 55% of STAC1 from E of 170°W longitude
2000 Allocations	B	C
CH/CVOA	15% Max	25% Max
Outside CH/CVOA	Max. 50% of STAC[1] from E of 170°W longitude	Max. 55% of STAC[1] from E of 170°W longitude

[1] STAC=Seasonal TAC

Rollover provisions for the B and C season will be established prior to 2000.

Additional alternatives proposed but not formally analyzed

In addition to the range of possible alternatives bounded by Alternatives 1 through 5 above, additional alternatives have been proposed during the public discussion on this issue. These alternatives generally fall into two categories: (1) a reduction in the pollock TAC to some level significantly below current levels, and (2) comprehensive rationalization of the pollock fishery (e.g., IFQs) to eliminate the race for fish and resulting pulses of fishing effort in time and space.

A discussion of the environmental effects of an approximate 30% reduction in the pollock TAC is contained in the SEIS prepared for the annual TAC specification process (NMFS, 1998c). A specific alternative to reduce the Bering Sea and GOA pollock TACs was not analyzed formally in this document because such an alternative would impose significant economic costs on industry and is inconsistent with the RPA principles in that it would not achieve temporal and spatial dispersion.

Analysis of an alternative to comprehensively rationalize the BSAI and GOA pollock fisheries is not feasible within the time frame required for action on Steller sea lion RPAs and is not attempted in this document. Should the Council decide to proceed with development of a program to comprehensively rationalize the BSAI and GOA pollock fisheries, the effects of such a program relative to Steller sea lions would be analyzed at that time.

2.0 ANALYSIS OF ALTERNATIVES RELATIVE TO THE RPA PRINCIPLES

In this section, the specific alternatives and options described in section 1.4 are analyzed with respect to their consistency with the RPA principles set out in the Biological Opinion. Due to the redundancy in specific management measures between the various alternatives, all proposed options pertaining to temporal dispersion, spatial dispersion, and pollock trawl exclusion zones in each management area (Bering Sea subarea, Aleutians Islands subarea, and Gulf of Alaska) are grouped together and addressed in a comparative manner.

2.1 Options for temporal dispersion in Bering Sea subarea

Temporal dispersion involves configuration of the pollock fishery with respect to TAC allocations by season, season lengths, start dates, end dates and any other strategies to reduce the amplitude of effort modes and spread out the removals over time. The Biological Opinion identifies two objectives of temporal dispersion, both of which are intended to reduce competitive interactions between pollock trawl fisheries and Steller sea lions.

The first objective is to avoid removal of prey during the winter period when Steller sea lions, and particularly adult females and juveniles, may be especially vulnerable to competition or lack of available prey. The current fishing regulations prohibit pollock fishing from November 1 through January 19 in the Bering Sea subarea. The RPA principles include a continuation of this prohibition and expand it to the GOA.

The second objective is to more evenly distribute the pollock trawl fisheries catch throughout the remainder of the year and thereby eliminate the probability of localized depletions associated with large removals over short periods of time (e.g., "derby" fishing). In the Bering Sea subarea, the pollock fishery has become concentrated in time from about 10 months in 1990 to less than 3 months in 1998 (split into two seasons). This kind of pulsed fishery represents one extreme of temporal dispersion. At the other extreme, the catch could be evenly distributed from 20 January to October 31, resulting in reduced likelihood of localized depletion. However, nearly year-round pollock harvesting activity may introduce chronic disturbance effects on foraging sea lions with unknown impacts. The division of the January 20 to October 31 period into four seasons represents an intermediate approach that provides a opportunity to create fishing seasons that are longer and slower, with reduced effort modes, separated by stand-down periods with little or no interaction with Steller sea lions.

Prior to the 1999 season, in the Bering Sea subarea, approximately 45% of the pollock TAC was caught in six- to eight-weeks, beginning January 20, during the winter roe (A) season. Subsequently, no directed pollock fisheries operated until the fall (B) season (September 1 to October 31) when the remaining 55% of pollock TAC was caught. Because sea lions are likely to utilize schooling aggregations of pollock year round, and particularly the spawning aggregations during the winter season, dispersal of both the roe-fishery and the fall fishery were recognized in the Biological Opinion as necessary, seasonally-specific goals.

Under the emergency rule, temporal protective measures have been instituted for the Bering Sea winter fishery, namely the separation of the A season into an A1 (January 20 - February 15) and an A2 release (February 20 - April 15). The combined TAC allocation for both seasons was reduced from 45 to 40%. In addition, the prohibition on directed fishing for pollock from November 1 to January 19 was also retained. This approach satisfied the goal of increased protection for sea lions without limiting overall pollock trawl fisheries harvests.

To ensure that seasonal TACs are reasonably balanced and accomplish the desired temporal dispersal of catch, the Biological Opinion indicated that the portion of the total TAC removed in any particular season must be constrained. An even distribution of the TAC would result in a 25% split to each of four seasons. Due to various seasonal considerations (which may be important to sea lions, the fisheries, or both) some flexibility in the single season cap was considered desirable. An maximum 30% apportionment to any one season was included in the Emergency Rule.

2.1.1 Options for Bering Sea subarea season dates

In this section, the starting and ending dates of each season and stand-down periods identified in the January 20, 1999, emergency rule, by the February 1999 Council motion and others developed by NMFS are discussed in general terms with respect to their compliance with the aforementioned RPA principles. This initial step in the analysis of temporal considerations examines each proposed option or group of similar options independent of other factors such as aggregate seasonal apportionments or sector allocations within season. The most obvious conflicts with the RPA principles are thus identified and not further addressed. Specific combinations of temporal factors are then considered in section 2.1.1.12. Note that the bulk of this discussion focuses on the non-CDQ fisheries. To date, the Council has not proposed, and NMFS has not required, a change in the CDQ fishing seasons which currently run from January 20 to April 15 for the A season and from April 15 to December 31 for the B season.

2.1.1.1 A1 season start dates

Various A1 season start dates have been proposed for various sectors of the fleet including January 20, January 26, and February 1. An A1 season start date of January 20 for the inshore, catcher/processor and CDQ sectors as contained in the emergency rule is consistent with the RPA principles. In previous years, the offshore sector A season did not begin until January 26 which, if proposed, also would be consistent with the RPA principles. Under the emergency rule, the mothership A season does not begin until February 1, likewise this start date is consistent with the RPA principles. Furthermore, the RPA principles do not require that all sectors begin fishing on the same date, a combination of starting dates could be consistent with the RPA principles.

Option 1: January 20. Consistent with RPA principles
Option 2: January 26. Consistent with RPA principles
Option 3: February 1. Consistent with RPA principles

2.1.1.2 A1/A2 stand-down period

The January 20, 1999, emergency rule mandates a 5-day stand-down period between the A1 and A2 seasons for the inshore and catcher/processor sectors. A stand down of this length for the bulk of the pollock fleet is consistent with the RPA principles. An increase in the stand-down period to 7, 10 or 20 days is not only consistent with the RPA principles, but also serves to further separate and define the fishing effort modes in A1 and A2. Because the CDQ and mothership sectors both have a single A season under the emergency rule and can fish during the 5-day stand-down period in effect for the inshore and catcher/processor sectors, the separation of the A1 and A2 seasons is not complete. True separation of the A1 and A2 seasons may be more effectively achieved by a longer stand-down period. A longer stand-down period also would provide greater opportunity for the CDQ fisheries to operate in the absence of an open access fishery.

Option 1: 5-day stand-down period. Consistent with RPA principles
Option 2: 7-day stand-down period. Consistent with RPA principles
Option 3: 10-day stand-down period. Consistent with RPA principles
Option 4: 20-day stand-down period. Consistent with RPA principles

2.1.1.3 A2 season start dates

The current emergency rule A2 start date of February 20 does not conflict with the RPA principles, however, in combination with a 5-day stand-down period, it offers only minimal separation between the A1 and A2 seasons. Further consideration of A2 start dates is essentially inseparable from consideration of alternative stand-down periods since the former is driven in large part by the latter. In general, the alternative dates suggested in the Council Motion , i.e., February 20, March 1, or March 15 are all viable alternatives in terms of their consistency with the RPA principles.

Option 1: February 20. Consistent with RPA principles
Option 2: March 1. Consistent with RPA principles
Option 3: March 15. Consistent with RPA principles

2.1.1.4 B season start dates

Although the current emergency rule expires July 19, 1999, and will, therefore, not be effective for the 1999 B and C seasons, NMFS incorporated the Council's recommendations for B and C season dates into the emergency rule to provide the public with a picture of anticipated changes for the B and C seasons. Therefore, consistent with the Council's recommendation, the emergency rule established a B season start date of August 1 for the inshore, catcher/processor and mothership sectors, although the rule itself will expire before those season dates can take effect.

In February, the Council requested additional consideration of a June 1 B season start date for some or all of the non-CDQ sectors. These dates, or essentially any others from summer through early fall may be consistent with the RPA principles when considered independent of other relevant factors. However, the range of options actually may be more constrained because the suitability of the B season start date with respect to compliance with the RPA principles is dependent on several factors including (1) the B season percentage allocation, (2) the B season end date, (3) the C season allocation, (4) the C season start date and (5) the fraction of the TAC to be caught inside the CH/CVOA area during the B and C seasons. Spatial considerations prescribing the fraction of the TAC to be taken inside and outside the CH/CVOA during the B and C seasons also would impact the choice of B season start date. Recognizing that the majority of the annual TAC will be allocated to the B and C seasons (e.g., 60% as recommended in the Council's December motion), a late B season start (e.g., August 1 or later) may not maintain adequate stand-down periods between the B and C seasons and still provide sufficient time to harvest the B and C season allocations both inside and outside CH/CVOA prior to November 1. As previously mentioned, specific start dates included in a package that considers other variables would allow more definitive evaluation.

The emergency rule also established a September 15 B season closure date. In February 1999, the Council proposed two additional alternatives for analysis, August 15 and August 30 (these are listed as suboptions to a June 1 start date). As with B season start dates, any of these season closure dates may be consistent with the RPA principles. However, they must be considered in the context of other season variables to allow meaningful analysis. As a case in point, the February Council Motion proposing an August 30 B season closing date would not work with a C season start date of September 1 (also in the Council Motion under Option 3, BSAI Specific, (b), suboption 2a). Considered independently, both dates are viable, but in combination, they negate the opportunity for a stand-down period which is inconsistent with the RPA principle of separation between fishing seasons. Taken in combination, these suboptions would violate the RPA principle which call for temporal distribution of the pollock harvest into four separate seasons.

The February Council Motion also contained a June 1 B season start date with a "differential application by sector keyed to co-op." This is assumed to represent a strategy for staggering the season start/end dates, tailored to the needs of individual sectors. In general, staggered seasons is a viable strategy for helping to distribute fishing effort, lower daily aggregate harvests, and slowing the pace of "derby fisheries." However, without specifying dates, by sector, to consider, even a qualitative analysis is difficult. One of the primary considerations from the sea lion conservation perspective would be the maintenance of stand-down periods between seasons across all sectors so as not to degrade their separation. Thus, different start and end dates, by sector, could be viable if placed inside a temporal window bounded by overall start and end date guidelines.

Option 1: June 1. Consistent with RPA principles
Option 2: August 1. Consistent with RPA principles

In addition, the Council requested an analysis of a combined B/C season for the mothership sector to begin on September 1 of each year. On its face, a single mothership season during the B/C period is inconsistent with the RPA principles which require four separate fishing seasons. However, a single mothership B/C season beginning on September 1 of each year could be consistent with the larger objectives of temporal and spatial distribution of the pollock fishery if the combined effort of all four sectors is adequately disbursed in time and space. In other words, the acceptability of a single combined B/C season for the mothership sector is dependent on adequate management measures for the other three sectors to prevent concentration of B/C season fishing effort during the same time period that the mothership sector is operating.

2.1.1.5 B and C season stand-down period

The January 20, 1999, emergency rule set September 15 as both the ending date for the B season and the starting date for the C season, thus providing no stand-down period to separate the openings. The result is one continuous B/C season, broken up in name only, from 1 August to 1 November, assuming TAC remained unharvested until late in the B season. Such a management regime would not ensure the integrity of separate B and C seasons would not be consistent with the RPA principles, specifically the second and fifth temporal RPA principles which call for four separate seasons and institution of mechanisms to avoid concatenation of adjacent seasons.

The February Council Motion does not specifically identify B/C season stand-down periods, although some combinations of proposed B season end dates and C season start dates would result in closed periods between the two seasons. For instance, the proposed B season end date of 15 August and C season start dates of either September 1 or September 15 would result in two week and 4 week stand-down periods, respectively. Likewise, a B season end date set on August 30 and a C season start date on September 15 provides a two week stand-down. Whereas the Council's much shorter stand-down periods explicitly proposed for the A1/A2 season are marginally consistent with the RPA principles, these inferred B/C season stand-downs more fully address the conservation objective of true seasonal separation.

Option 1: No B/C stand-down period. Inconsistent with RPA principles
Option 2: 15-day stand-down period. Consistent with RPA principles
Option 3: 30-day stand-down period. Consistent with RPA principles

In April 1999, the Council requested two additional options for stand-down periods in the BSAI.

Option 4: Stand-down periods only apply inside CH/CVOA
Option 5: 5 day stand-down period

To address the options of no stand-down period outside CH/CVOA during both the A1/A2 and B/C season periods, an additional Alternative 6 was developed to explorer the necessity of a stand-down period if adequate measures are in place to restrict fishing effort on a daily or weekly basis. This alternative is developed in section 1.4 above.

2.1.1.6 C season start date

A starting date for the C season on September 15 is identified in the January 22, 1999, Emergency Rule, and is repeated in the February Council Motion. In addition, the Council has proposed a September 1 C season start date. As previously noted in earlier sections, either of these dates, or others slightly earlier or later (e.g., +/- 2 weeks) could comply with the intent of the RPA principles, but their suitability can not be judged without consideration of the other factors which impact the duration of either the B or C seasons. Generally speaking, however, earlier B season start dates should provide greater flexibility in establishing stand-down periods, which in turn should provide opportunities for earlier C season start dates, such as September 1.

Option 1: September 1. Consistent with RPA principles if stand down between B/C seasons
Option 2: September 15. Consistent with RPA principles if stand down between B/C seasons

In April, 1999, the Council requested the addition of a third option to open the C season 5 days after the closure of the B season in a manner similar to the C/D season stand down proposed for the W/C GOA. Again, as explained in section 2.1.1.5, the reduction or elimination of stand-down periods for the B/C season period should be considered within the larger context of Alternative 6, outlined in section 1.4 above.

2.1.1.7 CDQ B and C season dates

The RPA principles do not specifically exempt the CDQ fishery from adherence to the pollock trawl closure from November 1 to January 19. However, under existing regulations, and under the January 22, 1999 emergency rule, the CDQ B season extends until December 31. The fraction of the B season CDQ apportionment that might remain unharvested by November 1 is unknown, but theoretically could be as high as 55% of the total CDQ allocation (i.e., 54,560 mt) if no CDQ fishing occurs between April 15 and November 1. Historically this has not been the case and minimal CDQ fishing has occurred after November 1 in recent years. The following table displays the extent of CDQ fishing between November 1 and December 31 during the past three years.

Year	CDQ harvest between 11/1 and 12/31 (in mt.)	Percent of annual CDQ allocation
1996	6,348	7.1%
1997	zero	0.0%
1998	9,603	11.5%

Impacts to Steller sea lions cannot be characterized, given this uncertainty, but qualitatively speaking, the greater the fraction potentially harvested by CDQ after November 1, the lower the compatibility with the

RPA principles. Thus, the question of CDQ access to pollock after November 1 must be addressed with respect to the RPA principles. Alternatively, management actions which create opportunities for prosecution of CDQ fisheries prior to November 1, and which minimize the potential for ongoing pollock harvest in late fall and early winter should be considered.

Option 1. April 1 - December 31. May be inconsistent with RPA principles
Option 2. April 1 - November 1. Consistent with RPA principles

2.1.1.8 Combined B/C Season with monthly caps

Under the Council's February 1999 motion Option 3, BSAI Specific, (b), 4, a combination of the B/C seasons with an early start date and a cap on the monthly catch is proposed for analysis with the restriction that harvest in any single month would not exceed 20-30% of annual harvest on a sector-by sector basis. This option conflicts with RPA principles 2 and 5 by not distributing the pollock trawl harvest into at least four seasons, and, more acutely, by not preventing concentration of pollock catch at the end of one season and beginning of the next. Using 1999 TAC to illustrate, under the proposed scenario, monthly caps of 20% and 30% would translate to 189,000 mt and 283,000 mt, respectively. At the 30% level, a continuous 2 month pulse of fishing, not unlike the pre-1999 B season, could result. At 20%, a reduction in the monthly harvest levels seen in previous B seasons could be achieved, but still without provisions to maintain separation of the fishery into two seasons in the June - October period. However, with the inclusion of mechanisms to prevent lumping across months, such as a monthly stand-down period or lower monthly caps, this option potentially could be made consistent with the RPA principles.

2.1.2 Apportionments between the A1/A2 period and B/C period

Under the emergency rule, the combined A1/A2 season is apportionment is 40% for the non-CDQ sectors and 45% for the CDQ sector. In the February 1999 Council motion, a combined A1/A2 season apportionment of 45% for the non-CDQ sectors is also proposed for analysis. Both options are consistent with the third RPA principle under temporal distribution which caps the combined A1/A2 seasonal apportionment at 45%. Thus, either approach could be considered in more detail when combined with other temporal factors. Furthermore, the RPA principles do not require that all sectors use the same percentage split between the A1/A2 and B/C season periods provided that the cumulative percentages of all sectors combined for the A1/A2 period is within the 45% cap specified in the RPA principles.

Option 1: 45/55 split. Consistent with RPA principles.
Option 2: 40/60 split. Consistent with RPA principles.

The February 1999 Council motion also references two other alternatives which mention seasonal apportionment as a means "to meet the 50% principle in the BSAI ," entailing either (1) equal proportion allocation reductions across sectors, or (2) constant percentage allocation reductions across sectors. Either approach would be consistent with the RPA principles as the target split inside and outside CH/CVOA is retained. Note, however, that the "50% principle" refers to a spatial distribution concept in the RPA principles, specifically a mechanism to determine A1 or A2 season TACs inside vs. outside the CH/CVOA in the absence of survey data to characterize the winter distribution of pollock biomass, and it is not a temporal allocation concern in and of itself. Examples of TAC allocations that would result from either reduction method are thus presented in the discussion of spatial considerations.

2.1.3 TAC apportionments to individual seasons for non-CDQ sectors

Under the emergency rule, the inshore and catcher/processor seasonal apportionments are set at 27.5, 12.5, 30 and 30 percent, respectively for the A1, A2, B and C seasons with the mothership sector receiving a single A season apportionment of 40%. Although not explicitly mentioned in the February Council motion, alternatives to the current apportionment scheme are implied by consideration of a change from the 40% to 45% for the combined A1/A2 seasons. As long as any individual seasonal apportionment does not exceed 30%, and the combined A1/A2 season apportionment does not exceed 45%, any option can be considered consistent with the RPA principles analyzed as part of a larger package. However, prior to determination of individual seasonal apportionments, a decision on the A1/A2 split as discussed in the preceding section would be a prerequisite.

In April 1999, the Council requested the addition of three options for A1 and A2 seasonal TAC apportionments.

Option 1:	A1 = 30%, A2 = 15%
Option 2:	A1 = 15%, A2 = 30%
Option 3:	A1 = 15% inside CH/CVOA, 7.5% outside CH/CVOA, A2 = 7.5% inside CH/CVOA, 15% outside CH/CVOA

Options 1 and 2 are clearly consistent with the RPA principles in that they comport with the 30% maximum limit for any one season. Option 3, which relates to spatial distribution as well is inconsistent with the RPA principles in that it would violate the 50% limit on removals from inside CH/CVOA during the A1 season. However, NMFS recognizes that the actual tonnages taken from inside CH/CVOA during any one season are of greater issue than the ratio of the tonnage taken inside to the tonnage taken outside CH/CVOA. Furthermore, if the fleet wished to fish under either of the scenarios depicted in Option 3, they could do so to the extent allowed by the TAC rollover provisions laid out in section 2.8 without the need to pre-specify greater than 50% of the TAC from CH/CVOA during any one season. Analysis of Option 3 is further complicated due to the Council's decision to treat the four sectors differently with respect to the percentage of catch that may be taken within CH/CVOA during the A1 and A2 periods. For example, all of the sectoral percentages laid out in 2.2.1 for catch inside and outside CH/CVOA become moot if a percentage other than 50% is used for determining total catch within CH/CVOA during any one season. For these reasons, NMFS does not recommend further development of Option 3 for A1 and A2 seasonal apportionments.

2.1.4 CDQ seasonal apportionments

The emergency rule apportions 45% of the CDQ allocation to the A season (January 20 - April 15) and 55% to the B season (April 15 - December 31). Unlike the other sectors, CDQ fishing is not currently constrained to 30% in any of the four seasons, moreover, they can operate during periods of time that non-CDQ fishing is closed. Although the Biological Opinion does not specifically require that the CDQ fisheries adhere to the same RPA principles as the non-CDQ participants, the question of whether the CDQ rules are consistent with the underlying goals of the Biological Opinion are open to further consideration.

2.1.5 Season dates and apportionments considered together

In this step in the analysis, a sample of the temporal options examined above that were found to be consistent with the RPA principles are combined into example packages. Each of three packages specifies seasonal start and end dates, seasonal TAC apportionments, and inter-season stand-down periods. The selection of packages are intended to point out alternatives that are likely to generate moderated fishing activity and reduced likelihoods of localized depletion, verses those that result in persistent periods of large daily removals.

As a means of comparing the examples, the temporal distribution of each season is projected using estimates of sector-specific daily harvesting capacity, and to the extent possible, patterns of sector-specific behavior with respect to decisions on when to fish. Both the sector capacity and behavioral assumptions were derived from discussions with industry, A and B season fishing patterns prior to 1999 and preliminary examination of the fishing patterns, by sector, demonstrated during the 1999 A1 season. To simplify the presentation, only the fishing activity inside the CH/CVOA is illustrated.

2.1.6 Model effort distribution

While comparisons of alternative packages can show the effect of different options on season length and intensity, they do not necessarily provide guidance on which pattern would be preferred from a Steller sea lion conservation perspective. The underlying goal of these management actions is to avoid localized depletion stemming from intense pulsed fisheries, and to reduce foraging disturbance impacts. The RPA principles do not prescribe a specific temporal effort distribution, but they identify important measures that would address the underlying management intent of limiting potential fisheries effects on Steller sea lions. Of these measures, the first three are directly listed in the RPAs:

1. Prohibition of pollock trawl fisheries from 1 November to 19 January.
2. Division of the pollock fisheries in four seasons.
3. Maintenance of separate seasons (i.e., harvesting punctuated by periods of no fishing).

The next two elements are implicit in the RPAs since they are consistent with more gradual harvesting of pollock, lower potential for localized depletion and, in effect, the antithesis of "the race for fish." These are:

4. Moderation in catch rates compared to previously observed patterns.
5. Broadened distribution of effort within seasons consistent with a more gradually paced fishery.

Based on these five key elements, a seasonal effort model can be constructed (Figures 2-1 and 2-2), recognizing that the details such as start and end dates, stand-down periods and seasonal apportionments reflect preferences for Steller sea lion conservation, but that they remain flexible. Likewise, the distributions of catch within seasons are an attempt to depict more gradual removal, but to the extent possible, they utilize projections of catch capacities and fisheries behavior derived from examination of prior fishing seasons and discussions with industry. It is critical to note that this distribution represents a direction to move towards, not necessarily the pattern to be duplicated *verbatim*. Also, as previously mentioned, Figure 2-1 only represents TACs and fishing effort inside the CH/CVOA, but the same temporal distribution pattern would generally apply outside the CH/CVOA as well.

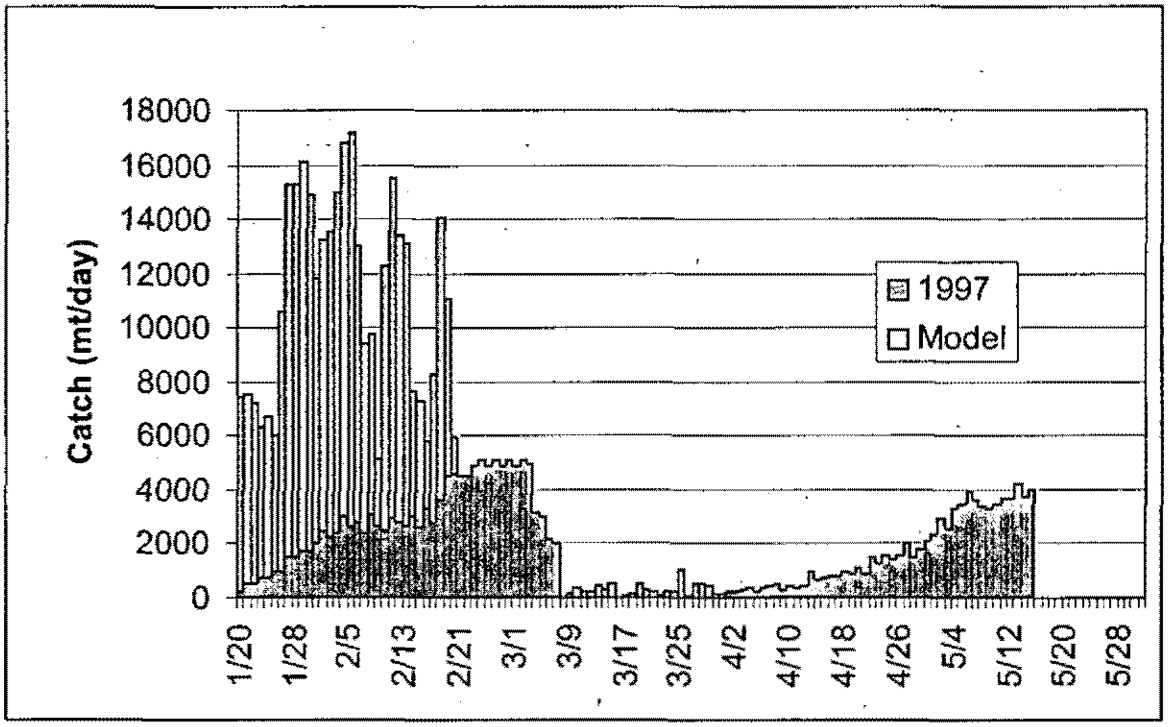

Figure 2-1 1997 A Season BSAI pollock catches vs model distribution inside CH/CVOA.

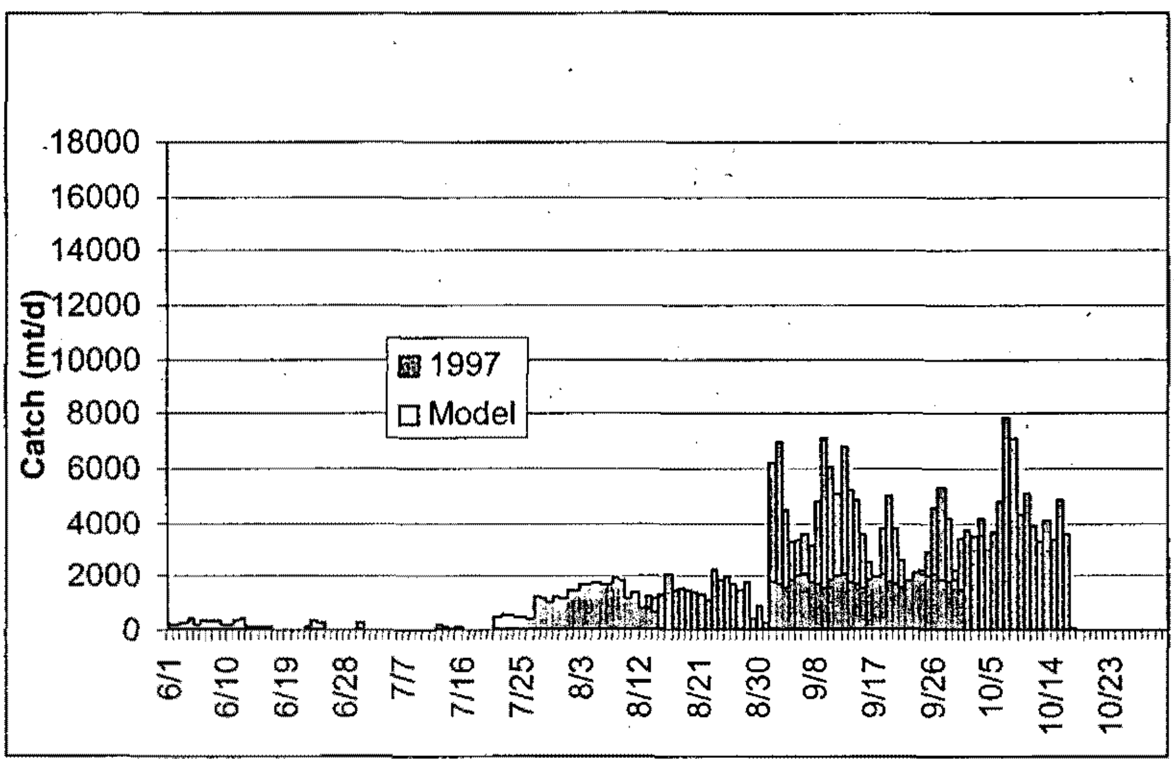

Figure 2-2 1997 B/C Season BSAI pollock catches vs model distribution inside CH/CVOA.

2.1.7 · Example scenarios - Effect of temporal factors

The three examples illustrate how decisions on temporal factors might influence the pattern of catches by season for the inside CH/CVOA portion of the fishery. All share a set of common assumptions including:

a) Annual TAC = 1,000,000 mt

b) A1 and A2 TAC allocations are split 50% inside/50% outside CH/CVOA.

c) The B and C season splits inside and outside CH/CVOA are 15%/85% and 25%/75%, respectively (see spatial distribution section for details).

d) Roll-over provisions are the same as 1999 A1/A2 seasons.

e) Within sector, daily catch capacities can differ depending on season, location (e.g., inside vs. outside CH/CVOA), season length and season dates. As a rule of thumb, the more constrained the season inside CH/CVOA, the more likely that higher daily catches would occur there. Table 2-1. contains the range of daily catch capacities observed during 1997, 1998 and the A1 and A2 seasons in 1999, by sector, by season, inside the CH/CVOA that could result from alternative temporal options.

Table 2-1 Daily catch capacities observed during 1997, 1998, and during the 1999 A1 and A2 seasons.

Sector	A Seasons	B/C Seasons
Catcher Processors	2,000 - 8,500 mt/d	0
Shoreside	4,500 - 8,500 mt/d	1500 - 6000 mt/d
Motherships	1,500 - 2,800 mt/d	0
CDQ	250 - 2,000 mt/d	100 - 1600 mt/d

The actual catches assigned by sector, by day, in each of the three example scenarios are intended to reflect the behavior of the fisheries either as demonstrated in the past, or as suggested might occur through informal discussions with industry representatives. For instance, in examples 1 and 3, the longer, sustained low daily harvests by the catcher/processors in the A1 and A2 seasons reflect their fishing pattern during 1999 after implementation of co-oping provisions in the AFA. Thus, to the extent possible, depiction of constant catches day in and day out across the seasons was avoided in lieu of an attempt to show possible changes in harvesting intensity within seasons.

The three example scenarios include (1) a case approximating the status quo, (2) a case which could result in more temporally compressed fishing patterns and (3) one which could result in more temporally relaxed fishing.

Example scenario 1 - Approximation of the 1999 emergency rule fishery

The first example scenario retains as many of the characteristics of the 1999 season and rules under the December Council motion as possible. Seasonal apportionments for A1, A2, B and C were set at 27.5%, 12.5%, 30% and 30%, respectively. AFA allocations were also the same, at 50% inshore, 40% C/P and 10% mothership. Season start dates, end dates and stand-down periods were unchanged. CDQ was assumed to operate under the 1999 rules. However, in order to meet new caps on the percentage of catch coming from inside the CH/CVOA that would be consistent with the RPAs, (50% for the A1 and A2 seasons, 15% for B and 25% for C), the inshore and catcher/processor's fraction of their respective inside allocations were adjusted downward at rates that were (in retrospect) slightly more favorable to the inshore sector. Since no stand-down period between the B and C seasons was specified in the December Council Motion, a 5-day period from 9/10-9/15 was assumed.

The distribution of pollock catch in Figure 2-3, suggests that a similar temporal distribution to that in 1999 may occur even with a reduction in the removals from the CH/CVOA capped at 50%. Likewise, with a 5-day stand-down period, a portion of the gap between the A1 and A2 seasons could be filled by the CDQ catch, aside from the question of whether 5 days is a sufficient break between seasons in the first place.

In comparison to the 1997 fishing pattern (Figures 2-1 and 2-2), however, the daily catch levels are considerably reduced, from highs above 16,000 mt/day to none above 12,000 mt/day. Most, if not all, of this reduction is directly attributable to the C/P sector, presumably resulting from the co-oping provisions of the AFA. The extent to which the shoreside sector could also reduce daily catches via co-ops in 2000 and operate in the CH/CVOA after the example's projected closure date could not be evaluated, but should be addressed as new information becomes available.

With respect to the temporal distributions of catch in the B and C seasons, the pattern in Figure 2-4 is largely dependent on the TAC percentage assigned to the CH/CVOA and to a lesser degree on options for season dates or stand-down periods. As noted above, potential reductions in the daily catches in the shoreside sector as a result of AFA could not be factored in, but might substantially alter the intensity and duration of both the B and C seasons. Likewise, the degree to which the B and C seasons would merge as a result of a longer B season, and CDQ activity in the stand-down period complicates predictions of B/C season temporal distribution adherence to the goals of the RPAs.

In general, both the A1/A2 and B/C seasons under this example scenario represent only fractional movement toward the model temporal distribution envisioned in the Biological Opinion and as depicted in Figures 2-1 and 2-2. Further dispersion of catch in both A1 and A2, as well as widening of the gap between A1 and A2 should be considered to achieve the RPA objectives.

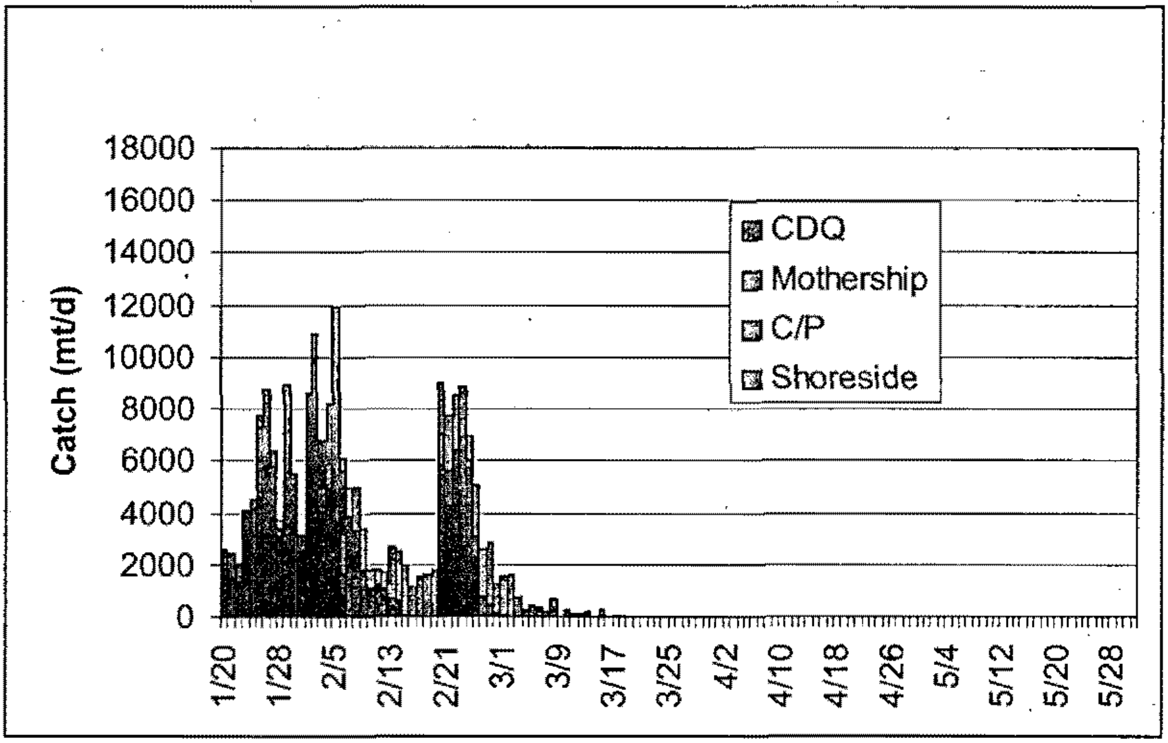

Figure 2-3 Example Scenario 1: A1 and A2 seasons- inside CH/CVOA.

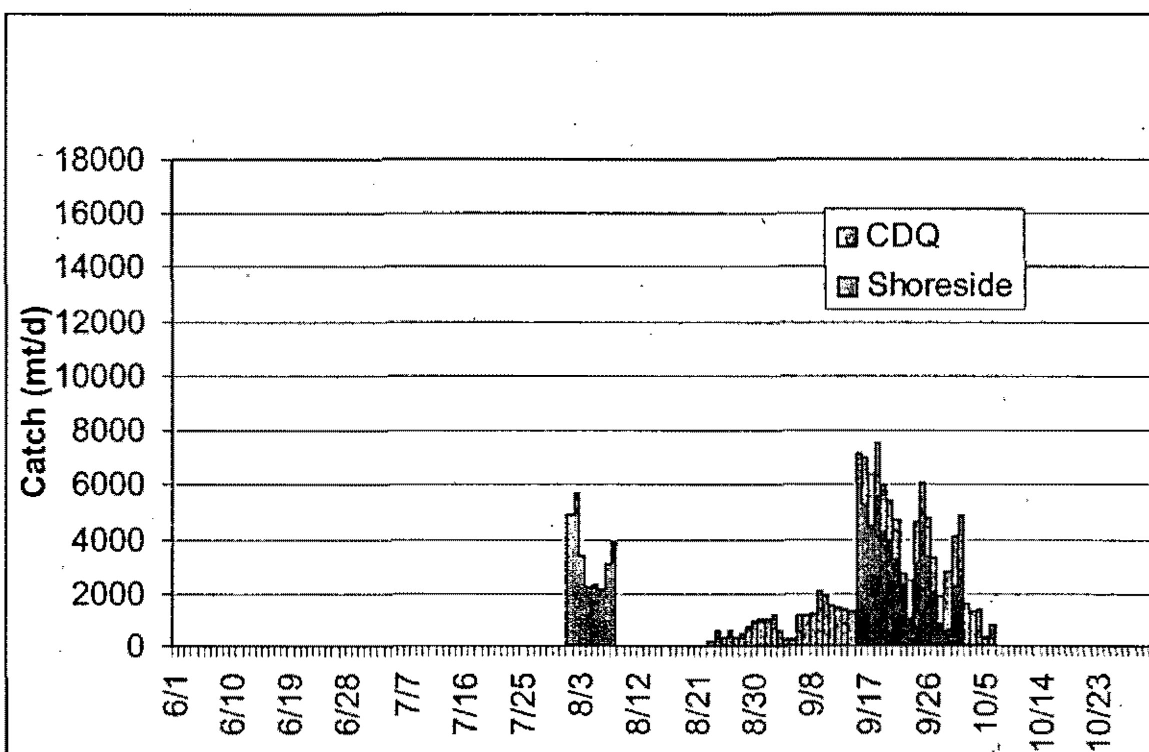

Figure 2-4 Example Scenario 1: B and C seasons - inside CH/CVOA.

Example scenario 2 - Measures expected to intensify the fishery

Example scenario 2 attempts to modify the temporal catch distribution pattern in example 1 and achieve greater separation between the A1 and A2 seasons by establishment of a 15 day stand-down period (Figures 2-5 and 2-6). Seasonal apportionments for A1, A2, B and C were set at 30%, 15%, 30% and 30%, respectively. American Fisheries Act allocations were unchanged, at 50% inshore, 40% C/P and 10% mothership. A1 season dates were unchanged, however, A2 started 10 days later than in the first example (i.e., 3/1) A 15 day stand down was also implemented between the B and C seasons. CDQ was assumed to operate under the 1999 rules.

Rather than producing a temporal distribution more like the model, the increased TAC in the A1, coupled with a stand-down which potentially spanned a large fraction of the peak roe period, may be expected to result in a more compressed fishing pattern in both A1 and A2. Prediction of how the CDQ fisheries would operate in this environment were uncertain, however, it was assumed that a large portion of the A1 CDQ TAC would be taken in the gap between A1 and A2, particularly if roe quality was high during that time. As shown in Figure 2-5, the CDQ catches could effectively fill in the gap between A1 and A2, although at catch levels ≤ 1/3 those in either the A1 or A2 seasons. Thus, in general, this particular mix of management options would probably not shift the temporal distribution pattern in the direction of the RPA principles, and in fact, may exacerbate persistence of short, intense harvest patterns.

As noted in the previous discussion of example scenario 1, the temporal distribution pattern of the B and C seasons are expected to be influenced largely by the amount of TAC allocated to the CH/CVOA, and less so by start dates, end dates or stand-down periods. As depicted in Figure 2-6, separation of the B and C seasons is possible, and catch rates could generally stay below 6,000 mt/day. However, reductions in the catch rates by the shoreside sector or different timing of the CDQ fishery could result in a lower, more consistent pattern of removals across both seasons. Conversely, if more TAC were allocated inside the CH/CVOA, the daily catches may continue at the illustrated levels longer.

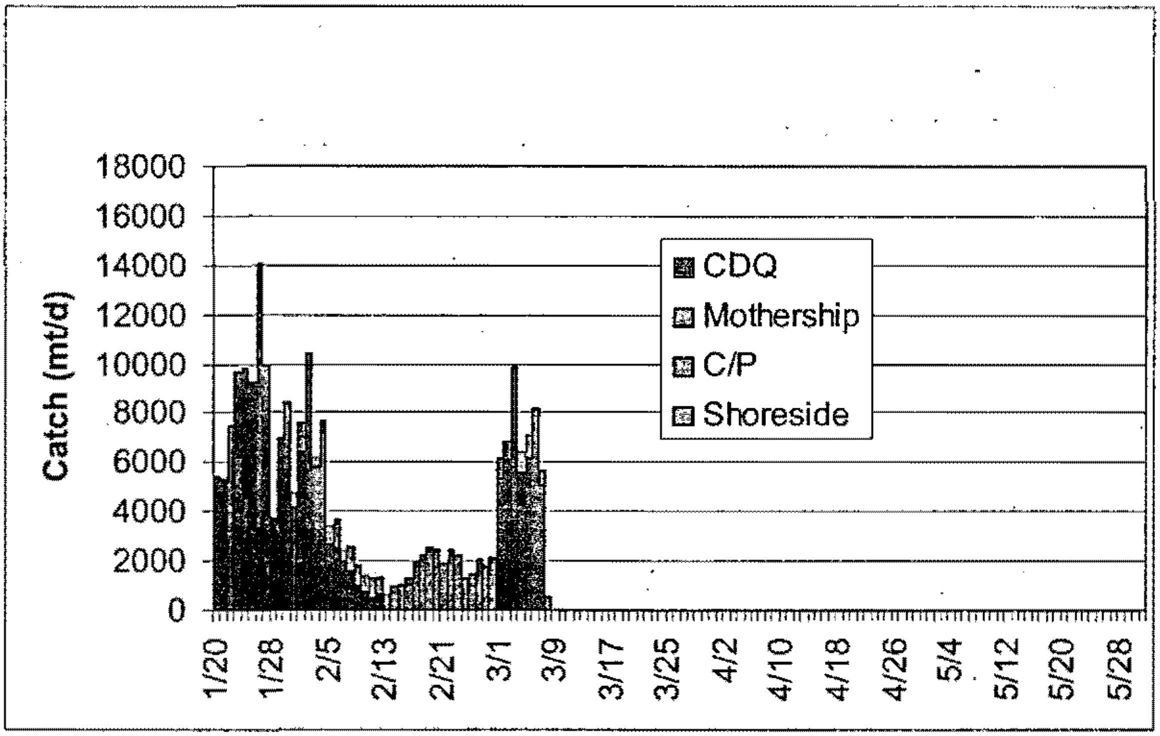

Figure 2-5 Example Scenario 2: A1 and A2 Seasons - Inside CH/CVOA.

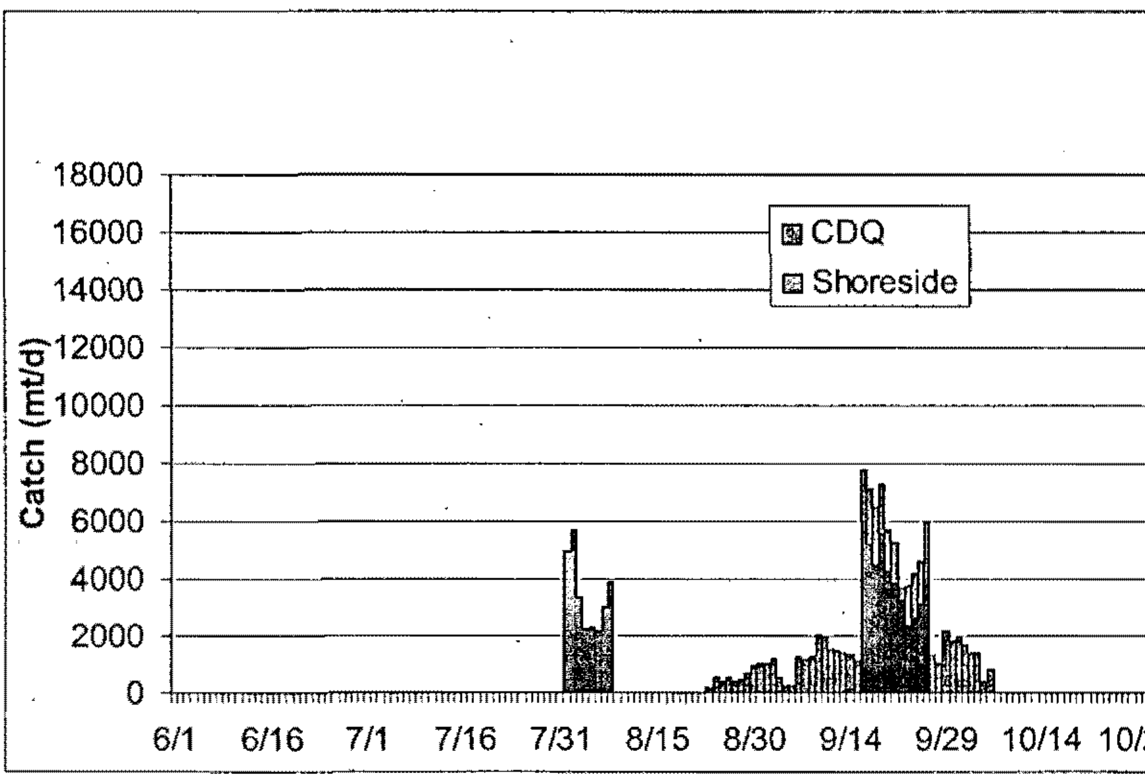

Figure 2-6 Example Scenario 2: B and C Seasons - Inside CH/CVOA.

Example Scenario 3: Measures expected to relax the fishery

The third example attempts to shift the temporal catch distribution pattern toward the model distribution in Figures 2-1 and 2-2 by maintaining stand-down periods between seasons while adjusting season start and end dates to provide the fisheries with as much flexibility as possible within the constraints in the RPAs. It was assumed that longer seasons, encompassing for instance, most of the peak roe period, would provide opportunities for more paced, less frantic fisheries with lower daily catch rates. While the 1999 A1 and A2 seasons provided suggestions that this may be realistic for the catcher/processor sector operating in co-ops, they did not provide insights on how best to project inshore harvest patterns given longer seasons. The pattern of daily catches for the shoreside sector were reduced from previous models, recognizing that lower catch rates over longer portions of available seasons may be possible through co-ops or other means in 2000 and beyond.

For example 3, the seasonal apportionments for A1, A2, B and C were set at 30%, 10%, 30% and 30%, respectively. American Fisheries Act allocations were 50% inshore, 40% C/P and 10% mothership. The portions of the seasonal TAC that could come from inside the CH/CVOA were the same as in earlier examples, 50% in A1, 50% in A2, 15% in B and 25% in C. A 15 day stand-down period was established between adjacent seasons. The length of the A1 season was increased considerably, beginning on January 20, and ending on March 22. The ending date was intended to be late enough to provide for open access fisheries throughout the period of highest roe quality and the maximum seasonal apportionment (30%) was applied. However, in order to accommodate both a long A1 season and a 15 day stand-down period, the start date for the A2 season shifted later than in previous examples. Ten percent of the annual TAC was applied to the A2 season which could end as late as May 15. The B season starting date was also set early, on July 1, running to August 22. The C season started on September 6 and ran to October 31.

The resulting A1 season temporal catch distribution shown in Figure 2-7 reflects a moderated harvest pace which is the most consistent of the three examples with the objectives of the RPAs. The separation between the A1 and A2 seasons is depicted greater than the 15 day stand-down period recognizing, that interest in harvesting pollock in a post-spawn condition would probably be minimal, but that a late spring fishery may be more feasible. Nonetheless only 10% of the TAC was allocated in A2 under the assumption that fishing a greater percentage of the TAC in A1, B and C would be preferable to industry while still adhering closely to the RPAs. Previous discussions of the resulting B and C seasons apply here as well, in that the distribution of catch will be sensitive to the amount of available TAC inside the CH/CVOA.

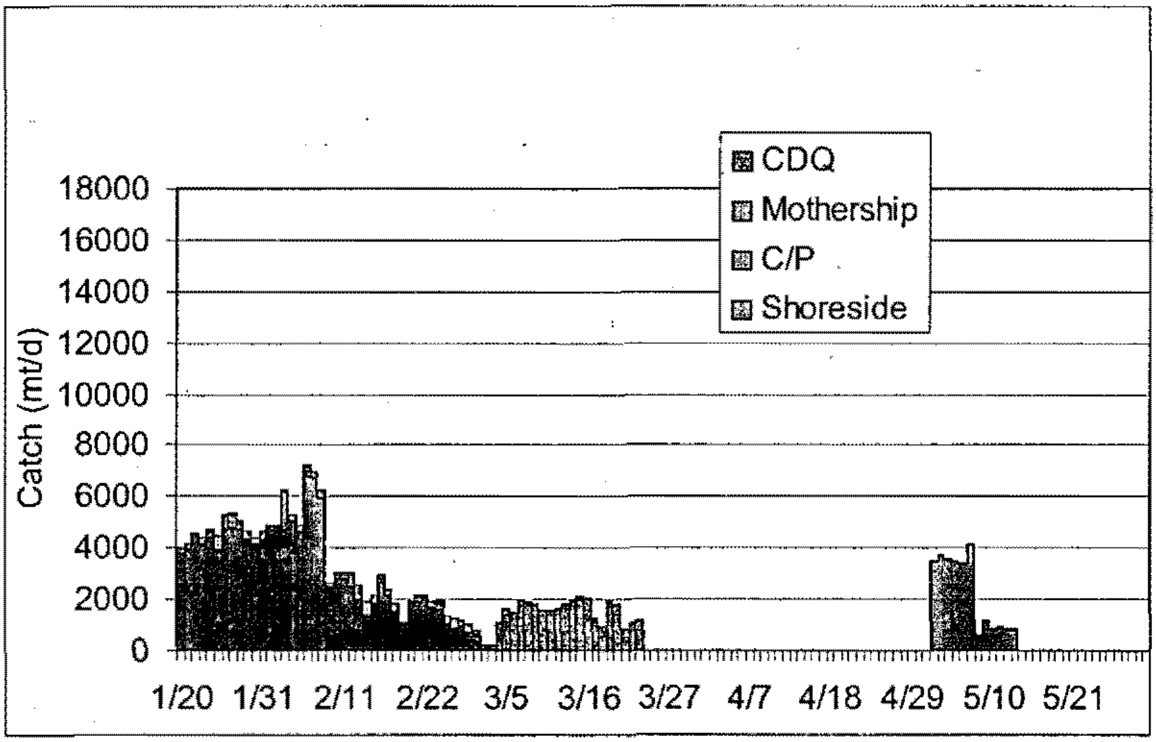

Figure 2-7 Example Scenario 3: A1 and A2 Seasons - Inside CH/CVOA.

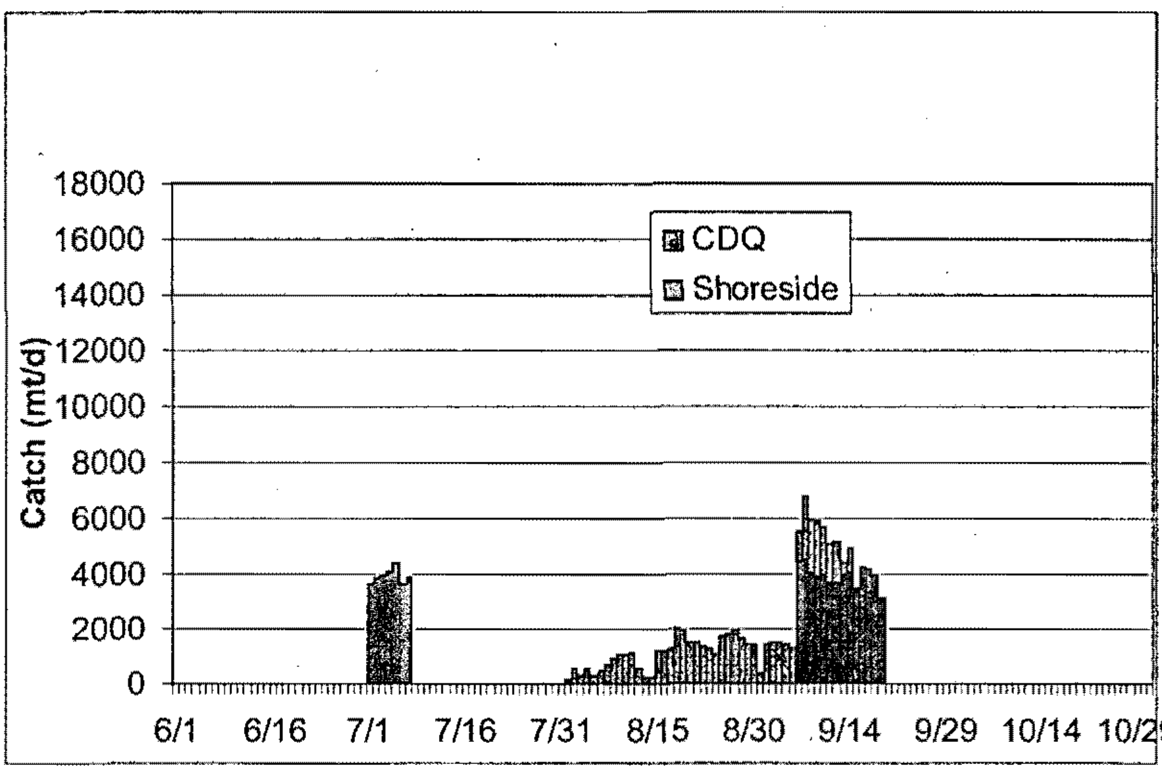

Figure 2-8 Example Scenario 3: B and C Seasons Inside CH/CVOA.

2.2 Spatial dispersion of the Bering Sea pollock fishery

The RPA principles for spatial dispersion of the fishery are as follows:

- Allocate TAC spatially in accordance with the distribution of the stock distribution,
- When the stock distribution is unknown, place a maximum limit on percentage of TAC from Steller sea lion critical habitat,
- Allow possibility of further reduction of harvesting in critical habitat,
- Prevent redistribution of TAC from outside to inside critical habitat, and
- Base spatial distribution on existing management/research areas or some other scheme that distributes TAC in a manner that is equivalent or better for sea lions.

The options for distributing pollock catch in the Bering Sea are based on a few main factors: the areas to be used for apportioning TAC, the portion of the TAC to be apportioned to each area, the options for determining portion of TAC per area, and variation in the above for the winter/spring (A1 and A2 seasons) and summer/fall (B and C seasons).

2.2.1 A1 and A2 seasons

From 1992 to 1997, about 50% to 90% of the annual A season TAC was taken from the CH/CVOA. This concentration of effort has been justified on the premise that this is the primary spawning area for pollock and virtually all of the recruited population is concentrated in this area in the winter/spring period. However, other spawning assemblages have been observed to the north and northwest of the CH/CVOA (Hinckley 1989) and, in general, the distribution of pollock in the winter period is not well known. Pollock biomass in the CH/CVOA has been surveyed in the winter/spring period only in 1991, 1993, and 1995. These surveys are described in section 3.5 on the seasonal EBS pollock distribution.

Based on these surveys, the percentage of pollock stock present in the CH/CVOA in winter/spring was estimated in the range from 17% to 58%, with most of the probability between 20 and 40%. These numbers were based, in part, on assumptions regarding the selectivity/catchability of the survey, the availability of age 3+ pollock in the area surveyed in winter, and the proportion of the age 3+ pollock that were mature. The high end of the range (58%) requires the assumption that the survey selectivity/catchability is low (i.e., 0.5), when catchability in the winter may, in fact, be higher than in the summer since pollock are less likely to be on the bottom. The midpoint of the estimated range is about 35%. This midpoint estimate, combined with the fact that 50% to 90% of the annual A-season TAC has been taken from the CH/CVOA suggests that the harvest rate in this period is higher than that indicated by relative biomass distributions.

Nevertheless, as pollock stock biomass is not regularly surveyed in the winter period, the TAC must be distributed in this period without the benefit of recent, regular, and reliable information on the distribution of the stock. Clearly, winter surveys are required to determine the stock distribution during this period and more effectively apportion the TAC among areas inside and outside of the CH/CVOA. In the absence of such surveys, the second spatial RPA principle takes a precautionary approach by requiring that the portion of the A1 and A2 TACs taken from the CH/CVOA be reduced to some cap or limit, and 50% was suggested as a cap. This cap was suggested as a balance that 1) achieves a meaningful reduction from the current high range (50% to 90%) and therefore reduces the probability of significant competition and 2) does so without excessive restrictions on the fishery.

The RPA principles also allowed for the cap to be reached over a two-year period. On December 13, 1998, the Council voted to recommend a cap of 62.5% for the portion of the TAC to be taken from the CH/CVOA in the A1 and A2 seasons,1999. Further reduction is required to avoid jeopardy in 2000 and beyond.

The first option that the Council suggested for analysis was to leave the cap for the percentage of TAC taken from CH/CVOA during the A1 and A2 seasons at 62.5%. This option fails to achieve a significant reduction in the percentage of TAC taken from this region, is inconsistent with the existing information available pertaining to the stock distribution during this period, and could result in excessive harvesting of pollock that could compromise foraging success of Steller sea lions. Based on observations in past years, this option would fail to provide any additional protection of Steller sea lion prey resources and would be nearly equivalent to a status quo approach.

The second and third options suggested by the Council require that the percentage of TAC taken inside the CH/CVOA to be further reduced to 50%. This lower level is approximately consistent with the lower limit of percentage taken from this area in the winter season of previous years. Therefore, it may not result in a reduction from the status quo in all years, but would likely do so in most years.

In April 1999, the Council requested a fourth option referred to as "equal access for all catcher boats". Under this option, all catcher boats would be allowed to fish an equal proportion of their catch within CH/CVOA. Stated another way, this option simply treats the inshore and mothership sectors equally with respect to CH/CVOA percentage removals. For the purposes of analyzing this option, the catcher boats delivering to catcher/processors are not included because their catch is not a separate TAC from the catcher/processor sector, but rather a minimum set-aside. If the Council wishes to include catcher vessels delivering to catcher/processors in the "equal access" alternative, the percentages for the inshore and mothership sector shown on option 4 would be reduced slightly to accommodate increased CH/CVOA removals by catcher vessels delivering to catcher/processors. The final percentages generated by option 4 also are dependent on the percentage of CH/CVOA removals allocated to the catcher/processor and CDQ sectors. The example percentages shown in Table 2-2 below are derived using the same catcher/processor sector percentage as option 2. Obviously, changing the percentage available to catcher/processors will change the percentage available to the inshore and mothership sectors under a 50% cap.

A reduction from 62.5% to 50% could be reached using an equal proportional reduction across all non-CDQ sectors or a constant percentage reduction across all non-CDQ sectors. The percentage of each sectors' allocation that could be taken from the CH/CVOA under each of the four options is provided in Table 2-2. Only the second, third and fourth options meet the RPA objectives.

Option 1: **Take no more than 62.5% from CH/CVOA (same as emergency rule for 1999).** Inconsistent with RPA principles.

Option 2: **Take no more than 50% using an equal proportional reduction across non-CDQ sectors.** Consistent with RPA principles.

Option 3: **Take no more than 50% using constant percentage point reduction across non-CDQ sectors.** Consistent with RPA principles.

Option 4: **Take no more than 50% treating inshore and mothership sectors equally.** Consistent with the RPA principles

Table 2-2 Percent of sector allocation taken from the CH/CVOA in the A1 and A2 seasons under four options suggested for consideration by the Council.

Option	Sector	A1 season	A2 season
Option 1 - 62.5% from CH/CVOA	Inshore	70 %	70 %
(same as 1999)	Catcher/processor	40%	40%
	Mothership	50%	50%
	CDQ	100%	100%
Option 2 - 50% from CH/CVOA	Inshore	54%	54%
(Equal proportional reduction)	Catcher/processor	31%	31%
	Mothership	39%	39%
	CDQ	100%	100%
Option 3 - 50% from CH/CVOA	Inshore	57%	57%
(Constant percentage point reduction)	Catcher/processor	27%	27%
	Mothership	37%	37%
	CDQ	100%	100%
Option 4 - 50% from CH/CVOA	Inshore	52%	52%
(Equal access for inshore and motherships	Catcher/processor	31%	31%
as adjusted from Option 2)	Mothership	52%	52%
	CDQ	100%	100%

2.2.2 B/C season split between CH/CVOA and outside CH/CVOA

The available evidence suggests that a relatively small portion of the pollock biomass is in the CH/CVOA during the B/C season. The evidence is based on summer surveys, which indicate that, on average, about 15% (range 6% to 27%) of the biomass has been in this region each year from 1991 to 1998. From 1992 to 1997, about 36% to more than 50% of the annual B season catch was taken from the CH/CVOA, suggesting that the harvest rate in this area may have been on the order of two to three times greater than expected on the basis of the total biomass and the overall harvest rate (see section 3.6 and Fig. 3-20).

The annual movements of pollock are thought to result in a periodic change in the portion of the stock within the CH/CVOA. A conceptual model of annual changes in pollock biomass within the CH/CVOA is discussed in section 3.5 (see Fig. 3-20). Based on the best estimates of pollock stock present in the summer and the limited estimates of pollock stock present in the winter/spring, the portion of the stock present in fall months is estimated to range from about 15% in August to 25% in October.

On December 13, 1998, the Council voted to recommend a B and C season split inside and outside of the CH/CVOA by sector as follows:

Sector	Inside CH/CVOA	Outside CH/CVOA
Inshore	80%	20%
Catcher-processor	0%	100%
Mothership	50%	50%
CDQ	100%	0%

In it's June 14, 1999, motion the Council recommended the following sector-specific CH/CVOA limits which achieve 1999 levels of 25% and 35% for the B and C season, respectively; and 2000 levels of 15% and 25% for the B and C season, respectively.

	Catch limits inside the CH/CVOA by sector			
	1999		2000	
	B season	C season	B season	C season
Inshore	45%	63%	27%	45%
Catcher/processor	0%	0%	0%	0%
Mothership	0%		0%	
CDQ	56%		37%	

Other methods exist for reducing the sector-specific catch inside the CH/CVOA to achieve the reduction to 15% in the B season and 25% in the C season and depend, in part, on when the CDQ sector fishes and whether CDQ catch during the summer is considered in calculation of percent taken during the open access fishery B and C seasons. If, for example, 60% of the CDQ catch is taken before the open access B and C seasons, and the remaining 40% is evenly distributed between the B and C seasons, then required reductions (of equal proportions) would be as follows for the B and C seasons:

Sector	B season	C season
Inshore	24%	40%
Catcher-processor	0%	0%
Mothership	15%	25%
CDQ	40%	40%
Overall	15%	24%

Option 1: **Inshore 80/20 (inside/outside CH/CVOA), motherships 0/0, Catcher-processor 0/0, CDQ 100/0.** Not consistent with RPA principles.

Option 2: **Base split on biomass distribution with necessary reduction taken from inshore, mothership, and/or CDQ.** Consistent with RPA principles.

2.2.3 Split of catch outside of CH/CVOA during the B/C seasons

The issue of distributing catch or TAC outside of CH/CVOA is based on two main concerns. The first stems from the need to maintain or protect the essential features of CH/CVOA. Those features are, in part, a function of activities that occur outside of the boundaries of this region. The dynamic nature of pollock (and other) stocks in this region means that prey resources move in an out of the CH/CVOA, moderating the value of those resources to Steller sea lions and other predators or consumers. That is, fishery removal of pollock outside of CH/CVOA could affect the quality of the habitat in the CH/CVOA if those pollock were, through normal movement or migration patterns likely to move into the CH/CVOA. Thus, fisheries concentrated at the border of CH/CVOA could have an "edge effect" on the pollock within the CH/CVOA. If this is the case, then some measure for preventing concentrated fishing at the edge of the CH/CVOA would be warranted. To prevent edge effects, the best approach might be to establish a buffer zone regulation to ensure that catch is not concentrated on the edge of CH/CVOA. The size of the buffer zone would depend, in part, on the distance stocks migrate as they move in and out of the CH/CVOA.

The second concern is based on consideration for the wider ecosystem. The annual TAC is based on the total biomass estimated over an extensive area covering most of the eastern Bering Sea shelf. The overall harvest rate is assumed to be safe and conservative for the entire pollock stock, but is not a good indicator of possible effects on other elements of the Bering Sea ecosystem (such as Steller sea lions) because the fishery tends to be heavily concentrated spatially and fishes only a relatively small part of the whole stock. This concentration is a function of many factors, including target size of pollock, vessel size, market conditions, economic effects of fishing in more distant regions, fleet composition by length, etc. However, the fact remains that by concentrating the catch in certain geographic regions, the potential for detrimental ecosystem effects increases accordingly. The issue of potential effects on Steller sea lions, particular in the southeastern Bering Sea, is only one example of such possible effects. To avoid localized concentration of harvest, mechanisms are needed to disperse the catch over a wider area. Apportionment of some of the TAC to west of the 170°W long. line provides a mechanism to reduce the probability for adverse ecosystem effects that result from spatially concentrated harvest. Importantly, measures that help disperse the catch in accordance with the distribution of the stock will also tend to prevent an edge effect simply by limiting the extent to which catch can be concentrated in any given area.

These two concerns are related. Management measures that fail to disperse catch in accordance with the distribution of the stock cannot ensure that fishing effort won't be heavily concentrated on the border of CH/CVOA.

Option 1: **Split TAC outside of CH/CVOA to the east and west of 170°W long.** Consistent with RPA principles.

Option 2: **Split TAC outside of CH/CVOA using a 10-mile buffer zone.** Consistent with RPA principles if some other mechanism is used to distribute the catch in accordance with the distribution of the stock outside of the CH/CVOA.

2.2.4 Options for determining split amounts

To distribute catch according to the distribution of the stock, some mechanism is required for determining the distribution of the stock for the period to be fished. The key feature of any such mechanism is its ability to predict or reflect stock distribution accurately and reliably. Any mechanism that does so should be consistent with the RPA principles, as the principles are not specific as to the mechanism that is used.

Three possible approaches have been discussed for determining the distribution of the stock. The first relies on the evaluation of the fishery distribution; that is, this approach assumes that the distribution of the fishery reflects the distribution of the stock. This approach is not reliable and is therefore inconsistent with the RPA principles. The distribution of the fishery is determined by multiple factors which are more or less unrelated to the distribution of the stock. Such factors include market demand (e.g., fillet versus surimi), weather conditions, vessel size and configuration, transiting costs, closed areas, season, ice formation, fishing industry agreements, fishing company strategies, and so on. In addition, the argument that the fishing vessels trawl where the fish are, and therefore the fish are where the vessels trawl is circular and does not provide a basis for confidence in the accuracy of this assertion or its reliability.

The second approach is to use real-time surveys of fishery distribution. The best available scientific data on the distribution of the stock is from the annual summer surveys conducted by the Alaska Fisheries Science Center. These surveys were not originally established to evaluate groundfish distribution and abundance, but have evolved over time to serve this function. With respect to these surveys, the most important questions are how long and to what extent do the surveys remain accurate and reliable after the actual surveying is completed. That is, if the survey data are collected in the summer months and the fishery occurs in late summer and fall, do the data collected in the summer still provide an accurate and reliable basis for estimating the distribution of the fish two or three months later. This same question can be raised with respect to the utility of the summer surveys for assessing distribution during the winter/spring seasons, and there appears to be general agreement that the summer surveys are not reliable indicators of the winter/spring distribution. At present and with the current system of surveys, it does not appear to be possible to provide truly "real-time" information on the distribution of pollock. The problem stems from lack of funding and staff, and the requirement for extensive post-survey analysis of the collected data, which results in a delay of at least several months. Therefore, while real-time surveys would be consistent with the RPA principles, such surveys do not appear to be possible for the immediate future.

The third approach involves the use of data from surveys conducted in previous years. If the distribution of pollock changes on a relatively regular and predictable basis, then surveys conducted in past years should provide the information necessary to estimate current survey distribution. Two problems could confound this approach. If the mean distribution is changing over time in a manner that is not predictable, then this approach may not be reliable. Secondly, even if mean measures of the distribution are relatively constant or predictable, this approach could be compromised by excessive annual variation. Significant interannual variation could result in directed fishing in areas where fish biomass or abundance is low and could therefore have effects to counter those intended. The changes in distribution observed in past surveys are discussed in section 3.

The patterns observed in previous surveys could be used to disperse TAC among fishing areas in multiple ways. The most obvious would be to split the TAC based on some long-term measure of central tendency of the distribution. Under this approach, a fixed percentage of the TAC could be apportioned to each area. Again, this approach would be compromised if the measure of central tendency was not stable or predictable. In addition, the use of a fixed percentage might fail to allow adjustments for interannual variability. If interannual variability is significant, then a better approach might be to use a target amount plus or minus some measure of interannual variability. If, for example, the TAC was to be distributed to the CH/CVOA, outside the CH/CVOA east of 170°W long., and outside of the CH/CVOA west of 170°W long., and the mean percentage observed outside of CH/CVOA east of 170°W long. was 26% plus or minus 10% (1 standard deviation), then the portion of TAC allocated to this area might be a range from 16% to 36%. In all cases, the best available predictor or indicator of the distribution of the stock should be used. Where good predictors are not available, then other measures will be required (i.e., a cap in the CH/CVOA) until a better predictor is developed.

The Council requested that 30% be considered as a possible measure of flexibility in the distribution of the catch. The measure of flexibility should not be fixed at any particular percentage, but should be based on observed variation in the distribution of the stock in previous years.

Option 1: **Use of real-time survey information.** Consistent with RPA principles, but not possible at present.

Option 2: **Base distribution of TAC on historic ranges from previous years.** Consistent with RPA principles.

Option 3: **Use range of ± 30%.** Inconsistent with the RPA principles unless the observed variability in the stock distribution is ca. 30%.

2.3 Options for Bering Sea subarea pollock no-trawl zones

The following options relate to the establishment of pollock no-trawl zones around rookeries and haulouts in the Bering Sea subarea as required by the RPA principles. Rookeries and haulouts are likely chosen by sea lions for their proximity to prey resources, which minimizes the energy lost to transiting from land to the foraging areas.

The RPA principles recommended closure zones of 10 nm in the Aleutian Islands and Gulf of Alaska and 20 nm in the Bering Sea. The size of the exclusion zones in each area reflects the relative widths of the continental shelf. In the Bering Sea subarea, the shelf is relatively wide and RPA exclusion zones have radii of 20 nm. In the Aleutian Islands and GOA, the shelf is narrower and exclusion zones have radii of 10 nm.

The proposed sites listed in Table 2-3 (Bering Sea), Table 2-5 (Aleutian Islands, and Table 2-6 (Gulf of Alaska) are based on ten Steller sea lion counts conducted since 1979 during the reproductive season (summer) and non-reproductive season (winter). For the January 22, 1999, emergency rule, NMFS used the following criteria to identify sites that require exclusion zones and to determine the period of the closure:

Rookeries. All rookery sites have 10 or 20 nm year-round pollock trawl exclusion zones.

Summer haulouts. Haulouts with greater than 200 sea lions in a summer survey since 1979 and less than 75 sea lions in winter surveys since 1979 have 10 or 20 nm pollock trawl exclusion zones effective May 1 through October 31.

Winter haulouts. Haulouts with less than 200 sea lions in summer surveys since 1979 and greater than 75 sea lions in a winter survey since 1979 have 10 or 20 nm pollock trawl exclusion zones effective November 1 through April 31.

Year-round haulouts. Haulouts with greater than 200 sea lions in a summer survey since 1979 and greater than 75 sea lions in a winter survey since 1979 have year-round 10 or 20 nm pollock trawl exclusion zones.

The size of the no-trawl zones (and the original 10 and 20 nm no trawl zones in place since the early 1990s) also was based on studies during the late 1980s and early 1990s using satellite-linked time-depth recorders (SLTDRs) attached to adult females at Gulf of Alaska and Aleutian Islands rookeries during the breeding season. Once the instruments were adequately developed and capture techniques reliable, the studies progressed to fall and winter periods with a greater focus on juvenile and young of the year (Loughlin and Spraker 1989; Merrick et al. 1994; Merrick and Loughlin 1997). These SLTDRs provided information on the location of the animal while at sea on a feeding trip, the duration and depth of feeding dives, the duration of time at sea, and other relevant information. They transmit information to an ARGOS satellite which then downloads the information to the user.

Results of these studies showed that during the breeding season adult female Steller sea lions traveled a mean distance of 17 km (9.2 nm) from the rookeries with a range of 3-49 km. The females studied first tended not to exceed 32 km (17.3 nm) but as more females were studied, the maximum distance extended to 49 km (26.5 nm). Mean distance traveled tended not to change over the time of the studies. The time at sea for a female averaged about one day; she tended to feed at night and return in the early morning hours to suckle her pup. Similar results were found in the Kuril Islands during June 1991 (Loughlin et al. 1998) and in southeast Alaska in the early and mid 1990s (Calkins 1997; Swain and Calkins 1997). The distance traveled away from the rookery during the breeding season generally reflects the width of the continental shelf near the rookery. In those areas where the shelf is near the rookery the females tend to travel less distance, and where it is farther offshore, they travel further, but large individual variation occurs. As the female's pup grows and becomes less dependent on frequent nursing bouts, the distance traveled by the female tends to increase as does the duration of time at sea. After the breeding season females tend to travel greater distances from the rookery or haulout site because they are not obligated to return to the rookery frequently to suckle their pup. Distance traveled was >500 km for adult females in winter and >320 km for young of the year in winter.

Early studies suggested a mean distance traveled by females with pups during the breeding season of about 17 km (9.2 nm) and a maximum distance of 32 km (17.3 nm). Later studies suggested a greater distance for some individuals. But because most studied animals only went a maximum of about 32 km, the size of the zones were not changed.

Industry has suggested that sea lion populations have increased in areas where fishing has occurred and decreased where no trawl zones were put in place and, therefore, fishing appears to be good for sea lions. This interpretation is problematic, at best.

First, the conceptual model for the analysis is questionable. The implication is that by removing pollock, the fisheries have improved conditions for sea lions, and sea lion populations in those area have responded by growing. However, sea lions move considerably between or among sites, most likely in response to prey distribution. If fishing vessels seek greater density of prey and sea lions do the same, then you might expect them to move toward the same areas. If that is the case, higher sea lion counts in the areas of fishing could support the argument for competition. Thus, the conceptual model for this analysis and the contention that fishing is good for sea lions are questionable.

Second, we know that counts at an individual site are not necessarily good indicators of the status of sea lions in a particular region. Animals shift distribution with prey density, weather, season, reproductive condition, age, sex, and any number of additional factors. One of the areas used by industry to suggest fishing is good for sea lions was the haulout at Mitrofania, where counts increased from 70 in 1990 to 247 in 1998. But only a few miles away, counts at neighboring Spitz Island declined from 645 in 1985 to 27 in 1998. Thus, even with a local decline, animals may simply have been shifting haulout location from Spitz Island to Mitrofania Island. This example indicates that considerable care must be used in evaluating trends of sea lions, and that counts from single sites may be very misleading if they are not compared to counts at nearby sites. Our scientists have been studying these trends to determine the best scale to use for evaluating trends, and the results to date suggest counts should be combined over fairly large regions to avoid this kind of error. That doesn't mean that these site counts are not meaningful, but it means considerable care should be used in their interpretation.

Third, other factors may confound the interpretation of fishery effects. Industry also used Cape Sarichef to suggest that nearby fishing may be good for sea lions at this site. However, we know that the population of sea lions at Cape Sarichef was driven to low levels, if not extinct, in the 1970s and 1980s due to human disturbance associated with the lighthouse at that site. Anecdotal but reliable reports indicate that sea lions were disturbed by lighthouse personnel and their dogs, and were even used for target practice by those personnel. The increasing number of sea lions at this site likely indicates movement of these animals following the end of permanent human habitation at the site. To claim that this increase is sea lions is a benefit of fishing offshore is unjustified.

Fourth, these analyses only go from 1989 to recent years, a period well after much of the decline occurred. The analyses therefore fail to account for important data prior to 1989. For example, counts in the eastern Aleutian Islands between 1989 and 1998 ranged between 3,032 and 4,839, whereas the count in 1985 was 7,505 and the count in 1977 was 19,195. The industry analysis therefore ignored an important part of the trend of sea lions in this region.

Fifth, the counts can be used to indicate trends, but whenever possible, the age composition and other information should also be included in those evaluations. The information collected to date clearly indicates that the decline continues in all regions. Pup production, in particular, is down, which indicates low near-term recruitment to the adult population and continued population decline.

Sixth, while the industry analysis compared areas that were "fished" and areas that were "not fished," the analysis does not really describe what that means. Were the areas fished only marginally, were they fished heavily, and what does the fishing level imply about the availability of prey in those regions?

Seventh, not every site in these regions was chosen for the analysis, and it is not clear why some were left out. Even in declining populations, certain rookeries and haulouts may be increasing for a time and others decreasing. But on balance, the whole population was decreasing. It is not clear that any apparent "increases" were not due simply to movements of animals as opposed to actual population growth.

All of these points indicate that the conclusions reached in the industry's analysis are questionable at best. That does not mean that this area of inquiry is not useful, but simply means that considerable care is necessary in the analysis to ensure a correct and reliable interpretation of results.

Option 1: No action.

Under this option, existing no-trawl zones that were established in 1993 would remain in effect. However, new pollock no-trawl zones required by the RPA principles and implemented in the January 20, 1999, emergency rule would expire on July 19, 1999. **The no-action alternative is inconsistent with the RPA principles.** The no-action alternative will result in continued fishing operations adjacent to Steller sea lion rookeries and haulout sites used by large numbers of sea lions and will continue to remove important prey from areas used by them to forage. The no-action alternative will not meet the criteria of spatial separation of pollock trawl fishing from foraging areas, nor will it meet the criteria of moving fishing 10 or 20 nm from terrestrial sites used for resting and breeding. The no-action alternative will continue to degrade critical habitat and reduce the probability of sea lion recovery.

Option 2: (PREFERRED) Council's June 1999 emergency rule recommendation

Under this option, all Bering Sea subarea no-trawl zones that meet the criteria established in the RPA principles would be established on a permanent basis with the exception of the Cape Sarichef haulout which would be closed to 10 nm for 1999. The alternative comes close to meeting requirements of the RPAs except for the exclusion of Cape Sarichef, which is a unique situation. Cape Sarichef is adjacent to Unimak Pass and the areas where extensive pollock A season roe fisheries occur. It is also adjacent to Amak Island/Sea Lion Rock and the eastern Aleutian Islands, specifically the Krenitzen Islands, the area that has suffered one of the most significant sea lion declines and that may be starting to recover. NMFS recognized this area as special in the early 1990s and proposed that the rookeries found there be given special protection to include 20 nm no-trawl zones. However, in the January 22, 1999, emergency rule, NMFS agreed to phase-in protection at this site with a 10 nm closure for 1999 extending to 20 nm for 2000 and beyond.

Cape Sarichef is used year-round for sea lions as a resting site, however the number of animals using the site varies by year and season. For a long period the site was unused by sea lions, likely a result of human occupation of the lighthouse there. In 1960, 200 animals were estimated there, but in subsequent years zero or <10 were counted (but at infrequent intervals). NMFS biologists conducting gray whale research at the west-facing cliffs at Cape Sarichef during November/December 1977, November/December 1978, and October/January 1980 did not see Steller sea lions there. During the first two surveys, the US Coast Guard (USCG) was still operating the Cape Sarichef station. In the summer of 1979, the US Fish & Wildlife Service (USFWS) took over the station because the USCG no longer wanted to maintain it. The USFWS also left shortly afterwards. Anecdotal accounts of harassment of sea lions by lighthouse personnel, shooting of sea lions, and the presence of dogs harassed the animals sufficiently over the years that they ceased to use to the site. Apparently, the USCG supervisor there after 1978 prohibited shooting at wildlife, but some harassment likely continued. As the lighthouse became automated and fewer of people occupied the site, sea lions began to reoccupy the site (USFWS unpublished data). From 1985 to 1998 ten counts were made with an average of 141 animals and range of 15-367 animals present.

