North Pacific Fishery Management Council

Richard B. Lauber, Chairman
Clarence G. Pautzke, Executive Director

605 West 4th Avenue
Anchorage, Alaska 99501

Mailing Address: P.O. Box 103136
Anchorage, Alaska 99510

Telephone: (907) 271-2809
FAX: (907) 271-2817

May 6, 1992

Dear Reviewer:

The North Pacific Fishery Management Council requests your comments on proposed amendments to the Gulf of Alaska groundfish fishery management plan. The amendment package includes the following proposed measures: (1) Extend the sunset date for the king crab protection zones near Kodiak Island, and (2) Close the Eastern Gulf of Alaska east of 140°W longitude to trawl gear. The enclosed Environmental Assessment/Regulatory Impact Review/Initial Regulatory Flexibility Analysis describes the proposed amendments and alternatives to be considered by the Council.

The comment period began on May 6 with the distribution of the Notice of Availability. All written comments should be received at the Council office by 5:00 p.m., ADT, Monday, June 8, 1992. At their meeting June 23-28 in Sitka, Alaska, the Council will review comments received and choose their preferred alternatives before sending the amendment to the Secretary of Commerce for review.

If you have questions concerning the amendment proposals, please contact Brent Paine at 907-271-2809.

Sincerely,

Clarence G. Pautzke
Executive Director

enclosure

Dr Rev/Am 26

HLA/CORR

DRAFT FOR PUBLIC REVIEW

ENVIRONMENTAL ASSESSMENT/REGULATORY IMPACT REVIEW/ INITIAL REGULATORY FLEXIBILITY ANALYSIS

FOR
AMENDMENT 26
TO THE FISHERY MANAGEMENT PLAN FOR
THE GROUNDFISH FISHERY OF THE GULF OF ALASKA AREA

Prepared by
the Staffs of the North Pacific Fishery Management Council,
the Alaska Department of Fish and Game and
LGL Alaska Research Associates, Inc.

Anchorage, Alaska

May 7, 1992

TABLE OF CONTENTS

1.0 INTRODUCTION 1-1
1.1 Management Background 1-1
1.2 List of Amendment Proposals 1-1
1.3 Purpose of the Document 1-2
1.4.1 Environmental Assessment 1-2
1.4.2 Regulatory Impact Review 1-2
1.5 Description of the Groundfish Fisheries 1-3

2.0 PROHIBIT TRAWL GEAR FROM FISHING FOR GROUNDFISH IN THE EASTERN GULF OF ALASKA 2-1
2.1 Need for Action and History of the Proposal 2-1
2.2 The Problem 2-3
2.3 Background 2-4
2.4 The Alternatives 2-4
2.4.1 Alternative 1: No action. 2-4
2.4.1.1 Option: Establish a framework procedure for setting time/area restrictions by gear and species group. 2-7
2.4.2 Alternative 2: Prohibit all groundfish trawling in waters east of 140 W. long. 2-7
2.4.2.1 Option: Close only waters east of 137 W. long. to groundfish trawling. 2-7
2.4.3 Alternative 3: Prohibit on-bottom trawling only. 2-7
2.4.4 Alternative 4: Establish separate TACs by FMP species group for the new Southeast District. 2-8
2.4.4.1 Option: Consider allocating the TACs of all species to trawl and longline gear based on past participation or some other criteria. 2-8
2.5 Description of the Fishery 2-8
2.5.1 History of the Fishery 2-8
2.5.2 Recent Fishery, 1981-1991 2-10
2.5.3 Management Overview and Review of the 1990 and 1991 Fisheries 2-10
2.5.3.1 Harvest Objectives 2-14
2.5.3.2 Acceptable Biological Catch (ABC) Considerations 2-14
2.5.3.3 The 1990 and 1991 Fisheries 2-20
2.5.4 Economic Review of the 1990 and 1991 Fisheries 2-31
2.5.4.1 Number of Vessels Reporting Groundfish Landings in 1990 and 1991 2-31
2.5.4.2 Quantity of Harvest Retained for Processing 2-33
2.5.4.3 Landings and Gross Revenues to the Shore-based Fleet 2-38
2.5.4.4 Markets and Market Price for Eastern Gulf Groundfish Products 2-42
2.5.4.5 Estimated Gross Revenues from Processed Eastern Gulf Groundfish in 1990 2-45
2.6 Bycatch and Habitat Considerations 2-45
2.6.1 Bycatch Considerations 2-45
2.6.2 Habitat Considerations 2-45
2.6.3 Marine Mammal Considerations 2-51

TABLE OF CONTENTS (continued)

2.7 Socioeconomic Considerations 2-52
2.8 Impacts of the Alternatives 2-54
2.8.1 Alternative 1: No action. 2-54
2.8.1.1 Biological and Environmental Impacts 2-54
2.8.1.2 Economic Impacts 2-55
2.8.2 Alternative 2: Prohibit all groundfish trawling in waters east of 140 W. longitude. 2-58
2.8.2.1 Biological and Environmental Impacts 2-58
2.8.2.2 Economic Impacts 2-60
2.8.3 Alternative 3: Prohibit on-bottom trawling only in the Southeast Outside District. 2-66
2.8.3.1 Biological and Environmental Impacts 2-66
2.8.3.2 Economic Impacts 2-66
2.8.4 Alternative 4: Establish separate TACs by FMP species group for the new Southeast Outside District. 2-67
2.8.4.1 Biological and Environmental Impacts 2-67
2.8.4.2 Economic Impacts 2-68
2.9 Conclusions 2-68
2.9.1 Biological and Environmental Considerations 2-69
2.9.2 Redistribution of Costs and Benefits and Other Economic Considerations 2-71
2.9.2.1 Administrative, Enforcement, and Information Costs 2-73
2.9.2.2 Reporting Costs 2-73
2.10 References 2-74
2.11 Consultation with Others 2-77
2.12 List of Preparers 2-77

3.0 RE-ESTABLISH THE CRAB PROTECTION TIME/AREA CLOSURES AROUND KODIAK ISLAND 3-1
3.1 Description of and Need for the Action 3-1
3.2 The Alternatives 3-3
3.2.1 Alternative 1: Status Quo - Do nothing. 3-3
3.2.2 Alternative 2: Extend existing time/area closure measures for another three years. 3-4
3.2.3 Alternative 3: Implement a permanent time/area closure scheme for non-pelagic trawling. 3-4
3.3 Biological and Physical Impacts 3-4
3.3.1 Alternative 1: Status Quo - Do nothing. 3-5
3.3.2 Alternative 2: Extend existing time/area closure measures for another three years. 3-6
3.3.3 Alternative 3: Implement a permanent time/area closure scheme for non-pelagic trawling. 3-6
3.4 Socioeconomic Impacts 3-6
3.4.1 Reporting Costs 3-9
3.4.2 Administrative, Enforcement, and Information Costs and Benefits 3-9
3.4.3 Impacts on Consumers 3-10
3.4.4 Redistribution of Costs and Benefits 3-10
3.4.5 Benefit-Cost Conclusion 3-10

TABLE OF CONTENTS (continued)

3.5 References 3-10
3.6 List of Preparers 3-11

APPENDIX 1. Alaska Longline Fishermen's Association — Request for Closure of the Eastern Gulf to Trawling

APPENDIX 2. PacFIN Catch Tables 1981-1991

APPENDIX 3. A Reanalysis of the 1987 and 1990 Triennial Trawl Surveys of the Eastern Gulf of Alaska, in Response to a Proposal to Prohibit Trawling East of 140 W. Longitude. By NMFS Auke Bay Laboratory

1.0 INTRODUCTION

1.1 Management Background

The domestic and joint venture groundfish fisheries in the exclusive economic zone (3-200 miles offshore) in the waters off Alaska are managed under two Fishery Management Plans (FMP); one for the Bering Sea/Aleutian Islands (BS/AI), and the second for the Gulf of Alaska (GOA). These FMPs were developed by the North Pacific Fishery Management Council (Council) under the Magnuson Fishery Conservation and Management Act (Magnuson Act). The GOA groundfish FMP was approved by the Secretary of Commerce and became effective in 1978.

The Council solicits public recommendation for amending the GOA or the BSAI groundfish FMPs on an annual basis. Amendment proposals are then reviewed by the Council's GOA and BSAI groundfish FMP Plan Teams (PT), Plan Amendment Advisory Group (PAAG), Advisory Panel (AP), and Scientific and Statistical Committee (SSC). These advisory bodies make recommendations to the Council on which proposals merit consideration for plan amendment.

Amendment proposals and appropriate alternatives accepted by the Council are analyzed by the Groundfish Plan Teams or other staff analytical teams for their efficacy and for their potential biological and socioeconomic impacts. After reviewing this analysis, the Council, Advisory Panel (AP), and Scientific and Statistical Committee (SSC) will make recommendations as to whether the amendment alternatives should be changed in any way, whether and how the analysis should be refined, and whether to release the analysis for general public review and comment. If an amendment proposal and accompanying analysis is released for public review, the AP, SSC, and the Council consider subsequent public comments before the Council decides whether to submit the proposals to the Secretary of Commerce for approval and implementation.

This document analyzes proposed Amendment 26 to the GOA groundfish FMP. This amendment package is being developed as part of the Council's annual amendment cycle. From a list of potential bycatch management alternatives submitted in response to the Council's annual solicitation for proposals, the Council selected those included in this draft EA/RIR/IRFA for analysis in 1992.

The tentative schedule for this alternative is as follows: (1) the draft analysis for this amendment will be reviewed by the Council in April; (2) it will be revised as directed by the Council; (3) it will be released for public comment in May; (4) the Council will be able to take final action on this amendment in June; and (5) if those recommendations are approved by the Secretary, the amendment regulations could be in place for the start of the 1993 fishery.

1.2 List of Amendment Proposals

At its September, 1991 meeting, The Council identified five amendment proposals for analysis as part of the Council's annual amendment cycle. Two of those comprise Amendment 26 to the Gulf of Alaska Groundfish FMP:

1. Prohibit trawl gear from fishing for groundfish in waters east of 140 degrees West longitude in the eastern Gulf of Alaska.

2. Re-establish the crab protection time/area closures around Kodiak Island.

1.3 Purpose of the Document

This document provides background information and assessments necessary for the Secretary of Commerce to determine if the Amendment is consistent with the Magnuson Act and other applicable law. It also provides the public with information to assess the alternatives that are being considered and to comment on the alternatives. These comments will enable to Council and Secretary to make more informed decisions concerning the resolution of the management problems being addressed.

1.4.1 Environmental Assessment

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

1.4.2 Regulatory Impact Review

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

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

This RIR analyzes the impacts of proposed changes to the BS/AI bycatch management regime. The SAFE document and its appendix provide a description of and an estimate of the number of vessels and processors (small entities) to which regulations implementing these amendments would apply.

1.5 Description of the Groundfish Fisheries

The most recent description of the groundfish fishery is contained in the Draft Economic Status of the Groundfish Fisheries off Alaska, 1991, an appendix to the Draft SAFE documents for the GOA groundfish fisheries for 1992. The draft includes information on the catch and value of the fisheries, the numbers and sizes of fishing vessels and processing plants, and other economic variables that describe or affect the performance of the fisheries.

2.0 PROHIBIT TRAWL GEAR FROM FISHING FOR GROUNDFISH IN THE EASTERN GULF OF ALASKA

2.1 Need for Action and History of the Proposal

In February 1991, the North Pacific Fishery Management Council was presented with a request for emergency rule-making to prohibit trawl groundfish fisheries in waters east of 140°W. long. (then known as the East Yakutat and Southeast Outside Districts). Submitted by the Alaska Longline Fishermen's Association (ALFA), the proposed emergency action was in response to the reported high bycatches (93 mt) of demersal shelf rockfish (DSR) attributed to the trawl fishery targeting on Pacific Ocean perch (POP) and shortraker/rougheye rockfish. While some bycatch of DSR is expected and included in the Alaska Department of Fish & Game's (ADF&G) quota management calculations, the apparent high rate and total quantity appeared to threaten the opening of a longline fishery on DSR species customarily scheduled for later in the year. The 1991 Total Allowable Catch (TAC) of DSR for the Southeast Outside District was 425 mt. In addition, other concerns with trawl fishing in this region were presented in support of the proposed closure.

While there exists no specific allocation of DSR between gear types, trawlers have been restricted to no more than 10% bycatch of DSR in the Southeast Outside District since 1990 and were further restricted to no more than 1% of DSR in the target fisheries for other rockfish and deep water flatfish in 1992 (see section 2.4.1 [B]). Since DSR species are found in greatest abundance on the continental shelf in areas usually unsuitable for trawling, this does not create an operational impediment to the trawl vessels. As a result, this species group has been targeted almost exclusively by relatively small longline vessels which service several on-shore processing plants. Similarly, slope rockfish and some pelagic shelf rockfish species have customarily been targeted by trawl vessels where abundance and effectiveness of trawl gear have produced a valuable fishery.

In March 1991 the National Marine Fisheries Service (NMFS) announced that they had discovered an error in the DSR catch data, apparently due to misreporting by fishermen. Most of the catch earlier categorized as DSR were actually rockfish belonging to the other species categories. The NMFS correction brought the DSR bycatch down from 93 mt to 15 mt; a level considered more acceptable by state and federal managers. There was no longer the immediate threat of the trawl fleet taking a large portion of the DSR TAC and thereby curtailing the directed longline rockfish fishery.

In April 1991, the Council reviewed ALFA's emergency rule request and follow-up plan amendment to prohibit trawling in the portion of the Eastern Gulf, east of 140°W. longitude (Figure 1). ALFA's expanded rationale for the proposed action was "to protect the marine resources, the traditional fisheries, and the socioeconomic health of coastal communities" given that "the intended level of effort by factory trawlers in the Eastern Gulf is unprecedented". The Council approved the emergency rule but it was not implemented because NMFS determined that the objective of reducing trawl fishery impacts on longline fisheries could be achieved by lowering the DSR directed fishing standard. In the interim, NMFS did implement a rule on July 26 which closed waters east of 137°W. long. to trawling. This interim action was taken to

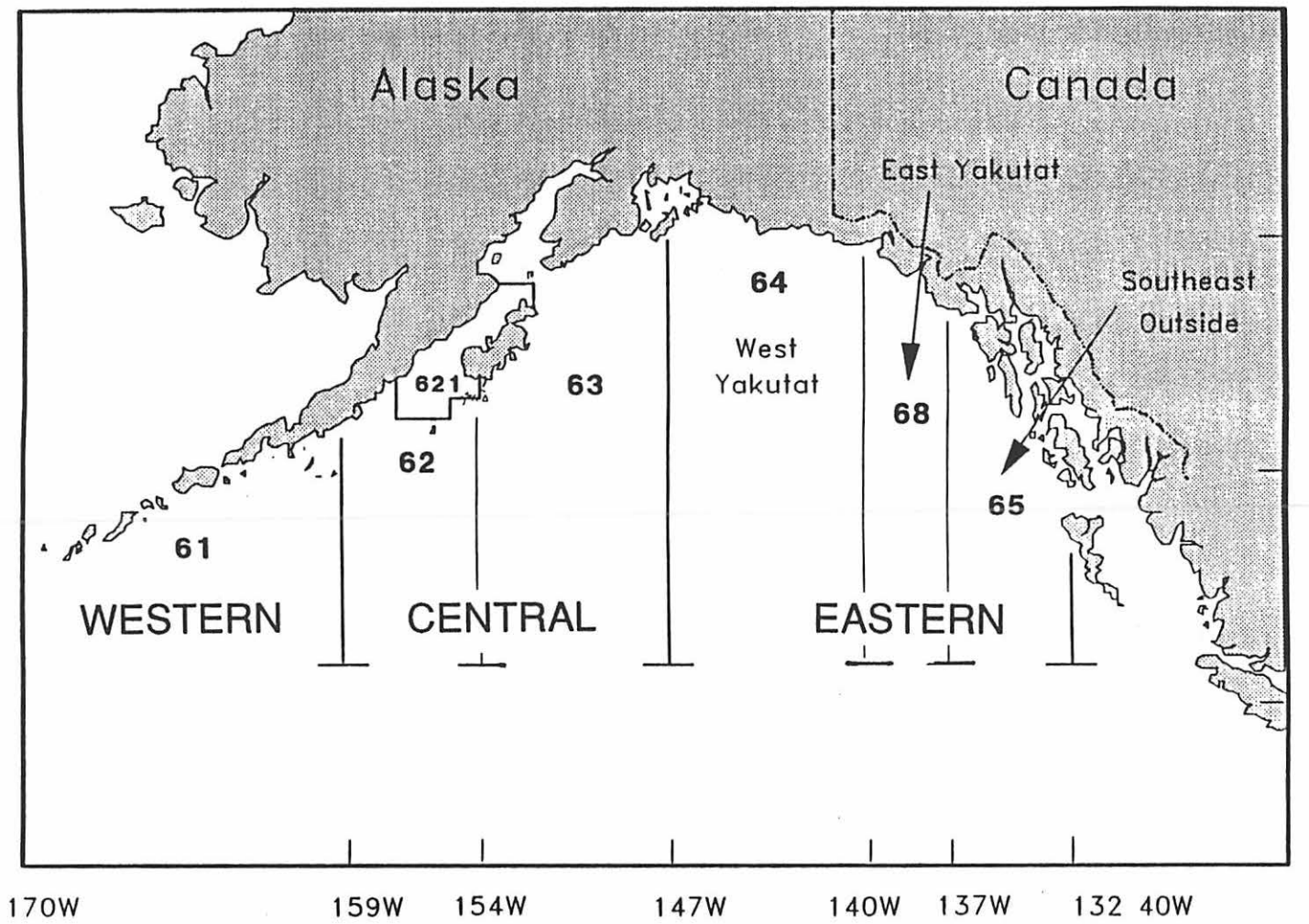


Figure 1. Regulatory and reporting areas of the Gulf of Alaska.

assure that trawl bycatch would not exceed the overfishing level of DSR, a situation which could have preempted the fall halibut fishery where some rockfish is taken incidentally.

With reference to ALFA's plan amendment proposal, the Council directed the Bycatch Committee to consider the proposal as part of its comprehensive package to be presented to the Council at its September 1991 meeting. In September the Council reviewed all the groundfish proposals submitted for the 1992 amendment cycle and approved the ALFA proposal for analysis. Given the limitations of Council and NMFS staff to perform this analysis due to other assignments, the Alaska Department of Fish and Game (ADF&G) was requested by Council staff to undertake the task of producing an EA/RIR for the proposed amendment.

The domestic groundfish fisheries in the federal waters of the Eastern Gulf are managed by the Secretary of Commerce under the Gulf of Alaska Groundfish Fishery Management Plan (FMP). The FMP was prepared by the Council under the authority of the Magnuson Fishery Conservation and Management Act (MFCMA). It is implemented by regulations for the U.S. fishery at 50 CFR part 672 with additional regulations found at 50 CFR part 620. To approve and implement the proposed trawl closure, or one of the alternatives, the Council must develop a plan amendment which includes an analysis, take public comment, and approve a preferred alternative. The Council then forwards their recommendations to the Secretary for review. Secretarial approval is required to implement the Council's decision.

2.2 The Problem

A multifaceted problem, whether real or perceived, exits in areas of the Eastern Gulf of Alaska which in the proposers mind can only be remedied by a prohibition on trawling in groundfish fisheries. ALFA has submitted a problem statement (Appendix 1) which can be summarized as follows:

(1) An anticipation of unprecedented levels of factory trawler participation in the Southeast Outside District (e.g., waters east of 137°W. long.) during 1991 and even greater future expansions.

(2) Concern with further depletion of Eastern Gulf rockfish stocks which are still considered by many to be depressed.

(3) Concern over high trawl bycatch levels of salmon in the Eastern Gulf.

(4) Concern over potential declines of marine mammals and seabirds as a result of trawl fishing activity in the Eastern Gulf.

(5) Concern over the potential impacts of trawling on deep water corals and benthic habitat.

(6) Grounds preemption and economic displacement of the local shore-based hook and longline fleet which is competing with trawl vessels for a limited groundfish resource.

(7) Concern that trawl harvests could exceed the TACs for some species thus potentially curtailing important traditional fisheries for groundfish and halibut.

The Council requested ADF&G to examine each of the stated problems and concerns and evaluate the biological and economic tradeoffs of the trawl closure and other alternatives in addressing the problems identified by ALFA. ADF&G has reviewed the existing data on the biological distribution and the harvest of the groundfish resource in the Eastern Gulf to determine if a trawl closure is warranted. The following analysis attempts to examine the extent of gear conflicts, bycatch problems, and localized depletion of nonmigratory species. The benefit of rebuilding rockfish stocks depleted by foreign fisheries is also examined. The resulting analysis was prepared to satisfy federal requirements customarily fulfilled by plan amendment documents. The intent is to scope out the issues, explore the alternatives, and identify other related subjects which may warrant further investigation and analysis.

2.3 Background

One underlying issue of this proposal is the concern of one fishery or gear type adversely impacting local southeast Alaska vessels. This is not a new issue. Managers widely agree that overfishing of POP occurred in the Gulf of Alaska during the period 1962-1977. Until passage of the Magnuson Act in 1976, unregulated foreign trawl fleets harvested large quantities of rockfish, with catches exceeding 100,000 mt for 6 out of the first 10 years of the fishery. Federal management of foreign rockfish fisheries began in 1977 and these fisheries were closed in waters east of 140°W. long. in 1982. Harvest levels, or TACs, were intentionally set very low (compared to historic catches—see Section 2.5.3.1) for the purpose of rebuilding depressed stocks. In 1988, the Council began increasing TACs as some stocks showed stable or slightly increasing abundance trends. As both domestic hook-and-line and trawl fishermen developed their independent markets for rockfish harvested from the Eastern Gulf area, there has existed a lingering resentment by local shore-based fishermen over the long-lasting damaging effects on rockfish stocks, caused by foreign fleets in general and trawl gear in particular.

Gear conflicts and grounds preemption problems are familiar issues in the Eastern Gulf of Alaska. In 1978 foreign longliners were banned from the area east of 140°W., in 1982 foreign trawling was prohibited in the Eastern Gulf, and in 1985 the Council prohibited the use of pot gear in the sablefish fishery. In the 1985 amendment the Council addressed concerns with sablefish bycatch in the trawl rockfish fishery by allocating 95% of the Eastern Gulf sablefish TAC to hook-and-line gear. More recently a regulatory amendment was adopted (pending approval) which sets the bycatch standard for DSR in the trawl rockfish and deep-water flatfish fisheries to no more than 1%.

2.4 The Alternatives

The following alternatives were identified by the ADF&G for purposes of analysis. The National Environmental Policy Act (NEPA) requires that all reasonable alternatives be considered when addressing a management problem. These alternatives must include the status quo (take no action) alternative.

2.4.1 Alternative 1: No action.

Under this alternative trawling for groundfish would continue in waters east of 140°W. long. However, it is important to realize that the regulatory regime used for managing the groundfish

fisheries in the Eastern Gulf of Alaska in 1991 has been modified by plan amendment (Amendment 24) and regulatory amendment which include management measures intended to address at least some of the problems identified in Section 2.2. Therefore, "status quo", as defined by the set of regulations intended for use in managing the 1992 fishery will serve as the basis for evaluating the costs and benefits of the other alternatives. A summary of each of these recent regulatory actions is provided below:

A. Season change for rockfish trawling.

Prior to 1992, all groundfish fisheries, with the exception of sablefish, opened to commercial fishing on January 1. As described in Section 2.1, rockfish bycatch problems were identified in the Eastern Gulf of Alaska when relatively large trawl vessels, capable of fishing in poor weather conditions, were fishing for slope rockfish species. Later in the spring, rockfish trawl vessels experienced a very high chinook salmon bycatch rate in the Central Regulatory Area of the Gulf. Plan Amendment 24, approved by the Council at its December 1991 meeting, recommended that the Secretary delay the opening of the Gulf rockfish trawl fishery until approximately July 1 to avoid the high bycatches of salmon and halibut experienced earlier in the year. Amendment 24 was approved and went into effect on March 30, 1992.