Weather is also an important determinant of the number of animals at the site. During winter storms, sea lions generally prefer to remain in the water or find sites protected from waves and wind. During aerial surveys in March 1999, one site at Cape Sarichef was directly in the way of storm waves and wind causing the haulout site to be awash; no sea lions were present. When the survey airplane returned one week later the weather was much improved and 5 large groups of sea lions were using the site. Thus, the number of sea lions hauled out is dependent on prevailing weather conditions.

NMFS believes that this site should be included in the 20 nm no-trawl zones to protect important feeding habitat and to protect sea lions that may be foraging there that are from nearby rookeries that have experienced precipitous declines.

Option 3: Pollock no-trawl zones in NMFS emergency rule

Under this option, 20 nm closures would be placed around all Bering Sea subarea sites that meet the criteria established in the RPA principles with the exception of Cape Sarichef which would receive a 10 nm closure. **This option is consistent with the RPA principles in the short-term**. As stated above, NMFS prefers that the Cape Sarichef site be included in the 20 nm pollock no-trawl zone group since the continental shelf there extends beyond 10 nm and that sea lions feeding from the site likely depend upon prey within the 20 nm radius. However, in the near term, the placement of 10 nm no-trawl zone around this site would be acceptable in efforts to minimize modification of important foraging areas for sea lions, particularly during the fall and winter periods.

Table 2-3 Proposed Steller sea lion protection areas in the Bering Sea subarea.[1]

Management Area/Island/Site	Boundaries to[2]				Proposed pollock no-trawl zones meeting criteria in Biological Opinion (nm)		Existing no-trawl zones. Trawling prohibited within (nm)	
	Latitude	Longitude	Latitude	Longitude	Nov. 1 through April 31	May 1 through Oct. 31	Jan. 1 through April 15	Year-round
Walrus	57 11.00N	169 56.00W			20	20		10
Uliaga	53 04.00N	169 47.00W	53 05.00N	169 46.00W		20		
Chuginadak	52 46.70N	169 41.90W				20		
Kagamil	53 02.50N	169 41.00W				20		
Samalga	52 46.00N	169 15.00W				20		
Adugak	52 55.00N	169 10.50W			20	20		10
Umnak/Cape Aslik	53 25.00N	168 24.50W			20	20		
Ogchul	52 59.71N	168 24.24W			20	20		10
Bogoslof/Fire Island	53 55.69N	168 02.05W			20	20		10
Emerald	53 17.50 N	167 51.50 W				20		
Unalaska/Cape Izigan	53 13.64 N	167 39.37 W			20	20		
Unalaska/Bishop Pt	53 58.40 N	166 57.50 W			20	20		
Akutan/Reef-lava	54 08.10 N	166 06.18 W	54 09.11 N	166 05.50 W	20	20		
Old Man Rocks	53 52.20 N	166 04.90 W			20	20		
Akutan/Cape Morgan	54 03.39 N	165 59.65 W	54 03.70 N	166 03.68 W	20	20	20	10
Rootok	54 03.90 N	165 31.90 W				20		
Akun/Billings Head	54 17.62 N	165 32.06 W	54 17.57 N	165 31.71 W	20	20	20	10
Tanginak	54 12.00 N	165 19.39 W			20			
Tigalda/Rocks NE	54 09.60 N	164 59.00 W			20	20		
Unimak/Cape Sarichef	54 34.30 N	164 56.80 W			10 (or 20)	10 (or 20)		
Aiktak	54 10.99 N	164 51.15 W			20			
Ugamak	54 13.75 N	164 47.90 W	54 12.82 N	164 47.60 W	20	20	20	10
Round	54 12.05 N	164 46.60 W				20		
Sea Lion Rock (Amak)	55 27.79 N	163 12.254 W			20	20	20	10
Amak and rocks	55 24.20 N	163 09.60 W	55 25.90 N	163 09.90 W	20	20		

[1]Closure zones around many of these sites also extend into statistical area 610 of the Gulf of Alaska Management Area
[2]Where two sets of coordinates are given, the baseline extends in a clock-wise direction from the first set of geographic coordinates along the shoreline at mean lower-low water to the second set of coordinates. Where only one set of coordinates is listed, that location is the base point.

Option 4: Pollock no-trawl zones recommended in Biological Opinion

Under this option, 20 nm closures would be placed around all Bering Sea subarea sites that meet the criteria established in the RPA principles including Cape Sarichef. **This option is consistent with the RPA principles.** NMFS concludes that 20 nm pollock no-trawl zones are necessary in areas where the continental shelf extends beyond 10 nm and where sea lions are likely to feed. In those areas that incorporate critical habitat, NMFS concludes that pollock no-trawl zones with 20 nm of rookeries will reduce deleterious impacts to critical habitat and enhance recovery.

Option 5: Combination of closures and no closures to comprise an adaptive management experiment

Under this option, some combination of closures and no closures would be devised to comprise an adaptive management experiment. The Council suggested that Cape Sarichef, Amak and other sites could be exempted from closure for study purposes. **This option would be inconsistent with the RPA principles.** However, NMFS concurs that adaptive management may be useful in identifying the optimal size and efficacy of the no-trawl zones. In fact, NMFS is currently developing an experimental design to include the possible effects of Atka mackerel and pollock commercial fishing activities and Steller sea lions and to assess the optimal size and efficacy of the zones. These studies will begin as pilot studies in FY 1999/2000 with full studies anticipated in FY 2001, assuming adequate funds.

2.4 Options for the Aleutian Islands subarea

The Aleutian Islands subarea consists of the area demarcated by 55°N lat. (northern boundary), 170°W long. (eastern boundary), the southern limit of the U.S. Exclusive Economic Zone (southern boundary), and the U.S.-Russian boundary (eastern boundary). This subarea is further divided into three management areas, 541, 542, and 543 (east to west) that are divided at 177°W long. and 177°E long. (Figure 2-9). These management areas, however, were established to protect the Atka mackerel stock by dispersing the catch of this fishery, and are not applied to the pollock fishery.

From 1979 to 1998, annual catch of pollock in the Aleutian Islands has ranged from 9,504 mt to 81,834 mt [(Table 2-4), Ianelli et al. 1998, D. Witherell, pers. comm.]. The catch has been taken primarily by catcher/processors (Fritz 1993) and, in recent years, most of the catch has been taken by a small subset of the vessels that fish in the Bering Sea. Fishing depths in this subarea range from ca. 100 to 500 m, about 300 to 400 m off bottom (on average; NMFS 1998e). In the 1990s, the mean length of pollock taken from the Aleutian Islands subarea has been on the order of 2 to 9 cm longer than the catch in the southeastern portion of the eastern Bering Sea shelf and up to 15 cm longer than the catch in the northwestern portion of the eastern Bering Sea shelf (Ianelli et al. 1998; their Fig. 1.8).

In general, most of the pollock caught in the Aleutian Islands subarea has come from critical habitat. From Yunaska Island to Attu Island, critical habitat is defined for waters around 20 major rookeries and 28 major haulouts (50 CFR 226.12). In 1998, approximately 80% of the observed pollock catch in the Aleutian Islands subarea was taken within 10 nm of the major haulouts identified for closures (NMFS, unpubl. data). The Aleutian Islands subarea corresponds approximately to the areas labeled as the central and western Aleutian Islands during Steller sea lion counts. In the central region, counts of nonpup animals have fallen from 36,632 in 1979 to 5,705 in 1998 (Figure 2-10; NMFS, unpubl. data). In the western region, counts of nonpups have fallen from 14,011 in 1979 to 1,913 in 1998.

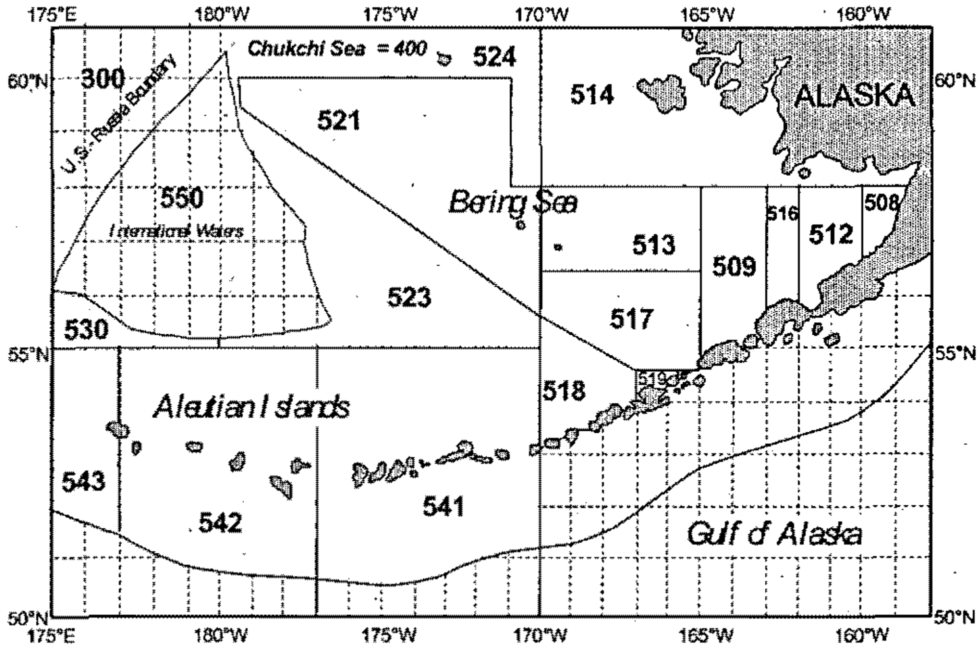

Figure 2-9 Bering Sea and Aleutian Islands Management Area.

Table 2-4 Annual catch (mt) of pollock from the Aleutian Islands region, 1979 to 1998.

Year	Catch (mt)	Year	Catch (mt)
1979	9,504	1989	15,531
1980	58,156	1990	79,025
1981	55,516	1991	78,649
1982	57,978	1992	48,745
1983	59,026	1993	57,132
1984	81,834	1994	58,637
1985	58,730	1995	64,429
1986	46,641	1996	29,062
1987	28,720	1997	25,478
1988	30,000	1998	21,945

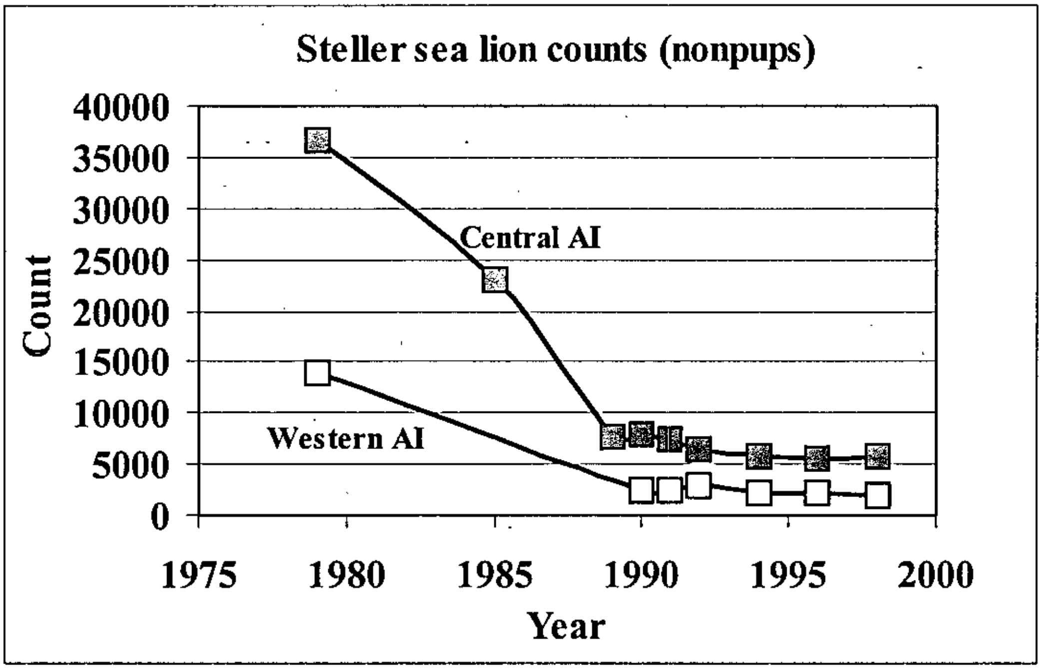

Figure 2-10 Counts of nonpup Steller sea lions in the central and western Aleutian Islands, 1979-1998 (NMFS, unpubl. data).

The RPA principles of the December 3, 1998 Biological Opinion included requirements for protection of the waters surrounding the rookeries and haulouts of Steller sea lions in the Aleutian Islands subarea. The protective measures were to include pollock trawl exclusion zones of at least 10 nm around the major rookeries and haulouts in this subarea. On December 13, 1998, the Council passed a motion that included closure of this subarea for directed fishing of pollock. This closure was effected both by the Council's immediate reduction in TAC allocated to this subarea (for bycatch only), and then by the emergency interim rule published January 22, 1999 (64 FR 3437). Closure of this region ensures complete protection from directed pollock fishing over a large geographic region where ca. 2% to 3% of the pollock TAC has been taken in recent years by a small fraction of one sector of the fishery. Although an experimental design has not been developed, this closure may allow the use of this large area as a control region for a study of the effects of pollock fishing.

The three options to be considered include the no-action alternative (i.e., revert to status quo when the emergency rule expires), implement pollock trawl exclusion zones as described in the Biological Opinion, or close the Aleutian Islands subarea to directed fishing for pollock.

Option 1: No action

The no-action alternative would fail to satisfy the RPA principles. This option would fail to provide the additional protection required for the waters around the rookeries and haulouts of the Aleutian Islands subarea.

Option 2: Implement pollock trawl closures as described in the RPA principles:

The second option would satisfy the RPA principles if it protected waters around major rookeries and haulouts out to a distance of at least 10 nm. Rookery and haulout sites meeting the closure criteria set out in the Biological Opinion are displayed in Table 2-5. The shelf and slope areas in the Aleutian Islands subarea is relatively narrow and limited, and the majority of the directed pollock fishing in this subarea (i.e., 80%) has occurred within 10 nm of the rookeries and haulouts. Therefore, 80% of the directed fishing for pollock would be displaced outside of these areas. Where the effort would be displaced to is not clear. In recent years, the tendency to concentrate fishing in the more eastern areas (e.g., around Seguam Island) has decreased and more effort has been directed farther west. As effort is displaced farther west and spread out over a larger area, the potential for this fishery to have a significant effect on Steller sea lions could be further reduced. However, it is not clear why the effort has shifted further west, and if it reflects a depletion of pollock in the more eastern portion of this region, then the fishery may be contributing to a significant reduction of an important sea lion prey item in the Aleutian Islands.

Option 3: Close the Aleutian Islands Subarea to directed fishing for pollock:

The third option is consistent with the RPAs. This option would completely close the Aleutian Islands Subarea to directed fishing for pollock. This approach was advocated in previous Council discussions for two main reasons. First, complete closure to directed pollock fishery would constitute a significant conservation measure that, taken with other conservation measures would increase the likelihood of satisfying the whole set of RPA principles. Second, the closure of the Aleutian Islands Subarea to directed pollock fishing could provide a control site for studies of the effect of pollock fishing on Steller sea lions.

Under ideal conditions, a control area has all the same characteristics as the experimental area except for the treatment (in this case, pollock fishing). At present, all areas from Prince William Sound westward to the western end of the Aleutian Islands are fished by one fishery or another, and usually by multiple fisheries. The majority are groundfish fisheries (e.g., pollock, cod, yellowfin sole, Alaska plaice, dover sole, rex sole, sablefish) and are centered or occur primarily in areas other than the Aleutian Islands Subarea, with the exception of a few fisheries (e.g., Atka mackerel, arrowtooth flounder, Greenland turbot, some rockfishes) (Fritz et al. 1998). Therefore, the Aleutian Islands Subarea is fished less intensively than other locations. As a consequence, establishing this subarea as a control site would likely be less disruptive than setting up a control site in the Gulf of Alaska or eastern Bering Sea/eastern Aleutian Islands. However, while use of this site as a control area might be less disruptive, it may also lead to a relatively small experimental effect that would be difficult to measure. To detect the effect of fishing may require an experiment that involves a far greater reduction in catch in other areas where the pollock fishery has historically occurred.

The Aleutian Islands Subarea also offers the advantage of considerable size and remoteness. Large geographic size is essential given the spatial and temporal dynamics of the fish stocks and Steller sea lions. Smaller areas would be less likely to serve as adequate controls because of the movements of prey and sea lions. The narrower shelf area in the Aleutian Islands Subarea is less like the shelf area in the Eastern Bering Sea, but more like the Gulf of Alaska. Remoteness is an advantage because the area is less likely to be affected by human activities other than fishing, which could otherwise confound any assessment of fishing effects.

At present, the Aleutian Islands Subarea is not a designated control site in any existing experiment. Based on its size, remoteness, and the relatively lower disruption to existing fisheries, this Subarea should be considered as a candidate area for such a control site. However, the design of a statistically powerful experiment to evaluate the size and location of control and experimental regions is a complicated matter that would best be accomplished by a multi-disciplinary group of scientists including fishery biologists, marine mammal biologists, and oceanographers.

Table 2-5 Proposed Steller sea lion protection areas in the Aleutian Islands subarea.

Island/Site	Boundaries to[1]				Proposed pollock no-trawl zones meeting RPA criteria (nm)		Existing no-trawl zones. Trawling prohibited year-round within (nm)
	Latitude	Longitude	Latitude	Longitude	Nov. 1 through April 31	May 1 through Oct. 31	
Attu/Cape Wrangell	52 54.50N	172 28.50E	52 57.50N	172 31.50E	10	10	10
Agattu/Gillon Point	52 24.00N	173 21.50E			10	10	10
Attu/Chirikof Point	52 50.00N	173 26.70E				10	
Agattu/Cape Sabak	52 23.50N	173 43.50E	52 22.00N	173 41.00E	10		
Alaid	52 46.50N	173 51.50E	52 46.50N	173 54.00E	10		
Shemya	52 44.00N	174 09.00E			10		
Buldir	52 23.50N	175 51.00E	52 20.50N	175 57.00E	10		
Kiska/cape St Stephn	51 53.50N	177 12.00E	51 52.50N	177 13.00E	10	10	10
Kiska/lief Cove	51 56.50N	177 19.50E	51 58.00N	177 21.00E	10	10	10
Kiska/Sobaka-Vega	51 48.50N	177 20.50E	51 49.50N	177 19.00E		10	
Kiska/Sirius Point	52 08.50N	177 36.50E			10		
Tanadak (Kiska)	51 57.00N	177 47.00E			10	10	
Segula/Gula Point	52 03.50N	178 09.00E			10	10	
Rat	51 50.20N	178 12.50E			10	10	
Ayugadak	51 45.50N	178 24.50E			10	10	10
Little Sitkin	51 59.50N	178 30.00E			10	10	
Amchitka/Column Rock	51 32.50N	178 49.50E			10	10	10
Amchitka/Cape Ivakin	51 24.50N	179 25.00E				10	
Amchitka/East Cape	51 22.50N	179 28.00E	51 21.50N	179 25.00E	10	10	10
Semisopochnoi/Pochnoi	51 58.50N	179 45.48E	51 57.00N	179 46.00E	10	10	10
Amatignak/Nitrof Point	51 13.00N	179 08.00W			10		
Unalga & Dinkum Rocks	51 34.00N	179 04.00W	51 34.50N	179 03.00W	10	10	
Ulak/Hasgox Point	51 20.00N	178 57.00W	51 18.50N	178 59.50W	10	10	10
Tag	51 33.50N	178 34.50W			10	10	10

[1]Where two sets of coordinates are given, the baseline extends in a clock-wise direction from the first set of geographic coordinates along the shoreline at mean lower-low water to the second set of coordinates. Where only one set of coordinates is listed, that location is the base point.

Table 2-5 (cont) Proposed Steller sea lion protection areas in the Aleutian Islands subarea

Island/Site	Boundaries to[1]				Proposed pollock no-trawl zones meeting RPA criteria (nm)		Existing no-trawl zones. Trawling prohibited year-round within (nm)
	Latitude	Longitude	Latitude	Longitude	Nov. 1 through April 31	May 1 through Oct. 31	
Ugidak	51 35.00N	178 30.50W				10	
Gramp Rock	51 29.00N	178 20.50W			10	10	10
Tanaga/Bumpy Point	51 55.00N	177 57.00W	51 55.00N	177 58.50W	10	10	
Bobrof	51 54.00N	177 27.00W			10		
Kanaga/Ship Rock	51 47.00N	177 22.50W			10	10	
Kanaga/N., Cape	51 56.50N	177 09.00W			10	10	
Adak/CapeYakak-Lake Point	51 36.50N	176 59.00W	51 38.00N	176 59.00W	10	10	10
Little Tanaga Strait	51 49.00N	176 13.00W	51 50.50N	176 13.00W		10	
Anagaksik	51 51.00N	175 53.50W				10	
Kasatochi/N. Point	52 10.00N	175 31.50W	52 10.50N	175 29.00W	10		
Atka/N. Cape-Cape Korovin	52 23.50N	174 17.00W	52 24.50N	174 07.50W	10		
Amlia/Sviech. Harbor	52 02.00N	173 23.00W				10	
Sagigik	52 00.50N	173 08.00W				10	
Amlia/East	52 06.00N	172 57.00W	52 05.00N	172 58.50W		10	
Tanadak (Amlia)	52 04.50N	172 57.00W				10	
Agligadak	52 06.50N	172 54.00W			20	20	20
Seguam/Saddleridge	52 21.00N	172 33.00W	52 21.00N	172 35.00W	20	20	20
Seguam/Other	52 19.50N	172 18.00W	52 15.50N	172 37.00W	10	10	
Amukta and Rocks	52 27.50N	171 17.50W				10	
Chagulak	52 34.00N	171 10.50W			10	10	
Yunaska	52 41.00N	170 34.50W	52 42.00N	170 38.50W	10	10	10

[1]Where two sets of coordinates are given, the baseline extends in a clock-wise direction from the first set of geographic coordinates along the shoreline at mean lower-low water to the second set of coordinates. Where only one set of coordinates is listed, that location is the base point.

2.5 Options for temporal dispersion in the Gulf of Alaska

The underlying goal of these management actions is to avoid localized depletion stemming from intense pulsed fisheries, and to reduce foraging disturbance impacts. The RPA principles do not prescribe a specific temporal effort distribution, but they identify important measures that would address the underlying management intent of limiting potential fisheries effects on Steller sea lions. Of these measures, the first three are directly listed in the RPAs:

1. Prohibition of pollock trawl fisheries from 1 November to 19 January.
2. Division of the pollock fisheries in four seasons.
3. Maintenance of separate seasons (i.e., harvesting punctuated by periods of no fishing).

The next two elements are implicit in the RPAs since they are consistent with more gradual harvesting of pollock, lower potential for localized depletion and, in effect, the antithesis of "the race for fish.". These are:

4. Moderation in catch rates compared to previously observed patterns.
5. Broadened distribution of effort within seasons consistent with a more gradually paced fishery.

2.5.1 Options for season dates and TAC apportionments

Option 1: No Action. Fishing seasons and seasonal TAC apportionments would revert to pre-1999 status when the current emergency rule expires on July 19, 1999. Under the no-action alternative, Western and Central (W/C) GOA fishing seasons and TAC apportionments would be as follows

Fishing season	TAC apportionment	Dates[1]	
		From	To
A Season	25%	January 1[2]	April 1
B Season	35%	June 1	July 1
C Season	40%	September 1	December 31

[1]The time of all openings and closures of fishing seasons, other than the beginning and end of the calendar fishing year, is 1200 hours, A.l.t.

[2]Under existing regulations, the A season pollock TAC becomes available on January 1. However, trawling for groundfish does not open until January 20. Because pollock is only targeted with trawl gear, the de-facto pollock season opening date is January 20 despite the fact that directed fishing for pollock with other than trawl gear could occur prior to January 20 of each year.

Under existing regulations, the pollock fishery in the Eastern Regulatory Area (Statistical Areas 640--West Yakutat) and 649--Prince William Sound) is not subdivided into seasons.

The no-action alternative is inconsistent with the RPA principles on several levels: First, it fails to meet the RPA principle that no pollock fishing occur between 1 November and 19 January. In recent years, the GOA pollock fisheries have closed before 1 November, but existing regulations would allow fishing after 1 November if the TAC had not already been taken. Second, it fails to meet the RPA principle that the pollock trawl harvest be divided into at least four fishing seasons. Finally, it fails to meet the RPA principle that no more than 30% of the annual TAC be apportioned to a single fishing season.

Option 2: Council's December 1998 Emergency Rule Recommendation. In December 1998, the Council recommended revised season dates and seasonal TAC apportionments for the Western and Central (W/C) Regulatory Areas of the GOA. No changes to the Eastern Regulatory Area pollock fishery were recommended and none were contained in the RPA principles. For the January 20, 1999, emergency rule, NMFS implemented the Council's W/C GOA season dates and TAC apportionments without modification. These W/C GOA season dates and TAC apportionments are consistent with the RPA principles and are displayed below as Option 2.

Fishing season	TAC apportionment	Dates	
		From	To
A Season	30%	January 20	April 1
B Season	20%	June 1	July 1
C Season	25%	September 1	The date of closure of a statistical area (610, 620, 630) to directed fishing, or October 1, whichever comes first.
D Season	25%	Five days after the date of closure of statistical area to directed fishing	November 1.

Option 3: Additional season dates requested by April 1999 Council motion. At its April 1999 meeting, the Council requested analysis of an additional set of season date options for the W/C GOA pollock fisheries. This change would basically move the B season start date from June 1 to a date 5 days after the A season closure in a particular area to match the C/D season scheme contained in Option 2. The resulting season dates and TAC apportionments would be as follows:

Fishing season	TAC apportionment	Dates	
		From	To
A Season	25%	January 20	The date of closure of a statistical area (610, 620, 630) to directed fishing, or March 1 (or other date), whichever comes first.
B Season	25%	Five days after the date of closure of statistical area to directed fishing	July 1
C Season	25%	September 1	The date of closure of a statistical area (610, 620, 630) to directed fishing, or October 1, whichever comes first.
D Season	25%	Five days after the date of closure of statistical area to directed fishing	November 30.

As proposed, option 3 is inconsistent with the RPA principles because it would apportion more than 45% of the TAC to the winter/spring season. In essence, the two winter seasons would really be a single season of 50% of the TAC with a 5-day stand down in the middle. Furthermore, the lumping of the four GOA seasons into what is essentially just two seasons with 5-day stand-down periods within each season is somewhat inconsistent with the RPA principle of distributing the pollock TAC into at least four discrete seasons. To be consistent with the RPA principles of limiting catch during the winter/spring season, the combined A and B season apportionments would have to be reduced to no more than 45% of the annual TAC. With some shifting of seasonal apportionments and greater stand-down periods between seasons, option 3 could potentially be revised to become an acceptable alternative.

2.5.2 Options for a seasonal exclusive area requirement for catcher vessels transiting between the BSAI and GOA

The pollock fisheries in the W/C GOA have been among the most difficult fisheries for NMFS to manage in recent years due to small TACs relative to potential effort and the constant potential that numerous large catcher vessels based in the BSAI may crossover to the GOA to participate in this fishery. In 1998, the Council addressed this problem by recommending a 3-day stand-down requirement for catcher vessels transiting between the BSAI and W/C GOA which was subsequently implemented by NMFS. The objective of the 3-day stand-down requirement was to reduce the unpredictable shifts of effort that have aggravated management of GOA pollock fisheries, especially in Area 610. However, the 3-day stand down requirement was dependent on concurrent BSAI and GOA fishing seasons. Otherwise it has no effect in reducing effort. Prior to the Steller sea lion emergency rule, all the BSAI and GOA seasons occurred concurrently except for the June quarterly opening in the GOA. This would not be the case under the emergency rule and many of the Bering Sea season date options under consideration.

Under the emergency rule adopted by the Council and implemented by NMFS on January 20, 1999, none of the BSAI and GOA seasons overlap completely for all sectors of the fleet. To address the potential for large-scale shifts of effort from the BSAI to the GOA that would lead to short pulse fisheries in the GOA and potential TAC overruns, a seasonal exclusive area requirement was proposed for analysis by the Council at its February 1999 meeting. Under this option, catcher vessels would be prohibited from engaging in directed fishing for pollock in both the BSAI and GOA during the following season pairs:

Bering Sea A1 Season and the W/C GOA A Season
Bering Sea A2 Season and the W/C GOA B Season
Bering Sea B Season and the W/C GOA C Season
Bering Sea C Season and the W/C GOA D Season

Once a catcher vessel engaged in directed fishing for pollock in the BSAI or W/C GOA during a fishing season it would be prohibited from subsequently engaging in directed fishing for pollock in the opposite area during the same season pairing. In the case of catcher vessels delivering to motherships which have a single A season, fishing that occurred between February 1 and February 20 would be considered A1 for the purpose of the stand-down requirement. Fishing that occurred between February 20 and April 15 would be considered A2.

Although the RPA principles do not require this sort of management measure, to the extent that a seasonal exclusive area requirement would moderate catch rates and broaden the distribution of effort within seasons, the option to establish a seasonal exclusive area requirement for the BSAI and W/C GOA is consistent with the RPA principles.

Suboption 1: Extend the exclusive area requirement to the Eastern Regulatory Area

None of the options for temporal dispersion in the GOA would subdivide the Eastern Regulatory Area pollock fishery into seasonal allowances. The Eastern Regulatory Area is composed of Statistical Areas 640 (West Yakutat) and 650 (SE Outside), however a directed pollock fishery exists only within Area 640 because trawling is prohibited in area 650. The Biological Opinion did not propose subdividing the 640 pollock TAC into separate fishing seasons because the pollock TAC specified for Area 640 is already quite small, 2,110 mt in 1999.

At present, the pollock fishery in Area 640 is quite distinct from the pollock fisheries in Areas 610, 620, and 630. The Area 640 pollock fishery tends to occur much further offshore and in deeper water than in other parts of the GOA and has historically been prosecuted by a small number of larger size catcher boats that transit down from the Bering Sea to prosecute this fishery. Only three catcher boats participated in this fishery in 1997 and only four participated in 1998. All of these vessels are traditionally based in the Bering Sea. Extending the seasonal exclusive area requirement to Area 640 would likely eliminate all of the current participants in this fishery unless the vessel operators chose to forego fishing in the Bering Sea during the A1 season.

Suboption 2: Exclusive area requirement applies only to vessels greater than or equal to 125 ft LOA

Under this suboption, the seasonal exclusive area requirement would apply only to vessels greater than or equal to 125 ft. Table 2-6 provides information on the size of catcher vessels that have transited between the BSAI and GOA to fish for pollock in both areas within a single A or B season period during 1997 and the first half of 1998. Inclusion of this suboption and accompanying table was specifically requested by the Council at its April 1999 meeting.

Table 2-6 Profile of pollock catcher vessels crossing over between BSAI and GOA during a single season during 1997 and the first half of 1998 sorted by length overall (LOA) and showing primary and secondary fishing areas in terms of tons.

This column lists individual "crossover" vessels by LOA(in ft.)	When vessel has fished in both BSAI and W/C GOA during a single season, "P" indicates "primary" fishing area (majority of tons harvested) and "S" indicates "secondary" fishing area (minority of tons harvested) for that vessel.					
	1997 A season		1997 B season		1998 A season	
	BSAI	W/C GOA	BSAI	W/C GOA	BSAI	W/C GOA
74					S	P
86			S	P		
90	P	S	S	P	S	P
93			S	P		
94	S	P	P	S	S	P
94			S	P		
95	P	S	P	S	P	S
97			S	P		
97			S	P		
99			P	S		
107			P	S		
117	P	S				
120			P	S		
122					P	S
123						
123			P	S		
123	S	P	S	P		
123					P	S
124	P	S	P	S	P	S
127	P	S			P	S
135			P	S		
144			P	S		
148			P	S		
152			P	S		
152			P	S		
166					P	S
180	P	S				
185			P	S		
201	S	P				

Summary for "crossover" vessels under 125 ft LOA

Total catch in mt	4,605	2,602	10,567	5,197	7,836	2,705
# of vessels	6	6	14	14	7	7
average catch/vessel	767	434	755	371	1,119	386

Summary for "crossover" vessels greater than or equal to 125 ft LOA

Total catch in mt	7,319	1,473	21,655	1,593	5,611	1,408
# of vessels	3	3	6	6	2	2
average catch/vessel	2,440	491	3,609	266	2,806	704

2.5.3 Options for trip limits in the GOA

In December 1998, the Council recommended the inclusion of a 300,000 lb pollock trip limit for vessels fishing for pollock in the W/C GOA. This 300,000 lb trip limit was included in the ER published on January 20, 1999 and included the addition of a 600,000 lb trip limit for vessels operating as tenders. The purpose of establishing a pollock trip limit for the W/C GOA was to moderate catch rates in the GOA where the problem of pulse fishing has exacerbated fisheries management and has created increased potential for TAC overruns and localized depletions of pollock stocks. In April 1999, the Council requested the addition of a third option to establish a 300,000 lb trip limit in the entire GOA with a 500,000 lb tender limit in area 610 and a prohibition on tendering in areas 620, 630, and 640.

Several trip limit options are presented for analysis

Catcher vessel trip limits

Option 1: 300,000 lb trip limit for W/C GOA. A 300,000 lb trip limit for catcher vessels fishing in the W/C GOA was recommended by the Council in December 1998 and adopted by NMFS as one of the RPA measures contained in the emergency rule. As noted in Section 7 of this analysis, a 300,000 lb trip limit would have the greatest impact in Area 610 where the largest fishing trips have occurred in the past several years. Fishing trips over 300,000 are less frequent in Area 620 and rare in Area 630 where few vessels ever exceed 300,000 lbs on typical fishing trips. Consequently, a 300,000 lb trip limit for the W/C GOA will have the greatest effect in slowing the pace of fishing in Area 610, a lesser effect in Area 620, and very little effect in Area 630 where few fishing trips exceeded 300,000 lbs in previous years. While a pollock trip limit for the W/C GOA is not required by the RPA principles, such a measure is consistent with the principle of a more moderate paced fishery will less potential for localized depletions of pollock stocks and less risk of inadvertent TAC overruns due to unpredictable effort.

Option 2: 300,000 lb trip limit for W/C and E GOA. This option would extend the 300,000 lb trip limit to the Eastern Regulatory Area where pollock fisheries occur in Area 640 (West Yakutat) and 649 (Prince William Sound). A 300,000 lb trip limit Area 640 would have a significant effect on the several vessels participating in that fishery. In 1997 the average size fishing trip in Area 640 was 676,898 lbs and in 1998 the average size fishing trip in Area 640 was 808,642 lbs. In only one instance in the past 2 years has a vessel fishing for pollock in Area 640 completed a fishing trip with 300,000 lbs or less pollock on board.

Tender vessel trip limits

The emergency rule motion adopted by the Council in December 1998 did not specify whether trip limits would apply to tender vessels that receive deliveries of pollock for transport to processing plants. In developing the Council's emergency rule motion for implementation, NMFS became concerned that a lack of restriction on tendering could lead to wide-spread use of tender vessels in the W/C GOA by operators who wished to evade the intent of the 300,000 catcher vessel trip limit. NMFS was specifically concerned that large catcher vessels might operate on the fishing grounds as tenders receiving codends caught by other vessels but not deploying fishing gear themselves. To prevent this type of "new" activity from undermining the effectiveness of the trip limit in slowing fishing effort, NMFS included a 600,000 lb tender limit in the emergency rule published on January 20, 1999. The 600,000 lb tender limit was chosen so that it would prevent unrestricted tendering by the largest catcher vessels but would still allow existing tendering operations in the GOA to continue traditional tendering where sorted pollock catch is transferred from catcher vessels to tender vessels through the use of fish pumps and/or brailers.

Option 1: Define pollock tendering to exclude codend transfers. Under this option, pollock trip limits would not apply to tender vessels operating in a "traditional" mode, e.g., that receive sorted catch from catcher vessels through fish pumps or brailers. However, the 300,000 lb limit would apply to vessels that receive transfers of unsorted codends at sea. For the purpose of the pollock trip limits, vessels receiving transfers of unsorted codends would be considered catcher vessels and not tender vessels and would be subject to the catcher vessel trip limit. Under this option, NMFS concerns about the potential for large-scale at-sea codend transfers would be addressed and separate trip limits for tender vessels would be unnecessary.

Option 2: 300,000 lb trip limit for tender vessels. Under this option, tender vessels would be prohibited from retaining on board the vessel at any one time more than 300,000 lbs of unprocessed pollock harvested in the W/C GOA. This option would be the most restrictive and would have the potential to affect existing operations that use tenders to transport catch from small vessels in the Alitak and Shelikof regions of Kodiak Island to processing plants in Kodiak and Cordova. However, NMFS databases currently do not track the size of tender deliveries to processing plants in a format that would allow easy analysis of the extent to which current tender operations would be affected by a 300,000 lb trip limit.

Option 3: 600,000 lb trip limit for tender vessels. Under this option, tender vessels would be prohibited from retaining on board the vessel at any one time more than 600,000 lbs of unprocessed pollock harvested in the W/C GOA. This option would match the current emergency rule and would be less restrictive on current tendering operations. Anecdotal reports from processors suggest that current W/C GOA pollock tender vessels rarely if ever exceed 600,000 lbs, largely because the hold capacity of most vessels used for tendering is less than 600,000 lbs. However, NMFS databases currently do not track individual tender deliveries in a format that would allow easy analysis of the extent to which current tender operations would be affected by a 600,000 lb trip limit.

Option 4: 500,000 lb trip limit for tender vessels in area 610, only (or in areas 610 and 620 only) with a prohibition on tendering in areas 620, 630, and 640. This option was added at the request of the Council's April 1999 motion. Under this option, tendering would be allowed in 610, or in 610 and 620 under a tender limit of 500,000 lbs. Tendering of pollock would be prohibited in the remaining statistical areas of the GOA. While such an alternative is not inconsistent with the RPA principles, the rationale for a complete prohibition on tendering in the Central and Eastern GOA is unclear. NMFS's original rationale for placing limits on tendering in the January 22, 1999, emergency rule was to prevent evasion of the intent of the catcher vessel trip limit through increased use of "high-seas" tendering. Tendering pollock as it has been traditionally practiced in the GOA, is not an activity that raises concerns with respect to Steller sea lions. Should the Council wish to proceed with an alternative that includes an outright prohibition on tendering of pollock in the central and eastern GOA, the rationale for such a prohibition should be developed more fully.

2.5.4 Effects of trip limits on 1999 A season fishery

The 1999 A season fishery in the W/C GOA was conducted under a 300,000 lb trip limit that was contained in the January 22, 1999 emergency rule. The following table 2-7 displays the A season catch rates and season lengths for areas 610, 620, and 630 from 1996 through 1998 when no trip limits were in effect, and during 1999 when a 300,000 lb trip limit was in effect. Under trip limits, the daily catch rate has decreased and season lengths have increased in areas 610 and 620. However, in area 630 the imposition of trip limits coincided with a more than doubling of the daily catch rate and a reduction in the season length by half. Anecdotal evidence indicates that this doubling of catch rate in area 630 during the 1999 A season may be due in part to an increase in the number of Bering Sea-based catcher vessels participating in this opening. Under the emergency rule, the Bering Sea mothership fleet was idle from January 20 to February 1 and those vessels were available to fish in area 630 at a time when they would have been fishing in the Bering Sea in previous years. In addition, a fire at one of the Bering Sea-based floating processors also idled a number of catcher vessels that would otherwise have been occupied fishing in the Bering Sea. The actual extent to which Bering sea-based vessels increased their level of effort in area 630 during the 1999 A season has not been examined due to the unavailability of 1999 fish ticket data.

Table 2-7 Season lengths and catch per day during the January quarterly opening in Areas 610-630 of the Gulf of Alaska

Year	*Length in days*	*TAC in mt.*	*Actual Catch in mt.*	*Catch/day in mt*
		Area 610		
1996	8	6,370	7,346	918
1997	6	4,650	6,569	1,095
1998	6	7,450	5,587	931
1999	11	6,936	8,071	734
		Area 620		
1996	9	3,210	3,465	385
1997	18	7,812	9,436	524
1998	18	12,510	12,245	680
1999	28	11,652	11,461	409
		Area 630		
1996	7	3,420	6,181	833
1997	15	6,138	8,151	543
1998	13	9,830	8,970	690
1999	7	9,156	9,988	1,427

2.6 Options for spatial dispersion in the GOA

Unlike the Bering Sea, the pollock TAC in the GOA is already distributed among four management areas (610, 620, 630, and 640) in proportion to the estimated biomass in each area. This spatial dispersion measure was implemented as a Steller sea lion protection measure under Amendment 25 to the FMP. Given that spatial dispersion measures are already in place for the GOA pollock fishery, the RPA principles do not mandate further spatial dispersion of the pollock TAC in the GOA with the exception of Shelikof Strait. Virtually all of the pollock fishing occurs in the Western and Central Regulatory Areas, which are further broken down into statistical/reporting areas: the Western Regulatory Area is comprised of reporting area 610, and the Central Regulatory Area is comprised of reporting areas 620 and 630. The Eastern Regulatory Area is comprised of reporting areas 640, 659, 650, and 659 (Figure 2-11). At present, the Shelikof Strait area does not constitute a statistical or reporting area.

Prior to 1999, the catch within the W/C GOA was apportioned on the basis of biomass distribution as determined from triennial bottom trawl surveys. Bottom trawl surveys have been conducted in summer months, and additional hydroacoustic surveys have been conducted in winter months. The hydroacoustic surveys indicate an extensive and relatively predictable spawning aggregation of pollock in the winter period in Shelikof Strait. In 1999 under the emergency rule, a cap was set for the catch from Shelikof Strait based on previous hydroacoustic surveys, and the GOA TAC was distributed to areas 610, 620, and 630 based on the trawl surveys. The cap in Shelikof Strait was estimated using the estimated biomass from the hydroacoustic survey divided by the estimated total GOA biomass from population modeling, and the quotient then multiplied by the GOA TAC for the A season.

In the GOA, overall pollock fishery harvest rates have varied from about 5% to 10% since 1990. Since 1994, the estimated harvest rate in Shelikof Strait has been on the order of 1% to 3%, or well below the overall harvest rate for the GOA (Fig. 2-12). This discrepancy suggests that the biomass of pollock in Shelikof Strait is under-utilized relative to the biomass of pollock outside the Strait. It therefore follows that, relative to the overall harvest rate, pollock biomass outside the Strait must be over-utilized. This relative over-utilization of pollock outside Shelikof Strait may have a detrimental effect on the

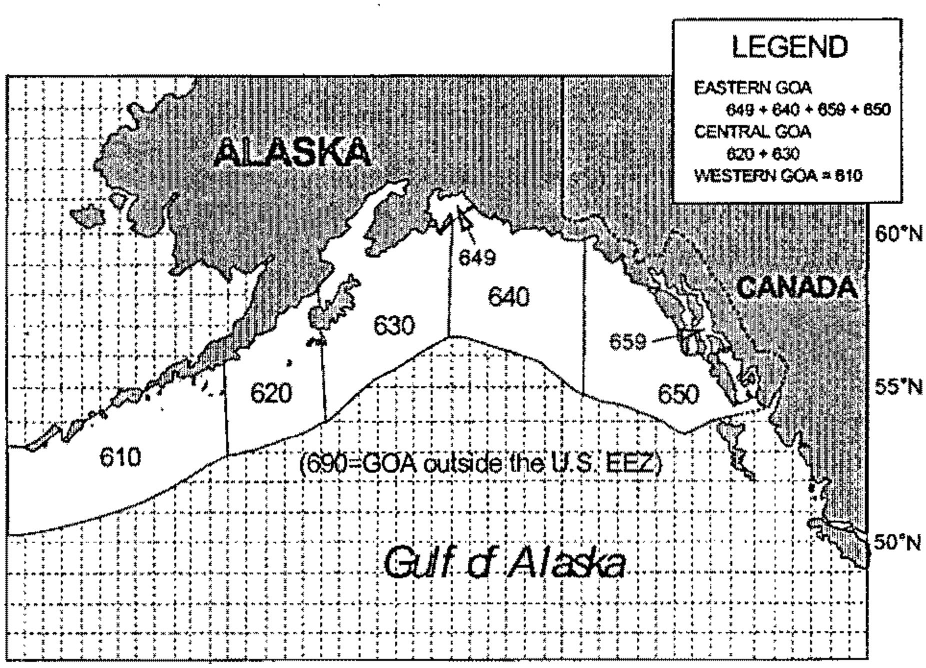

Figure 2-11 Regulatory and statistical/reporting areas in the Gulf of Alaska.

availability of pollock to Steller sea lions in those outer regions.

The RPA principles outlined in the Biological Opinion require that the catch be distributed according to the distribution of the stock. Those principles also recognize that in some cases, scientists and managers can not describe the distribution of the stock. However, annual hydroacoustic surveys of winter pollock biomass in Shelikof Strait provide a sufficient basis for distributing catch in this region during the winter season. The options for spatial dispersion of the pollock fishery in the GOA are based largely on the question of how this stock distribution is used to apportion catch.

Option 1: No Action

The first option is to take no action, so that management reverts to status quo when the emergency rule runs out on July 19, 1999. Status quo includes TAC apportionment among the statistical/reporting areas as done in previous years. This option is not consistent with the RPA principles as put forth in the Biological Opinion, as it fails to take advantage of the existing knowledge of pollock stock distribution in the GOA to distribute catch.

Option 2: Upper TAC cap in Shelikof Strait during the A season

The second option would define the Shelikof Strait area as consisting of previous reporting areas 621 and 631, and limit the portion of the catch that could be taken from the Shelikof Strait area. The limit or cap would be determined on the basis of hydroacoustic surveys and would apply to the A season only. The cap would not require that any of the catch come from the Shelikof Strait area, and all of the catch could potentially come from areas outside of Shelikof Strait. This option would not be consistent with the RPA principles of the Biological Opinion, as it fails to ensure that the catch would be distributed in accordance with the known distribution of the pollock stock during a period (the A season) when the stock distribution can be estimated on the basis of hydroacoustic surveys.

Option 3: Separate TAC in Shelikof Strait with proportionate reduction in TACs for areas outside of the Strait

The third option would establish Shelikof Strait as a reporting area (consisting of the combination of previous reporting areas 621 and 631) during the A season, and assign an A season TAC to this area based on hydroacoustic survey results. Results from the hydroacoustic surveys would be used to estimate pollock stock biomass in the Strait, that estimate would be divided by the estimated total biomass for the GOA (based on population modeling) and the quotient would be multiplied by the A season TAC to determine a Shelikof Strait TAC for the A season. This Shelikof Strait TAC would not be available to vessels outside of the Strait; that is, TAC assigned to, but not taken in, Shelikof Strait would be forfeited for the A season. For the A season, the remainder of the GOA TAC would be apportioned among areas outside of Shelikof Strait on the basis of the best available bottom trawl surveys. The Shelikof Strait area would be a reporting area for the A season only. During the remaining seasons, TAC would be apportioned among the reporting areas on the basis of the best available bottom trawl surveys.

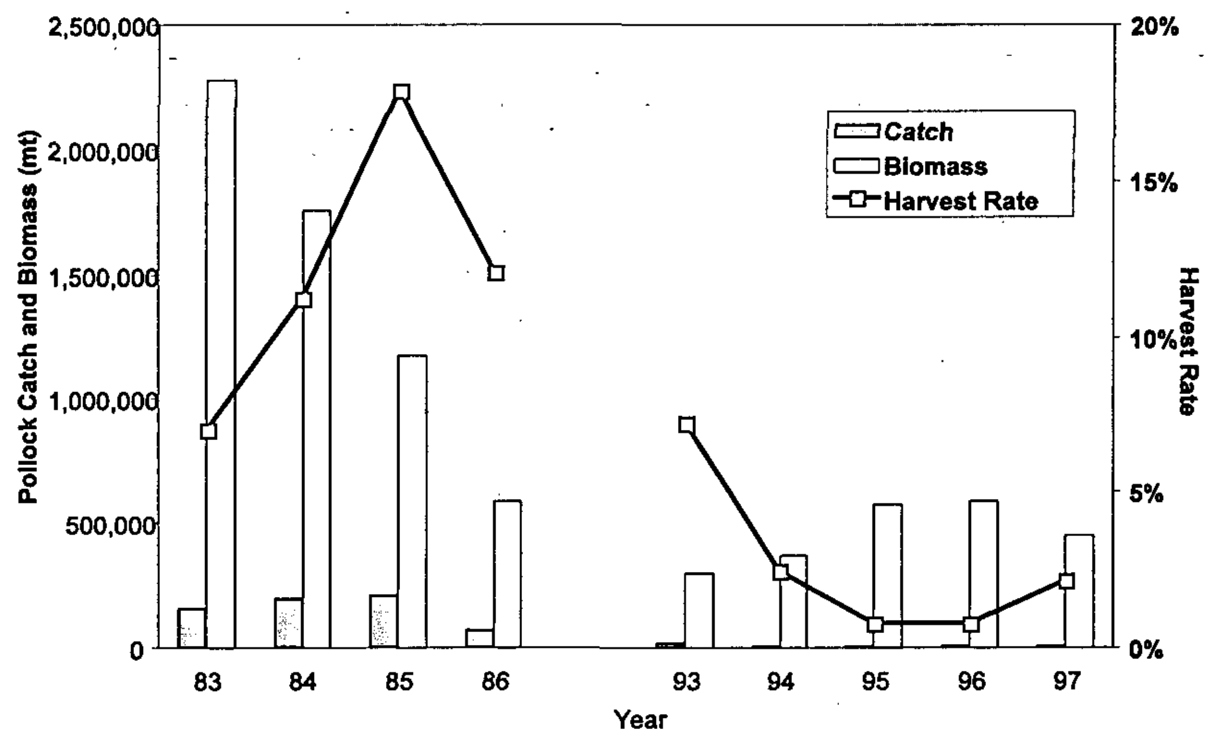

Figure 2-12 Estimated catch and biomass of pollock in Shelikof Strait in January-March of 1983-86 and 1993-97. Catch was estimated using observer and blend data. Biomass is from (hydroacoustic) echo-integration midwater trawl surveys of the spawning aggregation in Shelikof Strait. Harvest rate equal catch divided by biomass.

This option is consistent with the RPA principles of the Biological Opinion as it attempts to take advantage of the best available information on pollock stock distribution during the A season. By doing so, this option better distributes catch and may reduce or avoid potential detrimental effects in areas where excessive catch has been taken from relatively small portions of the whole GOA pollock stock.

2.7 Options for pollock no-trawl zones in the GOA

Option 1: No action. Under this option, no additional pollock no-trawl zones would be imposed in the GOA and the current no-trawl zones implemented under the January 20, 1999, emergency rule would cease to exist upon expiration of the emergency rule on July 19, 1999. However, existing no-trawl zone that were established prior to 1999 would continue unchanged. The no-action alternative will result in continued fishing operations adjacent to Steller sea lion rookeries and haulout sites used by large numbers of sea lions and will continue to remove important prey from areas used by them to forage. The no-action alternative will not meet the criteria of spatial separation of pollock trawl fishing from foraging areas, nor will it meet the criteria of moving fishing 10 nm from terrestrial sites used for resting and breeding. The no-action alternative will continue to degrade critical habitat and reduce the probability of recovery.

Option 2: Implement RPA proposed pollock trawl exclusion zones with eight exemptions. This option would make permanent the pollock trawl exclusion zones proposed by the Council in December

1998 and established in the emergency rule. For the emergency rule, the Council recommended no closures around Cape Barnabas, Gull Point, Rugged Island, Point Elrington, Cape Ikolik, the Needles, Mitrofania, and Sea Lion Rocks. The Biological Opinion stated that "some of the principles. . . may be accomplished by an incremental or phased approach if the incremental approach does not jeopardize the continued existence of the western population of Steller sea lions. The phase in of any reasonable and prudent alternative must not be drawn out, and two years is a general guideline with a significant portion occurring in year one." Consistent with the Biological Opinion, and based on the above criteria, NMFS decided to accept a 1 year phase-in period for these locations. In the January 22, 1999, emergency rule, NMFS did not to implement exclusion zones at these locations, but anticipates phasing-in 10 nm exclusion zones for 2000 and beyond absent an alternative recommendation by the Council that would provide equivalent protection for the sites in question.

The permanent exclusion of the eight sites in question from protection would be inconsistent with the RPA principles. These sites meet the criteria for inclusion of pollock no-trawl zones, are used by sufficient numbers of animals to be included, are adjacent to or nearby areas designated as critical habitat, and important commercial fisheries. As mentioned above, it is important to recognize the protection of habitat. As the population recovers and expands, its use of traditional and important feeding areas becomes increasingly vital. The eight sites proposed for exclusion are utilized by many animals (Table 2-8); more than 1,200 animals (almost 7% of the western stock) were counted there in the winter period which is likely a small portion of the animals using the site then.

Furthermore, effects of the Exxon Valdez oil spill in Prince William Sound (PWS) in 1989 may still be felt. Harbor seal and killer whale populations have not recovered from the aftermath of the spill. Although no effects to sea lions from the spill could be shown, probably because the population decline in the Gulf of Alaska overshadowed any effects from the spill, it is important to protect and conserve those areas used by endangered Steller sea lions for foraging, particularly those areas in the path of the spill. The Needles (inside PWS) and other of the eight sites along the Kenai Peninsula, were in the direct path of spilled oil; these habitats may not have completely recovered. The alteration or modification of those habitats through repetitive, intense removal of prey reduces the likelihood that those areas will be optimal for sea lion use. NMFS must insure that resources in those areas, especially those determined to be critical habitat, can sustain the growing needs of Steller sea lions as the population recovers.

Option 3: Pollock no-trawl zones recommended in Biological Opinion

Under this option, 10 nm closures would be placed around all GOA sites that meet the criteria established in the RPA principles including the eight sites currently exempt under the emergency rule. **This option is consistent with the RPA principles.**

Option 4: Adaptive management experiment

Under this option, some combination of closures and no closures would be devised to comprise an adaptive management experiment. The Council suggested that Cape Sarichef, Amak and other sites could be exempt from closure for study purposes. **This option would be inconsistent with the RPA principles.** However, NMFS concurs that adaptive management may be useful in identifying the optimal size and efficacy of the no-trawl zones. In fact, the NMFS is currently embarking on development of an experimental design to include the possible effects of Atka mackerel and pollock commercial fishing activities and Steller sea lions and to assess the optimal size and efficacy of the zones. These studies will begin as pilot studies in FY 1999/2000 with full studies anticipated in FY 2001, assuming adequate funds.

Table 2-8 Proposed Steller sea lion protection areas in the Gulf of Alaska.[1]

Management Area/Island/Site	Boundaries to[1]				Proposed pollock no-trawl zones meeting criteria in Biological Opinion (nm)		Existing no-trawl zones. Trawling prohibited within (nm)	
	Latitude	Longitude	Latitude	Longitude	Nov. 1 through April 31	May 1 through Oct. 31	Jan. 1 through April 15	Year-round
Bird	54 40.16 N	163 17.57 W			10	10		
South Rocks	54 18.14 N	162 41.52 W			10	10		
Clubbing Rocks	54 41.98 N	162 26.74 W	54 42.75 N	162 26.72 W	10	10		10
Pinnacle Rock	54 46.06 N	161 45.85 W			10	10		10
Sushilnoi Rocks	54 49.30 N	161 42.73 W				10		
Olga Rocks	55 00.45 N	161 29.81 W	54 59.09 N	161 30.89 W	10	10		
Jude	55 15.75 N	161 06.27 W			10	10		
Sea Lion Rocks (Shumagins)	55 04.64 N	160 31.04 W			10	10		
The Whaleback	55 16.82 N	160 05.04 W			10	10		
Chernabura	54 45.18 N	159 32.99 W	54 44.86 N	159 35.74 W	10	10		10
Castle Rock	55 16.47 N	159 29.76 W				10		
Atkins	55 03.50 N	159 18.50 W			10	10		10
Mitrofania	55 50.00 N	158 42.00 W			10	10		
Spitz	55 46.80 N	158 53.20 W				10		
Kak	56 17.30 N	157 50.10 W				10		
Lighthouse Rocks	55 46.79 N	157 24.89 W			10	10		
Sutwik	56 31.05 N	157 20.47 W	56 32.00 N	157 21.00 W		10		
Chowiet	56 00.54 N	156 41.42 W	56 00.30 N	156 41.60 W	10	10		10
Kodiak/Cape Ikolik	57 17.12 N	154 48.29 W			10			
Nagai Rocks	55 50.00 N	155 46.00 W			10	10		
Chirikof	55 46.50 N	155 39.50 W	55 46.44 N	155 43.46 W	10	10		10
Puale Bay	57 40.60 N	155 23.10 W			10	10		
Takli	58 01.75 N	154 31.25 W				10		
Cape Gull	58 11.50 N	154 09.60 W				10		

[1]Where two sets of coordinates are given, the baseline extends in a clock-wise direction from the first set of geographic coordinates along the shoreline at mean lower-low water to the second set of coordinates. Where only one set of coordinates is listed, that location is the base point.

Table 2-8 (cont) Proposed Steller sea lion protection areas in the Gulf of Alaska.

Management Area/Island/Site	Boundaries to[1]				Proposed pollock no-trawl zones meeting criteria in Biological Opinion (nm)		Existing no-trawl zones. Trawling prohibited within (nm)	
	Latitude	Longitude	Latitude	Longitude	Nov. 1 through April 31	May 1 through Oct. 31	Jan. 1 through April 15	Year-round
Sitkinak/Cape Sitkinak	56 34.30 N	153 50.96 W			10	10		
Kodiak/Cape Ugat	57 52.41 N	153 50.97 W			10	10		
Shakun Rock	58 32.80 N	153 41.50 W			10	10		
Twoheaded Island	56 54.50 N	153 32.75 W	56 53.90 N	153 33.75 W	10	10		
Cape Douglas (Shaw Island)	58 58.35 N	153 23.68 W				10		
Kodiak/Cape Barnabas	55 10.20 N	152 53.05 W			10	10		
Kodiak/Gull Point	55 21.45 N	152 36.30 W			10	10		
Latax Rocks	58 40.10 N	152 31.30 W			10	10		
Ushagat/SW	58 54.75 N	152 22.20 W				10		
Ugak	57 23.60 N	152 17.50 W	57 21.90 N	152 17.40 W		10		
Sea Otter Island	58 31.15 N	152 13.30 W			10	10		
Long	57 46.82 N	152 12.90 W			10			
Kodiak/Cape Chiniak	57 37.90 N	152 08.25 W			10	10		
Sugarloaf	58 53.25 N	152 02.40 W			10	10		10
Sea Lion Rocks (Marmot)	58 20.53 N	151 48.83 W			10	10		
Marmot	58 13.65 N	151 47.75 W	58 09.90 N	151 52.06 W	10	10		10
Perl	59 05.75 N	151 39.75 W			10	10		
Outer (Pye) Island	59 20.50 N	150 23.00 W	59 21.00 N	150 24.50 W	10	10		10
Steep Point	59 29.05 N	150 15.40 W				10		
Rugged Island	59 50.20 N	149 22.80 W			10			
Chiswell Islands	59 36.00 N	149 34.00 W			10	10		
Point Elrington	59 56.00 N	148 13.50 W			10	10		
The Needle	60 06.64 N	147 36.17 W			10	10		
Wooded Island (Fish)	59 52.90 N	147 20.65 W			10	10		
Glacier Island	60 51.20 N	147 08.80 W			10	10		
Seal Rocks	60 09.78 N	146 50.30 W			10	10		
Cape Hinchinbrook	60 14.00 N	146 38.50 W				10		
Hook Point	60 20.00 N	146 15.50 W				10		
Cape St. Elias	59 44.52 N	144 36.35 W			10	10		

[1]Where two sets of coordinates are given, the baseline extends in a clock-wise direction from the first set of geographic coordinates along the shoreline at mean lower-low water to the second set of coordinates. Where only one set of coordinates is listed, that location is the base point.

Table 2-9 Pollock landings in metric tons by year and month from ADF&G statistical areas that overlap the proposed 10 nm pollock no-trawl zones in the W/C GOA.

		Pollock landings by month in metric tons											
Haulout	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cape Ikolik	1988	29		333	5								
	1990	190		4									
ADF& G	1991	197						5					
statistical areas	1992	591		12			38	134					
545701, 545702,	1993		62	13									
545702	1995	17	81										
	1996	658		1	2			1	1	75	2	3	
	1997	1,355	979		2			11	4	407			
	1998	1,285	419				2	3		195	396		
Mitrofania	1991												
	1992			12									
ADF& G	1995						207	509					
statistical area	1996									72	112		
585531	1997	421	336				1,318			2,437			
	1998	502	763				1,472			3,865	157		
Rugged Island	1988												
	1990												
ADF& G	1992												
statistical area	1993												
495938	1995												
	1996	82											
	1997		299										
	1998	739	601										
Sea lion rocks	1988			1									17
	1989												
ADF& G	1991		89		3								
statistical areas	1992	16	42				102	372					
605503 and	1993		44				886	451			592		
605504	1995	11	455	27			369	32			403		
	1996	238					70			3,185			
	1997						305			2,195			
	1998				2		229			3,591			

Table 2-9 (cont). Pollock landings in metric tons by year and month from ADF&G statistical areas adjacent to proposed 10 nm pollock no-trawl zones in the W/C GOA.

		Pollock landings by month in metric tons											
Haulout	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Barnabas/	1988	518										96	
Gull Pt.	1989	43	122										
	1990	256								8	61		
ADF& G	1991	39	1,001				676	1,902		4	44		
statistical areas	1992						481	82	1				
525701, 525703,	1993						1,734	1,940			66		
525704, and	1995						112						
525705	1996		1					3					
	1997	69	9				1,084	3		5	12		
	1998			1			572	1		419			

Table 2-10 Prince William sound pollock landings in metric tons, from inside and outside proposed Pt. Elrington and Needles 10 nm haulout closures*

	Location				*Percent*
Year	*Pt. Elrington*	*The Needles*	*Outside*	*Total*	*Inside*
1995	1,845	550	480	2,875	83.3%
1996	1,482	0	1	1,482	100.0%
1997	1,561	3	51	1,615	96.8%
1998	1,474	122	226	1,822	87.6%
Total	6,362	675	758	7,794	90.3%

*Due to lack of observer and logbook data, precise haul location information is unavailable. As a proxy, landings from inside ADF&G Statistical Areas 486001, 45935 and 485932 were labeled as "inside Pt. Elrington" and landings from inside ADF&G Statistical area 476003 was labeled as "inside the Needles". All other Prince William Sound pollock landings were considered "outside" these two areas.

Additional options for no-trawl zones in the GOA

Industry representatives from the GOA have proposed a variety of additional options, short of complete closure, to control fishing effort within the eight proposed haulout zones currently exempted from closure under the emergency rule. These proposals include:

- reducing trip limit to 150,000 lbs for vessels fishing within 10 nm the eight haulout sites;
- limiting the size of trawl nets to a maximum footrope size of 400 ft for vessels fishing within 10 nm the eight haulout sites;
- establishing a horsepower limit (e.g., 600 hp) for vessels fishing within 10 nm the eight haulout sites;
- establishing a length limit (e.g., 60 ft LOA) for vessels fishing within 10 nm the eight haulout sites;

- establishing catch limits for the eight haulout sites in question when, once reached, these sites would be closed to directed fishing for pollock.

At present, NMFS cannot effectively evaluate the potential impacts to Steller sea lions that might result from such proposals because inadequate information exists on the spatial fishing patterns of the GOA pollock fleet. Under existing regulations, vessels under 60 ft LOA are exempt from observer coverage requirements and are exempt from the requirement to maintain a NMFS catcher vessel logbook. Consequently, NMFS does not have any data on the extent to which vessels under 60 ft LOA currently fish inside the eight sites in question. Furthermore, vessels between 60 ft LOA and 125 ft LOA are only required to carry an observer during 30% of their fishing days and the catcher vessel logbooks that such vessels are required to maintain are not available in electronic format. As a result, NMFS only has limited data on the extent of fishing effort that presently occurs within the sites in question.

Before any determination can be made as to the effectiveness of any of the previously listed industry proposals, an improved vessel monitoring program must be in place to enable NMFS to geographically track fishing effort by all sectors of the GOA pollock fleet. Such an improved monitoring program should include any or all of the following: (1) Increased observer coverage for GOA pollock vessels, (2) VMS requirements for GOA pollock vessels, and (3) increased recordkeeping and reporting requirements such as extending the catcher vessel logbook requirement to GOA pollock vessels under 60 ft LOA.

Specific options for Prince William Sound

At the April 1999 Council meeting, representatives from the Prince William Sound area described a possible proposal to the State of Alaska Board of Fisheries (Board) that would have the effect of more broadly distributing the pollock fishery within Prince William Sound and that would limit removals from the Pt. Elrington and Needles area to 40% of current levels. While the details of the proposal are somewhat unclear, and it has yet to be reviewed or adopted by the Board, this or similar proposals that would have the effect of significantly reducing removals in close proximity of haulouts and distributing effort more broadly are potentially consistent with the RPA principles. Because the Prince William Sound pollock fishery is managed by the State of Alaska, such measures would not be implemented at the Federal level as part of this regulatory package. However, if the State is actively pursuing management options to reduce removals in proximity to Prince William Sound Steller sea lion haulouts and distribute the pollock fishery within Prince William Sound over a larger area, then the two haulout sites in question could remain open on an interim basis for an additional year to provide the State with the opportunity to implement alternative management measures. If the State has not taken adequate action by 2000, then the Pt. Elrington and Needles haulout sites would be considered for closure in 2001.

2.8 Additional RPA elements: TAC rollovers

The ability to rollover uncaught TAC from one season to the next has been an issue of concern for the fishing industry. Traditionally, NMFS has adjusted for overages and underages of seasonal TAC allowances in both the BSAI and GOA pollock fisheries. Prior to 1999, only two seasons existed in the Bering Sea subarea and A season overages or underages were simply subtracted or added to the B season TAC allowance. In the W/C GOA, three or four seasons existed and overages or underages in one season were proportionately deducted from or added to the subsequent fishing seasons in the same fishing year. Such adjustments were generally made to account for management imprecision in closing open access fisheries.

Under the January 20, 1999, emergency rule, TAC rollovers have proven to be a larger issue in the Bering Sea subarea. This is so for two reasons. First, the number of separate TAC allowances in the Bering Sea subarea has at least quadrupled due to the increase from two to four season TAC allowances and separate seasonal harvest caps inside the CH/CVOA conservation zone. Second, industry has indicated interest in strategically timing fishing activity inside and outside the CH/CVOA conservation zone so that effort occurs in each area when fishing is most productive. Under the January 20, 1999, emergency rule, 50 CFR 679.20 (a)(5)(iii) provides that:

> *Within any fishing year, underage or overage of a seasonal allowance may be added to or subtracted from subsequent seasonal allowances in a manner to be determined by the Regional Administrator provided that overall pollock removals from all sectors during a fishing season do not exceed 30% of the combined annual TAC of pollock.*

While this language accommodates seasonal TAC rollovers within the RPA principle that no more than 30% of the annual TAC be taken during any single season, it does not specifically address the issue of rollover of uncaught portions of a sector's CH/CVOA catch limit. During the 1999 A season, NMFS has been forced to manage rollovers of uncaught CH/CVOA limits conservatively due to the short 5-day stand-down period between the A1 and A2 seasons and constraints in the ability of the agency to receive rapid catch reports from some sectors of the pollock fleet. During 1999, the inshore and catcher/processor A2 seasons began before all final catch reports from the A1 season were received. Consequently, NMFS was unable to determine within the short time available, whether uncaught TAC amounts were available for rollover. Improved electronic recordkeeping and reporting systems would facilitate quicker accounting of catch inside and outside the CH/CVOA conservation zone and decisionmaking about TAC rollovers. Additional information on possible improvements in catch accounting system is presented in section 6.

Under the RPA measures described in alternatives 2-5, two forms of overages and underages are possible. First, during a particular season, a sector may underharvest or overharvest its overall seasonal TAC allowance. Second, a sector may underharvest or overharvest a CH/CVOA catch limit.

TAC rollovers. With respect to underharvest or overharvest of a sector's overall seasonal TAC allowance due to management imprecision, routine adjustments in subsequent fishing seasons are possible under the RPA principles as long as the resulting "adjusted" seasonal allowances do not violate any of the RPA principles for temporal dispersion. For example, TAC rollovers from one season to the next are possible as long as such adjustments do not cause overall pollock removals from all sectors during a fishing season to exceed 30% of the annual pollock TAC and combined A1/A2 harvests do not exceed 45% of the annual TAC.

CH/CVOA rollovers. Under the emergency rule, NMFS views CH/CVOA catch limits to be caps and not separate TAC allowances. In other words, each sector receives a single TAC allowance per season of which no more than a specified percentage can be taken inside the CH/CVOA conservation zone. However, there is no limit on the percentage of a seasonal TAC allowance that can be taken outside the CH/CVOA should participants decide to deploy greater effort outside the CH/CVOA conservation zone than is strictly required. Consequently, if a sector reaches a seasonal TAC allowance without reaching its CH/CVOA limit there is nothing to rollover because the entire seasonal allowance has been taken. For this reason, rollover of CH/CVOA limits may be possible only when both the seasonal TAC allowance and the CH/CVOA limit have not been reached during a particular season. In such instances, any rollover of a CH/CVOA limit may be possible so long as such adjustments do not result in a violation of any of the principles for spatial and temporal dispersion. For example, with respect to the

A1/A2 seasons, rollover of CH/CVOA limits from A1 to A2 cannot result the combined CH/CVOA harvests by all sectors to exceed 50% of the combined annual TAC for the A1 and A2 seasons.

The following examples in Table 2-11 use the 1999 catcher/processor sector final TAC specifications for the A1 and A2 seasons illustrate how the above guidelines for rollovers could be applied in practice. Actual implementation of TAC rollovers for a specific sector under any of the alternatives is dependent on various factors such as the length of gap between season periods and the monitoring program in place.

Table 2-11 Hypothetical A1/A2 rollover scenarios for the catcher/processor sector using 1999 final specifications and CH/CVOA limits.

	A1 Season		A2 Season	
	TAC (27.5%)	CH/CVOA Limit (40% of TAC)	TAC (12.5%)	CH/CVOA Limit (40% of TAC)
Final 1999 TAC specifications	92,316	36,926	41,962	16,785
Example 1: TAC underharvested but CH/CVOA limit reached	actual harvest is 90,000 mt	actual harvest is 36,926 mt	2,316 mt is available for rollover to A2 season	no CH/CVOA cap is available for rollover to A2 season
Example 2: TAC harvested by CH/CVOA limit not reached	actual harvest is 92,316 mt	actual harvest is 30,000 mt	A1 season TAC was reached. No TAC is available for rollover to A2 season	Because overall A1 season TAC is reached, no TAC is available for rollover to the A2 season despite the fact that the A1 CH/CVOA limit was not reached.
Example 3: Both TAC and CH/CVOA limit are underharvested	actual harvest is 80,000 mt	actual harvest is 30,000 mt	12,316 mt is available for rollover to A2 season (provided that overall 30% cap is not reached)	6,926 is available for rollover to the A2 season (provided that overall 30% cap is not reached)
Example 4: TAC is overharvested but CH/CVOA limit is reached	actual harvest is 94,000 mt	actual harvest is 36,926 mt	entire TAC overage of 1,684 mt is deducted from A2 season TAC	no adjustment necessary
Example 5: TAC is reached by CH/CVOA limit is exceeded	actual harvest is 92,316 mt	actual harvest is 37,500 mt	no adjustment necessary	entire 574 mt CH/CVOA overage is deducted from A2 CH/CVOA limit
Example 6: Both the TAC and CH/CVOA limit are exceeded	actual harvest is 94,000 mt	actual harvest is 37,500	entire TAC overage of 1,684 mt is deducted from A2 season TAC	entire 574 mt CH/CVOA overage is deducted from A2

3.0 TEMPORAL AND SPATIAL DISTRIBUTION OF THE EBS POLLOCK FISHERY

Three areas were chosen for analysis of the historical distribution of the eastern Bering Sea pollock fishery: the combined southeast Bering Sea critical habitat foraging area and Catcher Vessel Operational Area (CH/CVOA), the area on the shelf east of 170°W outside of the CH/CVOA, and the area west of 170° northwest to the edge of the US EEZ (Figure 3-1). The CH/CVOA was chosen because of its significance with respect to Steller sea lion foraging. The 170°W meridian was chosen because it is the boundary between the old INPFC areas 51 and 52, and is retained as the boundary of many smaller NMFS fish management areas in use today. Consequently, if used for spatial dispersion of pollock TAC, the area west of 170°W is already used for catch reporting; accounting for catch east of 170°W between areas inside and outside of the CH/CVOA may require the development of new in-season management and catch reporting methods.

The following figures should be referred to in the discussion of the spatial distribution of the EBS pollock fishery from 1982-98. Estimated catches of pollock in each of the three areas by foreign, joint-venture, and domestic fisheries from 1982-98 are shown in Figures 3-2 through 3-4. Estimates of daily catches from each of the three areas in 1982, and 1996-98 are shown in Figures 3-5 through 3-8. Haul locations of the EBS pollock fishery in 1982, 1984, and 1996-98 are shown in Figures 3-9 through 3-13. The discussion of the spatial-temporal distribution of the pollock fishery as it existed prior to the January 22, 1999, Emergency Rule and AFA will be followed by a similar analysis of the 1999 A season fishery in the EBS after both went into effect.

The years 1982-98 were chosen for this analysis because of the relatively consistent level of observer coverage on fishing vessels during this time. Furthermore, these years also represent a consistent time series of summer bottom trawl survey methodology for the purposes of comparing the distributions of summer stock biomass and catch. Catches from the Bogoslof region (management area 518) were excluded from all years. This region has been closed to directed pollock fishing since 1992 as a conservation measure for the central Bering Sea pollock stock. Significant landings from the Bogoslof area occurred only from 1987-91. Previous analyses of pollock catch distribution (Fritz and Ferrero 1998) revealed that the amount of pollock removed from Steller sea lion critical habitat in the BSAI region increased almost three-fold between 1982-1995: about 300,000 mt (about 30% of the total BSAI pollock catch) was caught in critical habitat in 1982, while over 850,000 mt (about 60-70% of the total BSAI pollock catch) was caught in 1994-95. Catches from critical habitat have since decreased to about 600,000 mt in 1997 (about 55% of the catch). The temporal distribution of the catch from 1982-98 also changed from a fishery spread throughout much of the year, but with most of the landings occurring in summer-early fall, to two separate fisheries - an A season in January-February and a B season in September-October. The percent of total observed groundfish catches (by gear and species) within 10, 20, 40, and 60 nm of Steller sea lion terrestrial sites (rookeries and haulouts) used in the designation of critical habitat from 1977-97 are shown in Appendix F. Also in Appendix F are the percent of total observed trawl groundfish catches from 1977-97 within the trawl exclusion zones established around rookeries in 1991-93.

3.1 Foreign fishery 1982-85

Foreign fisheries caught the majority of the pollock landed from the Eastern Bering Sea in 1982-85. Catches from the CH/CVOA occurred primarily in August-November (Figure 3-2) and never exceeded 83,000 mt during any single month (Table 3-1). During these four years, the largest January-June catches from the CH/CVOA totaled only 51,000 mt (in 1983; Table 3-1). During this time, foreign trawlers were prohibited from fishing in much of the CH/CVOA during winter to avoid conflicts with the crab fishery. Of the three areas considered, the CH/CVOA accounted for the smallest percentage of the catch in three of the four years, ranging only from 13-27%. The remaining 2 areas had catch percentages ranging between 25-50% each year. In the area east of 170°W, catches in 1982-83 occurred mainly in June-September, but a March and April fishery appeared in 1984-85 in this area. The highest monthly total from 1982-85 from east of 170°W was 122,300 mt in July 1982 (Figure 3-3; Table 3-1). In the area west of 170°W, significant catches were landed in almost every month in 1982-85 (Figure 3-4; Table 3-1). There was a winter-early spring (January-April) fishery in 1982-84; significantly, two of these years (1983-84) were relatively cold and had considerable ice coverage in February-April north of Zhenchug Canyon (Appendix D). The ice-free area in these two years west of 170°W was directly west of the Pribilof Islands (Appendix D). In both 1984 and 1985, most of the pollock landings from west of 170°W were in summer (June-October), and never exceeded 143,800 mt/month (in September 1984; Figure 3-4).

Daily pollock catches in each of the three areas for 1982 are shown in Figure 3-5. From 1982-85, 1982 was the year with the highest percentage (27%) and total removals (255,430 mt) from the CH/CVOA. Daily catches rarely exceeded 5,000 mt in any of the three areas, and were generally much lower than that in the CH/CVOA.

Observed pollock fishery trawl locations for 1982 and 1984 are shown in Figures 3-9 and 3-10. In the area west of 170°W, the trawl locations along and deeper than the 200 m isobath represent primarily, but not exclusively, the winter and early spring fishery; those on the shelf in 1984 (Figure 3-10) were mostly from the summer and early fall fishery that occurred in that area, but the deeper, off-shelf areas were also fished at this time.

3.2 Joint-venture fishery 1986-88

Joint ventures between American catcher boats and foreign processing vessels caught the majority of the pollock landed from the EBS in 1986-88. In the CH/CVOA, the fishery was changing to become increasingly a winter fishery (Figure 3-2). Peak months per year were in March 1986, February 1987, January 1988, and again in December 1988 from the CH/CVOA. The highest monthly total listed for the CH/CVOA in 1986-88 in Table 3-1 is 411,600 mt in December 1988, and is most likely an over-estimate of the true monthly landings due to poor rates of observer coverage at this time. Other than this month, the highest monthly landing from the CH/CVOA was 123,500 mt, an increase of 40,000 mt from the 1982-85 period. Annual landings from the CH/CVOA also increased during this period, ranging from 308,000 mt in 1987 to possibly as high as 796,000 mt in 1988 (this latter figure is likely an over estimate since it includes the likely over-estimated catch from December 1988). Landings during January-June from the CH/CVOA increased to over 280,000 mt in 1988, an over 5-fold increase from the peak year in 1982-85. CH/CVOA pollock landings accounted for 31% of the annual EBS pollock catch in 1986-87, an increase from the 1982-85 period, and may have increased again in 1988.

The development of a 2-season fishery was evident in the area east of 170°W (Figure 3-3), where landings occurred primarily in February-June, and again in fall. West of 170°, pollock landings occurred predominately in summer in 1986, but in spring (April-May) in 1987-88 (Figure 3-4). Each of these three years were relatively warm. There were large ice-free areas of the shelf through the winter-springs of 1986 and 1987, and less in 1988; ice did not cover any of the CH/CVOA during any of these years (Appendix D).

3.3 Domestic fishery 1989-98

The domestic fishing industry landed the majority of the pollock from the EBS beginning in 1989, and the last joint-venture pollock landings occurred in 1990. The A and B season temporal structure of the pollock fishery was introduced in 1990. In 1990, significant (> 10,000 mt/month) landings of pollock were made from January-October from the CH/CVOA, but no month exceeded 60,000 mt. In the area east of 170°W in 1990, most of the fishery occurred in February-May, while west of 170°W, most of the fishery occurred from May-October. The peak month in 1990 outside of the CH/CVOA was September west of 170°W (145,700 mt).

Landings became increasingly concentrated in January-February (A season) and August-October (B season) in all 3 areas beginning in 1991(Table 3-1; Figures 3-2 through 3-4). In the CH/CVOA, the highest A season monthly landing was almost 400,000 mt (in February 1995), while the highest B season month was 220,000 mt in September 1993. The area west of 170°W was fished in January-February (with as much as 75,000 mt/month) as recently as 1992-93, but has not been utilized by the fishery during the A season since 1993. In 1994-98, almost all of the landings from west of 170°W have been concentrated in 1-2 months in the B season, with as much as 283,000 mt landed in a single month (September 1997).

The proportion of EBS pollock catch landed in the CH/CVOA increased from about 30+% in 1986-88 to between 25-69% in 1989-98; in 6 of these 10 years, more than 50% of the annual catch came from the CH/CVOA. The remaining two areas provided between 9-48% of the catch each year, but 10 of the 20 area/year percentages were 20% or less.

Daily production from the 3 areas in 1996-98 are shown in Figures 3-6 through 3-8. A season daily catches from the CH/CVOA commonly exceeded 10,000 mt/day and were greater than 15,000 mt/day on many occasions. The level of daily removals in the winter/spring increased considerably from the foreign fishery period. This spawning assemblage was hardly fished prior to 1986 (average yearly January-June catches from 1982-85 were only 23,000 mt). From 1986-1990, average January-June pollock catches increased almost 9-fold, to 202,000 mt, but did not exceed 280,000 mt in any one year. From 1991-1998, average January-June pollock catches almost doubled the 1986-90 average, increasing to 390,000 mt, with a single-year peak of 559,000 mt in 1995 (Table 3-1).

Daily production in the B season from the CH/CVOA has varied considerably from 1996-98. In 1996, daily rates were nearly all above 5,000 mt/day in September and October. However, in 1997 and 1998, there was considerably more variability in daily production, with peak rates of about 6,000 mt/day sustained for only 1-3 days in a row, followed by extended periods when less than 2,500 mt were landed each day. B season use of the areas outside the CH/CVOA has also varied considerably between years, as evidenced in Figures 3-6 through 3-8, and in the plots of haul locations in Figures 3-11 through 3-13.

3.4 1999 Bering Sea A seasons

Three factors changed between 1998 and 1999 that contributed to changes in the magnitude as well as the temporal and spatial distribution of the pollock fishery. These changes must be kept in mind when considering changes to the fisheries' distributions that occurred between the two years. First, the EBS pollock TAC was reduced by 118,000 mt (11%), from 1,110,000 mt to 992,000 mt. Second, the Steller sea lion emergency rule imposed temporal and spatial allocations on the fishery in hopes of dispersing the fishery and reducing removals from the CH/CVOA (or critical habitat). Specifically, the TAC allocated to the A season was reduced from 45% to 40% of the annual TAC (a reduction in A season magnitude), the A season for the inshore and catcher/processor sectors was split into A1 and A2 seasons beginning January 20 and February 20 (with a 5-day stand-down from February 15-20), and no more than 62.5% of the A season(s) TAC could come from the CH/CVOA. In the ER, each industry sector was assigned a maximum percentage of its TAC that could come from the CH/CVOA. Third, the AFA became law in 1999, and changed the pollock allocations between industry sectors. With regard to the temporal and spatial distribution of the fishery, an important component of the AFA was the granting to the catcher/processor sector the ability to form a co-operative. The ability to rationally divide their allocation among the members of the cooperative could reduce the "race for fish" in the offshore sector that has characterized the recent domestic fishery.

Table 3-2 summarizes the pollock TAC allocations between sectors, seasons, and areas for 1999 A seasons, as well as the preliminary estimates of catch. Estimates of the daily pollock catches by sector inside and outside the CH/CVOA are shown in Figure 3-14. Catch estimates in Table 3-2 and Figure 3-14 are based on preliminary in-season observer data. Because of the 100% observer coverage in the catcher/processor and CDQ sectors, and the observer's attempts to sample each haul, the observer data for these sectors are reported directly; the observer estimate was treated as the estimate of total catch. For the mothership sector, the observer estimates were scaled to the mothership sector's TAC; the rate of observer coverage for the mothership sector was 78% (observed pollock catch/TAC). For the inshore sector, the observer estimates were scaled to the blend estimate of total sector catch through March 6, 1999 as posted on the NMFS Alaska Region home page (www.fakr.noaa.gov); the rate of observer coverage for the inshore sector was 61% (observed pollock catch/blend catch). Observed pollock fishery trawl locations by all sectors are shown in Figure 3-15.

The mothership sector (allocated 10% of the non-CDQ TAC) had a single A season with 40% of its TAC, and could take no more than 50% of its allocation inside the CH/CVOA. The mothership A season began on February 1, 1999, the CH/CVOA was closed to motherships on February 9, 1999, and their A season outside of CH/CVOA ended on February 17, 1999. Based on preliminary in-season observer data, the mothership sector fished entirely within the CH/CVOA through February 8 and caught about 700 mt more inside the CH/CVOA than allocated. Motherships fished entirely outside the CH/CVOA from February 10-17, and came within approximately 2% of their projected 50%:50% inside:outside CH/CVOA split. Daily production by the mothership sector was similar inside and outside the CH/CVOA, averaging 2,127 mt/day inside the CH/CVOA (peak of 2,668 mt/day) and 2,006 mt/day outside the CH/CVOA (peak of 2,543 mt/day). These daily production estimates are slightly greater than the 1,900 mt/day estimated in December 1998 for the mothership sector in the 1999 A season.

All of the A season CDQ allocation could have come from inside the CH/CVOA, but the preliminary data suggest that only about 67% of it did (Table 3-2). This resulted in approximately 16,000 mt less pollock caught within the CH/CVOA than permitted by this sector. Some of the CDQ allocation was also fished while the non-CDQ fisheries were still open, a pattern different from previous years. During the A1 and A2 seasons for the inshore and offshore sectors, about 32,000 mt, or 72% of the A season CDQ pollock TAC was caught; only about 9,400 mt was caught during the 5-day stand-down between the seasons. This is most likely a result of the cooperative formed by the offshore fleet, some of whom fish much of the CDQ allocation. As of this analysis (through 3/19/99), there was still approximately 1,800 mt of A season CDQ pollock remaining to be harvested.

The catcher/processor and inshore sectors each had their A seasons divided into A1 and A2 seasons in 1999. (The catcher/processor sector was allocated 40% of the non-CDQ TAC, while the inshore sector was allocated 50% of the non-CDQ TAC.) The A1 season for both sectors began on January 20, and ended on February 15. There was a 5-day stand-down imposed on both sectors between the A1 and A2 seasons; the latter started on February 20. Both sectors were allocated 27.5% of their TAC in the A1 and 12.5% in the A2 seasons. Furthermore, the catcher/processor sector could take a maximum of 40% of each A1 and A2 season TAC inside the CH/CVOA, while the inshore sector could take 70% (Table 3-2).

The catcher/processor sector began the A1 season by fishing inside the CH/CVOA on January 20, but a portion of the fleet began working outside the CH/CVOA on January 28, prior to reaching their inside CH/CVOA A1 maximum. Portions of the fleet continued to fish both inside and outside until the end of A1. By February 15, the catcher/processor sector had caught 96% of its inside CH/CVOA allotment, but less than half its outside CH/CVOA portion, which was rolled over into the outside CH/CVOA A2 season. In the A2 season, the catcher/processor fleet worked primarily outside the CH/CVOA, where it caught 83% its A2 total of 73,000 mt. Portions of the catcher/processor fleet fished inside the CH/CVOA during the A2 only from about February 20-28, after which the majority of the fleet that was fishing was outside the CH/CVOA. In the A1 season, catcher/processor sector daily production averaged about 1,300 mt/day (max. of about 3,000 mt/day) inside the CH/CVOA by 16 vessels that had more than 10 observed sampled hauls; outside the CH/CVOA in the A1, the average was 1,000 mt/day (max. of about 2,400 mt/day) by 12 vessels with more than 10 sampled hauls (Figure 3-14). Daily production outside in the A2 peaked at about 4,600 mt/day on March 3 with 15 vessels fishing, and declined through March 18. The A1 daily production figures were considerably lower than the maximums of 8,500 and 4,500 mt/day estimated in December 1998 for the catcher/processor sector inside and outside the CH/CVOA, respectively. Because of this, the catcher/processor sector's A season was over twice as long as projected in December 1998 with lower daily removals from the CH/CVOA. Furthermore, the catcher/processor sector caught about 6,500 mt less pollock inside the CH/CVOA than they were permitted under the ER, resulting in a 36%:64% inside:outside CH/CVOA split. As of March 19, 1999, the catcher/processor sector had caught 99% of its A1 and A2 season TACs.

The inshore sector began by fishing inside the CH/CVOA on January 20, and the observed portion of the fleet did not fish outside until the CH/CVOA was closed to them by NMFS for the remainder of the A1 season on February 11. Average inshore daily catch rates inside the CH/CVOA (4,500 mt/day) exceeded the maximum estimates (4,200 mt/day) made in December 1998. Consequently, the CH/CVOA was not closed to the inshore sector soon enough, resulting in approximately 21,000 mt more pollock being caught inside the CH/CVOA than the inshore sector was allocated in the A1. The resulting inside:outside CH/CVOA split for the inshore sector in A1 was 82%:18%. This overage inside in A1 was to be subtracted from the A2 CH/CVOA inshore allocation, resulting in a new A2 inside CH/CVOA allocation for the inshore sector of 16,514 mt. During A2, the inshore sector took approximately 23,300 mt inside the CH/CVOA prior to its closure on February 24. The entire A2 season for the inshore sector was closed on February 28. Consequently, for the both A seasons, the inshore sector caught about 6,800 mt more inside the CH/CVOA than it was allocated, resulting in a 74%:26% inside:outside CH/CVOA split. This overage by the inshore sector was approximately balanced by the underage by the catcher/processor sector inside the CH/CVOA. Overall, the inshore sector caught 99% of its A season TAC. Average daily catch rates by the inshore fleet were similar inside and outside the CH/CVOA in both the A1 and A2 seasons (A1: 4,500 mt/day inside, 4,400 mt/day outside; A2: 4,700 mt/day inside, 4,500 mt/day outside). Estimated maximum daily catch rates were approximately 8,000 mt/day both inside and outside the CH/CVOA.

For all sectors combined, the target of a maximum of 62.5% of the A season pollock catch from the CH/CVOA was achieved; preliminary estimates suggest that 58% of the catch was from the CH/CVOA. Approximately 15,000 mt that was projected to come from the CH/CVOA was harvested outside; this was largely due to the spatial distribution of the CDQ catch. It is estimated that all sectors combined caught over 99% of the TAC allocated to the A seasons.

The pollock length distributions from fisheries inside and outside the CH/CVOA were similar (Figure 3-16), although pollock caught inside were slightly larger. Pollock caught inside the CH/CVOA had a modal length 1 cm larger than those outside the CH/CVOA, and there was a slightly greater percentage of fish smaller than 40 cm outside than inside. Mean length of the "inside" fish measured was 45.7 cm, while the "outside" fish averaged 43.9 cm in length.

Table 3-1 Estimated pollock catches by foreign, joint-venture, and domestic fishing vessels in the CH/CVOA, and two areas outside the CH/CVOA in the eastern Bering Sea (east and west of 170°W) by month from 1982-98. Catches from the Aleutian Islands and the Bogoslof area (518) are excluded in all years.

Area	Month	1982	1983	1984	1985	1986	1987	1988	1989
CH/CVOA	Jan	0	0	14	11	0	35,804	117,387	60,309
	Feb	0	201	142	183	24,523	123,469	68,261	3,218
	Mar	0	0	479	2,601	97,844	64,969	42,947	29,331
	Apr	5,013	21,875	1,090	233	55,851	17,520	36,798	32,589
	May	8,364	10,398	48	184	7,474	7,664	11,162	0
	Jun	10,664	18,346	9,401	1,847	5,129	54	4,261	17,475
	Jul	20,743	23,097	10,148	3,461	38,309	218	0	16,025
	Aug	43,012	23,550	13,399	15,997	18,277	214	0	21,905
	Sep	67,196	40,278	25,458	11,297	25,936	4,518	55,129	68,920
	Oct	82,845	69,981	33,114	41,042	51,538	53,992	41,929	127,885
	Nov	15,210	24,622	48,031	77,519	31,735	0	6,822	118,356
	Dec	2,378	404	500	0	6,678	0	411,574	65,442
	TOTAL	255,426	232,752	141,825	154,376	363,293	308,422	796,271	561,456
E of 170°W outside of the CH/CVOA	Jan	923	126	952	4,109	0	0	10,518	727
	Feb	279	43	542	1,818	0	3,441	34,606	7,791
	Mar	782	1,200	28,838	46,598	81,817	67,848	21,340	14,728
	Apr	7,100	5,611	43,031	60,602	25,941	30,824	45,551	16,994
	May	25,745	18,736	9,020	3,727	14,969	63,481	12,610	44,093
	Jun	55,602	70,006	39,519	26,869	57,065	14,721	2,986	325
	Jul	122,291	120,278	43,020	108,550	51,983	174	1,280	0
	Aug	106,549	114,384	43,081	105,982	20,527	0	0	1,850
	Sep	81,559	80,731	28,343	51,944	19,124	9,247	3,452	46,681
	Oct	48,812	23,304	7,852	19,116	5,194	104,695	6,885	1,845
	Nov	3,956	1,314	13,932	15,183	1,360	56,201	0	26,352
	Dec	4,853	18,926	42,720	5,514	724	0	57	709
	TOTAL	458,451	454,659	300,850	450,012	278,704	350,632	139,284	162,095
W of 170°W	Jan	21,736	6,155	8,959	4,745	2	40	0	0
	Feb	47,992	32,228	21,858	4,359	183	245	0	0
	Mar	33,973	30,969	20,574	11,711	4,606	39,350	0	2,049
	Apr	17,594	27,938	2,587	1,082	24,854	149,742	66,658	44,759
	May	8,825	6,477	6,866	3,698	41	96,751	180,985	54,324
	Jun	12,689	33,558	65,981	34,757	15,661	20,020	598	70,839
	Jul	19,094	71,887	140,781	102,242	138,456	1,749	412	53,967
	Aug	485	23,956	114,728	133,713	233,273	318	26	68,206
	Sep	3,597	19,451	143,827	100,802	100,802	8,278	1,538	119,257
	Oct	16,642	17,762	53,128	77,610	13,516	7,152	3,873	75,970
	Nov	28,609	16,798	25,179	18,711	10,516	821	0	9,472
	Dec	30,816	6,765	44,852	41,780	5,085	573	0	0
	TOTAL	242,052	293,946	649,322	535,211	546,996	325,039	254,090	498,844

Table 3-1 (continued).

Area	Month	1990	1991	1992	1993	1994	1995	1996	1997	1998
CH/CVOA	Jan	12,157	133,911	96,077	54,276	149,416	132,691	115,633	125,328	107,707
	Feb	20,749	132,492	130,222	145,254	319,049	393,432	165,579	235,127	323,099
	Mar	52,077	3,196	25,085	84,750	47,048	27,969	22,494	11,330	10,295
	Apr	28,137	6,204	1,208	5,991	9,423	2,018	2,875	1,487	74
	May	12,089	1,141	330	55	607	1,652	266	100	51
	Jun	22,059	70,495	10,593	1,274	10,772	1,468	4,969	0	0
	Jul	29,600	34,516	33,248	5,938	9,878	5,708	7,119	812	2,848
	Aug	60,326	91,474	96,338	100,053	145,603	122,315	16,514	35,308	25,133
	Sep	47,453	11,093	72,584	220,604	159,540	154,243	194,451	120,292	81,145
	Oct	20,184	0	0	31,122	11,839	26,838	105,204	70,591	85,147
	Nov	330	0	3	8,721	6,716	4,170	6,576	0	6,584
	Dec	23	0	105,011	10,187	1,180	0	0	0	0
	TOTAL	305,182	484,521	570,698	668,225	871,072	872,505	641,678	600,373	642,082
E of 170°W outside of CH/CVOA	Jan	1,949	1,153	26,156	25,701	3,583	1,270	735	9,424	9,702
	Feb	15,983	2,684	128,519	113,742	8,063	25,516	189,437	95,157	39,180
	Mar	80,841	576	14,966	34,703	9,181	2,417	12,582	12,454	11,936
	Apr	91,577	2,772	122	175	199	272	128	12	30
	May	22,049	356	51	19	60	0	18	26	0
	Jun	1,853	48,222	13,942	546	4	0	23	45	168
	Jul	2,546	52,693	11,275	6,904	2,527	483	198	580	267
	Aug	2,003	4,076	177	44,231	27,675	111,063	3,473	1,756	817
	Sep	1,608	963	795	182,073	178,628	139,766	120,708	16,317	85,764
	Oct	146	173	375	1,203	14,439	12,575	61,240	319	132,323
	Nov	87	0	38	12	107	0	0	25	138
	Dec	0	0	2,156	1,650	10,777	0	0	0	0
	TOTAL	220,642	113,668	198,572	410,959	255,243	293,363	388,542	136,116	280,326
W of 170°W	Jan	0	0	0	31,552	338	11	0	0	256
	Feb	0	51	74,774	50,608	1,411	45	0	0	0
	Mar	12,191	1,188	29,649	8,220	3,533	852	282	138	398
	Apr	22,565	5,924	1,660	1,437	30	309	257	3	4
	May	90,111	332	28	42	0	0	0	56	0
	Jun	106,163	105,465	184,343	4	0	0	0	274	0
	Jul	123,797	200,282	270,481	1,366	3,207	23	0	73	0
	Aug	128,508	223,160	46	115,011	133,944	53,255	2,331	2,042	1,824
	Sep	145,710	24,664	0	4,242	32,454	42,722	60,771	283,035	136,652
	Oct	52,508	0	0	160	10	0	40,821	32,111	13
	Nov	15	0	0	0	0	0	0	0	0
	Dec	17	0	14,584	23,025	4,305	0	0	0	0
	TOTAL	681,586	561,065	575,565	235,669	179,231	97,217	104,462	317,731	139,147

Table 3-2 Preliminary 1999 pollock catches and TACs by industry sector inside and outside the CH/CVOA in the A1, A2, and entire A seasons.

Sector	Season	Area	TAC	Catch	Difference	Max.%	Actual %
Motherships	A	CH/CVOA	17,142	17,828	686	50%	52%
		Outside CH/CVOA	17,142	16,456	(686)		48%
		TOTAL	34,284	34,284	0		
CDQ	A	CH/CVOA	44,640	28,844	(15,796)	100%	67%
		Outside CH/CVOA		13,984	13,984		33%
		TOTAL	44,640	42,829	(1,811)		
Catcher/ Processors	A1	CH/CVOA	37,712	36,202	(1,510)	40%	
		Outside CH/CVOA	56,568	27,024	(29,544)		
		TOTAL	94,280	63,225	(31,054)		
	A2	CH/CVOA	17,142	12,177	(4,964)	40%	17%
		Outside CH/CVOA	25,713	60,822	35,110		83%
		TOTAL	42,854	73,000	30,145		
	A	CH/CVOA	54,854	48,379	(6,474)	40%	36%
		Outside CH/CVOA	82,280	87,846	5,565		64%
		TOTAL	137,134	136,225	(909)		
Inshore	A1	CH/CVOA	82,495	103,479	20,984	70%	82%
		Outside CH/CVOA	35,355	22,407	(12,948)		18%
		TOTAL	117,850	125,886	8,036		
	A2	CH/CVOA	37,498	23,273	(14,224)	70%	
		Outside CH/CVOA	16,070	21,931	5,861		
		TOTAL	53,568	45,205	(8,363)		
	A	CH/CVOA	119,992	126,752	6,760	70%	74%
		Outside CH/CVOA	51,425	44,338	(7,087)		26%
		TOTAL	171,418	171,090	(327)		
All	A	CH/CVOA	236,628	221,804	(14,824)	61%	58%
		Outside CH/CVOA	150,847	162,624	11,776		42%
		TOTAL	387,475	384,428	(3,047)		

Figure 3-1 Areas of the eastern Bering Sea used for spatial analysis of pollock catch and survey data.

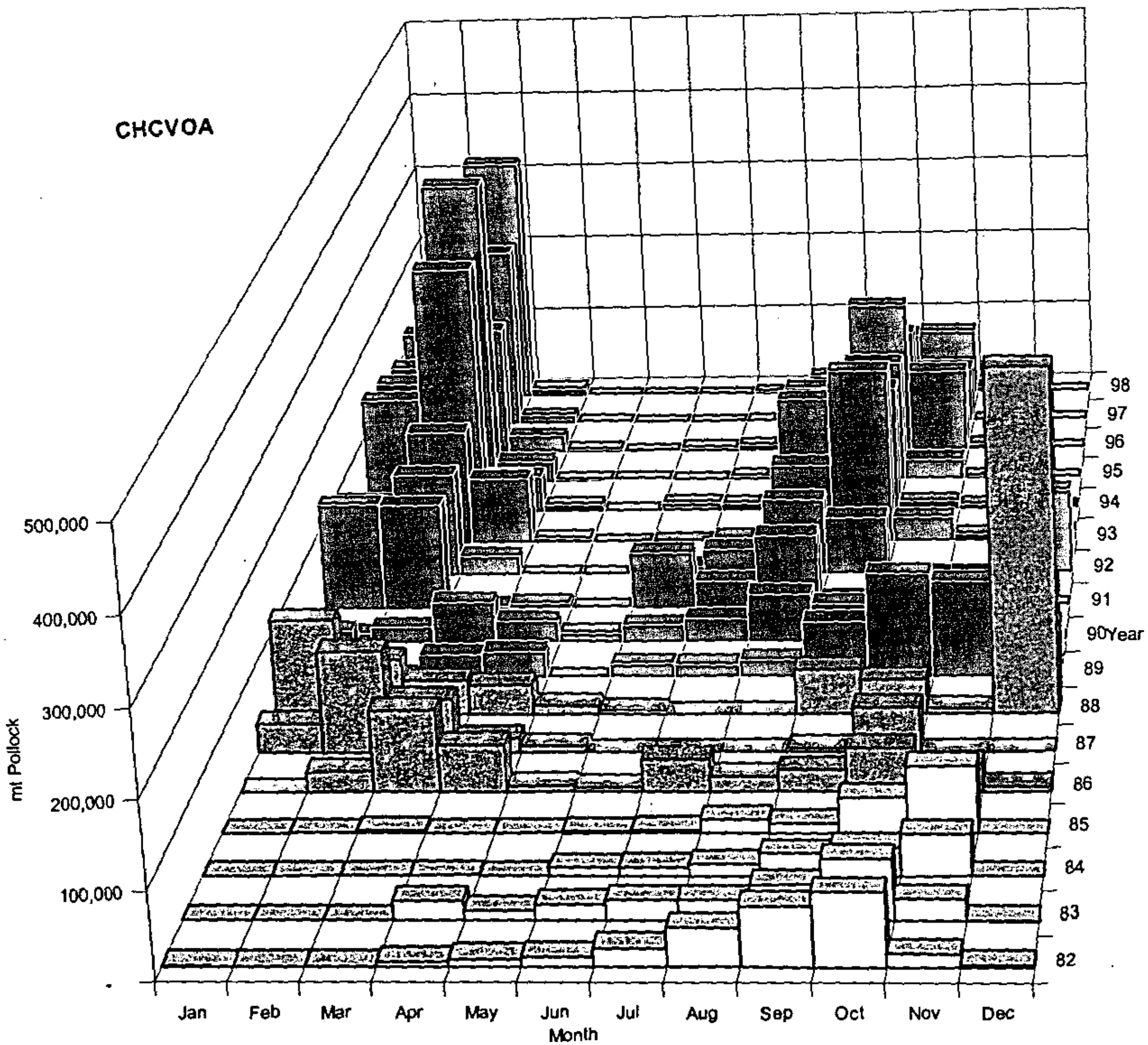

Figure 3-2 Pollock catch (mt) in the CH/CVOA by month from 1982-98. Shading of years is based on dominant fishery sector at the time: 1982-85: foreign; 1986-88: joint-venture; 1989-98: domestic. Bogoslof area catches are excluded from all years.

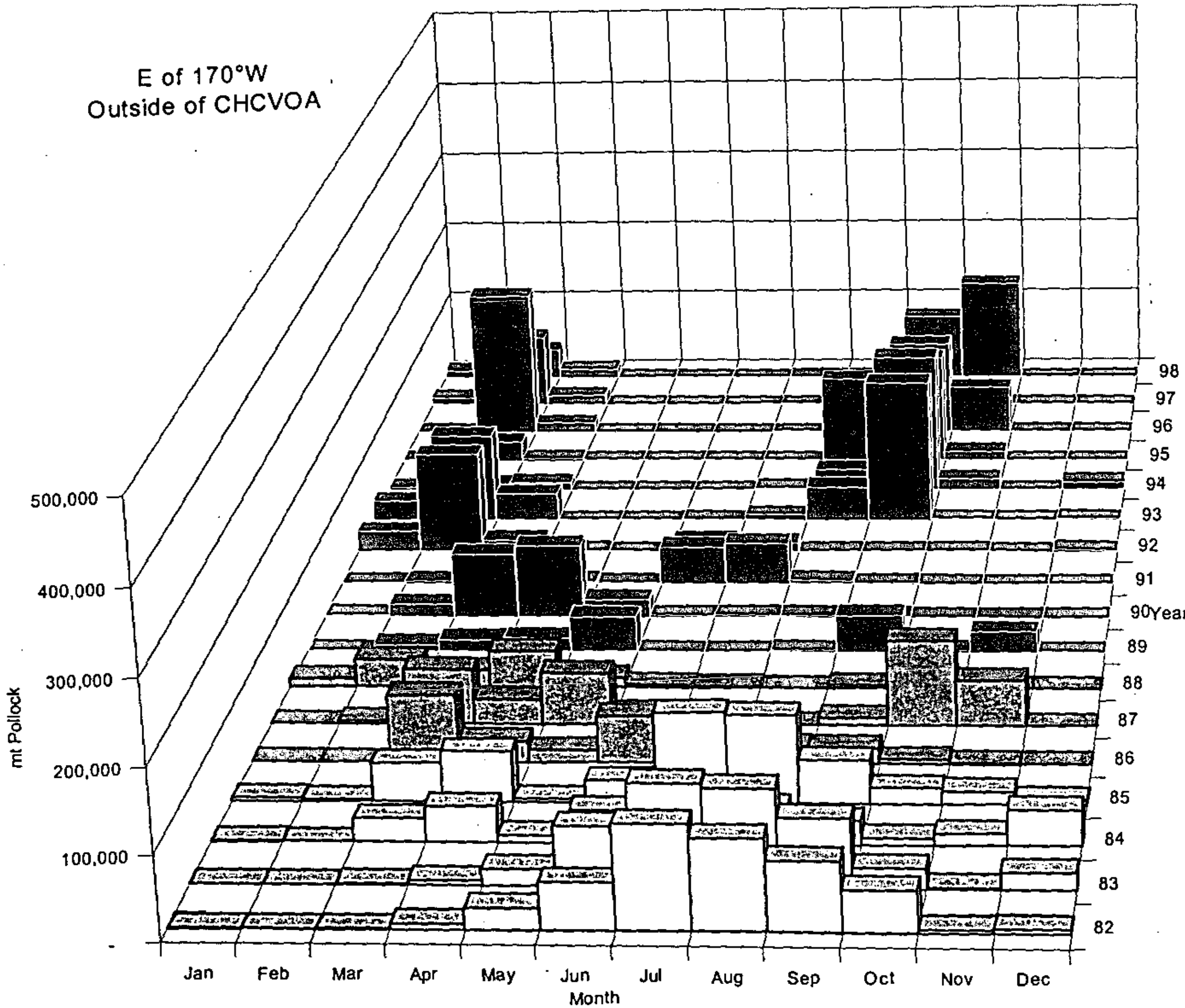

Figure 3-3 Pollock catch (mt) in the area east of 170°W outside the CH/CVOA by month from 1982-98. Shading of years is based on dominant fishery sector at the time: 1982-85: foreign; 1986-88: joint-venture; 1989-98: domestic.

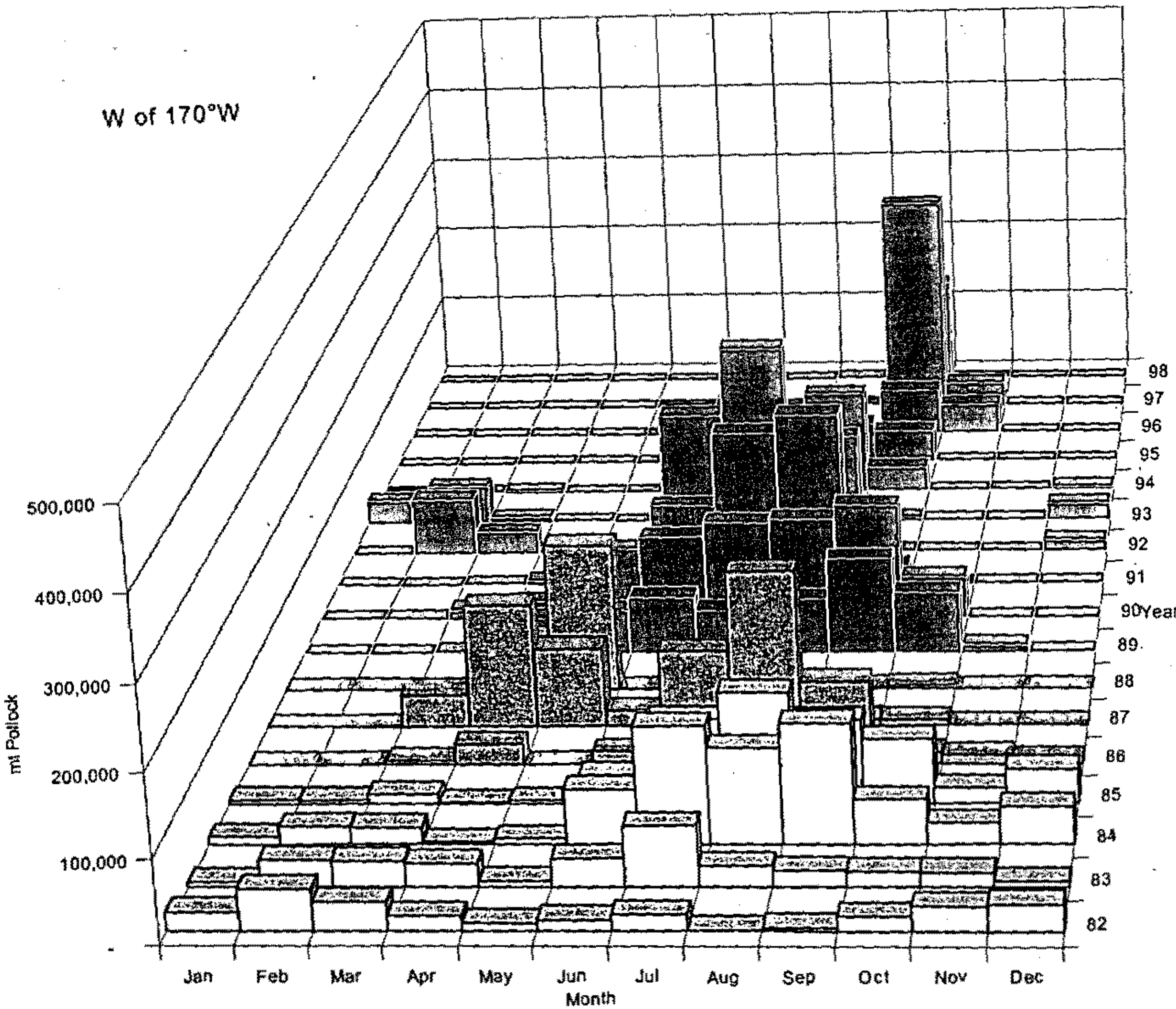

Figure 3-4 Pollock catch (mt) in the area west of 170°W by month from 1982-98. Shading of years is based on dominant fishery sector at the time: 1982-85: foreign; 1986-88: joint-venture; 1989-98: domestic.

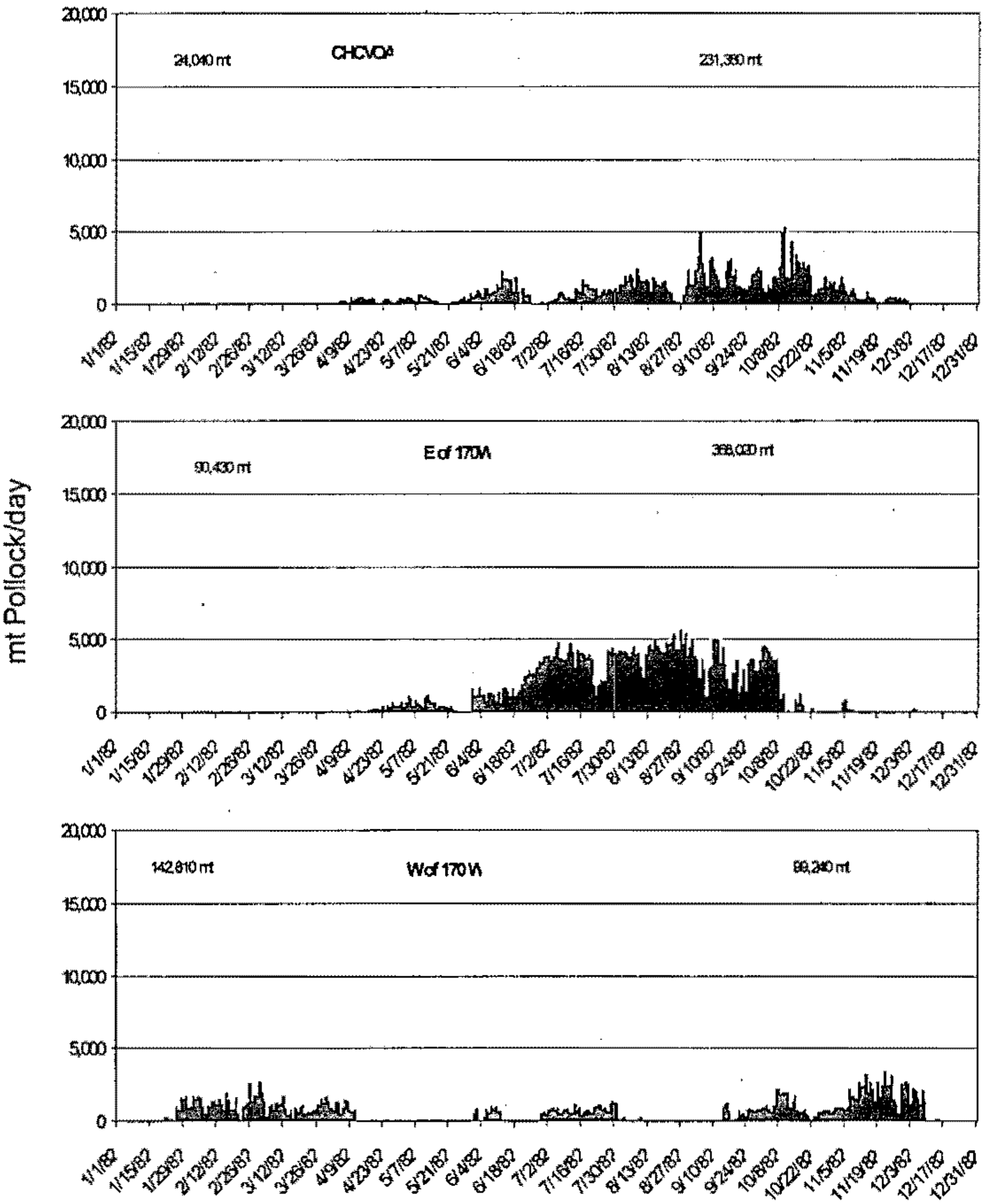

Figure 3-5 1982 Eastern Bering Sea pollock fishery catches per day in the CH/CVOA, east of 170°W outside of the CH/CVOA, and west of 170°W. Tonnages listed on the figures are pollock catches in January-June (left) and July-December (right).

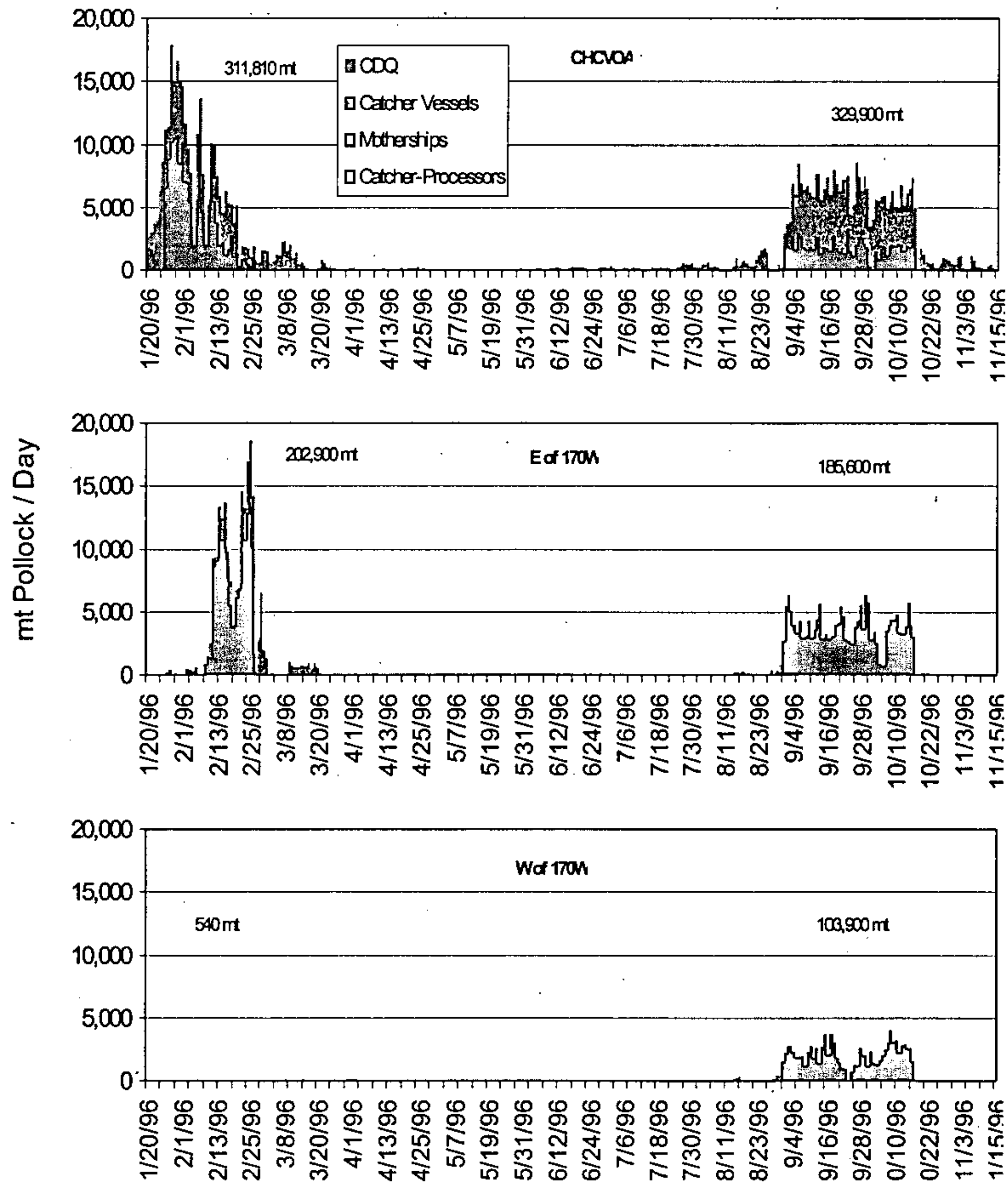

Figure 3-6 1996 Eastern Bering Sea pollock fishery catches per day in the CH/CVOA, east of 170°W outside of the CH/CVOA, and west of 170°W. Tonnages listed on the figures are pollock catches in January-June (left) and July-December (right).

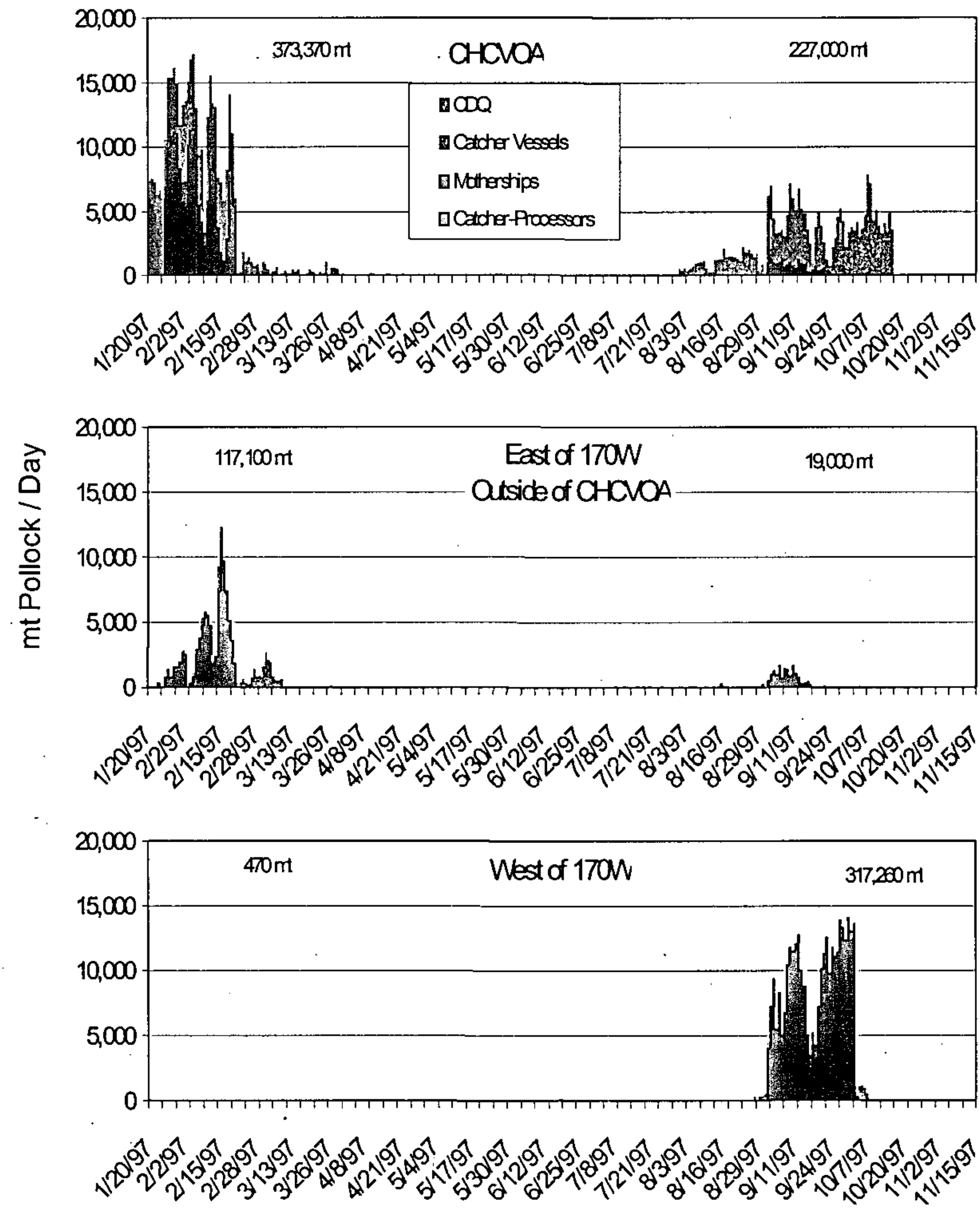

Figure 3-7 1997 Eastern Bering Sea pollock fishery catches per day in the CH/CVOA, east of 170°W outside of the CH/CVOA, and west of 170°W. Tonnages listed on the figures are pollock catches in January-June (left) and July-December (right).

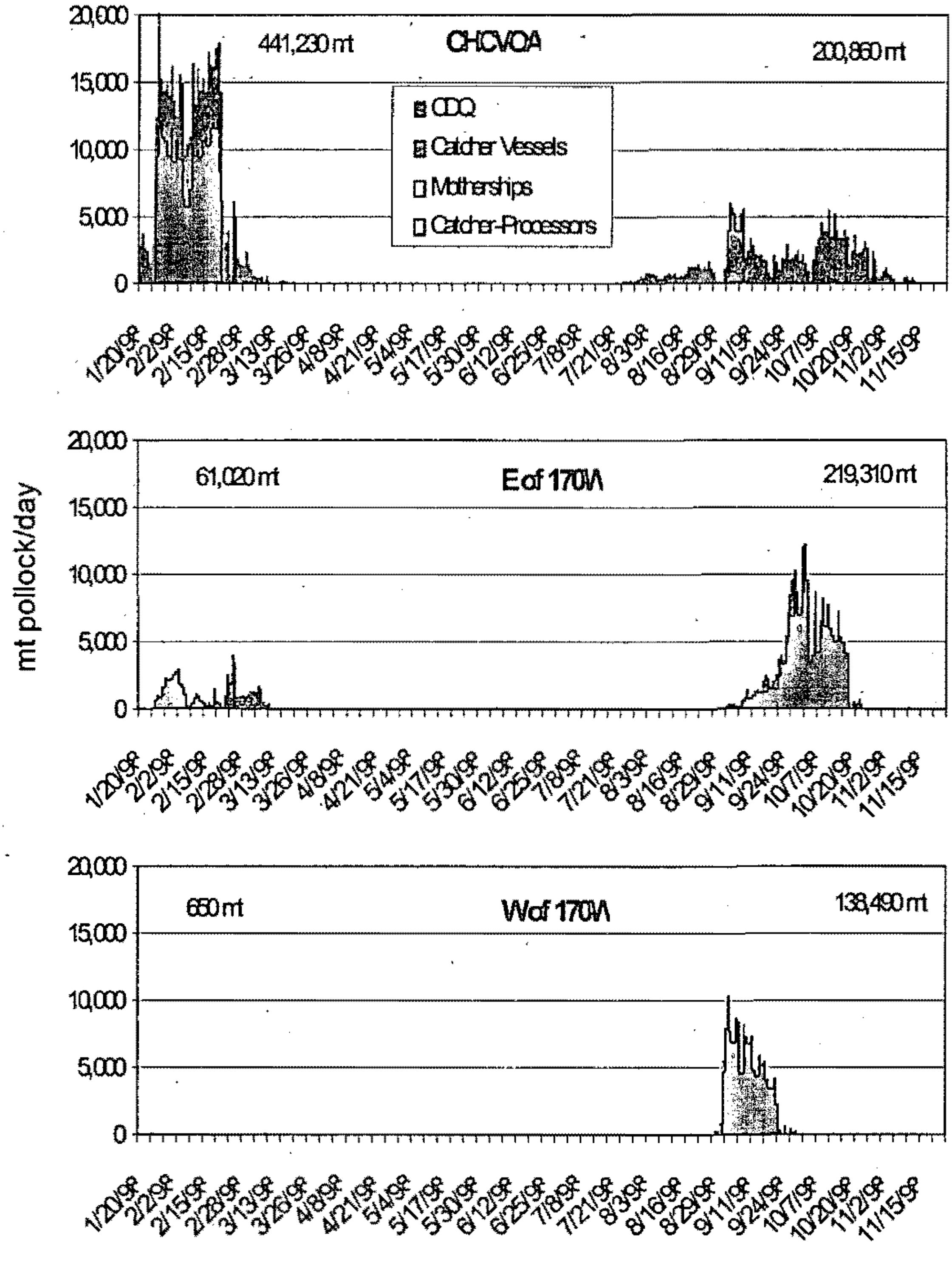

Figure 3-8 1998 Eastern Bering Sea pollock fishery catches per day in the CH/CVOA, east of 170°W outside of the CH/CVOA, and west of 170°W. Tonnages listed on the figures are pollock catches in January-June (left) and July-December (right).

Figure 3-9 Observed pollock fishery trawl locations in the eastern Bering Sea in 1982.

Figure 3-10 Observed pollock fishery trawl locations in the eastern Bering Sea in 1984.

Figure 3-11 Observed pollock fishery trawl locations in the eastern Bering Sea in 1996.

Figure 3-12 Observed pollock fishery trawl locations in the eastern Bering Sea in 1997.

Figure 3-13 Observed pollock fishery trawl locations in the eastern Bering Sea in 1998.

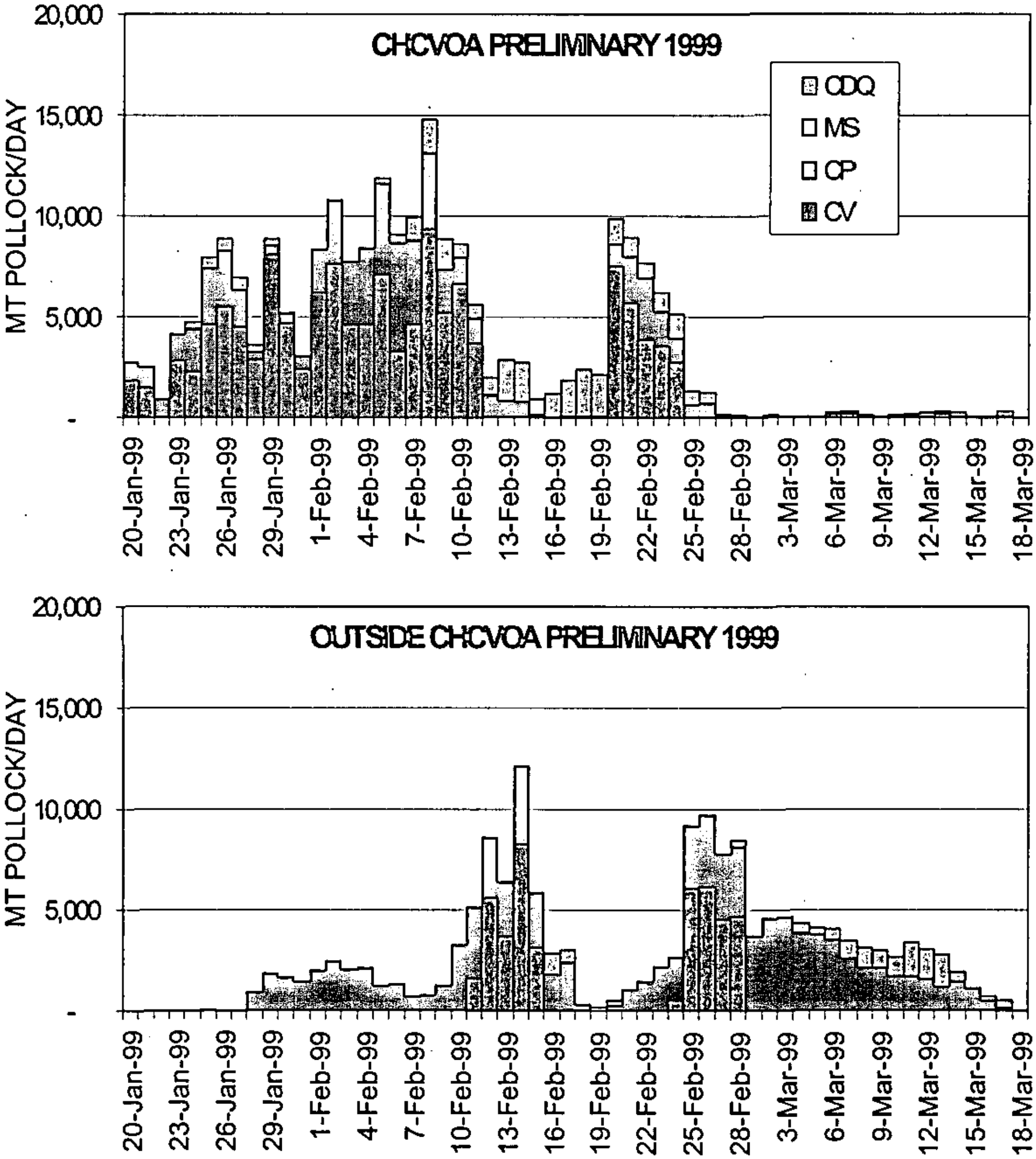

Figure 3-14 1999 Eastern Bering Sea pollock fishery catches per day per industry sector in two areas: inside the CH/CVOA and outside the CH/CVOA. These are based on preliminary inseason observer data available on 3/19/99.

Figure 3-15 Observed pollock fishery trawl locations in the eastern Bering Sea in 1999 (preliminary inseason data).

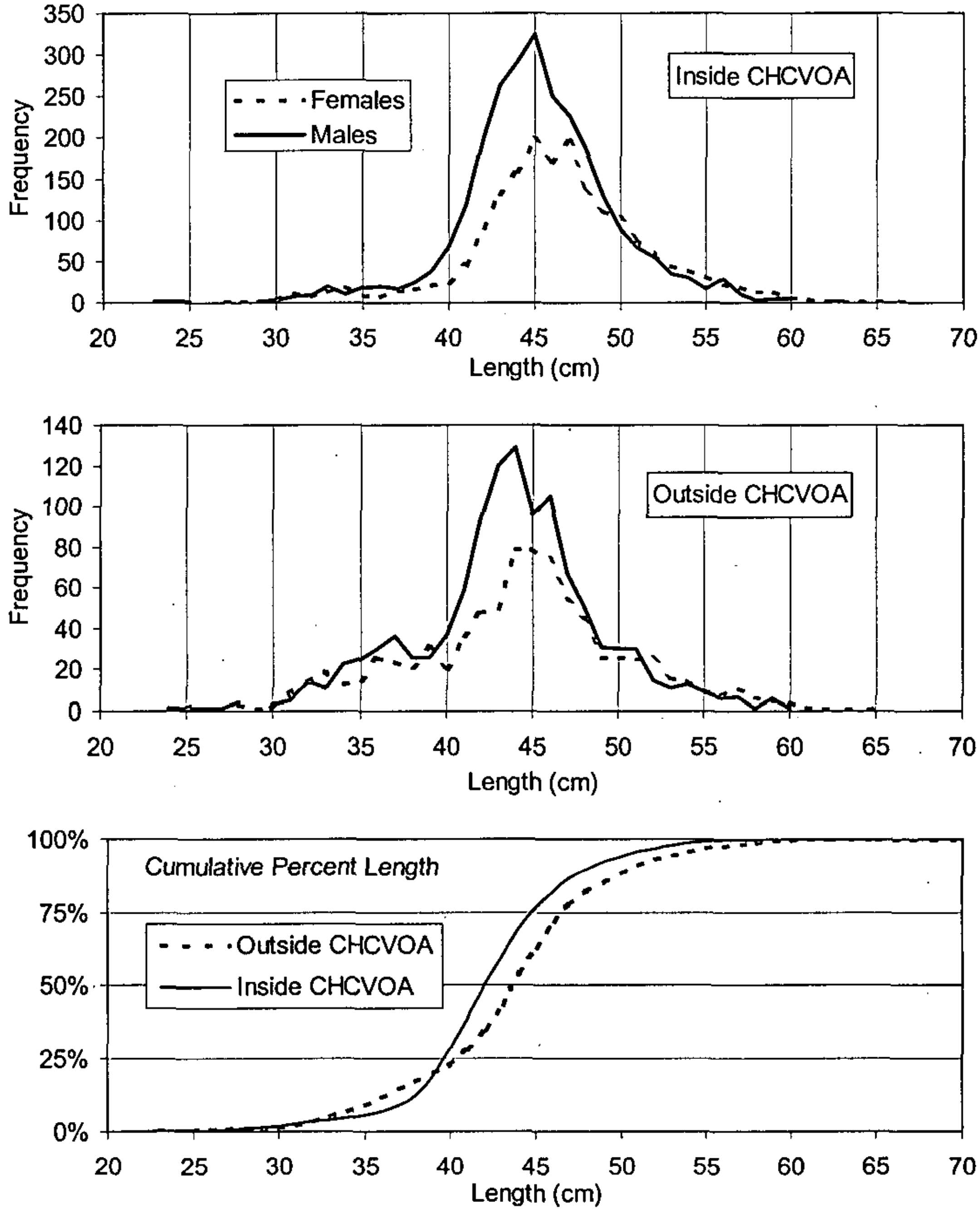

Figure 3-16 Preliminary 1999 pollock length frequency from the A season fisheries in the eastern Bering Sea.

3.5 Seasonal EBS pollock distribution - Analysis of survey data

The objective of spatial dispersion of pollock trawl fisheries is to have the distribution of catch mirror the distribution of exploitable pollock biomass for each seasonal release of TAC. This would include TAC allocated to areas both within and outside of the CH/CVOA. Relative to the current spatial distribution of the pollock fishery, the net benefit to sea lions of spatial catch dispersion would be to reduce the tonnages removed from critical habitat, which could increase local prey availability.

To accurately allocate TAC to regions in different seasons, it would be best to have survey information from the entire EBS shelf region for each season. However, ice in the winter/spring and financial constraints on the number of surveys that can be conducted each year are significant impediments to this. Analysis of the available survey data could reveal the range within which pollock have been distributed, and may likely be in the future. Survey data on spatial distribution of pollock biomass is limited almost solely to summer. In the EBS, bottom trawl surveys of the shelf (to 200 m depth) have been conducted annually in June-early August since 1979. The area north of the eastern Aleutian Islands (from Unimak Pass to 170°W) has been surveyed in the summers of 1980, 1983, 1986, 1991, 1994, and 1997 during the Aleutian Islands bottom trawl survey. Hydroacoustic surveys of the EBS shelf have been conducted in June-August of 1979, 1982, 1985, 1988, 1991, 1994, 1996, and 1997.

Winter/spring surveys of the EBS shelf have been more limited in scope and number. Due to differences in ice-cover each year, it has not been possible to establish a standard survey area. Consequently, results from winter surveys are not directly comparable between years. However, those conducted in February 1991, March 1993, and April 1995 surveyed most of the CH/CVOA as well as ice-free regions to the north and west between 163°-174°W longitude (See Appendix E). Nearly annual hydroacoustic surveys of the pollock spawning aggregation in the "Bogoslof" region of the eastern Aleutian Islands (north of the islands between 165°W to 171°W) have been conducted in February and early March since 1988. The eastern portion of this surveyed area (east of 167°W) is currently open to the pollock fishery, and the biomass estimates for this area are available.

For the purposes of this analysis of temporal and spatial pollock distribution on the EBS shelf, the principal data sources used were:

1. 30+ cm pollock biomass estimates from the summer EBS shelf bottom trawl surveys since 1982 (which have been conducted using a consistent methodology);
2. 30+ cm and total pollock biomass estimates from the summer EBS shelf hydroacoustic surveys in 1994, 1996, and 1997 (the only summer hydroacoustic surveys from which biomass estimates from sub-areas can be obtained) from the surface to 3 m above the bottom and from the surface to 0.5 m above the bottom. Included with the 1996 survey are the biomass estimates along two transects in the Horseshoe area north of Akun and Akutan Islands as far west as 166°19'W;
3. 30+ cm pollock biomass estimates from the summer eastern Aleutian Islands bottom trawl surveys of 1991, 1994, and 1997;
4. 30+ cm pollock biomass estimates from the winter/spring EBS shelf hydroacoustic surveys in 1991, 1993, and 1995 from the surface to 0.5 m above the bottom;
5. 30+ cm pollock biomass estimates from the winter "Bogoslof" survey in the area E of 167°W, and
6. the time-series of age 3+ biomass estimates from the stock assessment model (Ianelli et al. 1998).

The four principal time series of survey and model data (1, 2, 4, and 6 above) are shown in Figure 3-17. The top panel of Figure 3-17 shows the summer survey estimates along with the model biomass estimate, while the bottom panel shows the winter survey estimates with the model biomass estimate. For 1994, 1996, and 1997, the sum of the 30+ cm biomass estimates from the summer bottom and hydroacoustic surveys has averaged 89% of the model estimate (range of 83-99%).

There are two objectives of this analysis of seasonal spatial distribution of pollock on the EBS shelf. The first is to estimate the biomass in each of three areas (Figure 3-1) on the shelf in summer from 1982-98 to see how variable this distribution has been and to estimate a recent (1990s) summer "average" distribution. The second objective is examine the relationship of the winter biomass estimates in the SE Bering Sea shelf area with both the model and the summer surveys.

Summer Surveys. In the summer bottom trawl surveys since 1982, most (between 37-76% each year) of the 30+ cm pollock biomass has been located on the shelf west of 170°W longitude (Figure 3-18, top). The Critical Habitat-Catcher Vessel Operational Area (CH/CVOA) has had the smallest share of bottom trawl biomass, ranging between only 3-25% each year. The area east of 170°W and outside the CH/CVOA has generally had proportions of pollock intermediate between the CH/CVOA and the area W of 170°W, ranging between 14-51% each year. Since 1993, the two areas E and W of 170°W have had similar percentages, whereas prior to 1993, the western area consistently had more. The CH/CVOA percentage cycled between 5-15% through 1992, then increased to 25% in 1995, only to sharply decline to 3-4% in 1997-98. Various statistics summarizing the bottom trawl estimates of 30+ cm pollock biomass distributions in the EBS from 1982-98 are listed in the table below:

Summary Statistics for Distribution of 30+ cm Pollock Biomass from the EBS Bottom Trawl Surveys

Statistic	1982-98			1991-1998		
	CH/CVOA	E of 170W	W of 170W	CH/CVOA	E of 170W	W of 170W
Mean	11%	36%	54%	13%	40%	47%
Standard Deviation	6%	9%	11%	8%	8%	8%
Min	3%	14%	37%	3%	31%	37%
Max	25%	51%	76%	25%	51%	62%

The three summer hydroacoustic surveys in 1994, 1996, and 1997 yielded proportions in the CH/CVOA similar to those observed in the bottom trawl surveys (13% in 1994 and declining to 8% in 1997), but the relative proportions in the two areas E and W of 170°W were different from the bottom trawl survey (Figure 3-18, bottom). The hydroacoustic survey found a much greater proportion of age 3+ biomass in the western area (71-78%) than to the east (12-21%).

The following proportions were calculated and used to simulate the 1982-98 summer pollock biomass distributions:

For the three combined bottom and hydroacoustic survey years (1994, 1996, and 1997), the following percentages were calculated:

- The percent of total (bottom plus hydroacoustic) survey biomass observed in the bottom trawl survey by area (Table 3-3).
- The percent of total pollock biomass observed in the hydroacoustic surveys that was composed of 30+ cm fish (from the 1994, 1996, and 1997, this averaged 83%, with a range of 71-96%).

For the three combined EBS and eastern Aleutian Island (AI) bottom trawl survey years (1991, 1994, and 1997), the ratio of AI/EBS pollock biomass was obtained. The average was 2%, and ranged from 1-3%.

For the 1996 summer hydroacoustic survey, the fraction of total EBS biomass that was found in the Horseshoe area: 3%

The summer age 3+ biomass distribution by area and year (1982-98) was estimated by using the annual bottom trawl survey biomass by area, adding midwater biomass based on the average percent found on bottom by area (Table 3-3), adding AI biomass to the CH/CVOA based on the average percent found in the AI, adding Horseshoe biomass to the CH/CVOA based on fraction found in the Horseshoe in the 1996 hydroacoustic survey, and scaling to the model age 3+ biomass. For the years when a total pollock biomass from the hydroacoustic survey was available (not broken out by pollock size or by area; 1979, 1982, 1985, 1988, and 1991), the midwater fraction added was scaled to add to the average percent that was 30+cm in length (83%).

The relative distribution of pollock on the EBS shelf between the three areas has been relatively consistent in the 1982-98 period (Table 3-4). In summer, the CH/CVOA has had an average of 12.4% of the 30+ cm pollock in 1982-98; the percentage has ranged only from 6% to 27%. The average from 1991-98 in the CH/CVOA has been slightly higher at 14.5%, but is largely driven by the high percentage observed in 1995. Since 1995, the percentage in the CH/CVOA has declined to 6%. The CH/CVOA percentage has been as low as 6% at least twice before, in 1982 and 1988.

Most of the 30+ cm biomass has been located W of 170°W in summer; this area had a 1991-98 average of 55.9% and a 1982-98 average of 62.5%. The historical range has been from 48-78%, and has only been below 50% in one year (1994). The area E of 170°W and outside the CH/CVOA has had pollock biomass percentages intermediate between the CH/CVOA and W of 170°W: the recent and long-term averages were 26.1% and 30.5%, respectively. The historical range has been from 9% to 36%.

Winter Surveys. Hydroacoustic surveys of pollock in the Bogoslof region and on the EBS shelf in winter/spring principally assess the abundance of pollock in pre-spawning aggregations. These aggregations are composed primarily of sexually mature fish, but immature fish are also present and included in abundance estimates. Pollock in the Bogoslof area, thought to be primarily from the central Bering Sea pollock stock, spawn in March, about one month earlier than those on the shelf. Bogoslof surveys are conducted in February and early March prior to spawning, and have occurred each year (except 1990) since 1988. Because this region is generally ice-free year-round, the Bogoslof survey represents a consistent time series of abundance estimates of pollock in this region during the late winter.

Hydroacoustic surveys of pollock on the EBS shelf in winter/spring have been conducted on a time-available basis since the late 1980s. However, given the annual differences in ice-coverage in this portion of the shelf (Appendix D), each survey has covered a different area both in shape and size. Consequently, these series of surveys can not be considered a consistent time series, nor compared between years because of the differences between them. However, they do represent the only abundance estimates for the size of the spawning aggregation on this portion of the shelf and are suitable for intra-year analyses.

Estimates of 30+ cm pollock biomass from the EBS shelf surveys conducted in 1991, 1993, and 1995 are shown in Figure 3-17 (bottom). These years were chosen because in each, almost the entire CH/CVOA was surveyed, along with some of the ice-free portions of the outer shelf to the northwest (see Appendix

E for location of transects and pollock distribution). It can be seen that each survey "saw" only a fraction of what the model estimated was present in each of these years, most likely a result of the survey not spanning the entire range of pollock in the EBS. However, other factors which would reduce the fraction of model biomass observed in the spawning-time surveys are the proportion mature and the depth-range assessed by the hydroacoustic surveys. Winter surveys in the CH/CVOA have a dome-shaped selectivity curve (Figure 3-19). The low selectivity for immature fish is observed in the ascending limb of the curve, which is similar to the maturity ogive; immature fish were apparently not present in the spawning aggregation in the CH/CVOA. Winter hydroacoustic surveys in the CH/CVOA also appear to have lower selectivity for fish aged 9+ years old. This could be due to their affinity for the near-bottom depth range, and the fact that the winter hydroacoustic survey assesses pollock in the water column from the surface to 0.5 m off the bottom. Older pollock may also be distributed more outside the CH/CVOA (to the north) than younger, fully mature fish, but this is highly speculative at this time. The average total selectivity for age 3+ pollock was 0.4 for both the 1991 and 1995 winter/early spring surveys (J. Ianelli, AFSC, pers. comm.).

The data on 30+ cm pollock biomass distribution from the winter/early spring surveys conducted in 1991, 1993, and 1995 was used to estimate the proportion of total EBS pollock biomass present in the CH/CVOA. Estimates of the CH/CVOA proportion using the survey will be dependent on the survey's total selectivity, which can be considered to be the product of the proportion of 30+ cm pollock that are mature and the selectivity/catchability of the survey itself (termed the "survey-alone" selectivity). Each product of proportion mature and survey-alone selectivity would yield a different estimate of the proportion of 30+ cm pollock biomass within the CH/CVOA. Estimates of CH/CVOA biomass proportions (CH_p, or the average for the three winter surveys) were calculated across a range of maturity proportions (M_p) and survey-alone selectivities (Q) according to the following formula:

$$CH_p = \frac{\sum_{i=1}^{3} S_{CHi} / (P_i M_p Q)}{3} \qquad \text{Eq. 1}$$

where S_{CHi} is the survey biomass observed in the CH/CVOA in survey year *i* (e.g., February 1991), and P_i is the beginning-year model population estimate for year *i* (*i*=1 to 3 for the three surveys in 1991, 1993, 1995). The values for S_{CHi} and P_i for the three years are:

Winter Survey 30+ cm Biomass Estimates in the CH/CVOA
and Model EBS Age 3+ Population Biomass Estimates

Winter EBS Shelf Survey	Winter CH/CVOA Biomass (S_{CHi})	Model EBS Population Biomass (P_i)
February 1991	477,064 mt	5,180,000 mt
March 1993	1,267,902 mt	10,279,000 mt
April 1995	680,795 mt	8,680,000 mt

The proportion of age 3+ fish that are mature has ranged from approximately 0.38 to 0.76 from 1964-98, and the distribution by 0.05 bins is as follows (J. Ianelli, AFSC, pers. comm):

Distribution of the Proportion of Age 3+ EBS Pollock that were Mature, 1964-98

Range in Proportion mature	Midpoint of Range	Number of years	Percent
0.35 - 0.39	0.375	1	3%
0.40 - 0.44	0.425	6	17%
0.45 - 0.49	0.475	5	14%
0.50 - 0.54	0.525	4	11%
0.55 - 0.59	0.575	4	11%
0.60 - 0.64	0.625	6	17%
0.65 - 0.69	0.675	5	14%
0.70 - 0.74	0.725	2	6%
0.75 - 0.79	0.775	2	6%
Total		35	100%

Table 3-5 shows the relationship between assumptions concerning the proportion mature and the winter survey-alone selectivity on the percent of the total age 3+ pollock observed in the CH/CVOA in winter. For this exercise, a joint probability distribution of the proportion mature and the winter-alone selectivity is calculated using 1 assumption (prior) on the proportion mature and 2 assumptions of winter-alone selectivity. The priors on the proportion mature are available in the table immediately above using the midpoint of the ranges in proportion mature and the percent distribution of the number of years in each range. Priors on the survey-alone selectivity were estimated for "high" (mean selectivity = 0.74 across all ages) and "low" (mean selectivity = 0.52) survey-alone selectivity scenarios as outlined below:

Prior Distributions for "High" and "Low" Survey-Alone Selectivity Scenarios

Survey-Alone Selectivity	"High" Mean=0.74	"Low" Mean=0.52
0.2	1%	2%
0.3	2%	7%
0.4	3%	24%
0.5	5%	30%
0.6	10%	24%
0.7	24%	7%
0.8	30%	3%
0.9	24%	2%
1	1%	1%
TOTAL	100%	100%

Table 3-5A summarizes the information for the "high" survey-alone selectivity scenario, while Table 3-5B summarizes the "low" selectivity information. Part 1 of both A and B shows the joint probability distributions of the two parameters, the proportion mature and the survey-alone selectivity, for both scenarios. The cell values were calculated by multiplying the appropriate prior values for the two parameters. Part 2 of both A and B contains the same data; the estimated proportions of age 3+ pollock biomass in the CH/CVOA in winter calculated from Eq. 1. Part 3 of both A and B contains the probability weighted states of nature which were obtained by multiplying the values in Part 1 by those in

Part 2. Summing the probability weighted states of nature in Part 3 of A and B separately gives an estimate of the mean percentage of age 3+ pollock biomass in the CH/CVOA in the "high" and "low" selectivity scenarios, respectively. The cells in bold-face type in Part 3 A and B collectively have half of the weighted probability. The bold-faced biomass percentages in Part 2 of both A and B correspond to the bold-faced cells in Part 3; the range in values in this top 50% could represent a "confidence-bound" on the mean.

Table 3-5 in this version of the EA differs from that in the draft distributed at the April 1999 NPFMC meeting. There was an error in the draft Table 3-5 which was corrected in the current version. The error was that the survey selectivity was used twice in the formula to calculate the percentage in the CH/CVOA instead of once. The result of the error was that as one progressed up the table along a single column (proportion mature), the percentage of biomass in the CH/CVOA increased twice as fast as it should have. This has been corrected in the current version of the table.

The results shown in Table 3-5 suggest that, based on the 1991, 1993, and 1995 winter surveys of the CH/CVOA, that the percentage of age 3+ pollock biomass within the CH/CVOA was 26% (with a 50% confidence bound of 17% - 38%) in the "high" survey-alone selectivity scenario, and 38% (with a 50% confidence bound of 26% - 58%) in the "low" selectivity scenario. Comparisons of the relative proportion of ages observed in the survey and those in the modeled population for the same year suggest that survey has a dome-shaped selectivity curve across ages 3-10 (Figure 3-19), and that the average total survey selectivity across all ages is 0.4. In Table 3-5, the total survey selectivity was considered to be composed of two factors, the proportion mature and the survey-alone selectivity, which when multiplied together, would yield an estimate of the total survey selectivity. For both scenarios, the mean proportion mature resulting from the prior distribution is 0.56. Multiplying the two mean survey-alone selectivities (0.74 for the "high" and 0.52 for the "low") by the mean proportion mature yields an estimate of total survey selectivity of 0.41 for the "high" scenario, which is similar to that estimated separately for the 1991 and 1995 surveys (Figure 3-19; J. Ianelli, AFSC, pers. comm.). By contrast, the "low" scenario yields a mean estimate of total survey selectivity of 0.29, lower than the separate estimate. However, despite the lower assumed selectivity, the mean estimate of the percentage of age 3+ pollock biomass in the CH/CVOA increases only to 38%. These data in aggregate suggest that there has been a considerable proportion of the biomass of age 3+ pollock outside the CH/CVOA in winter.

Factors which would affect our perception of the true winter proportion of age 3+ pollock within CH/CVOA are differences in spatial and vertical distribution of pollock age groups in the EBS. If old pollock (age 9+) are on the bottom, then the winter hydroacoustic survey would not see them since it assesses only down to 0.5 m off the bottom. This could partially explain the dome-shaped selectivity curve in Figure 3-19. However, if age 9+ pollock are distributed evenly throughout the surveyed area (inside and outside the CH/CVOA), then this difference would be equal in all areas and not affect the proportion estimated within the CH/CVOA. If this is true, then the "high" selectivity scenario may be more probable. On the other hand, if there were relatively more old pollock within the CH/CVOA and they were on the bottom (in the lower 0.5 m of the water column), then the survey results would under-represent the age 3+ biomass disproportionately in the CH/CVOA relative to outside. If this latter assumption is true, then the mean percentage listed above for the "low" selectivity scenario may be more probable.

Summer and winter survey comparisons. Comparison of the summer hydroacoustic survey abundance estimates of 30+ cm pollock (from surface to 3 m above the bottom) with the most recent stock assessment model suggests that the survey "sees" approximately 33% of the pollock in one year (range from 23% to 42%). If this comparison is done between hydroacoustic estimates of 30+ cm pollock from the surface to 0.5 m above the bottom (like the winter estimates), then the survey "Q" (selectivity, availability, and catchability) increases to 43%. Comparison of the bottom trawl survey data (30+ cm pollock) suggests that it "sees" a higher overall proportion of the model estimate of annual abundance, 60% , but with a much greater range (from 33% to 110%). These data suggest that 30+ cm pollock are aggregated near-bottom in the summer.

Comparison of the winter hydroacoustic survey abundance 30+ cm estimates for 1991, 1993, and 1995, which are not EBS-shelf wide (but are from the surface to 0.5 m off the bottom), with the stock assessment model estimates for those years suggests that the survey "saw" an average of 18% (range from 9% to 22%), or less than half the summer survey.

Three differences between the winter and summer hydroacoustic surveys and pollock behavior in the two seasons must be kept in mind when comparing abundance estimates. First, the winter surveys were constrained to the ice-free regions of the outer shelf and were not EBS-shelf wide. This would make the winter survey "see" proportionally less of the model pollock stock size than the summer. Second, the winter survey assesses sexually mature fish better than it does immature fish. Third, pollock may be aggregated more off bottom in winter than in summer, which for the hydroacoustic surveys, would increase the winter survey's pollock catchability relative to summer.

Seasonal Movement of Pollock into and out of the CH/CVOA. Based on the results of these surveys as well as knowledge of the seasonal distribution of the fishery, pollock move into the CH/CVOA for spawning in winter/spring followed by movement out of the CH/CVOA. Thus, the proportion of total EBS pollock biomass in the CH/CVOA is relatively high in winter and relatively low in summer. The summer proportion (June-August), based on the time-series of bottom trawl and hydroacoustic surveys, has recently averaged 14.5% (average for the summers of 1991-98) and has had a lower long-term average of 12.4% (1982-98). The winter/spring proportion (February-April) is not known with the same level of precision as the summer proportion. However, based on the analyses outlined in Table 3-5, the proportion of age 3+ pollock biomass within the CH/CVOA in winter has likely been within the range of 17-58%, however, most of probability is centered in the range of approximately 20-40%.

A conceptual model of seasonal movement of pollock into and out of the CH/CVOA based on the survey data is shown in Figure 3-20. The percent of total 30+ cm pollock within the CH/CVOA by month is shown under the "high" and "low" survey-alone selectivity scenarios outlined in Table 3-5, and 3 different pollock movement scenarios back into the CH/CVOA following summer. All use the average 1991-98 CH/CVOA pollock biomass proportions shown in Table 3-4 for the June-August period.

The two proportions of age 3+ biomass within the CH/CVOA used were:

- 26%, based on the mean from the "high" survey-alone selectivity scenario; and
- 38%, based on the mean from the "low" survey-alone selectivity scenario.

The three post-summer migration scenarios used were:

- linear, with equal proportions per month in September through January;
- late summer migration, with a greater proportion moving back into the CH/CVOA in September and October than in November-January; and
- winter migration, with a greater proportion moving back into the CH/CVOA in December-January than in September-November.

Confidence bounds in Figure 3-20 were estimated around the two linear migration scenarios using ±2 standard deviations around the 1991-98 mean for June-August (Table 3-4), and the upper and lower percentages from the upper 50% of the probability-weighted states of nature for the mean winter estimates (bold-faced percentages in Table 3-5A and B, Part 2). For the spring and fall months, confidence bounds were linearly-interpolated between winter and summer.

While it is not known with certainty which of the scenarios is most likely, the data suggest that "high" survey-alone selectivity better reflect the survey and model data available for winter. This was discussed above in relation to the overall selectivity of the winter surveys. There is certainly annual variability which could result in a winter distribution near the confidence bounds suggested in Figure 3-20C and D, but the central tendency of the data available is that shown as the linear migration model.

Based on the ranges of winter biomass concentration given, and the possible migration scenarios, what do these trajectories suggest about biomass concentrations in the CH/CVOA in fall (September-October)? With "high" selectivity, the upper "confidence" bound on the proportion within the CH/CVOA is approximately 30%, the mean estimate is approximately 18%, and the lower "confidence" bound is 6% during September-October. For the "low" selectivity scenario, the proportion within the CH/CVOA is upper bounded at approximately 35%, has a mean of about 22%, and a lower bound of about 10%. These values from the two scenarios are quite similar, and suggest that the proportion within the CH/CVOA in September-October is between 10-30%. Clearly, there is annual variability in the seasonal distribution of pollock in the EBS shelf. Based on the survey information, the proportion of the pollock population in the CH/CVOA in summer has declined from 27% in 1995 to only 6% in 1998 (Table 3-4), suggesting that the middle or lower end of the 10-30% September-October range may better reflect current conditions.

3.6 Estimates of Summer Pollock Harvest Rates by Area, 1982-98

Using the information contained in Tables 3.1 and 3.4, estimates of the fishery harvest rate of pollock by area in the summer and early fall can be made. Figure 3-21 shows the estimated harvest rates by area from 1982-98 using the estimated catches by area for 4 different time periods in the summer/fall (June-July, June-August, June-September, and June-October; Table 3-1) and the estimates of biomass by area during the summer (June-August; Table 3-4).

There are considerable differences between the estimates of harvest rates by area. Regardless of the time period used for catch, estimated harvest rates have consistently been less than 20% (with most less than 10%) in both areas E and W of 170°W. Only in 1991 in the area W of 170° were any estimates of summer/fall harvest rates approaching 20%. By contrast, the CH/CVOA has experienced greater summer/fall pollock harvest rates since 1982. Except for 1982, the foreign and joint-venture fisheries through 1988 had harvest rates in this area of about 20% or less. However, beginning in 1989, harvest rate estimates increased with many between 20-30%, and some between 30-62%. The highest harvest rates from the summer/fall period were estimated for 1997 and 1998. This was due to the decline in CH/CVOA pollock survey biomass observed since 1995 (Table 3-4) combined with the relatively constant catches from this area in the B-seasons (Table 3-1).

In this analysis, no attempt was made to account for movement of fish back into the CH/CVOA in September/October as described in Section 3.2. If the movement is primarily in winter, then the differences between the harvest rates shown in Figure 3-21 and those which account for fish movement would be very small. If the movement is primarily in late summer/fall, then the June-September and June-October harvest rates would be lower than those shown in Figure 3-21.

3.7 Estimating stock distribution on the basis of historical fishery distributions

The Council's Scientific and Statistical Committee has suggested that NMFS scientists attempt to estimate the historical distribution of the pollock stock based on the distribution of the foreign fishery effort. In their minutes of April 24, 1999, they specifically recommended that "... estimates of seasonal changes in pollock distribution based on the foreign fishery performance be used along with other available information to evaluate consistency of proposed alternatives of spatial apportionment of B and C season quotas with the RPA."

While an assessment of foreign fishery distributions in the 1970s and 1980s might provide some relative indication of pollock distribution in restricted regions of the Bering Sea and Gulf of Alaska, those data are potentially biased by a large suite of factors that make interpretation of pollock distribution unreliable at best. Such factors include:

- differences in fishery management regulations between years, such as varying closed areas and periods, prohibited species bycatch rules, etc.;
- market conditions, which could cause differences in fishing patterns depending on the market demand for roe, fillets, or surimi at that time;
- country of origin of the fishing vessel (e.g., Russian, Japanese, Taiwanese, Korean, Polish) which could affect their fishing objectives and patterns. For instance, Japanese vessels were organized in company cooperatives and their fishing locations pre-determined to minimize internal competition;
- differences in processing ability and storage space between vessels and the groups of vessels that fished in different years;
- weather and ice conditions; and so on.

Perhaps most importantly, fishing vessels do not fish the entire range occupied by pollock; large regions of the eastern Bering Sea shelf were unfished by the fleet (see, for example, Fig. 3-9 in this document, or see pp. 8-61 in Fritz [1993]), and yet, nearly contemporaneous surveys conducted by NMFS found pollock of the appropriate size located in these regions. Thus, the information that might be obtained from a detailed analysis of the foreign fishery data would only provide effort and CPUE in limited and selected areas. The objective of distributing the catch according to the distribution of the stock would not be possible on the basis of these results, not only because of the limited areas fished, but also because of all the confounding factors that determined the distribution of these fisheries.

The argument that pollock are where fishers trawl because fishers trawl where the pollock are is circular. Fishers trawl where there are pollock. However, fishers do not distribute themselves according to the distribution of the stock for a variety or reasons. Their goal is to maximize their profit. If they can catch plenty of pollock close to shore-based plants or close to home port, and if economics is the primary consideration, it is clear why these areas have been used the most by fishers. Some industry sectors, such as the catcher-processors, may be able to distribute themselves more throughout the range of the pollock stock than the inshore sector, which is tied to shore-based processing plants.

Table 3-3 Percentage of total summer survey biomass (bottom trawl plus hydroacoustic) that was observed in the bottom trawl by area and year for 1994, 1996, and 1997.

Year	CH/CVOA	E of 170W	W of 170W	TOTAL
1994	76%	84%	54%	68%
1996	67%	87%	43%	62%
1997	42%	79%	58%	65%
All 3	62%	83%	52%	65%

Table 3-4 Estimated 30+ cm pollock biomass distribution in the summer on the eastern Bering Sea shelf based on bottom trawl survey, hydroacoustic survey, and stock assessment modeling results for 1982-98. Stan. Dev. and std = Standard deviation. Avg = average. CH/CVOA = Critical habitat/Catcher vessel operational area.