A review of the seven stated concerns in the problem statement reveals that the delay in the season opening date may have a variety of impacts which include:

- Concern with status of rockfish stocks: a later opening for all rockfish fisheries to a time after the normal spawning season may produce some biological benefits to the stocks. However, those benefits cannot be quantified with the existing data.

- Bycatch of halibut and salmon in the Gulf of Alaska: the season delay is estimated to reduce bycatch of these species by about 66% and 99.8% respectively (NPFMC 1991). Comparatively low salmon bycatch has been reported by observers in the Eastern Gulf trawl fisheries.

- Grounds preemption and gear conflicts: the season delay will eliminate and potential for conflict between the rockfish trawl fleet and the hook and longline fleet during the first halibut opening and the offshore sablefish fishery. Of course, this advantage will no longer apply if/when IFQ programs are implemented for the sablefish and halibut hook-and-line fisheries.

B. Modified catch standards for DSR.

Prior to 1992, the DSR directed fishing standard (as determined by ADF&G under authority of the FMP) was 10%: meaning that fishing vessels whose catch was comprised of more than 10% DSR, by weight, of all species of fish on board the vessel when the directed taking of DSR is prohibited, or when incidentally caught by gear other than longline, hand troll gear, or mechanical jigging machines. The purpose of the State's regulation is to allocate the directed rockfish fishery to hook-and-line gear and prohibit directed fishing for DSR by vessels using other gear types, and to limit amounts of DSR taken as bycatch in hook-and-line fisheries when the directed DSR fishery is closed.

Any vessel whose catches in excess of the 10% rate would be considered as directing its fishing on DSR. Catches below 10% in relation to the other groundfish species, was considered to be acceptable bycatch.

One problem identified by ALFA was the potential for closure of the directed longline fishery for DSR as a result of the DSR TAC being taken as bycatch in trawl fisheries. The NMFS has reviewed bycatch rates of DSR in fisheries for other target species categories. Many of these other fisheries occur over deep water or over the continental slope where DSR are not usually found in significant numbers. Unless vessels target on DSR to "top off" catches of other groundfish species, bycatch rates of DSR in fisheries for these other species categories typically are very low compared to the bycatch in shallower water fisheries. The NMFS has determined that the State's 10% rate is much higher than needed to support DSR bycatch needs in these deep water trawl fisheries. The NMFS has therefore prepared a Regulatory Amendment (currently undergoing Secretarial review) which provides the NMFS Regional Director with the authority to set the catch standard for DSR between 1% and 10% depending on the fishery. Once adopted, a bycatch standard of 1% will be applied to the rockfish trawl fishery. Compared to the earlier standard, a reduced percentage is expected to remove the incentive to top off catches of DSR and thereby prevent an unnecessary and premature closure of the directed DSR hook-and-longline fishery.

A review of the seven stated concerns suggest that the change in the DSR catch standard should provide some relief to the concern over trawl and longline vessels competing for limited groundfish resources; in particular, DSR. This action should also reduce the potential for trawl vessel activity to result in overfishing of DSR, thus reducing the possibility that important traditional hook-and-line fisheries could be curtailed as a result of excessive trawl bycatch.

C. Combined East Yakutat and Southeast Outside Districts.

Amendment 22 to the Gulf of Alaska FMP combined the former East Yakutat and Southeast Outside District into a new district which retained the name of the Southeast Outside District. Now all waters east of 140°W. long. fall within the expanded Southeast Outside District. The purpose of the change was recognition that in the Eastern Regulatory Area, the smaller independent management areas were only used in management of the sablefish and DSR fisheries. In recent years, difficulties have arisen in the reporting and monitoring of catches from East Yakutat and Southeast Outside Districts independently. The Council has determined that there was no further need to retain the two smaller separate districts and have combined them into the one larger district beginning in 1992.

With reference to the proposed trawl closure, the new Southeast Outside District provides ADF&G with improved control over the DSR resource out to 140°W. DSR rockfish catches taken in the former East Yakutat district, which were placed in the "Other Rockfish" category, are now controlled under a specific DSR TAC. Likewise, DSR bycatch which earlier would have been placed in the Other Rockfish category, can be better monitored and controlled. Conversely, trawl bycatch of DSR in the former East Yakutat area would now be part of the DSR TAC. Even at the revised 1% bycatch standard this could now impact hook-and-line fisheries for DSR or other species throughout the newly expanded Southeast Outside District.

Review of the seven concerns suggests that the effects of combining the two districts will be as follows:

- Concern over depleted DSR stocks: ADF&G now possesses under authority of the FMP, improved control over the harvest of DSR stocks over an additional 3 degrees of coastline.

- Economic displacement of hook-and-line fleet dependent on DSR: the combination of the regulations prohibiting directed trawling for DSR and the three degree westward extension of the State's regulatory control, could increase the chance for displacement of the hook-and-line fishery due to rockfish trawling since any bycatch of DSR in this area will now be counted as part of the DSR TAC for the Southeast Outside District whereas before the catch of DSR in this area would have been counted against the other rockfish TAC.

2.4.1.1 Option: Establish a framework procedure for setting time/area restrictions by gear and species group.

The intent of this option is to provide managers with a more flexible method for developing and implementing regulations to address grounds preemption conflicts and for protecting "critical" habitat. It is suggested here that a modification to the Regional Director's "Hot Spot" Authority be made whereby in addition to minimizing bycatch, specific time/area closures can be made for the purpose of eliminating gear conflicts or to protect habitat. Such a revision to the hot spot authority would require preparation of a plan amendment, development of framework criteria, and a thorough analysis prior to Council action.

2.4.2 Alternative 2: Prohibit all groundfish trawling in waters east of 140°W. long.

This is the recommended alternative presented by ALFA in their proposal. Under this alternative, all trawling would cease in the newly expanded Southeast Outside District. No trawl fishing would be allowed for any species in the E.E.Z east of 140° W. longitude. The 5% of the current sablefish TAC allocated to trawl gear would be transferred to the hook-and-longline fleet and the trawl fleet would forgo their opportunity to harvest all groundfish in the area. Some of this loss would be balanced by increased opportunities for hook-and-line harvest of rockfish and other groundfish species in the Southeast Outside District. In addition trawler losses may be reduced if they redirect fishing effort to areas with underutilized TACs.

2.4.2.1 Option: Close only waters east of 137°W. long. to groundfish trawling.

2.4.3 Alternative 3: Prohibit on-bottom trawling only.

Under this alternative, only use of pelagic trawls (defined by regulation) would be allowed in groundfish fisheries east of 140°W.

2.4.4 Alternative 4: Establish separate TACs by FMP species group for the new Southeast District.

Under this alternative, groundfish TACs which, with the exception of sablefish and DSR, are currently specified for the entire Eastern Regulatory Area (e.g., waters east of 147°W. long.), would be separated with TACs being specified for the West Yakutat District (waters between 147°-140°W. long.) and the new Southeast District (waters east of 140°W.). This alternative would allow managers to improve their control over harvests taken in the Eastern Gulf to assure that the entire Eastern Gulf TAC isn't taken in just one area. The TACs would be based on the Acceptable Biological Catch levels determined for each species or species group in the two districts. This alternative is included to address ALFA's concern for further depletion of rockfish stocks as this action should reduce the potential for localized depletion.

2.4.4.1 Option: Consider allocating the TACs of all species to trawl and longline gear based on past participation or some other criteria.

The Council may determine that the concerns and issues fleshed out in this document warrant pursuit of this option as one solution to permanently addressing the stated problems. Such action has already been approved by the Council for sablefish. This document does not attempt to justify this course of action; only to identify it as an option for possible further development and analysis.

2.5 Description of the Fishery

2.5.1 History of the Fishery

Groundfish species have been taken in the Eastern Gulf of Alaska by hook-and-line gear since the turn of the century. Although the target species was primarily halibut, "black cod", "rock cod" or "red snapper", and Pacific cod were routinely retained as part of the catch.

By 1913 directed longline fisheries for sablefish were occurring and by 1932 sablefish landings from as far west as Middleton Island were reported. A directed hook-and-line fishery for near-shore rockfish developed in the Southeast area during the late 1970s and continues today.

Beginning in the early 1960s extensive foreign trawl fisheries developed and harvests of slope rockfish, particularly POP, increased dramatically to a peak Gulf-wide harvest of 344,700 mt in 1965. Unrestrained harvests of POP had declined to 46,400 mt by 1976 when the MFCMA was adopted.

With the adoption of the Gulf of Alaska Fishery Management Plan in 1978 the foreign trawl fisheries came under restrictive regulations for the first time. Among the regulations initially adopted were:

(1) Closure of the area between 140° and 147°W. to foreign trawling between October 31 and February 15.

(2) Closure of the area east of 140°W. year-round to foreign set line fishing.

(3) Closure of the areas landward of 400 meters from May 1 to September 30 and landward of 500 meters from October 1 to April 1 to foreign longline fishing.

(4) Restrict trawling to off-bottom gear from December 1 to May 31.

(5) Established year-round trawl sanctuaries off Salisbury Sound and Cross Sound Gully in the Southeast Outside District and the Fairweather Gully in the East Yakutat area.

Even with those restrictions, conflicts continued between the shore-based longline fleet and the foreign trawl fleet. The longliners cited gear loss and grounds preemption as major problems causing direct economic harm. The Alaska Longline Fishermen's Association (ALFA) also presented logbook records to demonstrate that catch rates of sablefish diminished by an average of 42% and the size of fish caught decreased by an average of 12% in the presence of foreign bottom trawl effort (Environmental Assessment on Amendment 10 to the Fishery Management Plan for the Gulf of Alaska Groundfish Fishery, 1982).

Considerable concern was also expressed for the health of the POP population which had been fished so heavily by foreign trawl vessels over the previous years. A working paper submitted by ADF&G (Rigby 1982) recommended a dramatic reduction in the POP harvest objective to promote maximum rebuilding of that resource.

Amendment 10, which was adopted in June 1982, addressed these problems and imposed further restrictions on the Eastern Gulf groundfish fisheries as follows:

- Closed the area east of 140° to all foreign fishing.
- Reduced the POP harvest objective from 29,000 mt to 875 mt to promote maximum rebuilding.
- Restricted foreign trawling to off-bottom only year-round between 140° and 147°W.
- Eliminated the trawl sanctuary areas and time restrictions which were imposed on the foreign trawl fleet as no longer necessary.

As a result of this action, foreign trawling for groundfish ceased entirely in the Eastern Gulf of Alaska.

Subsequent management action has been taken by the Council and adopted into regulation which has further impacted management of groundfish in the Eastern Gulf Regulatory Area. These regulations include:

- Elimination of pot gear for sablefish.
- Restricting the allocation of trawl-caught sablefish to 5% of the TAC.
- Relegating trawl-caught sablefish to bycatch only.
- Establishing a separate TAC for demersal shelf rockfish (DSR).
- Authorizing state management of DSR with federal oversight.

- Establishing a DSR bycatch standard of 1% in rockfish trawl fisheries and up to 10% in fisheries for other species.
- Prohibiting trawling for rockfish prior to July 1.
- Combining the previous East Yakutat and Southeast Outside Districts into one larger management area.

2.5.2 Recent Fishery, 1981-1991

Catch tables from the PacFIN database for 1981 through 1991 are attached as Appendix 2. These tables depict retained landings only and are presented in landed weight. They are based on a combination of fish ticket records and catcher/processor reports. The finest available resolution is by INPFC area (all Southeast and all Yakutat) and landing records are not obtainable in a consistent format for the smaller management areas. The Southeast Alaska harvest records also include landings from the internal waters of Southeast Alaska which were removed from Council management by an amendment to the MFCMA in October 1984. In addition, the tables are by broad gear and species categories and do not differentiate between catcher/processors and shore-based harvests or the various components of the rockfish and flatfish assemblages. Regardless, this data was used to depict the groundfish harvest in the Eastern Gulf over the past 10 years as it is the only consistent record of reported groundfish harvest available over that entire time period. More detailed records of the 1990 and 1991 offshore groundfish fisheries are shown in Tables 1 and 2.

Apparently, in response to more restrictive regulations imposed by Amendment 10, the foreign trawl fleet did not fish in the Eastern Gulf after 1982. It was not until 1985 that domestic trawl landings were first reported in the offshore waters of the Eastern Gulf. The relatively small flatfish, Pacific cod, and rockfish landings reported in Table 1 (Appendix 2) between 1982 and 1985 are from the internal waters of Southeast Alaska.

Between 1985 and 1991 the total reported domestic trawl landings in the Southeast area increased from 423 mt to 1,402 mt. The change in the Yakutat area was even more dramatic with an increase from 807 mt in 1985 to over 5,108 mt in 1991. Discrepancies between Tables 1 and 2 of Appendix 2 and Tables 1 and 2 of this report can be explained by the fact that the appendix tables report only the landed weight of retained species while text Tables 1 and 2 report round weight of all reported harvests including at-sea discards.

The longline fishery also expanded quickly during the 1980s. The all-species domestic longline catch in Southeast Alaska increased from 1,980 mt in 1981 to 6,721 mt in 1991 and in the Yakutat area from 102 mt in 1981 to 5,963 mt in 1991. The vast majority of the harvest by both gear types was of the more highly valued rockfish and sablefish.

2.5.3 Management Overview and Review of the 1990 and 1991 Fisheries

A complete review of current groundfish management and a detailed look at the 1990 and 1991 fisheries is necessary to fully understand the dynamics of the Eastern Gulf groundfish fishery. That review is included in the following section.

Table 1. Total reported Eastern Gulf of Alaska groundfish harvest by gear type, species group, and management zone in metric tons, 1990.

SPECIES GROUP	GEAR	W. YAK.	E. YAK.	S.E. OUT.	TOTAL
POLLOCK	TRAWL	201.7	10.4	58.1	270.2
	HAL	--	--	--	--
	TOTAL	**201.7**	**10.4**	**58.1**	**270.2**
P. COD	TRAWL	16.5	--	.1	16.6
	HAL	9.2	7.2	33.9	50.3
	TOTAL	**25.7**	**7.2**	**34.0**	**66.9**
DEEP FLAT	TRAWL	405.8	12.1	84.1	502.0
	HAL	1.9	0.1	1.6	3.6
	TOTAL	**407.7**	**12.2**	**85.7**	**505.6**
SW FLAT	TRAWL	179.2	.3	23.1	202.6
	HAL	--	--	--	tr
	TOTAL	**179.2**	**.3**	**23.1**	**202.6**
AT FLOUND	TRAWL	1,030.3	37.1	466.7	1,534.1
	HAL	15.6	--	.1	15.7
	TOTAL	**1,045.9**	**37.1**	**466.8**	**1,549.8**
SABLEFISH[1/]	TRAWL	551.4	24.7	107.1	683.2
	HAL	3,971.2	1,568.7	4,576.3	10,116.2
	TOTAL	**4,522.6**	**1,593.4**	**4,683.4**	**10,799.4**
OTHER ROCK[2/]	TRAWL	4,157.9	186.6	1,352.9	5,697.4
	HAL	32.8	36.3	76.0	145.1
	TOTAL	**4,190.7**	**222.9**	**1,428.9**	**5,842.5**
DS ROCK	TRAWL	n/a	n/a	.5	.5
	HAL	8.9	30.8	322.7	362.4
	TOTAL	**8.9**	**30.8**	**323.2**	**362.9**
PS ROCK	TRAWL	508.2	.2	.3	508.7
	HAL	11.2	2.1	15.8	29.1
	TOTAL	**519.4**	**2.3**	**16.1**	**537.8**
ALL ROCK	TRAWL	4,666.1	186.8	1,353.7	6,206.6
	HAL	52.9	69.2	414.5	536.6
	TOTAL	**4,719.0**	**256.0**	**1,768.2**	**6,743.2**
THORNYHEADS	TRAWL	217.8	18.2	87.7	323.7
	HAL	52.0	18.4	41.8	112.2
	TOTAL	**269.8**	**31.4**	**129.2**	**435.9**
LINGCOD[3/]	TRAWL	n/r	n/r	n/r	n/r
	HAL	17.5	50.8	293.8	362.1
	TOTAL	**17.5**	**50.8**	**293.8**	**362.1**
OTHERS	TRAWL	337.0	24.4	163.1	524.5
	HAL	49.4	.3	4.0	53.7
	TOTAL	**386.4**	**24.7**	**167.1**	**578.2**
ALL GROUNDFISH	TRAWL	7,605.8	314.0	2,343.7	10,263.5
	HAL	4,169.7	1,714.7	5,366.0	11,250.4
	TOTAL	**11,775.5**	**2,028.7**	**7,709.4**	**21,513.9**

[1/] The hook-and-line allocation for sablefish is 95% of the TAC.
[2/] Other rockfish includes POP and shortraker/rougheye rockfish.
[3/] Lingcod are not reported (n/r) by species in trawl harvest reports.

Table 2. Total reported Eastern Gulf of Alaska groundfish harvest by gear type, species group, and management zone in metric tons, 1991.

SPECIES GROUP	GEAR	WEST YAKUTAT	EAST YAKUTAT	SE OUTSIDE	TOTAL
POLLOCK	TRAWL	3,532.0	6.0	25.0	3,563.0
	HAL	--	--	2.5	2.5
	TOTAL	**3,532.0**	**6.0**	**27.5**	**3,565.5**
P. COD	TRAWL	22.0	1.5	12.0	36.0
	HAL	14.0	16.7	34.0	65.6
	TOTAL	**36.0**	**18.2**	**46.0**	**101.6**
DEEP FLAT	TRAWL	74.0	11.0	63.0	148.0
	HAL	.4	--	--	.4
	TOTAL	**74.4**	**11.0**	**63.0**	**148.4**
SW FLAT	TRAWL	3.2	.4	3.0	7.0
	HAL	--	--	.8	.8
	TOTAL	**3.2**	**.4**	**3.8**	**7.8**
AT FLOUND	TRAWL	167.0	33.0	103.0	303.0
	HAL	11.2	.1	.1	11.4
	TOTAL	**178.2**	**33.1**	**103.1**	**314.4**
SABLEFISH[1/]	TRAWL	234.0	31.0	143.0	408.0
	HAL	4,621.0	1,094.3	3,819.5	9,534.8
	TOTAL	**4,855.0**	**1,125.3**	**3,962.5**	**9,942.8**
SLOPE ROCK[2/]	TRAWL	228.0	30.0	6.0	264.0
	HAL	35.9	8.4	14.8	59.1
	TOTAL	**263.9**	**38.4**	**20.8**	**323.1**
POP	TRAWL	766.0	189.0	1,015.0	1,970.0
	HAL	.3	.01	--	.3
	TOTAL	**766.3**	**189.1**	**1,015.0**	**1,970.4**
SHTRAK/RE	TRAWL	125.0	45.0	186.0	356.0
	HAL	42.9	14.7	34.1	91.7
	TOTAL	**167.9**	**59.7**	**220.1**	**447.7**
DS ROCK	TRAWL	28.0	6.0	15.0	49.0
	HAL	47.1	214.4	282.0	543.5
	TOTAL	**75.1**	**220.4**	**297.0**	**592.5**
PS ROCK	TRAWL	804.0	42.0	1.4	847.0
	HAL	6.9	8.2	66.5	81.6
	TOTAL	**810.9**	**50.2**	**67.9**	**928.6**
ALL ROCK	TRAWL	1,951.0	312.0	1,223.0	3,486.0
	HAL	133.1	245.8	397.3	776.2
	TOTAL	**2,084.1**	**557.8**	**1,620.3**	**4,262.2**
THORNYHEADS	TRAWL	90.0	13.0	36.0	139.0
	HAL	65.5	12.8	31.4	109.7
	TOTAL	**155.5**	**25.8**	**67.4**	**248.7**
LINGCOD[3/]	TRAWL	n/r	n/r	n/r	n/r
	HAL	3.6	116.0	355.5	475.1
	TOTAL	**3.6**	**116.0**	**355.5**	**475.1**

Table 2 (cont.). Total reported Eastern Gulf of Alaska groundfish harvest by gear type, species group, and management zone in metric tons, 1991.

SPECIES GROUP	GEAR	WEST YAKUTAT	EAST YAKUTAT	SE OUTSIDE	TOTAL
OTHERS	TRAWL	34.0	1.5	16.0	52.0
	HAL	65.9	1.5	1.5	68.9
	TOTAL	**99.9**	**3.0**	**17.5**	**120.9**
ALL GROUNDFISH	TRAWL	6,107.2	409.4	1,624.4	8,142.0
	HAL	4,914.7	1,487.1	4,642.7	11,045.4
	TOTAL	**11,021.9**	**1,896.5**	**6,267.1**	**19,187.4**

1/ The hook-and-line allocation for sablefish is 95% of the TAC.

2/ POP and shortraker/rougheye rockfish were separated into their own species groups for 1991.

3/ Lingcod are not reported (n/r) by species in trawl harvest reports and are included in the "other groundfish" harvest figures.

2.5.3.1 Harvest Objectives

The harvest objectives (OY, TQ, or TAC) for the various groundfish species are shown for the years 1984 through 1992 in Table 3. The harvest objectives and species groupings have varied quite dramatically over that time period.

One of the most notable overall changes is the decrease in the harvest allowances for the lower value species such as pollock, Pacific cod, flatfish, and Atka mackerel, and the rather substantial increases in the harvest allowances for the higher valued species such as rockfish and sablefish. In 1984 pollock, Pacific cod, flatfish, and Atka mackerel made up 88% of the Eastern Gulf OY and by 1992 those species made up only 47% of the TAC. In 1984 the harvest allowance for pollock was the highest of all individual species. By 1987 sablefish became the predominant groundfish species in the Eastern Gulf and has remained in that position each year since.

For the period between 1984 and 1987 the Eastern Gulf OY for POP was set at 875 mt. That OY applied not only to *Sebastes alutus*, but also to four other species including shortraker and rougheye rockfish which made up a five-species complex. A Gulf-wide OY of 7,600 mt was established for "other rockfish". This applied to all species of *Sebastes* rockfish not included in the POP category. There is very little documentation to support that additional level and most of the trawl fishing effort was directed at the species included in the POP category.

By 1991 the *Sebastes* complex had been separated out into smaller components with individual TAC levels set for five separate *Sebastes* management groups. The combined TAC for all *Sebastes* rockfish in the Eastern Gulf for 1992 is 10,900 mt which is the highest since the Council reduced the POP complex OY to 875 mt in 1982 to promote rebuilding of the rockfish population.

The sablefish harvest objective more than doubled from 4,200 mt in 1984 to 11,400 mt in 1988. The TAC has steadily decreased since 1990 in response to declining abundance trends and the 1992 TAC of 8,730 mt is comparable to the 1987 target quota (TQ) of 8,200 mt.