	30+ cm Pollock Biomass (mt)				Percent		
Year	CH/CVOA	E of 170W	W of 170W	TOTAL	CH/CVOA	E of 170W	W of 170W
1982	591,567	2,351,750	7,025,600	9,968,918	6%	24%	70%
1983	1,541,980	3,213,910	6,201,407	10,957,297	14%	29%	57%
1984	1,760,382	2,791,375	5,823,015	10,374,772	17%	27%	56%
1985	1,920,688	2,495,158	7,721,795	12,137,642	16%	21%	64%
1986	980,624	3,008,349	7,122,176	11,111,149	9%	27%	64%
1987	902,497	2,112,016	8,320,927	11,335,440	8%	19%	73%
1988	649,025	2,068,508	7,821,622	10,539,155	6%	20%	74%
1989	587,618	2,024,391	6,191,511	8,803,520	7%	23%	70%
1990	911,538	631,132	5,448,033	6,990,703	13%	9%	78%
1991	965,689	1,440,340	2,912,287	5,318,316	18%	27%	55%
1992	783,415	1,824,019	5,873,084	8,480,519	9%	22%	69%
1993	1,741,008	3,276,192	5,479,473	10,496,673	17%	31%	52%
1994	1,710,815	2,967,112	4,413,644	9,091,571	19%	33%	49%
1995	2,417,580	2,064,599	4,425,385	8,907,564	27%	23%	50%
1996	904,968	2,462,750	3,583,676	6,951,394	13%	35%	52%
1997	368,387	1,888,175	3,175,403	5,431,965	7%	35%	58%
1998	316,080	1,868,983	3,035,159	5,220,223	6%	36%	58%
				Average	12.4%	25.8%	61.7%
				min	5.9%	9.0%	48.5%
				max	27.1%	35.8%	77.9%
				Stan. Dev	6.0%	7.1%	9.4%
				Avg+1 std	18.4%	32.9%	71.1%
				Avg-1 std	6.4%	18.8%	52.3%
				Median	13.0%	26.9%	58.5%
				Average 1991-98	14.5%	30.2%	55.3%

Table 3-5. Estimated percent of total 30+ cm biomass present in the CH/CVOA in late winter using a range and a prior distribution on the proportion of 30+ cm EBS pollock that are mature and a range and two prior distributions on the selectivity/catchability of the winter-surveys-alone: (A) "High" survey-alone selectivity (mean=0.74), and (B) "Low" survey-alone selectivity (mean=0.52). Part 1 of both A and B shows the joint probability distributions based on the priors of proportion mature and survey-alone selectivity. Part 2 of both A and B shows the percent of 30+cm pollock biomass in the CH/CVOA using text equation 1 (the same in A and B). Part 3 of both A and B shows the probability weighted states of nature resulting from multiplying values in Part A times Part B. The mean percentage within the CH/CVOA is the sum of the probability-weighted states of nature. Bold-faced values in Part 3 are those providing the top 50% of the probability weight, and the corresponding percentages within the CH/CVOA are bold-faced in Part 2.

Table 3-5A. "High" Survey-Alone Selectivity

1. Joint Probability Distribution

		Proportion of 30+ cm pollock mature									
	Survey-Alone	0.375	0.425	0.475	0.525	0.575	0.625	0.675	0.725	0.775	
Prior	Selectivity	3%	17%	14%	11%	11%	17%	14%	6%	6%	<=Prior
1%	0.2	0.0%	0.2%	0.1%	0.1%	0.1%	0.2%	0.1%	0.1%	0.1%	
2%	0.3	0.1%	0.3%	0.3%	0.2%	0.2%	0.3%	0.3%	0.1%	0.1%	
3%	0.4	0.1%	0.5%	0.4%	0.3%	0.3%	0.5%	0.4%	0.2%	0.2%	
5%	0.5	0.1%	0.9%	0.7%	0.6%	0.6%	0.9%	0.7%	0.3%	0.3%	
10%	0.6	0.3%	1.7%	1.4%	1.1%	1.1%	1.7%	1.4%	0.6%	0.6%	
24%	0.7	0.7%	4.1%	3.4%	2.7%	2.7%	4.1%	3.4%	1.4%	1.4%	
30%	0.8	0.9%	5.1%	4.3%	3.4%	3.4%	5.1%	4.3%	1.7%	1.7%	
24%	0.9	0.7%	4.1%	3.4%	2.7%	2.7%	4.1%	3.4%	1.4%	1.4%	
1%	1	0.0%	0.2%	0.1%	0.1%	0.1%	0.2%	0.1%	0.1%	0.1%	

2. % of 30+ cm pollock biomass in the CH/CVOA as a function of proportion mature and selectivity

Survey-Alone	Proportion of 30+ cm pollock mature								
Selectivity	0.375	0.425	0.475	0.525	0.575	0.625	0.675	0.725	0.775
0.2	131%	115%	103%	93%	85%	78%	73%	68%	63%
0.3	87%	77%	69%	62%	57%	52%	48%	45%	42%
0.4	65%	58%	52%	47%	43%	39%	36%	34%	32%
0.5	52%	46%	41%	37%	34%	31%	29%	27%	25%
0.6	44%	**38%**	34%	31%	28%	26%	24%	23%	21%
0.7	37%	**33%**	**29%**	**27%**	**24%**	**22%**	**21%**	19%	18%
0.8	33%	**29%**	**26%**	**23%**	**21%**	**20%**	**18%**	17%	16%
0.9	29%	**26%**	**23%**	21%	19%	**17%**	16%	15%	14%
1	26%	23%	21%	19%	17%	16%	15%	14%	13%

3. Probability Weighted States of Nature

Survey-Alone	Proportion of 30+ cm pollock mature								
Selectivity	0.375	0.425	0.475	0.525	0.575	0.625	0.675	0.725	0.775
0.2	0.0%	0.2%	0.1%	0.1%	0.1%	0.1%	0.1%	0.0%	0.0%
0.3	0.0%	0.3%	0.2%	0.1%	0.1%	0.2%	0.1%	0.1%	0.0%
0.4	0.1%	0.3%	0.2%	0.2%	0.1%	0.2%	0.2%	0.1%	0.1%
0.5	0.1%	0.4%	0.3%	0.2%	0.2%	0.3%	0.2%	0.1%	0.1%
0.6	0.1%	**0.7%**	0.5%	0.4%	0.3%	0.4%	0.3%	0.1%	0.1%
0.7	0.3%	**1.4%**	**1.0%**	**0.7%**	**0.7%**	**0.9%**	**0.7%**	0.3%	0.2%
0.8	0.3%	**1.5%**	**1.1%**	**0.8%**	**0.7%**	**1.0%**	**0.8%**	0.3%	0.3%
0.9	0.2%	**1.1%**	**0.8%**	0.6%	0.5%	**0.7%**	0.6%	0.2%	0.2%
1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Weighted Mean	26%								

Table 3-5B "Low" Survey-Alone Selectivity

1. Joint Probability Distribution

		Proportion of 30+ cm pollock mature									
	Survey-Alone	0.375	0.425	0.475	0.525	0.575	0.625	0.675	0.725	0.775	
Prior	Selectivity	3%	17%	14%	11%	11%	17%	14%	6%	6%	<=Prior
2%	0.2	0.1%	0.3%	0.3%	0.2%	0.2%	0.3%	0.3%	0.1%	0.1%	
7%	0.3	0.2%	1.2%	1.0%	0.8%	0.8%	1.2%	1.0%	0.4%	0.4%	
24%	0.4	0.7%	4.1%	3.4%	2.7%	2.7%	4.1%	3.4%	1.4%	1.4%	
30%	0.5	0.9%	5.1%	4.3%	3.4%	3.4%	5.1%	4.3%	1.7%	1.7%	
24%	0.6	0.7%	4.1%	3.4%	2.7%	2.7%	4.1%	3.4%	1.4%	1.4%	
7%	0.7	0.2%	1.2%	1.0%	0.8%	0.8%	1.2%	1.0%	0.4%	0.4%	
3%	0.8	0.1%	0.5%	0.4%	0.3%	0.3%	0.5%	0.4%	0.2%	0.2%	
2%	0.9	0.1%	0.3%	0.3%	0.2%	0.2%	0.3%	0.3%	0.1%	0.1%	
1%	1	0.0%	0.2%	0.1%	0.1%	0.1%	0.2%	0.1%	0.1%	0.1%	

2. % of 30+ cm pollock biomass in the CH/CVOA as a function of proportion mature and selectivity

Survey-Alone	Proportion of 30+ cm pollock mature								
Selectivity	0.375	0.425	0.475	0.525	0.575	0.625	0.675	0.725	0.775
0.2	131%	115%	103%	93%	85%	78%	73%	68%	63%
0.3	87%	77%	69%	62%	57%	52%	48%	45%	42%
0.4	65%	**58%**	**52%**	**47%**	**43%**	**39%**	**36%**	34%	32%
0.5	52%	**46%**	**41%**	**37%**	**34%**	**31%**	**29%**	27%	25%
0.6	44%	**38%**	**34%**	31%	28%	**26%**	24%	23%	21%
0.7	37%	33%	29%	27%	24%	22%	21%	19%	18%
0.8	33%	29%	26%	23%	21%	20%	18%	17%	16%
0.9	29%	26%	23%	21%	19%	17%	16%	15%	14%
1	26%	23%	21%	19%	17%	16%	15%	14%	13%

3. Probability Weighted States of Nature

Survey-Alone	Proportion of 30+ cm pollock mature								
Selectivity	0.375	0.425	0.475	0.525	0.575	0.625	0.675	0.725	0.775
0.2	0.1%	0.4%	0.3%	0.2%	0.2%	0.3%	0.2%	0.1%	0.1%
0.3	0.2%	0.9%	0.7%	0.5%	0.5%	0.6%	0.5%	0.2%	0.2%
0.4	0.4%	**2.4%**	**1.8%**	**1.3%**	**1.2%**	**1.6%**	**1.2%**	0.5%	0.4%
0.5	0.4%	**2.4%**	**1.8%**	**1.3%**	**1.2%**	**1.6%**	**1.2%**	0.5%	0.4%
0.6	0.3%	**1.6%**	**1.2%**	0.9%	0.8%	**1.1%**	0.8%	0.3%	0.3%
0.7	0.1%	0.4%	0.3%	0.2%	0.2%	0.3%	0.2%	0.1%	0.1%
0.8	0.0%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.0%	0.0%
0.9	0.0%	0.1%	0.1%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%
1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Weighted Mean	**38%**								

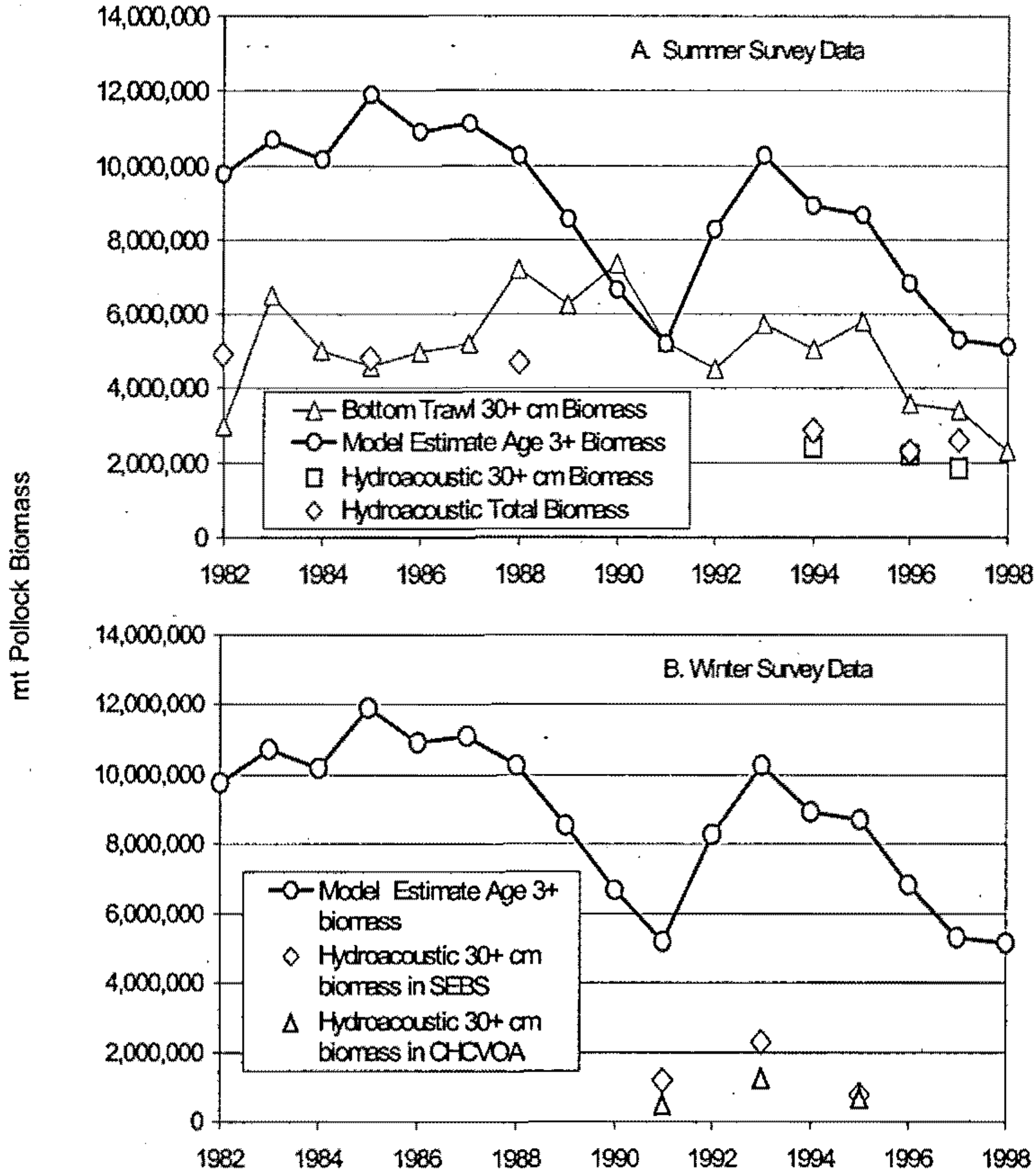

Figure 3-17 Pollock biomass on the eastern Bering Sea shelf as estimated by the stock assessment model (Ianelli et al 1998), compared with (A) summer bottom and hydroacoustic surveys of the entire EBS shelf and (B) winter hydroacoustic surveys of the ice-free region of the southeast Bering Sea shelf (SEBS). The hydroacoustic 30+ cm pollock biomass estimate in the CH/CVOA in winter is also shown in B.

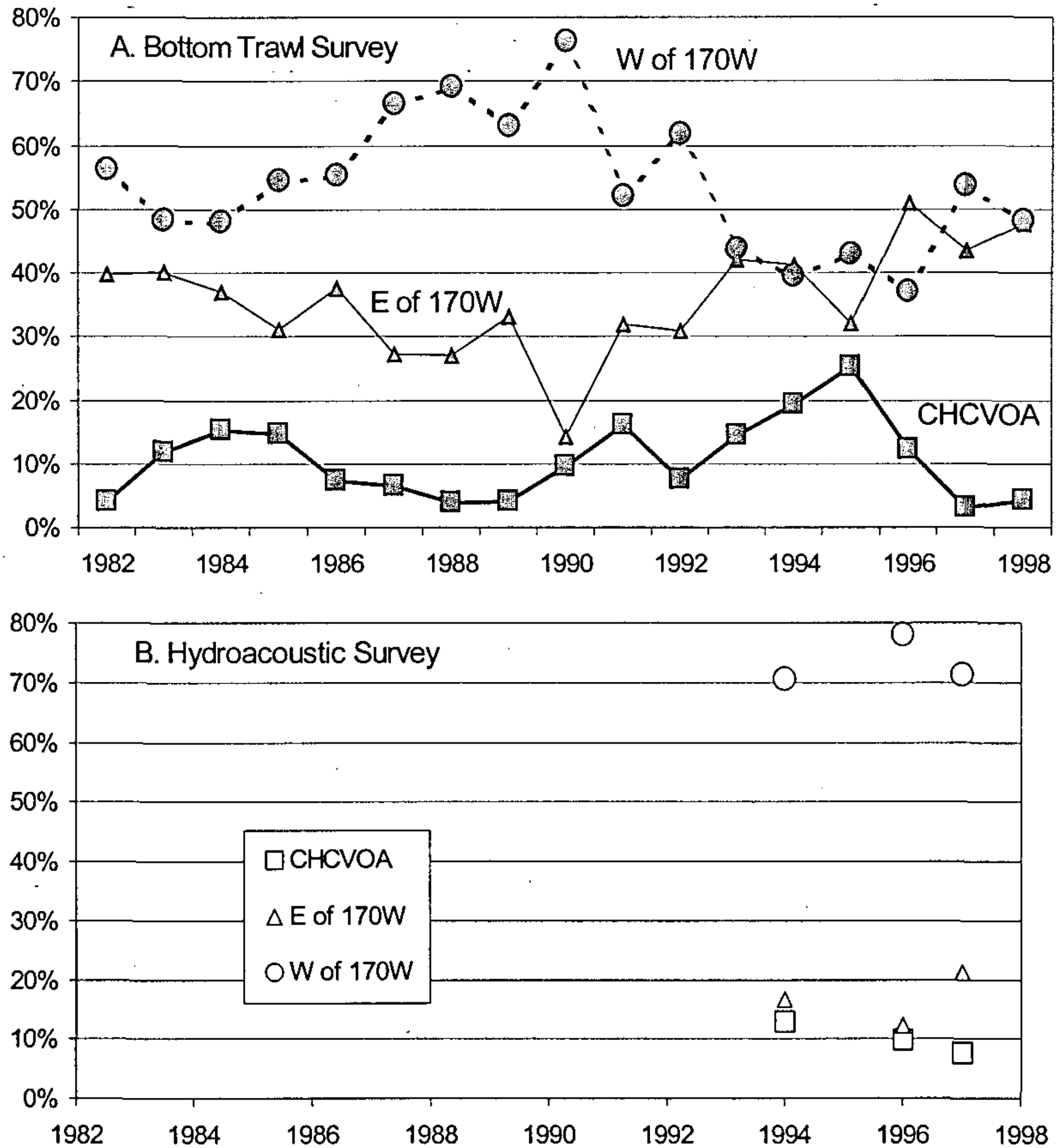

Figure 3-18 Percent distribution of 30+ cm pollock biomass in each of three areas (Figure 3-1) based on (A) the summer bottom trawl surveys of 1982-98, and (B) the summer hydroacoustic surveys of 1994, 1996, and 1997.

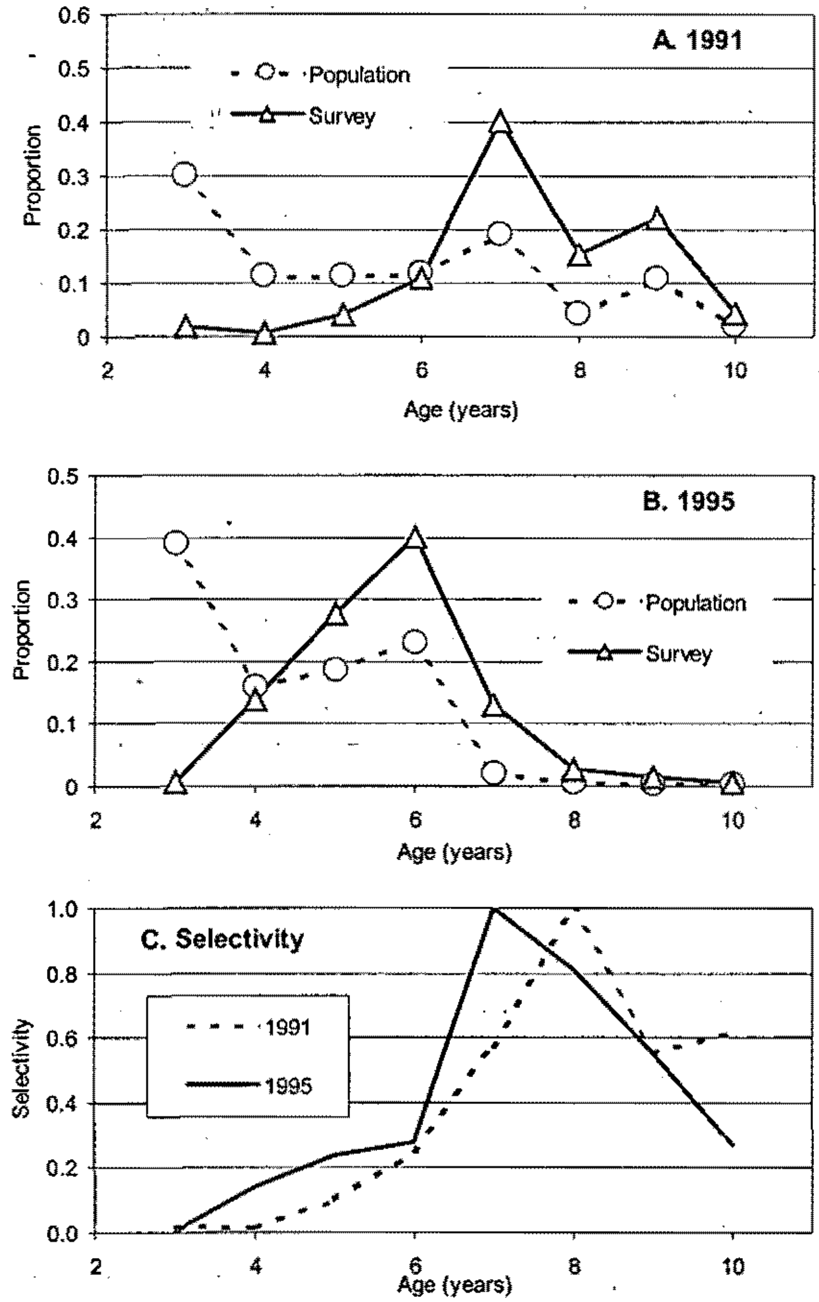

Figure 3-19 Comparisons of the relative proportion of age 3-10 year-old pollock from the Feb. 1991 (A) and April 1995 (B) hydroacoustic surveys of the southeastern Bering Sea shelf with the begin-year EBS pollock population as estimated by the stock assessment model (Ianelli et al. 1998). The age-specific selectivity of the two surveys are shown in C.

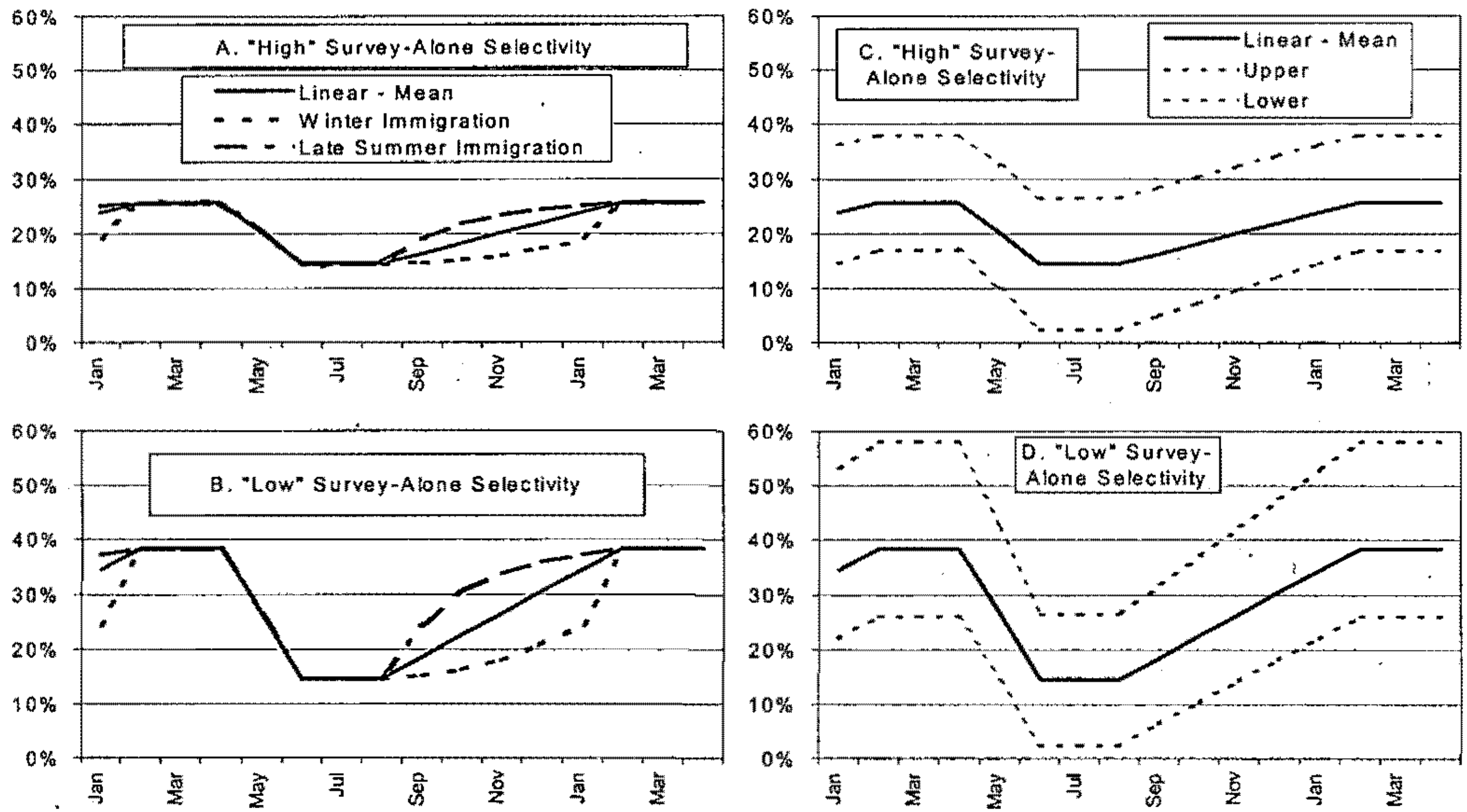

Figure 3-20 A conceptual model of the seasonal movement of pollock into and out of the CH/CVOA by month based on summer and winter survey information. Plots show the percent of total 30+ cm pollock within the CH/CVOA by month under the "high" winter survey-alone selectivity scenario (A and C) and the "low" (B and D) (Table 3-5). The biomass percentage for summer (June-August) is the 1991-98 average from Table 3-4. Biomass percentages for February-April are the mean estimates for the "high" and "low" scenarios shown in Table 3-5. In A and B, three conceptual models are shown for movement of pollock back into the CH/CVOA between August and February: (1) linear, with equal proportions per month in September through January; (2) late summer migration, with a greater proportion moving back into the CH/CVOA in September and October than in November-January; and (3) winter migration, with a greater proportion moving back into the CH/CVOA in December-January than in September-November. In C and D, "confidence bounds" are placed around the linear model: 2 standard deviations around the mean summer estimates (Table 3-4), the upper and lower percentages from the upper 50% of the probability-weighted states of nature for the mean winter-early spring estimates (bold-faced percentages in Table 3-5A and B, Part 2), and linear interpolation between them.

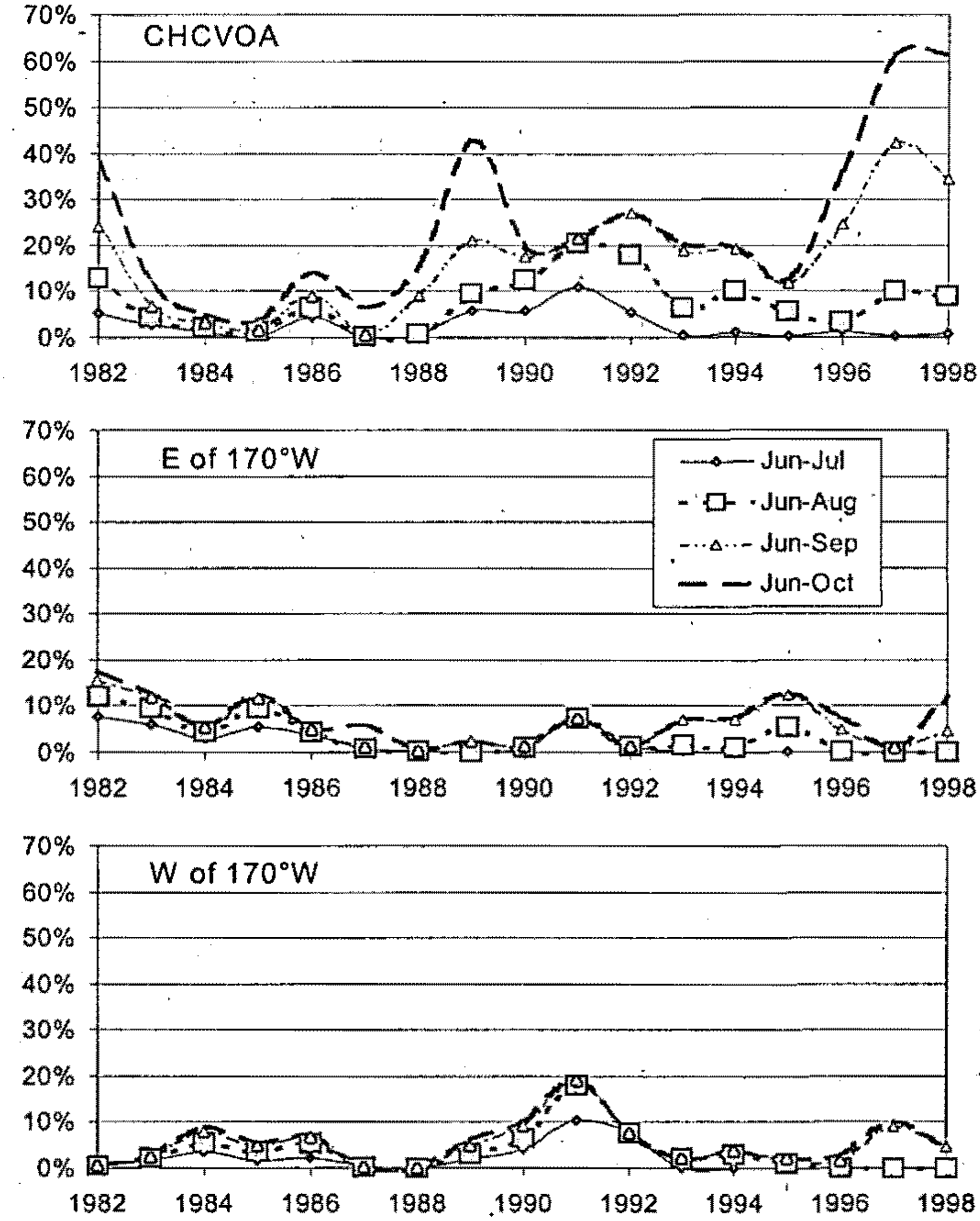

Figure 3-21 Estimates of pollock harvest rates by area and year in 4 periods in summer/early fall: June-July, June-August, June-September, and June-October. In each case, catches from the 2-5 month periods in each area (Table 3-1) were divided by the estimated summer pollock abundance in each area (Table 3-4).

4.0 STATUS OF THE STELLER SEA LION

4.1 Species description

The Steller sea lion (*Eumetopias jubatus*) is the only extant species of the genus *Eumetopias*, and is a member of the subfamily Otariinae, family Otariidae, superfamily Otarioidea, order Pinnipedia. The closest extant relatives of the Steller sea lion appear to be the other sea lion genera, including *Zalophus*, *Otaria*, *Neophoca*, and *Phocartos*, and the fur seals of the genera *Callorhinus* and *Arctocephalus*. Loughlin *et al.* (1987) provide a brief but informative summary of the fossil record for *Eumetopias*. Repenning (1976) suggests that a femur dated 3 to 4 million years old may have been from an ancient member of the *Eumetopias* genus, thereby indicating that the genus is at least that old. Presumably, *Eumetopias jubatus* evolved entirely in the North Pacific (Repenning 1976).

4.2 Distribution

The Steller sea lion is distributed around the North Pacific rim from the Channel Islands off Southern California to northern Hokkaido, Japan. In the Bering Sea, the northernmost major rookery is on Walrus Island (Pribilof Islands) and their northernmost major haulout is on Hall Island (off the northwestern tip of St. Matthew Island). Their distribution also extends northward from the western end of the Aleutian chain to sites along the eastern shore of the Kamchatka Peninsula. The center of distribution has been considered to be in the GOA and the Aleutian Islands (National Marine Fisheries Service [NMFS] 1992). Within this distribution, land sites used by Steller sea lions are referred to as rookeries and haulout sites. Rookeries are used by adult males and females for pupping, nursing, and mating during the reproductive season (late May to early July). Haulouts are used by all size and sex classes but are generally not sites of reproductive activity as occurs on rookeries. The continued use of particular sites may be due to site fidelity, or the tendency of sea lions to return repeatedly to the same site, often the site of their birth. Presumably, these sites were chosen and continue to be used because they provide protection from predators, some measure of protection from severe climate or sea surface conditions, and (perhaps most importantly) are in close proximity to prey resources.

The movement patterns of Steller sea lions are not yet well understood. Their movement patterns from a land base (rookery or haulout) might be categorized into at least three types. First, sea lions move on and offshore for feeding excursions. Limited data are available to describe these movements (e.g., Gentry 1970, Sandgren 1970, Merrick and Loughlin 1997), but such descriptions are essential for understanding foraging patterns, nursing strategies, and energetics. Second, at the end of the reproductive season, some females may move with their pups to other haulout sites and males may "migrate" to distant foraging locations [Spaulding 1964, Mate 1973, Porter 1997]). Limited data are available indicating that animals do shift from rookeries to haulouts, but the timing and nature of these movements need further description (i.e., what distances are involved, are movements relatively predictable for individuals, do movements vary with foraging conditions, etc.). Description of these types of movements are essential for understanding seasonal distribution changes, foraging ecology, and apparent trends as a function of season. Third, sea lions may make semi-permanent or permanent one-way movements from one site to another (Chumbley *et al.* 1997, their Table 8; Burkanov *et al.* unpubl. report [cited in Loughlin 1997]). Calkins and Pitcher (1982) reported movements in Alaska of up to1500 km. They also describe wide dispersion of young animals after weaning, with the majority of those animals returning to the site of birth as they reach reproductive age.

The distribution of Steller sea lions at sea is also not well understood. Their at-sea distribution is, however, a critical element to any understanding of potential effects of fisheries on Steller sea lions, and will be considered in greater detail below in the section on foraging patterns.

4.3 Reproduction

Steller sea lions have a polygynous reproductive system where a single male may mate with multiple females. As mating occurs on land (or in the surf or intertidal zones), males are able to defend territories and thereby exert at least partial control over access to adult females and mating privileges. The pupping and mating season is relatively short and synchronous, probably due to the strong seasonality of the sea lions' environment and the need to balance aggregation for reproductive purposes with dispersion to take advantage of distant food resources (Bartholomew 1970). In May, adult males compete for rookery territories. From late May to early July, adult females arrive at the rookeries, where pregnant females give birth to a single pup. The sex ratio of pups at birth is assumed to be approximately 1:1 (e.g., York 1994) or biased toward slightly greater production of males (e.g., Pike and Maxwell 1958, Lowry *et al.* 1982, NMFS 1992).

Mating occurs about one to two weeks later (Gentry 1970). The gestation period is probably about 50 to 51 weeks, but implantation of the blastocyst is delayed until late September or early October (Pitcher and Calkins 1981). Due to delayed implantation, the metabolic demands of a developing fetus are not imposed until well after fertilization.

For females with a pup, the nursing period continues for months to several years. Thorsteinson and Lensink (1962) suggested that nursing of yearlings was common at Marmot Island in 1959. Pitcher and Calkins (1981) suggested that it is more common for pups to be weaned before the end of their first year, but they also observed nursing juveniles (aged 1 to 3). Porter (1997) distinguished metabolic weaning (i.e., the end of nutritional dependence of the pup or juvenile on the mother) from behavioral weaning (i.e., the point at which the pup or juvenile no longer maintains a behavioral attachment to the mother). He also suggested that metabolic weaning is more likely a gradual process occurring over time and more likely to occur in March-April, preceding the next reproductive season. The transition to nutritional independence may, therefore, occur over a period of months as the pup begins to develop essential foraging skills, and depends less and less on the adult female. The length of the nursing period may also vary as a function of the condition of the adult female. The nature and timing of weaning is important because it determines the resources available to the pup during the more demanding winter season and, conversely, the demands placed on the mother during the same period. The maintenance of the mother-offspring bond may also limit their distribution or the area used for foraging.

Relatively little is known about the life history of sea lions during the juvenile years between weaning and maturity. Pitcher and Calkins (1981) reported that females sampled in the late 1970s reached reproductive maturity between ages 2 and 8, and the average age of first pregnancy was 4.9 ±1.2 years. These results suggest a mean age of first birth of about 6 years. The available literature indicates an overall reproductive (birth) rate on the order of 55% to 70% or greater (Pike and Maxwell 1958, Gentry 1970, Pitcher and Calkins 1981, Pitcher *et al.* in review). York (1994) derived the age-specific fecundity rates in Table 4-1 based on data from Calkins and Pitcher (1982). Those rates illustrate a number of important points and assumptions. First, the probability of pupping is rare (about 10%) for animals 4 years of age or younger. Second, maturation of 100% of a cohort of females occurs over a prolonged period which may be as long as 4 years. Third, the reported constancy of fecundity extending from age 6 to 30 indicates that either senescence has no effect on fecundity, or our information on fecundity rates is not sufficiently detailed to allow confident estimation of age-specific rates for animals older than age 6. Given the small size of the sample taken, the latter is a more likely explanation for such constancy.

Table 4-1 Life history table for Steller sea lions based on Calkins and Pitcher (1982) and York (1994). (From York 1994.)

Ages			Calkins-Pitcher life table			York life table		
From	To	Fecundity	Cum. survival	Annual survival	Percent at age	Cum. survival	Annual survival	Percent at age
0	1	0.000	1.000	0.776	16.676	1.000	0.782	16.251
1	2	0.000	0.776	0.776	12.546	0.782	0.782	12.709
2	3	0.000	0.603	0.776	9.438	0.612	0.782	9.938
3	4	0.105	0.468	0.868	7.100	0.478	0.930	7.772
4	5	0.267	0.406	0.879	6.163	0.445	0.909	7.228
5	6	0.286	0.357	0.888	5.417	0.404	0.895	6.570
6	7	0.315	0.317	0.893	4.811	0.362	0.884	5.880
7	8	0.315	0.283	0.898	4.296	0.320	0.875	5.198
8	9	0.315	0.254	0.874	3.857	0.280	0.867	4.548
9	10	0.315	0.222	0.899	3.372	0.242	0.859	3.943
10	11	0.315	0.200	0.893	3.031	0.208	0.853	3.338
11	12	0.315	0.178	0.896	2.707	0.178	0.847	2.889
12	13	0.315	0.160	0.895	2.425	0.150	0.841	2.447
13	31	0.315	0.160	0.895	15.99	0.150	p(x)d	11.239

Merrick *et al.* (1995) compared pup sizes at different sites where Steller sea lion populations were either decreasing or increasing, to determine if pup size or growth may be compromised in decreasing populations. Their results were not consistent with that hypothesis; rather, they found that pups about two to four weeks of age were larger at sites in the Aleutian Islands and GOA than they were in southeast Alaska or Oregon. These observed differences indicate that at least this phase of reproduction may not be affected; that is, if females are able to complete their pregnancy and give birth, then the size of those pups does not appear to be compromised.

Pitcher *et al.* (in review) provide data from the 1970s and 1980s that suggests a much higher pregnancy rate after the mating season (97%; both periods), which declined to 67% for females collected in the 1970s and 55% for females collected in the 1980s. These changes in pregnancy rate suggest a large fetal mortality rate that could be a common feature of the Steller sea lion reproductive strategy (i.e., may occur even when conditions are favorable and population growth is occurring), but is more likely an indication of stress (possibly nutritional) experienced by individual females.

The observed late pregnancy rates (67% in the 1970s and 55% in the 1980s) were not significantly different statistically. However, the direction of the difference is consistent with the hypothesis that reproductive effort in the 1980s was compromised. Pitcher *et al.* (in review) did observe a statistical difference in the late season pregnancy rates of lactating females in the 1970s (63%) versus lactating females in the 1980s (30%).

4.4 Survival

Much of the recent effort to understand the decline of Steller sea lions has been focused on juvenile survival, or has assumed that the most likely proximate explanation is a decrease in juvenile survival rates. This contention is supported by direct observations and a modeling study, and is consistent with the notion that juvenile animals are less adept at avoiding predators and obtaining sufficient resources (prey) for growth and survival.

The direct observations consist of extremely low resighting rates at Marmot Island of 800 pups tagged and branded at that site in 1987 and 1988 (Chumbley *et al.* 1997) and observations of relatively few juveniles at Ugamak (Merrick *et al.* 1988). The low resighting rates do not themselves confirm that the problem was a corresponding drop in juvenile survival, but only that many of the marked animals were lost to the Marmot Island population. Migration to other sites where they were not observed is a possibility, but unlikely. If the "loss" of these animals is viewed in the context of the overall sea lion decline in the central GOA (from 1976 to 1994 the number of non-pups counted at Marmot Island declined by 88.9% and by 76.9% at the 14 other trend sites in the Gulf; Chumbley *et al.* 1997), then a significant increase in juvenile mortality is a much more plausible conclusion.

Modeling by York (1994) provides evidence that the observed decline in sea lion abundance in the GOA may have been due to an increase in juvenile mortality. York used the estimated rate of decline between the 1970s and the 1980s, and the observed shift in the mean age of adult females (≥3 years of age) to explore the effects of changes in adult reproduction, adult survival, and juvenile survival. While she pointed out that the observed decline did not rule out all other possible explanations, she concluded that the observed decline is most consistent with a decrease in juvenile survival on the order of 10 to 20% annually.

However, juvenile survival may not be the only factor influencing the decline of the western population of Steller sea lions. Evidence indicating a decline in reproductive success was presented above. In addition, changes in adult survival may also have contributed to the decline. At present, survival rates for adult animals can not be determined with sufficient resolution to determine if those rates have changed over time or are somehow compromised to the extent that population growth and recovery are compromised.

4.5 Age distribution

Two life tables have been published with age-specific rates (Table 4-1). The first was from Calkins and Pitcher (1982) and was based on sea lions killed in the late 1970s. York (1994) created a second life table using a Weibull model and the data from Calkins and Pitcher (1982) and Calkins and Goodwin (1988). York's analysis of these two data sets suggests a shift from the 1970s to the 1980s in the mean age of females older than 3 years of age. The shift was about 1.55 years, and provided the basis for her determination that increased juvenile mortality may have been an important proximate factor in the decline of Steller sea lions. That is, such a shift in mean age would occur as the adult population aged without expected replacement by recruiting young females.

4.6 Foraging patterns

The foraging patterns of the Steller sea lion are clearly central to any discussion of the potential for interaction between this species and groundfish (or other) fisheries in the BSAI or GOA. A partial list of foraging studies is provided in Table 4-2 (located at the end of this section), together with notes on the sample sizes, locations, years, and primary findings of those studies.

4.6.1 Foraging distributions

At present, our understanding of Steller sea lion foraging distribution is based on observations of foraging behavior (or presumed foraging behavior) in areas such as the southeastern Bering Sea (Fiscus and Baines 1966, Kajimura and Loughlin 1988), records of incidental take in fisheries (Perez and Loughlin 1991), and satellite telemetry studies (e.g. Merrick *et al.* 1994, Merrick and Loughlin 1997). Observations and incidental take of sea lions (Loughlin and Nelson 1986, Perez and Loughlin 1991) in the vicinity of Seguam Pass, the southeastern Bering Sea, and Shelikof Strait provided a basis for establishment of those areas as critical habitat (FR 58:45269-45285).

The results of telemetry studies suggest that foraging distributions vary by individual, size or age, season, site, and reproductive status (i.e., is the female still supporting a pup; Merrick and Loughlin 1997). The foraging patterns of adult females differed during summer months when females were with pups versus winter periods when considerable individual variation was observed, but may be attributable to the lactation condition of the females. Trip duration for females (n = 14) in summer was approximately 18 to 25 hours. For five of those females that could be tracked, trip length averaged 17 km and they dove approximately 4.7 hours per day. For five females tracked in winter months, mean trip duration was 204 hours, mean trip length was 133 km, and they dove 5.3 hours per day. The patterns exhibited by females in winter varied considerably, from which the investigators inferred that two of them may still have been supporting a pup. Those two females continued to make relatively shorter trips (mean of 53 km over 18 hours) and dove 8.1 hours per day, whereas the other three ranged further, dove 3.5 hours per day, and spent up to 24 days at sea. Five winter young-of-the-year exhibited foraging patterns intermediate between summer and winter females in trip distance (mean of 30 km), but shorter in duration (mean of 15 hours), and with less effort devoted to diving (mean of 1.9 hours per day). Estimated home ranges (mean ± 1 SE) were 319 ± 61.9 km^2 for adult females in summer, 47,579 ± 26,704 km^2 for adult females in winter, and 9,196 ± 6799 km^2 for winter young-of-the-year.

The sea lions used in Merrick and Loughlin's (1997) study were from the GOA (Sugarloaf Island, Latax Rocks, Marmot Island, Long Island, Chirikof Island, Atkins Island, and Pinnacle Rock), and the BSAI region (Ugamak Island and Akun Island). This information is, therefore, directly pertinent to the action areas for both the GOA and BSAI fisheries, although it is perhaps most relevant to the GOA action area.

4.6.2 Foraging depths

The sea lions in the Merrick and Loughlin (1997) study tended to make relatively shallow dives, with few dives recorded at greater than 250 m (Fig. 4-1). Maximum depth recorded for the five summer adult females were in the range from 100 to 250 m, and maximum depth for the five winter adult females was greater than 250 m. The maximum depth measured for winter young-of-the-year was 72 m. These results suggest that sea lions are generally shallow divers, but are capable of deeper dives (i.e., greater than 250 m).

The instruments used to record diving depths do not determine the purpose of a dive, and many of the recorded dives (Fig. 4-1) may not be indicative of foraging effort. Dives between 4 and 10 m depth may be for foraging, or they may simply be grooming, porpoising, or transiting between locations. For example, animals transiting to and from foraging locations during rough sea surface conditions may transit in a series of long, shallow dives to avoid such conditions. The relatively large number of dives recorded between 4 and 10 m may therefore bias the assessment of "foraging" depths for these sea lions.

The results from this study also may not be indicative of diving depths and patterns for other sea lions at other times of year or in other locations. The winter young-of-the-year were instrumented in the period from November to March, when they were probably about five to nine months old and may have still been nursing. At this age, they are just beginning to develop foraging skills, which may take years to learn. The diving depths and patterns exhibited by these young-of-the-year are likely poor indicators of the foraging patterns of older juveniles (one- to three-year-olds). For example, Swain and Calkins (1997) report dives of a 2-year-old male sea lion to 252 m, and regular dives of this animal and a yearling female to 150 m to 250 m (Fig. 4-2). Clearly, if young-of-the-year are limited to relatively shallow depths, and older animals are capable of diving to much greater depths, then those younger animals are just beginning to develop the diving and foraging skills necessary to survive. The rate at which they develop those skills and, for example, begin to dive to greater depths or take prey at greater depths, is unknown, but probably occurs rapidly after weaning to take advantage of otherwise unavailable prey resources.

4.6.3 Prey, energetics and nutrition, and diversity

At the least, an understanding of Steller sea lion foraging requires a listing of their prey species, a qualitative or (preferably) quantitative measure of the relative importance of different prey types, descriptions of prey characteristics and predator-prey dynamics, and an assessment of diet diversity. A (partial) listing of Steller sea lion prey species or prey types would include (not in order of priority): Atka mackerel, capelin, crabs, dogfish sharks, eulachon, flatfish, greenling, hake, halibut, herring, lamprey, lingcod, molluscs, octopus, Pacific cod, pollock, ratfish, rockfishes, salmon, sand lance, sculpins, shrimps, smelt, squid, and yellowfin sole.

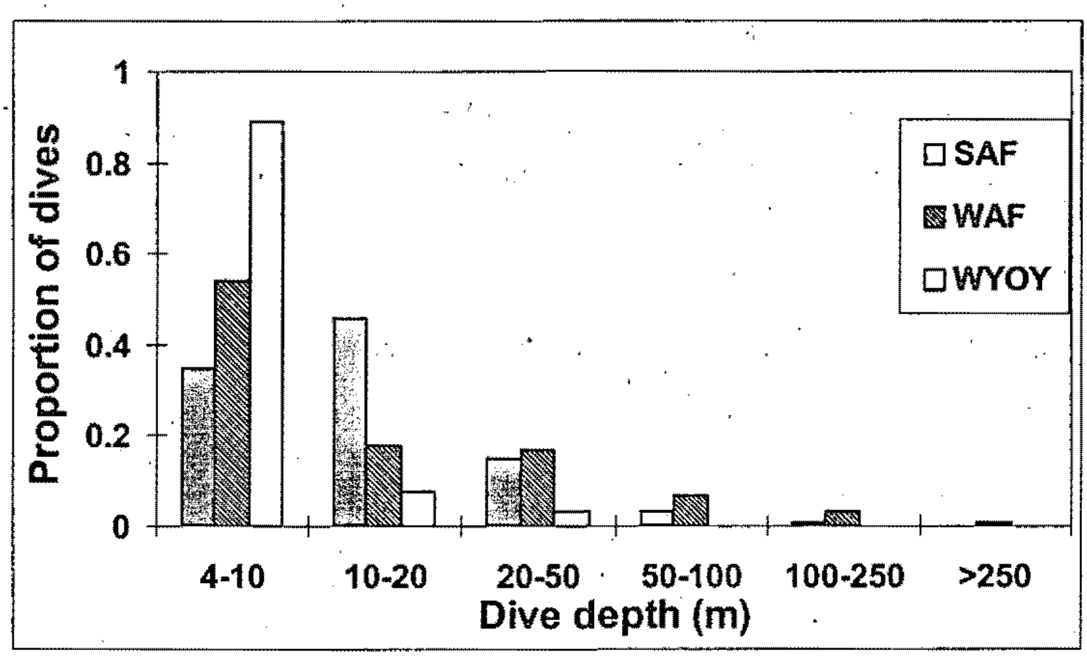

Figure 4-1 Proportion of dives by depth range for young-of-the-year (WYOY) and adult female Steller sea lions in summer (SAF) and winter (WAF) tracked during 1990-1993 (from Merrick and Loughlin 1997).

Qualitative or quantitative indices of prey importance might be developed on the basis of prey "selection" or "preference." However, we rarely have information on the distribution or availability of different prey types, and therefore don't have a basis for inferring "selection" or "preference" (Lowry *et al.* 1982, Frost and Lowry 1986). In most studies of Steller sea lion prey, rank frequency of occurrence is used as a qualitative (or semi-quantitative) index of relative importance. For example, the data from Merrick *et al.* (1997) and NMFS (1995) indicate that throughout the range of the western population of Steller sea lions, either pollock or Atka mackerel are the dominant prey on the basis of frequency of occurrence. Therefore, pollock and Atka mackerel can reasonably be assumed to be essential prey of Steller sea lions. Quantitative estimation of the importance of different prey types is considerably more difficult. The value of a prey type should be quantified on the basis of the observed net gain in calories and nutrients resulting from predation on that prey type versus other prey types. Such a determination would require information on biomass consumed, caloric and nutrient content of that biomass, energy and nutrients gained, and energy and nutrients expended (i.e., the costs of predation). Caloric and nutrient content of different prey types are relatively easy to determine using proximate analysis, although Stansby (1976) cautioned that individuals of the same prey type may vary considerably as a function of season, site, reproductive condition, and other factors. Assimilation efficiency has also been studied (Fadely *et al.* 1994, Rosen and Trites *in prep*) and appears to be relatively straightforward. Biomass consumed and costs of predation are more difficult to quantify, particularly with respect to any particular prey type.

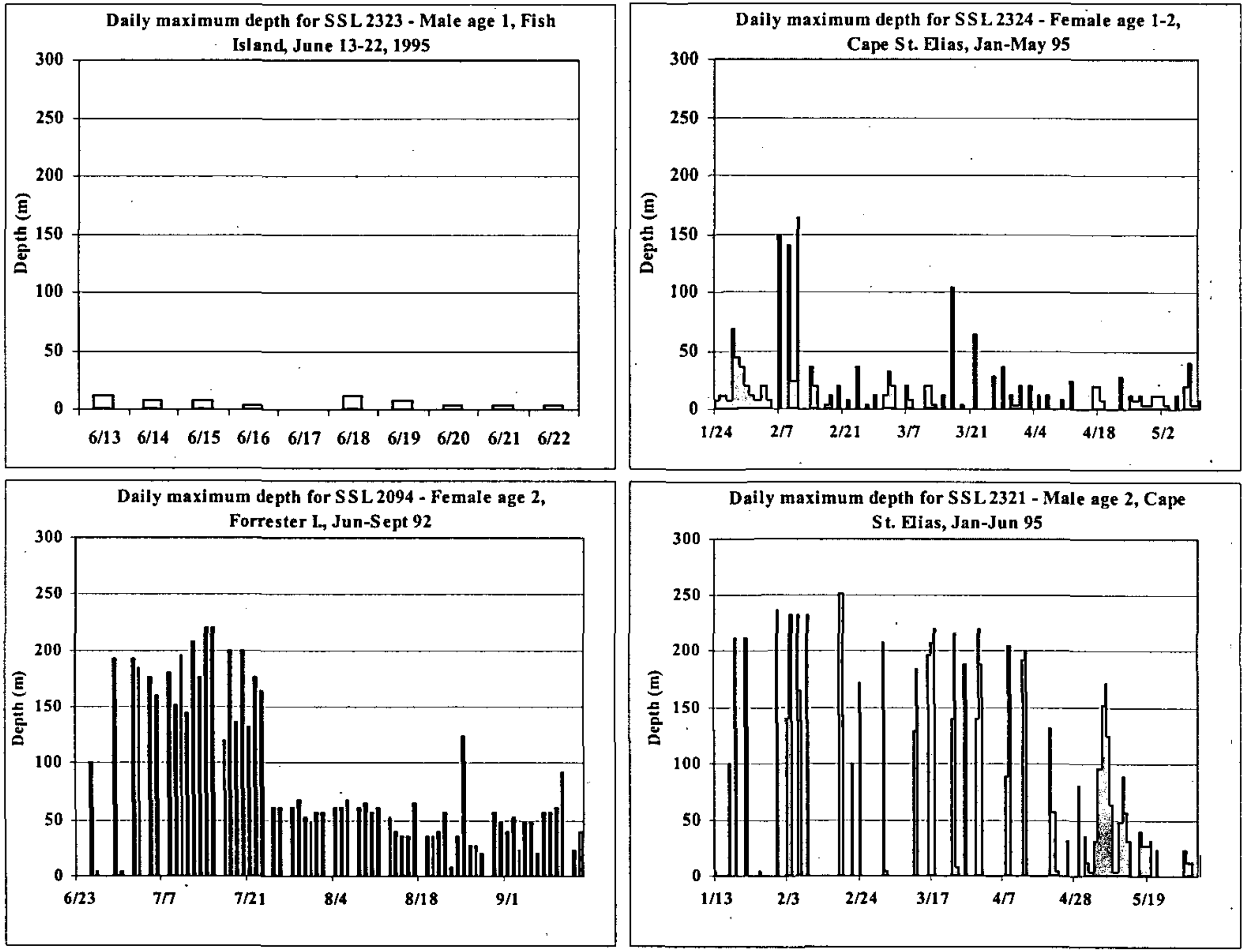

Figure 4-2 Maximum daily dive depths for four juvenile Steller sea lions (based on data from U. Swain, Alaska Department of Fish and Game).

Many of the studies on Steller sea lion foraging patterns (Table 4-2, located at the end of this section) provide information on frequency of occurrence, but such information cannot be readily converted into biomass consumed unless additional data are provided. Biomass estimates are more readily determined from volumetric measurements of stomach contents, but can also be estimated from length-weight relationships combined with measured lengths of prey or estimated length at age (with age based on otoliths; e.g., Frost and Lowry 1986). Costs of predation may also vary considerably by prey type, depending on the distribution, life history characteristics, and behavior of the prey.

Important prey characteristics include their tissue or body composition, individual size (mass), availability, depth in the water column, their degree of association with the bottom, their reproductive behaviors, their degree of aggregation (e.g., solitary versus schooling), and their temporal and spatial distribution patterns. To date, the limited information available indicates that sea lions generally forage at depths less than 250 m. Many of their prey are, at one life stage or another, associated with the bottom. Predation on prey associated with the bottom is a common pinniped strategy, perhaps because the bottom limits the spatial dimensionality of the predator-prey arena and thereby limits the prey's alternatives for escape. Male Atka mackerel may be susceptible to predation because they fertilize and then guard eggs laid by the female on the bottom. Schooling behavior of pollock and Atka mackerel probably enhances their value as prey as such schooling may increase sea lion consumption relative to costs associated with searching and capture.

The spatial and temporal distributions of prey types is a critical determinant of their availability to sea lions. The consistent pattern of the Atka mackerel fishery over time indicates that aggregations of Atka mackerel are distributed in patches that are relatively predictable. Aggregations of pollock are less predictable in time and space than aggregations of Atka mackerel, but also demonstrate considerable predictability, particularly for winter and spring spawning aggregations. To varying degrees, then, both of these prey species appear to be distributed in more (Atka mackerel) or less (pollock) predictable prey patches, and the availability and characteristics of those patches may be essential to the foraging success of sea lions. Important patch characteristics may include their size, location, persistence, and density (number of patches per area).

The quality of the sea lion diet appears to be determined not only by the individual components (species) of the diet, but also by the mix or diversity of prey in the diet. Merrick *et al.* (1997) found a correlation between a measure of diet diversity in different geographic regions of the western population and population trends in those regions. Their conclusions were that reliance on a single prey type may not be conducive to population growth; a diversity of prey may be necessary for recovery of the western population. Unfortunately, diet diversity is a function not only of prey selection, but of the diversity of prey available. To the extent that pollock or Atka mackerel currently dominate the prey field, sea lions survive on those prey.

4.6.4 Foraging and the winter period

Changes in behavior, foraging patterns, distribution, and metabolic/physiologic requirements during the annual cycle are all pertinent to consideration of the potential impact of prey removal by commercial fisheries. Steller sea lions, at least adult females and immature animals, are not like some marine mammals that store large amounts of fat to allow periods of fasting. They need more or less continuous access to food resources throughout the year. Nevertheless, the sensitivity of sea lions to competition from fisheries may be exaggerated during certain times of the year. Reproduction likely places a considerable physiological or metabolic burden on adult females throughout their annual cycle. Following birth of a pup, the female must acquire sufficient nutrients and energy to support both herself and her pup. The added demand may persist until the next reproductive season, or longer, and is exaggerated by the rigors and requirements of winter conditions. The metabolic requirements of a female that has given birth and then become pregnant again are increased further to the extent that lactation and pregnancy overlap and the female must support her young-of-the-year, the developing fetus, and herself. And again, she must do so through the winter season when metabolic requirements are likely to be exaggerated by harsh environmental conditions.

Nursing pups are still dependent, at least to some extent, on their mother. If the mother is able to satisfy all the pup's nutritional needs through the winter, then at least from a nutritional point of view, winter may not be a time of added nutritional risk to the pup. If, on the other hand, the pup begins a gradual transition to independence before or during the winter season, then the challenge of survival may be greater for the pup through the winter.

Weaned pups are independent of their mothers, but may not have developed adequate foraging skills. They must learn those skills, and their ability to do so determines, at least in part, whether they will survive to reproductive maturity. This transition to nutritional independence is likely confounded by a number of seasonal factors. Seasonal changes may severely confound foraging conditions and requirements; winter months bring harsher environmental conditions (lower temperatures, rougher sea surface states) and may be accompanied by changing prey concentrations and distributions (Merrick and Loughlin 1997). Weaned pups' lack of experience may result in greater energetic costs associated with searching for prey. Their smaller size and undeveloped foraging skills may limit the prey available to them, while at the same time, their small size results in relatively greater metabolic and growth requirements.

Diet studies of captive sea lions indicated that they adjust their intake levels seasonally, with increases in fall and early winter months (Kastelein *et al.* 1990). These adjustments varied with age and sex of the studied animals, and the extent to which the patterns observed are reflective of foraging patterns in sea lions in the BSAI or GOA regions is not known. Nonetheless, such studies support the contention that the winter period is a time of greater metabolic demands and prey requirements.

Changes in condition, availability, and behavior of prey may also be essential to successful foraging by all sea lions in winter. Pollock in reproductive condition (i.e., bearing roe—toward the end of the winter) are presumably of greater nutritional value to sea lions (for the same reasons that the fisheries would rather take roe-bearing pollock than pollock spent after the spawning season). Also, the relative value of any prey type must also depend on the energetic costs of capturing, consuming, and digesting the prey. The winter aggregation of roe-bearing pollock may lead to a reduction in sea lion energetic costs associated with foraging on this species. Pollock aggregations appear to be relatively predictable in, for example, Shelikof Strait or the southeastern Bering Sea, which supports the idea that these are important foraging areas for sea lions.

Nonetheless, the information that suggests that winter may be a crucial season for Steller sea lions does not lessen the importance of available prey year-round. The observed increases in consumption by captive animals in the fall months indicates that preparation for winter months may also be essential. In addition, Trites (1998) reviewed northern fur seal data that indicated that fur seals undergo a period of faster growth in spring months and, if sea lions experience the same seasonal pattern of growth, then spring months may also be a particularly important period. Spring may also be important as pregnant females will be attempting to maximize their physical condition to increase the likelihood of a large, healthy pup (which may be an important determinant of the subsequent growth and survival of that pup). Similarly, those females that have been nursing a pup for the previous year and are about to give birth may wean the first pup completely, leaving that pup to survive solely on the basis of its own foraging skills. Thus, food availability is surely crucial year-round, although it may be particularly important for young animals and pregnant-lactating females in the winter.

4.6.5 Foraging - integration and synthesis

While much remains to be learned about Steller sea lions, the available information is sufficient to begin a description of their foraging patterns. The emerging picture appears to be that:

- Steller sea lions are land-based predators but their attachment to land and foraging patterns/distribution may vary seasonally and as a function of age, sex, and reproductive status;
- Steller sea lions tend to be relatively shallow divers but also exploit deeper waters;
- Steller sea lions consume a variety of demersal, semi-demersal, and pelagic prey;
- a diet of a diversity of prey appears to be advantageous to Steller sea lions
- at present, pollock and Atka mackerel appear to be their most common or dominant prey;
- the life history and spatial/temporal distribution of pollock and Atka mackerel are therefore likely important determinants of sea lion foraging success;
- foraging patterns and prey requirements probably vary by season, due to changes in reproductive status, prey availability, and environmental conditions;
- foraging sites relatively close to rookeries may be particularly important during the reproductive season when lactating females are limited by the nutritional requirements of their pups; and
- the transition by young animals from dependence on their mothers to independent feeding may occur over a period of months or even years.

The question of whether competition exists between the Steller sea lion and pollock or Atka mackerel fisheries is a question of sea lion foraging success. For a foraging sea lion, the net gain in energy and nutrients is determined, in part, by the availability of prey or prey patches it encounters within its foraging distribution. Competition occurs if the fisheries reduce the availability of prey to the extent that sea lion condition, growth, reproduction, or survival are diminished, and population recovery is impeded. The question of whether competition occurs will be addressed in the "environmental baseline" and "effects of the action" sections below.

4.7 Natural predators

The Recovery Plan for the Steller Sea Lion (NMFS 1992) states: "Steller sea lions are probably eaten by killer whales and sharks, but the possible impact of these predators is unknown. The occurrence of shark predation on other North Pacific pinnipeds has been documented, but not well quantified (Ainley *et al.*, 1981)." The likelihood of shark attack is probably greater for Steller sea lions off the Washington, Oregon, and California coasts than in waters further north. A killer whale attack has been documented off the Oregon coast (Mate 1973), but killer whales are probably much more frequent predators in the waters of British Columbia and Alaska (Barrett-Lennard *et al.*, unpubl. rep.). Barrett-Lennard *et al.*

surveyed 126 respondents to estimate the rate of observation of sea lion/killer whale interactions. Of 492 interactions witnessed, 32 (6.5%) reportedly involved sea lion mortality. The lethal interaction rate appeared to be greatest in the Aleutian Islands region, but those results were based on the "vague recollection" of one observer of 3 kills over a 24-year period. Perhaps the most noteworthy anecdotal observation of apparent killer whale predation on sea lions occurred in 1992, when flipper tags from 14 sea lions that were both tagged and branded were found in the stomach of a killer whale dead on the beach in Prince William Sound (NMFS 1995). Barrett-Lennard *et al.* (unpubl. rep.) model sea lion mortality due to killer whales, and suggest that while such predation may account for a significant portion of natural mortality at the current low size of the sea lion population, it was not likely to have been the cause of the decline. The most recent status report on Steller sea lions (NMFS 1995) concurs and points out that relative abundance of killer whales is likely greater off southeast Alaska, where sea lion populations have been slowly increasing.

4.8 Natural competitors

Competition may take several forms. For exploitative competition to occur, the potential competitors must utilize the same resource, the availability of that resource must be limited relative to the needs of the potential competitors, and use of the available resource by one of the potential competitors must impede use by the other (Krebs 1985). Interference competition can occur even when resources are not limited if the use of the resource by one potential competitor harms another. Steller sea lions are most likely to compete with other (nonhuman) species, for food, although they may also compete for habitat (e.g., potential competition with northern fur seals for rookery or haulout space).

Steller sea lions forage on a variety of marine prey that are also consumed by other marine mammals (e.g., northern fur seals, harbor seals, humpback whales), marine birds (e.g., murres and kittiwakes), and marine fishes (e.g., pollock, arrowtooth flounder). To some extent, these potential competitors may partition the prey resource so that little direct competition occurs. For example, harbor seals and northern fur seals may consume smaller pollock than Steller sea lions (Fritz *et al.* 1995). Competition may still occur if the consumption of smaller pollock limits the eventual biomass of larger pollock for sea lions, but the connection would be difficult to demonstrate. Such competition may occur only seasonally if, for example, fur seals migrate out of the area of competition in the winter and spring months. . Similarly, competition may occur only locally if prey availability or prey selection varies geographically for either potential competitor. Finally, competition between sea lions and other predators may be restricted to certain age classes, as diet may change with age or size.

4.9 Disease

Hoover (1988) lists evidence of exposure of sea lions to leptospirosis (Fay *et al.* 1978), chlamydiosis (Goodwin and Calkins 1985), and San Miguel sea lion virus (Goodwin and Calkins 1985, Barlough *et al.* 1987). Barlough *et al.* (1987) also present evidence of eight types of calicivirus (including seven types of San Miguel sea lion virus and Tillamook [bovine] virus). And recent tests, indicate exposure to brucellosis (pers. comm., K. Pitcher, Alaska Department of Fish and Game, 333 Raspberry Road, Anchorage, AK 99518).

Hoover (1988) also lists parasites known to infect sea lions, including cestodes of the genera *Diplogonoporus*, *Diphyllobothrium*, *Anophryocephalus*, *Adenocephalus*, and *Pyramicocephalus*; trematodes of the genera *Pricetrema*, *Zalophotrema*, and *Phocitrema*; acanthocephalans of the genera *Bulbosoma* and *Corynosoma*; and nematodes of the genera *Anisakis*, *Contracaecum*, *Parafilaroides*, *Uncinaria*, and *Phocanema* (Hill 1968, Dailey and Brownell 1972, Daily 1975, Fay *et al.* 1978, Geraci

1979, Dieterich 1981). In addition, Thorsteinson and Lensink (1962) reported two types of parasites: Body louse (*Antarctophthirus michrochir*) severely infesting pups and nose mites *(Orthohalarachne diminuta)* invariably found on adults. And Scheffer (1946) reported ascarid worms (*Porocaecum decipiens*) nearly always found in adult stomachs.

While a range of different diseases or maladies have been documented for Steller sea lions, the available evidence is not sufficient to demonstrate that disease has played or is playing any significant part in the decline of the western population. Disease may have contributed to the *in utero* mortality rate observed in animals collected in 1975-1978 and 1985-1986 (Pitcher *et al.* in review) but, again, that hypothesis is not substantiated by any data. The long-term continuous nature of the decline, and the lack of morbid or moribund specimens argue that disease has not been a primary factor.

4.10 Population dynamics

The breeding range of the Steller sea lion covers virtually all of the North Pacific Rim from about 34° N to 60°N lat. Within this range, sea lions are found in hundreds of rookeries and haulouts. These rookery and haulout sites are frequently grouped into rookery/haulout clusters on the basis of politics, geography, demographic patterns, genetics, foraging patterns, or other reasons related to scientific study or management. Political divisions are drawn to separate animals that are found off Japan or the Republic of Korea, in Russian territories, in Alaska, British Columbia, or along the western coast of Washington, Oregon, and California. These divisions are largely for the purpose of management or jurisdiction, but may be related to sea lion population dynamics because of differing management strategies or objectives.

Geographic distinctions are frequently made on the basis of variable habitat or ecosystem characteristics in differing parts of the range. For example, rookeries and haulouts in the Aleutian Islands are often separated from those in the GOA, and these two areas are again separated from southeastern Alaska and British Columbia. These distinctions may have demographic significance because of the important variability in ecosystem features such as prey resources. Sea lion rookeries and haulouts are also grouped on the basis of observed demographic trends (York *et al.* 1996).

Many, if not most, descriptions of the decline of Steller sea lions begin with the statement that the decline was first witnessed in the eastern Aleutian Islands in the mid 1970s and then spread westward to the central Aleutian Island and eastward to the western GOA in the late 1970s and early 1980s. Similarly, counts are frequently presented for the area from Kenai to Kiska Island (NMFS 1995), which is considered to enclose the center of abundance for the species. Genetic studies (Bickham *et al.* 1996, Loughlin 1997) provided the basis for distinguishing western and eastern management stocks of the sea lion, and additional work may allow further differentiation of stocks. The relation between diet diversity and population trend was studied using rookery groups identified by geographic location and rates of change. The rookery groups were those identified by York *et al.* (1996). These examples indicate that, depending on the purpose at hand, the total sea lion population may be split meaningfully into subpopulations in any number of ways.

However, if the purpose is to study or understand the natural (i.e., without human influence) population structure of the Steller sea lion, then the biogeography of the species must be defined more narrowly. Genetic studies may provide the best description of the result of biogeographic patterns, as they are likely the least influenced by human interaction. Demographic trends and foraging patterns may be influenced by human activities and, clearly, the artificial boundaries determined for political purposes should not have an influence on the natural biogeography of sea lions.

Those natural factors that determine their biogeography include climate and oceanography, avoidance of predators, distribution of prey, the reproductive strategy of the species, and movement patterns between sites. The marine habitat of the Steller sea lion tends to reduce variation in important environmental or climatic features, allowing the sea lion to disperse widely around the rim of the North Pacific Ocean. The decline of Steller sea lions off California may indicate a contraction in their range, depending on the explanation for that decline. Avoidance of terrestrial predators must clearly be an important factor, as rookeries and haulouts are virtually all located at sites inaccessible to such predators. Distribution of prey is likely a critical determinant of sea lion biogeography, and probably determines the extent of their dispersion during the non-reproductive season. The reproductive strategy of the species, on the other hand, requires aggregation at rookery sites, and therefore likely places important limits on the species' movement patterns and dispersion. Finally, movement patterns between sites determine, in part, the extent to which such groups of sea lions at different rookeries and haulout sites are demographically independent. Steller sea lions are generally not described as migrators. Adult males, for example, are described as dispersing widely during the non-reproductive seasons, and juveniles are described as dispersing widely after weaning and not returning to the reproductive site until they are approaching reproductive age (Calkins and Pitcher 1982).

An understanding of the natural biogeography of the Steller sea lion is essential to describe their population dynamics and identify the effects of potential human-related influences on their dynamics. Without a better understanding of movement patterns of sea lions, the geographic extent of potential fisheries effects can not be estimated with confidence. For example, we can not, at this time, describe the geographic extent of fishing for Atka mackerel at Seguam pass because we can not confidently determine whether the sea lions foraging at that site are from just Seguam and Agligadak Island rookeries, or perhaps also from Yunaska and Kasatochi Island rookeries or sites more distant. Similarly, the pollock fisheries in Shelikof Strait may have influenced the dynamics of sea lion populations at Chirikof and Chowiet Islands, or may have even farther reaching effects if, for example, sea lions from the Shumagin Islands forage in Shelikof Strait. In addition, descriptions of population size, variability, and stability may vary depending on the definition of population units.

4.11 Population status and trends

Assessments of the status and trends of Steller sea lion populations are based largely on (a) counts of nonpups (juveniles and adults) on rookeries and haulouts, and (b) counts of pups on rookeries in late June and early July. Both kinds of counts are indices of abundance, as they do not necessarily include every site where animals haul out, and they do not include animals that are in the water at the time of the counts. Population size can be estimated by standardizing the indices (e.g., with respect to date, sites counted, and counting method), by making certain assumptions regarding the ratio of animals present versus absent from a given site at the time of the count, and by correcting for the portion of sites counted. Population estimates from the 1950s and 1960s (e.g., Kenyon and Rice 1961; see also Trites and Larkin 1992, 1996) are used with caution because counting methods and dates were not standardized, and the results contain inconsistencies that indicate the possibility of measurement error at some sites in some years. Efforts to standardize methods began in the 1970s (Braham *et al.* 1980); as a result, counts conducted since the late 1970s are the most reliable estimates of the total population or subpopulations. However, counts at single sites should be interpreted with caution as they may vary considerably over short periods of time due to weather, season, disturbance, prey availability, and perhaps a number of other factors. For this reason, counts are generally combined by region to reduce this variability and provide a more precise indicator of trends in a region.

For the western U.S. population (i.e., west of 144°W long.), counts of adults and juveniles have fallen from 109,880 animals in the late 1970s to 22,167 animals in 1996, a decline of 80% (Fig. 4-3; Hill and DeMaster 1998, and based on NMFS 1995, Strick *et al.* 1997, Strick *et al. in press*). Although the number of animals lost appears to have been far greater from the late 1970s to the early 1990s, the rate of decline has remained high. The 1996 count was 27% lower than the count in 1990. Final results from counts conducted in 1998 are not yet available, but preliminary results for trend sites between the Kenai Peninsula to Kiska Island indicate a decline of about 9% in nonpups since 1996, and 19% in pups since 1994.

From the late 1970s to 1996, abundance estimates for the GOA dropped from 65,296 to 9,782 (85%), and for the BSAI region dropped from 44,584 to 12,385 (72%). Counts in Russian territories (to the west of the action area for the BSAI pollock and Atka mackerel fisheries) have also declined and are currently estimated to be about one-third of historic levels (NMFS 1992). Counts in southeast Alaska (to the east of the action area for the GOA pollock fishery) are increasing slowly.

Some demographic patterns are lost when estimates are pooled for large areas. The index counts are often described by geographic region (Fig. 4-4; Table 4-3; T. Loughlin, pers. comm.). Counts at all trend sites by region indicate a slow decline in the central and western GOA between 1976 and 1985, followed by a severe drop in both regions from 1985 to 1989, and continued decline in the central Gulf continuing to at least 1997. Counts in the eastern, central, and western Aleutians all declined sharply from the late 1970s to the early 1990s, and since have been variable but declining in the western region, declined moderately in the central region, and relatively stable in the eastern region, at least through 1996. The decline of sea lions in the GOA and BSAI regions has effectively shifted the center of abundance for the species to the east. In the 1970s, for example, Ugamak Island in the eastern Aleutian Islands was the largest rookery in the world. As abundance declined at Ugamak Island, rookeries at Marmot and Sugarloaf Islands in the Central GOA became numerically dominant. But as abundance at these sites declined, the rookery at Forrester Island (southeast Alaska) became dominant.

Although the decline of Steller sea lions has occurred over extensive areas, site-by-site evaluation of the counts may be essential to understand the decline, and to anticipate the nature of threats to the species as local populations dwindle to extremely low numbers. However, changes observed at specific sites must be interpreted with caution because animals are known to move between sites on temporary, seasonal, and permanent bases. Therefore, the extent to which the collection of animals at a given site represent an independent or meaningful population unit is not yet clear.

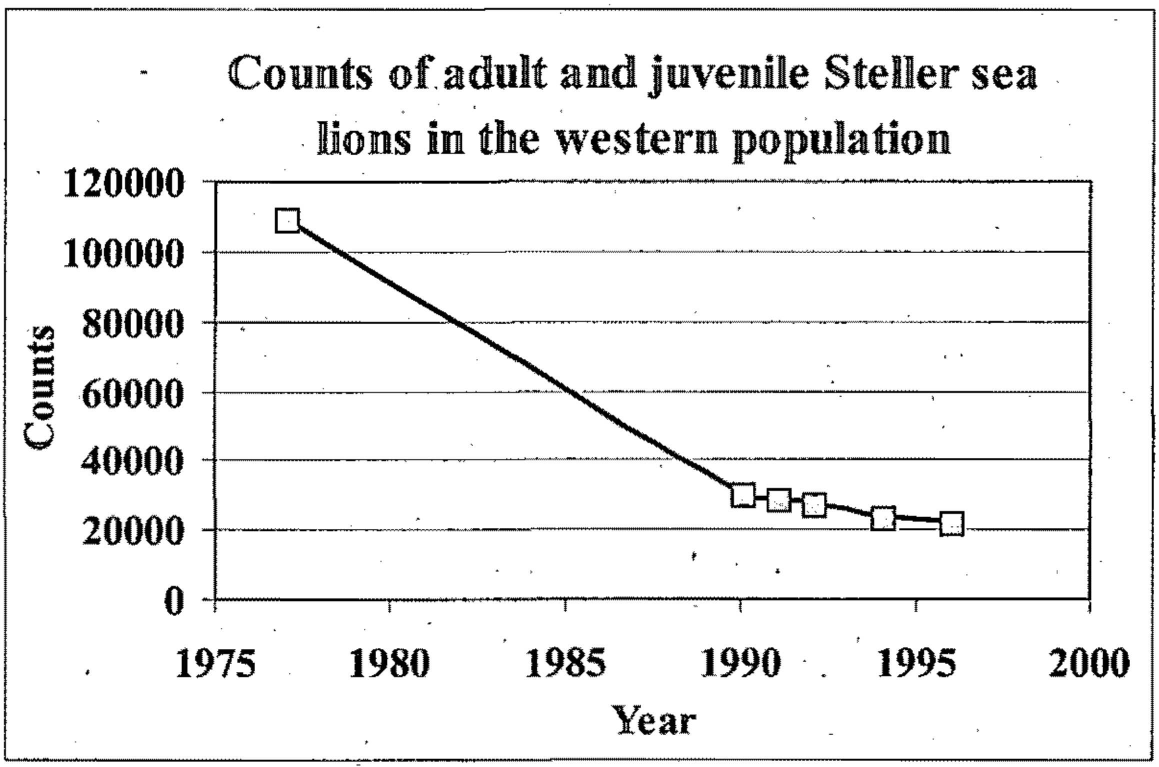

Figure 4-3 Counts of adult and juvenile Steller sea lions in the western population.

Table 4-2 Counts of Steller sea lions by region (NMFS, unpubl. data). For the GOA, the eastern sector includes rookeries from Seal Rocks in Prince William Sound to Outer Island; the central sector extends from Sugarloaf and Marmot Islands to Chowiet Island; and the western sector extends from Atkins Island to Clubbing Rocks. For the Aleutian Islands, the eastern sector includes rookeries from Sea Lion Rock (near Amak Island) to Adugak Island; the central sector extends from Yunaska Island to Kiska Island; and the western sector extends from Buldir Island to Attu Island.

Year	Gulf of Alaska			Aleutian Islands		
	Eastern	Central	Western	Eastern	Central	Western
1975				19,769		
1976	7,053	24,678	8,311	19,743		
1977				19,195		
1979					36,632	14,011
1985		19,002	6,275	7,505	23,042	
1989	7,241	8,552	3,800	3,032	7,572	
1990	5,444	7,050	3,915	3,801	7,988	2,327
1991	4,596	6,273	3,734	4,231	7,499	2,411
1992	3,738	5,721	3,720	4,839	6,399	2,869
1994	3,369	4,520	3,982	4,421	5,790	2,037
1996	2,133	3,915	3,741	4,716	5,528	2,190
1997		3,352	3,633			
1998		3,346	3,361	3,847	5,705	1,913

4.12 Population variability and stability

Populations change as a function of births, deaths, immigration, and emigration. During the nonreproductive season, some sea lions may move between the western and eastern populations (Calkins and Pitcher 1981), but net migration out of the western population is not considered a factor in the decline. The amount of growth observed in the eastern population is equivalent to only a small fraction of the losses in the western population. Thus, the decline must be due primarily to changes in birth and death rates. As mentioned above, computer modeling (York 1994) and mark-recapture experiments (Chumbley *et al.* 1997) indicate that the most likely problem leading to the decline is decreased juvenile survival, but lower reproductive success is almost certainly a contributing factor. Finally, adult survival has not been characterized and even small changes in the survival rate of adult females may be contributing significantly to past or current population trends.

These changes in vital rates would likely lead to changes in the age structure which, in turn, may tend to destabilize populations. With declining reproductive effort or juvenile survival, populations tend to become top heavy with more mature animals (e.g., the increase in mean age of adult females described by

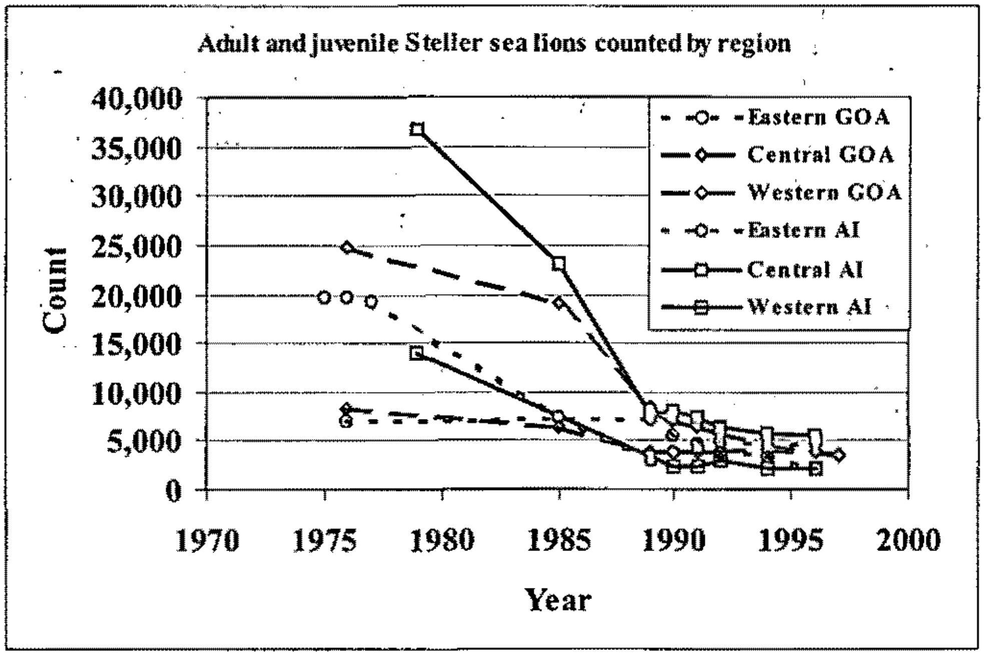

Figure 4-4 Counts by region of adult and juvenile Steller sea lions in the western population.