Table 4 shows the relative importance of the various groundfish species or species groups in the Eastern Gulf compared to the entire Gulf of Alaska. While the TACs for pollock and cod represent a very small portion of the total Gulf of Alaska TAC, other species such as sablefish, POP, and slope rockfish have high TACs relative to the entire Gulf of Alaska. It appears that sablefish and rockfish are the primary species of importance in the Eastern Gulf of Alaska. Any changes in allocation by gear would have the most likely impact on fisheries for those species.

2.5.3.2 Acceptable Biological Catch (ABC) Considerations

Table 5 shows the ABC levels for groundfish in the Eastern Gulf of Alaska with TAC expressed as a percent of ABC for 1988 through 1992. In 1988 the sablefish fishery was being managed at 80% of the ABC. By 1990 the TAC had increased to 100% of ABC. Virtually all of the rockfish species are currently being managed at or very close to the calculated ABC level. This is a profound departure from the very conservative rockfish management strategy used through 1986 which according to previous Council documents was employed to promote maximum rebuilding opportunities for depleted rockfish stocks.

Table 3. Harvest objectives (OY, TQ, or TAC) for groundfish by species group in the Eastern Gulf of Alaska in metric tons (x 1,000), 1984-1992.

SPECIES	AREA	1984	1985	1986	1987	1988	1989	1990	1991	1992
POLLOCK	EG	16.6	16.6	16.6	4.0	3.0	.2	3.4	3.4	3.4
P. COD	EG	9.9	9.9	12.0	2.0	.2	5.7	1.0	2.9	1.0
DEEP FLAT	EG	--	--	--	--	--	--	3.1	3.0	3.0
SW FLAT	EG	--	--	--	--	--	--	.3	2.0	1.7
FLATHEAD	EG	--	--	--	--	--	--	--	3.0	3.0
AT FLOUND	EG	--	--	--	--	--	--	4.4	5.0	5.0
ALL FLAT	EG	8.4	8.4	4.0	.5	.1	1.0	7.7	13	12.7
SABLEFISH	WYAK	1.7	1.7	2.6	4.0	4.9	4.6	4.6	4.1	3.7
	EYAK	1.1	1.1	1.1	--	--	--	--	--	--
	SE	1.4	1.4	2.4	--	--	--	--	--	--
	SE/EYAK	--	--	--	4.2	6.5	5.9	5.9	5.0	5.0
	EG TOT	4.2	4.2	6.1	8.2	11.4	10.5	10.5	9.1	8.7
ATKA MACK	EG	3.2	-0-	-0-	.04	--	--	--	--	--
POP	EG	0.9	0.9	0.9	2.0	--	--	--	2.4	2.2
OTHER ROCK	GW	7.6	5.0	5.0	5.3	--	--	--	--	--
	CSEO	--	--	0.6	1.3	--	--	--	--	--
SHTRAK/RE	EG	--	--	--	--	--	--	--	0.6	0.6
SLOPE ROCK	EG	--	--	--	--	4.9	5.8	5.7	3.4	6.2
DS ROCK	SE OUT	--	--	--	--	0.7	0.4	0.5	0.4	0.6
PS ROCK	EG	--	--	--	--	0.4	0.4	1.0	0.9	1.3
ALL ROCK[1/]	EG	0.9	0.9	1.5	3.3	6.0	6.6	7.2	7.7	10.9
THORNYHEADS	GW	3.75	3.75	3.75	3.75	3.75	3.8	3.8	1.4	1.8

1/ Includes only *Sebastes* rockfish species specifically assigned to the Eastern Gulf Regulatory District. Slope rockfish or "other rockfish" were not apportioned by Regulatory District until 1988.

Table 4. Harvest objective (OY, TQ, or TAC) for groundfish by species group in the Eastern Gulf of Alaska as a percent of the harvest objective for the entire Gulf of Alaska, 1984-1992.

SPECIES	AREA	1984	1985	1986	1987	1988	1989	1990	1991	1992
POLLOCK	EG	4%	5%	10%	4%	3%	.3%	5%	3%	4%
P. COD	EG	17%	16%	16%	4%	.2%	8%	1%	4%	2%
DEEP FLAT	EG	--	--	--	--	--	--	14%	20%	15%
SW FLAT	EG	--	--	--	--	--	--	3%	17%	15%
FLATHEAD	EG	--	--	--	--	--	--	--	30%	30%
AT FLOUND	EG	--	--	--	--	--	--	14%	25%	20%
ALL FLAT	EG	25%	25%	28%	6%	.4%	3%	12%	23%	19%
SABLEFISH	WYAK	19%	19%	17%	20%	18%	18%	18%	18%	18%
	EYAK	13%	13%	7%	--	--	--	--	--	--
	SE	16%	16%	16%	--	--	--	--	--	--
	SE/EYAK	--	--	--	21%	23%	23%	23%	22%	24%
	EG TOT	47%	47%	40%	41%	41%	41%	41%	40%	42%
ATKA MACK	EG	11%	bco[1]	-0-	17%	--	--	--	--	--
POP	EG	8%	14%	24%	40%	--	--	--	41%	42%
OTHER ROCK	GW	n/a	n/a	n/a	n/a	--	--	--	--	--
	CSEO	--	--	12%	24%	--	--	--	--	--
SHTRAK/RE	EG	--	--	--	--	--	--	--	29%	29%
SLOPE ROCK	EG	--	--	--	--	45%	29%	32%	34%	44%
DS ROCK	SE OUT	--	--	--	--	100%	100%	100%	100%	100%
PS ROCK	EG	--	--	--	--	12%	12%	12%	19%	19%
ALL ROCK[2]	EG	n/a	n/a	n/a	n/a	40%	28%	27%	33%	37%
THORNYHEADS	GW	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

[1] Bycatch only.

[2] Includes only *Sebastes* rockfish species specifically assigned to the Eastern Gulf Regulatory District. Slope rockfish or "other rockfish" were not apportioned by Regulatory District until 1988.

Table 5. Acceptable Biological Catch (ABC) for groundfish by species group in metric tons (x 1,000) in the Eastern Gulf of Alaska with Total Allowable Catch (TAC) expressed as a percentage of ABC, 1988-1992.

SPECIES	AREA	1988	1989	1990	1991[1/]	1992
POLLOCK	EG	3.0(100%)	3.4 (6%)	3.4(100%)	3.4(100%)	3.4(100%)
P. COD	EG	7.0 (3%)	5.7(100%)	1.0(100%)	2.9(100%)	1.0(100%)
FLOUNDERS	EG	86.8 (.1%)	58.9 (2%)	--	--	--
DEEP FLAT	EG	--	--	14.4 (21%)	9.6 (31%)	4.0 (75%)
SW FLAT	EG	--	--	2.1 (12%)	3.0 (67%)	1.7(100%)
FLATHEAD	EG	--	--	--	5.0 (60%)	3.7 (81%)
AT FLOUND	EG	--	--	26.6 (16%)	27.2 (18%)	11.7(43%)
SABLEFISH	WYAK	6.1 (80%)	5.3 (86%)	4.6 (99%)	4.1(100%)	3.7(100%)
	SE/EYAK	8.1 (80%)	6.8 (88%)	6.0(100%)	5.0(100%)	5.0(100%)
	EG TOT	14.3 (80%)	12.1 (87%)	10.6(100%)	9.0(100%)	8.7(100%)
POP	EG	--	--	--	--	2.4 (90%)
OTHER ROCK	EG	4.9(100%)	5.8(100%)	5.7(100%)	--	--
SHTRAK/RE	EG	--	--	--	--	.6(100%)
SLOPE ROCK	EG	--	--	--	--	6.2(100%)
DS ROCK	SE OUT	n/a	n/a	n/a	n/a	.6(100%)
PS ROCK	EG	.4(100%)	.8 (50%)	1.0(100%)	--	1.3(100%)
ALL ROCK[2/]	EG	5.3(100%)	6.6 (94%)	6.7(100%)	n/a	11.0 (98%)
THORNYHEADS[3/]	GW	n/a	n/a	n/a	n/a	n/a

[1/] In 1991 ABCs for rockfish were not apportioned by regulatory district.

[2/] Includes only *Sebastes* rockfish species specifically assigned to the Eastern Gulf Regulatory District. Slope rockfish or "other rockfish" were not apportioned by Regulatory District until 1988.

[3/] The thornyhead ABCs and TACs are not apportioned by regulatory district. The Gulfwide ABC was reduced from 3,800 mt in 1988 through 1990 to 1,798 mt in 1991 and 1992.

At the request of ADF&G, Dave Clausen and Jeff Fujioka of the NMFS Auke Bay Laboratory completed a reanalysis of the distribution of biomass by management area. This analysis was based on the results of the 1987 and 1990 triennial trawl surveys. The complete report is attached as Appendix 3. Table 6 presents a summary of their results. It displays the revised biomass estimates for the West Yakutat and the Southeast Outside Districts expressed as a percentage of the ABC levels presented in the 1992 SAFE document.

Table 6 of Appendix 3 indicates that the biomass of "other slope" rockfish is quite low in the West Yakutat District (407 mt) compared to the Southeast Outside District (5,850 mt). In the West Yakutat area redstripe and silvergray rockfish make up 60% of the other slope rockfish biomass and in the Southeast Outside District sharpchin, harlequin, and redstripe rockfish make up 95% of the other slope rockfish biomass.

In both instances the species which make up the preponderance of fish within those areas are not target species of the current fisheries and are often discarded at sea. Both redstripe and silvergray rockfish are transitional species which reside on the edge of the continental shelf. They were recently moved from the DSR assemblage to the "other slope" rockfish assemblage and it is doubtful that a directed fishery could be conducted for either of these species without a considerable bycatch of DSR.

Dusky rockfish is the only pelagic rockfish which shows up with any consistency in the trawl surveys. The estimated biomass is nearly four times greater for dusky rockfish in the West Yakutat district than in the Southeast Outside District. Black rockfish which make up much of the hook-and-line pelagic rockfish catch in the Southeast Outside District are apparently not adequately assessed by the triennial trawl survey.

The relative population weights for sablefish, rougheye rockfish, shortraker rockfish, and thornyhead rockfish from the 1988 through 1991 longline surveys are also presented in Appendix 3. These data indicate that the relative population weight of sablefish, rougheye rockfish, and thornyhead rockfish is considerably greater in the Southeast Outside District than in the West Yakutat District. Conversely, the relative population weight of shortraker rockfish was substantially greater in the West Yakutat District than in the Southeast Outside District. This difference in the relative abundance of shortraker and rougheye rockfish in the West Yakutat District is not consistent between the longline and trawl surveys. However, the marked increase in relative abundance of rougheye rockfish compared to shortraker rockfish in the Southeast Outside District is consistent between the two survey methods.

There is also a substantial discrepancy in the relative distribution of the sablefish resource as indicated by the trawl and longline surveys. In fact, the relative abundance values are almost exactly reversed between the two survey methods with 57% of the population attributed to the Southeast Outside District in the longline surveys and 56% of the population attributed to the West Yakutat area in the trawl surveys (Table 6). This can be explained because the 1987 and 1990 trawl surveys did not include deep stations in the Eastern Gulf and therefore did not adequately assess sablefish abundance (Personal communication with Dave Clausen, NMFS-ABL). Sablefish biomass levels were not recalculated as part of this reevaluation because the distribution currently used for management is based on the longline rather than trawl surveys and

Table 6. Distribution of groundfish biomass by species group and management zone in the Eastern Gulf of Alaska, based on 1987 and 1990 triennial trawl surveys.[1/]

SPECIES GROUP	1992 ABC	WEST YAKUTAT	SE/EAST YAKUTAT
POLLOCK	3.4	64%	36%
P. COD	1.0	64%	36%
DEEP FLAT	4.0	68%	32%
SW FLAT	1.7	95%	5%
FLATHEAD	3.7	74%	26%
AT FLOUND	11.7	40%	60%
SABLEFISH[2/]			
WYAK	3.7		
SE/EYAK	5.0		
EG TOT	8.7	43%	57%
POP	2.4	35%	65%
SHTRAK/RE[3/]	.6	44%	56%
SLOPE ROCK	6.2	6%	94%
DS ROCK[4/]			
SE OUT	.6	n/a	n/a
PS ROCK	1.3	82%	18%
ALL ROCK	11.0	24%	76%
THORNYHEADS[5/]			
GULFWIDE	1.8	39%	61%

1/ The relative distributions are the result of revised biomass estimates for each management zone calculated from an average of the 1987 and 1990 trawl surveys. See Appendix 3 for an explanation of the procedure used.

2/ Sablefish ABC levels were previously calculated for the two management zones from a combination of trawl and longline survey data. The percentages shown are from the 1991 longline surveys.

3/ Rougheye rockfish are the most prevalent species in this group, making up 55% of the biomass in the West Yakutat area and 73% of the biomass in the Southeast Outside District.

4/ Demersal shelf rockfish did not occur in the revised survey analysis.

5/ The thornyhead ABC is set for the entire Gulf of Alaska. An ABC estimate for the Eastern Gulf of Alaska is not available. The percentages shown refer only to the relative distribution between the East Yakutat and Southeast Outside Districts.

the ABCs for sablefish are already established for the Southeast Outside and West Yakutat districts.

Likewise, revised ABCs were not recalculated for pollock or Pacific cod because of the rather complex mechanisms included in the production models for those species. The distribution of sablefish, pollock, Pacific cod and thornyhead rockfish is expressed as a percentage of the total trawl survey biomass encountered in each management area (Table 6).

Based on this reevaluation, it appears that the relative abundance of pollock, Pacific cod, and most flatfish species except arrowtooth flounder is considerably greater in the West Yakutat area than in the Southeast Outside District. Conversely, the relative abundance of sablefish as assessed in the longline survey and of all rockfish species except shortraker rockfish and dusky rockfish is much greater in the Southeast Outside District than in the West Yakutat District.

2.5.3.3 The 1990 and 1991 Fisheries

Detailed reported harvest records for the 1990 and 1991 Eastern Gulf groundfish fisheries are shown in Tables 1 and 2. Table 1 shows the harvest for 1990 and Table 2 shows the same data for 1991. These tables are a composite of fish ticket information for the hook-and-line shore-based vessels and weekly production reports for the catcher/processor trawl vessels. Although some shore-based trawl landings and catcher/processor hook-and-line landings were reported, the amounts are small and the analysis conducted for this report treats the various components of each gear type the same.

The database theoretically reports both landed product and discard. It is assumed, however, that discards are substantially underreported particularly for the shore-based landings where there are no additional records such as observer files available to verify the accuracy of the reports. All fish have been converted to round weight equivalents and are reported in metric tons.

In both 1990 and 1991 sablefish dominated the hook-and-line harvest with 90% and 86% of all hook-and-line caught fish in each of those years respectively. Rockfish made up the second most important category with 5% of the 1990 harvest and nearly 7% of the 1991 harvest.

Other rockfish dominated the trawl catch in 1990 with 56% of all reported harvest. That was followed by arrowtooth flounder which made up 15% of the reported catch. In 1991 the distribution of trawl catch changed somewhat and pollock accounted for 44% of the total trawl harvest. POP was separated out of the "other rockfish" complex and managed as a independent species category in 1991. In 1991 POP alone accounted for 1,970 mt or 24% of the total trawl harvest.

Tables 7 and 8 present information on the relative amount of the total groundfish harvest which was taken by species and gear type. Table 7 contains 1990 data and Table 8 shows 1991 data. These tables show that hook-and-line gear took over half of all groundfish reported in both 1990 and 1991 with 52% and 58% of the total groundfish harvest in those two years. Sablefish harvested by hook-and-line gear made up 47% of all groundfish reported in 1990 and 50% in 1991 while sablefish taken by trawl gear made up only 3% and 2% of all groundfish harvested for those two years respectively (Note: that trawl harvests of sablefish are limited to 5% of the

Table 7. Reported Eastern Gulf of Alaska groundfish harvest by gear type compared to the total groundfish harvest of all species in metric tons, 1990.

SPECIES	AREA	1990 HARVEST	1990 HARVEST BY GEAR TYPE		PERCENT OF TOTAL 1990 GF HARVEST		
			HAL	TRAWL	HAL	TRW	TOTAL
POLLOCK	EG	270	-0-	270.2	-0-	1%	1%
P. COD	EG	67	50.3	16.6	<1%	<1%	<1%
DEEP FLAT	EG	506	3.6	502.0	<1%	2%	2%
SW FLAT	EG	203	tr	202.6	<1%	1%	1%
AT FLOUND	EG	1,550	15.7	1,534.1	<1%	7%	7%
ALL FLAT	EG	2,258	19.3	2,238.7	<1%	10%	10%
SABLEFISH[1/]	WYAK	4,523	3,971.2	551.4	18%	3%	21%
	SE/EYAK	6,277	6,145.0	131.8	29%	<1%	29%
	EG TOT	10,799	10,116.2	683.2	47%	3%	50%
OTHER ROCK[2/]	EG	5,882	184.8	5,697.4	<1%	27%	27%
DS ROCK	SE OUT	324	323.2	.5	1%	<1%	1%
PS ROCK	EG	538	29.1	508.7	<1%	2%	2%
ALL ROCK	EG	6,744	537.1	6,206.6	2%	29%	31%
THORNYHEADS	GW	436	112.2	323.7	<1%	2%	2%
OTHER GF[3/]	GW	941	415.8	524.5	2%	2%	4%
TOTAL ALL SPECIES		**21,516**	**11,251**	**10,264**	**52%**	**48%**	**100%**

[1/] The hook-and-line allocation of sablefish is 95% of the TAC and the trawl allocation is 5% of the TAC in each management zone.

[2/] Other rockfish includes POP, shortraker, and rougheye in all areas and DSR in the West and East Yakutat management zones.

[3/] Much of the hook-and-line harvest of "other groundfish" is lingcod which are not listed as an FMP species group. Lingcod are also landed by trawl gear, but are not specified in the landing records.

Table 8. Reported Eastern Gulf of Alaska groundfish harvest by gear type compared to the total groundfish harvest of all species in metric tons, 1991.

SPECIES	AREA	1991 HARVEST	1991 HARVEST BY GEAR TYPE HAL	TRAWL	PERCENT OF TOTAL 1991 GF HARVEST HAL	TRW	TOTAL
POLLOCK	EG	3,566	2.5	3,563	<1%	19%	19%
P. COD	EG	102	65.6	36	<1%	<1%	<1%
DEEP FLAT	EG	148	.4	148	<1%	1%	1%
SW FLAT	EG	8	.8	7	<1%	<1%	<1%
FLATHEAD	EG	1	-0-	1	-0-	<1%	<1%
AT FLOUND	EG	314	11.4	303	<1%	2%	2%
ALL FLAT	EG	471	12.6	459	<1%	2%	2%
SABLEFISH[1/]	WYAK	4,855	4,621.0	234	24%	1%	25%
	SE/EYAK	5,088	4,913.8	174	26%	1%	27%
	EG TOT	9,943	9,534.8	408	50%	2%	52%
POP	EG	1,970	.3	1,970	<1%	10%	10%
SHTRAK/RE	EG	448	91.7	356	<1%	2%	2%
SLOPE ROCK	EG	619	320.6	298	2%	1%	3%
DS ROCK	SE OUT	297	282.0	15	1%	<1%	1%
PS ROCK	EG	929	81.6	847	<1%	4%	5%
ALL ROCK	EG	4,262	776.2	3,486	4%	18%	22%
THORNYHEADS	GW	249	109.7	139	1%	1%	2%
OTHER GF[2/]	GW	596	544.0	52	3%	<1%	3%
TOTAL ALL SPECIES		**19,190**	**11,045**	**8,143**	**58%**	**42%**	**100%**

1/ The hook-and-line allocation of sablefish is 95% of the TAC and the trawl allocation is 5% of the TAC in each management zone.

2/ Much of the hook-and-line harvest of "other groundfish" is lingcod which are not listed as an FMP species group. Lingcod are also landed by trawl gear, but are not specified in the landing records.

TAC by regulation). Trawlers took a much higher percentage of slope rockfish (POP in 1991), flatfish, and pollock.

Tables 9 and 10 show the relative proportion of each species group taken by each gear type. A notable aspect of these tables is that there is such little overlap between the major species or species groups harvested by hook-and-line and trawl gear. Hook-and-line vessels consistently took higher percentages of the Pacific cod, sablefish, and DSR while trawl vessels took higher percentages of pollock, flatfish, POP, and shortraker and pelagic rockfish. A review of the observer data shows that most of the high trawl catch of "other rockfish" reported in 1990 was POP, shortraker, and rougheye rockfish which were separated
out into individual management categories in 1991.

The final set of catch tables in this series (Tables 11 and 12) show the 1990 and 1991 Eastern Gulf groundfish harvest as a percentage of the TAC for each species group. In general, the higher value species such as rockfish and sablefish are being harvested at or near the TAC levels while most lower value species are being harvested at rather low levels compared to the TAC. Pollock was an exception in 1991 and the TAC was exceeded by 5%. Sablefish harvests exceeded the TAC in both 1990 and 1991, the harvest of other rockfish exceeded the TAC in 1990, and the harvest of pelagic shelf rockfish exceeded the TAC in 1991.

1991 In-Season Management Regulations

This section contains a summary of in-season management regulations that limited either the quantity or timing of groundfish harvests in the Eastern Gulf of Alaska in 1991. In general, once the harvest of a species groups nears the TAC level, directed fishing is no longer allowed and the species group is placed on bycatch-only status. Depending on the directed fishing standard, bycatch status limits the harvest of the species group to a percentage of all groundfish retained during a trip. A species group is placed on prohibited species catch (PSC) status if the TAC is reached or exceeded. Once this occurs, subsequent landings of that species or species group must be discarded. All fisheries are closed when the seasonal Gulf-wide halibut PSC limit for the gear is reached. In 1991, the halibut PSC limits were 750 mt for hook-and-line gear and 2000-mt for bottom trawl gear.[1]

Figure 2 illustrates the in-season management regulations for the Eastern Gulf hook-and-line fishery. Similar information for the trawl fisheries is presented in Figure 3. Areas with no shading indicate times when directed fisheries on the species groups could occur. Light shading

---

[1] Allocation of the Gulf of Alaska halibut PSC limits in 1991

Hook-and-line		Bottom Trawl	
Jan 1 - May 14	200 mt	1st quarter	600 mt
May 15 - Aug 31	500 mt	2nd quarter	600 mt
Sept 1 to Dec 31	50 mt	3rd quarter	400 mt
		4th quarter	400 mt

Table 9. Reported Eastern Gulf of Alaska groundfish harvest by gear type and species in metric tons and the percent of each species harvested by gear, 1990.

SPECIES	AREA	1990 TOTAL HARVEST	1990 HARVEST BY GEAR TYPE		PERCENT OF 1990 HARVEST BY GEAR		
			HAL	TRAWL	HAL	TRW	TOTAL
POLLOCK	EG	270	-0-	270.2	-0-	100%	100%
P. COD	EG	67	50.3	16.6	75%	25%	100%
DEEP FLAT	EG	506	3.6	502.0	1%	99%	100%
SW FLAT	EG	203	tr	202.6	<1%	100%	100%
AT FLOUND	EG	1,550	15.7	1,534.1	1%	99%	100%
ALL FLAT	EG	2,258	19.3	2,238.7	1%	99%	100%
SABLEFISH[1/]	WYAK	4,523	3,971.2	551.4	88%	12%	100%
	SE/EYAK	6,277	6,145.0	131.8	98%	2%	100%
	EG TOT	10,799	10,116.2	683.2	94%	6%	100%
OTHER ROCK[2/]	EG	5,882	184.8	5,697.4	3%	97%	100%
DS ROCK	SE OUT	324	323.2	.5	100%	<1%	100%
PS ROCK	EG	538	29.1	508.7	4%	96%	100%
ALL ROCK	EG	6,744	537.1	6,206.6	8%	92%	100%
THORNYHEADS	GW	436	112.2	323.7	26%	74%	100%
OTHER GF[3/]	GW	941	415.8	524.5	44%	56%	100%

[1/] The hook-and-line allocation of sablefish is 95% of the TAC and the trawl allocation is 5% of the TAC in each management zone.