York [1994]), followed by a drop in population production as mature animals die without replacement through recruitment of young females. The extent to which the age structure is destabilized and the effect on population growth rate depends, in part, on the length of time that reproduction and/or juvenile survival remain suppressed. Increased mortality of young adult females may have the strongest effect on population growth and potential for recovery, as these females have survived to reproductive age but still have their productive years ahead of them (i.e., they are at the age of greatest reproductive potential).

Vital rates and age structures may change as a function of factors either extrinsic or intrinsic to the population. This biological opinion addresses the question of potential effects of the three fishery actions (i.e., extrinsic factors) on the Steller sea lion. However, the potential effects will be determined, in part, by the sensitivity of the western population to extrinsic influence, its resilience, and its recovery rate. Steller sea lions fit the description of a "K-selected" species of large-bodied long-lived individuals with delayed reproduction, low fecundity, and considerable postnatal maternal investment in the offspring. These characteristics should make sea lion populations relatively tolerant of large changes in their environment. Thus, the observed decline of the western population over the past two to three decades is not consistent with the description of the species as K-selected, and suggests that the combined effect of those factors causing the decline has been severe. The ability of the population to recover (i.e., its resilience) and the rate at which it recovers will be determined by the same K-selected characteristics (longevity, delayed reproduction, and low fecundity), as well as its metapopulation structure. Its maximum recovery rate will likely be limited to 8% to 10% annually (based on its life history characteristics and observed growth rates of other Otariids), which means that recovery could require 20 to 30 years. The metapopulation structure of the western population may enhance or deter recovery. Dispersal of populations provides some measure of protection for the entire species against relatively localized threats of decline or extinction. And rookeries that go extinct may be more likely recolonized by seals migrating between sites. On the other hand, the division of the whole population into smaller demographic units may exacerbate factors that accelerate small populations toward extinction (e.g., unbalanced sex ratios, allee effects, inbreeding depression). Such acceleration has been referred to as an "extinction vortex" (Gilpin and Soulé 1986).

Finally, any description of population stability for the Steller sea lion should be written with caution. Over the past three decades (or perhaps longer), we have witnessed a severe decline of the species throughout most of its range. Our inability to anticipate those declines before they occurred, and our limited ability to explain them now, and our limited ability to predict the future suggests that we are not yet capable of describing the stability of Steller sea lion populations.

4.13 Population projections

Population viability analyses have been conducted by Merrick and York (1994) and York *et al.* (1996). While such analyses require some assumptions, they provide a context for management and an indication of the severity and urgency of the sea lion dilemma, given the set of assumptions made in the analyses.

The results of these analyses indicate that the next 20 years may be crucial for the Steller sea lion, if the rates of decline observed in 1985 to 1989 or 1994 continue. Within this time frame, it is possible that the number of adult females in the Kenai-to-Kiska region could drop to less than 5000. Extinction rates for rookeries or clusters of rookeries could increase sharply in 40 to 50 years, and extinction for the entire Kenai-to-Kiska region could occur in the next 100-120 years.

4.14 Listing Status

On 26 November 1990, the Steller sea lion was listed as threatened under the Endangered Species Act of 1972 (55 FR 49204). The listing followed a decline in the U.S. population of about 64% over the three decades prior to the listing. In 1997, the species was split into two separate stocks on the basis of demographic and genetic dissimilarities (Bickham *et al.* 1996, Loughlin 1997), the status of the western stock was changed to endangered, and the status of the eastern stock was left unchanged (62 FR 30772).

4.15 Critical habitat description

The term "critical habitat" is defined in the ESA to mean: (i) the specific areas within the geographic area occupied by the species, at the time it is listed in accordance with the provisions of section 4 of this Act, on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management consideration or protection; and (ii) the specific areas outside of the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 4 of this Act, upon a determination by the Secretary that such areas are essential to the conservation of the species.

The definition continues: "Except in those circumstances determined by the Secretary, critical habitat shall not include the entire geographical area which can be occupied by the threatened or endangered species."

By this definition, critical habitat includes those areas that are essential to the "conservation" of a threatened or endangered species. The ESA defines the term "conservation" as: ". . . to use and the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this Act are no longer necessary." That is, the status of the species would be such that it would be considered "recovered." Therefore, the area designated as critical habitat should contain the physical and biological resources necessary to support and sustain a population of a threatened or endangered species that is sufficiently large and persistent to be considered recovered.

4.15.1 Establishment of Critical Habitat

NMFS designated critical habitat based on information contained in historical food habits and marking studies, and foraging ecology. Recommendations from the *Steller Sea Lion Recovery Team* (April 11, 1991 letter to Dr. William Fox, Assistant Administrator for Fisheries) and knowledgeable experts suggested terrestrial critical habitat based on tagging/branding and observational studies. Aquatic critical habitat was based on foraging studies of female and juvenile Steller sea lions conducted by both NMFS and the ADF&G, observations of sea lions foraging at sea (Fiscus and Baines 1966), and observed locations where sea lions have been killed incidentally in fisheries (Loughlin and Nelson 1986, Perez and Loughlin 1991). The Recovery team recommended three large aquatic areas for consideration as critical habitat.

Tagging studies indicated that animals generally return to the rookery of their birth to pup and breed (Calkins 1987; Loughlin 1997). Females frequently return to the same pupping site in successive years (Sandegren 1970). On average, adult males will hold a territory for 2-3 years, but a few may breed at the same site for at least seven seasons (Gisiner 1985); males generally return to the birth site to breed. The Recovery Team noted that the high degree of site fidelity accentuates the importance of protecting all land portions of rookeries.

The aquatic zones were designated on information gained from satellite telemetry studies, primarily on adult females during the breeding season. The available data suggests that females with pups swim an average of 10 miles from the rookery site on feeding trips, with the maximum distance generally less than 20 miles. These distances appear to be similar for animals in the Aleutian Islands and Gulf of Alaska (Merrick and Loughlin 1997; Merrick et al. 1994), southeast Alaska (Swain and Calkins 1997), and the Kuril Islands, Russia (Loughlin et al. 1998). As with all animals, the distance that female sea lions swim varies by individual, as it does for northern fur seals and other pinnipeds (e.g., *Loughlin et al.*, 1987). However, the mean and maximum distances used by female Steller sea lions during the breeding season appears somewhat consistent. These data were the only data of this type available at the time that critical habitat was being designated. Thus, the outer boundary for critical habitat was recommended by NMFS to be 20 nm, the maximum distance that a parturient adult female is likely to swim during the breeding season on a feeding bout during the summer months. Studies conducted after critical habitat designation suggest that juveniles and females in winter travel much greater distances (i.e. > 60 nm) during feeding bouts and during their movements within their home range (Merrick and Loughlin 1997; Swain and Calkins 1997).

The Recovery Team also recommended three large areas/features that may require special management protection. These areas were noted as needing special protection because they provide space, nutrition, shelter, reproductive sites, and habitats free of disturbance. The Team noted the need to protect or manage these habitats in such a way as to minimize impacts of human activities on sea lion distribution, behavior, and productivity. They noted that human activities may affect the suitability of habitats for Steller sea lion in several ways, including disturbance, pollution, entanglement in fishing nets, and alteration of food availability. The Team went on to recommend three specific areas based on possible affects of fishing. They state that data on the sea lion diet clearly indicate that from the mid-1970s through the mid-1980s, pollock had been a major food (Lowry et al. 1989). This is true through the 1990s as well (e.g., Merrick and Calkins 1996). The Team went on to say that large concentrations of pollock occur in the Shelikof Strait, Bogoslof, and Seguam areas, especially during the spawning season.

Large catches of pollock from these areas are near declining Steller sea lion rookeries. The Team recognized that similar relationships occur in other parts of the sea lion's range, but these three sites seem particularly important considering the precipitous decline of sea lions in adjoining areas. The Team recommended these three sites be designated as critical habitat. NMFS reviewed the recommendation by the Team and concurred. Additional information on historical incidental catch and Platform-of-Opportunity sightings data was sufficient to convince the NMFS that these areas need special designation as critical habitat.

The proposed rule for establishment of critical habitat for the Steller sea lion was published on April 1, 1993 (58 FR 17181), and the final rule was published on August 27, 1993 (58 FR 45269). The final rule included the following background information and justification. The following areas were designated as critical habitat (Figure 4-5).

(a) Alaska rookeries, haulouts, and associated areas. In Alaska, all major Steller sea lion rookeries identified in Table 1 [their Table 1] and major haulouts identified in Table 2 [their Table 2] and associated terrestrial, air, and aquatic zones. Critical habitat includes a terrestrial zone that extends 3,000 feet (0.9 km) landward from the baseline or base point of each major rookery and major haulout in Alaska. Critical habitat includes an air zone that extends 3000 feet (0.9 km) above the terrestrial zone of each major rookery and major haulout in Alaska, measured vertically from sea level. Critical habitat includes an aquatic zone that extends 3,000 feet (0.9 km) seaward in State and Federally managed waters from the baseline or basepoint of each major haulout in Alaska that is east of 144° W long. Critical habitat includes an aquatic zone that extends 20 nm (37 km) seaward in State and Federally managed waters from the baseline or basepoint of each major rookery and major haulout in Alaska that is west of 144° W long.

Three special aquatic foraging areas in Alaska. Three special aquatic foraging areas in Alaska, including the Shelikof Strait area, the Bogoslof area, and the Seguam Pass area.

(1) Critical habitat includes the Shelikof Strait area in the Gulf of Alaska which . . . consists of the area between the Alaska Peninsula and Tugidak, Sitkinak, Aiaktilik, Kodiak, Raspberry, Afognak and Shuyak Islands (connected by the shortest lines): bounded on the west by a line connecting Cape Kumlik (56°38"/157°26'W) and the southwestern tip of Tugidak Island (56°24'/154°41'W) and bounded in the east by a line connecting Cape Douglas (58°51'N/153°15'W)and the northernmost tip of Shuyak Island (58°37'N/152°22'W).

(2) Critical habitat includes the Bogoslof area in the Bering Sea shelf which . . . consists of the area between 170°00'W and 164°00'W, south of straight lines connecting 55°00'N/170 00'W and 55°00'N/168°00'W; 55°30'N/168°00'W and 55°30'N/166°00'W; 56°00'N/166°00'W and 56°00'N/164°00'W and north of the Aleutian Islands and straight lines between the islands connecting the following coordinates in the order listed:

52°49.2'N/169°40.4'W;
52°49.8'N/169°06.3'W;
53°23.8'N/167°50.1'W;
53°18.7'N/167°51.4'W;
53°59.0'N/166°17.2'W;
54°02.9'N/163°03.0'W;
54°07.7'N/165°40.6'W;
54°08.9'N/165°38.8'W;
54°11.9'N/165°23.3'W;
54°23.9'N/164°44.0'W

(3) Critical habitat includes the Seguam Pass area which . . . consists of the area between 52°00'N and 53°00'N and between 173°30'W and 172°30'W.

A question has been raised as to whether fishing practices in the 1980s could have created the perception that Shelikof Strait is an important foraging area for Steller sea lions. When the spawning aggregation in Shelikof Strait was discovered, it was fished heavily by joint venture and, later, domestic vessels. Fishing practices at the time allowed for considerable discard of waste, including that from roe-stripping. The question raised was whether the extensive dumping of waste may have served to attract sea lions to areas where they would not normally feed, or which might not have been essential to their foraging. Barring good information on the foraging distribution of sea lions prior to the fishing in Shelikof Strait, this could be viewed as a kind of "chicken-and-egg" question of which came first. However, the designation of Shelikof Strait as a special foraging area to be included in Steller sea lion critical habitat was justified, in part, on the fact that the spawning aggregation of pollock in this region constituted a major prey resource for sea lions that would exist irrespective of whether sea lions were following vessels and taking advantage of the discarded waste. Specifically, the justification (58 FR 17181) for this area stated:

"The Recovery Team recommended one aquatic zone for critical habitat designation that is located exclusively in the GOA (Shelikof Strait) . . . and two aquatic zones in the BSAI area. . . These sites were selected because of their geographic location relative to Steller sea lion abundance centers, their importance as Steller sea lion foraging areas, their present or historical importance as habitat for large concentrations of Steller sea lion prey items that are essential to the species' survival, and because of the need for special consideration of Steller sea lion prey and foraging requirements in the management of the large commercial fisheries that occur in these areas."

Figure 4-5 Critical habitat of the western population of Steller sea lions.

4.15.2 Physical and biological features of Steller sea lion critical habitat

For the Steller sea lion, the physical and biological features of its habitat that are essential to the species' conservation are those that support reproduction, foraging, rest, and refuge. While many of the important physical and biological features can be identified, most (particularly biological features) cannot be described in a complete and quantitative manner. For example, prey species within critical habitat can not be described in detail or with a demonstrated measure of confidence, and the lack of such information is an important impediment to the analysis of fishery effects. Pollock, Atka mackerel, Pacific cod, rockfish, herring, capelin, sand lance, other forage fish, squid, and octopus are important prey items found in Steller sea lion critical habitat but for most (if not all) of these species, we are not able to reliably describe their abundance, biomass, age structure, or temporal and geographic distribution within critical habitat with sufficient clarity and certainty to understand how they interact with Steller sea lions or other consumers, including fisheries. Atka mackerel may be one of the more easily characterized sea lion prey items, but we can not describe their onshore and offshore movements, their distribution inside and outside of critical habitat or in the vicinity of rookeries and haulouts, the relation between eastern and western stocks (or whether separate stocks exist), the causes for their (apparent) two- to three-fold changes in abundance over the last two decades, and so on. Pollock appear to be considerably more dynamic in their spatial and temporal patterns, and their presence within Steller sea lion critical habitat is even more difficult to describe in a detailed or quantitative fashion.

4.15.3 Critical habitat and environmental carrying capacity

Prey resources are not only the primary feature of Steller sea lion critical habitat, but they also appear to determine the carrying capacity of the environment for Steller sea lions. Therefore, the concepts of critical habitat and environmental carrying capacity are closely linked: critical habitat reflects the geographical extent of the environment needed to recover and conserve the species. The term "environmental carrying capacity" is generally defined as the number of individuals that can be supported by the resources available. The term has two main uses: first as a descriptive measure of the environment under any given set of circumstances, and the second as a reference point for the environment under "natural" conditions (i.e., unaltered by human activities). Thus, the definition can have markedly different implications depending on whether it is used as a reference point for the natural carrying capacity of the environment, or the carrying capacity of the environment as it may have been altered by human-related activities.

The changes observed in the 1970s and 1980s in Steller sea lion growth, reproduction, and survival are all consistent with limited availability of prey. At this time, the best scientific and commercial data available are not sufficient to distinguish the relative influences of natural (i.e., oceanographic) factors versus human-related activities (i.e., fisheries) on the availability of prey for sea lions. The notion that the observed changes in sea lion vital parameters are consistent with a change in "carrying capacity" does not necessarily mean that the changes are entirely natural. If carrying capacity is defined as a measure of the environment under any set of conditions, then that capacity could also have been reduced by fisheries. That is, natural and human-related changes to the carrying capacity are not mutually exclusive; both types of factors may have been operating at the same time.

Table 4-3 A partial listing of studies on the prey of Steller sea lions. When prey are listed in order of frequency of occurrence reported, an asterisk (*) or dagger (†) indicate that rank of the marked prey item was tied with the similarly marked prey item listed before or after. Sample sizes (*n*) for studies of stomach contents are given only for the number of stomachs with contents; empty stomachs are not included. Note that some studies used the same data and results are therefore redundant (e.g., Merrick and Calkins [1996] present reanalysis of data reported in Pitcher [1981], Calkins and Pitcher [1982], and Calkins and Goodwin [1988]).

Study	Years	Location	Methods	Main findings
Imler and Sarber 1947	1945-1946	Sitka to Kodiak Island	Stomach contents (*n* = 15)	- Eight sea lions sampled in southeast Alaska; all but one fed principally on pollock, and exception contained a skate and an octopus. - Three sampled from Barren Islands contained pollock, starry flounder, tom cod, arrow-toothed halibut, common halibut, and octopus. - Two from Chiswell Island contained salmon. - Two from Kodiak Island contained pollock and arrow-toothed halibut.
Sleptsov 1950 (cited in Spaulding 1964)	Unknown	Kuril Islands	Unknown	- Reported sea lion feeding on octopus.
Wilke and Kenyon 1952	1949, 1951	St. Paul Island	Stomach contents (*n* = 3)	- One sea lion contained primarily sand lance but also starry flounder, one contained halibut, cod, pollock, and flounders, and one contained a large cephalopod beak.
Pike 1958	Summary, 1901-1958	Primarily BC, but also off California and Alaska	Stomach contents, (*n* = 19)	- Reports a range of fish and cephalopods for 12 time/area studies. - Disputes claim that studies provide evidence of serious commercial competition. - For his study (in British Columbia), prey (in order of frequency of occurrence) included squid, herring, rockfish, octopus, salmon*, skate*, and hake*. - For other studies in his table (except Imler and Sarber 1947), prey items listed were (in no particular order) rockfish, perch, herring, skate, shark, squid, octopus, lamprey, salmon, "cod," "bass," mussels, clam, crab, dogfish, flatfish, and sardines.
Mathisen *et al.* 1962	1958	Chernabura	Stomach contents (*n* = 94; 14 yearlings, 42 adult females, 18 harem bulls, 20 unattached bulls)	- Prey (in order of frequency of occurrence) included squid/octopus , common bivalves, smelts, greenlings, shrimp/crabs, rockfish, sculpins, isopods, unclassified crustaceans*, segmented worms*, and single occurrences of lamprey, salmon, sand lance, sand dollar, and coelenterate.

Table 4-3 (cont.)

Study	Years	Location	Methods	Main findings
Thorsteinson and Lensink 1962	1959	Marmot, Atkins, Ugamak, Jude, Chowiet	Stomach contents (*n* = 56); primarily adult males	- Prey (in order of frequency of occurrence) included squid/octopus, clam/mussel/snail, sand lance, rockfish, crab, greenling*, sculpins*, flatfish*, and single occurrences of halibut and lumpfish.
Spaulding 1964	1956-1963(?)	British Columbia	Stomach contents (*n* = 190; overlap with specimens reported in Pike [1958] above)	- Suggests sea lions prey mainly on one item per feeding period. - Some seen feeding at surface on lingcod, rockfish, salmon, or halibut (*n* = 8). - Feed primarily at night (*n* = 269 or 393 sampled). - Consumption of herring and salmon by sea lions, fur seals, and harbor seals estimated about 2% to 4% of commercial catch. - Prey (in order of frequency of occurrence) included octopus, rockfish, herring*, withing*, salmon, dogfish, squid*, hake*, flatfish†, clam†, ratfish, shrimp*, sand lance*, graycod†, lingcod†, and single occurrences of lamprey, skate, eulachon, halibut, and jack mackerel .
Tikhomirov 1964	1962	Bering Sea	Stomach contents *n* = unknown)	- Large numbers of sea lions in the southeastern Bering Sea, winter/spring of 1962. - Suggests herring "staple food" of sea lions during this period. - Suggests sea lion distribution was influenced by the distribution of herring.
Fiscus and Baines 1966	1958-1963	California to Bering Sea	Stomach contents (*n* = 22)	- Steller sea lions taken off central California and Oregon fed only on bottom fish. - Steller sea lions taken in Alaskan waters fed mainly on small, schooling fishes. - Near Unimak Pass in 1962, capelin was the major food species. - A Steller sea lion taken on the Fairweather Grounds in the eastern GOA in May 1958 had eaten three salmon. - Most of the food species (capelin, sand lance, sculpins, rockfishes and flatfishes) found in the stomachs of Steller sea lions suggest that they feed near land or in relatively shallow water (<100 fm, 180 m). - Steller sea lions were seen at distances of 70-85 miles from land by Fiscus and Kenyon in 1960 (Kenyon and Rice 1961).

Table 4-3 (cont.)

Study	Years	Location	Methods	Main findings
Jameson and Kenyon 1977	1973-1976	Rogue River, Oregon	Observations of sea lions feeding at surface (84 observations; number of sea lions unknown)	- Prey consisted of 73 lampreys, 2 salmonids, 9 unidentified.
Gentry and Johnson 1981	1974-1975	St. George Island (Pribilof Islands)	Observations (163 verified observations, number of sea lions unknown)	- Observed sea lions taking 163 fur seal pups. Estimated such predation may result in the mortality of about 3% to 7% of fur seal pups born at St. George Island.
Jones 1981	1968-73	North and Central California	Stomach contents (*n* = 9)	- Noted 9 stomachs with fish, and 7 with squid and octopus. - Grouped 127 identified fishes from northern sea lions according to schooling (open-water), bottom-dwelling (rocky), and inshore-schooling species (his Table 6), and suggested results indicate that the northern sea lion feeds mainly on bottom-dwelling fishes.
Pitcher 1981	1975-78	GOA	Stomach contents (*n* = 153)	- Stomach contents were 95.7% fishes by volume, and included 14 species of fish in 11 families. - Gadids comprised 59.7% of total contents and occurred in 82.4% of stomachs with food. - Pollock comprised 58.3% of the total volume and occurred in 66.7% of stomachs with food. - Cephalopods occurred in 36.6% of stomachs with contents but made up only 4.2% of total volume. - Predation on salmon and capelin appeared to be largely limited to spring and summer. - Prey (by combination rank index) included pollock, squids, herring, capelin, cod, salmon, octopus, sculpins, flatfishes, rockfishes. - Herring and squids were extensively used by sea lions in Prince William Sound but appeared to be relatively unimportant in other areas. - Results for sea lions similar to results for harbor seals. - Mean fork length of 2030 pollock otoliths was 29.8 cm (range 5.6 to 62.9 cm, SD = 11.6 cm)

Table 4-3 (cont.)

Study	Years	Location	Methods	Main findings
Calkins and Pitcher 1982 (note redundancy with previous results of Pitcher 1981)	1975-1978	GOA, including northeastern GOA, Prince William Sound, Kenai Coast, Kodiak Island, and the Alaska Peninsula region	Stomach contents (*n* = 153)	- Fishes comprised 72.8%, cephalopods (octopus and Gonatid squids) 21.5%, decapod crustaceans (shrimps, tanner and spider crabs) 4.2%, gastropods (marine snails) 0.8%, and mammals 0.4% of the prey occurrences. - Fishes included minimum of 14 species of 11 families. - Gadids composed nearly half of total occurrences and nearly 60% of total volume. - Harbor seal remains were found in two stomachs (see Pitcher and Fay 1982). - Seven top-ranked prey (in order of modified Index of Relative Importance) were pollock, herring, squids, capelin, salmon, Pacific cod, and sculpins. - Pollock was dominant prey accounting for about 39% of all occurrences and 58% of the total volume. - Pollock was top-ranked prey in all areas except Kodiak, where it was ranked second below capelin. - Herring and squid were used extensively in Prince William Sound, but not in other areas. - Predation on salmon and capelin was largely limited to spring and summer. - Geographic differences in use of salmon and capelin may have been due to sampling at different sites and seasons. - Comparison with previous studies (Imler and Sarber 1947, Mathisen *et al.* 1962, Thorsteinson and Lensink 1962, and Fiscus and Baines 1966) which had more invertebrates, no herring, but included sand lance. Noted differences in sampling for this study (throughout year at wide range of locations) versus earlier studies (near rookeries during breeding season). - Four of the five top-ranked prey were off-bottom schooling species.
Lowry *et al.* 1982	1976	Pribilof Islands	Stomach contents (*n* = 4)	- Prey (in order of frequency of occurrence) included pollock, squids, and single occurrences of octopus, flatfish, lamprey, and prickleback. - Based on otoliths, lengths of pollock consumed ranged from 34 cm to 57 cm in length. - Also mentions the following prey items from a preliminary examination of 111 stomach samples collected in the central and western Bering Sea (in no particular order): pollock, cod, Gonatid squids, herring, octopus, and sculpins.
Frost and Lowry 1986			Stomach contents (*n* = 90; not stated how many had contents)	- Most pollock eaten by sea lions (76%) were 20 cm or longer. - Younger sea lions (≤4 yr) collected in 1981 (all were males) ate significantly smaller fish ($\bar{x}$ = 22.4 cm, *n* = 37) than did older animals ($\bar{x}$ = 26.9 cm, *n* = 51). - A sea lion collected in 1976 and another collected in 1979 (both near the Pribilofs) had eaten pollock averaging 46.9 cm in length (range 18.4-61.4 cm), while those collected in 1981 to the west had eaten substantially smaller pollock averaging 25.2 cm in length (range 8.3-64.2 cm). - In 1981 sea lions collected in the central Bering Sea had eaten larger pollock than those off the Kamchatka Peninsula ($\bar{x}$ = 26.8 cm vs. 23.5 cm). - "It is unknown whether the consumption patterns described above are a result of actual size selection of prey or if they result from coincidental distribution of predators and prey size classes." - ". . . the size range of pollock eaten by both yong and old sea lions was similar."

Table 4-3 (cont.)

Study	Years	Location	Methods	Main findings
Calkins and Goodwin 1988	1985-1986	GOA and southeast Alaska	Stomach contents (n = 88;47 had only trace amounts. Five with measurable contents and nine with trace amounts from southeast; remainder were from Kodiak area and adjacent portions of Alaska Peninsula.)	Southeast - Fishes comprised 98% of volume, mostly Pacific cod (57% of total volume) and pollock (32%). - Most frequently occurring were pollock (57%) and flatfishes (21%). - Only other prey observed were squid and octopus. - Mean fork length of 80 pollock otoliths from 8 sea lions in southeast was 25.5 cm (range 4.8 to 55.7 cm, SD = 10.4 cm) Kodiak area - Most important by volume were pollock (42%), octopus (26%), and flatfish (25%). - Most frequently occurring were pollock (58%) and octopus (32%). - Other prey (in no particular order) were other fishes, squid, decapod crustaceans, and clams. - Prey rank (based on combined rank index [Pitcher 1981]) in Kodiak area were pollock, octopus, flatfishes, sand lance, Pacific cod, and salmon. - Mean fork length of 1064 otoliths from 43 sea lions in Kodiak area was 25.4 cm (range 7.9 to 54.2 cm, SD = 12.4 cm). - Pollock was the most important prey item in both 1975-1978 collection (39% by frequency of occurrence in Kodiak area) and 1985-1986 collection (58%). - Capelin was most important in Kodiak area in 1975-1978. However, they suggest difference in capelin may be due to seasonal differences when animals collected (spring-summer 1975-1978 versus spring-autumn/early winter 1985-1986). Thus, comparisons may be compromised by potential seasonal bias. - Octopus ranked second in 1985-1986 collection near Kodiak, but fifth in 1975-1978. However, they suggest difference may be due to collection site. Thus comparisons may be compromised by potential location bias. - Sand lance occurred in 26% of sea lions from GOA in 1960s (Mathisen *et al.* 1962, Thorsteinson and Lensink 1962, Fiscus and Baines 1966), were not found in 1975-1978 sample, but were fourth in 1985-1986 sample.

Table 4-3 (cont.)

Study	Years	Location	Methods	Main findings
Byrnes and Hood 1994	1992	Año Nuevo, California	One observation	- Observed a territorial male Steller sea lion attack, kill, and consume what appeared to be a yearling California sea lion.
Merrick and Calkins 1996 (note redundancy with Pitcher 1981, Calkins and Pitcher 1982, and Calkins and Goodwin 1988)	1975-1978, 1985-1986	GOA	Stomach contents, (n = 178 in 1975-1978 and n = 85 in 1985-1986)	- Prey consumption was based on frequency of occurrence. - Most stomachs contained prey of only one kind. - Pollock were the most common prey of juvenile (≤4 years old) and adult sea lions in virtually all seasons and areas during these two periods. - Juvenile pollock were a major part of the diet in both periods. - Juvenile sea lions ate smaller and relatively more juvenile pollock. - Small forage fish were consumed on a seasonal basis. - Temporal comparisons were possible only in the Kodiak region. - The proportion of sea lions eating pollock increased from 49% in 1975-1978 to 69% in 1985-1986 in the Kodiak area. - Small forage fish were the second most common prey in the 1970s, and flatfish were second in the 1980s. - Of the fish consumed, 73% were < 30 cm, but they accounted for only 26.8% of the biomass consumed. - Half (50.7%) of the pollock mass consumed by juvenile sea lions came from fish <30 cm, while only 21% of the pollock mass consumed by adult sea lions came from juvenile pollock. - Seasonal differences were observed in the consumption of all prey taxa, but differences were not found in 1980s. - Between 1970s and 1980s, the portion consuming pollock and cephalopods increased significantly and the portion consuming small forage fish and other demersal fish decreased. - The increase in pollock consumed was only evident in summer months (all ages combined), but was evident in all seasons for juveniles. - (Note that sampling was not consistent with respect to seasons or specific locations between the two sampling periods, which weakens the basis for comparisons.)

Table 4-3 (cont.)

Study	Years	Location	Methods	Main findings
Merrick *et al.* 1997	1990-93 (summer - last week June, first week July, or first week August)	Kodiak to Agattu and Alaid - 37 collections at 19 rookeries and 3 haulouts	Scat analysis and population trends. No. scats analyzed = 338. Suggests most scats from adult females. Prey pooled into seven categories, rookeries and haulouts pooled into six areas. Report on 40 and 52 scats from Bogoslof and Ugamak (1985-89 and 1990-93, respectively), and compared with stomach contents in Kodiak area for 1976-78 (20) and 1985-89 (28), and 54 scats in 1990-93.	- Scats contained at least 13 species. - Atka mackerel most common prey category (62%), gadids second (43%), salmon (20%) third, cephalopods (12%) fourth, small schooling fish (9%) fifth, then other demersal fish (7%) and flatfish (3%). - Pollock occurred in 29% of the scats and unidentified gadids (which the authors suggest were probably pollock) in 28%. - Pollock dominated in the GOA, was approximately equal in the eastern Aleutian Islands and the area they designated as central Aleutian Islands I, and Atka mackerel dominated further west. - Salmon, small schooling fish, and flatfish were found more commonly in the eastern areas. - Diet diversity tended to be greater east to west and was correlated with rate of population change. - "The high correlation between area-specific diet diversity and population changes supports the hypothesis that diet is linked with the Steller sea lion population decline in Alaska." - If diet diversity (as measured in this study) is related to population trends, and the indices of diet are based on adult female foraging patterns, these results would indicate that juvenile survival is not the only vital rate being affected. - Emphasizes the importance of secondary prey.

Merrick and Loughlin 1997	1990-1993	GOA to eastern Aleutian Islands	Very High Frequency radio transmitters (*n* = 10 adult females instrumented in June-July); Satellite-linked time-depth recorders (*n* = 5 adult females instrumented in June-July, *n* = 5 adult females instrumented in November-March, and *n* = 5 young-of-the-year instrumented in November-March).	- Mean trip duration for adult females instrumented (either radio transmitter or satellite-linked time-depth recorder) on the order of 18 to 25 hours, with time on shore on the order of 18 to 19 hours, so slightly more than half of the females' cycles were spent at sea. - Mean trip duration for adult females instrumented (satellite-linked time-depth recorder) in winter was 204 hours, but time on shore was approximately the same as for summer adult females. Adult females in winter spent approximately 90% of their time at sea. - Young-of-the-year animals spent a mean time of 15 hours at sea and 25 hours on land, therefore spending about 37% of their time at sea. - Summer adult females dove about 17 times per hour, winter adult females about 12 times per hour, and young-of-the-year about 12-13 times per hour. *All groups dove most* frequently in the late afternoon and night. - Maximum dive depths for summer adult females was between 150 m and 250 m, for winter adult females was > 250 m, and for young-of-the-year was 72 m. - Mean number of diving hours per day was 4.7 for summer adult females, 5.3 for winter adult females, and 1.9 for young-of-the-year. - Mean trip distance for summer adult females was 17.1 km, winter adult females 133 km, and young-of-the-year 31 km (but were skewed by one trip by a young-of-the-year of 320 km). - Two of the winter adult females foraged in a manner that suggested they still were nursing pups. These females relatively dove 8.1 hours per day, made short trips (mean 53 km over 18 hours), and returned to the same or nearby haulout at the end of each trip. The remaining three winter adult females was 3.5 hours per day and spent up to 24 days at sea before returning to land. - In general, winter adult females spent more time at sea, dove deeper, and had greater home ranges than summer adult females.

5.0 ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES

The pollock trawl groundfish fisheries occur in the North Pacific Ocean and Bering Sea in the U.S. EEZ from 50° N to 65°N (Figures 2-9 and 2-11). These regulations affect groundfish fishing in statistical areas 509, 513, 514, 517, 518, 519, 521, 523, 541, 542, 543, 610, 620, 630, 640. Descriptions of the affected environment are given in the SEIS (NMFS 1998c). Substrate is described at section 3.1.1, water column at 3.1.3, temperature and nutrient regimes at 3.1.4, currents at 3.1.5, groundfish and their management at 3.3, marine mammals at 3.4, seabirds at 3.5, benthic infauna and epifauna at 3.6, prohibited species at 3.7, and the socioeconomic environment at 3.10. Additionally, the status of each target species category, biomass estimates, and acceptable biological catch specifications are presented both in summary and in detail in the annual GOA and BSAI stock assessment and fishery evaluation (SAFE) reports. The projections for fishing year 1999 are contained in the 1998 SAFE reports (NPFMC 1998a; 1998b.)

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

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

An analysis of the effects of groundfish fishing on the ecosystem, social, and economic environment is contained in the FSEIS (NMFS 1998c). This analysis displays only those effects that are additional and attributable to promulgation of a permanent rule to implement Steller sea lion reasonable and prudent alternatives necessary to remedy the pollock fishery from the likelihood of jeopardizing the continued existence of the western population of Steller sea lions, or adversely modifying its critical habitat.

5.1 Trophic interactions

The marine food-web of North Pacific marine fishes are complex (Livingston and Goiney 1983). Numerous species of plankton, phytoplankton, invertebrates, mollusks, crustaceans, forage fish, demersal, mid-water, and pelagic fish, marine mammals, seabirds, and humans combine to comprise the food-web present in the BSAI and GOA. Environmental changes as well as human exploitation patterns can effect changes to trophic interactions. Fishing causes direct changes in the structure of fish communities by reducing the abundance of target or by-catch species, then these reductions may lead to responses in non-target species through changes in competitive interactions and predator prey relationships. Indirect effects of fishing on trophic interactions in marine ecosystems may also occur. Current debates on these topics include comparing relative roles of "top down" (predator) or "bottom up" (environmental and prey) control in ecosystems and the relative significance of "donor controlled" dynamics (in which victim populations influence enemy dynamics but enemies have no significant effect on victim populations) in the food webs (Jennings and Kaiser 1998.)

Fishery management measures in the proposed rule are intended to reduce stress in the North Pacific marine food-web for the primary benefit of Steller sea lions. Similar effects, however, may accrue to the other ecosystem components as well. Below is an extensive explanation of predicted effects on Steller sea lion followed by effects to other marine mammal, seabird, forage fish species, and target fish species populations in the management areas.

5.1.1 Other marine mammals

The Bering Sea and Gulf of Alaska support one of the richest assemblages of marine mammals in the world. Twenty-six species are present from the orders Pinnipedia (sea lions, walrus, and seals), Carnivora (sea otter), and Cetacea (whales, dolphins, and porpoises) in areas fished by commercial groundfish fleets. Some species are resident throughout the year, while others migrate into or out of the management areas seasonally. Marine mammals occur in diverse habitats, including deep oceanic waters, the continental slope, and the continental shelf.

Three families of pinnipeds are represented in the Bering Sea and/or Gulf of Alaska, including Otariidae, the eared seals (Steller sea lion and northern fur seals), Odobenidae, the Pacific walrus, and Phocidae, the true seals. One marine member of the order Carnivora, the sea otter (Family Mustelidae), also inhabits areas in or near groundfish fishing areas in Alaskan waters. Large cetaceans with ranges (or historical occurrence) in either the Bering Sea subarea or the Gulf of Alaska include humpback, grey, sei, fin, blue, right, sperm, and minke whales. Small cetaceans include beluga whales, killer whales, Pacific white-sided dolphins, harbor porpoises and Dall's porpoises.

Evaluation of the impacts of any alternative in this EA on marine mammals can be thought of in two ways: through direct (operational) impacts and indirect (biological) impacts (Lowry 1982). With respect to direct interactions, estimates of marine mammal incidental takes in the federally managed groundfish fisheries are based on observer data whereby mortalities are tallied, and the observed takes are extrapolated to fishery-wide totals. The total take projection is calculated by the product of the take rate, expressed in numbers of marine mammals killed per mt of groundfish harvested, and the total tonnage harvested by the fishery. In all cases in the Alaskan groundfish fisheries, levels of direct incidental take are low relative to each marine mammal stock's Potential Biological Removal (PBR). None of the alternatives or suboptions in this EA are expected to increase the levels of incidental take for any marine mammal species and, therefore, direct impacts will not be considered further.

Indirect interactions between marine mammals and commercial fisheries include competition for similar prey resources which may result in local scarcity of prey and disturbance by fishing activities. While these circumstances may constitute potential indirect, prey-based competition, the relative severity of impacts can only be addressed qualitatively, lacking scientific information to characterize foraging dynamics or to predict effects in terms of mortality.

Indirect interactions between commercial fisheries and the 26 species of marine mammals inhabiting Alaskan waters vary widely, given their diverse life history and spatial distribution patterns. In general, the impacts resulting from the fisheries are likely to be constrained to those marine mammal species with the greatest potential dependence on prey species that are harvested commercially. Likewise, those marine mammals which feed more extensively in the commercial fishing grounds may be proportionally more affected. Of the 26 marine mammal species inhabiting the Bering Sea subarea and/or the Gulf of Alaska, only a subset have been shown to consume groundfish species as a large part of their diet, and to potentially do so in areas coincident with groundfish harvest operations. Of these, only the Steller sea lion is expected to be impacted by the proposed changes to the pollock trawl fisheries. None-the-less, the following section describes possible indirect effects. Among the pinnipeds, impacts to northern fur seal, harbor seal and Pacific walrus are discussed separately, while the other species are discussed jointly under "other pinnipeds." Among the cetacean species, a few include groundfish in their diets, but most exploit a larger prey base, with extensive consumption of invertebrates and small schooling fishes. Impacts to the baleen whales are discussed jointly, as are impacts to most of the toothed whales; Killer whales are discussed separately, as are sea otters.

5.1.1.1 Harbor seal

Harbor seals feed in marine and estuarine waters on a diverse variety of sublittoral and benthic prey. Most feed in waters less than 80 m in depth, while feeding trips are generally less than 12 hours. These characteristics underscore their near shore habitat preferences. The major prey of harbor seals in Alaska include fish from the following families: Gadidae, Clupeidae, Cottidae, Pleuronectidae, Salmonidae, Osmeridae, Hexagrammidae, and Trichodontidae. Octopus and gonatid squid are also important. However, overlaps with commercial groundfish fisheries occur primarily with reference to pollock, Atka mackerel and Pacific cod. Pollock, Atka mackerel and Pacific cod constitute approximately 12%, 9% and 8%, respectively, of harbor seal diet in the Aleutian Islands and Bering Sea (Perez 1990). In the GOA, pollock, octopus and caplelin were reported by Pitcher and Calkins (1979) as the most important prey, while Pacific cod was less important and Atka mackerel were absent in the sample. The degree to which these overlaps impact harbor seals is unknown.

Spatial partitioning of offshore commercial harvests and inshore feeding harbor seals may limit the degree of potential competition, but the foraging range of harbor seals may still overlap commercial fishing grounds. Thus, this overlap applies to the western and GOA harbor seal stocks, while the southeast Alaska stock of harbor seals are distributed such that overlap with federally managed commercial groundfish fisheries is minimal, and the potential for adverse fishery impacts there is low.

5.1.1.2 Northern fur seal

The current trend in the northern fur seal population has been generally stable over the past 10 years, concurrent to groundfish fishing as described under this alternative. One inference may be that any existing ecological interactions are not currently intense enough to cause further declines in the stock. However, because this stock contains approximately 50% fewer animals than it did in the 1950's and is designated as depleted under the MMPA. Given both spatial/temporal and prey overlap with commercial fisheries, concern for possible adverse ecological interactions is warranted. Note, however, the degree of overlap in the fur seal case is as not well pronounced as in the case of the Steller sea lion.

Northern fur seals are distributed widely in the Bering Sea, GOA and North Pacific Ocean. The largest rookeries are on the Pribilof Islands, where the highest numbers of northern fur seals are found during the summer breeding season. Juveniles are more widely distributed in pelagic waters at that time, as far south as the central North Pacific. They migrate out of the Bering Sea in November and don't return until June. Because of their higher density in the Pribilof Islands area as well as the Bogoslof Island area in the Bering Sea, fisheries there (as opposed to in the GOA) would be more likely to have indirect interactions with them, but only during June to November.

Northern fur seals forage in shallow to midwater depths (0-250m) of both near shore and pelagic regions throughout their migratory range [Gentry et al. 1986; Goebel et al. 1991; Loughlin et al. 1987; Sinclair et al. 1994). Diet studies have been conducted on juvenile and adult female northern fur seals throughout their range (Antonelis et al. 1997; Kajimura 1985; Perez and Bigg 1986; Sinclair et al. 1994; Sinclair et al. 1996; Sinclair et al. 1997), but the species and size of prey consumed by adult male northern fur seals is unknown. Female and young male fur seals generally consume juvenile and small-sized (5-20 cm) schooling fishes and squids. The species of prey consumed varies with oceanographic subregions along their migration routes (Perez and Bigg 1986) and around breeding locations (Antonelis et al. 1997; Sinclair et al. 1994). In the eastern Bering Sea, primary prey species include the fish families Gadidae (pollock, Pacific cod), Bathylagidae (deep sea smelts), Myctophidae (lanternfish), and squids of the family Gonatidae. Although northern fur seals prey on a wide variety of fishes, pollock, capelin and squids have consistently been the principal food of fur seals in the Bering Sea (Fiscus et al. 1964; Wilke and Kenyon 1954). Pollock and squids were the most frequently reported food items from observations in the 19th century (Lucas 1899, cited in Wilke and Kenyon 1954; Springer 1992). Sinclair et al. (1994) concluded that the diet of female and juvenile male northern fur seals in the eastern Bering Sea has probably not changed much since the turn of the century: "fur seal consumption of walleye pollock, gonatid squid, and bathylagid smelt in the eastern Bering Sea is consistent throughout historical records, despite the wide variety of prey available to fur seals within their diving range."

Declines of otariid populations in the Bering Sea and North Pacific Oceans are currently attributed to this reduction in diet diversity and may be indirectly related to anthropogenic factors such as commercial fishing and historical whaling operations. However, the extent to which fisheries removals might contribute to reduced northern fur seal foraging success has not been determined.

5.1.1.3 Pacific walrus

The fishery would have little or no impact on the Pacific walrus population under any of the proposed alternatives.

Indirect effects would probably be small because of partitioning between walrus aggregations and commercial fishing grounds. Although Pacific walrus occur in the shelf waters of the Bering Sea, regions also utilized by commercial groundfish fisheries, most of the population congregates at the southern edge of the Chukchi Sea pack ice during the summer (Smirnov 1929; Fay et al. 1984) With the exception of adult males which remain in the Bering Sea during the summer, most habitat utilized by the population is associated with the availability of haulout sites on ice (Brooks 1954; Burns 1965; Fay 1955; Fay 1982; Fay et al. 1984). Thus, spatially, much of the Pacific walrus population is spatially and temporally separated from commercial fishing activities. Walrus remaining in the Bering Sea many use haulouts on Round Island which is a State of Alaska preserve with a 12 nm no fishing zone established around it. Others may remain near haulouts on islands in the Bering Straits, the Punuk Islands or the beaches at Cape Seniavin, all of which are adjacent to shallow waters not utilized by federally managed groundfish fisheries. Thus, spatial partitioning of Pacific walrus and groundfish fisheries is expected to be the norm throughout much of the Bering Sea.

With regard to diet, Pacific walrus feed almost exclusively on benthic invertebrates (97%), particularly bivalve molluscs. Fish ingestion has been considered incidental to their normal feeding behavior (Fay and Stoker 1982).

5.1.1.4 Other pinnipeds

The "other pinnipeds" group includes spotted seals, bearded seals, ringed seals, and ribbon seals. Ecological interactions between these species and commercial fisheries are generally limited by both spatial separation and differences between commercial harvest targets and the species food habits.

The distributions of the "other pinnipeds" tend toward seasonally or permanently ice covered waters of the Beaufort, Chuckchi, Bering and Okhotsk Seas, generally north of most areas commercially fished for groundfish, although individuals of each species can be found further south in the Bering Sea. In particular, spotted seals also occur in coastal waters of Bristol Bay, on the Pribilof Islands and to a lesser extent, in the eastern Aleutian Islands.

With the exception of spotted seals, the food habits of these species do not overlap significantly with commercial fisheries targets. Bearded seals consume primarily benthic prey including crabs and clams as well as shrimps and Arctic cod (Kosygin 1966; Kosygin 1971; Lowry and Frost 1981). Ringed seals eat Arctic cod, saffron cod, smelt, herring, shrimps, amphipods and euphausiids (Fedoseev 1984; Johnson 1966; Lowry 1980; McLaren 1985). Ribbon seal diet has been characterized as intermediate between ringed and bearded seals (Shustov 1965). Spotted seals include pollock in their diet when feeding in the central Bering Sea (Bukhtiyarov *et al.* 1984), but their use of that resource in the eastern Bering Sea and Aleutian Islands in unknown. Spotted seal diet in Bristol Bay, the Priblof Islands and the eastern Aleutians is likewise unknown, but if similar to harbor seals in those areas, it is likely to be diverse and may include a small percentage of commercially important species. Thus, no adverse impacts are expected under any of the proposed alternatives.

5.1.1.5 Killer whale

Killer whales are distributed throughout Alaskan waters, including areas fished by the groundfish fleets. However, despite the spatial overlap, ecological interactions relating to competition for prey are probably minor given what is known of killer whale diet as well as their ability to range over large areas.

Most information regarding killer whale consumption of commercially important groundfish results from observations of whales depredating longlines as they are retrieved in locations ranging from the southestern Bering sea to Prince William Sound. In the waters between Unimak Pass and the Priblof Islands, killer whales regularly strip sablefish and Greenland turbot from longlines. Consumption of other groundfish species by killer whales not interacting with gear is largely unknown. In general, they are opportunistic feeders with diets that differ both seasonally and regionally. Nishiwaki and Handa (1958) examined killer whale stomach contents from the North Pacific Ocean and found squid, fish, and marine mammals, in order of abundance. Whether these findings are consistent with killer whale foraging patterns in either the BSAI or GOA groundfish management areas is uncertain, but there is no evidence to suggest exclusive reliance on commercially important groundfish species. Thus, the grounds for suggesting competition for forage, despite broad distributional overlaps between the species and commercial fisheries is weak.

5.1.1.6 Other toothed whales

The "other toothed whales" occurring in Alaskan waters include beluga whales, Pacific white-sided dolphins, harbor porpoise, Dall's porpoise, sperm whales and beaked whales. The impacts of any alternative considered in this document on these species would be minimal. While each of these species, except for beluga whale frequents areas used by the groundfish fishery, their ecological interactions with commercial fisheries are limited by differences between their prey and the fisheries harvest targets.

The beluga whale stocks along the western coast of Alaska from Bristol Bay north, and the one in Cook Inlet are generally restricted to shallow coastal and estuarine habitats not used by commercial groundfish fisheries. Their diet is predominantly salmonids and small schooling fishes such as eulachon and capelin. Thus, little grounds for groundfish fishery interactions exists for this species.

Similarly, Pacific white-sided dolphins are not commonly observed north of the Aleutian Islands, and appear to be seasonal visitors in parts of the Gulf of Alaska and Southeast Alaska, thus the main body of their population is more commonly found in the central North Pacific Ocean. With regard to diet, they, like Dall's porpoise feed mainly on cephalopods and small schooling fishes such as myctophids.

The remaining species consume a wide variety of both fish and invertebrate species, but overlap with commercially important species is limited in most cases. Beaked whales, a diverse group unto itself, are poorly known, but available information suggests that they prey on benthic and epibenthic species including squid, skates, rattails, rockfish, and octopus. Harbor porpoise diet in Alaskan waters is also poorly understood, although forage consumed by stocks in the Pacific Northwest and their tendency toward near shore distribution suggest that they probably consume a variety of coastal species.

Sperm whale diet overlaps with commercial fisheries targets more than any other species in this group, but the degree of overlap is at least partly due to direct interactions with longline gear. In addition to consuming primarily medium to large sized squids, they also consume salmonids, rockfish, lingcod and skates, and in the Gulf of Alaska they have been observed feeding off longline gear targeting sablefish and halibut. The interactions with commercial longline gear does not appear to have an adverse impact on sperm whales, much to the contrary, the whales appear to have become more attracted to these vessels in recent years.

5.1.1.7 Baleen whales

The baleen whales present in Alaskan waters include the gray, humpback, fin, minke, northern right, bowhead, blue and sei whales. Ecological interactions between commercial fisheries and these species are well partitioned on the basis of major differences between the whale's diets and commercially important target species. Several whale species such as blue, fin, sei, and northern right whale feed primarily on copepods, euphausiids, and amphipods. Gray whales feed mostly on epibenthic and benthic invertebrates, while humpbacks have a more diverse diet including euphausiids, mackerel, sand lance, herring and capelin. None of these are commercially important target species.

With regard to distributional overlaps, one or more of these whale species, with the probable exception of the bowhead whale, are likely to occur in groundfish harvesting areas. The effect of commercial fishing activity on baleen whale prey aggregations is unknown. However, these prey species, like the whales themselves, are broadly distributed both inside and outside of areas commercially fished so that reliance on localized prey, should it be temporarily disrupted by fishery activities, is unlikely to adversely impact overall foraging success or the status and trends of the population at large.

5.1.1.8 Sea otter

Sea otter distribution is generally inshore, in depths less than 34 m, although large groups were observed 30 km north of Unimak Island in the Bering Sea during the late 1960s (Kenyon 1969). Sea otter prey is highly diverse, consisting of over 80% benthic invertebrates, including sea urchins, abalone, numerous bivalve species, crabs, snails, squid and octopus. Of the remaining 20% fish, lumpsuckers, sculpins and greenlings are most common, and none of these are commercially important in the groundfish fisheries. Less than 1% of the sea otter diet is comprised of commercially exploited species, including Atka mackerel, rockfishes, sablefish Pacific cod and pollock (Perez 1990). Given such minor occurrence of commercially exploited groundfish in the sea otter diet and their otherwise broad utilization of benthic resources, the availability of groundfish would be expected to have little, if any, impact on sea otter foraging.

5.1.2 Seabirds

As stated in the SEIS (NMFS 1998c page 562 through 573), information voids for various aspects of seabird ecology make it difficult to predict impacts of fishery management on seabirds. Lacking are diet and foraging ecology information for most seabird species during autumn, winter, and early spring; the seasons of greatest activity by the pollock trawl fishery. Also lacking are oceanographic and food-web information relative to seabird diet and foraging.

Seabirds are known to feed on age 0 and age 1 pollock, however, most species of seabirds feed largely or exclusively on forage species other than pollock (capelin, sand lance, juvenile herring, Myctophids, Pacific saury, juvenile cods, jellyfish, large zooplankton, and other invertebrates.) Direct competition does not occur because the size of pollock targeted for harvest in the fisheries are larger than any taken for food by seabirds. Impacts may, however, accrue to the prey-sized fish (pollock as well as other prey species) from relocated or reduced harvest of their predators, the large pollock, which in turn may result in localized areas of either increased or decreased abundance of prey-sized fish.

Seabird populations usually are limited by their food supply to a much greater degree than by other factors. If the management measures employed cause a change in forage abundance or availability they could cause a large-scale, long-term changes in seabird populations. Not enough information exists, however, to estimate whether changes in seabird forage abundance or availability will occur as a result of these proposed management measures. Whether the proposed management measures will have a positive, negative, or even measurable impact on seabird populations cannot be estimated from information currently available.

Food consumption by seabirds depends not only on forage stocks in their feeding areas, but also on the availability of stocks to the birds. All seabirds forage on concentrations of prey, which are created by prey schooling behavior or by physical processes in the water column. Different seabirds species require different foraging conditions and have different strategies for adapting to changes. When conditions are not suitable for foraging, even a large stock of prey may be unavailable to birds. Relationships between forage availability and stock sizes are virtually unknown at present. For instance, some physical factors (such as strength of upwellings) may influence both forage production and its availability to seabirds; other factors that make prey available to birds (such as schooling behavior) may partially be determined by stock sizes; and still other factors (such as water column stratification) may vary independently of stocks. Neither the no-action alternative or the proposed harvest management measures will effect physical oceanographic conditions in any way.

5.1.3 Forage species

The following species groups are included in the forage fish category established in 1998: Osmeridae (capelin, eulachon, and other smelts), Myctophidae (lanternfishes), Bathylagidae (deep-sea smelts), Ammodytidae (Pacific sand lance), Trichodontidae (Pacific sand fish), Pholidae (gunnels), Stichaeidae (pricklebacks, warbonnets, eelblennys, cockcombs, and shannys), Gonostomatidae (bristlemouths, lightfishes, and anglemouths), and the Order Euphausiacea (krill). Although other species such as herring and juvenile pollock are considered important forage for marine mammals, birds, and fish, those groups are discussed in the sections that are specific to those species. Only the species included in the new forage fish category established in 1998 in amendments 36 and 39 to the BSAI and GOA FMPs are discussed in this section.

Bycatch amounts of some of the forage species have been recorded in BSAI and GOA groundfish fisheries in previous years. Smelts have been recorded more regularly than some of the other groups, and no reporting previous to 1998 has been done for species such as Euphausiacea and Gonostomatidae. Forage species catch under status quo management is estimated in Tables 4-25 through 4-35 of the SEIS (NMFS 1998c.) Data in rows under the target fishery heading "Pelagic Pollock" and "Bottom Pollock" are applicable to the proposed management measures. The concurrent action prohibiting use of nonpelagic trawl gear in the BSAI directed pollock fishery (FMP amendment 57) will result in an increase in the "Pelagic Pollock" catch proportional to the reduction in "Bottom Pollock" catch of pollock. NMFS assumes quantities of forage fish taken as bycatch in the pollock harvest will remain the same under the no-action alternative and action alternatives.

5.2 Habitat impacts

Inclusively all the marine waters and benthic substrates in the management areas comprise the habitat of all marine species. Additionally the adjacent marine waters outside the EEZ, adjacent State waters inside the EEZ, shoreline, freshwater inflows, and atmosphere above the waters, constitutes habitat for prey species, other life stages, and species that move in and out of, or interact with, the fisheries' target species, pollock, and the ESA protected species, Steller sea lion. This section contains analyses of fishing gear impacts on benthic substrate attributable to the proposed action for Steller sea lion. No other potential impacts to habitat (water quality, circulation, primary production, etc) are thought to be remotely attributable to the proposed action.

The pelagic trawl is the principle gear used in the directed pollock fisheries in the GOA and BSAI. Amendment 57 (to the FMP for Groundfish Fishery of the BSAI) prohibiting nonpelagic trawl gear was passed by the Council and the new regulation on the fishery is expected to be effective by fishing year 2000. Beginning in 1999, however, nonpelagic trawl gear is being prohibited in the BSAI pollock fishery through allocation of zero mt of pollock to nonpelagic trawl gear. Pelagic trawls may, however, be fished on the bottom and, in some cases, may come in contact with and disturb substrate. No data are available predicting the reduction in amount of contact with benthic substrates by use of only pelagic trawl gear or whether reducing contact with benthic substrate in the pollock fishery alone is enough to comprise a measurable reduction of impacts that have accrued from other fisheries that will continue to use bottom trawl gear i.e., the Pacific cod, rock sole, yellowfin sole, and Atka mackerel fisheries.

The proposed action or alternatives to the proposed action are not expected to result in either more or less habitat disturbance than accrues from status quo directed pollock trawl fishing. Stated another way, negligible and equal amounts of habitat disturbance are expected from the proposed action, return to status quo, and alternatives to the proposed action.

5.3 Bycatch of prohibited species

Changes in the distribution of pollock fishing effort may affect the amount and seasonality of prohibited species taken incidentally in the pollock fishery. Prohibited species taken include: Pacific salmon (chinook, coho, sockeye, chum, and pink salmon), steelhead trout, Pacific halibut, Pacific herring, and Alaska king, Tanner, and snow crab. The Council recommends annual prohibited species catch (PSC) limits in the BSAI and GOA to control the bycatch of prohibited species in the groundfish fisheries. Historically, the Gulf of Alaska fisheries encounter much less PSC than the Bering Sea fisheries, and therefore the Council has found it necessary to cap only halibut bycatch in the GOA. During haul sorting, these prohibited species or species groups are to be returned to the sea with a minimum of injury except when their retention is required by other applicable law.

Alternative RPA measures to redistribute the fishery that may affect PSC rates include: (1) dispersing the fishery over time, and (2) limiting fishing inside the CH/CVOA conservation zone. The proposed temporal and spatial changes to the pollock fishery may alter the fishery in ways vastly different from historical patterns. Therefore, extrapolating current or historic effort to future situations is problematic. We have attempted to show in the Bering Sea, what amount of PSC has been harvested in a few spatial and temporal components to identify if generally, PSC bycatch could increase or decrease. However, future bycatch of prohibited species under these scenarios is unknown. The observer data used in this analysis is not extrapolated to cover the entire fishery, and therefore cannot be compared to total amounts in the fishery. This approach is more accurate when determining relative rates of bycatch.

For the purposes of this discussion the following seasons were used to characterize future prohibited species bycatch in the pollock trawl fishery. For the BSAI in 1999, the following seasons were adopted by the Council (1) A1, beginning January 20; (2) A2, beginning February 20; (3) B, beginning August 1; and (4) C, beginning September 15. For the GOA in 1999, the following seasons were adopted by the Council (1) A, January 20 - April 1; (2) B, June 1 - July 1; (3) C, September 1 - the date of closure of a statistical area or October 1, whichever comes first; (4) D, five days after the closure of the C season - November 1.

The amount of pollock harvested in the pollock trawl fishery from 1994 – 1997 is presented in Table 5-1. Note that the amount of pollock taken outside CH/CVOA has been about 44% during the years 1996 and 1997. However, there has been wide fluctuation from year to year, with most of the catch either occurring inside CH/CVOA in the A season, or outside of CH/CVOA.

Table 5-1 Observed catch of pollock in the pollock trawl fisheries, 1994 – 1997 (mt).

Total Groundfish Catch	1994	Percent	1995	Percent	1996	Percent	1997	Percent
Outside CH/CVOA	352,546	36.8%	301,872	32.5%	379,544	44.7%	338,591	43.5%
Inside CH/CVOA, A season	392,789	41%	392,231	42.2%	241,525	28.5%	283,913	36.5%
Inside CH/CVOA, 8/ 1-12/15	182,503	19.1%	172,844	18.6%	72,134	8.5%	86,083	11.1%
Inside CH/CVOA, 9/15- 11/ 1	25,464	2.7%	58,561	6.3%	151,408	17.8%	70,381	9.0%
Inside CH/CVOA, 11/1-12/31	4,792	0.5%	3,082	0.3%	4,252	0.5%	0	0.0%
Total	958,094		928,590		848,863		778,967	

For 1999, NMFS allocated 0 mt of pollock to bottom trawl gear, effectively prohibiting trawling with bottom trawl gear for pollock. For 2000, NMFS is promulgating rulemaking that would ban trawling with bottom gear for pollock in the BSAI. This is expected to reduce the amount of bottom species such as halibut and crab that is caught as bycatch in the pollock fishery. However, no such ban is in effect or being promulgated for the GOA.

5.3.1 1999 Pollock fishery and associated PSC bycatch

Initial reports indicate that 1999 prohibited species catch rates in the pollock fishery are either equal to or lower than historic levels. Due to the bottom trawl ban, crab bycatch has been extremely low, about one quarter of the amount harvested by the pollock fleet last year by this time. Herring bycatch is also low, only 6% of the annual limit for the pollock fleet had been caught by the completion of the A season. It also appears that chinook salmon bycatch is down significantly. Preliminary data indicates chinook salmon to be about a third of what was caught last year by this time, and catch of other salmon species is roughly about one tenth of the amount caught in 1998. However, all 1999 data is preliminary, it is certain that there will be changes as updates to the observer database are made. These numbers are likely to change in the final EA. The database for herring was incomplete at this time due to data inconsistencies.

Tables 5-2 and 5-3, show the preliminary results from the A season pollock fishery. Crab bycatch was low, about equal with amounts in 1998 in the pelagic trawl fishery. The chinook bycatch rates closely mirrored the rate of catch for the pollock fishery. However, halibut bycatch was more prevalent inside CH/CVOA than outside (66% to 34%). Note that a higher percentage of all prohibited species were taken inside rather than outside of CH/CVOA (Table 5-2, A season total column).

Table 5-2 Observed A season prohibited species bycatch in 1999 for pelagic trawls, inside and outside of CH/CVOA as a percentage of seasonal catch.

	A1 Season		A2 Season		Mothership A		A Season Total	
Species	**Inside**	**Outside**	**Inside**	**Outside**	**Inside**	**Outside**	**Inside**	**Outside**
Pollock	73%	27%	23%	77%	57%	43%	52%	48%
Chinook	81%	19%	18%	82%	69%	31%	69%	31%
Halibut	66%	34%	69%	31%	59%	41%	66%	34%
Bairdi	65%	35%	94%	6%	0%	0%	91%	9%
Opilio	56%	44%	91%	9%	0%	0%	87%	13%
Herring	-----	-----	-----	-----	-----	-----	-----	-----

Table 5-3 Observed A season prohibited species bycatch in 1999 for pelagic trawls, inside and outside of CH/CVOA (pollock weights are in mt; halibut is in kg; chinook, bairdi crab and opilio crab are in numbers).

	A1 Season		A2 Season		Mothership A		A Season Total	
Species	**Inside**	**Outside**	**Inside**	**Outside**	**Inside**	**Outside**	**Inside**	**Outside**
Pollock	99,505	37,684	25,241	82,317	27,652	21,238	152,398	141,239
Chinook	2,953	709	158	702	138	63	3,249	1,474
Halibut	19,546	10,059	14,129	6,277	4,533	3,194	38,208	19,530
Bairdi	9	5	102	7	0	0	111	12
Opilio	37	29	394	37	0	0	431	66
Herring	67	23	(1)	19	3	3	0	45

(1) The herring A2 season data is not available due to data inconsistencies.

In 1998 (Table 5-4 and 5-5), 86% of the pollock was harvested inside CH/CVOA, and all of the prohibited species were caught at rates over 92% inside CH/CVOA. Chinook salmon bycatch amounts for 1998 are double what was recorded for 1999 in the A season. In 1999, halibut bycatch was up significantly in all seasons and areas over 1998.

Table 5-4 Observed A season prohibited species bycatch in 1998 for pelagic trawls, inside and outside of CH/CVOA as a percentage of seasonal catch.

	A1 Season		A2 Season		Mothership A		A Season Total	
Species	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside
Pollock	90%	10%	58%	42%	100%	0%	86%	14%
Chinook	91%	9%	83%	17%	100%	0%	92%	8%
Halibut	95%	5%	92%	8%	100%	0%	93%	7%
Bairdi	100%	0%	99%	1%	0%	0%	99%	1%
Opilio	100%	0%	100%	0%	0%	0%	100%	0%
Herring	96%	4%	96%	4%	100%	0%	99%	1%

Table 5-5 Observed A season prohibited species bycatch in 1998 for pelagic trawls, inside and outside of CH/CVOA (pollock weights are in mt; halibut is in kg; chinook, bairdi crab and opilio crab are in numbers).

	A1 Season		A2 Season		Mothership A		A Season Total	
Species	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside
Pollock	175,296	19,433	32,348	23,275	48,105	65	255,750	42,772
Chinook	6,527	607	517	106	682	0	7,727	713
Halibut	2,071	117	3,521	297	99	0	5,691	414
Bairdi	5	0	174	1	0	0	179	1
Opilio	182	0	67	0	0	0	249	0
Herring	458	22	33	1	1,941	0	2,432	23

5.3.2 Pacific salmon

Pacific salmon are managed by the State of Alaska. A detailed description of its management, production history, and life history are contained in Section 3.7.2 of the FSEIS (NMFS, 1998a). Salmon runs off Alaska have exhibited wide variations throughout its known history and have generally been strongly correlated to environmental factors.

In the Bering Sea, there is a PSC limit of 48,000 chinook salmon between January 1 and April 15 for trawl gear, if this amount is reached then the Chinook Salmon Savings Area (CSSA) closes (Figure 3-9 of the FSEIS (§ 679.21 (e)(1)(v)). A PSC limit of 42,000 non-chinook salmon between August 15 and October 15 in the Catcher Vessel Operational Area (§ 679.21 (e)(1)(vi) was also established. Chinook salmon data are the only Pacific salmon bycatch data that are historically tabulated by species. All other salmon species and steelhead trout are merged as "other salmon." The Council recently adopted Amendment 58 which is now under Agency review. If approved, this amendment would incrementally reduce the chinook salmon PSC cap from the current level of 48,000 salmon to 41,000 salmon in 2000; 37,000 in 2001; 33,000 in 2002; and 29,000 in 2003. Accounting for the cap would begin January 1 and continue year-round. Non-pollock fisheries would be exempt from the closure and those fisheries' chinook PSC bycatch would not be counted towards the cap. In the event the cap is triggered in the A season, the chinook savings areas would close immediately. The closure would be removed at the beginning of the B season, during August when the chum area is in effect, but would be reinitiated September 1.

Table 5-6 summarizes chinook and chum salmon bycatch during 1994 – 1997, inside and outside of CH/CVOA, and in relation to the new seasonal schemes which were adopted for 1999. Chinook salmon bycatch tends to be fairly constant, with an increasing trend in the C season. Note that in 1994 and 1995, the B season began on August 15, Increases in the C season are probably due to the adoption of a B season beginning Sept 1 in 1996. Fishing later in the year C season should be expected to increase chinook bycatch. For chum salmon, some years a majority of the bycatch is taken outside CH/CVOA while other years bycatch is high inside CH/CVOA in the B or C seasons.. For chinook salmon, bycatch is concentrated inside CH/CVOA either in the A or C seasons. The transfer of fishing effort outside CH/CVOA could decrease the total catch of chinook salmon due to the low historical catch ratio of chinook salmon outside of CH/CVOA. However, chum salmon bycatch might increase under this scenario because in the last few years (1996 and 1997) bycatch rates have been higher outside CH/CVOA compared to inside CH/CVOA (in relation to the total pollock harvest amount). It is likely also that the proposed changes to the pollock fishery will transfer effort into the summer months in the BSAI. This is generally a time of reduced chinook salmon bycatch rates (7 % total bycatch for August 1 -- September 15), but is a period when chum salmon bycatch rates are at their highest (35 % total bycatch during this period).

Table 5-6 Observed bycatch of chinook and chum salmon in BSAI pollock trawl fisheries, 1994 – 1997 (number of animals based on NMFS observer data).

Chinook salmon	1994	Percent	1995	Percent	1996	Percent	1997	Percent
Outside CH/CVOA	3,516	18.5%	2,227	22.7%	2,585	7.0%	6,981	22.3%
Inside CH/CVOA, A season	14,108	74%	6,194	63.0%	22,729	61.7%	7,021	22.5%
Inside CH/CVOA, 8/ 1-12/15	778	4.1%	603	6.1%	484	1.3%	4,856	15.5%
Inside CH/CVOA, 9/15- 11/ 1	243	1.3%	801	8.2%	10,798	29.3%	12,388	39.7%
Inside CH/CVOA, 11/1-12/31	372	2.0%	0	0.0%	248	0.7%	0	0.0%
Total	19,017		9,825		36,844		31,246	

Chum salmon	1994	Percent	1995	Percent	1996	Percent	1997	Percent
Outside CH/CVOA	18,166	31.7%	3,198	32.1%	26,301	49.4%	23,085	51.6%
Inside CH/CVOA, A season	1,576	2.8%	136	1.4%	778	1.5%	868	1.9%
Inside CH/CVOA, 8/ 1-12/15	37,239	65.1%	5,000	50.2%	1,651	3.1%	14,436	23.3%
Inside CH/CVOA, 9/15- 11/ 1	236	0.4%	1,633	16.4%	24,496	46.0%	10,323	23.1%
Inside CH/CVOA, 11/1-12/31	11	0.0%	0	0.0%	14	0.0%	0	0.0%
Total	57,228		9,967		53,240		44,715	

In the GOA, while PSC limits have not been established for salmon, the timing of seasonal openings for pollock in the Central and Western GOA have been adjusted to avoid periods of high chinook and chum salmon bycatch. In 1998, 14,188 chinook salmon and 11,634 "other salmon" were taken in the GOA by the pollock trawl fishery. Because the season opening dates in the GOA are very similar to past dates, it is not expected that there will be a significant change in the amount of salmon taken as bycatch.

5.3.3 Pacific halibut

Pacific halibut fisheries are managed by a Treaty between the United States and Canada through recommendations of the International Pacific Halibut Commission (IPHC). Pacific halibut is considered to be one large interrelated stock, but is regulated by subareas through catch quotas. Further details on the management, production history, and life history of Pacific halibut are described in section 3.7.2 of the FSEIS (NMFS, 1998a).

The halibut resource is considered to be healthy, with total catch near record levels. The exploitable biomass of the Pacific halibut stock apparently peaked at 326,520 mt in 1988 (Sullivan, 1998). The population has since declined slightly and has maintained a biomass in the range of 270,000 to 277,000 mt for the past 5 years. The long-term average reproductive biomass for the Pacific halibut resource was estimated at 118,000 mt (Parma, 1998). Long-term average yield was estimated at 26,980 mt, round weight (Parma, 1998). The species is fully utilized. Recent average catches (1994-96) were 33,580 mt for the U.S. and 6,410 mt for Canada, for a combined total of 39,990 mt for the entire Pacific halibut resource. This catch was 48% higher than long-term potential yield, which reflects the good condition of the Pacific halibut resource. At its January 1999 annual meeting, the IPHC recommended commercial catch limits totaling 33,131 mt for the United States and Canada in 1998, up 1.6 % from 1998.

Fixed PSC mortality limits have been set for the Alaska groundfish fisheries. These PSC amounts for Pacific halibut are actually deducted from the available fishery yields for the directed Pacific Halibut fishery by the IPHC. Therefore, the allowable commercial catch of halibut is reduced on account of halibut bycatch in the groundfish fisheries.

In the GOA, the PSC mortality limit for halibut is 2,300 mt (allocated as 2,000 mt for the trawl fisheries and 300 mt to the hook & line fisheries). The BSAI halibut PSC mortality limit is 4,675 mt (3,775 mt for trawl and 900 mt for non-trawl gear). The trawl mortality component (3,775 mt) is sub-allocated to target groundfish fisheries (Pacific cod, yellowfin sole, rock sole, pollock/Atka mackerel/other species, rockfish). The Council uses the best estimate of halibut bycatch mortality rates each year and the groundfish TAC apportionments to project halibut bycatch mortality allowances for each gear and target fishery group. NMFS monitors halibut bycatch performance throughout the fishing season, including the extrapolation of data to unobserved vessels, and closes fishing by gear group before bycatch mortality limits are reached.

The majority of halibut caught by the pollock fishery has generally occurred either inside CH/CVOA in the A season or outside CH/CVOA (Table 5-7) which is similar to pollock harvest ratios in Table 5-1. In 1997, halibut taken inside CH/CVOA in the A season accounted for about 60 % of the total bycatch amount. Halibut bycatch was minimal in the B and C seasons inside CH/CVOA (about 5 % respectively in 1997). A shifting of effort in the A season to outside of CH/CVOA is not likely to increase the amount of halibut caught because the relative percentage of catch has been less outside than inside. Also, the proposed ban on trawling with bottom gear, if accepted, will drastically reduce the amount of halibut caught as bycatch in the pollock fishery. In 1998 in the BSAI, about 165 mt of halibut mortality was associated with pelagic trawl and about 117 mt of halibut mortality with bottom trawl gear. In contrast in the GOA, only 9.5 mt of halibut mortality was associated with pelagic trawl gear and about 22.5 mt of halibut mortality with bottom trawl gear.

Table 5-7 Observed bycatch of halibut in BSAI pollock trawl fisheries, 1994 – 1997 (kg, NMFS observer data).

Halibut	1994	Percent	1995	Percent	1996	Percent	1997	Percent
Outside CH/CVOA	457,441	58.1%	167,275	36.3%	189,939	44.5%	100,292	30.9%
Inside CH/CVOA, A season	319,502	40.6%	266,916	57.9%	175,719	41.2%	193,767	59.7%
Inside CH/CVOA, 8/ 1-12/15	8,787	1.1%	10,009	2.2%	6,590	1.5%	14,345	4.4%
Inside CH/CVOA, 9/15- 11/ 1	1,427	0.2%	16,018	3.5%	54,298	12.7%	16,306	5.0%
Inside CH/CVOA, 11/1-12/31	22	0.0%	468	0.1%	516	12.0%	0	0.0%
Total	787,180		460,686		427,063		324,711	

5.3.4 Pacific herring

Pacific herring fisheries are managed by the State of Alaska. A detailed description of its management, production history, and life history are contained in Section 3.7.4 of the FSEIS. The fisheries occur in specific areas in the Gulf of Alaska and the Bering Sea when the stocks come inshore to spawn. In the Gulf of Alaska, spawning concentrations occur mainly off southeastern Alaska, in Prince William Sound, and around the Kodiak Island-Cook Inlet area. In the Bering Sea, the centers of abundance are in northern Bristol Bay and Norton Sound. Although most herring are harvested near-shore in the sac-roe season in spring, fall seasons are also designated for food and bait fisheries. From catch records, it is evident that herring biomass fluctuates widely due to influences of strong and weak year-classes. The Bering Sea and Gulf of Alaska stocks are currently at moderate levels. In Prince William Sound, however, herring abundance is at a historic low following a disease outbreak in 1993.

Pacific herring PSC limitations in the groundfish fisheries apply to trawl gear in the Bering Sea. The PSC limit for trawl gear is determined each year during the ABC and TAC setting process, and is set at 1% of the estimated EBS herring biomass, which is further apportioned by target fishery (§ 679.21 (e)(1)(iv)). Should the herring PSC limit for a particular groundfish target fishery be reached during the fishing year, the trawl fishery for that species is closed in the Herring Savings Areas (Figure 3-10 of the FSEIS) (§ 679.21 (e)(7)(v)). For 1994 – 1997, the bycatch amounts of Pacific herring in the pollock trawl fishery are given in Table 5-8.

In the BSAI, herring bycatch occurs primarily in the summer months inside CH/CVOA and outside CH/CVOA on an annual basis (Table 5-8). About 45 % of the total bycatch of herring on average, was taken between August 1 and September 15 inside CH/CVOA. Shifting trawl effort for pollock into the summer months could result in higher rates of herring bycatch. Herring bycatch has been lowest inside CH/CVOA in the A season, a period which has been designated as a critical foraging period for Steller sea lions.

Table 5-8 Observed bycatch of herring in BSAI pollock trawl fisheries, 1994 – 1997 (kg, NMFS observer data).

Herring	1994	Percent	1995	Percent	1996	Percent	1997	Percent
Outside CH/CVOA	378,873	31.8%	198,584	30.4%	539,569	60.4%	238,631	31.4%
Inside CH/CVOA, A season	77,346	6.5%	24,575	3.8%	9,088	1.0%	22,837	3.0%
Inside CH/CVOA, 8/ 1-12/15	668,235	56.1%	382,887	58.7%	193,404	21.7%	323,906	42.6%
Inside CH/CVOA, 9/15- 11/ 1	66,299	5.6%	46,338	7.1%	150,714	16.9%	174,419	23.0%
Inside CH/CVOA, 11/1-12/31	3	0.0%	0	0.0%	1	0.0%	0	0.0%
Total	1,190,756		652,385		892,776		759,794	

For the GOA, only about 19,077 kg of herring was caught as bycatch by the pollock fishery in 1998. We do not expect this amount to drastically change due to the minor alterations in the spatial and temporal components of the pollock fishery in the GOA.

5.3.5 Alaska king, Tanner and snow crab

Crab fisheries in the EEZ are managed by the State of Alaska, with Federal oversight established in the FMP for the BSAI crab fisheries. The commercially important crab species are: red king crab (*Paralithodes camtschaticus*), blue king crab (*Paralithodes platypus*), golden or brown king crab (*Lithodes aequispinus*), Tanner crab (*Chionoecetes bairdi*), and snow crab (*Chionoecetes opilio*). A detailed description of their management, production history, and life history are contained in Section 3.7.1 of the FSEIS.

Annual trawl surveys for crab stock assessments are conducted by NMFS in the BSAI. A length-based analysis, developed by ADF&G, incorporates survey, commercial catch, and observer data to estimate stock abundance (Zheng, 1995; Zheng, 1998). Abundance estimates generated by this model are used to set guideline harvest levels for the crab fisheries. Catches are restricted by guideline harvest levels, seasons, permits, pot limits, and size and sex limits that restrict landings to legal sized male crabs. Fishing seasons are set at times of the year which avoid molting, mating, and softshell periods, both to protect crab resources and to maintain product quality.

For red king crabs, an analysis of the 1998 NMFS survey results show that large female crabs and pre-recruits increased in abundance and legal males decreased in abundance from 1997 (NMFS, 1998b). Legal males increased from an estimated 5.58 million crabs in 1996 to 9.4 million crabs in 1997, and then decreased to 7.4 million crabs in 1998. Large females (>89 mm carapace length) increased from 11.9 million in 1996 to 25.3 million crabs in 1997 to 35.3 million crabs in 1998 (Morrison, 1998; NMFS, 1998b). Due to this increase in effective spawning biomass, ADF&G increased the 1998 guideline harvest level from a 10% to a 15% exploitation rate (Zheng, 1998). Though the stock abundance increases are encouraging, the Bristol Bay stock remains depressed compared to past abundance levels. Survey and fishery data also indicate a long term decline of Pribilof Islands red king crab. Localized, high concentrations of Pribilof Islands red king crabs were not apparent during the 1997 survey, though in years past such concentrations had occurred frequently (Morrison, 1998).

The Tanner crab (*C. bairdi*) fishery was closed in 1997 and 1998 due to low abundance. The 1998 survey abundance estimates for large males (≥135 mm carapace width) and large females is the lowest on record for the survey (NMFS, 1998c). Most legal males encountered were in the Eastern District, with the highest abundance in central Bristol Bay. The cohort which began recruiting into the fishery in 1988-1992 has declined as a result of natural mortality and fishery removals. During the 1997 survey, 95% of legal males encountered were old shelled and not expected to molt again, and few young males in the 50-115 mm carapace width were surveyed. Given these two factors, it is likely that the Bering Sea Tanner crab population will continue to decline for years (Morrison, 1998). The Council considers the stock overfished and the Council's Crab Plan Team is creating a rebuilding plan for the stock (NMFS, 1998b).

C. opilio crab (snow crab) biomass sharply rebounded from a low in 1985, to high abundance in 1991. However, a recent decline in the commercial stock has been masked by increasing numbers of pre-recruit males, which should provide improved catches in the next few years. Harvests of snow crab from the Bering Sea were approximately 53,000 mt in 1985, and reached 108,848 mt in 1998 according to ADF&G catch data (http://www.cf.adfg.state.ak.us). Recent stock assessments show increases in snow crab and decreases in Tanner crab biomass (Stevens, 1998). According to the 1996 survey, the majority (87 percent) of large male crabs were located east of the 173°W longitude. Recruitment for the 1997 fishery apparently was due to southward migration and growth of a population of small males, which had previously concentrated at the northern limit of the survey areas. The 1998 survey indicates that the abundance of large males has peaked and declined 17% from 1997. The snow crab population is expected to decline rapidly in 1999, but continued recruitment of small crab may offset the decline (NMFS,1998c).

The overall amount of crab bycatch in 2000, in the BSAI pollock fishery, is expected to decrease due to the proposed bottom trawl ban for pollock. Additionally, distribution of fishing effort into the summer months (much lower crab bycatch rates within CH/CVOA) would also reduce the likelihood of crab bycatch. The historic catch ratio of crab in the GOA has been very low, less than 500 *C. bairdi* were caught in the GOA in 1998, and is not expected to increase as a result of manipulations in the timing or location of the pollock fishery. All of the crab caught in the GOA was attributed with bottom trawl targets. Table 5-9 displays observed bycatch of crab species in pollock fisheries from 1994-1997.

Table 5-9 Observed bycatch of *C. Bairdi*, *C. Opilio*, and red king crab in BSAI pollock trawl fisheries, 1994 – 1997 (number of animals based on NMFS observer data).

Bairdi crab	1994	Percent	1995	Percent	1996	Percent	1997	Percent
Outside CH/CVOA	374,456	99.1%	116,264	59.6%	80,886	71.4%	50,745	49.6%
Inside CH/CVOA, A season	41,160	9.9%	78,675	40.6%	31,494	27.8%	51,512	50.4%
Inside CH/CVOA, 8/ 1-12/15	44	0.0%	21	0.0%	48	0.0%	4	0.0%
Inside CH/CVOA, 9/15- 11/ 1	1	0.0%	252	0.1%	811	0.7%	16	0.0%
Inside CH/CVOA, 11/1-12/31	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Total	415,661		195,212		113,239		102,277	

Opilio crab	1994	Percent	1995	Percent	1996	Percent	1997	Percent
Outside CH/CVOA	1,739,87 9	99.9%	421,065	98.7%	236,614	95.9%	284,888	81.0%
Inside CH/CVOA, A season	2,513	0.1%	5,767	1.4%	6,585	2.7%	66,707	19.0%
Inside CH/CVOA, 8/ 1-12/15	5	0.0%	8	0.0%	130	0.1%	5	0.0%
Inside CH/CVOA, 9/15- 11/ 1	0	0.0%	3	0.0%	3,313	1.3%	64	0.0%
Inside CH/CVOA, 11/1-12/31	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Total	1,742,397		426,843		246,642		351,664	

Red king crab	1994	Percent	1995	Percent	1996	Percent	1997	Percent
Outside CH/CVOA	23,406	85.0%	2,317	71.6%	3,941	99.9%	166	19.4%
Inside CH/CVOA, A season	4,137	15.0%	920	28.4%	4	0.1%	691	80.6%
Inside CH/CVOA, 8/ 1-12/15	0	0.0%	1	0.0%	0	0.0%	0	0.0%
Inside CH/CVOA, 9/15- 11/ 1	0	0.0%	0	0.0%	1	0.0%	0	0.0%
Inside CH/CVOA, 11/1-12/31	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Total	27,543		3,238		3,946		857	

5.4 Endangered Species Act considerations

The Endangered Species Act of 1973 as amended (16 U.S.C. 1531 *et seq*; ESA), provides for the conservation of endangered and threatened species of fish, wildlife, and plants. The program is administered jointly by the NMFS for most marine mammal species, marine and anadromous fish species, and marine plants species and by the USFWS for bird species, and terrestrial and freshwater wildlife and plant species.

The designation of an ESA listed species is based on the biological health of that species. The status determination is either threatened or endangered. Threatened species are those likely to become endangered in the foreseeable future [16 U.S.C. § 1532(20)]. Endangered species are those in danger of becoming extinct throughout all or a significant portion of their range [16 U.S.C. § 1532(20)]. Species can be listed as endangered without first being listed as threatened. The Secretary of Commerce, acting through NMFS, is authorized to list marine fish, plants, and mammals (except for walrus and sea otter) and anadromous fish species. The Secretary of the Interior, acting through the USFWS, is authorized to list walrus and sea otter, seabirds, terrestrial plants and wildlife, and freshwater fish and plant species.

In addition to listing species under the ESA, the critical habitat of a newly listed species must be designated concurrent with its listing to the "maximum extent prudent and determinable" [16 U.S.C. § 1533(b)(1)(A)]. The ESA defines critical habitat as those specific areas that are essential to the conservation of a listed species and that may be in need of special consideration. Federal agencies are prohibited from undertaking actions that destroy or adversely modify designated critical habitat. Some species, primarily the cetaceans, which were listed in 1969 under the Endangered Species Conservation Act and carried forward as endangered under the ESA, have not received critical habitat designations.

Federal agencies have an affirmative mandate to conserve listed species (Rohlf 1989). One assurance of this is Federal actions, activities or authorizations (hereafter referred to as Federal action) must be in compliance with the provisions of the ESA. Section 7 of the Act provides a mechanism for consultation by the Federal action agency with the appropriate expert agency (NMFS or USFWS). Informal consultations, resulting in letters of concurrence, are conducted for Federal actions that have no adverse affects on the listed species. Formal consultations, resulting in biological opinions, are conducted for Federal actions that may have an adverse affect on the listed species. Through the biological opinion, a determination is made as to whether the proposed action poses "jeopardy" or "no jeopardy" of extinction to the listed species. If the determination is that the action proposed (or ongoing) will cause jeopardy, reasonable and prudent alternatives may be suggested which, if implemented, would modify the action to no longer pose the jeopardy of extinction to the listed species. These reasonable and prudent alternatives must be incorporated into the Federal action if it is to proceed. A biological opinion with the conclusion of no jeopardy may contain a series of management measures intended to further reduce the negative impacts to the listed species. These management alternatives are advisory to the action agency [50 CFR. 402.24(j)]. If a likelihood exists of any taking[2] occurring during promulgation of the action, an incidental take statement may be appended to a biological opinion to provide for the amount of take that is expected to occur from normal promulgation of the action. An incidental take statement is not the equivalent of a permit to take.

Fourteen species occurring in the GOA and/or BSAI groundfish management areas are currently listed as endangered or threatened under the ESA (Table 5-10). The group includes seven great whales, one pinniped, three Pacific salmon, two seabirds, and one albatross.

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[2] the term "take" under the ESA means "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct" [16 U.S.C. § 1538(a)(1)(B)].

Table 5-10 Species currently listed as endangered or threatened under the ESA and occurring in the GOA and/or BSAI groundfish management areas.

Common Name	Scientific Name	ESA Status
Northern Right Whale	*Balaena glacialis*	Endangered
Bowhead Whale [1]	*Balaena mysticetus*	Endangered
Sei Whale	*Balaenoptera borealis*	Endangered
Blue Whale	*Balaenoptera musculus*	Endangered
Fin Whale	*Balaenoptera physalus*	Endangered
Humpback Whale	*Megaptera novaeangliae*	Endangered
Sperm Whale	*Physeter macrocephalus*	Endangered
Snake River Sockeye Salmon	*Onchorynchus nerka*	Endangered
Short-tailed Albatross	*Diomedia albatrus*	Endangered
Steller Sea Lion	*Eumetopias jubatus*	Endangered and Threatened [2]
Snake River Fall Chinook Salmon	*Onchorynchus tshawytscha*	Threatened
Snake River Spring/Summer Chinook Salmon	*Onchorynchus tshawytscha*	Threatened
Spectacled Eider	*Somateria fishcheri*	Threatened
Steller Eider	*Polysticta stelleri*	Threatened

[1] The bowhead whale is present in the Bering Sea area only.

[2] Steller sea lion are listed as endangered west of Cape Suckling and threatened east of Cape Suckling.

In summary, species listed under the ESA are present in the action area and, as detailed below, some are negatively affected by groundfish fishing. The NMFS is the expert agency for ESA listed marine mammals. The USFWS is the expert agency for ESA listed seabirds. The proposed action, promulgation of a permanent rule to implement Steller sea lion reasonable and prudent alternatives necessary to remedy the pollock fishery from the likelihood of jeopardizing the continued existence of the western population of Steller sea lions, or adversely modifying its critical habitat, must be in compliance with the ESA.

Section 7 consultations have been done for all the above listed species, some individually and some as groups. See the FSEIS, section 3.8, for summaries of all previous section 7 consultations and Biological Opinions (NMFS 1998a). None of the alternatives considered for this rule are expected to have an impact on endangered, threatened, or candidate species other than the Steller sea lion. The purpose of this rule is to implement reasonable and prudent alternatives to avoid the likelihood of the pollock fisheries off Alaska jeopardizing the continued existence of the western population of Steller sea lions, or adversely modifying its critical habitat. To the extent to which this purpose is achieved, this action will benefit rather than harm Steller sea lions.

5.5 Marine Mammal Protection Act considerations

Under the Marine Mammal Protection Act, commercial fisheries are classified according to current and historical data on whether or not the fishery interacts with marine mammals. Two groups, takers and non-takers, are initially identified. For takers, further classification then proceeds on the basis of which marine mammal stocks interact with a given fishery. Fisheries that interact with a strategic stock at a level of take which has a potentially significant impact on that stock would be placed in Category I. Fisheries that interact with a strategic stock and whose level of take has an insignificant impact on that stock, or interacts with a non-strategic stock at a level of take which has a significant impact on that stock are placed in Category II. A fishery that interacts only with non-strategic stocks and whose level of take has an insignificant impact on the stocks is placed in Category III.

Species listed under the Endangered Species Act present in the management area were listed in section 5.4. Marine mammals not listed under the ESA that may be present in the BSAI and GOA management area include cetaceans, [minke whale (*Balaenoptera acutorostrata*), killer whale (*Orcinus orca*), Dall's porpoise (*Phocoenoides dalli*), harbor porpoise (*Phocoena phocoena*), Pacific white-sided dolphin (*Lagenorhynchus obliquidens*), and the beaked whales (e.g., *Berardius bairdii* and *Mesoplodon spp.*)] as well as pinnipeds [Pacific harbor seal (*Phoca vitulina*), northern fur seal (*Callorhinus ursinus*), Pacific walrus (*Odobenus rosmarus*), spotted seal (*Phoca largha*), bearded seal (*Erignathus barbatus*), ringed sea (*Phoca hispida*) and ringed seal (*Phoca fasciata*)], and the sea otter (*Enhydra lutris*).

Take of the above listed marine mammals in trawl fisheries has been monitored through observer programs. The subject fisheries (Gulf of Alaska groundfish trawl, and Bering Sea and Aleutian Islands groundfish trawl) are classified as Category III. Steller sea lion, harbor seal, northern elephant seal, Dall's porpoise were species recorded as taken incidentally in the Gulf of Alaska groundfish trawl fisheries according to records dating back to 1990 (Hill et al 1997.) Steller sea lion, northern fur seal, harbor seal, spotted seal, bearded seal, ribbon seal, ringed seal, northern elephant seal, Dall's porpoise, harbor porpoise, Pacific white-sided dolphin, killer whale, sea otter, and walrus were recorded as taken incidentally in the Bering Sea and Aleutian Islands groundfish trawl fisheries according to records dating back to 1990 (Hill et al 1997.)

5.6 Coastal Zone Management Act considerations

Implementation of the emergency rule would be conducted in a manner consistent, to the maximum extent practicable, with the Alaska Coastal Management Program within the meaning of section 30(c)(1) of the Coastal Zone Management Act of 1972 and its implementing regulations.

5.7 Impacts on Essential Fish Habitat (EFH)

The proposed action would potentially involve all BSAI and GOA species noted in the environmental assessment prepared for EFH (NPFMC 1999). The impacts of fishing gear on substrates and benthic communities was analyzed in the FSEIS (NMFS 1998b). A specific discussion of impacts of trawl gear on substrates and benthic communities can be found in section 3.1.2 of the FSEIS. This action reduces the potential for negative environmental impacts, therefore, this action would not adversely effect EFH.

5.8 Conclusions

NMFS acknowledges that the Steller sea lion mitigation measures must be extended through fishing year 1999 and made permanent for fishing year 2000 and thereafter for a finding of no significant impact to be reached. The options set out as the preferred alternative in this analysis would implement the revised reasonable and prudent alternatives for the 1999 BSAI and GOA pollock fisheries as outlined by NMFS in the 1998 Biological Opinion (NMFS, 1998b), and as updated in a memorandum on December 16, 1998 (NMFS, 1998e).

This Environmental Assessment tiers off the SEIS (NMFS 1998c), the 1999 Groundfish Total Allowable Catch Specification EA (NMFS 1999b), and the Emergency Rule to Implement Reasonable and Prudent Steller Sea Lion Protection Measures in the Pollock Fisheries of the BSAI and GOA EA (NMFS 1999)

For the reasons discussed above, implementation of the preferred Alternative would not significantly affect the quality of the human environment. Therefore, the preparation of an environmental impact statement is not required by section 102(2)(C) of NEPA or its implementing regulations.

JUL 16 1999

Assistant Administrator for Fisheries, NOAA

Date

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6.0 MANAGEMENT, MONITORING AND ENFORCEMENT

Implementation of any of the alternatives (other than the no-action alternative) will require improved inseason catch monitoring and increased enforcement efforts on the part of NMFS. The following section provides a discussion of the issues related to inseason management, monitoring, and enforcement.

6.1 Inseason management of Steller sea lion RPA measures

The Bering Sea temporal and spatial RPA measures proposed in the alternatives (four seasons, inside/outside CH/CVOA etc.) will generate at least four times more individual quotas for NMFS to monitor. Presently, under the emergency rule, NMFS is able to gather real-time catch location information from the catcher/processor fleet because all pollock catcher/processors carry two observers and observer catch data provides the basis for inseason management of the catcher/processor sector. As a result, NMFS is able to monitor actual catch activity by the catcher/processor fleet inside and outside CH/CVOA on a real-time basis.

This is not the case for the inshore and mothership sectors. Currently, inseason catch monitoring of the inshore and mothership sector pollock quotas occurs at the processor level rather than at the catcher vessel level. In other words, NMFS uses data aggregated at the processor level to monitor the inshore and mothership pollock quotas and does not have real-time information on the location of catch by individual catcher vessels. Haul location information is available on observed vessels, however many inshore catcher vessels in the Bering Sea fall into the 30% coverage category, and catcher vessels delivering to motherships are not required to carry observers at all. Consequently, the current inshore and mothership catch monitoring system does not provide NMFS with adequate data to monitor catch inside and outside the CH/CVOA on a real-time basis.

As a result, NMFS has been forced to manage inshore and mothership CH/CVOA limits conservatively under the emergency rule. For the inshore and mothership sectors, this means that NMFS attributes all inshore and mothership pollock catch to the CH/CVOA when the CH/CVOA is open to the inshore or mothership sectors. Once a sector's specified CH/CVOA catch limit is reached, NMFS closes the CH/CVOA to directed fishing for pollock by that sector. After-the-fact adjustments may be made where observer data clearly shows catch coming from outside CH/CVOA, however such observer information may not be available on a rapid enough basis to use for inseason management purposes. These monitoring constraints also have limited NMFS' ability to accommodate A1/A2 season rollovers of uncaught CH/CVOA limits because actual CH/CVOA catch by the inshore sector is not available in a comprehensive or timely enough manner to determine if an overage or underage situation exists during the shore 5-day stand down between the A1 and A2 seasons.

6.2 Changes to recordkeeping and reporting requirements

NMFS must have a reporting system that is able to discern pollock landings by individual catcher vessels in order to monitor on a real-time basis catch inside and outside CH/CVOA. NMFS has already developed such a system for monitoring CDQ operations and is currently developing an electronic shoreside logbook system that would provide sufficient vessel-by-vessel landing information to monitor inshore CH/CVOA activity on a vessel-by-vessel basis. Interagency discussions are also underway regarding possible merger of State and Federal reporting requirements for fish delivered by catcher vessels. A suitable system could be developed by 2000, but would require significant revisions to the existing recordkeeping and reporting program. Serious reservations exist whether implementing regulations would be effective in time for the 2000 A season pollock fishery and a target implementation date for the 2000 B season likely is more reasonable.

If the insufficient time exists to implement a new Federal electronic recordkeeping and reporting system to provide timely documentation of catcher vessel deliveries by January 2000, interim revisions to existing processor logbook and Weekly Production Reports (WPRs) might be considered. NMFS notes, however, that even these seemingly minor changes will require significant changes to existing recordkeeping and reporting forms, regulations, and associated software used by NMFS to monitor fishery quotas.

6.3 Enforcement and Vessel Monitoring Systems

The benefits of catch limits inside and outside of Steller sea lion critical habitat will be realized only if fishing vessels adhere to the spatial boundaries of the fishery, as established under this amendment. Determination of precise location during fishing operations will be essential to the determination of whether or not the vessel is fishing inside or outside of critical habitat or in no-trawl zones. Precise locations at any given point in time can be determined from Global Positioning System (GPS) coordinates read by the on-board observer, but continuous "manual" monitoring would require extensive time by the observer, making it difficult for the observer to accomplish other objectives. Manual monitoring would also likely involve greater measurement error. In addition, may catcher vessels fall into the zero or 30% observer coverage category. For these vessels, VMS would provide a much more economic monitoring tool than increased observer coverage requirements.

Surveillance flights by the U.S. Coast Guard will presumably continue, but such flights are not sufficiently frequent for full evaluation of vessel locations during the fishing period, and determination of precise location could be difficult from overflying aircraft, especially under adverse conditions. Sufficient numbers of vessels have violated no-trawl and buffer exclusions zones to conclude that such violations occur. Precise measurements of vessel location are essential for the purposes of enforcement of pollock no-trawl zones and for analysis of fisheries data to determine the amount of catch taken from within CH/CVOA.

6.1.1 Description of VMS and expected costs

Vessel Monitoring System (VMS) is an automated, real-time, satellite-based tracking system coupled with a GPS unit that obtains accurate position reports of vessels at sea. That is, real-time vessel location information is sent automatically from a transceiver on board the fishing vessel.

In order to participate in a fishery requiring VMS, a vessel would be required to install a VMS tracking unit on their boat. The tracking unit automatically determines the vessel's location several times per hour using Global Positioning System (GPS) satellites. The position is then transmitted to NMFS via a mobile communication service provider. Currently, the charge to the vessel owner for this data transmission is $5.00 per day. The VMS transmitters are designed to be tamper resistant. In most cases, the vessel owner would not be aware of exactly when the unit was transmitting and would be unable to alter the signal or the time of transmission.

The cost of a VMS is approximately $3,500 to $5,000 per vessel for the initial purchase of the equipment, including the transceiver and antenna. Installation of the equipment costs may be ca. $1,000, and communication charges for required automated position reports are about $2.50 per day. Repair and maintenance costs may approach $1,000 per year. Additional costs could include the purchase of an optional personal computer and transmission costs for text messages (approximately $0.01 per character) that are sent or received by the vessel.

Three logical options or stages exist for deployment of VMS technology in the pollock fleet (1) catcher/processors, (2) BSAI catcher vessels, and (3) GOA catcher vessels. With respect to all three of these vessel groupings, VMS obviously provides heightened ability to monitor and enforce no-trawl zones. However, other specific uses for the technology also exist. In addition to monitoring compliance with pollock trawl exclusion zones, VMS technology on board catcher/processors if interfaced with catch data would provide greater opportunity to monitor removals inside and outside of CH/CVOA (and E/W of 170) so that managers can attribute all pollock catch to precise locations. VMS technology is also crucial to NMFS's ability to adequately account for removals inside and outside of CH/CVOA by unobserved catcher vessels. At present, the agency is attributing all catcher vessel landings as having been taken from within CH/CVOA while that area is open, and then prohibiting directed fishing within the CH/CVOA when the cap is reached. VMS technology would allow NMFS to account for catch taken outside CH/CVOA during periods when that area is open and properly attribute such catch to outside CH/CVOA. This would provide the inshore and mothership fleets with greater flexibility to manage fishing operations inside and outside CH/CVOA. To the extent that co-ops form in the Inshore and Mothership sector, VMS would provide greater flexibility for co-ops to deploy effort spatially, especially where unobserved vessels are involved. In the GOA, VMS may be used by NMFS to better gauge the deployment of fishing effort throughout the GOA during pollock openings. Such information could provide NMFS with the ability to more precisely close fisheries upon the attainment of TAC with less likelihood of overage or underage.

However, because final VMS standards are not available as of this writing, it is premature for the Council to consider final action on specific options for VMS requirements for different sectors of the pollock fleet. While VMS technology will enhance NMFS' ability to implement and monitor Steller sea lion protection measures, VMS itself is not specifically mandated as part of the RPA principles. Consequently, NMFS intends to bring forward a separate analysis of specific VMS options at a later date when such information becomes available. NMFS anticipates that VMS requirements could be in place by early 2000.

6.1.2 VMS specifications

Specifications and criteria for VMS were provided by NMFS in the Federal Register, 59 FR 15180, March 31, 1994. The following will be required components for a VMS:

1. It shall be tamper-proof, i.e., shall not permit the input of false positions. It shall be password protected to prevent unauthorized reconfiguration of the transceiver.

2. It shall be fully automatic and operational at all times, regardless of weather and environmental conditions. It shall automatically generate position reports during power up, power down, antennae disconnection and antenna blockage.

3. It shall be capable of tracking vessels throughout their range and shall provide position accuracies that meet current industry standards. All systems certified by NMFS must be accurate to within 400 m (1,300 ft).

4. It shall have the capability of transmitting and storing information, including vessel identification, date-time, latitude, longitude, speed and bearing.

5. It shall provide accurate position transmissions, the interval between which can be determined by NMFS and set or changed remotely. In addition, the VMS shall allow NMFS to poll individual vessels or any set of vessels at any time and receive position reports in real time.

6. It shall incorporate a low-cost reporting mode over the signal channel to allow the transmission of the vessel identifier and the location of the vessel. Communications shall include, but not be limited to, transmitting and receiving telex and full or compressed data messages to and from shore. The VMS shall allow NMFS to initiate communications or data transfer at any time.

7. It shall include a fully integrated International Maritime Satellite (Inmarsat)-C and GPS Transceiver.

VMS technology is rapidly evolving and a wide variety of systems have been developed and tested for different uses. NMFS Office of Law Enforcement is currently developing national standards for VMS transmitters, base stations and communication service providers. These standards will help to ensure that a vessel purchasing a unit for use in one region of the United States will not have to purchase a different unit to fish in another region.

7.0 ECONOMIC AND SOCIOECONOMIC IMPACTS OF THE ALTERNATIVES

While no market exists within which Steller sea lions are "traded" (in the traditional economic sense), they nonetheless have economic value. Indeed, the economic value of Steller sea lions may include both "use" (consumptive) value and "non-use" (non-consumptive) value elements.

In the former case, Alaska Native populations have a traditional "subsistence" harvest right to the Steller sea lion resource. To the extent that declining Steller populations (in this case, with respect specifically to the western Steller sea lion stocks) reduce or even preclude subsistence harvest of these marine mammals, the Alaska Native community will suffer a welfare loss. Or expressed alternatively, rebuilding depressed Steller sea lion populations would be expected to yield direct benefits to the Alaska Native subsistence community, by enhancing their traditional "use" of these marine mammal resources.

A second and potentially substantially larger aggregate economic value attributable to the Steller sea lion resource is associated with non-use/non-consumptive values. In general, it can be demonstrated that society places economic value on (relatively) unique environmental assets, even if those assets are never directly exploited. That is, for example, society places real (and measurable) economic value on simply "knowing" that, in this case, Steller sea lion populations are flourishing in their natural environment.

A substantial literature has developed which describes the nature of these non-use values to society. In fact, it has been demonstrated that these non-use economic values may include several dimensions, among which are "existence" value, "option" value, and "bequest" value. As the respective terms suggest, society places an economic "value" on, in this case, the continued *existence* of the Steller sea lion resource; society further "values" the *option* it retains through the continued existence of the resource for future access to Steller sea lion populations; and society places "value" on providing future generations the opportunity to enjoy and benefit from this resource. These estimates are additive and mutually exclusive measures of the value society places on these natural assets, and are typically calculated as "willingness-to-pay" or "willingness-to-accept" compensation (depending upon with whom the implicit ownership right resides) for non-marginal changes in the status or condition of the asset being valued.

Quantitatively measuring society's non-use value for an environmental asset, e.g., the western stock of Steller sea lion, is a complex but technically feasible task. However, in the current situation, an empirical estimation of these values is unnecessary, because the Endangered Species Act (ESA) implicitly assumes that society automatically enjoys a *"net benefit"* from any action which protects threatened or endangered species (including the habitat they rely upon), and/or facilitates the recovery of populations of such species (or their habitat). Therefore, it is neither necessary nor appropriate to undertake the estimation of these benefits. It is sufficient to point out that these very real "use" and "non-use" values to society from enhancement of the western Steller sea lion resource do exist.

However, because the alternative actions under consideration by the Council in connection with the proposed management action (consistent with the proposed "reasonable and prudent alternatives") do carry with them potential economic and social costs, it is appropriate to evaluate, to the extent practicable, the *trade-off* society is making in order to obtain these net National benefits.

To the extent that the RPAs are effective in improving the state of the Steller sea lion population in western Alaska, and the habitat upon which they depend,[3] all of society collectively benefits. However, the potential

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[3] This is a crucial assumption, and one upon which the following analytical discussion relies.

attributable costs of the application of the RPA principles are distributed much more narrowly. Indeed, they accrue most obviously to those who directly exploit and depend upon the environmental resource base in the affected areas. In the present context, this is primarily the fishing industry operating in the BSAI and GOA which target pollock and, by extension, the communities which support and depend upon those fisheries. The following discussion summarizes the economic and social impacts which might be expected to accompany adoption of the proposed amendment to the BSAI and GOA groundfish management plans to implement one or more of the alternative RPA management actions for the second half of the 1999 fishery under the Emergency Rule and in preparation for the year 2000 eastern Bering Sea, Aleutian Islands and Western/Central/Eastern Gulf of Alaska pollock fisheries and thereafter.

The *"principles for reasonable and prudent alternatives,"* proposed by NMFS and set forth in the EA above, identify three fundamental elements in connection with management of the commercial pollock fisheries in the eastern Bering Sea, western, eastern, and central Gulf of Alaska, and Aleutian Islands management areas. These include: (1) temporal dispersion, (2) spatial dispersion, and (3) pollock trawl exclusion zones. The economic implications of each of these RPA elements for the primary subsectors of the eastern Bering Sea, Gulf of Alaska, and Aleutian Islands pollock fisheries are treated in subsequent sections of this assessment. The management environment within which the RPAs must be integrated is described in the following section.

7.1 Historical management of the pollock fisheries

Since adoption and implementation of Amendments 18/23 to the FMPs for the groundfish fisheries of the BSAI and GOA, respectively, the pollock trawl fisheries have been governed by an Inshore/Offshore (I/O) TAC allocation regime. While this regime has evolved over time, it nonetheless provides a consistent structural basis for evaluating the harvesting and processing elements of the domestic pollock fishing industry in the North Pacific and Bering Sea.

Under I/O, there are two primary operational subsectors defined for the pollock target fishery. These include: catcher/processors and "true" motherships (which together comprise the offshore sector), and shore plants and floating processors operating in a "fixed" location (which together comprise the inshore processing sector).[4] For purposes of assessing the impacts which may accrue from application of one or more of the RPA principles, these same sectoral definitions will prove useful.

Subsequent to the I/O amendments (adopted in 1992, reauthorized in 1996, and amended in 1998), the Congress of the United States passed, and the President signed into law, the American Fisheries Act (AFA), which superseded I/O and, among other things, further clarified the relationship of the three Bering Sea and Aleutian Islands subsectors with one another. It did so by: (1) precisely defining which individual vessels could participate in the BS and AI pollock fisheries as catcher/processors, true motherships, or catcher vessels delivering to either component of the offshore sector; (2) establishing strict criteria based on historical catch records for catcher vessels delivering inshore; (3) identifying the authorized inshore pollock processors; and (4) by reapportioning the BSAI pollock TAC among the three processing operational modes.[5]

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[4] In the GOA, 100% of the pollock TAC has been apportioned to the inshore sector.

[5] AFA did not alter the GOA pollock apportionment.

Specifically, the AFA effectively limits the number of motherships participating in these BSAI fisheries to three vessels, and identifies the authorized fleet of supporting catcher vessels, naming 19. (Subsequently, two additional vessels were determined to qualify for inclusion in this operational category.) Catcher vessels in this mothership category, with a historical record of inshore deliveries may choose to make deliveries to either or both sectors, under AFA. Preliminary data suggest that 14 of the mothership-qualifying catcher boats will be authorized to operate in this manner in the future. The remaining seven mothership-qualifying catcher boats will be limited to deliveries to the mothership sector.

The Act effectively limits the number of catcher/processors to 20. The AFA names seven catcher vessels which are authorized to deliver pollock to the catcher/processors "over-the-side." The fleet of catcher boats supporting the C/P processing subsector is exclusive of the other catcher boat operations. That is, AFA precludes catcher vessels delivering pollock "over-the-side" to C/P from delivering pollock to either of the other two processing modes or subsector.

Under provisions of the AFA, the BSAI inshore sector is somewhat less precisely identified at present, although the best available information suggests that there are eight authorized inshore processors, supported by deliveries of pollock from a fleet of (approximately) 106 catcher boats, which qualify to fish for pollock (among these are the 14 cross-over boats from the mothership sector).

Within limits, then, AFA permits a relatively clear enumeration of the "universe" of pollock fishing and processing operations in the BS and AI management areas which might be directly impacted by RPA actions targeting the pollock fishery in these areas.

The AFA does not establish criteria, nor identify specific qualifying operations, in the GOA pollock fisheries. Therefore, the GOA pollock fleet is somewhat less well defined.

Nevertheless, NMFS Blend and ADF&G fish ticket data for the GOA indicate that 124 vessels participated in the pollock target fishery in 1997, of which 118 were catcher boats and six were catcher/processors. These numbers were 95 and three, respectively, in 1996. Fourteen inshore processors participated in the GOA pollock fishery in 1997, with six located in Kodiak, one each in Sand Point, Cordova, Seward, and King Cove.[6] In addition, relatively small quantities of GOA pollock were reportedly delivered for processing to three facilities located in Unalaska/Dutch Harbor. There was also one floating processor active in the Gulf pollock fishery. In 1998, this same pattern of participation was repeated.

While participation data for the 1999 pollock fisheries are not readily available at this time, some *preliminary* indications of participation levels can be consulted. Utilizing a combination of NMFS Weekly Processor Reports, Blend data, and Observer data sources, it appears that the 1999 GOA pollock fishery had, through the "A-opening", eleven active inshore processors.[7] Catcher vessel data are drawn from ADF&G fish tickets, and are not at present available. However, informed sources, familiar with this fishery, estimate that the GOA pollock catcher boat fleet numbered approximately 75 for this opening.[8] (This total is subject to change as ADF&G fish ticket data become available.)

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[6] Some pollock harvested in the Bering Sea was delivered for processing to GOA facilities.

[7] These include: six in Kodiak, one each in Sand Point, King Cove, Cordova, and Seward. There was also one "floater."

[8] Per. comm., Tom Pearson, March 3, 1999.

All participating vessels and processors in the GOA pollock fishery were classified as "inshore" operations under I/O and AFA provisions.

In the case of the 1999 Bering Sea A1 and A2 releases, these same data sources suggest that only 16 of the 20 AFA-authorized C/Ps participated in the initial pollock openings. Of these, five also received deliveries "over-the-side," from a fleet of seven catcher vessels. There were, reportedly, three true motherships, supported by 19 catcher vessels, operating during this period. Six inshore processors participated in the fishery, receiving deliveries from 53 catcher boats.[9] Again, these participation estimates are only preliminary, and subject to change as better data become available. They, nonetheless, provide some basis for evaluating the most recent levels of activity in these fisheries, by operating sector.

The Aleutian Islands pollock trawl fishery was closed in 1999, under the Emergence Rule for Steller sea lions.

7.1.1 Status quo seasonal pollock releases and apportionments

Under provisions of AFA, which took effect beginning January 1, 1999, the Bering Sea pollock TAC is apportioned in the following way. The TAC is initially reduced by a 10% set aside for qualifying CDQ operations, then further reduced to accommodate pollock bycatch in non-target fisheries by an amount expected to be approximately 5% of the TAC. The remaining 85% of the TAC is then divided, 50% to the inshore sector, 10% to the true mothership sector, and 40% to the catcher/processor sector.

In the BSAI management area, the pollock TAC is further divided between an A and B season, with 45% of each sector's share released on January 20, and the remaining 55% released on September 1 of the fishing year. The pollock target fishery is closed from November 1 to January 20.

In the GOA, as previously noted, 100% of the pollock TAC is apportioned to the inshore sector. The AFA does not alter this relationship.

7.1.2 An evolving pattern of fishing effort

In recent history, pollock target fisheries have taken place over shorter and shorter periods of time. In the 1990 BSAI fishing season, for example, the fishery took place over a 10 month period. By 1998, the season lasted fewer than three months, divided between the A and B seasons.

In the GOA, season length has fluctuated widely, but an overall trend has been for shortened seasons, even as pollock TACs in the GOA have increased. In the western Gulf (Area 610), the directed season lasted approximately 90 days in 1991, fell to 54 days in 1992, then averaged just 18 days from 1994 through 1997. In the central Gulf (Areas 620 and 630) pollock target fishing has exhibited the same pattern of contraction. In Area 620, the fishing season decreased from 90 days in 1991 to as few as 16 days in 1995. The 1997 season lasted approximately 45 days. In Area 630, the season length decreased from 90 days in the early 1990s to slightly fewer than 10 days in 1996. The 1997 GOA pollock season was 34 days long.

This degree of temporal compression of the fishing season has a number of undesirable results, not the least of which is the risk of localized depletion of stocks of pollock.

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[9] This does not include 6 boats displaced from the fishery by a fire at one of the inshore processing operations. Per. comm., Nick Hindman, March 3, 1999.

While the 1999 pollock fisheries are temporarily governed by provisions of an emergency rule (which will extend for 180 days beginning January 1, 1999, and may be "rolled-over" for another 180 days), beginning January 1, 2000, the AFA provisions[10] will be the fisheries management and operational context within which the proposed Steller sea lion FMP amendment will be implemented. This is a very different operational environment from that which existed pre-AFA and prior to the temporary emergency rule.

Against this background, it may nonetheless be possible to predict how the industry is likely to respond to each of the RPA principles, and to characterize, in general terms, the nature and size of the economic and social impacts that may accompany these adjustments. Some of these predictions may be evaluated against the industry's "performance-to-date," under the 1999 Steller emergence rule. Obviously, data limitations will restrict the degree to which the estimates can be confirmed, but they may provide the Council with useful *directional* indicators for the key management principles and options.

7.2 RPA principle one: Temporal dispersion

For the Bering Sea subarea, the proposed *"principles for reasonable and prudent alternatives"* (of which there are several specific suboptions under consideration) provide for significant temporal adjustments to the status quo pattern of utilization of this area's pollock resource. Under the RPA principle of temporal dispersion, a primary objective is *"... to more evenly distribute the pollock trawl fisheries catch..."* throughout the fishing year. Temporal dispersion serves to diminish the risk of localized depletions caused by pulse fishing.

To this end, this first principle provides that the existing A and B seasons in the Bering Sea subarea be further subdivided into four seasonal apportionments. For example, the Council's proposed action in the BS pollock fishery would separate the A/B seasons into four distinct elements, i.e., A1, A2, B, and C seasons, with a limit of 30% of the total TAC coming from any one season.

The Council's Steller sea lion proposal suggests several alternative ways of achieving the objectives of this RPA. One option would set the start date of the A2 release at a date-certain each season. Three such dates are suggested in the present proposal; these being February 20, March 1, and March 15. Alternatively, the Council proposal suggests that a fixed stand-down period be employed to provide the requisite separation between A1 and A2. Again, three options are suggested. These include a 5 day, 7 day, or 10 day stand-down interval.

With respect to the temporal distribution of the B and C seasons, the Council's proposal suggests the following options. Start the B season June 1, with ending dates of either August 15 or August 30. Begin the C season September 1 or, alternatively, September 15. Optional closure dates would include October 31 or November 30.

The Council also proposed to examine a reduction of the overall roe season fishery to 40% of the annual total TAC, from its current level of 45%.

The GOA pollock fisheries would also be managed on the basis of modified seasonal TAC releases, under the Steller sea lion proposal. Until 1996, the GOA fishery had been prosecuted under a four quarter

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[10] In GOA, the AFA does not directly alter the apportionment pattern or qualifying criteria and, therefore, implicitly provides for a retention of the I/O management structure.

apportionment regime. In 1996, the fishery was changed to a trimester release schedule with approximately equal shares of the TAC split between January, June, and September.[11]

The temporal dispersion scheme for the GOA pollock fisheries is similar to that contemplated for the Bering Sea subarea, inasmuch as the current A season would be divided in two, with the A release becoming available on January 20, and a B allocation being made on June 1. The proposed C season release would be made on September 1, and the fourth quarterly apportionment would occur no later than October 1 of each fishing year, but in no case sooner than five days after the close of the C season. This is, incidently, consistent with the terms of the emergency rule which prevails for the 1999 GOA A season (and presumably for the B, C, and D-seasons, as well).

Finally, under one provision of the Council's February 1999 motion, there would be no pollock target fishery in the Aleutian Islands management area (again, this is consistent with the prevailing emergency rule "temporal dispersion" provisions governing the 1999 season).

7.3 RPA principle two: Spatial dispersion

A primary objective of the "spatial dispersion principle" for pollock trawl fisheries is to have the distribution of catch mirror the distribution of exploitable pollock biomass for each seasonal TAC, including allocations made to areas within critical habitat and outside of critical habitat.

Prior to 1987, less than 30% of the BSAI annual pollock catch was taken from Steller sea lion critical habitat in all years except 1971 (when about 31% was taken). After 1987, the annual percentage increased to between 36% and 69% (with an 1987 through 1997 mean removal of approximately 52%). From 1992 to 1997 during the A season, the percentage of pollock catch taken in these areas ranged from 53% to 89%, with a mean of 69%.

In the GOA management areas, the percentage of the annual pollock TAC taken from Steller sea lion critical habitat was on the order of a few percent, until 1979, when the level rose abruptly to about 35%. From 1982 to 1997, the level of removals from critical habitat was consistently above 50%, ranging to as high as 93% in 1988.

The allocation of catch according to the geographic distribution of stock biomass, as suggested by RPA principle two, implies some subdivision of the entire area into meaningful geographic units. For the pollock stocks in the BSAI region, some specific geographic areas have already been identified (e.g., Aleutian Islands area, Bogoslof area, eastern Bering Sea).

In the GOA, geographic management areas 610, 620, and 630 have already been established, and the Shelikof Strait area has been identified as critical habitat for Steller sea lions (and a site for annual hydroacoustic trawl surveys).

Consistent with RPA principle two, management areas for the spatial dispersion of pollock trawl fishing effort in the eastern Bering Sea and GOA target fisheries should be based on these and/or other meaningful geographic delineations which are proportionate to pollock stock distribution.

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[11] In 1998, slightly more (i.e., 40%) of the GOA TAC was shifted into the September release.

7.4 RPA principle three: Pollock trawl exclusion zones

Notwithstanding the foregoing discussion, in some circumstances spatial dispersion, wherein pollock catch is proportionate to pollock stock distribution within a given area, is not sufficient to provide the level of protection deemed necessary. In such cases, trawl exclusion zones are an appropriate management option. RPA principle three provides for complete exclusion of pollock trawl fishing from specific habitat zones, based on the available evidence that the regions around major rookeries and haulouts are so essential to the recovery and conservation of the western population of Steller sea lions that risk of competition from pollock trawl fisheries must be completely eliminated. Such exclusions are believed to be particularly important to protect prey resources for reproductive females and for pups and juveniles learning to forage.

Based on the need to eliminate the possibility of competition in foraging areas immediately adjacent to rookeries and haulouts, this principle proposes to establish exclusion zones which provide absolute spatial separation of pollock trawl fishing and Steller sea lion foraging areas adjacent to terrestrial haulouts and rookeries. These exclusion zones are specified in the proposed FMP amendment so as to provide protection for all rookeries and haulouts used by significant numbers of animals since the beginning of the decline in the 1970s.

In the Bering Sea subarea, pollock trawl protection zones are proposed to have a minimum radius of 20 nm with the exception of Cape Sarichef. In the GOA management area the zones extend to 10 nm for 2000 and beyond. The RPA specifies a 10 nm pollock trawl exclusion zone in the Aleutian Islands management area, as well.[12]

7.5 The "no action" alternative

It is standard practice for all regulatory analyses to include an examination of the "No Action Alternative," to contrast the proposed or contemplated actions with the "status quo" condition. Often this is done by assuming that, absent the proposed action, the fishery would revert to the management and operational patterns observed in the latest period prior to the proposed implementation date for the action. In this case, that would be the 1999 fishing year. However, the 1999 pollock fisheries are being managed under an emergency rule, which will "sunset" prior to January 1, 2000.

Furthermore, should (perhaps on the Council's advice) the Secretary take "no action" in this case, management of the BSAI and GOA pollock resources would not simply revert to the pre-emergency rule condition. Instead, because the emergency rule and the current proposed action were triggered by an ESA "jeopardy" finding, it is probable that a "no action" decision by the Secretary would initiate a series of legal and administrative actions which, in the limit, could result in a complete closure of all target fisheries for pollock in the Bering Sea, Aleutian Islands, and Gulf of Alaska management areas, beginning in 2000.

Should a "no action" decision by the Secretary result in such a closure, the direct economic costs to the pollock harvesting and processing sectors would be enormous. For perspective, the 1998 SAFE document estimates the "ex vessel" value of the pollock trawl fisheries at over $18 million for the GOA, and over $227

[12] However, under the ER and the Council's option to completely close the Aleutian management area to pollock trawl fisheries, the size of the exclusion zones in this area becomes irrelevant.

million for the Bering Sea and Aleutian Islands management areas (estimates reflect the 1997 fishing year).[13] The aggregate product value for all pollock output, all areas combined, was estimated at just under $672 million.[14] When compared to the value of all other groundfish production from these same management areas, pollock accounts for well over half of the total (approximately 57%, in 1997) and almost exactly 50% of the quantity (as expressed in tons of product).[15]

These estimates reflect only the approximate direct gross revenue impacts which would accompany closure of the region's pollock trawl fisheries. In addition, one would expect significant social and economic disruptions to accrue as pollock vessel operators, primary and secondary processors, support industries, and dependent communities attempted to adjust to such a fundamental structural change in the region's economy.[16]

A complete characterization of these impacts is not possible. However, even a superficial examination clearly suggests economic losses in the hundreds of millions of dollars, annually, as well as, significant adverse impacts to employment, capital investment, and community and social stability. In addition, there would be adverse impacts on domestic users of pollock products (e.g., wholesalers, restaurants, and retails), as well as, U.S. consumers.

Because a substantial share of the total pollock production from these fisheries enters the export market (primarily destined for Japan, but also supplying other east Asian and European markets), closure of these fisheries could have destabilizing effects on world whitefish supply and demand, with implications for U.S. import/export balance of trade accounts.

Finally, "spill-over" effects from a closure of the pollock trawl fisheries, attributable to a "no action" decision, could adversely impact many of the remaining commercial fisheries in the GOA and BSAI regions. Because pollock harvesting and processing activities support so much of the industrial, commercial, and community infrastructure throughout the region, loss of that fishery could reduce (or eliminate altogether) availability of services which other fisheries rely upon (e.g., fuel docks, marine supply, cold storage). The extent to which these outcomes would accrue may vary by community or fishing port (e.g., see the community dependency profiles in the IRFA Section 7.5.4, below), however, every community which directly or indirectly supports the commercial groundfish fisheries of the GOA or BSAI would feel some adverse effect from a closure of pollock fishing in the North Pacific and Bering Sea, should the "no action" alternative be adopted.

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[13] Source: Stock Assessment and Fishery Evaluation Report for the Groundfish Fisheries of the Gulf of Alaska and Bering Sea/Aleutian Islands Area: Economic Status of the Groundfish Fisheries Off Alaska 1997. REFM. Alaska Fisheries Science Center. NMFS. November 25, 1998.

[14] The totals are not additive. Product values include the ex vessel value, plus value added through processing.

[15] Op. cit.

[16] Provisions of the AFA severely restrict the ability of pollock vessels to diversify their operations by participating in alternative fisheries. This suggests that a closure of the pollock fisheries in GOA and/or BSAI management areas would almost certainly completely idle the majority of the fleet.

7.6 Economic implications of the RPA principles-based alternatives

While quantitative estimates of the probable economic or social impacts on the pollock fisheries of the Bering Sea, Gulf of Alaska, and/or Aleutian Islands management areas attributable to any of the three proposed RPA dispersion principles are difficult to derive, there are several obvious (if largely qualitative) outcomes that can be predicted.

First, any regulatory action that requires an operator to involuntarily alter his or her fishing pattern (whether temporally or geographically) will impose costs. Furthermore, it is likely that some or all of these costs will be uncompensated under the newly mandated regulatory regime.

Within the present Steller sea lion RPA context, for example, it is unlikely that, following time or area closures of fishing grounds that have historically been the preferred site of pollock harvesting activity for an operation, increases in catch in the areas which remain open (or during alternative time periods) will fully offset the costs imposed by the RPA action. If they did, then, presumably, a profit maximizing operator would have adopted these fishing patterns and schedules voluntarily. So, temporal, spatial, and/or exclusion zone management actions, as defined under the RPA principles, will impose direct and unavoidable costs on the participants of the eastern Bering Sea, Gulf of Alaska, and Aleutian Islands pollock target fisheries, if adopted.

When implemented, the RPAs will alter the pattern of the fisheries, both temporally and geographically. The outcomes for individual operators may take several forms. For example, anecdotal information supplied by the industry suggests that CPUE may decline, in some cases significantly, as a result of being forced into unfamiliar or unfavorable areas (or periods). In addition, vessels delivering to inshore processors may experience increased running and queuing times. In either circumstance, the number of fishing days required to take the TAC-share apportioned to each sector would have to increase, all else equal.[17] How many additional days may be required would vary by sector, stock and ocean conditions, etc., and cannot be anticipated at this time.

The magnitude of costs deriving from the RPA-induced changes in fishing patterns will likely vary by vessel (plant), depending on size, operating configuration, home (and/or operating) port, principal product forms produced, and markets supplied. Empirical data on operating costs are not readily available for the several sectors which collectively comprise the pollock industry in the GOA and BSAI management areas. However, the At-Sea Processors Association (APA) has voluntarily submitted estimates of economic impacts they suggest may be associated with RPA actions for operations they represent. While these data have not been independently verified, they may provide an indication of one sector's expectation about direct operating cost effects.

The APA reports that, on average, the marginal operating cost per additional catcher/processor vessel day, in the BSAI pollock fishery, would be approximately $20,000. There are 20 catcher/processors authorized to participate in the BSAI pollock fisheries under the AFA.[18] On the basis of this information, if all

[17] In the limit, of course, the RPAs could result in the failure of one or more sectors to catch 100% of its allocation. Initial projections, based upon the best available information on capacity and utilization rates, by sector, and preliminary 1999 fisheries performance data, suggest this will not be the outcome, i.e., on average, the full TAC-allocation will be achieved by each sector.

[18] These vessels do not participate in the GOA pollock fisheries.

authorized vessels took part in the fishery, the aggregate marginal operating cost *per additional fishing day*, for this segment of the industry, would be $400,000.

This should be regarded as an upper-bound estimate, even assuming that the $20,000 per day estimate is precise, because under provisions of AFA, the C/P fleet is able to enter into "cooperative" operational arrangements which permit this sector to harvest its pollock allocation in a more efficient, i.e., economically "rational," pattern than has been possible under the open access "race-for-fish" that has characterized this fishery, historically. Indeed, this group appears to have done precisely that for the A1 and A2 seasons of 1999.

Details of the 1999 C/P cooperative agreement are not available for analysis. And, while it is not suggested that the APA co-op necessarily is of the form described below, in theory a co-op could permit its members to function in a substantially more "efficient" manner than would be the case if each operation continued to pursue its fishing interests independently. This suggests that the marginal cost to the co-oping sector (attributable to additional operating days) would almost certainly be smaller than (as in the APA case), the $400,000 maximum estimate. In the limit, an operating co-op, like that authorized under AFA (but not necessarily like that of APA), could govern the respective fishing rates and location of each of its co-op member vessels, making possible the realization of economic efficiencies, which would not accrue in the absence of joint, coordinated management of the aggregate capacity of the co-op's members.

It may be worth noting that preliminary data for the 1999 A1 and A2 Bering Sea pollock openings indicate only 16 of the 20 AFA authorized C/Ps took part in the fishery and, reportedly, they all did so under a single cooperative operating agreement.[19] It is certainly possible that the four remaining C/P vessels, authorized to harvest and process pollock in the BSAI management area under AFA, will enter the fishery in the B or C seasons.

The same data suggest that catch rates for the C/P co-op were well below historical levels observed during previous BSAI "A-season" openings. Industry members reported to the Council that these reduced rates were voluntary (i.e., not attributable to reduced stock densities). Furthermore, the "distribution" of C/P co-op effort differed (again, voluntarily) from historic pattern, with fishing activity occurring both inside and outside CH/CVOA, simultaneously. It seems likely that any increased operating expenses attributable to additional fishing days were more than offset by the increases in revenue provided by the cooperative fishing agreement. If this were not so, the voluntary fishing pattern observed in the 1999 C/P pollock target fishery, described above, would likely not have emerged.

Since both the inshore and mothership sectors will have the same opportunity to enter into operational cooperatives, beginning perhaps as early as 2000, it is probable that they, too, will be in a position to *minimize* the incremental marginal costs of any extension of the fishing period, associated with the RPA dispersion principles. That is, all three primary sectors will have the opportunity, under AFA, to "rationalize" their respective fishing patterns and schedules (within the gross limits imposed by the FMP amendment), so as to maximize harvest and delivery of their respective TAC-shares.

The degree to which the hypothesized changes in fishing patterns and season duration will be a "real," as opposed to a "potential" problem is an empirical question.

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[19] Per. comm., Ed Richardson, At-Sea Processors Assoc., March, 1999.

Once again, the opportunity provided by AFA for each sector to enter into integrated cooperative operating agreements may largely mitigate any attributable adverse impact associated with this element of the proposed RPA action. For example, the pace of the fishery could be voluntarily adjusted, e.g., allowing time for each respective sector to be more "selective" in its fishing practices, prospecting for larger fish and, thus, avoiding concentrations of smaller fish, moving out of areas of high bycatch, or PSC concentrations, etc.. Alternatively, a co-op group might be able to shift its collective production capacity around in such a way as to minimize adverse operational impacts (e.g., an involuntary increase in the number of fishing days) which might otherwise accrue from a proposed RPA management action.

In another often cited example of an RPA-attributable effect, that of smaller average fish size in the catch of a vessel without the capability to fully utilize such fish, the hypothetical C/P co-op might substitute a vessel with a greater range of processing capabilities, e.g., move a "surimi-producing" vessel, or a combination "fillet/surimi" operation, into the area in place of a "fillet-only" boat, once the presence of predominantly "small" fish was discovered there.

If, again as often hypothesized, CPUE was significantly reduced, a co-op might choose to reduce total effort (idle some of its vessels) and either wait for CPUEs to increase, or fish the TAC-share with its most cost effective operations.

While these response patterns would not be costless, nor likely to fully compensate for the hypothesized reduction in the average size and/or catch rate of pollock, they would permit a co-op to "optimize" its production, subject to the new set of RPA constraints. In this way, economic risk could be distributed across a larger number of operations, reducing the potential burden born by any single operator.

The distribution of the direct economic impacts, cited above, among the entire universe of participating fleets of vessels and processors will likely be uneven, with a disproportionate burden falling upon the smaller, less mobile, and/or less operationally diversified vessels and plants. Clearly, regulatory actions which move operations farther offshore, to more remote fishing areas (relative to their traditional operating/delivery ports), and/or reschedule openings during periods of more extreme weather and sea conditions, will impose a relatively greater burden on smaller operation than on their larger counterparts.

In some circumstances, the physical safety of a vessel and crew may be threatened if openings occur at times, or in areas, which are at the operational limits of the smaller elements of the fleet. In some cases, an operator may have to weigh the risk of testing the limits of a vessel's physical and/or operational capability, against the economic costs of dropping out of some portion or all of the fishery, as a result of RPA-induced dispersion of the pollock fishery. In the latter circumstance, this could be expected to result in effective economic redistribution *within* a given sector or fleet. That is, if smaller operations are forced to forego participation in an opening, the share of catch that would have accrued to those operations would become available to the larger elements of the sector, all else equal. Whether the remaining operations would have the capacity to actually utilize this newly available TAC is an empirical question.

There are, of course, several recent actions which could tend to ameliorate these disproportionate burdens, to some degree. For example, while, under provisions of the Steller RPAs, smaller catcher boats operating in the eastern Bering Sea pollock fishery and delivering inshore could be placed at a disadvantage, due to their more limited operating range relative to the catcher/processor or true mothership sectors, the significant TAC reapportionment to the "inshore" sectors provided for under AFA, referenced above, should offset some of this disadvantage by simply making a vastly greater absolute quantity of pollock available to these operations.

Likewise, provisions in AFA which eliminated nine vessels from the eligible catcher/processor fleet should mitigate some of the costs imposed by the Steller RPAs, in comparison to what the impacts would have been absent this AFA provision. In a sector plagued by chronic problems of excess capacity, the removal of a substantial number of vessels should, all else equal, improve the economic prospects for those which remain.

To the extent that some individual ports (e.g., Sand Point, Cordova) support resident fleets composed exclusively (or even primarily) of small boats, there may be distributional effects across geographical regions, attributable to management actions deriving from the proposed Steller RPA principles. While the AFA largely precludes redistribution of TAC allocations *between* sectors, it does not absolutely foreclose intra-sectoral shifts (including, potentially, between GOA and BSAI inshore operators). Small communities with relatively greater dependence on "local" pollock fisheries, whether sites of onshore processing or simply fleet home ports, could be disproportionately impacted through this same economic mechanism. Specifically which fishing port (or ports) may be disadvantaged, and how and by how much, cannot be predicted on the basis of current information.

Perhaps in anticipation of this intra-sectoral competition for TAC-share, the Council's Steller proposal contains a set of "exclusive registration" and "trip limit" options for the GOA pollock fishery which could substantially reduce the prospects that inshore Bering Sea-based capacity would enter the fishery in the GOA and displace the smaller, traditional Gulf operators. How effective these trip limits and registration requirements would be, if ultimately adopted by the Council and implemented by the Secretary, is an empirical question which cannot be fully assessed at present. Nonetheless, a general examination of these provisions and their likely implications for the pollock fisheries are treated in the next several sections.

7.6.1 Seasonal exclusive area requirements

Under the emergency rule adopted by the Council and implemented by NMFS on January 20, 1999, none of the BSAI and GOA seasons overlap completely for all sectors of the fleet. To address the potential for large-scale shifts of effort from the BSAI to the GOA that could lead to short pulse fisheries in the GOA, *inter-* as well as *intra-sectoral* transfers, and potential TAC overruns, a seasonal exclusive area requirement was proposed for analysis by the Council at its February 1999 meeting. Under this option, catcher vessels would be prohibited from engaging in directed fishing for pollock in both the BSAI and GOA during the following season pairs:

Bering Sea A1 Season and the W/C GOA A Season
Bering Sea A2 Season and the W/C GOA B Season
Bering Sea B Season and the W/C GOA C Season
Bering Sea C Season and the W/C GOA D Season

Once a catcher vessel engaged in directed fishing for pollock in the BSAI or W/C GOA during a fishing season it would be prohibited from subsequently engaging in directed fishing for pollock in the opposite area during the same season pairing. In the case of catcher vessels delivering to motherships which have a single A season, fishing that occurred between February 1 and February 20 would be considered A1 for the purpose of the exclusive area registration requirement. Fishing that occurred between February 20 and April 15 would be considered A2.

Based on historic fishing practices, such an exclusive area requirement is expected to have the greatest effect in slowing down the pace of the pollock fishery in Area 610. Less inseason crossover activity occurs between the BSAI and Area 620 and almost no inseason crossover activity occurs between the BSAI and Area 630. While a seasonal exclusive area requirement was not specifically addressed in the Biological

Opinion, such a requirement would be consistent with the RPA principle of temporal dispersion in the GOA to the extent that the potential for short-term pulse fisheries is reduced, especially in Area 610. Table 7-1 displays the number of vessels that fished in both the BSAI and GOA during the same seasonal period in 1997 and 1998

Table 7-1 Catcher vessels that fished in both the BSAI and GOA during the same season period, 1997-1998.

	Total vessels	BSAI-based	GOA-based	Average BSAI catch in mt	Average GOA catch in mt
1997 A season	9	6	3	1,325	453
1997 B season	20	13	6	1,611	340
1998 A season	9	6	3	1,494	457
1998 B season	data not available				

Of the vessels that crossed over between the Bering Sea and GOA in the past 2 years, approximately 70% are based in the Bering Sea and fish predominantly in the Bering Sea during the fishing year. Based on the past two years examined, a seasonal exclusive area requirement between the Bering Sea and W/C GOA would prevent between 6 and 13 Bering Sea-based catcher vessels from entering the W/C GOA and would prevent between 3 and 6 GOA-based catcher vessels from entering the Bering Sea.

At present, the pollock fishery in Area 640 of the Eastern Regulatory Area is quite distinct from the pollock fisheries in Areas 610, 620, and 630. The Area 640 pollock fishery tends to occur much further offshore and in deeper water than in other parts of the GOA. Historically, it has been prosecuted by a small number of larger size catcher boats that transit from the Bering Sea to prosecute this fishery. The total number of catcher boats participating in this fishery was three in 1997 and four in 1998. All of these vessels are traditionally based in the Bering Sea. Extending the seasonal exclusive area requirement to Area 640 would likely eliminate all of the current participants in this fishery unless the vessel operators chose to forego fishing during the Bering Sea A season. It is not clear whether smaller catcher vessels based in the GOA have the capacity or interest to prosecute this fishery. To date, they do not appear to have done so.

Should an inshore co-op emerge in the coming years, some internal allocation of effort and capacity among co-op vessels might make prosecution of this fishery more operationally and economically feasible for the traditional participants, even in the face of an exclusive area registration requirement.

7.6.2 Effects of trip limits

Figures 7-1 through 7-5 display the largest pollock fishing trip, by vessel size, for each of the five statistical areas of the GOA where pollock fisheries occur. In the W/C GOA (Areas 610-630) the effects of a proposed 300,000 lb trip limit would be most significant in Area 610, where the bulk of the largest fishing trips occur. During 1997 and 1998, approximately half of the fishing trips in Area 610 exceeded 300,000 lbs, with the largest fishing trips approaching 2 million lbs.

In area 620, the large-scale fishing trips common in Area 610 are less prevalent. However, a number of vessels fishing in Area 620 achieved fishing trips in the 500,000 lb to 700,000 lb range, in 1997 and 1998. In Area 630, the vast majority of vessels participating in this fishery did not exceed 300,000 lbs, in either

1997 or 1998, and only a few vessels participating in this fishery appear to have the capacity to exceed 300,000 lbs.

In Area 640, the fishery is characterized by a small number of vessels harvesting large catches per trip (i.e., in the 600,000 to 1.5 million lb range). In Area 649, no vessel exceeded 300,000 lbs, in either 1997 or 1998. The average fishing trip catch size, by area, is displayed in Table 7-2.

Table 7-2 Average fishing trip by statistical area (in lbs of catch), 1997-1998.

Year	GOA Reporting Area				
	610	620	630	640	649
1997	288,071	168,741	151,855	676,898	136,305
1998	320,367	162,210	149,360	808,642	147,868

Trip limits have been employed to temporally and/or geographically distribute fishing effort, and to diminish the natural advantage that larger, more mobile vessels have over their smaller counterparts in a given fishery. The degree to which trip limits potentially may achieve these objectives depends upon the attributes of the specific fishery (e.g., whether the fishery is single- or multi-species based; the distances from home port to fishing grounds; weather and sea conditions; the relative size of the competing fleets; markets; whether the trip limits are properly scaled to the fishery and for the capacities of the competing subsectors; etc.).

As pointed out by the SSC, during the April 1999 Council meeting, *"real world"* experience with trip limits has been mixed, at best. They noted: *"Trip limits as a tool of effort control are classically ineffective, routinely providing only short-term relief and requiring frequent revision. Beside deliberately encouraging discards, they confound time series* (data) *from the fishery by capping fishery catch per unit effort. Under a trip limit management regime, accurate effort and catch monitoring requires 100% observer coverage."*[20]

The trip limits provisions in the current Steller sea lion proposal are certainly not expected to be a panacea, either for the potential problem of RPA induced intra-sectoral transfers, or for the assumed Steller sea lion - pollock fishery interactions. However, they do represent *one possible* tool available to managers for mitigating some potential RPA effects. (In addition, their inclusion in the amendment package was explicitly requested by the Council).

When applied to, for example, groundfish fisheries in the U.S. Pacific Northwest (PNW), concerns emerged regarding the economic losses associated with (some would suggest "induced"by) trip limits, e.g., discards of economically valuable groundfish species bycaught in excess of authorized trip limit landings amounts. In that context, *single-species* trip limits were applied to a *multi-species* fishery, setting up a series of economic incentives which were socially and politically undesirable. For unobserved vessels, for example, the profit maximizing operator could find it in his/her economic interest to discard bycaught species in excess of authorized landings limits, while continuing to fish for species whose limits had not yet been obtained. The result was, reportedly, substantial (if largely unmeasured and unaccounted for) waste of economically

[20] Source : Draft Minutes, Scientific and Statistical Committee. April 19-21, 1999.

valuable fisheries resources. For observed trips,[21] these contradictory incentives may have the potential to induce an operator to artificially alter fishing behavior to *"accommodate"* the presence of an observer (thus, reducing the value of the observed fishery catch data), or, alternatively, curtail fishing when one species-limit is obtained, and return to port with an aggregate catch that is not profitable. In neither the observed nor unobserved case would the fishery be sustainable, over the long term.

For several reasons, the outcome of the trip limit program proposed in the present action may, *at least in theory*, be different. First, it has been argued that the pollock target fishery in question is a *single-species* target fishery, in contrast to the multi-species trip limited fisheries in the PNW. The trip limits proposed in the Steller sea lion action would apply *only* to pollock and not to other groundfish species which might be present in the catch. Vessels fishing for pollock would be free to retain any amount of other groundfish species caught during pollock fishing, within the current MRB constraints.

Second, the pollock target fishery is prosecuted primarily with pelagic trawl gear and has traditionally had very low bycatch rates (whether PSC or other groundfish species). In combination with IR/IU retention requirements already in place in this fishery (for pollock and P.cod), the very low bycatch rates in mid-water trawling for pollock suggests that induced 'waste' of economically valuable groundfish, attributable to trip limits, should be minimal.

Finally, unlike the PNW groundfish experience, wherein participation in the observer program was voluntary, in the GOA pollock fishery, the presence of NMFS observers is mandatory. (Granted, many of the vessels in question are not required to have 100% coverage while fishing for pollock, which diminishes the strength of this point. However, reliance on comparisons of unobserved and unsampled hauls with those which are observed and are sampled is the basis for much of the fisheries management conducted in the GOA and BSAI, at present.)

While certainly not resolving all of the shortcomings of trip limits, the Alaska pollock fishery context may be sufficiently different from that in the PNW groundfish fisheries to suggest that there could be a different outcome, should this option be recommended by the Council and adopted by the Secretary, as part of the Steller sea lion action.

Notwithstanding the foregoing discussion, and other efforts to minimize sectoral transfers (e.g., Bering Sea-based catcher vessels usurping portions of the GOA pollock TAC), some distributional effects seem probable between regions and among elements of the inshore sector. Some of these may be directly attributed to the proposed Steller RPAs.

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[21] The observer program for PNW groundfish (excluding Pacific whiting) is voluntary. It is not always clear how the presence of an observer effects fishing behavior in this case. Per. comm., Mark Saelens, ODF&W, Newport, Oregon. May 5, 1999.

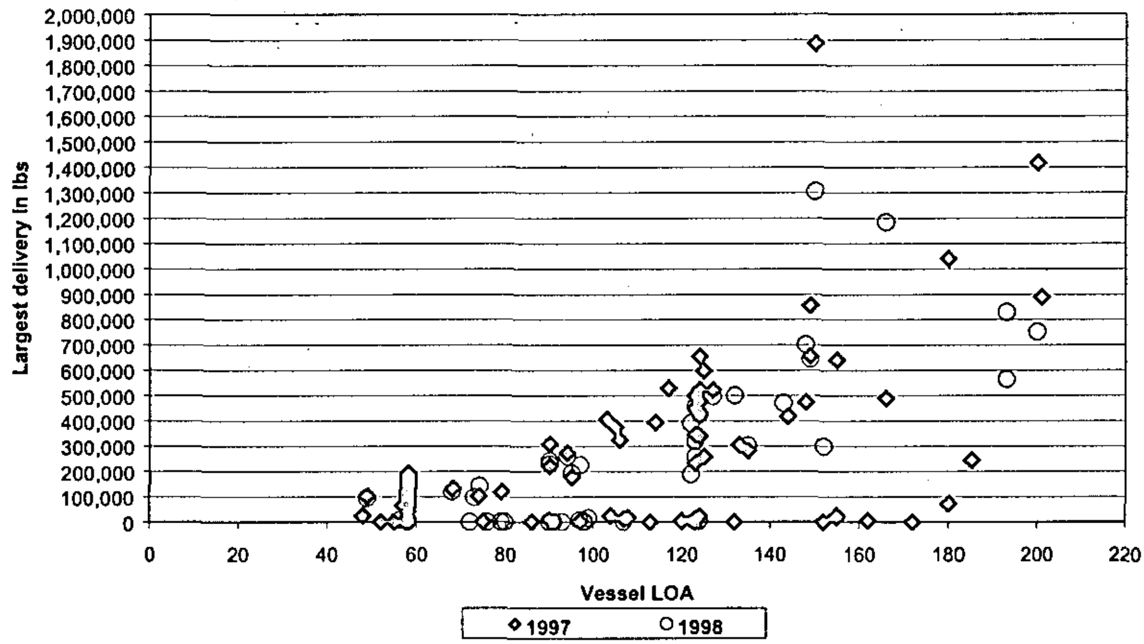

Figure 7-1 Area 610 maximum pollock delivery weight, by vessel size, 1997-1998.

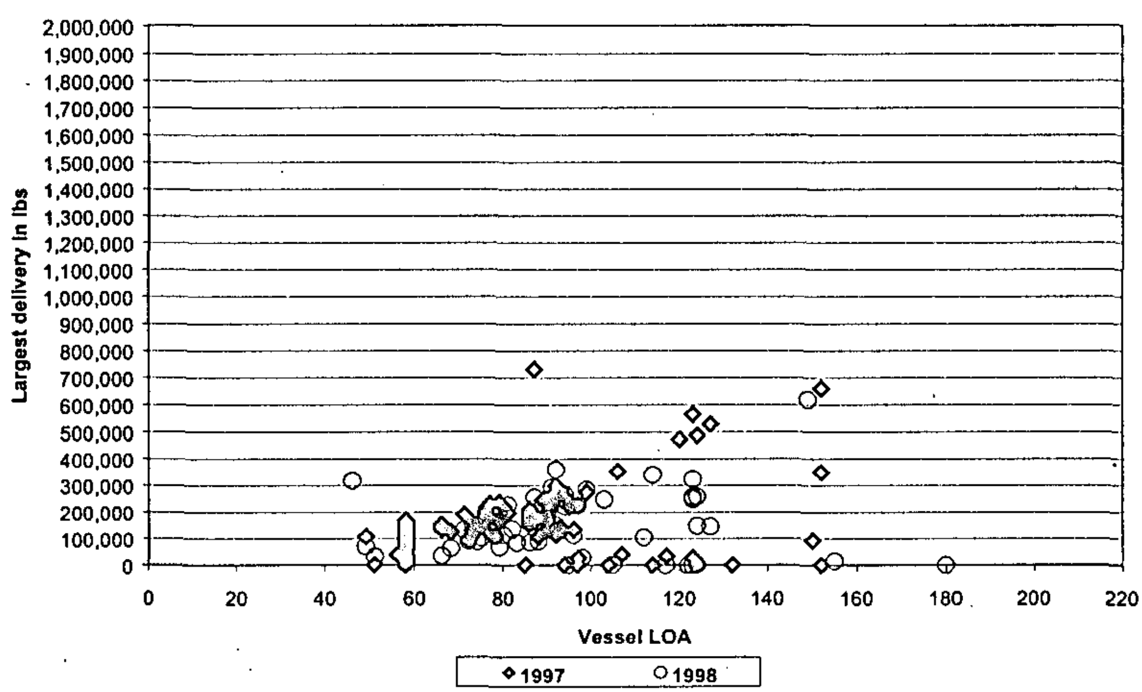

Figure 7-2 Area 620 maximum pollock delivery weight, by vessel size, 1997-1998.

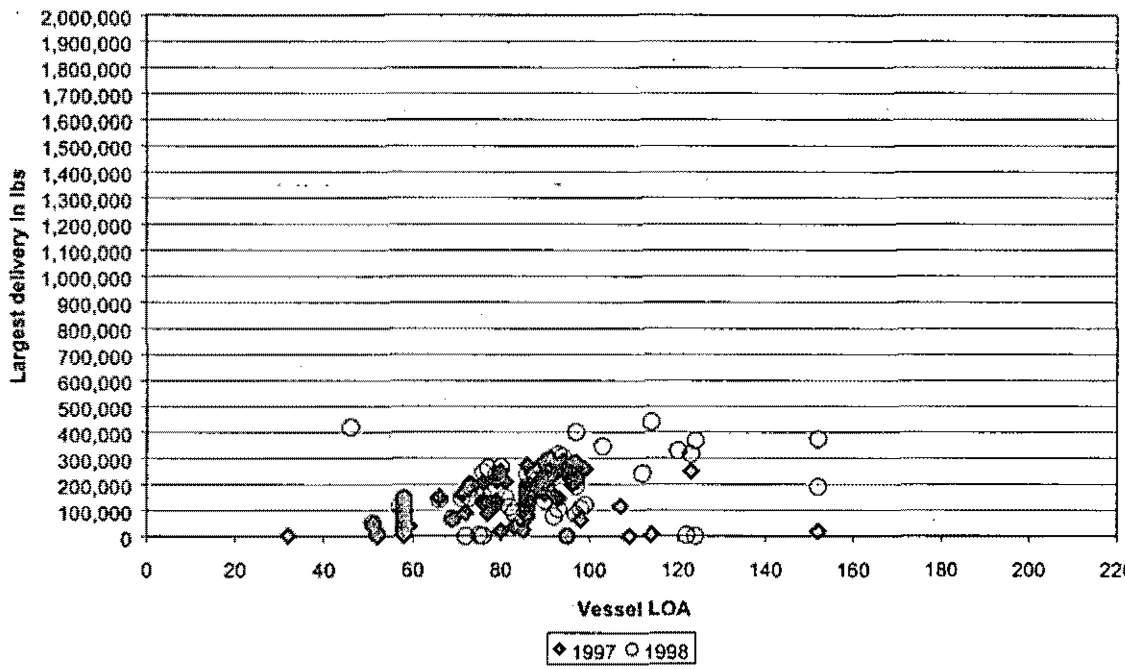

Figure 7-3 Area 630 maximum pollock delivery weight, by vessel size, 1997-1998.

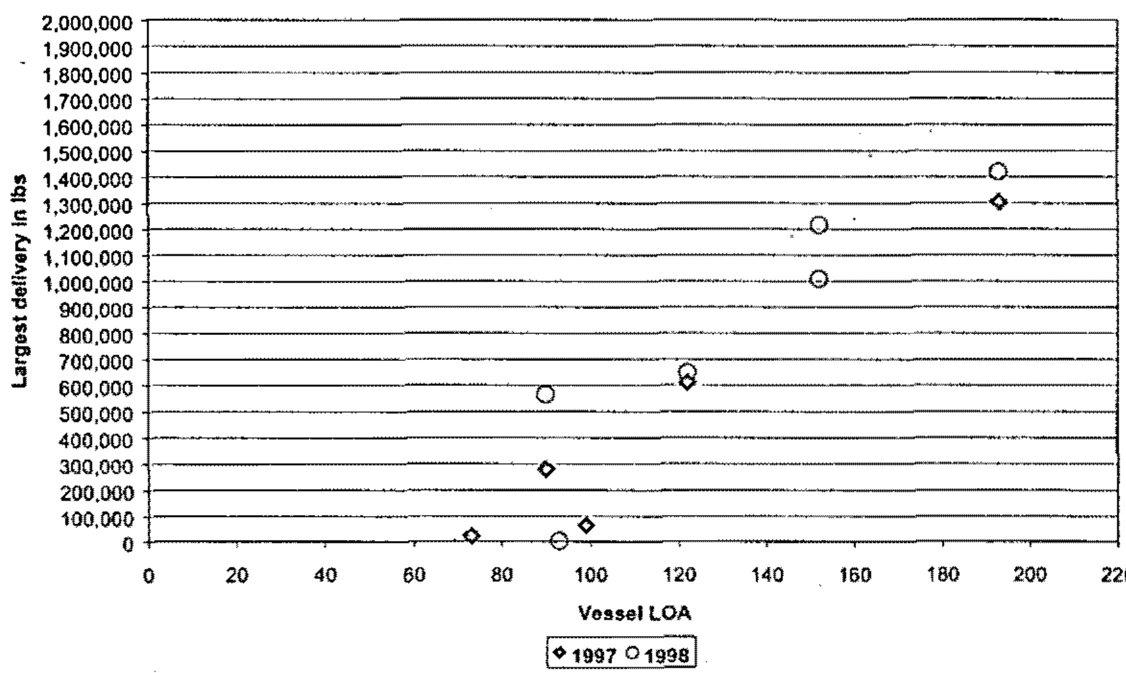

Figure 7-4 Area 640 maximum pollock delivery weight, by vessel size, 1997-1998.

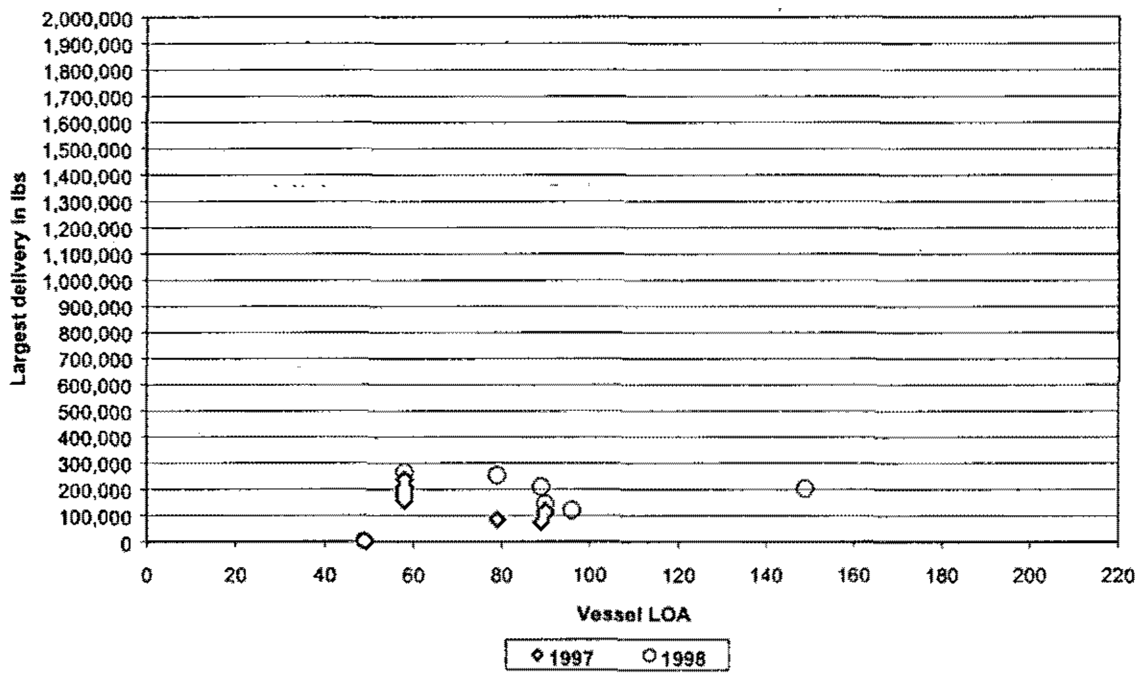

Figure 7-5 Area 649 maximum pollock delivery weight, by vessel size, 1997-1998.

7.6.3 CH/CVOA Closure Exemption

In the Council's original proposal, provision was made to accommodate the unique physical limitations of a subset of the BSAI *inshore* catcher vessel fleet. This group of vessels is composed of boats which are 99' (LOA) or smaller, and which have historically participated in the BSAI pollock trawl fishery. Under the assumption that any such vessel would face disproportionate economic and operational burdens if forced to operate in areas outside the current CVOA, the Council proposed a limited "exemption" for this class of vessels from the CH/CVOA closure.[22] Specifically, it was proposed that this class of vessel would be exempt from CH/CVOA closures from September 1 through March 31, unless the percentage cap for the inshore sector had been reached. To accomplish this objective, NMFS would announce the closure of the CH/CVOA conservation zone to catcher vessels over 99' (LOA) before the inshore sector percentage limit is reached and in a manner intended to leave remaining quota within CH/CVOA sufficient to support fishing be vessels less than or equal to 99' (LOA) for the duration of the current inshore sector opening.

If one consults the ADF&G fish ticket files (which represent the best source of participation and landings data for inshore groundfish deliveries) for recent fishing years, say 1997 and 1998, the following statistics emerge. In 1997, for the BSAI *pollock target fisheries*, a total of 28 vessels 99' (LOA) or smaller recorded

[22] It is asserted that boats 99 feet in length or smaller, and delivering their catch onshore, do not have the physical capability to operate safely and economically outside of the CVOA.

landings from the CH/CVOA operating area. There were 66 additional vessels recording landings in these fisheries which were greater than 99' (LOA), in that year.

Of the 28 boats 99' and under, 19 are reported to have landed less than 1,000 mt (round weight) of groundfish (mostly pollock) in the pollock target fishery, and 14 of these actually landed less than 500 mt in the target fishery, for the fishing year 1997. The aggregate catch of the vessels under 100' (LOA) represented approximately 8.2% of the total groundfish landings in the *pollock target fishery* from this area, in this year.

According to ADF&G fish tickets, in 1998, 18 boats of 99' (LOA) or less recorded landings of groundfish from the *pollock target fisheries* in the CH/CVOA. The balance of the inshore pollock catcher boat fleet operating in this area, composed of vessels greater than 99' (LOA), totaled 63 in this year.

Ten of the 18 vessels 99' and under in this fishery recorded landings of less than 1,000 mt (round weight). Seven of these delivered less than 500 mt in the BSAI *pollock target fishery*. The aggregate total landings of the vessels under 100' (LOA) represented approximately 4% of the total reported groundfish catch in the *pollock target fishery*, from this area, in 1998.

Provisions of the AFA may limit future participation of some of these vessels in the BSAI pollock target fishery, although the precise number is uncertain at this time. AFA provides that a catcher vessel, delivering inshore, must have landed at least 250 mt (at least 40 mt, if under 60' LOA) to "qualify" for future participation in the BSAI pollock fisheries. In 1997, five of the vessels 99' or under (but greater than 60' LOA), cited above, had landings of less than 250 mt in this fishery and one boat <60' in length landed less than 40 mt. For reference, in 1998, just two of the boats identified as 99' or less (LOA) did not meet these thresholds.

The AFA qualifying period applies to the 1995, 1996, and 1997 fishing years, and the complete analysis of which boats meet the criteria and which do not, has not been completed. In the limit, all 28 of the catcher boats identified as participating in the 1997 fishery might "qualify" to participate in future pollock target fisheries, based on their full participation history over the qualifying period. Obviously, most already do, based exclusively on the 1997 season, and could, therefore, take advantage of the CH/CVOA operational exemption, if adopted.

The economic implications of this proposed action would appear to be primarily "ameliorative" in nature. That is, by "exempting" from the CH/CVOA closure a portion of the inshore catcher vessel fleet, which in the absence of this action could be severely and disproportionately disadvantaged relative to the balance of the fleet, the exemption may: 1) reduce the likelihood of intra-sectoral transfers of catch share from the smaller to the larger operations in the BS pollock fishery; 2) avoid imposing economic and operational burdens on small operations which could reduce their ability to compete and, in the limit, might force them to drop out of some or all of the BS pollock fishery; and 3) diminish the likelihood that small operators could be forced to place their vessels and crew in physical jeopardy to fish open areas/periods outside of the CH/CVOA.

As an interesting aside, based on anecdotal information obtained from industry, it is reported that some owners of vessels which are greater than 99' LOA, and which also qualify under AFA to participate in future BSAI pollock inshore fishing, may physically modify their vessels so as to meet the 99' threshold, and thus enjoy the benefits of the CH/CVOA exemption. Whether this is a real option, and if so for how many vessels, is a question that cannot be answered at this time. There are clearly both economic and physical considerations which only the individual vessel owners would be able to assess. However, there does not seem to be a regulatory or legal barrier to prevent this from taking place. Thus, the exemption might provide an unanticipated (and perhaps undesirable) economic incentive for some operators to make the necessary structural changes in their vessels so as to qualify, under this program. There were, for example, 14 catcher vessels delivering pollock inshore from the CH/CVOA, in 1997, which were under 120' (LOA) but over the 99' limit. There were 12 such vessels participating in the 1998 fishery.

Because the number of "qualifying" vessels which could avail themselves of this exemption is (ultimately) strictly limited by the AFA, and because the share of the total catch in the BSAI pollock fishery accounted for by this class of vessels has been relative small (e.g., 4% in 1998, 8.2% in 1997), it is not likely that including this exemption provision in the final action will have significant adverse economic impact on the prosecution or future stability of this fishery. One may not draw the same conclusion in the absence of the exemption.[23]

7.6.4 Product effects

Another aspect of catch dispersion, with implications for disparate impacts by operational mode, concerns the length of time which elapses between catching pollock and processing the catch. The interval between catch and delivery is, reportedly, negatively correlated with product quality and value. For those vessels which do not have the capability to process their own catch, given a fixed catch rate and hold capacity, any action which substantially increases the time between catch and delivery imposes costs, both on the harvester and the processor.

Beyond some point, which varies by vessel size, configuration, condition of the target fish, and weather/sea conditions, delivery of a "usable" catch is not feasible. That is, for any given harvesting operation (without the means to process), this combination of factors will define an operational limit beyond which the vessel cannot produce a marketable product for delivery for processing. This limit will be different for each area and vessel class, but could result in a disproportionate distribution of impacts among shoreside processing facilities and ports.

Similarly, some products, such as pollock roe, are more sensitive to the period between catch and processing than are other product forms. As a result, output of these products could be disproportionately impacted. In the limit, some product forms, like pollock roe, could become effectively unavailable to some segments of the industry (e.g., some inshore operations) as a consequence of RPA-attributable changes in the timing of openings, distance between processing facility and open areas, etc.

A corollary effect might accrue, should the average size of fish in the catch fall below the "minimum" requirement for specific product forms (e.g., deep-skin fillets). These minimums are often dictated by the marketplace, but may also be directly linked to the technical limits of the available processing technology.[24] It is the case that these impacts could accrue to any or all segments of the fishery.

A related consideration is how scheduling of the pollock fisheries may affect product quality. While some delay in (or reapportionment of TAC from) the January 20 opening date in the eastern Bering Sea fishery may actually enhance the value of the catch and improve the overall recovery rate of production (by, for

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[23] Up an octave.