[2/] Other rockfish includes POP, shortraker, and rougheye in all areas and DSR in the West and East Yakutat management zones.

[3/] Much of the hook-and-line harvest of "other groundfish" is lingcod which are not listed as an FMP species group. Lingcod are also landed by trawl gear, but are not specified in the landing records.

Table 10. Reported Eastern Gulf of Alaska groundfish harvest by gear type and species in metric tons and the percent of each species harvested by gear, 1991.

SPECIES	AREA	1991 TOTAL HARVEST	1991 HARVEST BY GEAR TYPE		PERCENT OF 1991 HARVEST BY GEAR		
			HAL	TRAWL	HAL	TRW	TOTAL
POLLOCK	EG	3,566	2.5	3,563	<1%	100%	100%
P. COD	EG	102	65.6	36	65%	35%	100%
DEEP FLAT	EG	148	.4	148	<1%	100%	100%
SW FLAT	EG	8	.8	7	10%	90%	100%
FLATHEAD	EG	1	-0-	1	0%	100%	100%
AT FLOUND	EG	314	11.4	303	4%	96%	100%
ALL FLAT	EG	471	12.6	459	3%	97%	100%
SABLEFISH[1/]	WYAK	4,855	4,621.0	234	95%	5%	100%
	SE/EYAK	5,088	4,913.8	174	97%	3%	100%
	EG TOT	9,943	9,534.8	408	96%	4%	100%
POP	EG	1,970	.3	1,970	<1%	100%	100%
SHTRAK/RE	EG	448	91.7	356	21%	79%	100%
SLOPE ROCK	EG	619	320.6	298	55%	45%	100%
DS ROCK	SE OUT	297	282.0	15	95%	5%	100%
PS ROCK	EG	929	81.6	847	8%	92%	100%
ALL ROCK	EG	4,262	776.2	3,486	18%	82%	100%
THORNYHEADS	GW	249	109.7	139	44%	56%	100%
OTHER GF[2/]	GW	596	544.0	52	91%	9%	100%

[1/] The hook-and-line allocation of sablefish is 95% of the TAC and the trawl allocation is 5% of the TAC in each management zone.

[2/] Much of the hook-and-line harvest of "other groundfish" is lingcod which are not listed as an FMP species group. Lingcod are also landed by trawl gear, but are not specified as lingcod in the landing records.

Table 11. Reported Eastern Gulf of Alaska groundfish harvest by species group and gear type compared to the harvest objective (TAC or gear allocation) in metric tons, 1990.

SPECIES	AREA	1990 TAC	1990 HARVEST HAL	1990 HARVEST TRAWL	1990 HARVEST AS A PERCENT OF TAC HAL	TRW	TOTAL
POLLOCK	EG	3,400	-0-	270.2	-0-	8%	8%
P. COD	EG	1,000	50.3	16.6	5%	2%	7%
DEEP FLAT	EG	3,050	3.6	502.0	<1%	16%	16%
SW FLAT	EG	250	tr	202.6	<1%	81%	81%
AT FLOUND	EG	4,380	15.7	1,534.1	<1%	35%	35%
ALL FLAT	EG	7,680	19.3	2,238.7	<1%	29%	29%
SABLEFISH[1/]	WYAK	4,550	3,971.2	551.4	87%	12%	99%
	SE/EYAK	5,960	6,145.0	131.8	103%	2%	105%
	EG TOT	10,510	10,116.2	683.2	96%	7%	103%
OTHER ROCK[2/]	EG	5,700	184.8	5,697.4	3%	100%	103%
DS ROCK	SE OUT	470	323.2	.5	62%	<1%	62%
PS ROCK	EG	1,000	29.1	508.7	3%	51%	54%
ALL ROCK	EG	7,170	537.1	6,206.6	7%	87%	94%
THORNYHEADS	GW	3,800	112.2	323.7	3%	9%	12%
OTHER GF[3/]	GW	14,179	415,8	524.5	3%	4%	7%

[1/] The hook-and-line allocation of sablefish is 95% of the TAC and the trawl allocation is 5% of the TAC in each management zone.

[2/] Other rockfish includes POP, shortraker, and rougheye in all areas and DSR in the West and East Yakutat management zones.

[3/] Much of the hook-and-line harvest of "other groundfish" is lingcod which are not listed as an FMP species group. Lingcod are also landed by trawl gear, but are not specified in the landing records.

Table 12. Reported Eastern Gulf of Alaska groundfish harvest by species group and gear type compared to the harvest objective (TAC or gear allocation) in metric tons, 1991.

SPECIES	AREA	1991 TAC	1991 HARVEST		1991 HARVEST AS A PERCENT OF TAC		
			HAL	TRAWL	HAL	TRW	TOTAL
POLLOCK	EG	3,400	2.5	3,563	<1%	105%	105%
P. COD	EG	2,900	65.6	36	2%	1%	3%
DEEP FLAT	EG	3,000	.4	148	<1%	5%	5%
SW FLAT	EG	2,000	.8	7	<1%	<1%	<1%
FLATHEAD	EG	3,000	-0-	1	0%	<1%	<1%
AT FLOUND	EG	5,000	11.4	303	<1%	6%	6%
ALL FLAT	EG	13,000	12.6	459	<1%	4%	4%
SABLEFISH[1/]	WYAK	4,050	4,621.0	234	114%	6%	120%
	SE/EYAK	4,950	4,913.8	174	99%	4%	103%
	EG TOT	9,000	9,534.8	408	106%	5%	111%
POP	EG	2,400	.3	1,970	<1%	82%	82%
SHTRAK/RE	EG	580	91.7	356	16%	61%	77%
SLOPE ROCK	EG	3,400	320.6	298	9%	8%	17%
DS ROCK	SE OUT	425	282.0	15	66%	4%	70%
PS ROCK	EG	900	81.6	847	8%	94%	102%
ALL ROCK	EG	7,700	776.2	3,486	10%	45%	55%
THORNYHEADS	GW	1,398	109.7	139	8%	10%	18%
OTHER GF[2/]	GW	15,766	544.0	52	3%	<1%	3%

[1/] The hook-and-line allocation of sablefish is 95% of the TAC and the trawl allocation is 5% of the TAC in each management zone.

[2/] Much of the hook-and-line harvest of "other groundfish" is lingcod which are not listed as an FMP species group. Lingcod are also landed by trawl gear, but are not specified as lingcod in the landing records.

indicates when the species group was placed on bycatch-only status, and darker shading indicates PSC status for the species group (it must be discarded).

The hook-and-line fishery closed on July 8 for the remainder of the year due to the halibut PSC limit. Trawl fisheries closed from May 8 until July 1 and from October 14 to December 31 due to quarterly halibut PSC limits. In addition to these closures, all trawl fishing in the Southeast Outside District was closed on July 26 due to concern for overfishing DSR. Closures are indicated by the darkest blocks on Figures 2 and 3.

Sablefish is the only species that had separate TACs for the two gear groups. In the hook-and-line fishery, sablefish was placed on bycatch-only status from January 1 through May 15. The directed fishery occurred from May 15 to May 25 in the Southeast Outside and East Yakutat areas and from May 15 to June 10 in the West Yakutat area. Following the directed fishery, sablefish was again placed on bycatch-only status in both areas and, in West Yakutat, was placed on PSC status on July 5.

No directed trawl fishery for sablefish was allowed. The species was placed on bycatch status on January 1 in all areas and on PSC status on April 12 in the Southeast Outside and East Yakutat areas and on October 10 in West Yakutat. All sablefish harvested by trawlers after these dates should have been discarded.

In 1991, TACs for species groups other than sablefish could be harvested by either gear group. In-season regulations on bycatch or PSC status for pelagic shelf rockfish, other slope rockfish, thornyhead rockfish, Pacific cod, flatfish, arrowtooth flounder and pollock applied to both the hook-and-line and trawl fisheries. Following is a summary of the in-season regulations applying to species groups that could be harvested by both gear groups in the Eastern Gulf, subject to gear and area specific closures noted above:

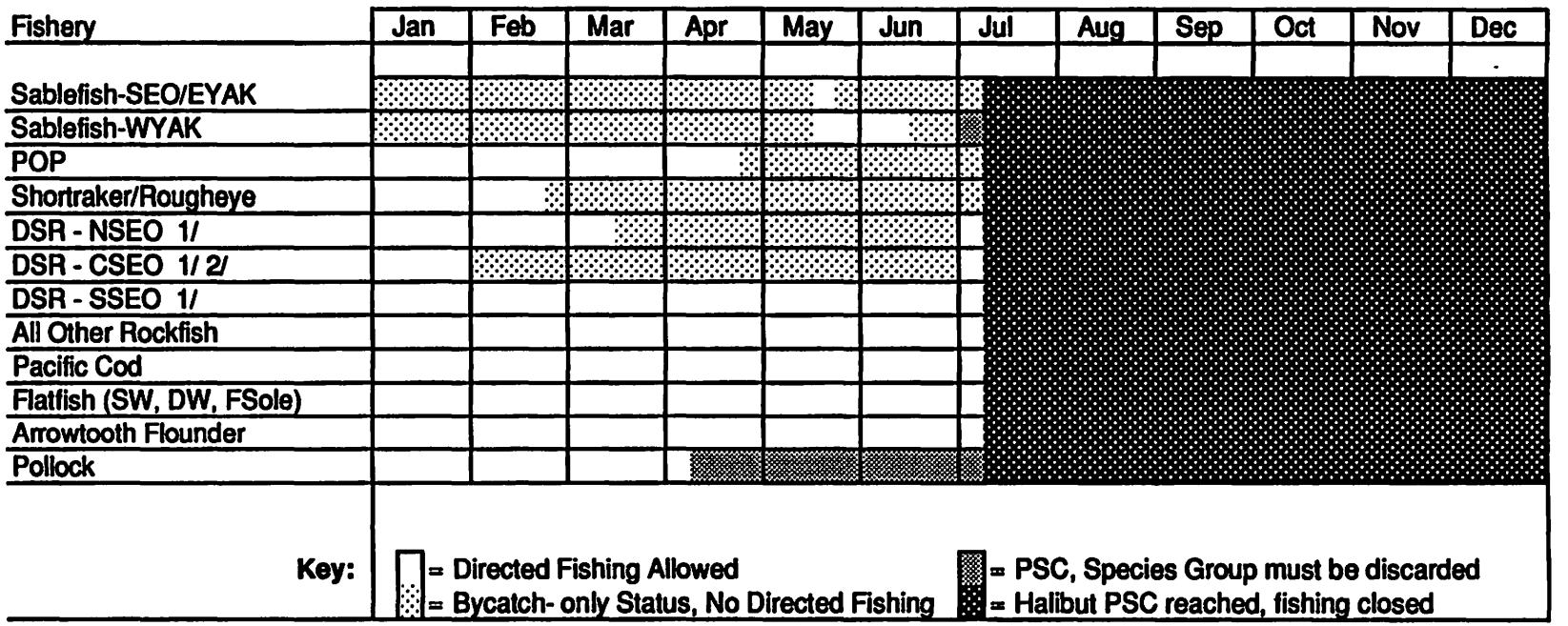
- Shortraker and rougheye rockfish were placed on bycatch-only status in the Eastern Gulf after February 25 due to overfishing concerns. They were placed on PSC status on June 21, although the TAC was not reached during 1991.

- Pacific Ocean perch was placed on bycatch-only status on April 22.

- Demersal shelf rockfish is an FMP species group only in the Southeast Outside area. It is on bycatch-only status for trawlers all year. In the hook-and-line fishery, DSR was placed on bycatch-only status from February 4 to July 1 in part of the Central Southeast Outside area and from March 21 to July 1 in the remainder of the Southeast Outside area. In the Northern Southeast Outside area DSR was placed on bycatch-only status from May 17 to July 1. Directed fisheries by hook-and-line gear was allowed from July 1 until July 8 when the entire Gulf hook-and-line fisheries closed due tot he halibut PSC limit. Trawl bycatch of DSR was allowed from July 1 until July 26 when trawl fisheries in the Southeast Outside area closed due to DSR overfishing concerns.

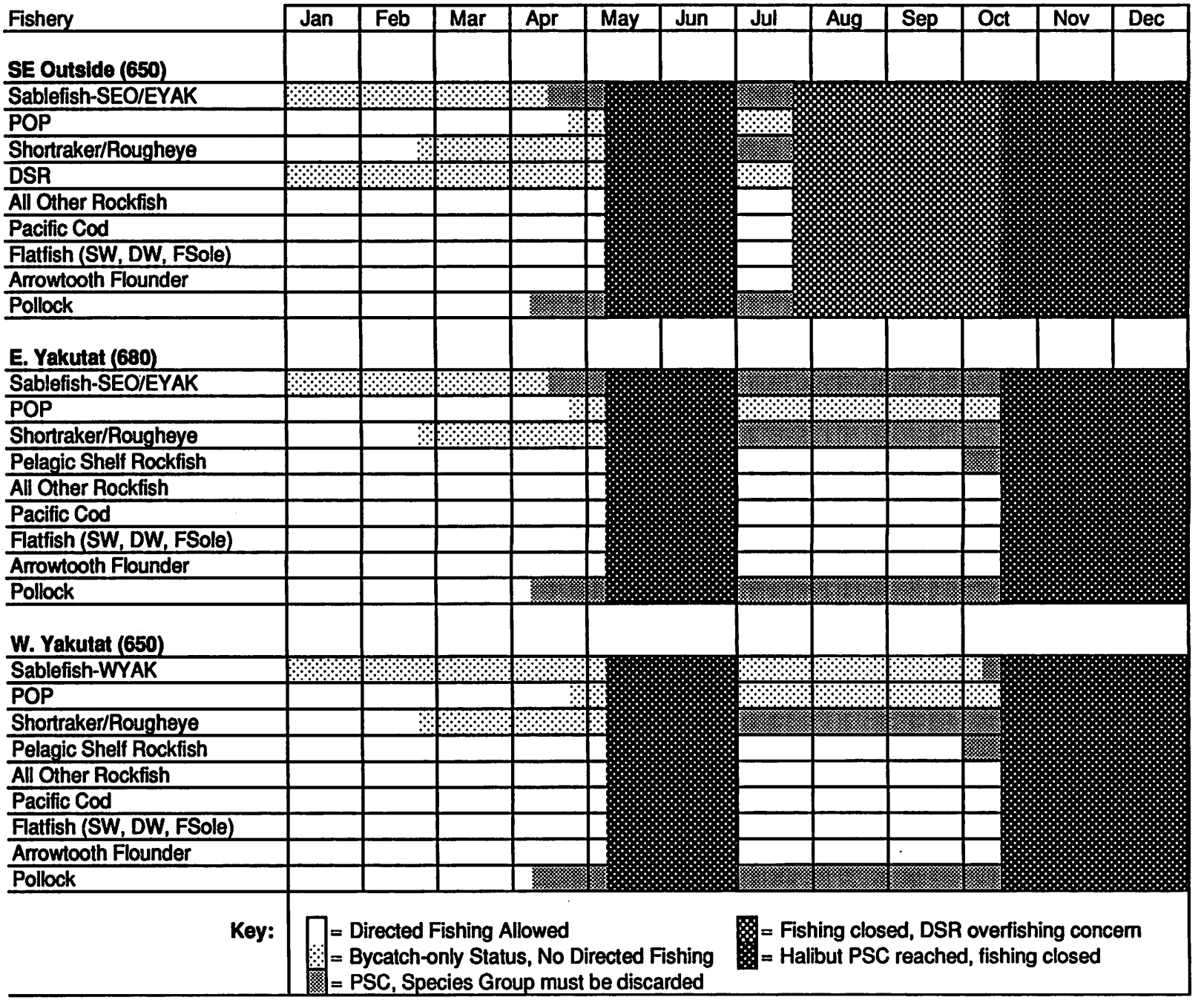
- Pelagic shelf rockfish were placed on PSC status on October 5. The TAC for this species group was exceeded in 1991.

Figure 2. In-season management regulations for the hook-and-line fisheries in the Eastern Gulf of Alaska in 1991.



1/ The Southeast Outside is divided into Northern (NSEO), Central (CSEO), and Southern (SSEO) areas.
2/ DSR in part of the CSEO was placed on bycatch-only status on 2/4/91 and in the remainder of the CSEO on 3/21/91.

Figure 3. In-season management regulations for the trawl fisheries in the Eastern Gulf of Alaska in 1991.



- Pollock was placed on PSC status from April 8 through the remainder of the year. The TAC for this species was exceeded in 1991.

- TACs for all other species groups including other slope rockfish, thornyhead rockfish, Pacific cod, shallow water flatfish, deepwater flatfish, flathead sole, and arrowtooth flounder were not fully taken in 1991. None of these species groups were placed on bycatch or PSC status and harvests were limited only by lack of effort or overall fishery closures.

The Eastern Gulf of Alaska contains the halibut regulatory Area 2C and part of Area 3A. In 1991, two 1-day halibut hook-and-line openings occurred on May 7-8 and September 3-4. A total of 8.8 million pounds of halibut were landed in Area 2C, 4.9 million pounds during the May opening and 3.9 million pounds during the September opening. Halibut landings in Area 3A totaled 23.6 million pounds, 10.7 million pounds in May and 12.9 million pounds in September (IPHC, 1992). All groundfish that had not been placed on PSC status could be landed during these openings. Species that had to be discarded included pollock during the May opening and pollock, shortraker rockfish, and rougheye rockfish during the September opening. Sablefish landed in the West Yakutat area during the September opening also had to be discarded.

2.5.4 Economic Review of the 1990 and 1991 Fisheries

Information on which to base an economic analysis of proposed changes to the Eastern Gulf of Alaska groundfish fishery is limited by access to economic information about the fishing industry and by the time necessary to fully investigate all sources of information. This section includes summaries of the distribution of retained species and gross revenues to the various harvesting and processing groups in 1990 and 1991 based on information provided by industry to the Alaska Department of Fish and Game, the Commercial Fisheries Entry Commission (CFEC), and National Marine Fisheries Service. Landings and ex-vessel value of the shore-based hook-and-line fleet's harvest are summarized by species to show the relative importance of different species groups and their contribution to fishermen's gross revenues. Shore-based landings are also summarized by port to show the geographic distribution of harvesting and processing activity. Finally, estimated gross revenues to processors from the processed groundfish product in 1990 is presented.

2.5.4.1 Number of Vessels Reporting Groundfish Landings in 1990 and 1991

Table 13 summarizes the number of vessels participating and average retained landings per vessel in the Eastern Gulf groundfish fisheries by area and gear type for 1990 and 1991.[2] Although the number of catcher/processor trawlers declined from 11 in 1990 to 10 in 1991 and average total landings declined from 932 mt to 814 mt, the average retained landings per vessel increased from about 600 mt to over 700 mt. Shore-based hook-and-line vessels included longliners, jig, hand troll and power troll. In 1990, there were 1,060 different vessels vessels reporting

[2] The standard deviation about the mean landings per vessel in the shore fleet exceeds the mean in almost all cases indicating that landings per vessel varies widely. In other words, the range of catcher vessel landings is large.

Table 13. Number of Vessels Landing Groundfish in the Eastern Gulf of Alaska in 1990 and 1991 by Gear Type and Management Zone.

1990

Gear Type	West Yakutat (640)	East Yakutat (680)	Southeast Outside (650)	Eastern Gulf of Alaska	Average Retained Landings (mt)[2/]
Catch/Proc. Trawlers	10	[1/]	7	11	595.1
Catch/Proc. Longliners	6	0	[1/]	6	36.0
Longliners	178	205	554	774	13.8
Jig	[1/]	[1/]	43	48	3.6
Troll	11	121	390	440	0.1
Trawlers Delivering Shoreside	0	0	[1/]	[1/]	[1/]

1991

Gear Type	West Yakutat (640)	East Yakutat (680)	Southeast Outside (650)	Eastern Gulf of Alaska	Average Retained Landings (mt)[2/]
Catch/Proc. Trawlers	10	[1/]	[1/]	10	711.3
Catch/Proc. Longliners	7	[1/]	[1/]	9	74.7
Longliners	216	222	591	835	11.9
Jig	0	[1/]	59	59	59
Troll	9	53	405	439	0.1
Other Salmon Gear	0	[1/]	[1/]	[1/]	0.2
Trawlers Delivering Shoreside	[1/]	0	[1/]	[1/]	[1/]

[1/] Confidential because four or less vessels reported landings in this area.

[2/] Average total landings for catcher/processor trawlers decreased from 932 mt in 1990 to 814 mt in 1991.

hook-and-line landings. This number increased to 1,109 in 1991.[3] Average total landings for all hook-and-line vessels decreased from 10.4 mt in 1990 to 9.3 mt in 1991. Of the 1,109 hook-and-line vessels reporting groundfish landings in 1991, about 225 landed less than 100 pounds of groundfish, approximately half landed less than 4.5 mt (10,000 lbs.), and about 150 landed over 22 mt (50,000 lbs). The total number of shore delivering longliners increased from 774 to 835, but average retained landings decreased from about 14 mt to less than 12 mt. Both the catcher/processor longliners and the shore-based jig fishermen increased in number and the size of average retained landings from 1990 to 1991.

2.5.4.2 Quantity of Harvest Retained for Processing

Throughout this analysis, total harvest refers to the sum of retained landings and discards. Tables 14 and 15 summarize the distribution of total harvest and retained landings in the 1990 and 1991 Eastern Gulf groundfish fishery by species group, gear or processor type, and management area.[4] The proportion of total harvest that is retained is generally related to the value of the product with lower valued species being discarded at a much higher rate than higher valued species.

There are four categories of catcher or catcher/processor vessels operating in the Eastern Gulf: catcher/processor trawlers (CPTWL), trawlers delivering to shore plants, catcher/processor longliners (CPHAL), and hook-and-line catcher vessels delivering to shore plants (SBHAL). Although total groundfish harvest in the Eastern Gulf decreased from 21,500 mt in 1990 to about 19,200 mt in 1991, the total retained landings of groundfish increased from 17,700 mt in 1990 to 18,100 mt in 1991. Retained landings by the catcher/processor vessels increased while landings by the shore delivering catcher vessels decreased.

In 1990, none of the 270 mt of pollock, only 3% of the 1,550 mt of arrowtooth flounder, and less than 20% of the 708 mt of other flatfish were retained and processed. However, 98% of sablefish, 93% of Pacific cod, 90% of *Sebastes* rockfish, and 99% of thornyhead rockfish were retained. The relationship between the retained and discarded portion of the total harvest differed somewhat in 1991. Over 75% of flounder and flatfish were discarded, but 95% of the nearly 3,600 mt of pollock harvested was retained. As in 1990, the retained portion of the harvest was 90% or greater for sablefish, Pacific cod, and most rockfish species. However, after the higher valued POP, shortraker, and rougheye rockfish were separated from the "other slope rockfish" group in 1991, the proportion of discards in the latter category increased from 10% in 1990 to 49% in 1991. Lower valued species remained in the other slope rockfish category and were retained at a lower rate.

---

[3] The total number of hook-and-line vessels reported in Table 13 sums to more than totals reported in the text because some vessels report landings under more than one gear type. For example, the same vessel could have landings under salmon troll, longline, and jig gear.

[4] Reported discards should be considered a minimum estimate of total discards. It is likely that discards from catcher/processors are more reliably reported than discards from catcher vessels only because the catcher processors have observers on board and because discards have not traditionally been reported on fish tickets.

Table 14. Total harvest and amount retained in the 1990 Eastern Gulf of Alaska groundfish fishery (metric tons round weight equivalent).

Species Group		W. Yakutat (640) % Retained	E. Yakutat (680) % Retained	S.E. Outside (650) % Retained	Eastern Gulf Total Total Harvest	Retained	% Retained
Pollock	CPTWL	0.0	0.0	0.0	270.2	0.0	0.0
Pacific Cod	CPTWL	69.6	0.0	0.0	16.6	11.6	69.6
	SBHAL	100.0	100.0	100.0	50.2	50.2	100.0
	Total	80.5	100.0	100.0	66.9	61.8	92.5
Deepwater Flatfish	CPTWL	14.9	1.7	0.2	502.0	61.0	12.1
	CPHAL	0.0	0.0	0.0	2.0	0.0	0.0
	SBHAL	0.0	100.0	2.6	1.6	0.2	11.3
	Total	14.9	2.9	0.3	505.6	61.1	12.1
Shallow Water Flatfish	CPTWL	19.0	100.0	0.0	201.4	35.6	17.2
	SBHAL	0.0	0.0	0.0	1.5	1.3	0.0
	Total	19.0	100.0	11.0	202.9	36.9	18.2
Arrowtooth Flounder	CPTWL	3.9	1.9	0.1	1,534.1	41.7	2.7
	CPHAL	0.0	0.0	0.0	13.7	0.0	0.0
	SBHAL	0.0	0.0	0.0	2.4	0.4	0.0
	Total	3.9	1.9	0.1	1,550.2	42.1	2.7
Sablefish	CPTWL	68.7	100.0	99.9	683.3	510.7	74.8
	CPHAL	100.0	0.0	100.0	203.6	203.6	100.0
	SBHAL	100.0	100.0	99.8	9,912.4	9,903.4	99.9
	Total	96.2	100.0	99.8	10,799.3	10,617.7	98.3
Other Slope Rockfish	CPTWL	90.8	85.7	86.0	5,691.1	5,093.6	89.5
	CPHAL	100.0	0.0	0.0	7.1	7.1	100.0
	SBHAL	89.0	100.0	96.7	144.7	138.9	96.0
	Total	90.8	88.0	86.6	5,842.8	5,239.6	89.7
Pelagic Shelf Rockfish	CPTWL	91.0	100.0	100.0	508.7	463.1	91.0
	SBHAL	99.5	63.3	100.0	29.0	28.2	97.1
	Total	91.2	66.6	100.0	537.7	491.3	91.4
Demersal Shelf Rockfish	CPHAL	100.0	0.0	100.0	3.2	3.2	100.0
	SBHAL	72.1	82.1	97.2	359.5	343.1	95.4
	Total	80.5	82.1	97.2	362.7	346.3	95.5
All Sebastes Rockfish	CPTWL	90.8	85.7	86.0	6,199.8	5,556.7	89.6
	CPHAL	100.0	0.0	100.0	9.9	9.9	100.0
	SBHAL	89.3	90.9	97.2	533.0	510.1	95.7
	Total	90.8	87.1	88.7	6,742.7	6,076.7	90.1
Thornyheads	CPTWL	100.0	100.0	100.0	323.7	323.7	100.0
	CPHAL	100.0	0.0	100.0	5.7	5.7	100.0
	SBHAL	91.7	100.0	99.3	106.2	102.1	96.1
	Total	98.6	100.0	99.8	435.6	431.5	99.1

CPTWL = Catcher/Processor Trawler, CPHAL = Catcher/Processor Hook and Line, SBHAL = Shore-based Hook and Line

Table 14. Total harvest and amount retained in the 1990 Eastern Gulf of Alaska groundfish fishery (metric tons round weight equivalent).

Species Group		W. Yakutat (640) % Retained	E. Yakutat (680) % Retained	S.E. Outside (650) % Retained	Eastern Gulf Total Total Harvest	Retained	% Retained
Lingcod	SBHAL	100.0	100.0	100.0	362.2	362.1	100.0
Other Groundfish	CPTWL	2.1	0.0	0.0	524.5	6.9	1.3
	CPHAL	0.0	0.0	0.0	13.4	0.0	0.0
	SBHAL	0.0	16.1	99.6	40.1	1.2	3.0
	Total	1.8	0.2	0.7	578.0	8.1	1.4
All Groundfish[1/]	CPTWL	65.6	65.0	58.0	10,257.0	6,549.5	63.8
	CPHAL	89.1	0.0	47.2	248.4	219.4	88.1
	SBHAL	98.7	99.6	99.6	11,008.3	10,929.4	99.3
	TWL	65.6	65.0	58.1	10,263.6	6,556.1	63.9
	HAL	98.2	99.6	99.5	11,250.1	11,142.2	99.0
	Shore-base	98.7	99.6	99.6	11,014.9	10,936.0	99.3
	Catch/Proc.	66.3	65.0	57.9	10,498.9	6,762.3	64.4
	Total	77.1	94.2	86.9	21,513.7	17,698.3	82.3

CPTWL = Catcher/Processor Trawler, CPHAL = Catcher/Processor Hook and Line, SBHAL = Shore-based Hook and Line

[1/] Totals reflect actual landings and may vary due to rounding.

Table 15. Total harvest and amount retained in the 1991 Eastern Gulf of Alaska groundfish fishery (metric tons round weight equivalent).

Species Group		W. Yakutat (640) % Retained	E. Yakutat (680) % Retained	S.E. Outside (650) % Retained	Eastern Gulf Total Total Harvest	Retained	% Retained
Pollock	CPTWL	95.6	0.0	0.0	3565.7	3380.5	94.8
Pacific Cod	CPTWL	88.6	100.0	94.0	33.7	30.9	91.1
	SBHAL	100.0	99.7	100.0	67.6	67.6	99.9
	Total	94.3	99.7	98.5	101.3	98.5	97.1
Deepwater Flatfish	CPTWL	8.6	4.6	35.5	147.8	29.2	19.8
	SBHAL	0.0	0.0	0.0	1.6	0.0	0.0
	Total	8.6	4.6	35.5	149.4	29.2	19.6
Shallow Water Flatfish	CPTWL	22.1	0.0	80.5	6.3	3.2	50.7
	SBHAL	0.0	100.0	100.0	1.4	1.4	100.0
	Total	22.1	100.0	84.7	7.7	4.6	59.6
Arrowtooth Flounder	CPTWL	34.8	32.5	4.4	301.8	73.1	24.2
	CPHAL	0.0	0.0	0.0	5.7	0.0	0.0
	SBHAL	9.2	0.0	75.0	5.7	0.6	10.1
	Total	32.9	32.5	4.5	313.2	73.7	23.5
Flathead Sole	CPTWL	37.5	100.0	100.0	0.7	0.6	86.5
Sablefish	CPTWL	93.0	93.6	99.4	408.7	389.4	95.3
	CPHAL	100.0	100.0	100.0	617.3	617.3	100.0
	SBHAL	100.0	100.0	100.0	8917.3	8915.6	100.0
	Total	99.6	99.8	100.0	9943.3	9922.3	99.8
Pacific Ocean Perch	CPTWL	90.6	90.4	88.9	1970.2	1767.5	89.7
	SBHAL	51.5	100.0	100.0	0.3	0.2	51.5
	Total	90.6	90.4	88.9	1970.5	1767.7	89.7
Shortraker/ Rougheye	CPTWL	84.5	100.0	99.0	355.6	334.3	94.0
	CPHAL	100.0	0.0	0.0	0.5	0.5	100.0
	SBHAL	100.0	100.0	100.0	91.0	91.0	100.0
	Total	88.5	100.0	99.5	446.2	425.9	95.4
Other Slope Rockfish	CPTWL	41.6	17.8	100.0	263.4	105.8	40.2
	CPHAL	100.0	0.0	0.0	10.4	10.4	100.0
	SBHAL	95.3	100.0	99.3	48.8	47.5	97.4
	Total	49.1	35.8	99.5	322.6	163.7	50.8
Pelagic Shelf Rockfish	CPTWL	98.2	100.0	100.0	847.9	833.8	98.3
	CPHAL	100.0	41.4	0.0	7.9	7.2	91.4
	SBHAL	100.0	100.0	100.0	73.6	73.6	100.0
	Total	98.3	98.7	100.0	929.4	914.6	98.4
Demersal Shelf Rockfish	CPTWL	83.7	46.4	38.4	48.7	31.7	65.1
	CPHAL	100.0	0.0	0.0	24.6	24.6	100.0
	SBHAL	99.7	99.7	100.0	519.0	518.3	99.9
	Total	93.9	98.3	96.8	592.3	574.5	97.0

CPTWL = Catcher/Processor Trawler, CPHAL = Catcher/Processor Hook and Line, SBHAL = Shore-based Hook and Line

Table 15. Total harvest and amount retained in the 1991 Eastern Gulf of Alaska groundfish fishery (metric tons round weight equivalent).

Species Group		W. Yakutat (640) % Retained	E. Yakutat (680) % Retained	S.E. Outside (650) % Retained	Eastern Gulf Total Total Harvest	Retained	% Retained
All Sebastes	CPTWL	87.5	85.3	89.9	3485.7	3073.1	88.2
Rockfish	CPHAL	100.0	41.4	0.0	43.5	42.8	98.4
	SBHAL	98.4	99.7	100.0	731.8	730.5	99.8
	Total	88.3	91.5	92.4	4261.0	3846.4	90.3
Thornyheads	CPTWL	99.2	100.0	84.8	139.1	133.0	95.6
	CPHAL	96.0	0.0	0.0	13.2	12.2	92.9
	SBHAL	93.4	99.6	98.8	96.8	92.9	95.9
	Total	97.0	99.8	90.8	249.0	238.1	95.6
Lingcod	SBHAL	100.0	99.8	100.0	475.0	474.8	100.0
Other Groundfish	CPTWL	8.8	55.8	2.8	51.7	4.5	8.6
	CPHAL	0.0	0.0	0.0	41.4	0.0	0.0
	SBHAL	5.4	62.5	83.3	27.5	1.6	5.9
	Total	7.3	56.3	3.1	120.6	6.1	5.0
All Groundfish[1/]	CPTWL	89.7	78.7	80.9	8136.5	7112.9	87.4
	CPHAL	98.9	95.3	99.5	721.0	672.3	98.9
	SBTWL	100.0	na	100.0	6.7	6.7	100.0
	SBHAL	99.1	99.9	100.0	10321.3	10282.7	99.6
	TWL	89.7	78.7	80.9	8143.2	7119.6	87.4
	HAL	99.1	99.9	100.0	11042.3	10955.0	99.6
	Shore-based	99.1	99.9	100.0	10328.0	10289.5	99.6
	Catch/Proc.	90.5	79.2	81.8	8857.5	7785.2	88.3
	Total	93.9	95.3	95.0	19185.5	18074.6	94.4

CPTWL = Catcher/Processor Trawler, CPHAL = Catcher/Processor Hook and Line, SBHAL = Shore-based Hook and Line

[1/] Totals reflect actual landings and may vary due to rounding.

Retained harvest varied by vessel type and location. Catcher/processor trawlers harvested about 75% of their retained groundfish in the West Yakutat area, 20% in the Southeast Outside and less than 5% in East Yakutat in both 1990 and 1991. Although their total retained landings increased from 6,600 mt in 1990 to 7,100 mt in 1991, this increase was largely to the pollock harvest.[5] This landing aside, catcher/processor trawlers increased their retained landings of Pacific cod and arrowtooth flounder but decreased retained landings of flatfish, sablefish, all *Sebastes* rockfish, and thornyhead rockfish. As mentioned previously, changes in the species groupings of rockfish to split out POP, shortraker, and rougheye from the other slope rockfish complex probably influenced the reported distribution of rockfish harvests as well as the total landings.

Actual landings by shore-based trawlers are confidential, but were less than 10 mt in both 1990 and 1991. The 1990 harvests were all taken in the Southeast Outside area and were primarily rockfish with small landings of Pacific cod, flatfish, sablefish and lingcod. In 1991, only pollock and Pacific cod were landed in both the West Yakutat and the Southeast Outside areas.

Catcher/processor longliners operate in the West Yakutat area and target almost exclusively on sablefish. Total retained groundfish landings in the Eastern Gulf increased from 216 mt in 1990 to 672 mt in 1991, an increase of over 200%. In both years, sablefish represented over 90% of their retained landings with most of this harvested in the West Yakutat area. The harvest of rockfish also increased considerably. In 1990, 6.8 mt of *Sebastes* rockfish and 5.8 mt of thornyheads were landed. This increased to 42.8 mt and 12.2 mt respectively in 1991.

Shore-based hook-and-line catcher vessels include longliners, jig fishermen, salmon trollers, and a few other salmon gear types (purse seine and gill net). Overall, their retained landings of groundfish in the Eastern Gulf decreased from 10,900 mt in 1990 to 10,300 mt in 1991. The sablefish harvest declined from 9912 mt in 1990 to 8917 mt in 1992 as a result of a reduced TAC. Retained landings of thornyhead rockfish also declined from 1990 to 1991. The shore-based hook-and-line fleet increased their retained landings of Pacific cod, all *Sebastes* rockfish and lingcod. In 1990, the shore-based hook-and-line fleet harvested 49% of their Eastern Gulf groundfish in the Southeast Outside area, 35% in West Yakutat and 16% in East Yakutat. This changed to 44% Southeast Outside, 42% West Yakutat and 14% East Yakutat in 1991. Sablefish is by far the most important groundfish species to the hook-and-line fleet, representing 91% of retained landings in 1990 and 87% in 1991. All rockfish represented 5% and 8% of retained landings in 1990 and 1991 with demersal shelf rockfish being the most important rockfish species group.

2.5.4.3 Landings and Gross Revenues to the Shore-based Fleet

Shore-based processors obtain groundfish from catcher vessels while catcher/processors harvest the groundfish they process on board. Thus, the "ex-vessel" level, or point at which fish are transferred from a vessel, is not comparable between the two gear/processor types. It refers to product at different stages of processing. The most common understanding of ex-vessel level refers to fish sales between the shore-based fleet and processors. Information about the retained

---

[5] Harvests in the pollock fishery resulted in 19.10 mt of discarded thornyhead rockfish which was 89% of the reported thornyhead discard in the Eastern Gulf in 1991.

landings and gross revenue to fishermen from these ex-vessel level sales are summarized in Tables 16 and 17. Similar information is not available for the catcher/processors. However, this section is followed by a comparison of the processed product value of the shore-based processors and catcher/processor vessels.

Table 16 summarizes landings, gross revenue, and weighted average ex-vessel prices to the shore-based fleet (hook-and-line and trawl vessels) in 1990 and 1991 by species group. The total amount of groundfish retained by the shore fleet fell from about 10,900 mt in 1990 to 10,300 mt in 1991, however, total gross revenues increased from $17.9 million to about $21.4 million. Sablefish was by far the most important groundfish species to the shore fleet, representing over 94% of gross revenues in both 1990 and 1991. The rockfish species were a distant second with about 3.3% and 3.7% of total gross revenues in 1990 and 1991. Demersal shelf rockfish was the most important of this species group in terms of total gross revenues. The weighted average round weight equivalent ex-vessel price for groundfish increased from $0.74/lb. to $0.94/lb. due largely to higher sablefish prices in 1991.

Several average ex-vessel prices in Table 16 seem out of line with what would have been expected. For example, the weighted average ex-vessel product price for POP in 1990 was $0.47/lb. This is much higher than the 1991 price of $0.23 and possibly represents an error in the fish ticket data. The high average ex-vessel value of shallow water flatfish in 1991 ($0.35/lb.) may have been due to landings of higher valued roe-bearing rock sole. Both of these prices were based on very small landings. Prices for the species groups with larger landings probably more accurately reflect the ex-vessel value of these fish.

Shore-based Landings of Eastern Gulf Groundfish by Port

The economic benefits of the Eastern Gulf of Alaska groundfish fishery are largely due to income and employment from harvesting and processing activity. The distribution of this activity provides important information for evaluating the impacts of proposed changes to the fishery. Unfortunately, complete information with which to estimate the contribution of Eastern Gulf groundfish to economies of various communities, or the U.S. as a whole, is not available. Fish tickets, which record the port of landing for fish harvested by the shore-based fleet, provide some information about the geographic distribution of income and employment from this groundfish fishery. No such information is recorded for the catcher/processor fleet. However, since most of their product is exported to Japan, if any of this product is stored or reprocessed in the U.S., this activity likely occurs in Seattle or Dutch Harbor.

Table 17 presents the retained landings and estimated gross revenue to the shore-based fleet by port of landing. As expected, the majority (nearly 75%) of Eastern Gulf groundfish landed shoreside was processed in Southeast Alaska ports, and between 18% and 24% was processed in Southcentral Alaska ports. Sitka, Petersburg and Pelican were the most important ports in Southeast, and Seward dominated the South Central processing activity. Although the majority of landings were processed in these four ports, groundfish processing was distributed to many coastal Alaskan communities.

Table 16. Retained landings and gross revenues to fishermen delivering groundfish harvested in the Eastern Gulf of Alaska to shorebased processors in 1990 and 1991[1/] (metric tons round weight equivalent and dollars).

Species Group	Landings (mt)	Gross Revenues ($)	% of Gross Revenue	Weighted Average Ex-Vessel Price ($/lb)
		1990		
Pacific Cod	50.3	30,786	0.2	0.30
Flatfish	2.6	756	<0.1	0.13
Arrowtooth Flounder	0.4	138	<0.1	0.15
Sablefish	9,903.5	16,959,428	94.9	1.23
POP	1.5	888	<0.1	0.47
Shortraker/Rougheye	94.5	53,611	0.3	0.32
Slope Rockfish	46.2	22,904	0.1	0.34
Pelagic Shelf Rockfish	28.2	18,657	0.1	0.33
Demersal Shelf Rock.	343.3	392,825	2.2	0.54
Thornyheads	102.4	100,486	0.6	0.67
Lingcod	362.2	292,757	1.6	0.52
Other Groundfish	1.2	257	<0.1	0.10
TOTAL	10,936.3	$17,873,493	100%	
		1991		
Pollock	2.5	1,679	<0.1	0.31
Pacific Cod	69.2	38,912	0.2	0.28
Shallow Water Flatfish	1.4	1,064	<0.1	0.35
Arrowtooth Flounder	0.6	175	<0.1	0.13
Sablefish	8,915.6	20,126,602	94.2	1.60
POP	0.2	90	<0.1	0.23
Shortraker/Rougheye	91.0	50,551	0.2	0.32
Slope Rockfish	47.5	26,028	0.1	0.34
Pelagic Shelf Rockfish	73.5	43,774	0.2	0.28
Demersal Shelf Rock.	518.3	578,951	2.7	0.54
Thornyheads	92.9	93,407	0.4	0.64
Lingcod	474.7	395,851	1.9	0.55
Other Groundfish	1.6	872	<0.1	0.25
TOTAL	10,289.0	$21,357,956	100%	

[1/] 1991 data is preliminary.

Source: CFEC Fish Ticket Records, 1992

Table 17. Landings and gross revenues to fishermen by port for groundfish harvested by the shorebased fleet in the Eastern Gulf of Alaska, 1990 and 1991 (metric tons round weight equivalent).

	1990			1991		
Port	Landings	Gross Revenue to Fishermen ($)	% Gross Revenue	Landings	Gross Revenue to Fishermen ($)	% Gross Revenue
Southeast:						
Craig	642.9	989,211	5.5	463.3	831,817	3.9
Juneau	17.0	17,937	<1.0	16.5	23,203	<1.0
Ketchikan	287.9	454,748	2.5	297.7	633,732	3.0
Petersburg	878.7	1,615,612	9.0	873.6	2,267,129	10.6
Sitka	2,689.6	4,439,605	24.8	2,428.2	4,900,333	22.9
Yakutat	1,389.2	2,349,810	13.1	1,560.7	3,147,919	14.7
Other SE Ports[1/]	2,079.4	3,292,896	18.4	1,865	4,071,260	19.1
Southeast Total	7,984.7	13,159,820	73.6	7,505.4	15,875,394	74.3
Southcentral:						
Cordova	670.6	1,083,312	6.1	971.1	1,965,455	9.2
Seward	1,254.2	2,045,091	11.4	1,478.3	2,893,364	13.5
Other SC Ports[1/]	38.0	52,056	<1.0	136	264,451	1.2
Southcentral Total	1,962.8	3,180,459	17.8	2,585.6	5,123,270	24.0
Kodiak	159.2	247,457	1.4	144.7	279,537	1.3
Other Non-Alaskan Ports[1/]	29.4	45,999	<1.0	16.5	41,370	<1.0
Floating	742.1	1,176,689	6.6	8.3	5,451	0.0
Unknown	58.0	63,069	<1.0	28.4	32,934	<1.0
Total All Ports	10,936.3	$17,873,493	100%	10,289.0	$21,357,956	100%

[1/] Individual port information is confidential because four or fewer processors reported purchases.

Source: CFEC Fish Ticket Records, 1990 and 1991

2.5.4.4 Markets and Market Price for Eastern Gulf Groundfish Products

Groundfish products from the Eastern Gulf of Alaska generally compete in either the U.S. (domestic) market or the Japanese (export) market. Sablefish processed by both the shore plants and the catcher/processors is primarily headed and gutted, frozen, and exported to Japan. Pacific cod harvested by the catcher vessels is either used as bait or processed as fresh fillets for the domestic market. Catcher/processors primarily head, gut, freeze and export Pacific cod, flatfish, and arrowtooth flounder.

The catcher/processors are heading, gutting, and freezing most of their rockfish harvests and exporting them to Japan. Although there is competition from Canadian and New Zealand rockfish products, the Alaskan rockfish is valued for its size, color and oil content and often commands a premium price. A representative of the catcher/processor fleet reported that Eastern Gulf of Alaska rockfish are considered to be of better quality than rockfish from the Western Gulf or Bering Sea.

The majority of DSR delivered to shore plants is yelloweye, and is generally sold as a fresh, whole, bled product to fresh West Coast markets. Some is also sold as fresh or frozen fillets. The market for fresh, whole, bled product is limited and the value of rockfish delivered to the shore plants is maximized if this fresh market can be supplied on a consistent basis. However, if high valued rockfish deliveries exceed the fresh market demand in any one week, shore plants are forced to fillet or freeze this product which results in a lower wholesale price. Most shortraker, rougheye and thornyhead rockfish processed in shore plants is headed, gutted, frozen, and exported to Japan. Pelagic shelf rockfish are generally filleted and sold fresh or frozen in the U.S. market.

Price for the rockfish species groups varies depending on the species and product form. There are four important quality aspects of rockfish: uniform red color, large size, oil content, and consistency of flesh. Domestic consumers prefer fresh yelloweye rockfish (DSR) because of the red color, large size, and the light, flaky, non-fishy tasting flesh. Thus, DSR commands a premium price in fresh domestic markets. The Japanese, however, prefer the uniform red color and a more oily flesh. Thornyhead is the highest valued rockfish in the Japanese market, followed by shortraker and rougheye rockfish. POP are red in color, but not as large as these higher valued species. Rougheye rockfish has similar flesh quality as shortraker rockfish but is lower valued because of the dark blotches on its skin. Although they both have uniform red color, thornyhead and shortraker rockfish are not substitutes in the Japanese market because their size and flesh quality differs. Similarly, shortraker rockfish would not substitute for yelloweye rockfish in the domestic market because its flesh quality is not as desirable to U.S. consumers.