[24] For an extensive discussion of this topic, see the Final EA/RIR/IRFA prepared for the Improved Retention/Improved Utilization FMP for the Bering Sea Groundfish Fisheries, NPFMC. September 1996.

example, pushing the peak of the catch into the prime roe season), other scheduling changes may work in the opposite direction. For example, it has long been asserted by the industry that, at least in the BSAI,[25] post-spawn pollock are of poorer physical condition (e.g., soft flesh, high water content) and, thus, of significantly lower value than winter fish, or those taken later in the fall fishery. Likewise, if the RPA actions, for example, substantially delay the opening of the A2 season, beyond the point in time when recovery levels of roe drop off substantially, the reduction in the value of the A2 pollock catch could be significant. Any action which transferred catch from periods of relatively high fish quality, to periods where the average quality was lower, would impose costs. Presumably, these costs (as reflected in lower aggregate quality of output and perhaps reduced supply) would fall upon all segments of the market, from harvesting and processing, through to the final consumer.[26]

As previously noted, there is some concern that there may be economically significant variation in the average size of the fish being harvested. This has potential implications for all aspects of the industry, insofar as specific product forms require different *minimum* fish size. For example, on average, fillet production "requires" a larger pollock than does, say, surimi. If temporal and/or spatial dispersion results in a significant decline in the average size of fish harvested by a given operation, there could be impacts on product mix, quality, grade, and value. In the limit, of course, some operations may be unable to product any marketable product from a significant portion of their catch, e.g., a "fillet-only" boat might be unable to utilize much of its catch if its average size-per-fish was below the production specified minimum size.

Preliminary length frequency data from the 1999 eastern Bering Sea pollock fisheries were presented in Table 3-16, page 88. On the basis of these, admittedly, limited observations, one may conclude that (for the 1999 A-season) there is no statistically significant difference in mean length frequency between "inside" and "outside" CVOA-CH pollock catches. Whether these relationships will be sustained over time is an empirical question. To the extent that they are, the threat to production efficiency and product mix, discussed above, will not emerge.

The following series of tables (Tables 7-3 through 7-6) present the product mix, output quantities, and estimated value, by sector (where appropriate), area, and season, for the pollock trawl fishery, as an indication of the baseline performance of these sectors. While there are no empirical data, as yet, against which the potential changes (attributable to the Steller sea lion action) may be contrasted, these data may reveal the relative importance of individual product forms, by sector, area, and season. Depending upon the suite of alternatives and options adopted, assuming all else equal, these data may suggest, in general, how production and value may be impacted, sector by sector.

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[25] Informed sources suggest that in the GOA there is not the same concern about pollock taken in the post-spawn period (Per. comm. Chris Blackburn, 1998).

[26] Changes in the product mix or the amounts of individual products on the market resulting directly from the proposed RPA principles are difficult to anticipate or value. Further complicating the attempt to estimate impacts is the fact that a significant share of total pollock output from BSAI and GOA fisheries is exported, principally to Japan. Changes in consumer surplus (and, for that matter, producer surplus) attributable to a regulatory action, but which accrue to non-U.S. consumers (producers), are not to be included in impact estimates, according to OMB direction.

Table 7-3 Production and value of pollock products in the BSAI fisheries, by season and sector, 1997. (1,000 metric tons product weight and million dollars)

	BSAI A Season						*BSAI B Season*					
	Mothership		*Catcher/Processor*		*Inshore*		*Mothership*		*Catcher/Processor*		*Inshore*	
	Quantity	*Value*	*Quantity*	*Value*	*Quantity*	*Value*	*Quantity*	*Value*	*Quantity*	*Value*	*Quantity*	*Value*
Roe	1.5	$13.50	10.6	$98.00	5.2	$34.70	na	na	<.05	$0.10	0.1	$0.70
Deep-skin	na	na	10.8	$27.60	na	na	na	na	11.7	$30.10	na	na
Other fillets	na	na	1.9	$3.50	2.6	$4.90	na	na	1	$1.80	3.4	$6.30
Surimi	9.9	$23.70	29.1	$69.60	31.3	$65.90	10.6	$25.50	35	$83.80	35.2	$74.10
Fish meal	2.1	$1.30	4.4	$2.80	13.8	$8.10	2.4	$1.50	5.1	$3.30	15.2	$9.00
Other products	na	na	4	$3.10	5.1	$4.50	na	na	6.6	$5.00	8.2	$7.20

'na' denotes quantities or values that cannot be reported due to confidentiality considerations.
* It is not possible to disaggregate the Bering Sea and Aleutian Island Fisheries because the areas are grouped together in the 1998 Weekly processor report.
Source: Weekly processor report data and annual processor price survey, National Marine Fisheries Service, 7600 Sand Point Way NE, Seattle, WA

Table 7-4 Production and value of pollock products in the GOA fisheries, by season, 1997 (1,000 metric tons product weight and million dollars)

	A season		*B season*		*C season*	
	Quantity	*Value*	*Quantity*	*Value*	*Quantity*	*Value*
Roe	1.2	$5.30	na	na	na	na
Deep-skin	na	na	na	na	0.4	$0.90
Other fillets	4.1	$9.50	0.8	$1.90	2.2	$5.10
Surimi	2.1	$4.90	1.4	$3.40	5.2	$12.30
Fish meal	na	na	na	na	2.3	$1.40
Other products	0.2	$0.60	0.2	$0.30	0.9	$1.20

'na' denotes quantities or values that cannot be reported due to confidentiality considerations.
Source: Weekly processor report data and annual processor price survey, National Marine Fisheries Service, 7600 Sand Point Way NE, Seattle, WA

Table 7-5 Production and value of pollock products in the BSAI fisheries, by season and sector, 1998. (1,000 metric tons product weight and million dollars)

	BSAI A Season						*BSAI B Season*					
	Mothership		*Catcher/Processor*		*Inshore*		*Mothership*		*Catcher/Processor*		*Inshore*	
	Quantity	*Value**	*Quantity*	*Value**	*Quantity*	*Value**	*Quantity*	*Value**	*Quantity*	*Value**	*Quantity*	*Value**
Roe	1.2	$11.00	7.1	$65.80	3.2	$20.20	na	na	<.05	$0.40	na	na
Deep-skin	na	na	10.9	$27.90	na	na	na	na	13.5	$34.70	3.8	$7.40
Other fillets	na	na	<.05	<$.05	1.6	$3.10	na	na	16.1	$29.30	6.9	$13.10
Surimi	8.6	$20.70	30.9	$74.00	31.6	$66.40	11.2	$26.90	21.4	$51.30	31.9	$67.20
Fish meal	2.1	$1.30	4.7	$3.00	14.4	$8.50	na	na	5.5	$3.50	14.7	$8.70
Other products	na	na	6.6	$5.00	4.5	$5.90	0.4	$0.10	14.5	$10.40	10.6	$11.70

'na' denotes quantities or values that cannot be reported due to confidentiality considerations.
* It is not possible to disaggregate the Bering Sea and Aleutian Island Fisheries because the areas are grouped together in the 1998 Weekly processor report.
* Product prices are not available for 1998. The 1998 product values were calculated using 1997 product prices.
Source: Weekly processor report data and annual processor price survey, National Marine Fisheries Service, 7600 Sand Point Way NE, Seattle, WA

Table 7-6 Production and value of pollock products in the GOA fisheries, by season, 1998 (1,000 metric tons product weight and million dollars)

	A season		*B season*		*C season*	
	Quantity	*Value**	*Quantity*	*Value**	*Quantity*	*Value**
Roe	1.2	$5.50	na	na	na	na
Deep-skin	na	na	na	na	na	na
Other fillets	3	$7.00	2.6	$5.90	5	$11.50
Surimi	3.3	$7.80	3.6	$8.50	5.4	$12.80
Fish meal	na	na	1.2	$0.70	2.3	$1.30
Other products	2.2	$1.40	0.3	$0.70	2.1	$7.60

'na' denotes quantities or values that cannot be reported due to confidentiality considerations.
* Product prices are not available for 1998. The 1998 product values were calculated using 1997 product prices.
Source: Weekly processor report data and annual processor price survey, National Marine Fisheries Service, 7600 Sand Point Way NE, Seattle, WA

7.6.5 Effects of stand-downs

As earlier suggested, one of the fundamental tenants of the RPA proposal is the further subdivision of the pollock A and B seasons into four "approximately equal" quarterly apportionments. To be effective, these quarterly releases must be separated by *meaningful* closed periods. That is, without such closed intervals, it might be possible for the industry to strategically manage each release in such a way as to effectively combine two (or perhaps more) quarterly releases into a single fishing period. The potential to do this is enhanced by the ability to fish cooperatively within each sector (i.e., avoid the race-for-fish associated with open access management), thus controlling the timing and pace of harvest. This outcome would be in direct conflict with the stated objectives of the temporal dispersion principle.

From the perspective of the fishing industry, mandatory idle periods between openings impose costs. Clearly, the longer the period of imposed idleness the greater the potential economic and operational burden. Presumably, there exists some form of a "step function" which characterizes these potential adverse impacts. That is, it may be likely that a mandatory stand-down of 24-hours, or 48-hours, or even 72 hours, would impose costs which could be readily absorbed by most operations participating in the pollock fisheries (although all would likely prefer to avoid them). Indeed, over such a relatively brief interval, an operation might keep its crew productively employed with maintenance and/or other forms of preparation for the re-opening. Recall, however, that over this period, the plant or vessel must continue to pay its variable costs, e.g., wages and salaries, food and housing expenses, fuel and other "consumables" costs, etc., while producing no product and therefore earning no revenue.

Under such condition, at some point in time, each operation will reach a "break point", or threshold, beyond which the cost of "standing by" become a significant economic burden. Precisely where this break point lies will likely vary, operation by operation. At present, no empirical information is available with which to predict when these thresholds might be attained by any given plant or vessel. However, when the threshold is reached, the operator will face a series of decisions with potentially significant economic costs and operational consequences.

These costs may be characterized as "staging expenses." For example, transporting crews, by air, to and from remote Alaska locations four times in a fishing year (rather than twice, as is presently required) can represent a significant additional expense. APA reports that, on average, each catcher/processor carries a crew of between 100 and 125 crew members. The true motherships, and many onshore plants, have at least as many transient employees.

Similarly, moving fishing supplies and support materials to and from the vessel's Alaska staging port two more times each season, as well as providing for secure stand-down status of the vessel and its equipment between openings, could impose considerably higher operating costs. Onshore plants could experience equivalent logistical costs, depending upon their relative level of operational diversification, geographic location, length of current operating season, etc.

Additionally, substantial operating costs might also be expected to accompany actions which imposed strict "stand-down" periods (or even significantly delayed openings of the target fishing seasons), especially if these coincided with periods when fish were at their peak economic value (e.g., during the height of the roe season or later in the fall when fish size and flesh quality enhance fillet or surimi production).

It should be noted that the availability of pollock community development quota (CDQ) may enable operators with CDQ partners to bridge some portion of these proposed mandatory closed periods and, thus, largely avoid some portion of these duplicate staging costs. This solution will not be available to all potentially affected operations, however.

Paradoxically, permitting the use of CDQs to bridge closed periods may actually work to diminish the effectiveness of the fundamental objective of the stand-down provisions of the RPAs, which, as noted, depend upon meaningful separation of quarterly releases.

7.6.6 Effects of TAC rollovers

Specific provisions of the Steller sea lion RPA proposal would permit a sector to "roll-over" unharvested portions of their allocation, either from "inside" to "outside" fishing areas during a given opening, or even between openings, as long as no additional catch was taken from CH. If adopted, these provisions could reduce the adverse economic and operational burden the RPAs might otherwise impose. This is so, because by providing additional operational latitude to each sector, these "roll-over" provisions could facilitate enhanced efficiency for the sector, while achieving the conservation objectives of the RPA action. While it is unlikely that the entire adverse effect of the temporal and geographic dispersion provisions contained in the RPA proposal could be ameliorated by this additional operational flexibility, the ability to "roll-over" unharvested TAC could reduce these imposed costs.

7.6.7 Spill-over effects on non-pollock fisheries

It is possible that actions which are taken in connection with the proposed RPA principles could have unanticipated spillover effects on non-pollock fisheries. For example, under provisions of the improved retention/improved utilization regulations (IR/IU), operations which are targeting species other than pollock must, nonetheless, retain 100% of their pollock bycatch up to an amount of pollock equal to 20% of the retained catch of non-pollock species onboard.[27]

Bycatches of pollock are significant, and reportedly largely unavoidable, in many groundfish trawl fisheries. It is the case for some operations that retention of pollock bycatches actually impose significant costs on the intercepting vessel (e.g., P.cod H&G operations) as pollock catch displaces the potentially more valuable target species in the limited available hold space of these boats. To the extent that geographic and/or temporal dispersion of effort "targeting" pollock results in higher rates of bycatch of pollock in non-target fisheries, operational costs may be imposed on the non-pollock target groundfish sector.

The marketplace will largely determine whether, and by how much, pollock bycatch is an economic and operational burden to vessels fishing groundfish species other than pollock. According to industry sources, H&G pollock, which was characterized as having "no economic value whatsoever", during the IR/IU debate, has begun to find a market.[28] Apparently, the sharp decline in world supplies of true cod has produced a "substitution" effect, wherein H&G pollock are in relatively strong demand. Reportedly, H&G pollock are selling for a price which is roughly equal to their production cost (i.e., a break even price). These markets are volatile and the price may or may not be sustained at this level over time.[29] Nonetheless, this new

[27] The Improved Retention/Improved Utilization amendments were implemented in the BSAI and GOA groundfish fisheries in January, 1998, and set out (relatively) ambitious goals for reducing bycatch discards and increasing utilization.

[28] Per. comm., Teressa Kandianis, Kodiak Fish Co., April 1999.

[29] Per. comm., John Gauvin, Groundfish Forum, Inc., April 1999.

information suggests that the hypothesized "spill over" effect may not be of serious concern, at least in the near term.

Other provisions specifically contained in, for example, the AFA provide a considerable degree of protection to non-pollock fisheries from other forms of "spill-over," (e.g., capacity or effort displaced or idled in the pollock target fisheries are largely precluded from transferring into non-pollock fisheries). Nothing in the Steller sea lion action would be expected to diminish these protections.

7.6.8 Attainment of the TAC

With the advent of the AFA, and the "side boards" which are being evaluated by the Council, the structural parameters within which the North Pacific (and, especially, eastern Bering Sea) pollock fisheries take place have changed in fundamental ways from those that prevailed prior to January 1, 1999. There is very little experience upon which to base predictions about how the several operational sectors that make up this fishery will adapt to and accommodate these basic structural changes in their respective operating environments.

Empirical data are presently limited to the first two pollock "releases" in the 1999 fishing year in the BS, the first in GOA, as regulated under provisions of the temporary emergency rule. On the basis of these initial 1999 catch and production figures, and under the assumptions set forth in the biological harvest models (see Section 2.1) expectations are that there will be no unharvested pollock TAC in either the BS or GOA management areas. Expressed another way, it appears that, while costs may be imposed on operators (as delineated above), adoption of the RPA principles will not result in any significant foregone catch of pollock, for any of the operational sectors.[30]

The single exception would be if the option to continue the complete closure of the Aleutian Islands management area pollock target fishery was adopted and implemented under the current action. In that case, the total Aleutian management area pollock TAC allocation would be forfeited (from the perspective of those that typically target pollock in this area). Because the TACs are established by management area, there would be no opportunity for this catch to be "made up" elsewhere. (The estimated gross value of that foregone TAC is presented below.)

7.6.9 Aleutian Islands foregone TAC

The Steller proposal before the Council includes an option which calls for the complete closure of the Aleutian Islands management area to the pollock target fishery, in connection with the RPA principles. Although the total amount of catch and numbers of operators potentially impacted by this action are relatively small, as compared to the eastern Bering Sea pollock fishery, as suggested, if the closure option were adopted the foregone catch could not be made up in areas which remain open. Therefore, the economic and socioeconomic costs could be relatively significant.

In 1996, for example, one mothership, twenty-three catcher/processors, and four inshore processors recorded pollock landings deriving from the Aleutian Islands management area, according to NMFS Blend data files. The mothership was greater than 155' length overall (LOA), as were 22 of the 23 catcher/processors. One catcher/processor was reportedly less than 124' (LOA). ADF&G Fish Ticket data indicate that 22 catcher

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[30] This conclusion can be assumed to hold, of course, only so long as environmental and stock conditions are approximately equivalent to those observed in the first half of 1999.

vessels delivered pollock to inshore processors from the Aleutian Islands area in that year. Of these, four were less than 124' (LOA), 13 were in the 124' to 155' LOA class, and five were greater than 155' in length.

The same data sources reveal that in 1997, there were no motherships participating in this fishery. There were 19 catcher/processors (all of which were greater than 155' LOA), while four inshore processors received pollock from the Aleutian Islands management area, and were supported by 19 catcher boats (four under 124' LOA, 11 in the 124' to 155' length category, and four greater than 155' LOA).

The 1998 data show no participation by the mothership sector. Six C/Ps were present, while three inshore processors reported deliveries from the AI fishery in that year. A total of 26 catcher boats were credited with deliveries of pollock from the AI target fishery in 1998.[31] Three catcher boats reportedly delivered only "over-the-side" to C/Ps, while as many as 14 catcher boats are reported to have delivered pollock catch to both at-sea and inshore processors. Nine boats delivered exclusively to inshore operations from the Aleutian Islands management area, that year. NORPAC and ADF&G data suggest that this "fleet" of catcher boats was comprised of 3 vessels 60' to 99' LOA, 9 in the 100' to 124' LOA class, and 14 vessels 125' or greater.

Virtually all of these operations were participants in the much larger eastern Bering Sea pollock target fishery. In 1999, the pollock TAC for this area was scheduled to be just under 24,000 tons, round weight. If one makes the following series of simplifying assumption, an upper-bound estimate of the potential gross loss can be derived. Assuming that: (1) future Aleutian pollock TACs would have been of this same magnitude; (2) in the absence of the closure, this entire amount would have been harvested in the target fishery and therefore will be foregone; (3) the product mix would have remained constant, i.e., as observed historically; and (4) the catch can be appropriately valued at the weighted average output price for all pollock production; the attributable first wholesale loss from Steller RPA closure of the Aleutian Islands target pollock fishery could reach just over $54.6 million. All else equal, this would be the annually accruing foregone gross value attributable to the Steller sea lion RPA closure of the Aleutian Islands pollock target fishery.

This is clearly a crude estimate of the attributable economic impact of this action. This is so because the estimate reflects only the gross wholesale value of the potentially foregone output and, thus, does not capture changes in operating and production costs that may accompany adjustments to the RPA closure. These changes may increase or decrease the estimated impact.

In addition, if adopted, the closures may result in economic redistributions among operations in ways that have not been anticipated in the calculation. For example, smaller, less efficient vessels may be relatively less capable of adjusting to the new management regime(s) than are their larger counterparts. How such intra-sectoral and geographic redistributions may effect individual sectors or communities remain largely empirical questions.

Alternatively, if there is no complete closure of the Aleutian Islands pollock fishery, the "no pollock trawl zone" provisions of the RPAs would apply. In this case, it is assumed that, while fishing would be displaced to areas outside the identified haul-out and rookery area closure zones, the full TAC apportionment for this area would be harvested. While additional costs, in the form of operational and variable cost increases, would be expected to accompany this spacial displacement of effort, no empirical data are available upon

[31] Source: NMFS NORPAC and ADF&G fish tickets. Inshore targets calculated by Alaska Fisheries Science Center, on a per vessel basis. At-sea vessels delivering to pollock target processors during the pollock season opening are assumed to be catching pollock.

which to base a quantitative estimate. Because no TAC would be foregone, the impact on total gross revenue would be effectively zero.

7.7 Summary and conclusions

Disentangling effects that are primarily and appropriately attributable to Steller sea lion related actions from those which may more appropriately be assigned to the AFA is an analytical complication which only time and empirical experience will resolve. Nonetheless, the foregoing assessment of the "potential" economic effects and "probable" responses of the several sectors which comprise the BS, AI, and GOA pollock fishing industry should provide an adequate basis upon which the Council may judge the *relative* implications of the several proposed RPA actions and options.

One should not lose sight of the fact that the purpose of the proposed management amendment is to implement reasonable and prudent alternatives to avoid the likelihood of the pollock fisheries off Alaska jeopardizing the continued existence of the western population of Steller sea lions, or adversely modifying their critical habitat. In 1990, the Steller sea lion (*Eumetopias jubatus*) was designated as a threatened species under the Endangered Species Act of 1973 (ESA). The designation followed severe declines throughout much of the Gulf of Alaska and Aleutian Islands region. In 1993, critical habitat for the species was defined to include (among other areas), the marine areas within 20 nm of major rookeries and haulouts of the species west of 144°W longitude. In 1997, two separate populations were recognized, and the western population (west of 144°W longitude) was reclassified as endangered. Counts of adults and juveniles in the western population of Steller sea lions declined by 72% between the late 1970s and 1990. The decline has continued in the 1990s, with counts dropping 27% from 1990 to 1996. The absolute magnitude of the decline has been smaller in recent years because the population has been severely reduced. The rate of decline, however, remains a serious problem.

Multiple factors have contributed to the decline, but considerable evidence indicates that lack of available prey is a major problem. Foraging studies confirm that Steller sea lions depend on pollock as major prey, and sea lions may be particularly sensitive to the availability of prey during the winter. The significance of pollock to Steller sea lions may have increased since the 1970s, due to shifts in community composition related to oceanographic changes.

Pollock are also the target of extensive fisheries that have, as described above, become concentrated in time and space. This concentration occurs in Steller sea lion critical habitat, and may reduce prey availability at critical times in the life history of sea lions. Pollock trawl fisheries, then, may compete with sea lions, and either contribute to their decline or impede their recovery.

On December 3, 1998, NMFS issued a Biological Opinion on the pollock fisheries of the BSAI and GOA, and the Atka mackerel fishery of the Aleutian Islands subarea. The Biological Opinion concluded that the BSAI and GOA pollock trawl fisheries, as proposed, are likely to, (1) jeopardize the continued existence of the western population of Steller sea lions, and (2) adversely modify its critical habitat. The clause, *"jeopardize the continued existence of"* means, *"to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species"* (CFR §402.02). The clause, *"adversely modify its critical habitat"* means, *"a direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species. Such alterations include, but are not limited to, alterations adversely modifying any of those physical or biological features that were the basis for determining the habitat to be critical"* (CFR §402.02).

The Biological Opinion concluded that to avoid the likelihood of jeopardizing the continued existence of the western population of Steller sea lions, or adversely modifying its critical habitat, reasonable and prudent alternatives to the proposed pollock trawl fisheries in the BSAI and GOA must accomplish temporal and spatial dispersion of the BSAI and GOA pollock fisheries and contain pollock trawl exclusion zones around major rookeries and haulouts.

At its December 1998 meeting, the Council adopted an emergency rule to implement the reasonable and prudent alternatives prior to the start of the pollock fisheries on January 20, 1999. The emergency rule implemented three types of management measures for the BSAI and GOA pollock fisheries: (1) pollock trawl exclusion zones, (2) temporal dispersion of the pollock fishery, and (3) spatial dispersion of the pollock fishery. The emergency rule "sunsets" prior to the beginning of the 2000 fishing year. The Council proposes to replace the emergency rule with the FMP action which is the subject of this document.

While the objective remains the protection and enhancement of the western Steller sea lion resource (and the critical habitat it relies upon), achieving that objective should be done in the most efficient (i.e., least cost) and least burdensome manner possible, so as to "maximize" the net benefit to the Nation deriving from this suite of management actions. The analysis in the preceding RIR, and that contained in the following IRFA section, point out the nature, gross magnitude, and distribution of economic and social impacts which can reasonably be assumed to accompany the range of RPA alternatives and suboptions. It is incumbent upon the Secretary, with the advice of the Council, to *balance* the competing tradeoffs inherent in this suite of alternatives.

8.0 INITIAL REGULATORY FLEXIBILITY ANALYSIS

If it cannot be certified that a proposed rule "*will not* have a significant economic impact on a substantial number of small entities", an initial regulatory flexibility analysis (IRFA) must be prepared. To ensure a broad consideration of impacts and alternatives, NMFS has prepared an IRFA pursuant to 5 USC 603, without first making the threshold determination of whether or not this proposed action would have a significant economic impact on small entities.

The central focus of the IRFA should be on the economic impacts of a regulation on small entities and on the alternatives that might minimize the impacts and still accomplish the statutory objectives.

8.1 Requirement to Prepare an IRFA

The level of detail and sophistication of the analysis should reflect the significance of the impact on small entities. Under 5 U.S.C., Section 603(b) of the RFA, each IRFA is required to address:

- A description of the reasons why action by the agency is being considered;
- A succinct statement of the objectives of, and the legal basis for, the proposed rule;
- A description of and, where feasible, an estimate of the number of small entities to which the proposed rule will apply (including a profile of the industry divided into industry segments, if appropriate);
- A description of the projected reporting, record keeping and other compliance requirements of the proposed rule, including an estimate of the classes of small entities that will be subject to the requirement and the type of professional skills necessary for preparation of the report or record;
- An identification, to the extent practicable, of all relevant Federal rules that may duplicate, overlap or conflict with the proposed rule;
- A description of any significant alternatives to the proposed rule that accomplish the stated objectives of the Magnuson-Stevens Act and any other applicable statutes and that would minimize any significant economic impact of the proposed rule on small entities. Consistent with the stated objectives of applicable statutes, the analysis shall discuss significant alternatives, such as:

    1. The establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities;

    2. The clarification, consolidation, or simplification of compliance and reporting requirements under the rule for such small entities;

    3. The use of performance rather than design standards;

    4. An exemption from coverage of the rule, or any part thereof, for such small entities.

8.2 What is a "small entity"?

The RFA recognizes and defines three kinds of small entities: (1) small businesses, (2) small non-profit organizations, and (3) and small government jurisdictions.

8.2.1 Small businesses

Section 601(3) of the RFA defines a "small business" as having the same meaning as "small business concern" which is defined under Section 3 of the Small Business Act. "Small business" or "small business concern" includes any firm that is independently owned and operated and not dominate in its field of operation. The SBA has further defined a "small business concern" as one "organized for profit, with a place of business located in the United States, and which operates primarily within the United States or which makes a significant contribution to the U.S. economy through payment of taxes or use of American products, materials or labor...A small business concern may be in the legal form of an individual proprietorship, partnership, limited liability company, corporation, joint venture, association, trust or cooperative, except that where the form is a joint venture there can be no more than 49% participation by foreign business entities in the joint venture."

The SBA has established size criteria for all major industry sectors in the US including fish harvesting and fish processing businesses. A business involved in fish harvesting is a small business if it is independently owned and operated and not dominant in its field of operation (including its affiliates) and if it has combined annual receipts not in excess of $ 3 million for all its affiliated operations worldwide. A seafood processor is a small business if it is independently owned and operated, not dominant in its field of operation, and employs 500 or less persons on a full-time, part-time, temporary, or other basis, at all its affiliated operations worldwide. A business involved in both the harvesting and processing of seafood products is a small business if it meets the $3 million criterion for fish harvesting operations. Finally a wholesale business servicing the fishing industry is a small businesses if it employs 100 or less persons on a full-time, part-time, temporary, or other basis, at all its affiliated operations worldwide.

The SBA has established "principles of affiliation" to determine whether a business concern is "independently owned and operated." In general, business concerns are affiliates of each other when one concern controls or has the power to control the other, or a third party controls or has the power to control both. The SBA considers factors such as ownership, management, previous relationships with or ties to another concern, and contractual relationships, in determining whether affiliation exists. Individuals or firms that have identical or substantially identical business or economic interests, such as family members, persons with common investments, or firms that are economically dependent through contractual or other relationships, are treated as one party with such interests aggregated when measuring the size of the concern in question. The SBA counts the receipts or employees of the concern whose size is at issue and those of all its domestic and foreign affiliates, regardless of whether the affiliates are organized for profit, in determining the concern's size. However, business concerns owned and controlled by Indian Tribes, Alaska Regional or Village Corporations organized pursuant to the Alaska Native Claims Settlement Act (43 U.S.C. 1601), Native Hawaiian Organizations, or Community Development Corporations authorized by 42 U.S.C. 9805 are not considered affiliates of such entities, or with other concerns owned by these entities solely because of their common ownership.

Affiliation may be based on stock ownership when (1) A person is an affiliate of a concern if the person owns or controls, or has the power to control 50% or more of its voting stock, or a block of stock which affords control because it is large compared to other outstanding blocks of stock, or (2) If two or more persons each owns, controls or has the power to control less than 50% of the voting stock of a concern, with minority holdings that are equal or approximately equal in size, but the aggregate of these minority holdings is large as compared with any other stock holding, each such person is presumed to be an affiliate of the concern.

Affiliation may be based on common management or joint venture arrangements. Affiliation arises where one or more officers, directors or general partners controls the board of directors and/or the management of another concern. Parties to a joint venture also may be affiliates. A contractor and subcontractor are treated as joint venturers if the ostensible subcontractor will perform primary and vital requirements of a contract or if the prime contractor is unusually reliant upon the ostensible subcontractor. All requirements of the contract are considered in reviewing such relationship, including contract management, technical responsibilities, and the percentage of subcontracted work.

8.2.2 Small organizations

The RFA defines "small organizations" as any not-for-profit enterprise that is independently owned and operated and is not dominant in its field.

8.2.3 Small governmental jurisdictions

The RFA defines small governmental jurisdictions as governments of cities, counties, towns, townships, villages, school districts, or special districts with populations of less than 50,000.

8.3 Reason for considering the proposed action

The purpose and intent of the Steller sea lion management action, under consideration herein, were treated at length in Sections 6.2, 6.3, and 6.4 of the Regulatory Impact Review. A detailed description of the problem that underlies the proposed action, and the actions objectives, is contained in Section 1.0 of this combined EA/RIR/IRFA document.

8.4 Number and description of affected small entities

The following series of subsections enumerate, to the extent practicable, the number and nature of the "small entities" which comprise the commercial sectors, not-for-profit organizations, and governmental jurisdictions and communities which depend directly or indirectly upon the pollock fisheries of the Bering Sea and Gulf of Alaska. Taken as a whole, these "entities" define the potentially impacted universe for purposes of the IRFA.

8.4.1 Small entities in the BSAI pollock fishery

To identify the number and type of business concerns participating in the BSAI pollock fishery that meet the definition of "small entities," each must be measured against the size and affiliation standards outlined in Section 8.2.1. While available data on ownership and affiliation patterns in the 1999 BSAI pollock fishery are not sufficiently detailed to discern whether each individual business concern meets the definition of "small entity," data available from the sector profiles prepared for the Inshore/Offshore-3 FMP Amendment[32]

[32] See: Final EA/RIR/IRFA for Amendments 51/51 (Inshore/Offshore 3). NPFMC. December 9, 1998.

and the NMFS Economic SAFE[33] document do allow some general conclusions to be drawn concerning the number of small entities present in recent years in each component of the industry. These general conclusions are displayed in Table 8-1.

While these data reflect the 1996-1997 fishing years, they are believed to be a reasonable description of the several operational sectors, with respect to RFA size criteria. AFA provisions, adopted January 1, 1999, reduced the *total* number of "entities" which are authorized to participate in the BSAI management area pollock fisheries in the future, below those reflected in Table 8-1. However, none of the remaining vessels or processing operations, authorized to participate in these fisheries under AFA, would be expected to have been reclassified *from* the "large" to the "small" RFA categories. That is, if an operation was classified as "large" (for IRFA purposes) prior to AFA, it is highly unlikely that it would now meet the RFA "small entities" criteria.

Table 8-1 also contains a summary of the "not-for-profit" and "governmental jurisdictions" with direct linkages to this fishery. These entities will be treated in subsequent sections of the IRFA, but are presented in the table for completeness.

Table 8-1 Estimated numbers and types of entities participating in the BSAI pollock fishery.

Industry component or type of entity	*Small*	*Large*	*Total*
Inshore sector			
Inshore processors	0	8	8
Catcher boats < 125' LOA	37	15	52
Catcher boats ≥ 125' LOA	2	15	17
Offshore sector			
"True" motherships	0	3	3
Catcher/processors	0	31	31
Catcher boats < 125' LOA	21	5	26
Catcher boats ≥ 125' LOA	2	0	2
Vessels delivering to both sectors			
Catcher boats < 125' LOA	1	13	14
Catcher boats ≥ 125' LOA	0	8	8
CDQ groups (not-for-profit)	6	0	6
Government jurisdictions	60	1	61

Source: 1996-97 NMFS Blend and ADF&G Fish ticket data

[33] Stock Assessment and Fishery Evaluation Report for the Groundfish Fisheries of the Gulf of Alaska and Bering Sea/Aleutian Islands Area: Economic Status of the Groundfish Fisheries Off Alaska 1997. REFM. Alaska Fisheries Science Center. NMFS. November 25, 1998.

8.4.1.1 Inshore pollock processors

Four of the 8 inshore processors operating in the BSAI pollock fishery are either wholly owned subsidiaries or close affiliates of Japanese multi-national corporations. Due to their affiliation with large foreign entities with more than 500 employees worldwide, none of these processors is a small entity, within the RFA definition. Of the remaining 4 inshore processors, 3 are owned by U.S. companies that employ more than 500 persons in all their affiliated operations, and therefore cannot be considered small entities. The remaining inshore processor has been identified as closely affiliated with its 5 delivering catcher boats and the gross annual receipts of the affiliated entities, taken together (the processor and its 5 affiliated catcher boats), exceed the $3 million criterion for fish harvesting operations. Therefore, none of the inshore processors in the BSAI pollock fishery appear to meet the RFA criteria for small entities.

8.4.1.2 Pollock catcher boats

There were 119 catcher boats active in the BSAI pollock target fisheries, altogether: Sixty-nine operated in the inshore sector exclusively, 28 operate in the offshore sector exclusively, and 22 operated in both sectors. (This latter pattern of dual-sector activity is limited under AFA. Specifically, catcher vessels delivering to C/Ps are precluded, under AFA, from delivering pollock to any other processing sector, in the future.)

Of the 91 catcher boats that operated exclusively or partly in the inshore sector, the available ownership data identify 26 vessels owned, in whole or in part, by inshore processors. These 26 vessels may be considered to be affiliated with their respective inshore processor owners and cannot therefore be considered small entities, because none of the inshore processors in the BSAI pollock fishery, themselves, are small entities for RFA purposes. An additional 5 catcher boats have been identified as closely affiliated with an inshore floating processor. These 5 catcher boats, taken together with their affiliated processor, exceed the $3 million criterion for fish harvesting operations and are therefore not believed to be small entities. Furthermore, an additional 20 catcher boats have ownership affiliations with other catcher boats or catcher/processors. The gross annual receipts of each of these groups of affiliated catcher boats is believed to exceed the $3 million criterion for small entities, when all their fisheries earnings are taken as a whole.

The remaining 40 catcher boats operating exclusively or partly in the inshore sector are believed to qualify as "small entities." As earlier suggested, the number of catcher vessels which will be permitted to participate in future inshore pollock target fisheries in the Bering Sea management area is smaller than the totals identified above owing to provisions of the AFA. As noted in the RIR, in the initial 1999 A1 and A2 pollock fisheries in the Bering Sea, it is estimated that approximately 53 catcher vessels participated in the harvest of the inshore pollock allocation. In subsequent 1999 Bering Sea pollock openings, additional catcher vessels may choose to enter the fishery, since as many as 106 appear to be "eligible" under AFA criteria.

Twenty eight catcher boats operated in the offshore sector exclusively, while 22 operated in both sectors, for a total of 50 offshore catcher boats. (As noted, this multi-sector operational pattern is precluded in the future for the seven boats affiliated with the C/P fleet, by provisions of the AFA.) Of the combined at-sea catcher boat sector, 13 have ownership affiliations with large inshore or offshore processors and, therefore, do not meet the $3 million criterion for small entities. An additional 13 catcher boats have ownership affiliations with other vessels or operations that, taken together with their affiliated entities, are believed to exceed the $3 million gross receipts criterion for small entities. The remaining 24 catcher boats operating exclusively or partly in the offshore sector are believed to qualify as "small entities." The number of catcher vessels which will be permitted to participate in future Bering Sea pollock target fisheries is restricted to a slightly smaller total by provisions of the AFA.

The provisions of the AFA which permit establishment of operational cooperatives in all three processing sectors (i.e., catcher/processor, mothership, and inshore) beginning in 2000 *could* result in there being no small entities (as defined under RFA) participating in the harvesting and processing of the pollock TAC. This may be so, because fishing sector cooperatives, by definition, coordinate and prosecute the fishery as an integrated organization, sharing information, risk, and (presumably) profits among the "affiliated" members of the co-op. Under such circumstances, it is improbable that any of the co-ops would meet the RFA "small entities" criteria, and through "affiliate" status, neither would the individual cooperative members.

8.4.1.3 "True" motherships

Three "true" motherships[34] operate in the offshore sector. All three "true" motherships have ownership or business affiliations with large Japanese-owned processing companies, and are further affiliated with some of their delivering catcher boats. Taken together with their affiliated entities, none of the "true" motherships meet the criteria for small entities.

8.4.1.4 Pollock catcher processors

For an offshore catcher/processor to qualify as a small entity, it must be independently owned and operated, have no more than 49% foreign ownership, and have gross annual receipts of less than $3 million. None of the offshore catcher/processors operating in the BSAI pollock fishery appear to meet the criteria for small entities, i.e., none qualify as "small entities." The number of catcher/processors authorized to participate in future Bering Sea pollock target fisheries has been reduced to 20, under provisions of the AFA.

8.4.1.5 Small not-for-profit organizations

The Community Development Quota (CDQ) program was implemented in December 1992, as part of the original BSAI Inshore/Offshore FMP amendment. The CDQ program has made it possible for both individuals from western Alaska villages and the CDQ groups (which were formed to facilitate administration of the program) to participate directly in the commercial fisheries occurring in the adjacent Bering Sea and Aleutian Islands management areas. The six CDQ groups participating in the BSAI pollock fishery, comprised of 56 western Alaska Native villages, are the only *small* not-for-profit organizations that have been identified as potentially directly affected by the Steller sea lion RPA alternatives under consideration. (The CDQ program does not extent to the Gulf of Alaska fisheries.)

8.4.1.6 Small governmental jurisdictions

Fifty-six CDQ communities and four Alaska non-CDQ communities (Unalaska/Dutch Harbor, Sand Point, King Cove, and Kodiak[35]) are identified as small governmental jurisdictions with direct involvement in and

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[34] The reference to "true" motherships was proposed by the Council to clearly distinguish these operations from floating processing facilities which are either "permanently" moored or operate only in State waters.

[35] Note: While Sand Point, King Cove, and Kodiak are all located in the Gulf of Alaska, each has traditionally received pollock harvested from the Bering Sea for processing, thus their inclusion here. Absent from the list of BSAI communities dependent on pollock is Akutan. As the community profiles will show, Akutan is a *unique* case insofar as the "village" of Akutan is regarded as being distinctly

dependence on the BSAI pollock fishery. The remaining government jurisdiction with direct involvement in the BSAI pollock fishery, Seattle, Washington, does not qualify as a small governmental jurisdiction. The small governmental jurisdictions with direct involvement in the BSAI pollock fishery are described in detail in Section 8.5.4.

8.4.2 Small entities in the GOA pollock fishery

As was the case for the BSAI fisheries, to identify the number and type of business concerns participating in the GOA pollock fishery that meet the definition of "small entities," each must be measured against the size and affiliation standards outlined in Section 8.1.1.

NMFS Blend and ADF&G fish ticket data for the GOA indicate that 124 vessels participated in the pollock target fishery in 1997, of which 118 were catcher boats and six were catcher/processors. These numbers were 95 and three, respectively, in 1996. Eleven inshore processors participated in the GOA pollock fishery in 1997, with nine in Kodiak and one each in Sand Point and King Cove.[36] In 1998, a total of fourteen inshore processors reported GOA pollock landings. Six were reportedly Kodiak-based, one each were reported in Sand Point and King Cove, one was in Cordova, and one was in Seward. The remaining processors on this list were located in Dutch Harbor/Unalaska, but received and processed catch from the GOA pollock fishery.

While participation data for the 1999 pollock fisheries are not readily available at this time, some *preliminary* indications of participation levels can be consulted. Utilizing a combination of NMFS Weekly Processor Reports, preliminary Blend data, and Observer data sources, the following preliminary results emerge. It appears that the 1999 GOA pollock fishery had, through the "A" opening, eleven active inshore processors. At least nine of these are owned, operated, and/or affiliated with companies with extensive national or multi-nation holdings and, therefore, do not qualify as "small" under RFA criteria. There may, therefore, be as few as two GOA pollock processing plants which are "small," for purposes of the RFA, however it is not possible to confirm this at this time.

Usually, catcher vessel data are drawn from ADF&G fish tickets. These data are not available for 1999, at this writing. However, informed sources familiar with this fishery estimate that the GOA pollock catcher boat fleet numbered approximately 75 for this opening.[37]

While detailed ownership and affiliation information is very limited (even more so than for the BSAI management area), it appears that virtually all of the vessels operating in this fishery meet the "small entity" definition. By making this simplifying assumption, even if a small number of these boats are actually "affiliated" with larger entities, the IRFA avoids the risk of *understating* the potential impact on "small entities." If more precise data become available, prior to completion of the Final Regulatory Flexibility Analysis, the totals will be corrected.

There were no true motherships or C/Ps represented in the 1999 GOA A season, according to preliminary data sources.

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separate and largely independent of the fish processing facility of the same name, located near by. Indeed, the community of Akutan is counted among the 56 CDQ communities, referenced above.

[36] Some pollock harvested in the Bering Sea was delivered for processing to GOA facilities.

[37] Per. comm., Tom Pearson, March 3, 1999.

All of the Alaska communities adjacent to the GOA management area with direct links to the pollock fisheries meet the RFA criteria for "small governmental jurisdictions." These totaled five in 1999. In addition, Seattle, Washington, is identified as having a direct link to the GOA pollock fishery, but does not meet the RFA criteria for a "small governmental jurisdiction."

There are no CDQ (or other not-for-profit) entities associated with the GOA pollock target fishery.

The preliminary 1999 participation data are summarized in Table 8-2, below. These findings are subject to change as better data become available.

Table 8-2 Estimated numbers and types of entities participating in the GOA pollock fishery.

Industry component or type of entity	*Small*	*Large*	*Total*
Inshore sector *			
Inshore processors	2	9	11
Catcher boats	75	0	75
"True" motherships	0	0	0
Catcher/processors	0	0	0
Governmental jurisdictions	5	1	6

* In GOA, 100% of the pollock TAC is allocated for processing by the inshore sector.

Data: PRELIMINARY 1999 A season

8.5 Adverse economic impacts on small entities

After reviewing the alternatives and suboptions analyzed in "environmental assessment" and "regulatory impact review" sections of this document, several conclusions may be drawn concerning the potential differential impacts of this suite of RPA actions on "small entities"in the Bering Sea, Aleutian Islands, and Gulf of Alaska management areas. These are summarized in the following sections.

8.5.1 Impacts on catcher boats

As identified in Table 8.1, the only small businesses that participate directly in the BSAI pollock fishery are independent catcher boats. All other business entities (catcher/processors, motherships, shoreside processors, and processor affiliated catcher boats) participating in the BSAI pollock fishery are categorized as "large" entities, on the basis of the RFA criteria.

Historically, independent catcher boats have participated in both the inshore and offshore sectors of the BSAI pollock fishery, and would be expected to do so under provisions of the AFA, and under any of the alternative and suboptions proposed for the current Steller RPA action.[38]

On the basis of the pre-AFA fisheries data (which represent the "best available" statistics, at present) of the 50 independent catcher boats estimated to be "small entities" in the BSAI, 46 are under 125' and 4 are 125'

[38] See discussion under Section 8.4.1.2

or larger. The estimated number of catcher boats that participated in the 1996 pollock fishery by sector, vessel size, and "small" or "large" entity status are displayed in the Table 8-3.

Table 8-3 Estimated number of catcher boats that participated in the BSAI pollock fishery by sector, vessel size, and "small" or "large" entity status.

Catcher boat size and sector	*Small entities*		*Large entities*	
	<125'	*≥125'*	*<125'*	*≥125'*
Inshore sector	37	2	15	15
Offshore sector	21	2	5	0
Both sectors	1	0	13	8
Total	59	4	33	23

Source: NMFS Blend and ADF&G Fish Ticket data, 1996-97.

As noted, under AFA, catcher vessels delivering to C/Ps will not be permitted to deliver to either of the other processing sector in the pollock target fishery. Thus, the pattern described in Table 8-3, which cites 22 cross-over boats in this fishery, may not reflect the actual vessel counts in this category in future fisheries. Based upon data prepared by Council staff in connection with analysis of the AFA, just 14 catcher vessels will be permitted to operate in this "cross-over" mode, in the future. Since virtually all boats which have historically fished this pattern were "large" entities (and future participation is strictly based on past performance) this class would, by default, have to be composed virtually exclusively of "large" entities, in the future.

Under AFA, only seven catcher boats are authorized to participate in the C/P "over-the-side" pollock harvest and only 21 are authorized to support true motherships. A "fixed" (but as yet not completely defined) number are authorized to deliver to inshore processors in the BSAI management area (preliminary estimates place this number at ninety-two[39]).

Comparing the preliminary 1999 participation data with the table above suggests that, for the A1 and A2 BS openings, a total of 26 catcher vessels supported the C/P and true mothership sectors (combined into the "Offshore sector" in the table). On the basis of the counts in Table 8-3, the majority of these would be expected to be "small entities," for IRFA purposes.

However, except for the segment of the catcher vessel fleet which, absent the proposed action, would have participated in the Aleutian Islands area pollock target fishery (assuming the final Steller RPA action completely closes that fishery), the adverse economic impacts attributable to the proposed action are likely to be small, indirect, and limited to the types of operational effects discussed in the RIR, e.g., increased variable operating costs, greater running time/reduced fishing time, potentially higher physical risk for the smaller segments of the fleet, CPUE implications. Operational, logistical, and variable costs data are not available with which to quantitatively estimate the possible magnitudes of these impacts for the potentially effected small entities.

The determination that any adverse economic effects will be of this indirect nature stems from the conclusion in the EA that all three processing sectors will harvest and process their full pollock TAC-apportionments,

[39] Per. comm., Darrell Brannan, NPFMC, March 1999.

following adoption and implementation of the Steller RPA action. That is, while there may be some, as yet unmeasurable, impacts from the proposed action, none are expected to significantly adversely impact a substantial number of small entities, as those terms are defined for RFA purposes.[40] Unfortunately, while that is the expectation, given the information currently available, it is not possible to quantitatively certify this outcome.

In the GOA, as earlier suggested, the fleet of catcher vessels is much less well defined than that for the BSAI management area. Furthermore, it is reasonable to conclude that virtually all are "small," within the meaning of that term under RFA. However, as was the case in the BS fishery, on the basis of all the available evidence, including preliminary 1999 A season catch and production data, it appears that the entire GOA pollock TAC will be obtained, each season, under provisions of the Steller sea lion RPA action. Therefore, there should be no discernable impact on the gross revenue stream accruing to the GOA pollock fishery as a result of foregone pollock catch, attributable to this action.

Variable operating cost data are not available with which to assess the probable net economic effects of the RPA actions, although the RIR section of this document qualitatively evaluates a number of cost categories and operational impacts which may reasonably be expected to accompany the range of actions under consideration (see the discussion in Section 6.6, above). On the basis of available information and empirical data, it is not possible to *quantitatively* evaluate the size and distribution of potential adverse impacts which may be associated with the proposed Steller sea lion actions. A detailed qualitative evaluation of these effects is contained in this document. It seems unlikely, in any case, that any of these alternatives will have a significant effect on a substantial number of small entities, but it is not possible to quantitative certify this to be the case.

Under the proposed action, specific provisions have been included which provide ameliorative relief for small catcher vessels in the GOA management area. These provisions specifically provide for restrictive catch trip limits and seasonal exclusive registration for vessels operating in the eastern/western/central Gulf fisheries and those fishing the Bering Sea. Each of these alternative provisions (if adopted) would be expected to reduce or eliminate the natural advantage that large, operationally diversified, and technologically sophisticated vessels enjoy when compared to smaller operations, competing in the same fishery. Because operating data are not available for either group, a quantitative estimate of the net effects of these ameliorative actions cannot be made. Nonetheless, if adopted, each of these actions would be expected to reduce the burden that may accrue to small catcher vessels from implementation of the RPAs.

8.5.2 Impacts on processors

All of the C/Ps, motherships, and inshore processors in the BSAI management area qualify as "large" entities, under RFA criteria, as do most of those operating in the GOA pollock fishery.[41] While ownership and affiliation data are quite limited, no more than perhaps two GOA processors could be reasonably assumed to meet the "small entities" criteria.

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[40] Indeed, the majority of structural changes expected to take place in the Bering Sea pollock fishery can be attributed to the provisions of the American Fisheries Act, and not to the Steller sea lion action.

[41] Under I/O, all pollock is allocated inshore in the GOA. Provisions in those regulations permit small C/Ps and other floating processors to participate in the inshore pollock sector.

Provisions of the proposed RPA action could result in adverse impacts, in the form of changes in operating periods or duration of openings, changes in product mix and quality, availability of raw material and/or quality of fish delivered, and market or price effects. There is no reason to conclude, however, that these impacts would accrue disproportionally to the small processors, visa` vis the large processor.

No data are presently available with which to quantitatively assess the probability and magnitude of these potential impacts. Furthermore, based on preliminary catch and production data for the 1999 GOA A season and the assessment made in the EA , it is assumed that the full pollock TAC will be taken in the Gulf, thus the expected impact on gross revenue attributable to any of the RPA alternatives (while perhaps not zero) would be expected to be small.

How this reduction might be distributed between competing entities in the GOA fishery was discussed above, in the RIR section which addressed the GOA fisheries. Because that treatment was substantially qualitative and based upon preliminary data, it is not possible to "certify" that there will be no significant adverse impacts on a substantial number of small entities in the GOA fishery, as those terms are defined under RFA, despite the fact that all indications are that this will likely be the outcome.

8.5.3 Impacts on small organizations

The only entities directly associated with the pollock target fisheries which meet the strict RFA standards for inclusion as "small organizations" are the Community Development Quota (CDQ) groups. The Alaska CDQ program was designed to provide an avenue of entry into the BSAI management area pollock harvesting and processing sectors for groups of communities adjacent to, but with no prior history of participation in, these economically important fisheries. Established in 1991, the program established six "not-for-profit" CDQ groups. These include: (1) the Aleutian Pribilof Island Community Development Association [comprised of six communities]; (2) the Bristol Bay Economic Development Corporation [comprised of 13 communities]; (3) the Norton Sound Economic Development Corporation [comprised of 15 communities]; (4) the Yukon Delta Fisheries Development Association [representing 4 communities]; (5) the Central Bering Sea Fisherman's Association [representing a single community]; and (6) the Coastal Villages Region Fund [comprised of 17 communities]. An extensive treatment of the structure, relationship, and dependence of the CDQ groups and the pollock fishery is contained in the Inshore/Offshore-Three FMP EA/RIR/IRFA.[42] Interested readers may consult that document.

Based upon the EA and RIR analyses, reported above, there would be expected to be no measurable adverse economic effects from the proposed management action accruing to small entities, as that term is defined under RFA. However, empirical data are insufficient to support a rigorous quantitative examination of this issue and, therefore, the agency is not able to "certify" this outcome.

8.5.4 Impacts on small governmental jurisdictions

The RPA principles are not expected to result in substantial reductions in total pollock catch from a given management area, as a result of spatial, temporal, or exclusionary dispersion of the target fishery (except in the case of a complete closure of the Aleutian Islands area). However, some change in pollock target harvest patterns seems probable, as described in detail in the EA and RIR sections, above. The size and scope of likely impacts on the principal pollock-dependent communities, adjacent to the eastern Bering Sea, Aleutian

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[42] See: Final Environmental Assessment/Regulatory Impact review/Initial Regulatory Flexibility Analysis. Amendments 51/51 (Inshore/Offshore 3). NPFMC. December 9, 1998.

Islands, and GOA management areas, will vary directly with the magnitude of these changes and may be appropriately attributable to the proposed RPA regulatory alternatives.

A description of the potentially effected small governmental jurisdictions is provided below. In addition to those explicitly described in the following section, the 56 CDQ villages, referenced in the section on small "not-for-profit" entities, immediately above, would be among the "small government jurisdictions" appropriately included under the IRFA. However, because their primary link to the pollock fishery is through their CDQ-group affiliations, and there are not expected to be adverse economic impacts attributable to the RPA actions accruing to the CDQ groups, the affiliated villages and communities are not expected to incur significant losses.

When NMFS Blend data are employed to rank Alaska fishing ports, from highest to lowest, on the basis of their 1997 groundfish landings and value, the first five ports account for in excess of 95% of total Alaska groundfish landings, the vast majority of which is comprised of pollock.

These communities are, in order:

Port	*Metric tons* (Groundfish)*	*Value*	*No. of Processors (Groundfish)*
1. Dutch Harbor/Unalaska	224,000	$59,774,500	6
2. Akutan	<120,000	NA	1
3. Kodiak	84,000	$33,488,800	9
4. Sand Point	<45,000	NA	1
5. King Cove	<25,000	NA	1

(* - estimated total groundfish landings ; NA - data cannot be reported due to confidentiality constraints)

The communities of Dutch Harbor/Unalaska and Akutan are located on the Bering Sea side of the Alaska Peninsula/Aleutian Island chain, while Sand Point and King Cove are on the Gulf of Alaska side. Kodiak Island, where the port and City of Kodiak are located, is in the Gulf of Alaska. Nonetheless, a substantial portion of the groundfish processed in Sand Point and King Cove is harvested in the Bering Sea, as is a somewhat lesser share of that landed in Kodiak. Relatively small amounts of groundfish, including pollock, harvested in the GOA have been delivered for processing in Dutch Harbor/Unalaska and Akutan (e.g., in 1998, fish tickets indicate GOA pollock were delivered for processing in Dutch Harbor.)

As suggested, pollock is the primary groundfish species landed and/or processed in these five ports, with Pacific cod making up almost all of the rest. In Dutch and Akutan, pollock represented 83% and 76%, respectively, of the 1997 total groundfish landings in these ports (Pacific cod accounting for virtually all of the balance).[43] In the case of Sand Point, pollock was 69% of groundfish landings, Pacific cod 29%, with fractional percentages of other groundfish species accounting for the rest. King Cove presented the single exception among these port communities, with pollock catch-share at 31% and Pacific cod at 69% of the groundfish total. Kodiak presented the most diversified species complex, with pollock representing 43%, Pacific cod 36%, assorted flatfishes at 14%, and a mix of other groundfish species making up the balance

[43] Source: State of Alaska Fish tickets

of the total. These data clearly demonstrate, however, the substantial dependence these five communities have on the pollock resource.

In addition to the five "key" pollock processing ports, referenced above, the RPA actions may effect pollock processing operations in the communities of Seward and Cordova, both located within Prince William Sound.

Taken in total, the majority of the output from the processing operations in these landings ports is exported, principally to Asian markets, although some enters the domestic market for secondary processing and/or sale.

While significant reductions in catch deliveries of any groundfish species, in the eastern Bering Sea, GOA, or Aleutian Islands management areas, could have indirect economic consequences for any or all of these port communities, the impacts would be most severe and direct if pollock catches were substantially reduced. Furthermore, these impacts would not be uniform in distribution across the seven pollock landings port communities, owing to geographic location, physical proximity to fishing grounds, plant capacity and capability differences, availability and variety of support facilities offered, and intermediate and final markets served.

In addition, the inshore processors in each of these port communities compete directly with the mothership and catcher/processor fleets, which participate in many of these same fisheries.[44] [45] Each sector has different capabilities and limitations. And, while each supplies some amount of product into common markets, each also has developed the potential to focus a portion of its operation on specific markets. These attributes suggest variability in response to changing management environments, such as might be associated with application of the RPA principles.

Based upon the relatively limited data which are available on individual communities and processing facilities, the following characterizations of the principal pollock-dependent Alaska landings ports can be offered.[46]

8.5.4.1 Dutch Harbor/Unalaska

Dutch Harbor/Unalaska is located approximately 800 miles southwest of Anchorage and 1,700 miles northwest of Seattle. Unalaska is the 11th largest city in Alaska, with a reported year-round population of

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[44] Some of these port communities earn considerable revenues from supporting and servicing the catcher/processor, catcher boat, and/or mothership fleets. In these instances, a reduction in pollock catch in any of the three sectors could compound the economic dislocation for the local community.

[45] While pollock motherships and C/Ps are restricted to the BSAI management area, plants in the GOA, nonetheless, "compete" with them, at a minimum, in the marketplace. In some instances (e.g., Kodiak, King Cove, Sand Point) GOA plants may actually compete for access to the pollock harvest with BSAI-based processors.

[46] As noted, while the proposed Steller sea lion RPA actions are not expected to result in reductions in total pollock catch (except in the case of the Aleutian Islands fishery, should the complete closure option be selected), they may cause shifts in operating patterns and schedules; changes in product mix, quality and/or price; increases in operating costs; and, in the limit, some intra-sectoral redistribution. Any of these may have localized impacts which are not amenable to quantitative measurement, given currently available data.

just over 4,000. The name Dutch Harbor is often applied to the portion of the City located on Amaknak Island, which is connected to Unalaska Island by a bridge. Dutch Harbor is fully contained within the boundaries of the City of Unalaska, which encompasses 115.8 square miles of land and 98.6 square miles of water (Alaska Department of Community and Regional Affairs, 1998).

The population of Unalaska is primarily non-Native, although the community is culturally diverse. According to the 1990 U.S. Census, there were 682 total housing units, and 107 of these were vacant. More than 2,500 jobs were estimated to be in the community. The official unemployment rate at that time was 1.0%, with 7.8% of the adult population not in the work force. The median household income was reportedly $56,215, and 15.3% of residents were living below the poverty level.

Dutch Harbor/Unalaska has been called *"... the most prosperous stretch of coastline in Alaska."* With 27 miles of ports and harbors and several hundred local businesses, most of them servicing, supporting, or relying on the seafood industry, this city is the heart of the Bering Sea fisheries.

Dutch Harbor is not only the top ranked fishing port in terms of the tonnage of fish landed in Alaska, but has held that distinction for the Nation, as a whole, each year since 1989, and ranked at or near the top in terms of value of fish landed over the same period.

Virtually the entire local economic base in Dutch/Unalaska is fishery-related, including fishing, processing, and fishery support functions such as fuel, equipment supply, repairs and maintenance, transshipment, and cold storage. Indeed, Dutch Harbor/Unalaska is unique among Alaska coastal communities in the degree to which it provides basic support services for a wide range of Bering Sea fisheries (Impact Assessment Incorporated, 1998). It has been reported that over 90% of the population of this community considers itself directly dependent upon the fishing industry, in one form or another (NPFMC 1994).

Historically, Dutch Harbor was principally dependent upon non-groundfish (primarily king and Tanner crab) landings and processing for the bulk of its economic activity. These non-groundfish species continue to be important components of a diverse processing complex in Dutch Harbor. In 1997, for example, nearly 2 million pounds of salmon, more than 1.7 million pounds of herring, and 34 million pounds of crabs were reportedly processed in this port.

Nonetheless, since the mid-1980s, groundfish and particularly pollock has accounted for the vast majority of landings in Dutch Harbor/Unalaska. Again, utilizing 1997 catch data, over 93.5% of total pounds landed and processed in this port were groundfish, 83% of which were pollock.

The facilities and related infrastructure in Dutch Harbor/Unalaska support fishing operations in the eastern Bering Sea, Aleutian Islands and GOA management areas. Processors in this port receive and process fish caught in all three areas, and the wider community is linked to, and substantially dependent upon, serving both the inshore and at-sea sectors of the fishing industry.

In a profile of regional fishing communities, published by the Council in 1994, the local economy of Unalaska was characterized in the following way:

> *"If it weren't for the seafood industry, Unalaska would not be what it is today. . . In 1991, local processors handled 600 million lbs. of seafood onshore, and 3 billion lbs. of seafood were processed offshore aboard floating processors that use Dutch Harbor as a land base. Seven shore-based and many floating processors operate within municipal boundaries."* (NPFMC, 1994. p. 26).

While these figures presumably include both groundfish and non-groundfish species, and current sources identify at least eight shore-based processing facilities, they are indicative of the scope of this community's involvement in, and dependence upon, seafood harvesting and processing.

Because of this high level of economic integration between Dutch Harbor/Unalaska and, in particular, the pollock fishing industry, any action which significantly reduced or substantially redistributed the total catch of pollock from the eastern Bering Sea or Aleutian Islands (and to a lesser extent the GOA) management areas would be expected to have a negative impact on the port and surrounding community.

While the port continues to be actively involved in support operations for crab, salmon, herring, and other groundfish fisheries, these resources do not hold the potential to offset economic impacts which would be associated with a significant reduction in pollock landings. Indeed, the newest and largest of the processing facilities in Dutch Harbor are dedicated to pollock surimi production, and could not readily shift production to an alternative species or product form, even if such an opportunity were to exist.

Detailed data on costs, net earnings, capital investment, and debt service for the harvesting, processing, and fisheries support sectors in Dutch Harbor/Unalaska are not available. Therefore, it is not possible to quantify net economic impacts on this community. It is apparent, however, that there are no alternative fisheries into which the port might diversify, in order to offset a significant reduction in pollock target fishing activity. Neither are there prospects (at least in the foreseeable future) for non-fishery related economic activity in Dutch Harbor/Unalaska that could substantially mitigate impacts from a significant reduction in locally based pollock fishing activity.

While Dutch Harbor has been characterized as one of the world's best natural harbors, it offers few alternative opportunities for economic activity beyond fisheries and fisheries support. Its remote location, limited and specialized infrastructure and transportation facilities, and high cost make attracting non-fishery related industrial and/or commercial investment doubtful, at least in the short-run. [47]

Without the present level of pollock fishing and processing activities, it is probable that many of the current private sector jobs in this community could be lost or, at the very least, could revert to highly seasonal patterns, with the accompanying implications for community stability observed historically in this and other Alaska seafood processing locations dependent upon transient, seasonal work forces. It is likely, for example, that the number of permanent, year-round residents of Dutch Harbor/Unalaska would decline, perhaps significantly. This, in turn, would alter the composition and character of the community and place new, and different, demands on local government.

The municipal government of the City of Unalaska is substantially dependent upon the tax revenues which are generated from pollock fishing, processing, and support activities. While a detailed treatment of municipal tax accounts is beyond the scope of this assessment, it is clear that, between the State of Alaska's Fisheries Business Tax and Fishery Resource Landings Tax revenues (both of which are shared on a 50/50 basis with the community of origin), local raw fish sales tax, real property tax (on fishery-related property), and permits and fees revenues associated with fishing enterprises, the City of Unalaska derives a substantial portion of its operating, maintenance, and capital improvement budget from fishing, and especially pollock fishing, related business activities. Should the pollock harvest in the eastern Bering Sea or Aleutian Islands

[47] Sea floor minerals exploration, including oil drilling, in the region have been discussed. No such development seems likely in the short run, however. Unalaska, also, reportedly expected nearly 6,000 cruise ship visitors in 1996.

management areas be substantially reduced, the municipality could experience a very significant reduction in its tax base and revenues.

The local private business infrastructure which has developed to support the needs and demands of the fishery-based population of Dutch Harbor/Unalaska would very clearly suffer severe economic dislocation, should the number of employees in the local plants and fishing fleets decline in response to pollock catch reductions. Insufficient cost and investment data exist with which to estimate the magnitude of net economic impacts to these private sector businesses.

8.5.4.2 Akutan

The community of Akutan is located on an island of the same name in the eastern Aleutians, one of the Krenitzin Islands of the Fox Island group. The community is approximately 35 miles east of Unalaska and 766 air miles southwest of Anchorage. Akutan is surrounded by steep, rugged mountains reaching over 2,000 feet in height. The village sits on a narrow bench of flat, treeless terrain. The small harbor is ice-free year round, but there are frequent storms in winter and fog in summer. The community is reported to have a population of 414 persons, although the population can swell to well over 1,000 during peak fish processing months.

During the 1990 U.S. Census, there were 34 total housing units, and three of these were vacant. There were 527 jobs estimated to be in the community. The official unemployment rate at that time was 0.4%, with 7.4% of all adults not in the work force. The median household income was $27,813, and 16.6% of the residents were living below the poverty level. There is one school in the community, serving 24 students.

Village water is supplied from local streams, treated, and piped into homes. The seafood processing plant adjacent to the community operates its own water treatment facility.

Akutan ranks as the second most significant landings port for groundfish, most of which is pollock, on the basis of tons delivered and has been characterized as a *unique* community in terms of its relationship to the BSAI fisheries. According to a recent social impact assessment, prepared for the Council[48], while Akutan is the site of one of the largest of the onshore pollock processing plants in the region, the community is geographically and socially separate from the plant facility.

As a result, Akutan has a very different relationship to the region's pollock fisheries than does, for example, Dutch Harbor/Unalaska or Kodiak. While the community of Akutan derives economic benefits from its proximity to the large Trident Seafoods shore plant (and a smaller permanently moored processing vessel, operated by Deep Sea Fisheries, which handles only crab), the entities have not been integrated in the way other landings ports and communities on the list have. And, while the community derives some economic benefits, including a 1% raw fish tax from the nearby plant, unless a change in pollock landings were of sufficient magnitude to severely destabilize the region's pollock fisheries, which the Trident Seafood plant depends upon, there are not likely to be significant impacts on the village attributable to moderate changes in plant operating patterns.

[48] Inshore/Offshore-3 Socioeconomic Description and Social Impact Assessment. Impact Assessment, Inc. NPFMC. July 15, 1998.

Although this conclusion pertains to the community of Akutan, implications for the landings port of Akutan are quite different. Because the Trident plant is the principal facility [49] in the Akutan port, a substantial change in pollock landings in this region, in response to RPA induced management changes, could have negative implications. The port of Akutan does not have a boat harbor, nor is there an airport in the community. Beyond the limited services provided by the plant, itself, there does not appear to be an opportunity in Akutan to provide a support base for other major commercial fisheries. Indeed, alternative economic opportunities of any kind are extremely limited.

There does not appear to be an obvious alternative fishery resources which could be developed to offset a significant reduction in pollock landings in Akutan. For example, fisheries for crabs, halibut, salmon, and herring, while important sources of income to the region, are fully developed. Therefore, should pollock landings to this port be significantly reduced in response to RPA temporal or geographic dispersion principles, most of the jobs held by employees of the plant would likely disappear, or at a minimum, become seasonal. Consequently, some people would likely leave the area.

No data on cost, net revenues, capital investment and debt structure are available with respect to Trident Seafood's Akutan plant complex. It is not possible, therefore, to quantify probable attributable net economic impacts to plant owners/operators of a potential reduction in pollock landings. While some adjustment to alternative groundfish species might be possible, in response to a decline in pollock deliveries, insufficient data exist to support an analysis of this scenario. One may conclude, however, that this is an economically inferior solution for the plant, otherwise one would observe it engaged voluntarily in this behavior, at present.

While the distribution of impacts across ports would not be expected to be uniform, should pollock catches be reduced, under some extreme circumstances, there could be stranded capital costs and job losses in the port of Akutan. The size and rate of such losses is largely an empirical question, but in any event would not be "expected" as a result of any of the proposed Steller sea lion RPA actions.

8.5.4.3 Kodiak

The fishing port of Kodiak is located near the eastern tip of Kodiak Island, southeast of the Alaska Peninsula, in the Gulf of Alaska. The City of Kodiak is the sixth largest city in Alaska, with a population of 6,869 (Alaska Department of Community and Regional Affairs, 1998). The City of Kodiak is 252 air miles south of Anchorage. The port and community are highly integrated, both geographically and structurally. The port and community are the *de facto* center of fishing activity for the Gulf of Alaska.

Kodiak is primarily non-Native, and the majority of the Native population are Sugpiaq Eskimos and Aleuts. Filipinos are a large subculture in Kodiak due to their work in the canneries. During the 1990 U.S. Census, there were 2,177 total housing units, and 126 of these were vacant. An estimated 3,644 jobs were in the community. The official unemployment rate at that time was 4.4%, with 23% of the adult population not in the work force. The median household income was $46,050, and 6.2% of residents were living below the poverty level.

Kodiak supports at least nine processing operations which receive pollock harvested from the GOA and, to a lesser extent, the eastern Bering Sea and Aleutian Islands management areas, and four more which process

[49] Historically, a number of smaller, mobile processing vessels have operated out of the port of Akutan, seasonally.

exclusively non-groundfish species. The port also supports several hundred commercial fishing vessels, ranging in size from small skiffs to large catcher/processors and everything in between.

According to data supplied by the City, *"The Port of Kodiak is 'home port' to 770 commercial fishing vessels. Not only is Kodiak the state's largest fishing port, it is also home to some of Alaska's largest trawl, longline, and crab vessels."*

Unlike Akutan, or even Dutch Harbor/Unalaska, Kodiak has a more generally diversified seafood processing sector. The port historically was very active in the crab fisheries and, although these fisheries have declined from their peaks in the late-1970s and early-1980s, Kodiak continues to support shellfish fisheries, as well as significant harvesting and processing operations for Pacific halibut, herring, sablefish, and the five Pacific salmon species.

Kodiak processors are highly dependent on pollock landings, with this species accounting for 43% of total groundfish deliveries, by weight, in 1997. Unlike the other primary landings ports discussed above, while pollock landings are an extremely valuable and important component of the suite of species processed, Kodiak tends to be much more of a multi-species fishing community. The port participates in a broader range of groundfish fisheries than any of the other ports in the state. Most of this activity centers on the numerous flatfish species which are present in the GOA, but also includes relatively significant rockfish and sablefish fisheries. In addition, salmon, halibut, crabs, and herring fisheries are very important to the local community. Many of these fisheries are highly seasonal, and Kodiak processors have come to rely upon pollock landings to bridge the inevitable operating gaps.[50] That is, Kodiak processors reportedly often depend on pollock deliveries as a means to maintain continuous operation of their plants and full employment of their processing crews.

Kodiak often ranks near the top of the list of U.S. fishing ports, on the basis of landed value, and is frequently regarded as being involved in a wider variety of fisheries than any other community on the North Pacific coast.

In 1997, for example, the port recorded salmon landings of just under 44 million pounds, with an estimated exvessel value of over $12 million. Approximately 4.3 million pounds of Pacific herring were landed in Kodiak with an exvessel value of more than $713,000. Crab landings exceeded 1.1 million pounds and were valued exvessel at more than $2.7 million.

In addition to seafood harvesting and processing, the Kodiak economy includes sectors such as transportation (being regarded as the transportation hub for southwest Alaska), federal/state/local government, tourism, and timber (the forest products industry, based upon Sitka spruce, is an important and growing segment of the Kodiak economy).

The community is, also, home to the largest Coast Guard base in the U.S., located a few miles outside of the city center proper, which contributes significantly to the local economic base. The University of Alaska, in conjunction with the National Marine Fisheries Service, operates a state-of-the-art fishery utilization laboratory and fishery industrial technology center in Kodiak, as well.

While Kodiak appears to have a much more mature and diversified economy than any other of the five primary groundfish landings ports in Alaska, it is likely that a substantial reduction in pollock landings in

[50] Per. comm., Chris Blackburn, Kodiak, Alaska, December 1998.

the GOA (and to a lesser degree, Aleutian Islands and/or eastern Bering Sea management areas) could impose adverse economic impacts on the community.

The absence of detailed cost, net revenue, capital investment and debt structure data for the Kodiak pollock fishing and processing sectors precludes a quantitative analysis of the probable net economic impacts of such a change. Nonetheless, one may draw insights from history. In the early 1980s king crab landings declined precipitously and Kodiak suffered a severe community-wide economic decline. It was largely the development of the pollock and other groundfish fisheries which reinvigorated the local economy.

No alternative fishery resource appears available to Kodiak fishermen and processors that could ameliorate significant reductions in pollock landing that might be associated with one or more of the RPA dispersion principles. Neither do there appear to be non-fishery based opportunities, at least in the short run, which could be developed to reduce any adverse economic impacts of such a change in regional pollock harvesting and processing.

8.5.4.4 Sand Point and King Cove

These are two independent and geographically separate landings ports (lying approximately 160 miles apart), but because each has only a single processor and each community is small and remote, they are described jointly in this section.

State of Alaska CIS data place Sand Point's 1998 population at 808, while King Cove's population is listed as 897. Sand Point is located on Humboldt Harbor, Popof Island, 570 air miles from Anchorage. Sand Point is described by the Alaska Department of Community and Regional Affairs as "a mixed Native and non-Native community" with a large transient population of fish processing workers. During the April 1990 U.S. Census, there were 272 total housing units, and 30 of these were vacant. A total of 438 jobs were estimated to be in the community. The official unemployment rate at that time was 2.9%, with 32.1% of all adults not in the work force. The median household income was $42,083, and 12.5% of the residents were living below the poverty level.

King Cove is located on the North Pacific side of the Alaska Peninsula, 625 miles southwest of Anchorage. The community is characterized as a mixed non-Native and Aleut village. In the 1990 U.S. Census, there were 195 total housing units, with 51 of these vacant. The community had an estimated 276 jobs, with an official unemployment rate of 1.8% and 24.0% of all adults not in the work force. The median household income was $53,631, and 10% of the residents were living below the poverty level.

Sand Point and King Cove, like Akutan, are part of the Aleutians East Borough. Both Sand Point and King Cove have had extensive historical linkages to commercial fishing and fish processing, and currently support resident commercial fleets delivering catch to local plants. These local catches are substantially supplemented by deliveries from large, highly mobile vessels, based outside of the two small Gulf of Alaska communities.

King Cove possesses a deep water harbor which provides moorage for approximately 90 vessels of various sizes, in an ice-free port. Sand Point, with a 25 acre/144 slip boat harbor and marine travel-lift, is home port to what some have called *"... the largest fishing fleet in the Aleutians"* (NPFMC, 1994).

For decades, each of these the two communities has concentrated principally on salmon fisheries. For example, in 1997, both Sand Point and King Cove recorded salmon landings of several million pounds.[51] In addition, King Cove had significant landings of Pacific herring and crabs. Recently, each community has actively sought to diversify its fishing and processing capabilities. Groundfish, especially pollock, is key to these diversification plans.

By any measure, these two communities are fundamentally dependent upon fishing and fish processing. In recent years, groundfish (primarily pollock and Pacific cod) have supplanted salmon, herring, and crabs as the primary target species, becoming the basis for both communities' economic activity and stability.

Few employment alternatives to commercial fishing and fish processing exist, within the cash-economy, in these communities. However, subsistence harvesting is an important source of food, as well as a social activity, for local residents in both Sand Point and King Cove.

Any action which significantly diminishes the harvest of GOA and BSAI pollock resources could adversely impact these two communities. King Cove is somewhat unique among the five key groundfish ports insofar as it is relatively more dependent upon Pacific cod than pollock, among the groundfish species landed (69% and 31%, respectively). Sand Point follows the more typical pattern with pollock and Pacific cod representing 69% and 29% of its groundfish landings, respectively, in 1997.

No data on cost, net revenues, capital investment and debt structure are available with respect to the Sand Point or King Cove plant complexes. It is not possible, therefore, to quantify probable attributable net economic impacts to plant owners/operators of a potential reductions in pollock catches and deliveries to these landings ports.

As suggested earlier, these are very small, isolated villages with exceedingly limited infrastructure. A significant reduction in pollock deliveries, especially those from eastern Bering Sea fisheries, would likely result in costs, in the form of stranded capital, and job losses. Furthermore, there does not appear to be any viable alternative economic activity which could alleviate the probable adverse impacts on these small communities from a significant decline in their primary groundfish species deliveries.

None of the proposed alternatives associated with the Steller sea lion RPA action, under consideration here, are expected to have such a significant direct adverse effect on these communities. However, there may be distributional effects which cannot be fully anticipated. Consequently, while no significant adverse economic effect is anticipated, it is not possible, based on available data, to "certify" this result.

8.5.4.5 Cordova and Seward

While neither Cordova nor Seward typically rank among the top "pollock-dependent" port communities in Alaska, they do actively participate in the Prince William Sound fishery for pollock. Aspects of the proposed Steller sea lion action, under consideration by the Council, may effect the prosecution of this target fisheries. Therefore, the action may have implications for these two communities. Each is profiled below.

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[51] State of Alaska data confidentiality requirements preclude reporting actual quantities and value when fewer than four independent operations are included in a category. Sand Point and King Cove each have one processor reporting catch and production data.

Cordova is located at the southeastern end of Prince William Sound, in the Gulf of Alaska. The community was built on Orca Inlet, at the base of Eyak Mountain. It lies 52 air miles southeast of Valdez and 150 miles southeast of Anchorage.

The resident population is estimated to be 2,571. Cordova has a land area of 4.6 square miles. The area has historically been the home to Aleuts, with the addition of migrating Athabascan and Tlingit natives who called themselves Eyaks. Alaskan Natives of other descents also settled in Cordova.

Orca Inlet was originally named "Puerto Cordova" by Don Salvador Fidalgo, in 1790. One of the first producing oil fields in Alaska was discovered at Katalla, 47 miles southeast of Cordova, in 1902. The town of Cordova was named in 1906, by Michael Heney, builder of the Copper River and Northwestern Railroad. Cordova became the railroad terminus and ocean shipping port for copper ore from the Kennecott Mine up the Copper River. The first trainload of ore was loaded onto the steamship "Northwestern," bound for a smelter in Tacoma, Washington, in April 1911. The Bonanza-Kennecott Mines operated until 1938 and yielded over $200 million in copper, silver and gold. The Katalla oil field produced until 1933, when it was destroyed by fire. Fishing became the economic base in the early 1940s.

Today, Cordova has a majority of non-Natives, but sustains a significant Native population with an active Village Council. Commercial fishing and subsistence are central to the community's culture.

Cordova supports a large fishing fleet, for Prince William Sound, and several fish processing plants. Three-hundred ninety-three residents hold commercial fishing permits, and nearly half of all households have someone working in commercial fish harvesting or processing. Copper River red salmon, pink salmon, herring, halibut, and groundfish, among other species, are harvested and processed locally.

The largest employers are North Pacific Processors; the Cordova school district, hospital, city government; and the State Department of Transportation. The U.S. Forest Service and the U.S. Coast Guard maintain personnel in Cordova, as well. In 1989, the Prince William Sound Science Center was established to study and monitor the ecosystem of the Sound.

Cordova is accessed by plane or boat. It is linked directly to the North Pacific Ocean shipping lanes through the Gulf of Alaska. It receives year-round barge services, and State Ferry service in the summer. Harbor facilities include a breakwater, dock, a 500-slip small boat harbor, boat launch, boat haul-out, a ferry terminal, and marine repair services.[52]

Seward is situated on Resurrection Bay on the southeast coast of the Kenai Peninsula, 125 highway miles south of Anchorage. It lies at the foot of Mount Marathon, and is said to be the gateway to the Kenai Fjords National Park. With a resident population estimated at 3,040 and a land area of 15.4 square miles, Seward is the larger of these two Prince William Sound communities.[53]

Seward is primarily a non-Native community, although the Mount Marathon Indians are very active in the community.

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[52] Alaska Department of Community and Regional Affairs. 1999.

[53] Op. cit.

As the southern terminus for the Alaska Railroad and highway link to Anchorage, and the Interior, Seward has long been a transportation center. The economy has diversified with tourism, commercial fishing and processing, ship services and repairs, oil and gas development, a coal export facility for Usibelli Mine, a State Prison, and the University of Alaska's Institute of Marine Sciences. The new $52 million Alaska SeaLife Center was scheduled to open in May 1998.

Eighty-one residents hold commercial fishing permits. Seward hosted tourists from over 110 cruise ship dockings in 1997. Over 200,000 travelers toured the Kenai Fjords National Park visitors center in Seward in 1996.

As noted, Seward is connected to the Alaska Highway system by the Seward Highway. Daily air services and charters are available at the State-owned airport. The Port serves cruise ships, the State Ferry, cargo barges and ocean freighters from Seattle and overseas. The small boat harbor has moorage for 650 boats, and two boat launch ramps. The Alaska Railroad provides over 1.4 billion pounds of cargo transit each year, importing cargo for the Interior and exporting coal to the Pacific Rim. A new railroad depot was completed in the fall of 1997.

While the proposed Steller sea lion RPA actions may result in some increased operating costs to harvesters and processors of PWS pollock resource, it is not expected to significantly impact a substantial number of small entities (in this case, small governmental jurisdictions), as defined under RFA. It is not possible, however, to quantitatively measure the potential effects and "certify" this result, based on available data.

8.5.4.6 Alaska's dependence on seafood processing employment

While the foregoing discussion focused on the role of pollock fishing and processing by individual ports in Alaska, it is possible to see the contribution of this industry within a broader context. Drawing upon data and analysis developed by the State of Alaska Department of Labor, cited in a March 1996 volume of *Alaska Economic Trends*, the importance of seafood processing to the Statewide economy becomes apparent. Excerpting from an article by Neal Fried, entitled *Alaska Seafood Processing - A Growing Job Source?*, the following insights are offered:

> *Seafood processing is the leading manufacturer in the state. In 1995, Alaska's 197 seafood processing plants accounted for about 64 percent of all manufacturing employment. No other state in the U.S. approaches this level of industrial concentration. Seafood processing provided an average of 11,000 jobs with a total payroll of more than $240 million. In July [*of that year*] the number of processing jobs climbed to 19,300. Over 25,000 people held fish processing jobs at some time during the year. These numbers exclude most of the factory trawler fleet and other off-shore processing vessels because much of their employment occurs outside the state's jurisdiction. Including factory trawlers, employment could add another 5,000 workers to the fish processing work force.*

The article continues:

> *After the collapse of the king crab fishery in the early 1980s, processing employment slid for three years and then changed little for the next five. But, in 1988, the Americanization of the groundfish resource along the state's coastal waters began to turbo-charge Alaska's fish processing industry. The next year, the volume of groundfish processed surpassed salmon production for the first time in history. During the past decade, employment in the processing industry grew much more rapidly*

than total wages and salary employment. From 1991 to 1995, processing employment, also boosted by strong salmon harvests, surpassed 10,000. Employment peaked in 1992 at 11,200.