Market price and quantity processed are the determinants of gross revenues to all sectors of the fishing industry involved in harvesting, processing or selling groundfish originating from the Eastern Gulf. Estimates of the market price for groundfish in the U.S. and export markets is limited. Many reported prices offer a snapshot of a particular market on a particular day, but are not representative market prices for all products. As an alternative, the average processed product price (a wholesale price) provides information about wholesale level prices for different species groups and for the same species processed by different processor types. These prices are

derived from market prices and probably represent the relative value of the species group to consumers.

Table 18 summarizes the weighted average round weight equivalent and product weight prices for processed product by processor type. Prices are estimated using information about processed product quantity, product form, and wholesale value reported by processors to the ADF&G in annual Commercial Operator Reports (COR).[6] Only information from processors who purchased or processed groundfish harvested in the Eastern Gulf are used to estimate the processed product prices for this analysis. Prices are based on all product processed by these processors regardless of origin, and the total amount of processed product used to calculate the average price is provided in the "processed product weight" column.

A weighted average round weight equivalent (RWE) processed product price is calculated by dividing processed product value by the round weight equivalent of the processed product weight.[7] These prices indicate that, for the processors who purchased Eastern Gulf groundfish, sablefish is generally the highest valued species. Information about the rockfish species groups is not as clear because POP, shortraker and rougheye rockfish had not been removed from the "other slope rockfish" category yet. No processing of shortraker and rougheye rockfish were reported by the catcher/processors, but the shore processors provided separate information for these species. Some POP, shortraker and rougheye rockfish are undoubtedly included in the slope rockfish category, causing average price to be higher than expected. In general, thornyhead and demersal shelf rockfish are the highest valued rockfish species for the shore-based processors and thornyhead and slope rockfish (which included shortraker and rougheye rockfish) are the highest valued for catcher/processors.

Within a particular species group and processor type, the average price for different product forms varied considerably. For example, the weighted average round weight equivalent price for DSR processed in shore plants was $1.20/lb. Average prices for the various DSR product forms ranged from $0.26/lb. for a small amount processed as headed and gutted and frozen rockfish to $1.30/lb. for fresh whole rockfish. Prices also varied between different processor types for the same species and product form. Also note that the average shore-based processed product price for lingcod was $0.41/lb. which is lower than the ex-vessel price of $0.52/lb. reported in Table 16.

---

[6] Processor codes from fish ticket records were matched with processor codes on CORs. Nearly all shore processors filing fish tickets also filed CORs. Product processed by shore plants was distributed as 98% frozen, 3% smoked and salted, and 2% fresh. Product value information was supplied for all the fresh, smoked and salted product, however, only 68% of the frozen product had values reported. Five of 11 factory trawlers (63% of retained landings) and three of six factory longliners (68% of retained landings) reported product value information on CORs.

[7] Conversion factors from processed product form to round weight equivalent were provided by NMFS.

Table 18. Weighted average processed product prices for Eastern Gulf of Alaska groundfish in 1990.

Species Group	Shore-based Processors			Catcher/Processor Trawler			Catcher/Processor Longliner		
	Weighted Average Price		Processed Product Weight[1/] (mt)	Weighted Average Price		Processed Product Weight (mt)	Weighted Average Price		Processed Product Weight (mt)
	Rnd. Wt. ($/lb)	Prod. Wt. ($/lb)		Rnd. Wt. ($/lb)	Prod. Wt. ($/lb)		Rnd. Wt. ($/lb)	Prod. Wt. ($/lb)	
Pacific Cod	0.50	1.15	4,838.4	0.51	0.93	1,302.0	0.51	0.84	1,560.6
Deepwater Flat	0.64	1.47	75.3	0.75	0.96	57.8	0.85	1.18	1.2
Shallow Water Flatfish	0.43	1.92	32.5	0.69	0.96	0.3			
Arrowtooth Flounder	0.94	1.92	1.2	0.71	0.83	52.3			
Sablefish	1.33	2.05	15,359.3	1.15	1.74	958.5	1.51	2.23	486.1
Pacific Ocean Perch	0.87	1.08	0.2	0.26	0.50	609.1			
Shortraker/Rougheye	0.73	0.82	0.6	[2/]			[2/]		
Slope Rockfish	0.75	1.30	215.1	0.77	1.32	5,055.2	1.07	1.79	1.0
Pelagic Slope Rockfish	0.63	1.12	25.8	0.32	0.56	943.4			
Demersal Shelf Rockfish	1.20	1.26	344.3	0.36	0.61	12.1	1.14	1.76	10.6
Thornyheads	1.10	1.67	129.8	1.17	1.68	377.0	1.87	3.12	15.3
Lingcod	0.26	0.41	15.8	[3/]					
Other Groundfish	0.57	0.72	28.5	0.49	0.82	1,283.8			

[1/] Processed product weight reported by processors and used to calculate average prices. This product is not necessarily all from fish harvested in the Eastern Gulf but represents all product processed by processors who purchased or harvested Eastern Gulf groundfish.

[2/] Pacific Ocean perch, shortraker, and rougheye rockfish were included in the slope rockfish complex in 1990.

[3/] Lingcod landings by catcher/processors are included with other groundfish.

Source: Alaska Department of Fish and Game Commercial Operator's Reports, 1990

2.5.4.5 Estimated Gross Revenues from Processed Eastern Gulf Groundfish in 1990

Estimated gross revenues to processors from Eastern Gulf groundfish in 1990 are presented in Table 19. Round weight equivalent product prices (from Table 18) are applied to the round weight equivalent of retained landings to generate estimated gross revenues to processors. Total gross revenues from processed product by the shore-based processors and the catcher/processors total $42.1 million. Seventy-five percent was earned by the shore-based processors, 23% by the catcher/processor trawlers, and 2% by the catcher/processor longliners. The majority of catcher/processor trawler earnings came from the West Yakutat area (74%), followed by the Southeast Outside (22%), and East Yakutat (4%). Catcher/processor longliners earned 99% of their gross revenues from sablefish harvested in the West Yakutat area. Gross revenues to the shore-based processors was distributed as 37% West Yakutat, 16% East Yakutat, and 48% Southeast Outside.

2.6 Bycatch and Habitat Considerations

2.6.1 Bycatch Considerations

Bycatch problems, particularly those related to salmon, were included as one of the issues prompting the request for a trawl closure in the Southeast Outside District. A review of the 1990 observer data did not demonstrate a noteworthy problem with interception of salmon in the Eastern Gulf trawl fishery; at least during that year. Table 20 shows the summary of the salmon bycatch in the 1990 trawl observer data. The composite catch rate of .0076 salmon per ton of groundfish was considerably lower than the composite catch rate of .08 salmon per metric ton of groundfish observed in the Central and Western Gulf Regulatory Areas. Preliminary analysis of the 1991 observer data shows a comparable catch rate of .009 salmon per metric ton of groundfish in the Eastern Gulf. Data for 1991 was not yet available from the other areas of the Gulf.

The bycatch of halibut was considerably higher than that of salmon in the trawl fisheries in the Eastern Gulf during 1990 with a composite ranking of ninth of all species caught. Halibut made up over 2% of all fish landed and were taken at the rate of .07 mt/hour.

Preliminary analysis indicates that the bycatch of halibut remained about the same in 1991 at approximately 2% of the total groundfish catch. During 1990 the halibut bycatch rate was slightly higher in the in the West Yakutat District than in the Southeast Outside District. However, in 1991 the halibut bycatch rate in the Southeast Outside District was markedly higher than in the West Yakutat District. It is presumed that at least part of that change can be attributed to the fact that a large proportion of the West Yakutat groundfish harvest was taken by pelagic trawl gear in 1991 and the database which was available for this analysis does not differentiate between pelagic and bottom trawl gear.

2.6.2 Habitat Considerations

The expanded Southeast Outside District is characterized by a much narrower shelf area than found in the other parts of the Gulf of Alaska. Much of the East Yakutat portion is glacial moraine with cobble or large boulders surrounded by a combination of gravel, glacial silt, and

Table 19. Round weight equivalent of processed product and estimated gross revenues to processors from groundfish harvested in the Eastern Gulf of Alaska in 1990 (metric tons round weight equivalent and dollars).

Species Group		West Yakutat (640) Processed Product[1/] (mt)	West Yakutat (640) Est. Gross Revenues ($)	East Yakutat (680) Processed Product (mt)	East Yakutat (680) Est. Gross Revenues ($)	Southeast Outside (650) Processed Product (mt)	Southeast Outside (650) Est. Gross Revenues ($)	Eastern Gulf Total Processed Product (mt)	Eastern Gulf Total Est. Gross Revenues ($)
Pacific Cod	CPTWL							11.5	12,944
	SBHAL							50.3	55,490
	Total	20.7	23,115	7.1	7,800	33.9	37,382	61.8	68,434
Deepwater Flatfish	CPTWL							61.0	100,811
	SBHAL							<0.1	60
	Total	60.6	100,149	0.2	347	0.2	374	61.0	100,870
Shallow Water Flatfish	CPTWL							36.9	54,711
Arrowtooth Flounder	CPTWL							42.1	66,085
Sablefish	CPTWL							510.6	1,294,780
	CPHAL							203.7	678,276
	SBHAL							9,903.4	29,043,197
	Total	4,350.0	12,686,433	1,593.1	4,662,127	4,674.7	13,667,693	10,617.7	31,016,254
Pacific Ocean Perch[2/]	CPTWL							601.4	344,778
	CPHAL							0.6	1,151
	SBHAL							1.5	2,808
	Total	511.8	295,663	0.1	148	91.6	52,926	603.5	348,737
Shortraker/[2/] Rougheye	CPTWL							9.3	15,013
	SBHAL							93.5	150,547
	Total	27.1	43,689	25.5	41,106	48.2	77,525	102.9	165,560

CPTWL = Catcher/Processor Trawler, CPHAL = Catcher/Processor Hook and Line, SBHAL = Shore-based Hook and Line

Note: Particular sections of this table have been purposely left blank to protect confidential data.

Table 19. Round weight equivalent of processed product and estimated gross revenues to processors from groundfish harvested in the Eastern Gulf of Alaska in 1990 (metric tons round weight equivalent and dollars).

Species Group		West Yakutat (640) Processed Product[1/] (mt)	West Yakutat (640) Est. Gross Revenues ($)	East Yakutat (680) Processed Product (mt)	East Yakutat (680) Est. Gross Revenues ($)	Southeast Outside (650) Processed Product (mt)	Southeast Outside (650) Est. Gross Revenues ($)	Eastern Gulf Total Processed Product (mt)	Eastern Gulf Total Est. Gross Revenues ($)
Slope Rockfish[2/]	CPTWL							4,475.9	7,599,411
	CPHAL							4.6	9,851
	SBHAL							43.4	71,729
	Total	3,257.8	5,533,101	170.3	288,696	1,091.5	1,852,151	4,523.9	7,680,991
Pelagic Shelf Rockfish	CPTWL							463.1	326,765
	SBHAL							28.2	39,142
	Total	473.8	341,940	1.5	1,993	15.9	21,956	491.3	365,907
Demersal Shelf[2/] Rockfish	CPTWL							9.5	7,894
	CPHAL							3.1	7,915
	SBHAL							343.1	907,608
	Total	16.1	25,692	25.7	67,123	313.9	830,603	355.7	923,417
Thornyheads	CPTWL							323.5	834,621
	CPHAL							5.9	23,956
	SBHAL							102.2	247,782
	Total	266.0	688,600	36.3	90,822	129.2	326,937	431.5	1,106,359
Lingcod	SBHAL	17.5	10,047	50.9	29,155	293.8	168,413	362.2	207,644
Other Groundfish	Total							8.1	7,505

CPTWL = Catcher/Processor Trawler, CPHAL = Catcher/Processor Hook and Line, SBHAL = Shore-based Hook and Line

Note: Particular sections of this table have been purposely left blank to protect confidential data.

Table 19. Round weight equivalent of processed product and estimated gross revenues to processors from groundfish harvested in the Eastern Gulf of Alaska in 1990 (metric tons round weight equivalent and dollars).

Species Group		West Yakutat (640) Processed Product[1/] (mt)	West Yakutat (640) Est. Gross Revenues ($)	East Yakutat (680) Processed Product (mt)	East Yakutat (680) Est. Gross Revenues ($)	Southeast Outside (650) Processed Product (mt)	Southeast Outside (650) Est. Gross Revenues ($)	Eastern Gulf Total Processed Product (mt)	Eastern Gulf Total Est. Gross Revenues ($)
All Groundfish[3/]	CPTWL							6,551.2	10,665,022
	%EGOA							100.0%	100.0%
	CPHAL							216.1	717,751
	%EGOA							100.0%	100.0%
	SBHAL							10,930.9	30,728,843
	%EGOA							100.0%	100.0%
	Total	9,083.1	19,871,408					17,698.2	42,111,617
	%EGOA	51.3%	47.2%					100.0%	100.0%
	TWL	4,989.1	7,914,137			1,567.0	2,758,534	6,556.1	10,672,671
	%EGOA	76.1%	74.2%			23.9%	25.9%	100.0%	100.0%
	HAL	4,094.0	11,957,271	1,707.5	4,808,126	5,340.7	14,673,549	11,142.1	31,438,945
	%EGOA	36.7%	38.0%	15.3%	15.3%	47.9%	46.7%	100.0%	100.0%
	Shorebase	3,880.5	11,248,090	1,707.5	4,808,126	5,348.0	14,680,277	10,935.9	30,736,493
	Catch/Proc.	5,202.6	8,623,318			1,559.7	2,751,806	6,762.3	11,375,124
	Total	9,083.1	19,871,408	1,707.5	4,808,126	6,907.7	17,432,083	17,698.2	42,111,617

CPTWL = Catcher/Processor Trawler, CPHAL = Catcher/Processor Hook and Line, SBHAL = Shore-based Hook and Line

Note: Particular sections of this table have been purposely left blank to protect confidential data.

1/ Round weight equivalent of processed product.

2/ Total harvest figures presented in Table 15 combine POP and SRRE with other slope rockfish according to the NMFS species group designation. In this table, information is presented as reported by processor. Some of them reported components of the other slope rockfish category under their individual species names.

3/ Totals reflect actual landings and may vary due to rounding.

Table 20. 1990 Observer Data - Observed Hauls Only. Number of hauls, total groundfish catch, and salmon bycatch rate expressed as the total number of salmon/the total groundfish catch in metric tons.

Salmon rates (total #/total tons) for the Eastern GOA

Month	# Hauls	Salmon Rate	Total Catch	Fish
3	35	0.045411	352.34	16
4	190	0.006622	2,567.09	17
5	249	0.005640	2,127.56	12
6	11	0.013653	146.49	2
7	10	0.050852	78.66	4
8	115	0.000000	1,405.00	0
	610	0.0076	6,677.2	51

Salmon rates (total #/total tons) for the Central and Western GOA

Month	# Hauls	Salmon Rate	Total Catch	Fish
1	46	0.08133	2,164.14	176
2	190	0.04761	3,424.01	163
3	586	0.06160	7,126.65	439
4	653	0.06654	10,233.76	681
5	391	0.04001	4,149.33	166
6	41	0.86831	547.04	475
7	990	0.05474	10,449.53	572
8	551	0.12331	6,949.86	857
9	473	0.08016	7,172.71	575
10	854	0.08738	19,249.27	1 682
11	220	0.07775	2,199.38	171
	4,995	0.0809*	73,665.70	5,957

*(10.6 x rate in Eastern GOA)

sand substrate. The Fairweather Grounds, a large, shallow rocky bank, approximately forty miles offshore, is a major feature of this area. Predominant features of the Southeast portion include rocky ridges, lava plains, offshore pinnacles, and associated hard bottom habitat. The shelf break is very steep and the number of deepwater gullies is limited. The percentage of smooth bottom habitat and the width of the shelf both increase slightly toward the southern half of the area, but the entire area is still much rougher and narrower than the remainder of the Gulf.

There are three major effects of this narrow shelf and extensive rocky hard bottom habitat. The first is that most species normally associated with large areas of smooth bottom such as pollock, Pacific cod, and most flatfish, do not occur in large numbers. Second, the remaining commercial species complex, which is made up primarily of rockfish, sablefish, and halibut, coexist in a limited amount of productive habitat. This has a tendency to compress the population into a smaller area. Third, the bottom topography limits the amount of trawlable area and the trawling which occurs tends to be concentrated in relatively small portions of the entire area. These factors greatly increase the risk of conflicts between gear type and/or grounds preemption problems because both hook-and-line and trawl gear are often competing for limited areas of productive fishing.

One concern expressed by ALFA was the potential for on-bottom trawl gear to destroy or disrupt the bottom habitat. The rocky substrate serves as a hold-fast for various forms of corals, sponges, and other benthic invertebrates which inhabit this area in large numbers.

The Eastern Gulf of Alaska has been identified as having more diversity and abundance of corals than other parts of the state. Hard corals are presumed to grow slower and live longer (up to 100 years) than corals in more temperate regions, but that has not been adequately researched or quantified (Climberg and Gerrodette, 1981). Much of that report was made up of anecdotal information and the exact distribution and abundance of coral in Alaskan waters is poorly understood. It should be noted that in other areas of the country, coral habitat is protected by federal law and the South Atlantic Fishery Management Council has taken measures to assure protection of coral habitat in the development of their FMPs. There was insufficient time available in preparing this analysis to determine whether South Atlantic fishery managers had better coral/trawl interaction data when developing their regulations.

Corals, sponges, bryozoans, sea anemones, and other benthic invertebrates are reported in the 1990 trawl observer database, but in very small amounts relative to other species. It is not known how consistently these species are accurately monitored as part of the observer effort. These species, particularly sponges, are also reported as being taken in the triennial trawl surveys, but data was not available to document the extent of that catch and the trawl survey is designed to stay away from rough bottom habitat.

There are numerous reports available regarding the impact of trawling on bottom habitat in other parts of the world, but none directly related to the North Pacific Ocean. The actual impact is very likely a function of the type of gear used, the area fished, and the target species. If trawling is allowed to continue, studies should be initiated to document the impact, particularly on corals which have received special attention for protection in some areas.

The reports available on trawl impacts indicate a potential threat to soft-bottom habitat and to the bottom-dwelling invertebrates living in the soft-bottom areas. Much of the impact is a direct result of suffocation from disturbed and redeposited bottom substrate. In some studies a change in composition of bottom-dwelling invertebrates was directly attributed to trawl activity. This aspect of the impact of trawling on bottom habitat should also be further explored in the Gulf of Alaska as data to evaluate the impacts are lacking.

Pacific Ocean perch, which were the single most important target rockfish species landed by trawl gear in 1990 and 1991, are often observed associated with smooth to relatively smooth bottom substrate where impacts on coral and sponges is considered to be minimal. Shortraker rockfish, another important commercial species, are often found in association with moderately sloped substrate on smooth bottom interspersed with large boulders or schooling over very steep rugged substrate. Most slope rockfish observed associated with the coral "forests" in submersible studies conducted by the ABL were lesser utilized species such as silvergray rockfish. Rosethorn, redbanded, and to a lesser extent, yelloweye rockfish, which are all members of the DSR assemblage were also often associated with the coral habitat (Personal communication with Ken Krieger, NMFS, ABL).

Over the past 10 years there have been at least four documented reports of longline vessels retrieving portions of trawl nets off Southeast Alaska with sablefish in them. In at least two of the instances fish were in various stages of decomposition from fresh to highly decomposed suggesting that the nets had continued to capture or entangle fish over an extended period. Again, it is not know the extent of this problem, but it is included as a consideration since lost gear is one documented impact of trawling on the habitat in the Southeast Outside District.

2.6.3 Marine Mammal Considerations

It is not known to what extent fishermen in the Eastern Gulf of Alaska interact with marine mammals. Problems in the sablefish longline fishery associated with killer whales in Prince William Sound and the Bering Sea have not been reported in the outside waters of the Eastern Gulf. Steller sea lions have been reported in close proximity to both hook-and-line and trawl operations, but the extent of interaction is not well documented and the direct impacts on marine mammals is not known.

A recent report (Perez and Loughlin, 1991) indicates that the incidental rate of Steller sea lions in foreign trawl fisheries off Yakutat was relatively high, averaging over 25 animals per 10,000 mt of groundfish, during 1978, 1979, and 1980. The rate dropped to zero for 1981 and 1982. There were no documented incidental catches of sea lions in the Southeast area. According to the "Marine Mammal Considerations" section of the 1992 SAFE Report (NPFMC, 1991), Steller sea lion populations have increased in Southeast Alaska by 38% from the 1970s to 1991 and by 6% from 1990 to 1991. However, the entire Eastern Gulf population has decreased by 32% over that same period. While not explicitly stated in the report, this suggests that the decline in the Yakutat portion of the Eastern Gulf was substantial. While trawl activity has been much greater in the West Yakutat area than in the Southeast Outside area, there is no conclusive evidence to directly link changes in sea lion abundance to fishing activity.

2.7 Socioeconomic Considerations

Fishery Management Plan (FMP) amendment proposals must be evaluated based on economic and social objectives defined in the MFCMA and other related legislation. National standards for the FMPs (50 CFR part 602) require that regulations promote economic efficiency in utilization in the harvesting, processing and marketing sectors of the fishing industry. No action may be taken which decreases economic efficiency unless it can be justified on other biological or social criteria. Social objectives include promoting stability and economic well-being in the industry and in communities dependent on the industry. The socioeconomic analysis should evaluate the impacts of a proposed regulation on economic efficiency at the national level and on the distribution of these effects among user groups, industry and communities affected by the fishery. However, although evaluating economic impacts of alternative actions may be straightforward on the theoretical level, it is rarely possible on the practical level. Social objectives are much more subjective and often in conflict with economic objectives.

Maximizing economic efficiency requires that resources are allocated so as to maximize the net value of output in an economy. In the case of fisheries, efficiency is achieved or improved if resources such as capital investment, labor, raw fish, fuel and other inputs necessary to produce a seafood product are combined in such a way that the product is produced for the lowest cost. Economic efficiency is not promoted by an action that increases the cost of producing the same amount of output.

Maximizing net national benefits (EO 12291) requires that the objective of a proposed regulation be to maximize national net benefits. "[T]he chosen regulatory approach or alternative is the one with the least net cost to society, if practicable; and regulatory action is not undertaken unless the potential benefits outweigh the potential costs to society". This is directly related to the economic efficiency criteria because the most efficient alternative maximizes net national economic benefit.

Net national benefit is a measure of the net effect of changes in supply and demand on consumers and producers in the economy. Theoretically, to measure the impact of a particular regulatory proposal on net national benefit requires information about the aggregate retail level demand and supply of a particular fisheries product and how supply and demand for this product interacts with potential substitute products. Although net national benefit is evaluated at the retail/consumer level, costs and benefits to participants at all levels from fishermen to consumers are included in these supply and demand relationships. If we manage to maximize net national benefit, we are attempting to maximize the sum of benefits to individual/firms at all levels; we are not managing for a particular combination of costs and benefits.

The social objective requires managers to balance economic efficiency and net national benefits criteria against impacts on "winners and losers". Efficiency, and the objective of maximizing the net national benefits imply that consumers and producers in the U.S. as a group are better off; however, individual groups may suffer losses as a result of a more efficient allocation of resources. Many of the perceived costs and benefits of an action are transfers between two groups and cancel each other at the national level. This is why social objectives are also important in the decision making process. Impacts of a proposed regulation on the distribution of harvests, earnings, and employment to user groups and communities are considered in the

socioeconomic analysis. Ultimately the trade offs between economic efficiency and the distribution of costs and benefits must be weighed.

Although the effects on consumers and producers outside the U.S. are not considered directly in the calculation of net national benefits, impacts on international markets enter the analysis if they influence market prices, which most certainly impacts net national benefits calculations. In other words, if an action results in an increase in market prices the loss to foreign consumers is not of concern, but the loss to domestic consumers and potential benefits to domestic producers must be considered.

Estimating the change in net national benefits as a result of any of the alternatives in this amendment proposal is not possible because we do not have estimates of the aggregate demand or supply functions for any of the fisheries products originating from the Eastern Gulf of Alaska. A less satisfying alternative is to prepare a benefit cost analysis which places a monetary value on the incremental benefits and costs of each alternative on impacted groups. However, this method of analysis is complicated by the lack of information available to quantify all costs and benefits and the lack of time to develop good estimates of those factors which could be quantified. Specifically, market price determination is unknown (or unquantifiable at this time), information on harvesting and processing costs is limited, and as is information about the indirect effects such as the effect of employment and income from these fisheries on communities in Alaska and other states. The analysis is further complicated because we have no experience with status quo under important regulation changes that have just been put in place for the 1992 season.

A formal social analysis was not done for this FMP amendment proposal. According to guidelines written for the inshore-offshore analysis, a social impact analysis "attempts to answer basic questions such as: who is affected? what will happen to those people affected? what will change under each alternative? how will any of the proposed changes affect social systems and the stability of these systems?" (NMFS, 1990) The social impacts of each alternative are tied primarily to the economic impacts in that changes in harvests by each gear group in the future directly impacts income and employment to fishermen and processors and indirectly impacts the economies and social conditions in communities dependent on the fisheries. A social analysis could provide information about the importance of both income and participation in the Eastern Gulf hook-and-line and trawl fisheries to the people and communities that support and benefit from these fisheries. Economic information presented in this analysis, including distribution of harvest and gross earnings by gear type and processor type, distribution of shore-based landings by community, and discussion of future changes in harvest and earnings are also relevant in determining social impact.

Some of the information necessary for to evaluate social impacts is contained in data already collected by management agencies. For example, information about residence address could be used together with the port of landing information presented in Table 17 to identify impacted communities. Attributing the economic activity on catcher/processors to a particular community is more complicated because their processing activity takes place at sea. Nonetheless, these processors contribute some level of benefits to a community although it may be difficult to identify these communities and provide social and economic analysis comparable to that for the shore-based processing sector. Allocating a portion of each community's annual harvesting or

processing employment specifically to the Eastern Gulf groundfish fishery would be complicated, however, given enough time, some estimate could be made. Finally, the impact of economic and social losses are determined, in part, by how dependent a group is upon this fishery as a source of income. Fish ticket records and weekly production reports could be used to estimate the proportion that the Eastern Gulf groundfish fishery represents of each vessels overall gross earnings from fishing activity in Alaska. This information would provide some indication of the relative dependence of the various fleets on the Eastern Gulf fishery.

There are many limitations on the economic and social analysis possible for this amendment proposal. In light of these limitations, the economic impacts of each alternative will be evaluated by identifying the nature of costs and benefits to the impacted groups, quantifying them, if possible, and providing some conclusions regarding the impact of each alternative on the distribution of costs and benefits between user groups. In the absence of formal social analysis, the social impacts of the alternatives must be inferred based on the economic impacts.

2.8 Impacts of the Alternatives

Much of the discussion under this section is rather subjective simply because of the characteristics of the information available. Information was reviewed to determine how each of the alternatives might resolve conflicts between user groups and address the seven problems presented by ALFA (Section 2.2). Where information is inconclusive, an attempt has been made to present the pros and cons of a particular action knowing full well that the results are often speculative rather than absolute.

2.8.1 Alternative 1: No action.

2.8.1.1 Biological and Environmental Impacts

Under this alternative groundfish would continue to be managed in the Eastern Gulf of Alaska as they are today, subject only to subsequent regulatory changes. TAC levels for most species would continue to be set for the entire area. With the exception of the present gear allocation for sablefish throughout the Eastern Gulf and the bycatch standards set for DSR in the Southeast Outside District, all groundfish could be harvested competitively by all gear groups wherever they choose to fish.

If one gear group were to take the TAC of a given species category the entire Eastern Gulf would be closed to directed fishing or the retention of that particular species or species category would be prohibited, depending on the amount harvested in relationship to the TAC. The fishery for that species would remain closed throughout the Eastern Gulf for the remainder of the calendar year regardless of who had taken the fish or in which management area the fish were taken.

The entire TAC of a given species group apportioned to the whole Eastern Gulf could be harvested in a small segment of the area. This potentially increases the risk of localized depletion for those species which are non-migratory. Also, the competitive race for fish potentially increases the risk of exceeding harvest objectives. If concentrated fishing effort results in harvest of a species group which reaches or exceeds the overfishing definition, all fisheries which take that species or species group in any amount could be curtailed.

This alternative would also allow for the continuation of habitat degradation, bycatch of prohibited species, and impacts on marine mammals caused by trawling in the Southeast Outside District to the extent that these problems are already occurring. However, as indicated in Section 2.6.1, the impacts of trawling on salmon are small in the Eastern Gulf compared to other areas of the Gulf. The impacts of trawling on the bottom habitat and impacts on marine mammals have received only limited documentation (see Sections 2.6.2 and 2.6.3). Given that the predominant species taken in the Southeast Outside District by trawl gear is rockfish, it must be presumed that at least some of the trawl effort takes place over rocky substrate where physical impacts on larger benthic invertebrates such as sponges and corals are likely to occur.

However, as reported in Section 2.6.2, POP which are the predominant rockfish species landed by trawl gear, are most often observed in association with smooth to relatively smooth and readily trawlable bottom substrate where impacts on corals and sponges is considered to be slight. Shortraker rockfish, another important commercial species, are often found in association with moderately sloping substrate on smooth bottom interspersed with large boulders or schooling over very steep rugged substrate. Species harvested in large amounts by trawl gear in recent years were not frequently observed in association with the coral areas. Corals and sponges are reported in the Eastern Gulf trawl harvest, but in relatively small amounts. It is not known if trawl activity results in significant damage to the benthic environment.

Option: Establish a framework procedure for setting time/area restrictions by gear and species group to resolve conflicts.

Expansion of the Regional Director's "hot spot" authority could be extended to allow resolution of gear and grounds preemption conflicts. This would, however, require preparation of a separate plan amendment and a thorough independent analysis prior to action. While worthy of further consideration, this option is beyond the scope of this document.

2.8.1.2 Economic Impacts

The social and economic consequences of the "no action" alternative depend on how the Eastern Gulf of Alaska groundfish fishery changes in the future. The future distribution of fishing effort, harvests, and earnings from this fishery will not only depend on what happens in this fishery, but in other fisheries as well. The combination of possible events that could lead to changes in the Eastern Gulf groundfish fishery are numerous and the likelihood that any one scenario will be realized is very difficult to quantify. Rather than trying to predict exactly what will occur in this fishery in the future, the following discussion considers some of the important aspects of the no action alternative. The issues discussed here are not limited to the status quo, however, and many also apply to the future under the other alternatives as well.

Of the seven problems raised by ALFA, the most important from the social and economic perspective are concern about increased effort by the catcher/processor trawlers in the Southeast Outside District, grounds preemption, and economic displacement of the shore-based hook-and-line fleet either through direct competition for groundfish or through curtailment of groundfish and halibut fisheries as a result of overfishing small rockfish TACs.

The information presented in the sections which reviewed the 1990 and 1991 groundfish fishery indicate that "unprecedented" levels of catcher/processor trawler activity in the Southeast Outside District did not occur in these years. The total number of catcher/processor trawlers in the Eastern Gulf declined from 11 in 1990 to 10 in 1991, and the number participating in the Southeast Outside/East Yakutat areas declined from 7 to 6. Total harvests by the catcher/processor trawlers in the Eastern Gulf declined from 10,300 mt to 8,100 mt and in the Southeast Outside/East Yakutat area from 2,300 mt to 1,600 mt. Catcher/processor trawlers increased their bycatch of both sablefish and DSR in the Southeast Outside/East Yakutat areas in 1991 and also increased harvests of Pacific cod and pelagic shelf rockfish. Harvests of pollock, flatfish, arrowtooth flounder, and thornyhead rockfish decreased. POP and shortraker/rougheye rockfish were harvested under separate TACs for the first time in 1991.

About 1,100 shore-based hook-and-line vessels reported landings of groundfish in the Eastern Gulf of Alaska in 1991. This was an increase of about 49 over 1990. The number of vessels in the shore-based hook-and-line fleet (except troll) increased from 1990 to 1991, while average landings per vessel declined. This information illustrates the high level of participation in this fishery by the shore-based fleet, and thus the social and economic dependence on the fishery. At the same time it demonstrates the increase in effort on the part of the hook-and-line fleet, which also contributes to gear conflicts.

No analysis was done to estimate the relative dependence of the catcher/processor trawlers or the shore-based hook-and-line fleet on the Eastern Gulf groundfish fisheries in comparison to their overall fishing activities.

Sablefish and DSR are the most important groundfish species to the shore-based hook-and-line fleet. Therefore, in spite of the fact that overall trawl effort did not appear to increase in 1991, increased bycatch of sablefish and DSR are of concern. Although total harvest of sablefish in the Eastern Gulf declined from 1990 to 1991 as a result of lower TACs, trawl bycatch in the Southeast Outside/East Yakutat area increased. However, in both 1990 and 1991, this harvest remained below the 5% of TAC allocated to trawlers in the Southeast Outside/East Yakutat areas. However, the 5% sablefish TAC allocated to trawlers was exceeded in both years in the West Yakutat area.

Reported trawl bycatch of DSR in the Southeast Outside area increased considerably from 0.5 mt in 1990 to 15 mt in 1991. Trawling was closed in the Southeast Outside area on July 26, 1991 due to concern about overfishing of DSR. Recent regulations prohibiting rockfish trawling in the Gulf prior to July 1, and proposed regulations to establish a separate halibut PSC for DSR and to reduce the directed trawl fishing standard for DSR to 1% should decrease the amount of DSR taken by the trawlers and increase the proportion of the DSR TAC taken by the hook-and-line fleet in the future. Shortraker and rougheye rockfish were also placed on bycatch-only status early in 1991 due to concern about overfishing. ALFA has expressed concern that increased trawl effort in the future could result in overharvesting small rockfish TACs which could lead to curtailment of the fall halibut fishery. During the September 1991 opening, 3.9 million pounds of halibut were harvested in area 2C. Ex-vessel prices ranged from $1.60/lb. to $2.35/lb. (IPHC, 1992). Potential for overharvesting to occur depends on many factors including the ability of managers to regulate harvest to stay within the established TAC limits.

Although economic displacement of the hook-and-line fleet as a result of trawl effort cannot be established at current levels of effort, this does not preclude future expansion of the trawl fleet, or the catcher/processor longliner fleet, from impacting the fisheries and economies on which coastal Alaskan communities are dependent. Increased trawl effort in the Southeast Outside District could occur if more vessels harvest the same amount of fish that is currently being harvested or if either the same number of vessels or more vessels harvest increasing amounts of groundfish. Information in Table 12 shows that the Eastern Gulf TACs for Pacific cod, flatfish, arrowtooth flounder, and other slope rockfish are currently underutilized. In 1991, harvests of these species groups were not curtailed by in-season management regulations. Changes in market conditions, fishing technology, or the availability of fish in other areas could result in increased effort on these underutilized TACs. Trawler's harvests of sablefish, POP, DSR, shortraker and rougheye rockfish, and thornyhead rockfish may not increase in total in the future, however, if these TACs go on bycatch-only status or PSC status earlier, hook-and-line harvests may be reduced. Finally, increased trawl effort may lead to direct gear conflicts on the fishing grounds or changes in longline catch rates as was experienced while the foreign fleet was operating in the Eastern Gulf.

Complicating predictions of the future of the Eastern Gulf groundfish fisheries is the impact of the IFQ and inshore-offshore regulations. If IFQ's are implemented and are successful in spreading effort in the sablefish and halibut fisheries throughout the year, gear conflicts could increase. The current regulation closing the Gulf to trawling prior to July 1 would not be effective in reducing gear conflict during the early halibut and sablefish seasons because, under IFQs, these seasons would presumably not be concentrated in a several day or several week period. The inshore-offshore allocation currently under consideration allocates 100% of the pollock and 90% of the Pacific cod in the Gulf of Alaska to inshore fisheries. Offshore vessels displaced from these fisheries may view the underutilized species found in the Eastern Gulf as an option for their vessels. However, these underutilized species are also found in much greater abundance in the Western and Central Gulf and future development of these fisheries will most likely occur there.

Increased harvests of sablefish and rockfish by the catcher/processor longliners from 1990 to 1991 occurred primarily in the West Yakutat area. Further expansion in the Southeast Outside area by this fleet is unlikely due to competition with the large shore-based hook-and-line fleet for limited grounds (IFQs may change this). Similarly, the economic incentive for catcher/processor longliners to increase harvests of DSR in the Southeast Outside area is constrained by the 7,500 pound weekly trip limit under state regulations.

Market price may be adversely impacted by status quo in fisheries where the harvest is occurring during shorter and shorter seasons. In general, price is higher for consistently higher quality products targeted at specialty markets and supplied on a consistent basis throughout the year. All participants in the fishery suffer a loss when market price falls. Consumers may benefit from decreasing market prices unless it is at the expense of high quality, available product, which they prefer. In general, however, groundfish specifically from the Southeast Outside/East Yakutat area of the Eastern Gulf represent a small proportion of total groundfish supplies and changes in harvests in this area are unlikely to impact market prices for most species.

Damage to slow growing corals and impacts on marine mammals and seabirds in the Eastern Gulf were listed as potential problems of the "no action" alternative. These impacts would certainly result in a cost to user groups, and to society. However, the lack of documentation of these problems makes it difficult to verify them and impossible to quantify economic impacts.

2.8.2 Alternative 2: Prohibit all groundfish trawling in waters east of 140°W. longitude.

2.8.2.1 Biological and Environmental Impacts

Under this alternative all trawling for groundfish would be banned from the recently expanded Southeast Outside District. This option would clearly result in the maximum alleviation of the problems presented by ALFA to the extent that they actually occur and to the extent that the problems are the result of trawl activity.

The notable increase in trawl effort anticipated by ALFA did not materialize during 1991 and, in fact, total trawl harvests were lower in 1991 than in 1990 (see Section 2.5.2). In addition, a higher proportion of the total 1991 trawl landings was made up of pollock taken by pelagic trawl gear in the West Yakutat area.

Other issues such as high salmon bycatch, direct grounds preemption/gear conflicts and concern over potential declines in marine mammals can not be substantiated by the existing data at the current levels of trawl participation in the area.

If the Southeast Outside District is closed to trawling some reapportionment of the current TAC levels would likely have to be considered. Table 21 shows one possible reapportionment of TAC by management area in the Eastern Gulf. It is based upon the percentage of biomass in each management area as recalculated by the Auke Bay Laboratory applied to the 1992 TACs.

If the Council were to adopt this approach, a substantial segment of the Eastern Gulf rockfish TAC would be reapportioned to the Southeast Outside District. Certain species which are currently harvested almost exclusively by trawl gear such as POP would likely go unharvested or be caught at much lower levels. Other species could be harvested by hook-and-line gear, but large portions of the TAC limits would likely be unutilized at least until alternative non-trawl methods could be developed to fish for them effectively.

Elimination of trawl effort in the Southeast Outside District would undoubtedly result in a reduction in the overall harvest of POP, shortraker and rougheye rockfish, thornyhead rockfish, arrowtooth flounder, and some species of other slope rockfish.

Adoption of this alternative could result in a much more conservative approach to rockfish management by default. This would offer the greatest level of protection to the POP and other slope rockfish stocks and would promote the most aggressive rebuilding schedule for POP possible under any of the alternatives. It is conceivable that rebuilding of POP stocks in the Southeast Outside District would benefit the adjacent West Yakutat area and even areas further to the west through a drift of larvae and juvenile fish along the prevalent westerly flowing coastal current.

Table 21. Apportionment of the 1992 Total Allowable Catch (TAC) levels for groundfish in the Eastern Gulf of Alaska based on the Auke Bay Laboratory's reassessment of biomass by management zone. Results are shown in metric tons.

SPECIES	1992 TAC	WEST YAKUTAT APPORTIONMENT	S.E./E. YAKUTAT APPORTIONMENT
POLLOCK[1/]	3,400	2,176 (64%)	1,224 (36%)
P. COD[1/]	1,000	640 (64%)	360 (36%)
DEEP FLAT	3,000	2,028 (68%)	960 (32%)
SW FLAT	1,740	1,653 (95%)	87 (5%)
FLATHEAD	3,000	2,220 (74%)	780 (26%)
AT FLOUND	5,000	2,006 (40%)	3,000 (60%)
SABLEFISH[2/]			
WYAK	3,740 (43%)		
SE/EYAK	4,990 (57%)		
EG TOT	8,730	4,889 (56%)	3,841 (44%)
POP	2,169	759 (35%)	1,410 (65%)
SHTRAK/RE	570	251 (44%)	319 (56%)
SLOPE ROCK	6,160	370 (6%)	5,790 (94%)
DS ROCK[3/]			
SE OUT	550	n/a	550 (100%)
PS ROCK	1,281	1,050 (82%)	231 (18%)
ALL ROCK	10,730	2,430 (33%)	8,300 (77%)
THORNYHEADS[4/]			
GULFWIDE	1,798	n/a (39%)	n/a (61%)

1/ Revised ABCs were not calculated for these species. The percentages shown are the result of revised biomass estimates for each management zone calculated from an average of the 1987 and 1990 trawl surveys. See Appendix 3 for an explanation of the proceedure used.

2/ Sablefish ABC levels were previously calculated for each management zone from a combination of trawl and longline survey data. The percentages shown in the management zone columns are from the revised biomass estimates calculated from an average of the 1987 and 1990 trawl surveys. The fishery is managed based upon relative abundance indicators from the longline surveys as the trawl surveys are not considered to be reliable estimators of sablefish abundance.

3/ Demersal shelf rockfish did not occur in the revised survey analysis and are considered part of the "other slope" rockfish complex in the West Yakutat area.

4/ The thornyhead ABC is not apportioned by regulatory district. The Gulfwide ABC was reduced from 3,800 mt in 1988 through 1990 to 1,798 mt in 1991 and 1992. The percentages shown are for comparative purposes only and cannot be applied to the Gulfwide TAC to calculate distribution by mangement zone.

However, issues such as the impacts of fishing on rockfish stocks and rebuilding schedules for depressed or depleted species should be a function of overall management strategy rather than promoted through gear allocation. With few exceptions, the rockfish TACs currently in place for the Eastern Gulf of Alaska are not being fully taken at this time. While of concern to many people, discussions regarding the appropriate setting of rockfish harvest objectives and rebuilding schedules for depressed species are beyond the scope of this document.

This alternative would reduce the risk that trawl effort could result in overfishing of species governed by small TACs. This would minimize the potential for traditional fisheries for other species to be curtailed.

Option: Close only waters east of 137°W. longitude to groundfish trawling.

This option would allow trawling to continue between 137°W. longitude and 140°W. longitude, an area closed under Alternative 2. However, according to Auke Bay personnel, the trawlable habitat in the this area is very limited and there are not enough survey stations available to calculate an independent biomass estimate for the area. The survey stations in the former East Yakutat area were combined with the stations from the former Southeast Outside District to determine the proportion of the Eastern Gulf groundfish biomass east of 140°W. longitude. Because there is no independent biomass estimate available for the former East Yakutat District, the biological impacts of this option cannot be adequately addressed at this time.

Another factor to consider is that the area between 137° and 140°W. longitude was just recently incorporated into the expanded Southeast Outside District. To go back to using 137° as a line for managing trawl fisheries is contrary to the rationale stated in the Amendment 22 which combined the former Southeast Outside District and the former East Yakutat area into a single management area. Should the Council wish to pursue this option, a review of the merits of combining the two old districts should be undertaken.

2.8.2.2 Economic Impacts

A trawl closure would probably result in a reallocation of the Eastern Gulf TACs that would: (1) eliminate the opportunity for trawlers to harvest any groundfish in this area, (2) increase the opportunity for the catcher/processor and shore-based hook-and-line fleet to harvest some species, and (3) leave some portion of the former Eastern Gulf TACs unharvested. Quantifying the costs and benefits associated with a trawl closure is limited to estimating the change in gross revenues to the processing sectors as a result of one scenario of how harvests by the two major gear groups will change. Other gains and losses as a result of this alternative are discussed qualitatively.

The following sections discuss possible gains and losses in gross revenues to processors as a result of a trawl closure in the new Southeast Outside district based on 1991 harvests by the different gear groups. Changes in gross revenue overestimate real gains and losses to the processors because they do not adjust for production costs. In other words, when processors do not harvest or process fish, they do not "lose" that portion of gross revenues that would have been paid in production costs. Similarly, some proportion of gross revenue increases are

production costs. Net revenues (gross revenues minus production costs) are a better measure of real gains and losses, but are not presented here due to lack of information about costs.

Another limitation of this scenario to measure gains and losses is that the exact pattern of fishing that occurred in 1991 is unlikely to occur in 1992 or in future years. New regulations that close the Gulf to rockfish trawling prior to July 1 will impact harvests. Proposed regulations to establish a separate halibut PSC for DSR and to reduce the directed fishing standard for DSR to 1% should increase the proportion of the DSR TAC that is taken by the hook-and-line fleet in the future. Closures due to the halibut PSC limit will change future fishing patterns as may implementation of the IFQ program or the inshore-offshore allocation. In addition to the effects of the regulatory structure on harvests are the impacts of potential changes in the demand and market price for groundfish products. Species groups which now represent a small proportion of Eastern Gulf harvests could become target fisheries if new products or markets are developed and price increases are sufficient to make processing economically feasible.

Losses to trawlers: Catcher/processor and shore-based trawlers would lose the opportunity to harvest groundfish in the expanded Southeast Outside district and would only be allowed to fish in the West Yakutat area of the Eastern Gulf. TACs available to trawlers in the Eastern Gulf would be reduced, possibly as outlined in Table 21. Almost all trawl vessels who fished in the Southeast Outside/East Yakutat area in 1990 and 1991 also fished in the West Yakutat area, so there would not necessarily be an increase in the total number of vessels fishing in West Yakutat. However, fishing effort would increase and, if CPUE decreases, not only will these trawlers catch fewer fish (because of the reduced TAC), but it will be more costly to catch the fish they do harvest.

Table 22 presents an estimate of the gross revenues that catcher/processor trawlers could lose as a result of this alternative. These estimates are based on the trawlers 1991 harvests in the Southeast Outside/East Yakutat area and a range of current processed product prices. Column (a) lists the 1991 harvest. Column (b) lists the percent of total harvest that was retained by the trawlers in the 1991 Southeast Outside/East Yakutat fishery. The two columns labeled (c) present either one estimate of current processed product price or low and high range price estimates.[8] A point estimate or a range of estimated gross revenues lost to trawlers is presented in the two columns labeled (d). These numbers were calculated by multiplying the harvest (a) by the 1991 percent retained (b), a product conversion factor, 2205 to convert metric tons to pounds, and the estimated prices.