These figures tell only part of the story because the non-Alaskan factory trawler fleet harvests more than half of the groundfish. When this fleet's activity is included, the growth becomes even more impressive. In 1986, only 12 trawlers were fishing in Alaska's waters [actually within the U.S. EEZ off Alaska], *but by 1992 the trawler fleet had grown to 75. Including processing on the factory trawlers, Alaska's fish processing employment more than doubled in less than five years - a feat few other large industries have ever managed.*

The author presents region-specific processing employment numbers for 1995. These annual employment estimates pertaining to eastern Bering Sea, Aleutian Islands, and GOA pollock fisheries include: Aleutian East Borough - 2,175; Kodiak Island Borough - 2,034; and Aleutian West - 1,142.

Given the small local populations, discussed in the port descriptions above, seafood processing employment clearly represents the foundation upon which these local economies are based. And, while these employment numbers include both groundfish and non-groundfish processing activity, for the principal processing ports, the vast majority of fish processed are pollock.

While none of the Steller sea lion RPA actions, under consideration by the Council, are expected to have a significant effect on total pollock production, anything which diminished the current level of fish harvesting and processing activity, especially in the pollock-dominated regions of the State, could have negative implications for the economic vitality and growth potential of the State of Alaska, as a whole. This is so because, as the Department of Labor analysis points out, the state is uniquely dependent upon fishing and fish processing. Furthermore, because pollock accounts for a substantial part of that industry's activity, significant reductions in pollock landings in the eastern Bering Sea, Aleutian Islands, and/or Gulf of Alaska management areas could have negative implications extending beyond the ports and adjacent communities of Alaska's coastline.

The extent and scope of any social and economic impacts deriving from application of one or more of the RPA principles is largely an empirical question. Nonetheless, society should be conscious of the trade-offs implicit in the ESA actions which are being contemplated under the RPA principles.

8.6 Reporting and record keeping requirements

The proposed Steller sea lion action contains no new or revised record keeping or reporting requires. Therefore, there are no attributable costs or burdens to cite.

8.7 Other relevant Federal regulations

The foregoing analysis, contained in both the regulatory impact review and regulatory flexibility analysis sections of this document, provides extensive treatment and documentation of the close relationship which exists between the proposed Steller sea lion FMP amendment and, in particular, the recently enacted American Fisheries Act. While the AFA contains many key elements which influence the implementation, application, and effect that the Steller sea lion RPA proposal will have on the fisheries, there does not appear to be any duplication, overlap, or conflict between the two. Neither are there other pending Federal regulations, which can be identified, which would have such undesirable interactions with the proposed action.

8.8 Alternatives which minimize impacts on small entities

The Council's proposal contains several options which were specifically intended to minimize the burden which might potentially accrue to small entities. These are identified and analyzed in Sections 7.6.1, 7.6.2, and 7.6.3 of the RIR. If adopted, each of these options would provide significant, targeted relief to small entities from the potential adverse impacts which could otherwise accompany the implementation of the RPA actions or arise from their provisions.

9.0 REFERENCES

Ainley, D.G, C.S. Strong, H.R. Huber, T. J. Lewis, and S.H. Morrell. 1981. Predation by Sharks on Pinnipeds at the Farallon Islands. Fish. Bull. 78:941-945.

Alverson, D.L. 1992. A review of commercial fisheries and the Steller sea lion (*Eumetopias jubatus*): The conflict arena. Rev. Aquat. Sci. 6:203-256.

Antonelis, G. A., Sinclair, E. H., Ream, R. R., and Robson, B. W. 1997. "Inter-island variation in the diet of female northern fur seals (*Callorhinus ursinus*) in the Bering Sea." *J. Zool. Lond.* 242: 435-451.

Barlough, J.E., E.S. Berry, E.A. Goodwin, R.F. Brown, R.L. DeLong, and A.W. Smith. 1987. Antibodies to marine caliciviruses in the Steller sea lion (*Eumetopias jubatus* Schreber). J. of Wildl. Dis. 23:34-44.

Barrett-Lennard, L.G., K. Heise, E. Saulitis, G. Ellis and C. Matkin. *In prep.* The impact of killer whale predation on Steller sea lion populations in British Columbia and Alaska. Report for the North Pacific Universities Marine Mammal Research Consortium, Vancouver, B.C.

Bartholomew, G.A. 1970. A model for the evolution of pinniped polygyny. Evolution 24:546-559.

Bickham, J.W., J.C. Patton, and T.R. Loughlin. 1996. High variability for control-region sequences in a marine mammal: Implications for conservation and biogeography of Steller sea lions (*Eumetopias jubatus*). J. Mammal. 77(1):95-108.

Braham, H.W., R.D. Everitt, and D.J. Rugh. 1980. Northern sea lion decline in the eastern Aleutian Islands. J. of Wildl. Management 44: 25-33.

Brooks, J. W. 1954. "A contribution to the life history and ecology of the Pacific walrus." in *Special Report 1* Alaska Coop. Wildl. Res. Unit, University of Alaska Fairbanks, Fairbanks, AK 99775. 103 p.

Burns, J. J. 1965. "The walrus in Alaska: its ecology and management." in *Fed. Aid Wildlife Restoration Project Report 5* Alaska Department of Fish and Game. pp. 48.

Byrnes, P.E., and W.R. Hood. 1994. First account of Steller sea lion (*Eumetopias jubatus*) predation on a California sea lion (*Zalophus californianus*). Marine Mammal Science 10:381-383.

Calkins, D. G., and K.W. Pitcher. 1982. Population assessment, ecology and trophic relationships of Steller sea lions in the Gulf of Alaska. U.S. Dep. of Commer., NOAA. OCSEAP Final Report 19 (1983), pp. 445-546.

Calkins, D.G., E.F. Becker, and K.W. Pitcher. 1998. Reduced body size of female Steller sea lions from a declining population in the Gulf of Alaska. Mar. Mamm. Sci. 14:232-244.

Calkins, D.G., and E. Goodwin. 1988. Investigation of the declining sea lion population in the Gulf of Alaska. Alaska Department of Fish and Game, 333 Raspberry Road, Anchorage, AK 99518, 76 pp.

Calkins, D.G. 1987. Marine Mammals. *In* The Gulf of Alaska: physical environment and biological resources. D. W. Hood, S. T. Zimmerman (eds.), pp. 527-560. (Alaska Office, Ocean Assessments

Division, National Oceanic and Atmospheric Administration, U.S. Dep. of Commer., and the Alaska OCS Region Office, Minerals Management Service, U.S. Department of the Interior. Washington, DC)

Chumbley, K. J. Sease, M. Strick, and R. Towell. 1997. Field studies of Steller sea lions (*Eumetopias jubatus*) at Marmot Island, Alaska 1979 through 1994. NOAA Tech. Mem.

Daily, M.D. 1975. The distribution and intraspecific variation of helminth parasites in pinnipeds. Rapp. P.-v. Réun. Cons. Int. Explor. Mer 169:338-347.

Daily, M.D., and R.L. Brownell. 1972. A checklist of marine mammal parasites. Pp. 528-589 *in* S.H. Ridgway (ed.), Mammals of the sea: biology and medicine. Charles C. Thomas, Springfield, Ill.

Dieterich, R.A. 1981. Alaskan wildlife diseases. Univ. Alaska, Fairbanks.

Fadely, B.S., J.A. Zeligs, and D.P. Costa. 1994. Assimilation efficiencies and maintenance requirements of California sea lions (*Zalophus californianus*) fed walleye pollock (*Theragra chalcogramma*) and herring (*Clupea harengus*). Final Report to the National Marine Mammal Laboratory, Alaska Fisheries Science Center, National Marine Fisheries Service, 7600 Sand Point Way NE, Seattle, WA 98115-0070.

Fay, F.H., R.A. Dieterich, L.M. Shults, and B.P. Kelly. 1978. Morbidity and mortality of marine mammals. U.S. Dep. Commer., NOAA, OCSEAP Environ. Assess. Alaska Continental Shelf, Annual Rep. Year ending March 1978, 1:39-79.

Fay, F. H. 1982. "Ecology and biology of the Pacific walrus, (*Odobenus rosmarus divergens*)." *Illiger. N. Am. Fauna.* 74:279.

Fay, F. H., and Stoker, S. W. 1982. "Reproductive success and feeding habits of walruses taken in the 1982 spring harvest, with comparisons from previous years." in Eskimo Walrus Commission, Nome, AK (Available from Institute of Marine Science, University of Alaska, Fairbanks, AK). 91 p.

Fay, F. H. 1955. The Pacific Walrus (*Odobenus rosmarus divergens*): spatial ecology, life history, and population. Ph.D. Thesis. University of British Columbia. 171 p.

Fay, F. H., Kelly, B. P., Gehnrich, P. H., Sease, J. L., and Hoover, A. A. 1984. "Modern populations, migrations, demography, trophics, and historical status of the Pacific walrus." in *OCSEAP Final Report 37* U.S. Department of Commerce, NOAA. pp. 231-376.

Fiscus, C.H., and G.A. Baines. 1966. Food and feeding behavior of Steller and California sea lions. J. of Mammal. 47:195-200.

Fritz, L.W. 1993. Trawl locations of walleye pollock and Atka mackerel fisheries in the Bering Sea, Aleutian Islands, and Gulf of Alaska. AFSC Proc. Rep. 93-08.

Fritz, L.W., A. Greig, And R.F. Reuter. 1998. Catch-per-unit-effort, length, and depth distributions of major groundfish and bycatch species in the Bering Sea, Aleutian Islands, and Gulf of Alaska regions based on groundfish fishery observer data. NOAA Tech. Memo. NMFS-AFSC-88, 179 pp.

Fritz, L.W., R.C. Ferrero, and R.J. Berg. 1995. The threatened status of Steller sea lions, *Eumetopias jubatus*, under the Endangered Species Act: Effects on Alaska Groundfish Fisheries Management. Mar. Fish. Rev. 57:14-27.

Frost, K.J., and L.F. Lowry. 1986. Sizes of walleye pollock, *Theragra chalcogramma*, consumed by marine mammals in the Bering Sea. Fish. Bull. 84:192-197

Gentry, R.L., and J.H. Johnson. 1981. Predation by sea lions on northern fur seal neonates. Mammal. 45(4):423-430

Gentry, R.L. 1970. Social behavior of the Steller sea lion. Ph.D. thesis, Univ. California, Santa Cruz. 113 pp.

Gentry, R. L., Kooyman, G. L., and Goebel, M. E. 1986. "Feeding and diving behavior of northern fur seals." in *Fur Seals: Maternal Strategies on Land and At Sea.* R. L. Gentry, G. L. Kooyman, Eds. (Princeton University Press. Princeton, NJ) pp. 41-60 .

Geraci, J.B. 1979. The role of parasites in marine mammal strandings along the New England coast. Pp. 85-90 *in* J.B. Geraci and D.J. St. Aubin (eds.), Biology of marine mammals: insights through strandings. Marine Mammal Commission, Washington, D.C.

Gilpin, M.E., and M.E. Soulé. 1986. Minimum viable populations: processes of species extinction. Pp. 19-34 *in* Conservation biology: the science of scarcity and diversity, M.E. Soulé (ed.), Sinauer Associates, Inc., Sunderland, Massachusetts, 584 pp.

Gisiner, R.C. 1985. Male territorial and reproductive behavior in the Steller sea lion, *Eumetopias jubatus*. Ph.D. dissertation, University of California, Santa Cruz

Goebel, M. E., Bengtson, J. L., DeLong, R. L., Gentry, R. L., and Loughlin, T. R. 1991. "Diving patterns and foraging locations of female northern fur seals." *Fishery Bulletin.* 89:171-179.

Goodwin E.A., and D.G. Calkins. 1985. Preliminary results of ongoing investigations of San Miguel Sea lion Virus, leptospirosis, and chlamydiosis in Alaska Steller sea lions and their relationship to declining pup counts. Sixth Biennial Conference on the biology of Marine Mammals, 22-26 November, Vancouver, B.C. (Abstract).

Hill, B.L. 1968. A survey of parasites of sea lions from Año Nuevo Islands. Pp. 39-43 *in* Año Nuevo reports. Vol. 2, 1967-1968. Scientific studies in Año Nuevo State Reserve, California and Related Investigation. Univ. California, Santa Cruz.

Hill, P. S., DeMaster, D. P., and Small, R. J. 1997. "Alaska Marine Mammal Stock Assessments, 1996." in *NOAA Technical Memorandum NMFS-AFSC-78* National Marine Fisheries Service, National Marine Mammal Laboratory, 7600 Sand Point Way NE, Seattle, WA 98115. 154 p.

Hill, P.S., and D.P. DeMaster. 1998. Draft Alaska marine mammal stock assessments 1998. National Marine Mammal Laboratory, 7600 Sand Point Way NE, Seattle, WA 98115-0070.

Hoover, A.A. 1988. Steller Sea Lion. Pp. 159-193 *in* Selected Marine Mammals of Alaska: Species Accounts with Research and Management Recommendations, J.W. Lentfer (ed.). Marine Mammal Commission, Washington, D.C.

Ianelli, J.N., L. Fritz, T. Honkalehto, N. Williamson, and G. Walters. 1998. Eastern Bering Sea walleye pollock stock assessment with yield considerations for 1999. Pp. 31-112 *in* Stock Assessment and Fishery Evaluation Report for the Groundfish Resources of the Bering Sea/Aleutian Islands Regions as Projected for 1999. Bering Sea/Aleutian Islands Plan Team (eds.). North Pacific Fishery Management Council, 605 W. 4th Avenue, Suite 306, Anchorage, AK 99501.

Imler, R.H., and H.R. Sarber. 1947. Harbor seals and sea lions in Alaska. U.S. Dept. of the Interior, Fish and Wildlife Service, Spec. Sci. Rep. 28, 23 pp.

Iverson, S.J. 1993. Milk secretion in marine mammals in relation to foraging: can milk fatty acids predict diet? Symp. Zool. Soc. London 66:263-291.

Iverson, S.J. K.J. Frost, and L.F. Lowry. 1997. Fatty acid signatures reveal fine scale structure of foraging distribution of harbor seals and their prey in Prince William Sound, Alaska. Mar. Ecol. Prog. Series 151:255-271.

Jameson, R.J., and K.W. Kenyon. 1977. Prey of sea lions in the Rogue River, Oregon. J. Mammal. 58:672.

Jennings, S. and M. J. Kaiser. 1998. The effects of fishing on Marine Ecosystems. Advances in Marine Biology 34:201-352.

Jones, R.E. 1981. Food habits of smaller marine mammals from northern California. Proc. Calif. Acad. Sci. 42:409-433.

Kajimura, H. 1985. "Opportunistic feeding by the northern fur seal (*Callorhinus ursinus*)." in *Marine mammals and fisheries.* J. R. Beddington, R. J. H. Beverton, K. M. Lavigne, Eds. (George Allen and Unwin Ltd. London) pp. 300-318 .

Kajimura, H., and T.R. Loughlin. 1988. Marine mammals in the oceanic food web of the eastern subarctic Pacific. Bull. Ocean Res. Inst. 26:187-223.

Kenyon, K. W. 1969. "The sea otter in the eastern Pacific Ocean." *N. Am. Fauna.* 68:352.

Kenyon, K.W., and D.W. Rice. 1961. Abundance and distribution of the Steller sea lion. J. of Mammal. 42:223-234

Kosygin, G. M. 1966. "Some data on the feeding of the bearded seal in the Bering Sea during the spring-summer period." in *Soviet research on marine mammals of the Far East.* K. I. Panin, Ed., (U.S. Department of the Interior, Bureau of Commercial Fisheries. Seattle, Washington) vol. 58. pp. 78-82 .

Kosygin, G. M. 1971. *Feeding of the bearded seal, Erignathus barbatus nauticus (Pallas), in the Bering Sea during the spring-summer period.* Izv. TINRO. vol. 75. pp. 144-151.

Krebs, C.J. 1985. Ecology: The experimental analysis of distribution and abundance. Harper & Row, Publishers, New York, 800 pp.

Livingston, P. A., and Goiney, B. J. 1983. "Food habits literature of North Pacific marine fishes: A review and selected bibliography." in NOAA Technical Memorandum NMFS F/NWC-54 U.S. Department of Commerce, NOAA. 81 p.

Loughlin, T.R., M.A. Perez, R.L. Merrick. 1987. *Eumetopias jubatus*. Mammalian Species 283:1-7.

Loughlin, T., and Nelson Jr, R. 1986. Incidental mortality of northern sea lions in Shelikof Strait, Alaska. Mar. Mamm. Sci. 2:14-33.

Loughlin, T.R., A.S. Perlov, J.D. Baker, S.A. Blokhin, and A.G. Makhnyr. 1998. Diving behavior of adult female Steller sea lions in the Kuril Islands, Russia. Biosphere Conservation 1:21-31.

Loughlin, T.R. 1997. Using the phylogeographic method to identify Steller sea lion stocks. Molecular Genetics of Marine Mammals, Spec. Pub. 3:159-171.

Loughlin, T. R., Bengtson, J. L., and Merrick, R. L. 1987. "Characteristics of feeding trips of female northern fur seals." *Can. J. Zool.* 65:2079-2084.

Lowry, L. F., Frost, K. J., and Loughlin, T. R. 1989. Importance of walleye pollock in the diets of marine mammals in the Gulf of Alaska and Bering Sea, and implications for fishery management. Alaska Sea Grant Report AK-SG-89-01. Pp. 701-726.

Lowry, L. F., and Frost, K. H. 1981. "Feeding and trophic relationships of phocid seals and walruses in the eastern Bering Sea." in *The eastern Bering Sea shelf: oceanography and resources.* D. W. Hood, J. A. Calder, Eds. (U.S. Department of Commerce, NOAA, Office of Marine Pollution Assessment, Juneau, AK) vol. 2. pp. 813-824 .

Lowry, L. F. 1982. "Documentation and assessment of marine mammal-fishery interactions in the Bering Sea." K. Sobol, Ed., Trans. 47th North American Wildlife and Natural Resource Conference. Portland, Oregon. Wildlife Management Inst., Washington, DC. pp. 300-311.

Lowry, L.F., K.J. Frost, D.G. Calkins, G.L. Swartzman, and S. Hills. 1982. Feeding habits, food requirements, and status of Bering Sea marine mammals. Final report to the North Pacific Fishery Management Council, P.O. Box 3136 DT, Anchorage, Alaska 99510. Contract No. 81-4.

Mate, B.R. 1973. Population kinetics and related ecology of the northern sea lion, *Eumetopias jubatus*, and the California sea lion, Zalophus californianus, along the Oregon Coast. Ph.D. dissertation, University of Oregon, 94 pp.

Mathisen, O.A., R.T. Baade, and R.J. Lopp. 1962. Breeding Habits, Growth and Stomach Contents of the Steller Sea Lion in Alaska. J. of Mammal. 43:469-477.

Merrick, R.L., M.K. Chumbley, and G.V. Byrd. 1997. Diet diversity of Steller sea lions (*Eumetopias jubatus*) and their population decline in Alaska: a potential relationship. Can. J. Fish. Aquat. Sci. 54:1342-1348.

Merrick, R.L., R. Brown, D.G. Calkins, and T.R. Loughlin. 1995. A comparison of Steller sea lion, *Eumetopias jubatus*, pup masses between rookeries with increasing and decreasing populations. Fish. Bull. 93:753-758.

Merrick, R.L., and A.E. York. 1994. A viability analysis for the southwest Alaskan Steller sea lion population, 1985-94. Draft report, 20 pp.

Merrick, R.L., and D.G. Calkins. 1996. Importance of juvenile walleye pollock, *Theragra chalcogramma*, in the diet of Gulf of Alaska Steller sea lions, *Eumetopias jubatus*. Pp. 153-166 *in* U.S. Dep. of Commer., NOAA Tech. Rep. NMFS 126.

Merrick, R. L., and T. R. Loughlin. 1997. Foraging behavior of adult female and young-of-the-year Steller sea lions (*Eumetopias jubatus*) in Alaskan waters. Can. J. of Zool. 75 (5):776-786.

Merrick, R.L., T.R. Loughlin, G.A. Antonelis, and R. Hill. 1994. Use of satellite-linked telemetry to study Steller sea lion and northern fur seal foraging. Pol. Res. 13:105-114.

Merrick, R., P. Gearin, S. Osmek, and D. Withrow. 1988. Field Studies of Northern sea lions at Ugamak Island, Alaska during the 1985 and 1986 breeding seasons. U.S. Dep. of Commer., NOAA Tech. Memo. NMFS F/NWC-143.

Morrison, R., Gish, R., Ruccio, M., and Schwenzfeier, M. 1998. "Annual Area Management Report for the Shellfish Fisheries of the Bering Sea." in Alaska Department of Fish and Game.

Nishiwaki, M., and Handa, C. 1958. "Killer whales caught in the coastal waters off Japan for recent 10 years." *Sci. Rep. Whales Res. Inst. Tokyo.* 13:85-96.

NMFS. 1999. Environmental Assessment/Regulatory Impact Review for an Emergency Rule to Implement Reasonable and Prudent Steller Sea Lion Protection Measures in the Pollock Fisheries of the Bering Sea and Aleutian Islands Area and the Gulf of Alaska (January 1999, FONSI signed January 14, 1999.) Available from NMFS, Alaska Regional Office, P.O. Box 21668, Juneau, AK 99801. 89 pg.

NMFS. 1998a. "Endangered Species Act Section 7 Consultation - Biological Opinion: Authorization of an Atka mackerel fishery under the BSAI groundfish FMP between 1999 and 2002; Authorization of a walleye pollock fishery under the BSAI groundfish FMP between 1999 and 2002; and Authorization of a walleye pollock fishery under the GOA groundfish FMP between 1999 and 2002 (Marine mammals including Steller sea lion)." in National Marine Fisheries Service, Alaska Region, P.O. Box 21668, Juneau, AK 99802. 139 pp + Tables and Figures.

NMFS. 1998b. Revised reasonable and prudent alternative for the 1998 Biological Opinion on NMFS' authorization of a pollock fishery under the Bering Sea-Aleutian Island groundfish Fishery Management Plan, and authorization of a pollock fishery under the Gulf of Alaska groundfish Fishery Management Plan. Memorandum dated December 16, 1998, From Gary Matlock, Director, Office of Sustainable fisheries to Hilda Diaz-Soltero, Director, Office of Protected Resources. 1315 East-West Highway, Silver Spring, Maryland 20910. 6pp.

NMFS. 1998c. Final Supplemental Environmental Impact Statement: Groundfish Total Allowable Catch Specifications and Prohibited Species Catch Limits Under the Authority of the Fishery Management

Plans for the Groundfish Fishery of the Bering Sea and Aleutian Islands Area and Groundfish of the Gulf of Alaska. December 1998. National Marine Fisheries Service, P.O. Box 21668, Juneau, Alaska 99802. 692 pp + Appendices and Comments.

NMFS. 1998d. Environmental Assessment for 1999 Groundfish Total Allowable Catch Specifications Implemented under the Authority of the Fishery Management Plans for the Groundfish Fishery of the Bering Sea and Aleutian Islands Area and Groundfish Fishery of the Gulf of Alaska Area. (December 24, 1998, FONSI signed December 24, 1998.) Available from NMFS Alaska Regional Office, P.O. Box 21668, Juneau, AK 99801. 45 pg.

NMFS. 1998e. "Results of the 1998 NMFS Bering Sea Crab Survey: Executive Summary." in *1998 Crab Stock Assessment and Fishery Evaluation.* (North Pacific Fishery Management Council, 605 W. 4th Avenue, Suite 306, Anchorage, AK 99501)

NMFS. 1995. Status review of the United States Steller sea lion, *Eumetopias jubatus*, population. U.S. Dep. Commer., NOAA, National Marine Mammal Laboratory, AFSC, 7600 Sand Point Way NE, Seattle, WA 98115. 61 pp.

NMFS. 1992. Recovery plan for the Steller sea lion (*Eumetopias jubatus*). Prepared by the Steller Sea Lion Recovery Team for the National Marine Fisheries Service, Silver Spring, Maryland, 92 pp.

NPFMCa. 1998. "Stock Assessment and Fishery Evaluation Report of the Gulf of Alaska as Projected for 1999." Compiled by the Plan Team for the Groundfish Fisheries of the Gulf of Alaska, North Pacific Fishery Management Council, 605 West 4th Avenue, Suite 306, Anchorage, AK 99501.

NPFMCb. 1998. "Stock Assessment and Fishery Evaluation Report of the Bering Sea and Aleutian Islands as Projected for 1999." Compiled by the Plan Team for the Groundfish Fisheries of the Bering Sea and Aleutian Islands, North Pacific Fishery Management Council, 605 West 4th Avenue, Suite 306, Anchorage, AK 99501.

Parma, A. M. 1998. "Changes in halibut recruitment, growth, and maturity and the harvesting strategy." in *International Pacific Halibut Commission 74th Annual Meeting Report* International Pacific Halibut Commission, P.O. Box 95009, Seattle, WA 98145. pp. 43-56.

Perez, M. A., and Bigg, M. A. 1986. "Diet of northern fur seals, *Callorhinus ursinus*, off western North America." *Fishery Bulletin.* 84:959-973.

Perez, M. A. 1990. "Review of marine mammal population and prey information for Bering Sea ecosystem studies." in *NOAA Technical Memorandum NMFS F/NWC-186* U.S. Department of Commerce, NOAA. 81 p.

Perez, M.A., and T.R. Loughlin. 1991. Incidental catch of marine mammals by foreign and joint venture trawl vessels in the U.S. EEZ of the North Pacific, 1973-88. NOAA Tech. Rep. NMFS 104, 57 pp.

Pike, G.C., and B.E. Maxwell. 1958. The abundance and distribution of the northern sea lion (*Eumetopias jubata*) on the coast of British Columbia. J. Fish. Res. Bd. Canada 15:5-17.

Pitcher, K. W. 1981. Prey of the Steller sea lion, *Eumetopias jubatus*, in the Gulf of Alaska. Fish. Bull. 79:467-472.

Pitcher, K. W., and Calkins, D. G. 1979. "Biology of the harbor seal (*Phoca vitulina richardsi*) in the Gulf of Alaska." in *OCEAP Final Report 19 (1983)* U.S. Department of Commerce, NOAA. pp. 231-310.

Pitcher, K.W., and D.G. Calkins. 1981. Reproductive biology of Steller sea lions in the Gulf of Alaska. J. Mammal. 62:599-605.

Rohlf, D. J. 1989. "The Endangered Species Act, A Guide to its Protections and Implementation." in Stanford Environmental Law Society, Stanford Law School, Stanford, CA 94305. 207 p.

Sinclair, E. H., Loughlin, T., and Pearcy, W. 1994. "Prey selection by northern fur seals (*Callorhinus ursinus*) in the eastern Bering Sea." *Fishery Bulletin.* 92:144-156.

Sinclair, E. H., Antonelis, G. A., Robson, B. R., Ream, R., and Loughlin, T. R. 1996. "Northern fur seal, *Callorhinus ursinus*, predation on juvenile pollock, *Theragra chalcogramma*." in *NOAA Technical Report NMFS 126* U.S. Department of Commerce, NOAA. pp. 167-178.

Sinclair, E. H., Antonelis, G. A., Robson, B. W., Ream, R. R., and Loughlin, T. R. 1997. "Norther fur seal predation on juvenile walleye pollock." in *NOAA Technical Report NMFS 126* U.S. Department of Commerce, NOAA.

Smirnov, N. A. 1929. "A review of the Pinnipedia of Europe and northern Asia." *Izv. Otd. Priklad. Ikhtiol.* 9:231-268.

Stevens, B. G., Otto, R. S., Haaga, J. A., and MacIntosh, R. A. 1998. "Report to the Industry on the 1997 Eastern Bering Sea Crab Survey." in *Alaska Fisheries Science Center Processed Report 98-02* Department of Commerce, NOAA, NMFS, Alaska Fisheries Science Center, 7600 Sand Point Way NE, Seattle, WA 98115. 55 p.

Zheng, J., Kruse, G. H., and Murphy, M. C. 1998. "A Length-based approach to estimate population abundance of Tanner crab, *Chionoecetes bairdi*, in Bristol Bay, Alaska" in *Proceedings of the North Pacific Symposium on Invertebrate Stock Assessment and Management*." *Can. Spec. Publ. Fish. Aquat. Sci.* 125:97-105.

Zheng, J., Murphy, M. C., and Kruse, G. H. 1995. "A length-based population model and stock recruitment relationship for red king crab, *Paralithodes camtshaticus*, in Bristol Bay, Alaska." *Can. J. of Fish. Aquat. Sci.* 52:1229-1246.

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APPENDIX A: Council emergency rule motion of December 13, 1999

There is considerable scientific uncertainty regarding the relationships between the pollock fisheries and the Western population of Steller sea lions. This uncertainty lies at the heart of the concerns expressed by the AP and the SSC. The Council recognizes and shares these concerns. This uncertainty has placed the industry at risk, and forced the Council to react to Endangered Species Act concerns in a very compressed time frame and make critical decisions based on incomplete and conflicting data. This is not acceptable.

Nonetheless, as the SSC has noted, the Endangered Species Act involves a fundamental shift in the burden of proof and some basic facts are clear: 1) The Western population of Steller sea lions is greatly reduced; 2) the Western population has been listed as endangered; 3) pollock forms a large part of the contemporary diet of Steller sea lions; and 4) pollock fisheries remove and disperse potential prey. In view of the importance of the pollock fisheries, the Council is compelled to take immediate action to address the Endangered Species Act issues. Therefore, the Council adopts the following measures for emergency action in 1999:

A) Aleutian Islands

Close the Aleutian Islands area to directed pollock fishing.

B) Bering Sea

1. Establish a quarterly system of seasonal sector allocations (between A1, A2, B, and C seasons). Seasons to start on January 20, February 20, August 1 and September 15, respectively.

   a) No pollock fishing between November 1 through January 19.
   b) CH/CVOA = excluding NW corner

2. The combined A1+A2 harvest for the non-CDQ fisheries is set at 40% of the annual non-CDQ TAC.

3. Set the A1 and A2 seasonal allocations at 27.5% and 12.5%, respectively, of each sector allocation in the non-CDQ fisheries.

4. No more than 30% of the annual TAC may be harvested in any single season.

5. Five day closed period between the A1 and A2 seasons.

6. Allow rollover from one season to the next if it doesn't boost the following season over the 30% of annual TAC seasonal limit.

7. Establish seasonal harvest measures from inside Bering Sea critical habitat as follows:

Catcher/processor Sector:

a) Neither A1 or A2 harvest in CH/CVOA (except NW corner) may exceed 40% of the respective A1 or A2 apportionments for the catcher/processor sector.

b) Prohibited from fishing in CH/CVOA in the B and C seasons.

Catcher Vessels Delivering to Motherships:

a) A single A season beginning February 1. 50% may come from the CH/CVOA.

b) B season starting September 1. 50/50% inside/outside CH/CVOA

Inshore sector:

a) In the B and C seasons, no size restrictions on CVs, fishing in CH limited to 80% of the inshore sector seasonal allocations.

b) Vessels delivering onshore that are 99 ft LOA or less shall not be excluded from the CH/CVOA during Sept 1 through March 31 during any time that the Bering Sea onshore pollock season is open.

c) Of the overall A1/A2 inshore cap, no more than 70% shall come out of the CH/CVOA.

CDQ Sector:

a) Harvests in A1 and A2 seasons, combined, may not exceed 45% of the CDQ allocation. Stand-down provisions do not apply.

b) Harvests in B and C seasons to be conducted as under present regulations.

8. Existing stand-down requirements of the A season shall be removed.

9. Exempt Cape Sarichef from sea lion closures.

C) GOA

1. Seasons:

Establish the following seasons and allocations:

Season	Start Date	Allocation
A	Jan. 20	30%
B	June 1	20%
C	Sept. 1	25%
D	No later than 10/1; no sooner than 5 days after close of C season	25%

1a. Rollover allowed, subject to 30% rule, and November 1st closure still applies.

2. Limit the A season harvest from the Shelikof critical foraging area in accordance with the method described in the Final Biological Opinion (p. 122), i.e.: (Shelikof survey estimate/Total GOA survey estimate) * A season TAC.

3. Pollock Trawl Exclusion Zones:

   Adopt the pollock trawl exclusion zones proposed by NMFS in the Biological Opinion with the following exceptions for 1999:

   Cape Barnabas; Gull Point; Rugged Island; Point Elrington; Cape Ikolik; Needles; Mitrofania; and Sea Lion Rocks.

4. Trip limits: Establish a 300,000 lb. trip limit for directed pollock fishing in the W/C GOA.

D. Other Actions

These measures are being adopted as an Emergency Order in accordance with the MSFCMA. They will be in effect for 180 days. In reviewing the possible extension of these measures for an additional 180 day period, the Council will pay great attention to NMFS' response to the following:

1. The Council request that NMFS, in consultation with the Council, the Marine Mammal Commission, ADF&G, and other relevant management agencies, coordinate an independent scientific review of the biological data, Biological Opinion, and other relevant information relating to factors affecting Steller sea lions and their prey. The purpose of the scientific review is to provide guidance to the Council as it prepares to address the long-term aspects of the Steller sea lion situation through the plan amendment process. The Council requests that the scientific peer review be completed by April 1, 1999.

2. The Council requests that NMFS reconstitute the Steller Sea Lion Recovery Team to address concerns such as those expressed by the SSC to ensure that the Council has an appropriate additional source of advice as the Council prepares for long-term treatment of Steller sea lion issues.

3. The Council requests that NMFS prepare and submit a budget proposal for the FY 2000 budget for a sustained research program to investigate: The efficacy of the emergency actions adopted by the Council; sea lion dietary foraging patterns; sea lion/fishery interactions; and current trends in sea lion population dynamics.

4. It is the intent of the Council that the NMFS move as quickly as possible to develop National Standards for Vessel Monitoring Systems (VMS) so that such systems can be required on fishing vessels engaged in the trawl fisheries of the Bering Sea and Gulf of Alaska. Furthermore, it is also Council intent that in developing the National Standards that the NMFS consult with affected states, Councils and other Federal and enforcement agencies with the intent that the U.S. Coast Guard and other regional enforcement agencies have timely and efficient access to VMS data.

The Council recognizes that these management measures represent an incremental step, and are for 1999 only. To fully comply with both the ESA and MSFCMA requirements, amendments to the

BSAI and GOA FMPs will be necessary. Such FMP amendments may need to consider additional measures to satisfy statutory requirements.

APPENDIX C: Council's February 5, 1999, Steller sea lion analysis motion

North Pacific Fishery Management Council
February 5, 1999
As Approved

Sea Lion Analysis Motion

Options for analysis:

1) Emergency Action as adopted by the NPFMC 12/98.

2) Emergency Action adopted 12/98, modified to meet the "50% principle" in the BSAI by reducing the seasonal apportionments as follows:

   (a) using an equal proportional reduction across the Inshore, True Mothership, and Catcher-Processor sectors
   (b) using a constant percentage point reduction across the Inshore, True Mothership, and Catcher-Processor sectors
   (c) 45/55 A/(B/C) Split

   Sub-options:
   (a) A2 start dates of February 20, March 1, or March 15
   (b) 5, 7, or 10 day stand-down periods between seasons
   (c) revised rollover provisions identified by NMFS

3) Emergency Action adopted 12/98 modified to meet the "50% principle" as provided under (2) above, including the sub-options, plus the following:

   GOA Specific
   (a) tender trip limits of 136mt and 272 mt.
   (b) seasonal exclusive registration between E/W/C GOA and BSAI
   (c) re-examine Shelikof Strait critical foraging area
   (d) pollock trawl closures not included in 12/98 Emergency Action

   BSAI Specific
   (a) Spatial distribution of catch:
      Option 1: CH and non-CH
      Option 2: CH and non-CH with non-CH split east/west of 170°
         Suboption: Range of +/- 30% of sector percentage
      Option 3: CH and non-CH, with 10-mile buffer around CH

   (b) B/C Season start dates:
      1. B Season start date: June 1
         a. with differential application by sector keyed to co-op.
         b. end Aug 15
         c. end Aug 30

      2. C Season start dates:
         a. Sept 1
         b. Sept 15

3. C Season end dates:
    a. Oct 31
    b. Nov 30

4. Combine B/C season with early start date, and with cap on monthly catch. No month to exceed 20-30% of annual harvest on a sector-by-sector basis.

(c) Pollock trawl closures not included in 12/98 Emergency Action.
(d) Analysis of Aleutian closure and long-term management options.
(e) Rollovers:
    1. Repeal restriction that doesn't allow harvest of uncaught CH fish.
    2. Rollover restrictions evaluated on a sector-by-sector basis.

General

The Council requests that the analysis should include discussion of the following: Safety issues related to closures; and the following fishery data:

1. Review time series of bottom trawl surveys for inter-annual variation.
2. Review time series of acoustic surveys for inter-annual variation
3. Correlate findings of acoustic and bottom trawl surveys in years when both surveys were conducted to evaluate consistency on distribution.
4. Review foreign, JV and DAP harvest patterns with reference to CPUE and total catch compared to survey distribution.
5. Review portion of commercial catch taken outside survey area.
6. Review areas in CH/CVOA that are not currently being surveyed.
7. Review all options with or without real time survey data as a basis for establishing CH/non-CH split.
8. Review adaptive management measures leaving Amak, Sarichef or other Bering Sea rookeries open as a control site to evaluate efficacy of haulout/rookery closures.

Continue to evaluate the hypothesis that Steller sea lions are food-limited by the lack of pollock, with particular attention to the alternative hypothesis on the role killer whales have played in their decline as received in public testimony. We encourage the use of local knowledge of indigenous peoples, communities and fishermen.

The Council requests that appropriate staff continue work on the following items in the motion adopted by the Council at the December, 1998 meeting:

1. The Council requests that NMFS, in consultation with the Council, the Marine Mammal Commission, ADF&G, and other relevant management agencies, coordinate an independent scientific review of the biological data, Biological Opinion, and other relevant information relating to factors affecting Steller sea lions and their prey. The purpose of the scientific review is to provide guidance to the Council as it prepares to address the long-term aspects of the Steller sea lion situation through the plan amendment process. The Council requests that the scientific peer review be completed by April 1, 1999.

2. The Council requests that NMFS reconstitute the Steller Sea Lion Recovery Team to address concerns such as those expressed by the SSC to ensure that the Council has an appropriate additional source of advice as the Council prepares for long-term treatment of Steller sea lion issues.

3. The Council requests that NMFS prepare and submit a budget proposal for the FY 2000 budget for a sustained research program to investigate: the efficacy of the emergency actions adopted by the Council; sea lion dietary and foraging patterns; sea lion/fishery interactions; and current trends in sea lion population dynamics.

4. It is the intent of the Council that the NMFS move as quickly as possible to develop National Standards for Vessel Monitoring Systems (VMS) so that such systems can be required on fishing vessels engaged in the trawl fisheries of the Bering Sea and Gulf of Alaska. Furthermore, it is also Council intent that in developing the National Standards that the NMFS consult with affected states, Councils and other Federal and enforcement agencies with the intent that the U.S. Coast Guard and other regional enforcement agencies have timely and efficient access to VMS data.

APPENDIX D: Bering Sea ice coverage advance and retreat, 1973 -1994.

The following figures show geographically, a time series of ice coverage advance and retreat during the winter/spring months in the Bering Sea. Each year from 1973 - 1994 has two views. "Month of First Ice" shows where, by month, ice was first recorded during that season. "Month of Last Ice" shows the month that ice was last recorded at a location.

Method. For each week a polygon of the ice coverage was created including areas that contained any percentage of ice. All the polygons from a season were unioned together keeping the date of the first and last observation if ice for easy subpolygon intersection. The first and last observation dates were grouped by month for the final output.

Sources. 1973 - 94 ice data is from the "Navy/NOAA National Ice Center (NIC) Weekly Sea Ice Concentrations and Extents 1972 - 1994." NIC made weekly compilations of visible/infared and microwave data to produce an ice concentration grid of 15 nm cell size. Coast lines are from Environmental Systems Research Institute's (ESRI) Digital Chart of the World.

APPENDIX E: Charts of transects and pollock density from the winter and summer hydroacoustic surveys of the EBS shelf and Bogoslof area, 1991-97

The following figures are included:

1. Pollock density (acoustic signal) along trackline during the winter 1991 EBS shelf and Bogoslof surveys. Shelf survey dates were Feb 15-22, 1991, and Bogoslof survey followed the shelf survey.

2. Pollock density (acoustic signal) along trackline during the winter 1993 EBS shelf and Bogoslof surveys. Shelf survey dates were March 6-12, 1993, and followed the Bogoslof survey.

3. Pollock density (acoustic signal) along trackline during the winter 1995 EBS shelf and Bogoslof surveys. Shelf survey dates were April 2-13, 1995, and followed the Bogoslof survey by a month.

4. Pollock density (tons/nmi^2) along trackline during the winter 1993 EBS shelf survey (March 6-12, 1993).

5. Pollock density (tons/nmi^2) along trackline during the winter 1995 EBS shelf survey (April 2-13, 1995).

6. Pollock density (tons/nmi^2) along trackline during the summer 1994 EBS shelf survey.

7. Pollock density (tons/nmi^2) along trackline during the summer 1994 EBS shelf survey E of 170°W.

8. Pollock density (tons/nmi^2) along trackline during the summer 1996 EBS shelf survey.

9. Pollock density (tons/nmi^2) along trackline during the summer 1996 EBS shelf survey E of 170°W.

10. Pollock density (tons/nmi^2) along trackline during the summer 1997 EBS shelf survey.

11. Pollock density (tons/nmi^2) along trackline during the summer 1997 EBS shelf survey E of 170°W.

APPENDIX F Observed catches (mt) of groundfish by gear and species in the Bering Sea/Aleutian Islands region and in the Gulf of Alaska from 1977-97, the percent caught within 10, 20, 40, 60 nm of terrestrial sites (rookeries and haulouts) used to designate Steller sea lion critical habitat, and the percent caught by trawls within 10 nm year-round of Steller sea lion rookeries west of 142°W and 20 nm from January 1 - April 15 at six rookeries in the central and eastern Aleutian Islands.

Table F1. **Bering Sea and Aleutian Islands**: Observer-sampled groundfish catch amounts by gear and species, 1977-97. (metric tons).

Table F2. **Gulf of Alaska** west of 142°W longitude: Observer-sampled groundfish catch amounts by gear and species, 1977-97 (metric tons).

Table F3. **Percent** of observed **Bering Sea and Aleutian Islands** groundfish catch by gear and species caught within 10, 20, 40, 60 nautical miles of Steller sea lion terrestrial sites used to define critical habitat (western stock only), 1977-97.

Table F4. **Percent** of observed **Bering Sea and Aleutian Islands** groundfish **trawl** catch by species caught within 10 nm year-round of Steller sea lion rookeries west of 150°W and 20 nm from January 1 - April 15 at six rookeries in the central and eastern Aleutian Islands, 1977-97.

Table F5. **Percent** of observed **Gulf of Alaska** groundfish catch by species and gear west of 142°W longitude caught within 10, 20, 40, 60 nautical miles of Steller sea lion terrestrial sites used to define critical habitat (western stock only), 1977-97.

Table F6. **Percent** of observed **Gulf of Alaska** groundfish **trawl** catch by species caught within 10 nm year-round of Steller sea lion rookeries west of 142°W and 20 nm from January 1 - April 15 at three rookeries in the eastern Aleutian Islands, 1977-97.

Table F1. **Bering Sea and Aleutian Islands**: Observer-sampled groundfish catch amounts by gear and species, 1977-97. (metric tons).

	Total	Poll.	P.cod	Atka mack.	Sable fish	Rock sole	G. turb.	Yell. fin	Arrow tooth	Flat other	Rock fish	POP
Hook & line												
1977	40	-	-	-	10	-	20	-	-	-	-	-
1978	700	40	490	-	50	-	100	-	10	-	-	-
1979	1,870	40	880	-	230	-	610	-	80	-	30	-
1980	1,680	20	560	-	130	-	890	-	40	-	30	-
1981	1,670	10	600	-	220	-	740	-	80	-	20	-
1982	4,530	50	1,300	-	1,080	-	1,910	-	120	-	60	10
1983	6,810	120	3,450	-	1,320	-	1,690	-	120	20	80	-
1984	21,900	450	20,090	-	870	-	310	-	130	10	40	-
1985	31,100	950	29,750	-	150	10	40	-	150	20	20	-
1986	24,670	590	23,790	-	60	10	20	-	170	20	-	-
1987	45,910	1,770	43,530	-	40	20	60	-	410	60	10	-
1990	37,970	420	35,400	-	690	10	800	-	500	50	100	-
1991	61,530	1,870	55,320	-	950	10	1,150	-	1,720	230	280	-
1992	82,610	2,810	75,570	50	540	20	1,050	70	1,490	220	670	130
1993	55,470	1,710	46,970	10	900	20	3,990	10	1,090	220	560	10
1994	67,700	2,110	62,100	30	520	20	1,180	30	1,310	180	220	-
1995	76,970	2,450	70,090	30	630	30	2,110	40	1,160	250	180	-
1996	71,960	2,150	65,060	20	420	30	2,310	120	1,380	280	200	-
1997	89,990	3,250	81,010	20	420	20	3,380	170	1,190	340	170	-
Pot												
1990	520	-	510	-	-	-	-	-	-	-	-	-
1991	2,820	-	2,810	-	-	-	-	-	-	-	-	-
1992	5,550	10	5,510	-	-	-	-	10	-	-	-	-
1993	1,180	-	1,170	-	-	-	-	-	-	-	-	-
1994	3,160	-	3,140	10	-	-	-	-	-	-	-	-
1995	5,720	20	5,650	20	-	-	-	20	-	-	-	-
1996	8,710	20	8,560	10	-	-	-	100	10	-	-	-
1997	6,080	40	5,980	10	-	-	-	30	10	-	-	-

Table F1 (continued). **Bering Sea and Aleutian Islands**: Observer-sampled groundfish catch amounts by gear and species, 1977-97 (metric tons).

	Total	Poll.	P.cod	Atka mack.	Sable fish	Rock sole	G. turb.	Yell. fin	Arrow tooth	Flat other	Rock fish	POP
Trawl												
1977	360,130	311,590	7,090	1,320	30	920	5,600	25,330	2,540	5,200	130	390
1978	467,370	395,210	12,680	1,940	150	710	10,630	37,010	2,810	5,620	350	260
1979	469,200	397,430	13,200	2,370	190	390	9,450	38,530	2,700	4,120	440	380
1980	392,640	332,330	10,250	640	130	1,070	6,310	36,790	1,410	3,470	90	160
1981	355,340	289,330	7,720	1,360	240	1,890	4,890	42,630	2,290	4,620	130	240
1982	689,280	574,990	20,270	8,330	460	7,010	10,320	54,190	6,090	6,920	530	160
1983	775,000	636,480	24,680	8,010	530	7,310	16,100	66,500	5,270	9,570	410	140
1984	1015470	826,830	33,990	19,030	480	9,100	12,650	93,890	4,430	14,330	310	430
1985	1067070	844,540	34,170	22,280	150	18,430	9,300	116,450	4,220	17,120	170	230
1986	963,140	740,600	43,120	18,980	320	10,990	4,720	113,450	4,390	26,220	160	190
1987	718,280	538,430	38,380	17,950	70	6,870	650	100,300	2,710	12,390	200	330
1988	728,220	437,170	68,900	12,290	10	24,050	60	135,880	1,570	46,740	1,240	320
1989	296,930	146,190	29,470	40	-	13,900	50	94,490	1,630	11,120	10	20
1990	54,180	10,830	3,800	-	-	4,910	-	25,480	390	8,760	-	-
1990	1,110,370	995,330	49,050	14,290	640	9,200	5,660	8,450	6,910	6,550	2,990	11,300
1991	984,340	786,360	63,350	18,010	350	24,810	3,300	58,570	9,120	15,100	1,090	4,270
1992	1,051,720	821,050	52,670	31,830	40	28,270	500	81,640	5,530	19,260	2,270	8,680
1993	1,067,820	841,530	54,620	45,310	50	32,710	740	59,690	4,050	14,070	4,050	10,980
1994	1,212,200	941,280	71,620	45,300	320	31,270	4,110	82,760	7,740	15,540	3,840	8,440
1995	1,207,980	949,100	68,880	52,330	240	28,560	2,280	73,820	3,780	19,300	2,900	6,800
1996	1,105,280	824,510	64,980	70,320	110	25,850	1,180	76,260	6,850	19,290	5,370	10,550
1997	1,058,560	767,540	61,330	45,620	40	33,940	740	107,190	3,320	26,670	2,330	9,850

Table F2. Gulf of Alaska west of 142°W longitude: Observer-sampled groundfish catch amounts by gear and species, 1977-97 (metric tons).

	Total	Poll.	P.cod	Atka mack.	Sable fish	Rock sole	G. turb.	Yell. fin	Arrow tooth	Flat other	Rock fish	POP
Hook & line												
1977	280	-	-	-	250	-	-	-	-	-	30	-
1978	2,110	10	1,310	-	670	-	10	-	30	-	80	-
1979	2,640	10	1,430	-	1,010	-	-	-	50	10	130	-
1980	2,120	20	1,600	-	390	-	20	-	40	-	40	-
1981	2,400	20	1,800	-	490	-	-	-	40	-	40	-
1982	2,590	20	1,910	-	590	-	-	-	20	10	30	-
1983	12,470	160	10,420	-	1,560	-	-	-	240	20	70	-
1984	12,640	60	11,780	-	600	10	-	-	140	10	40	-
1985	8,560	10	8,520	-	-	-	-	-	20	-	-	-
1986	14,990	110	14,780	-	-	10	-	-	70	10	10	-
1990	3,030	10	990	-	1,780	-	-	-	100	10	140	-
1991	3,060	-	1,340	-	1,470	-	-	-	110	-	120	-
1992	6,440	20	4,200	-	1,730	-	10	-	210	10	240	-
1993	4,910	10	1,530	-	2,690	-	-	-	320	20	340	-
1994	2,600	-	1,130	-	1,230	-	-	-	130	-	100	-
1995	5,660	10	2,730	-	2,520	-	10	-	160	10	220	-
1996	3,620	10	1,360	-	1,920	-	-	-	130	10	200	-
1997	3,190	10	1,000	-	1,840	-	10	-	140	10	180	-
Pot												
1990	660	-	660	-	-	-	-	-	-	-	-	-
1991	950	-	950	-	-	-	-	-	-	-	-	-
1992	1,180	-	1,180	-	-	-	-	-	-	-	-	-
1993	950	-	950	-	-	-	-	-	-	-	-	-
1994	670	20	660	-	-	-	-	-	-	-	-	-
1995	1,630	10	1,620	-	-	-	-	-	-	-	-	-
1996	880	-	880	-	-	-	-	-	-	-	-	-
1997	500	-	500	-	-	-	-	-	-	-	-	-

Table F2 (continued). Gulf of Alaska west of 142°W longitude: Observer-sampled groundfish catch amounts by gear and species, 1977-97 (metric tons).

	Total	Poll.	P.cod	Atka mack.	Sable fish	Rock sole	G. turb.	Yell. fin	Arrow tooth	Flat other	Rock fish	POP
Trawl												
1977	3,490	2,610	140	90	10	10	-	-	170	60	110	290
1978	9,130	7,400	290	370	50	20	-	-	320	100	120	480
1979	12,180	9,820	390	1,070	40	30	-	-	310	60	140	320
1980	11,480	9,450	530	360	220	40	-	-	300	120	210	260
1981	18,750	15,800	680	990	90	10	-	-	320	60	460	340
1982	72,580	65,360	1,130	1,090	220	60	10	-	1,150	610	1,930	1,020
1983	162,900	149,930	2,770	2,000	380	680	30	20	2,560	840	2,500	1,190
1984	172,720	159,120	4,730	730	710	200	70	10	3,290	640	1,490	1,750
1985	149,910	143,580	1,980	1,470	210	160	-	10	1,800	470	150	90
1986	34,390	32,930	660	-	20	140	-	-	400	160	40	20
1987	18,170	11,470	1,550	30	100	2,730	-	30	1,510	670	60	30
1988	2,510	100	1,190	-	20	350	-	-	580	270	10	-
1989	30	20	10	-	-	-	-	-	-	-	-	-
1990	70,210	30,580	12,490	1,590	1,910	1,270	20	20	7,570	2,730	5,820	6,220
1991	76,910	39,180	15,630	2,360	1,040	1,290	10	10	7,040	3,110	4,980	2,260
1992	79,270	34,430	13,970	9,320	1,080	2,010	10	10	6,390	2,550	7,220	2,300
1993	72,760	40,740	7,180	4,820	970	1,120	-	-	6,740	3,410	6,780	1,010
1994	59,860	36,260	3,970	2,570	1,050	410	10	30	5,950	2,550	6,490	580
1995	66,500	35,170	11,910	430	920	840	100	10	5,300	2,820	6,270	2,740
1996	50,400	19,690	10,650	950	730	950	-	10	7,350	3,790	3,370	2,910
1997	55,510	30,740	8,350	210	470	1,080	-	50	4,410	2,390	3,990	3,820

Table F3. **Percent** of observed **Bering Sea** and **Aleutian Islands** groundfish catch by gear and species caught within 10, 20, 40, 60 nautical miles of Steller sea lion terrestrial sites used to define critical habitat (western stock only), 1977-97.

	Total	Poll.	P.cod	Atka mack.	Sable fish	Rock sole	G. turb.	Yell. fin	Arrow tooth	Flat other	Rock fish	POP
1. Hook and Line												
10nm												
1977	39	-	-	-	52	-	33	-	-	-	-	-
1978	13	0	10	-	43	-	14	-	13	-	-	-
1979	9	1	9	-	20	-	6	-	6	-	22	-
1980	2	0	5	-	1	-	1	-	2	-	5	-
1981	1	0	2	-	1	-	0	-	0	-	1	-
1982	1	-	1	-	1	-	1	-	1	-	1	1
1983	1	0	0	-	4	-	0	-	1	0	3	-
1984	1	0	0	-	7	-	4	-	1	-	4	-
1985	0	0	0	-	9	0	15	-	0	-	7	-
1990	3	0	2	-	29	2	14	-	3	0	39	-
1991	3	0	2	-	28	2	21	-	3	1	42	-
1992	11	1	11	48	19	6	10	0	4	1	49	62
1993	12	1	12	70	28	19	8	10	9	1	38	49
1994	6	1	6	65	35	20	18	2	5	2	47	-
1995	4	2	4	86	27	20	12	0	8	5	31	-
1996	4	2	4	73	24	9	6	1	3	4	35	-
1997	4	2	4	69	19	15	3	1	5	3	38	-
20nm												
1977	92	-	-	-	79	-	99	-	-	-	-	-
1978	38	12	32	-	73	-	52	-	50	-	-	-
1979	36	26	36	-	50	-	32	-	23	-	45	-
1980	18	5	16	-	24	-	18	-	38	-	9	-
1981	13	21	26	-	11	-	4	-	2	-	3	-
1982	13	3	8	-	20	-	12	-	18	-	11	9
1983	12	9	6	-	26	-	14	-	16	45	13	-
1984	4	1	3	-	30	-	18	-	15	8	18	-
1985	5	3	5	-	30	3	28	-	4	5	16	-
1986	4	5	4	-	1	1	3	-	2	5	-	-
1987	5	4	5	-	2	1	2	-	3	6	0	-
1990	5	2	4	-	55	3	28	-	9	8	60	-
1991	8	2	7	-	60	5	49	-	5	3	76	-
1992	23	5	23	92	49	15	29	2	10	7	74	94
1993	24	7	24	86	59	33	22	30	21	4	64	56
1994	15	5	14	92	73	29	50	16	14	10	77	-
1995	13	11	12	99	52	31	27	8	17	23	56	-
1996	14	8	13	96	51	27	15	5	11	14	66	-
1997	15	14	15	97	48	34	9	4	14	11	68	-

Table F3 (continued). **Percent of observed Bering Sea and Aleutian Islands** groundfish catch by gear and species caught within 10, 20, 40, 60 nautical miles of Steller sea lion terrestrial sites used to define critical habitat (western stock only), 1977-97.

	Total	Poll.	P.cod	Atka mack.	Sable fish	Rock sole	G. turb.	Yell. fin	Arrow tooth	Flat other	Rock fish	POP
1. Hook and Line (continued)												
40nm												
1977	100	-	-	-	100	-	100	-	-	-	-	-
1978	90	82	89	-	95	-	92	-	90	-	-	-
1979	64	47	59	-	85	-	63	-	59	-	79	-
1980	51	66	49	-	65	-	49	-	67	-	49	-
1981	51	59	77	-	51	-	36	-	7	-	34	-
1982	34	22	29	-	49	-	30	-	44	-	26	46
1983	48	55	55	-	55	-	30	-	47	85	29	-
1984	18	12	16	-	56	-	42	-	28	24	29	-
1985	24	7	24	-	40	9	33	-	13	27	27	-
1986	29	33	29	-	5	8	20	-	12	23	-	-
1987	28	22	29	-	10	10	11	-	16	27	6	-
1990	17	13	15	-	84	12	53	-	22	16	80	-
1991	20	8	19	-	86	13	66	-	13	9	86	-
1992	35	14	35	99	72	28	42	13	24	18	83	100
1993	43	21	43	89	87	57	42	74	36	12	78	99
1994	31	13	30	98	93	42	64	47	30	25	93	-
1995	32	26	32	100	77	43	43	29	38	36	76	-
1996	30	24	30	99	75	41	28	23	28	23	85	-
1997	34	31	34	99	72	53	21	14	33	26	83	-
60nm												
1977	100	-	-	-	100	-	100	-	-	-	-	-
1978	98	99	98	-	99	-	97	-	98	-	-	-
1979	79	65	77	-	92	-	78	-	72	-	88	-
1980	75	86	76	-	83	-	72	-	89	-	87	-
1981	89	84	96	-	90	-	84	-	90	-	91	-
1982	55	43	51	-	73	-	48	-	63	-	65	90
1983	65	71	74	-	71	-	43	-	65	93	59	-
1984	23	17	20	-	65	-	45	-	32	30	39	-
1985	34	12	35	-	54	14	38	-	26	42	28	-
1986	40	41	40	-	23	13	34	-	24	33	-	-
1987	44	36	44	-	27	16	19	-	32	40	9	-
1990	25	21	22	-	89	30	63	-	31	26	82	-
1991	29	14	27	-	92	18	76	-	23	41	90	-
1992	42	22	42	100	80	40	50	54	34	29	95	100
1993	48	24	48	97	93	66	53	99	42	14	83	99
1994	40	19	40	100	98	44	74	58	44	30	96	-
1995	46	35	45	100	85	54	48	44	51	44	80	-
1996	47	43	47	99	84	54	33	44	45	48	89	-
1997	45	46	45	100	81	63	29	29	47	34	87	-

Table F3 (continued). **Percent of observed Bering Sea and Aleutian Islands groundfish catch by gear and species caught within 10, 20, 40, 60 nautical miles of Steller sea lion terrestrial sites used to define critical habitat (western stock only), 1977-97.**

	Total	Poll.	P.cod	Atka mack.	Yell. fin	Arrow tooth
2. Pot						
10nm						
1990	6	-	6	-	-	-
1991	41	-	41	-	-	-
1992	42	18	42	-	3	-
1993	34	-	34	-	-	-
1994	36	-	36	67	-	-
1995	28	49	28	58	0	-
1996	28	32	28	58	1	35
1997	19	9	20	51	0	52
20nm						
1990	24	-	24	-	-	-
1991	84	-	84	-	-	-
1992	78	31	78	-	15	-
1993	77	-	77	-	-	-
1994	76	-	76	100	-	-
1995	65	70	65	98	1	-
1996	66	75	66	95	23	87
1997	61	25	61	96	14	76
40nm						
1990	46	-	46	-	-	-
1991	96	-	96	-	-	-
1992	92	86	92	-	68	-
1993	91	-	92	-	-	-
1994	94	-	94	100	-	-
1995	89	97	89	100	51	-
1996	92	91	92	100	70	95
1997	81	34	81	100	39	85
60nm						
1990	82	-	82	-	-	-
1991	98	-	98	-	-	-
1992	100	99	100	-	94	-
1993	100	-	100	-	-	-
1994	100	-	100	100	-	-
1995	96	99	96	100	93	-
1996	98	96	98	100	95	100
1997	88	41	88	100	54	93

Table F3 (continued). **Percent** of observed **Bering Sea and Aleutian Islands** groundfish catch by gear and species caught within 10, 20, 40, 60 nautical miles of Steller sea lion terrestrial sites used to define critical habitat (western stock only), 1977-97.

	Total	Poll.	P.cod	Atka mack.	Sable fish	Rock sole	G. turb.	Yell. fin	Arrow tooth	Flat other	Rock fish	POP
3. Trawl												
10nm												
1977	0	0	0	14	-	0	-	-	0	-	7	8
1978	0	0	1	0	1	0	0	-	0	0	8	10
1979	0	0	0	0	1	0	0	-	1	0	10	10
1980	0	0	1	3	0	0	0	0	0	0	4	2
1981	0	0	0	0	0	0	0	-	0	0	16	24
1982	2	0	17	70	16	2	1	0	1	0	12	6
1983	2	1	12	73	11	2	1	0	1	0	18	11
1984	2	1	9	78	26	2	1	0	4	0	10	35
1985	2	1	5	62	18	1	0	0	1	0	17	40
1986	4	2	7	78	32	2	0	1	4	0	28	65
1987	8	5	12	43	57	3	0	13	3	6	35	46
1988	5	5	4	20	28	5	1	6	4	1	24	38
1989	2	4	1	33	-	5	0	1	2	0	0	3
1990	6	4	11	84	38	2	23	0	18	2	29	26
1991	6	4	7	87	27	3	20	0	8	1	26	26
1992	2	1	4	11	9	1	6	0	1	0	11	7
1993	2	2	7	2	5	3	1	1	1	3	4	7
1994	2	2	5	7	11	3	6	0	6	1	5	5
1995	5	6	5	8	7	0	5	0	3	1	4	6
1996	4	3	5	10	14	0	9	0	4	0	8	4
1997	3	3	7	9	4	0	3	0	1	0	5	4
20nm												
1977	0	0	0	15	6	0	0	0	0	0	20	17
1978	1	0	2	11	10	2	2	0	2	0	30	32
1979	1	0	1	23	8	2	2	0	7	0	30	28
1980	1	1	6	33	9	4	0	0	2	0	21	31
1981	3	3	4	46	18	2	2	0	5	1	41	44
1982	6	4	22	80	26	3	3	0	4	1	41	27
1983	5	4	19	97	23	8	4	0	13	1	44	59
1984	6	5	12	88	39	3	7	0	15	1	17	54
1985	5	4	9	82	25	1	1	0	2	0	33	57
1986	8	7	10	85	44	7	0	7	7	1	37	89
1987	23	19	19	50	66	9	1	40	6	20	48	87
1988	16	16	8	46	45	11	12	21	12	5	75	86
1989	4	5	3	97	-	12	1	2	6	1	2	5
1990	26	25	20	91	64	8	61	7	44	11	57	51
1991	28	27	16	94	60	12	53	33	20	10	44	39
1992	14	14	15	28	49	8	50	13	12	7	29	32
1993	14	11	20	43	60	10	56	10	21	12	21	43
1994	14	11	17	68	58	16	47	5	25	5	70	48
1995	18	17	11	84	70	1	56	0	29	3	69	48
1996	16	13	19	74	87	2	68	1	27	3	64	48
1997	12	10	15	82	68	1	53	3	17	2	61	44

Table F3 (continued). Percent of observed Bering Sea and Aleutian Islands groundfish catch by gear and species caught within 10, 20, 40, 60 nautical miles of Steller sea lion terrestrial sites used to define critical habitat (western stock only), 1977-97.

	Total	Poll.	P.cod	Atka mack.	Sable fish	Rock sole	G. turb.	Yell. fin	Arrow tooth	Flat other	Rock fish	POP
3. Trawl (continued)												
40nm												
1977	11	11	13	92	27	10	5	0	10	6	83	40
1978	7	7	13	26	27	5	7	0	15	3	51	50
1979	5	5	8	88	33	8	5	1	16	3	60	67
1980	6	6	28	97	29	11	4	0	11	2	53	79
1981	14	15	12	100	36	6	9	1	12	6	57	75
1982	18	18	36	97	53	8	17	1	12	7	64	73
1983	18	18	30	99	49	20	24	4	28	6	69	85
1984	15	15	30	91	58	13	25	1	24	4	56	78
1985	18	19	28	84	64	6	11	1	10	3	43	91
1986	22	23	32	85	59	21	2	11	19	4	44	93
1987	49	49	49	50	74	30	3	52	17	28	57	89
1988	41	46	52	47	61	25	49	33	48	9	76	88
1989	21	19	54	100	-	51	13	11	20	9	70	37
1990	46	44	63	95	84	40	82	15	63	34	91	76
1991	51	52	43	99	76	34	79	47	38	23	61	46
1992	44	45	47	84	85	33	65	22	33	22	68	85
1993	46	45	58	67	99	51	73	18	48	31	36	83
1994	42	43	46	80	89	40	87	8	43	16	83	90
1995	44	44	55	95	96	48	88	1	59	10	87	89
1996	45	45	54	88	96	37	80	1	51	11	85	75
1997	37	36	55	95	88	29	70	5	45	16	84	78
60nm												
1977	20	20	22	99	66	18	14	6	23	12	87	50
1978	17	18	24	99	44	14	16	1	40	10	80	74
1979	15	15	16	99	57	16	14	3	27	10	70	76
1980	14	14	36	97	51	28	12	3	17	7	67	87
1981	37	42	32	100	45	26	18	3	25	19	68	85
1982	35	36	47	100	64	19	29	8	29	19	67	75
1983	32	34	40	99	56	38	34	9	33	13	74	89
1984	25	24	39	100	67	23	35	12	27	9	67	83
1985	31	33	42	100	71	21	17	9	14	8	82	95
1986	36	38	45	100	83	29	4	14	41	9	86	94
1987	72	75	68	100	88	54	6	57	33	35	99	93
1988	59	69	76	100	67	41	85	35	72	13	100	99
1989	59	44	84	100	-	75	32	75	36	28	78	81
1990	54	51	76	100	90	77	90	23	72	54	97	79
1991	62	63	59	100	85	62	88	52	49	37	66	49
1992	64	66	60	100	98	63	65	36	43	36	96	90
1993	74	75	78	100	100	87	87	31	60	47	86	88
1994	65	67	75	100	95	77	96	13	52	28	100	93
1995	68	72	75	100	99	69	94	2	70	18	94	92
1996	64	66	77	100	100	62	94	10	72	24	100	87
1997	59	62	81	100	97	57	80	13	68	30	99	99

Table F4. **Percent** of observed **Bering Sea and Aleutian Islands** groundfish **trawl** catch by species caught within 10 nm year-round of Steller sea lion rookeries west of 150°W and 20 nm from January 1 - April 15 at six rookeries in the central and eastern Aleutian Islands, 1977-97.

	Total	Poll.	P.cod	Atka mack.	Sable fish	Rock sole	G. turb.	Yell. fin	Arrow tooth	Flat other	Rock fish	POP
1977	0	0	0	5	-	-	-	-	0	-	3	6
1978	0	0	1	0	1	0	0	-	0	-	3	5
1979	0	0	0	1	1	0	0	-	1	0	10	10
1980	0	0	5	3	0	2	0	0	0	0	3	3
1981	0	0	0	4	4	0	1	-	1	0	4	14
1982	2	0	18	69	14	2	0	0	1	0	3	5
1983	2	0	11	69	10	4	0	0	1	0	1	4
1984	2	1	10	76	25	2	0	0	4	0	9	24
1985	2	1	5	61	17	1	0	0	1	0	16	39
1986	4	2	6	73	27	3	0	0	3	0	27	51
1987	6	6	9	41	54	2	0	0	2	0	32	41
1988	3	4	4	19	27	5	1	0	3	0	24	37
1989	3	4	2	22	-	6	0	1	2	0	0	2
1990	6	5	10	70	38	4	27	0	17	2	14	14
1991	8	7	10	88	35	3	19	0	7	1	22	21
1992	0	0	1	1	-	0	0	0	1	0	1	1
1993	0	0	0	1	2	0	4	0	0	0	1	2
1994	0	0	0	1	1	0	1	0	3	0	1	0
1995	0	0	0	2	1	0	0	0	0	0	2	0
1996	0	0	0	0	1	0	3	0	2	0	1	0
1997	0	0	0	3	-	0	0	0	0	0	1	0

Table F5. Percent of observed Gulf of Alaska groundfish catch by species and gear west of 142°W longitude caught within 10, 20, 40, 60 nautical miles of Steller sea lion terrestrial sites used to define critical habitat (western stock only), 1977-97.

	Total	Poll.	P.cod	Sable fish	Rock sole	G. turb.	Arrow tooth	Flat other	Rock fish
1. Hook and Line									
10nm									
1979	1	0	1	1	-	-	2	1	0
1980	2	0	2	0	-	-	0	-	0
1981	1	0	1	0	-	-	0	-	0
1983	0	0	0	1	-	-	0	0	0
1984	0	0	0	1	0	-	0	-	0
1985	0	0	0	-	-	-	-	-	-
1990	6	15	18	0	-	-	2	3	2
1991	5	-	11	0	-	-	1	-	0
1992	18	47	26	1	-	8	9	9	3
1993	5	6	15	1	-	-	1	1	1
1994	8	-	18	0	-	-	1	-	0
1995	4	6	7	0	-	0	4	1	0
1996	6	5	14	1	-	-	2	1	1
1997	3	9	7	1	-	-	2	1	5
20nm									
1977	10	-	-	10	-	-	-	-	11
1978	8	2	8	7	-	35	9	-	8
1979	17	4	20	13	-	-	7	7	13
1980	13	6	15	6	-	-	6	-	9
1981	24	23	26	15	-	-	15	-	20
1982	20	16	22	11	-	-	12	11	29
1983	18	13	19	15	-	-	11	12	19
1984	27	23	27	27	46	-	18	15	43
1985	29	24	29	-	-	-	31	-	-
1986	37	26	38	-	51	-	25	32	39
1990	31	79	82	5	-	-	7	10	8
1991	35	-	64	11	-	-	11	-	14
1992	39	64	53	11	-	18	20	15	17
1993	28	36	64	11	-	-	11	4	13
1994	34	-	62	12	-	-	24	-	9
1995	31	36	52	9	-	7	20	11	22
1996	20	26	39	8	-	-	14	4	12
1997	25	23	61	8	-	6	7	30	14

Table F5 (continued). **Percent of observed Gulf of Alaska** groundfish catch by species and gear west of 142°W longitude caught within 10, 20, 40, 60 nautical miles of Steller sea lion terrestrial sites used to define critical habitat (western stock only), 1977-97.

	Total	Poll.	P.cod	Sable fish	Rock sole	G. turb.	Arrow tooth	Flat other	Rock fish
1. Hook and Line (continued)									
40nm									
1977	47	-	-	47	-	-	-	-	45
1978	60	72	69	45	-	75	55	-	52
1979	68	88	80	52	-	-	58	48	56
1980	64	46	69	45	-	100	48	-	48
1981	81	84	85	65	-	-	79	-	79
1982	73	72	76	61	-	-	74	66	80
1983	79	81	83	57	-	-	70	72	58
1984	92	94	92	82	97	-	83	60	94
1985	100	100	100	-	-	-	100	-	-
1986	99	100	99	-	100	-	94	99	93
1990	60	82	98	41	-	-	45	25	39
1991	76	-	98	58	-	-	72	-	63
1992	85	98	99	54	-	63	68	73	63
1993	65	100	97	49	-	-	51	29	51
1994	69	-	97	46	-	-	61	-	49
1995	76	99	100	50	-	70	71	60	67
1996	71	96	98	52	-	-	67	75	61
1997	63	32	95	46	-	40	68	73	59
60nm									
1977	53	-	-	53	-	-	-	-	53
1978	90	100	100	72	-	85	93	-	78
1979	91	100	100	81	-	-	87	78	82
1980	95	99	98	83	-	100	89	-	86
1981	98	99	99	94	-	-	97	-	96
1982	96	99	99	85	-	-	95	86	94
1983	97	99	99	83	-	-	98	98	76
1984	100	100	100	100	100	-	100	100	100
1985	100	100	100	-	-	-	100	-	-
1986	100	100	100	-	100	-	100	100	100
1990	82	97	100	72	-	-	82	53	73
1991	92	-	100	86	-	-	98	-	88
1992	96	99	100	86	-	100	91	97	92
1993	84	100	99	78	-	-	77	92	75
1994	92	-	100	85	-	-	87	-	82
1995	92	100	100	82	-	100	94	94	90
1996	90	100	100	82	-	-	94	96	89
1997	86	99	97	79	-	58	92	94	85

Table F5 (continued). Percent of observed Gulf of Alaska groundfish catch by species and gear west of 142°W longitude caught within 10, 20, 40, 60 nautical miles of Steller sea lion terrestrial sites used to define critical habitat (western stock only), 1977-97.

	Total	Poll.	P.cod
2. Pot			
10nm			
1990	42	-	42
1991	33	-	33
1992	35	-	35
1993	19	-	19
1994	28	61	27
1995	27	48	27
1996	21	-	21
1997	46	-	46
20nm			
1990	83	-	83
1991	76	-	76
1992	90	-	90
1993	60	-	60
1994	94	91	94
1995	62	50	62
1996	65	-	65
1997	72	-	72
40nm			
1990	100	-	100
1991	100	-	100
1992	100	-	100
1993	100	-	100
1994	100	100	100
1995	97	52	97
1996	98	-	98
1997	100	-	100
60nm			
1990	100	-	100
1991	100	-	100
1992	100	-	100
1993	100	-	100
1994	100	100	100
1995	100	100	100
1996	100	-	100
1997	100	-	100

Table F5 (continued). **Percent** of observed **Gulf of Alaska** groundfish catch by species and gear west of 142°W longitude caught within 10, 20, 40, 60 nautical miles of Steller sea lion terrestrial sites used to define critical habitat (western stock only), 1977-97.

	Total	Poll.	P.cod	Atka mack.	Sable fish	Rock sole	G. turb.	Yell. fin	Arrow tooth	Flat other	Rock fish	POP
3. Trawl												
10nm												
1978	0	0	0	0	-	-	-	-	0	0	0	0
1979	0	0	0	-	-	0	-	-	0	0	-	-
1980	4	3	30	1	2	0	-	-	8	39	3	2
1981	2	2	0	0	0	0	-	-	0	-	0	0
1982	17	19	2	-	0	4	1	-	0	0	0	0
1983	16	16	12	4	6	25	0	40	5	18	1	1
1984	15	16	13	0	4	13	0	21	10	11	1	4
1985	53	55	29	0	12	17	-	37	19	24	5	2
1986	35	36	15	-	2	34	-	-	5	20	1	0
1987	6	2	13	-	5	16	-	22	5	17	1	0
1988	11	11	13	-	2	15	-	-	9	5	11	-
1989	100	100	100	-	-	-	-	-	-	-	-	-
1990	13	12	33	0	1	31	1	40	7	8	1	2
1991	16	21	23	8	1	20	94	28	3	3	0	0
1992	10	16	12	0	1	26	0	61	4	13	0	0
1993	22	34	20	2	0	48	-	-	4	8	0	1
1994	16	23	15	2	1	39	96	3	3	6	0	0
1995	11	11	20	3	1	41	0	9	6	9	0	0
1996	15	22	17	0	0	50	-	61	5	9	0	0
1997	21	27	29	1	1	45	-	21	8	15	0	0
20nm												
1977	3	2	3	0	2	1	-	-	1	0	9	12
1978	4	3	3	4	1	7	-	-	6	10	6	9
1979	6	6	9	1	6	10	-	-	8	7	5	11
1980	21	19	56	12	9	41	-	-	19	59	8	16
1981	21	24	6	8	6	5	-	-	6	6	4	11
1982	46	50	17	17	20	24	1	-	5	1	8	19
1983	54	57	48	12	20	79	0	95	17	52	10	14
1984	40	41	47	2	21	54	1	42	37	44	4	14
1985	76	77	61	78	36	70	-	79	48	57	64	15
1986	79	80	50	-	10	57	-	-	41	65	16	1
1987	13	5	22	0	7	32	-	47	16	53	6	1
1988	49	68	55	-	21	38	-	-	53	26	32	-
1989	100	100	100	-	-	-	-	-	-	-	-	-
1990	48	65	59	2	15	64	16	84	30	33	15	19
1991	47	47	74	99	4	69	99	71	17	21	7	16
1992	59	63	73	99	11	67	7	94	28	33	11	28
1993	58	75	47	80	4	76	-	-	22	24	8	17
1994	57	70	55	84	5	72	97	6	34	30	17	10
1995	51	63	64	44	11	75	0	26	25	32	5	29
1996	49	67	62	77	7	75	-	75	24	23	3	25
1997	52	61	66	98	6	77	-	55	31	36	5	23

Table F5 (continued). **Percent of observed Gulf of Alaska** groundfish catch by species and gear west of 142°W longitude caught within 10, 20, 40, 60 nautical miles of Steller sea lion terrestrial sites used to define critical habitat (western stock only), 1977-97.

	Total	Poll.	P.cod	Atka mack.	Sable fish	Rock sole	G. turb.	Yell. fin	Arrow tooth	Flat other	Rock fish	POP
3. Trawl (continued)												
40nm												
1977	61	62	60	75	47	44	-	-	56	49	47	63
1978	49	52	48	5	29	91	-	-	45	44	40	45
1979	82	82	87	98	57	93	-	-	66	66	56	45
1980	84	84	92	99	80	97	-	-	69	87	48	63
1981	85	88	54	97	75	62	-	-	59	49	44	53
1982	89	92	76	98	70	78	99	-	53	22	39	48
1983	82	82	82	85	72	98	32	100	63	80	56	71
1984	88	88	97	96	91	99	49	100	90	94	70	87
1985	98	98	98	100	97	98	-	91	97	98	98	86
1986	100	100	99	-	99	99	-	-	99	100	99	98
1987	99	99	99	100	99	99	-	100	97	99	97	87
1988	94	94	98	-	97	95	-	-	89	86	100	-
1989	100	100	100	-	-	-	-	-	-	-	-	-
1990	87	98	97	100	54	98	85	100	78	75	55	65
1991	93	96	99	100	64	99	99	99	82	77	87	73
1992	90	97	98	100	50	99	17	99	81	64	53	81
1993	89	99	96	100	47	98	-	-	69	61	60	52
1994	90	99	96	100	45	98	97	100	69	67	73	29
1995	89	98	97	100	47	98	100	100	64	67	59	72
1996	83	96	94	96	41	96	-	94	69	63	47	50
1997	88	98	97	100	40	98	-	57	83	75	41	60
60nm												
1977	90	91	93	89	75	100	-	-	88	94	69	89
1978	96	98	96	98	92	100	-	-	88	84	84	74
1979	96	97	97	99	82	100	-	-	89	87	65	78
1980	97	98	98	100	88	100	-	-	82	93	69	77
1981	99	99	99	100	93	99	-	-	84	97	94	92
1982	98	99	96	100	92	99	99	-	91	93	80	85
1983	99	99	98	100	95	100	100	100	92	97	92	93
1984	100	100	100	100	99	100	100	100	98	99	87	92
1985	100	100	100	100	100	100	-	100	100	100	100	100
1986	100	100	100	-	100	100	-	-	100	100	100	100
1987	100	100	100	100	100	100	-	100	100	100	100	100
1988	100	100	100	-	100	100	-	-	100	100	100	-
1989	100	100	100	-	-	-	-	-	-	-	-	-
1990	93	99	99	100	77	100	98	100	92	88	75	77
1991	97	99	100	100	90	100	99	100	92	89	95	79
1992	95	99	99	100	81	100	18	100	93	77	69	85
1993	93	100	97	100	74	100	-	-	82	70	69	60
1994	96	100	98	100	77	100	100	100	90	86	86	54
1995	94	99	99	100	79	100	100	100	85	85	74	83
1996	92	99	99	100	73	100	-	94	91	87	58	59
1997	93	99	99	100	57	99	-	60	93	85	55	75

Table F6. **Percent** of observed **Gulf** of **Alaska** groundfish **trawl** catch by species caught within 10 nm year-round of Steller sea lion rookeries west of 142°W and 20 nm from January 1 - April 15 at three rookeries in the eastern Aleutian Islands, 1977-97.

	Total	Poll.	P.cod	Atka mack.	Sable fish	Rock sole	G. turb.	Yell. fin	Arrow tooth	Flat other	Rock fish	POP
1980	0	0	3	-	-	0	-	-	0	-	-	-
1983	0	0	3	-	0	3	-	3	0	3	0	0
1984	0	0	0	0	0	0	-	-	0	0	0	4
1985	0	0	3	-	2	1	-	-	2	3	1	-
1986	0	0	2	-	-	3	-	-	0	0	-	0
1987	0	0	0	-	5	0	-	-	0	0	-	-
1988	1	0	3	-	-	0	-	-	0	0	-	-
1989	33	3	97	-	-	-	-	-	-	-	-	-
1990	3	2	6	0	0	5	-	3	4	2	0	2
1991	7	3	23	9	1	33	46	9	1	0	0	0
1992	5	2	20	0	0	27	2	1	0	1	0	-
1993	0	0	1	2	-	0	-	-	0	0	0	0
1994	1	1	0	2	0	0	96	-	0	0	0	0
1995	1	2	1	0	0	1	0	0	0	0	0	0
1996	2	5	1	0	-	1	-	3	0	0	0	0
1997	2	3	2	-	0	2	-	-	0	1	-	-

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