The total estimated gross revenue loss to trawlers ranges from $3.0 million to $3.6 million. Sablefish, POP, and shortraker/rougheye rockfish revenue losses range from $2.7 million to $3.2 million and represent about 90% of overall revenue losses. Trawlers can probably make up losses from harvests of Pacific cod, flatfish, flathead sole, and arrowtooth flounder by redirecting their effort to underutilized TACs in the West Yakutat area. However, these species groups represent less that 3% of the total gross revenues losses. Losses from sablefish and rockfish

[8] Current market prices were obtained by personal communication with several catcher/processor vessel owners.

Table 22. Estimated gross revenue losses to trawlers from closure of the Southeast Outside/ East Yakutat area of the Eastern Gulf of Alaska.

Species	(a) Actual 91 Harvest SE/EYak (mt)	(b) Trawlers 1991 % Retained	(c) 1992 Processed Product Price Range Low ($)	(c) High ($)	(d) Estimated Gross Revenues[1/] Low ($)	(d) High ($)
Pollock[2/]	31.0	0.0	1.65		0	0
Pacific Cod	13.5	95.0	2.95		16,685	16,685
Deep. Flatfish	74.0	31.0	0.80	1.00	26,303	32,879
SW Flatfish	3.4	80.5	0.80	1.00	3,138	3,923
Flathead Sole	0.6	100.0	0.80	1.00	688	860
Arrow. Flndr.	136.0	11.0	0.80	1.00	17,153	21,441
Sablefish	174.0	95.3	2.75	3.00	653,577	712,993
POP	1,204.0	89.2	0.80	0.90	1,231,412	1,385,338
Shortraker/RE	231.0	99.0	2.50	3.50	819,425	1,147,195
Slope Rockfish	36.0	31.0	0.65		10,397	10,397
DSR	21.0	41.0	0.65		8,021	8,021
Pelagic Shelf	43.4	100.0	0.65		40,432	40,432
Thornyheads	49.0	88.9	3.00	4.00	187,301	249,735
TOTAL					$3,016,229	$3,631,596

1/ Pacific cod is filleted (20% recovery) all others headed and gutted (65% recovery).

2/ Pollock losses are estimated to equal zero because no pollock was retained by the trawlers in 1991.

harvests will not be so easily recovered. Their 5% allocation of the Southeast Outside/East Yakutat sablefish TAC will not be transferred to another area. In 1991, 61% of the trawlers POP harvests in the Eastern Gulf were made in the Southeast Outside/East Yakutat area. TAC reallocations based on biomass estimates (Table 21) suggest that 65% of the POP biomass is in the area that will be closed to trawling. The suggested West Yakutat TAC of 759 mt POP is approximately equal to the trawlers 1991 harvests in the West Yakutat area. Therefore, it is unlikely that revenue losses from POP harvests can be made up by redirecting effort to the West Yakutat area. The ability to recover losses in shortraker, rougheye, and thornyhead rockfish are more difficult to predict because these rockfish are generally harvested as bycatch in other fisheries.

Gains to the hook-and-line fleet: Table 23 summarizes the estimated increase in gross revenues to the shore-based processors as a result of the trawl closure. Increased hook-and-line harvests of sablefish, DSR, and shortraker/rougheye rockfish result in an increase of gross revenues to shore-based processors of from $1.9 million to $2.3 million. Gains to the shore-based hook-and-line fleet and processors will be distributed throughout coastal Alaskan communities, and perhaps some non-Alaska communities, as suggested by the distribution of landings by port presented in Table 17.

The catcher/processor and shore-based hook-and-line fleet would be able to harvest the full amount of the sablefish TAC (4,990) allocated to the Southeast Outside/East Yakutat area. Without a trawl closure, 5% (250 mt) would have been allocated to the trawlers. The processed product value of this 250 mt of sablefish, based on an average wholesale price of from $2.75 to $3.00 and a 65% recovery rate, would be from $985,000 to $1.1 million. This is gross revenues to processors, not fishermen, and does not include the cost of harvesting or processing the sablefish product. The increase in gross revenues to shore-based processors from sablefish is greater than the loss in gross revenues to the trawlers for several reasons. First, trawler losses were based on 1991 harvest (174 mt) which was less than 5% of the TAC. The shore based processor revenues are based on a full 5% allocation of the TAC (250 mt). Second, the hook-and-line fleet is assumed to retain 100% of the sablefish they harvest rather than the 95.3% retained by the trawlers. On the other hand, the difference in value between the shore-based and catcher/processor processed product is based on prices ranging from $2.75/lb. to $3.00/lb. Because much of the trawl caught sablefish has been harvested prior to the intense hook-and-line fishery, trawlers often received higher prices for their product. However, closure of the Gulf to rockfish trawling will probably reduce trawl bycatch of sablefish prior to the hook-and-line season.

Due to new regulations discussed previously, hook-and-line harvests of DSR are likely to increase in the future regardless of whether trawlers are present in the new Southeast Outside district. In 1991, DSR was placed on bycatch-only status early in the year as a result of concern about overfishing. This probably would not have occurred had trawlers not been fishing in the Southeast Outside district. However, hook-and-line harvests of DSR were also curtailed by closure of all hook-and-line fisheries due to the halibut PSC limit. A similar problem exists in trying to estimate gains to the shore-based processors as a result of increased harvests of shortraker and rougheye rockfish. Hook-and-line harvests in 1991 were also curtailed by shortraker/rougheye rockfish being placed on bycatch-only status and PSC status due to concern about overfishing. If a trawl closure results in reallocation of the shortraker and rougheye

Table 23. Estimated gross revenue gains to shore-based processors from closure of the Southeast Outside/East Yakutat area of the Eastern Gulf of Alaska.

Species[1/]	Increase in Harvest (mt)	1992 Processed Product Price Range		Estimated Gross Revenues	
		Low ($)	High ($)	Low ($)	High ($)
Sablefish	250	2.75	3.00	985,359	1,074,938
DSR	21	1.30		60,197	60,197
Shortraker/RE	231	2.50	3.50	819,425	1,147,195
Total				$1,864,981	$2,282,330

1/ Sablefish and shortraker/rougheye have a 65% recovery rate and DSR a 100% recovery rate.

rockfish TAC for the new Southeast Outside area, it is very likely that the hook-and-line fleet will harvest a larger proportion of the TAC before they are shut down by the halibut PSC limit. In addition, they would not have to discard shortraker/rougheye rockfish during the fall halibut season as was the case in 1991.

Determining how much more DSR, shortraker or rougheye rockfish the hook-and-line fleet could have caught in 1991 before they were closed due to the halibut PSC limit is difficult. Therefore, in this scenario the gains in estimated gross revenues to shore-based processors from increased DSR and shortraker and rougheye rockfish harvests is based on the trawlers 1991 harvest of 21 mt of DSR and 231 mt of shortraker/rougheye rockfish in the Southeast Outside/East Yakutat area.

The estimated increase in gross revenues to shore-based processors from 21 mt of DSR is $60,000. The value for DSR is based on the assumption that 100% of the harvest is retained and sold as a fresh, whole, bled rockfish for twice the price of catcher/processor processed DSR ($1.30/lb.).[9] The estimated increase in gross revenues to shore-based processors from 230 mt of shortraker/rougheye rockfish is from $820,000 to $1.2 million and is based on the same assumptions used for the catcher/processor trawl harvests.

Harvests of other species or species groups by the hook-and-line fleet in 1991, including Pacific cod, flatfish, arrowtooth flounder, other slope rockfish, and thornyhead rockfish, were probably not impacted by the presence of trawlers. Therefore, increased gross revenues to the shore-based processing sector from these species as a direct result of the trawl closure are assumed to be zero.

Comparison of the decrease in gross revenues to trawlers and the increase in gross revenues to shore-based processors as presented in Tables 22 and 23 are not good measures of the change in net benefits as a result of the trawl closure. It is merely the results of one scenario which assumes that losses to the trawlers and gains to the hook-and-line fleet can be measured by what occurred during the 1991 fishery. The actual loss to trawlers is the loss in net revenues (gross revenues minus production costs) that is not made up by increased net revenues in other fisheries as a result of redirected effort. Benefits to the shore-based processors and the hook-and-line fleet include the increase in net revenues from fish formerly harvested by the trawlers as well as those fish harvested because more of the TAC can be taken before a species group is placed on bycatch-only or PSC status.

The conclusion that can be reached from this scenario is that trawlers will lose the opportunity to harvest groundfish in the expanded Southeast Outside district. Some of these losses can be made up by increased effort in the West Yakutat area. Eastern Gulf TACs will likely be reapportioned under this alternative with some proportion of most TACs no longer available to trawlers. Reductions in TACs in underutilized species groups such as Pacific cod, flatfish, and arrowtooth flounder probably do not represent a large loss to trawlers. However, because sablefish and several valuable rockfish TACs are nearly fully utilized, income lost the Southeast Outside area's fisheries would have to be made up in fisheries for other species groups or outside

[9] This relationship between the wholesale price of DSR from shore-based processors versus catcher/processor trawlers is based on information presented in Table 18.

the Eastern Gulf. In this case, the net loss as a result of the trawl closure is reduced only if trawlers earn income in another fishery without reducing the income to their competitors. Another important point is that if trawlers move to another area where CPUE is lower, the cost of producing the same seafood product increases (because it is more costly to harvest each fish) which further reduces trawlers net income and has a negative impact on overall efficiency.

The proportion of revised TACs (Table 21) for pollock, flatfish, flounder, and Pacific Ocean perch that have historically been taken by the trawlers, or would be harvested by trawlers in the future, will likely go unharvested by the longliners. As long as these TACs are truly harvestable surplus, a loss to the nation is incurred by not fully utilizing these fish.

Increases in gross revenues to the hook-and-line fleet can make up for a large proportion of the trawlers losses, particularly in sablefish and some rockfish harvests. In addition to benefits from increased harvest, the hook-and-line fleet is assured that increased trawl effort in the future will not result in erosion of the economic base of coastal Alaska communities. They will maintain the maximum control over management of the rockfish stocks and be able to benefit from any conservation measures taken to increase rockfish stocks in the future. The environmental impacts of trawling are very difficult to quantify, and the impacts on slow growing corals, marine mammals and seabirds in the Eastern Gulf do not appear to be a serious problem at current levels of effort. Lack of documentation of problems does not mean that they are not occurring or will not occur with increased trawl effort. Closure of the expanded Southeast Outside district to trawling eliminates the possibility that these problems will become more serious in the future.

2.8.3 Alternative 3: Prohibit on-bottom trawling only in the Southeast Outside District.

2.8.3.1 Biological and Environmental Impacts

Under this alternative only pelagic gear as defined by regulation would be allowed to fish for groundfish east of 140°W. longitude. This alternative may resolve at least part of the concern regarding impacts of trawling on benthic invertebrates and would be somewhat less restrictive than a complete ban on trawl gear. It would also reduce direct conflicts with hook-and-line vessels fishing for bottom-dwelling species and potentially slow the competitive race for certain species. It would also substantially reduce or eliminate impacts on bottom habitat since pelagic trawls are not equipped to fish over rough substrate.

However, given that most groundfish species reported taken by trawlers in the Southeast Outside District are bottom-dwellers, this option could effectively curtail much of the trawl fishing effort. With the possible exception of pollock, virtually all FMP species which would normally be taken by trawl gear would very likely be underutilized in relationship to the established TACs if this alternative is adopted. When the foreign trawl fleet was no longer allowed to fish with on-bottom trawl gear in the West Yakutat area in 1982, they opted instead to leave the area all together.

2.8.3.2 Economic Impacts

The economic impacts of prohibiting on-bottom trawling only and allowing pelagic trawling in the Southeast Outside and East Yakutat area is effectively the same as a complete trawl ban.

Pelagic trawlers have targeted on pollock only in the West Yakutat area of the Eastern Gulf to date. Although pollock is availabe in the Southeast Outside/East Yakutat areas, it is uncertain whether trawlers would prosecute a fishery in this area for such a limited amount of available resource.

2.8.4 Alternative 4: Establish separate TACs by FMP species group for the new Southeast Outside District.

2.8.4.1 Biological and Environmental Impacts

Under this alternative, groundfish TACs which, with the exception of sablefish and DSR, are currently specified for the entire Eastern Regulatory Area (e.g., all waters east of 147°W. Long.), would be broken down with separate TACs specified for the West Yakutat District (waters between 147°-140°W. Long) and the expanded Southeast Outside District (waters east of 140°W.).

This alternative would allow managers to improve their control over harvests taken in the Eastern Gulf to assure that the entire Eastern Gulf TAC for any species or species category is not taken in just one area. The TACs would be based on the ABC levels determined by NMFS for each species or species category in the two districts. This alternative would potentially decrease the risk of localized depletion of the non-migratory species.

However, separating the Eastern Gulf TACs into two areas would result in even smaller TACs for each management zone. It could prove difficult to manage the fisheries to stay within the smaller TACs. If the smaller TACs are taken, the target fisheries will be closed. If the TACs are exceeded, it is conceivable that traditional fisheries which harvest the effected species could also be curtailed. It is difficult to weigh the advantages to the resource offered by separating the TACs against the increased difficulty of management created by this approach. Some fisheries which were prosecuted as directed fisheries under the larger, broad-area TACs may have to be relegated to bycatch-only status to reduce the risk of overharvest.

In Section 2.5.3.2 (ABC considerations) it was pointed out that there is a substantially different distribution of biomass between the Southeast Outside and the West Yakutat Districts for most species. Table 6 shows the revised biomass distribution and Table 21 shows how the 1992 TAC would be reapportioned by management district based on the analysis conducted by the Auke Bay Laboratory.

There is a considerable variation in the biomass estimates for the different species groups between the two areas. According to the ABL reevaluation of biomass distribution, 94% of the other slope rockfish complex and 77% of all *Sebastes* rockfish populations occur in the Southeast Outside District. Most rockfish species are presumed to be largely non-migratory. A high harvest of those non-migratory species in the West Yakutat area could result in an inappropriately high exploitation rate. For species such as pollock, Pacific cod, and most of the flatfish species which reside primarily in the West Yakutat area, it would likewise be inappropriate to harvest a high proportion of the TAC in the Southeast Outside District. For species known to be much more mobile, such as sablefish, the long-term biological impact of localized harvest would not likely be as harmful.

If the distribution of species was fairly uniform between the areas this alternative might not warrant serious consideration. However, the substantial difference in distribution of most species between the two areas suggests that it might be important to consider managing the Eastern Gulf by smaller geographic unit. This would greatly reduce the risk of over-harvesting any single species or stock component in a small geographical area. Given that rockfish are a major component of the Eastern Gulf groundfish complex and given the fact that they are known to be highly vulnerable to over-exploitation, this alternative should be given serious consideration as a biological precaution regardless of who is allowed to fish in the area.

Option: Consider allocating the TACs of all species to trawl and longline gear based on past participation or some other criteria.

The Council may determine that the concerns and issues fleshed out in this document warrant pursuit of this option as one solution to permanently addressing the stated problems. Such action has already been approved by the Council for sablefish. This document does not attempt to justify this course of action; only to identify it as an option for possible further development and analysis.

2.8.4.2 Economic Impacts

The economic impact of establishing separate TACs by FMP species group for the new Southeast Outside District depends largely on the effect these changes have on the total groundfish harvest and the distribution of the harvest by gear group. Sablefish and DSR TACs are already separated for these areas. Pollock, Pacific cod, and thornyhead rockfish TACs will probably not be separated. Therefore, this alternative deals primarily with separate TACs for POP, shortraker/rougheye rockfish, other slope rockfish and pelagic shelf rockfish.

Under the status quo trawlers and hook-and-line vessels are free to harvest the Eastern Gulf TACs of these species groups in any management zone. If the TACs were apportioned as in Table 21, harvests of POP by the trawlers in the new Southeast Outside area would be limited to 1,410 mt. This is slightly more than their 1991 harvests of about 1,200 mt. With respect to pelagic shelf rockfish, the trawlers currently harvest 5% of this species group in the Southeast Outside/East Yakutat area. The TAC for pelagic shelf rockfish was exceeded in 1991, so it is a fully utilized species group. Allocating 18% of the Eastern Gulf TAC to the new Southeast Outside area would encourage trawlers to increase their harvests of pelagic shelf rockfish in this area. The same is true for other slope rockfish. In 1991, only 17% of the TAC was taken by all gear groups and 15% of these harvests occurred in the Southeast Outside/East Yakutat area. Allocating 94% of the TAC to the new Southeast Outside area forces future expansion of the fishery to occur in this area.

2.9 Conclusions

All known information available on groundfish fisheries in the Eastern Gulf of Alaska was examined and a number of reports regarding impacts of trawling and groundfish management philosophy were reviewed prior to preparing this analysis. This review brought to light several issues which should be considered when discussing future manage strategy and setting regulations

for the Eastern Gulf of Alaska groundfish fisheries. Some of the issues are biological and others are socioeconomic, but all are important considerations.

2.9.1 Biological and Environmental Considerations

The groundfish resource in the Eastern Gulf of Alaska is primarily made up of higher value species such as sablefish and rockfish. The only other species available in large quantities is arrowtooth flounder which are not currently being sought after or marketed. All major management decisions regarding the Eastern Gulf should take this factor into consideration.

There is a definite gradient of biological distribution of groundfish species in the Eastern Gulf of Alaska. A much higher proportion of the rockfish and sablefish populations occur in the Southeast Outside District while a larger proportion of the gadids (e.g., pollock and Pacific cod) and most flatfish species reside in the West Yakutat area. This presents two management problems. First, TACs set for the entire Eastern Gulf increase the potential for localized depletion because the entire TAC can be taken in a small portion of the area. Conversely, under this scenario, other segments of the population may be underutilized. Second, the higher value species are more abundant in the Southeast Outside District where gear and grounds preemption conflicts are most likely to occur. Alternative 4 appears to be one way of reducing the potentially negative biological impact of localized depletion in the Eastern Gulf, but if adopted independently could lead to increased gear conflicts between trawl and hook-and-line vessels.

One of the largest components of the rockfish complex, the "other slope rockfish" is made up of species which are not currently being utilized. The 1992 TAC of 6,160 mt makes this group the most available complex in the Eastern Gulf; second only to sablefish. Two of the dominant species, redstripe and silvergray rockfish are transitional species which were recently removed from the DSR category and added to the "other slope rockfish" complex at the recommendation of ADF&G. The primary reason for this action was to minimize the potential of trawl vessels exceeding their bycatch standards for DSR. It was not intended to promote a directed fishery and it is unlikely that either species could be targeted to any extent without a very high bycatch of DSR. Other species in this complex such as northern, harlequin, sharpchin, darkblotch, blackgill, splitnose, etc. can be mistaken for POP. Continuing to allow a high TAC of "other slope rockfish" TAC presents two potential problems. First, target fisheries for major species within this complex such as redstripe and silvergray could result in very high bycatch rates of DSR. Second, continuation of this high TAC increases the likelihood that POP could be over-harvested and marketed as other slope rockfish in the same category with the other perch-like species. Consideration should be made toward relegating the "other slope rockfish" to bycatch only to allow for their retention in target fisheries for the more valuable components of the rockfish complex such as POP, shortraker/rougheye rockfish, and DSR.

There is another potential biological problem with current rockfish management. There has been a dramatic increase in overall TAC of the entire *Sebastes* complex over the past several years. Much of this increase appears to be the result of separating the complex into five categories, and setting TAC equal to ABC for each of the component parts. The Eastern Gulf TAC for *Sebastes* rockfish has increased from a very conservative 875 mt limit set for a five-species POP complex as recently as 1985 to 10,900 mt limit for all species in 1992. There is very little biological evidence available which supports this level of increase (NPFMC, 1992 SAFE). Francis (1985)

states that "the more diverse the target of management is, the more biologically conservative the management policy must be to maintain long-term productivity of the resource base". There are both multiple gears competing for these resources and a very diverse groups of species involved. Both of these factors increase the diversity of the management target. This problem is exacerbated by the fact that most species in the *Sebastes* complex are long-lived and demand a very conservative management approach to remain viable (Leaman and Beamish, 1984). POP are just beginning to recover from extensive exploitation by foreign fleets and are currently presumed to be well below maximum sustainable yield levels (NPFMC, 1991). In addition, there is evidence that most of the POP population in the Eastern Gulf is made up of young fish (under age 15), many of which have not yet even recruited into the reproductive population. It appears that, for whatever reason, the very conservative management strategy for rockfish initiated in 1982 has been abandoned for a much more aggressive harvest approach over the ensuing years. The entire management policy for GOA rockfish should be reexamined.

Over the past several years at least some species groups have been taken in excess of the harvest objectives each year. For example, in 1988 the TAC for both flounder and sablefish was exceeded; in 1989 the TACs for sablefish, Pacific cod, and pelagic rockfish were exceeded; in 1990 both the sablefish and other rockfish harvest objectives were exceeded; and in 1991 the harvest objectives for sablefish, pollock, and pelagic rockfish were exceeded.

Many of the TACs for the various species groups are quite small in the Eastern Gulf and can be taken very quickly. The monitoring of the fisheries usually lags behind the harvest by at least one week. This makes it very difficult to stay within the individual species quotas. While most of the target species taken by the trawl and longline fleets appear to be different, some overlap occurs. Having multiple user groups fishing concurrently increases the complexity of monitoring the harvest. The current management approach which sets TAC equal to ABC combined with the apparent inability to closely monitor and regulate the harvest work together to increase the risk of overexploitation.

There is no conclusive evidence in any of the materials examined which would suggest major habitat degradation as a result of trawling in the Eastern Gulf at the current level of participation. Only two reports were located dealing specifically with impacts of trawling on hard bottom (Tilmant, 1979 and Van Dolah et.al., 1987). Both of these studies are from the east coast, the first in Florida and the second in Georgia. In the first study significant damage to sponge and hard coral communities was observed as a direct result of commercial trawling for shrimp in shallow water. The second study was set up as a long-term experiment with productivity monitored before, immediately after, and 12 months after roller gear was towed once through a defined trawl alley. Although there was some immediate damage, long-term damage was deemed to be insignificant. The author of the second report concluded that the extent of long-term damage to bottom habitat is largely a function of the type of gear used and the number of times the same bottom is trawled. It can be presumed that habitat damage caused by trawling can be directly linked to the level of effort in a given area and the type of bottom being fished.

No conclusive evidence of a direct link between trawl activity and marine mammal populations could be found. The only anecdotal link suggesting any effect is the fact that Steller sea lion populations are declining in the West Yakutat area where most groundfish trawling has occurred

and increasing in the Southeast Outside District where comparatively little trawling has occurred. These relationships should be studied in more detail as opportunities allow.

The longline fleet has been operating in the Eastern Gulf of Alaska for nearly a century fishing for a combination of halibut, rockfish, sablefish, and Pacific cod. They have a long history of cooperating with the management agencies in promoting conservative management of the groundfish resources in the Eastern Gulf. Recommendations initiated by ALFA were instrumental in reducing the sablefish OY in the Eastern Gulf in the early 1980s. In 1982 they also supported efforts by ADF&G and the NPFMC to dramatically reduce the rockfish harvest objective in order to promote rebuilding of the POP complex.

From the mid-1960s through the 1970s the longline fleet suffered from a substantial reduction in availability of halibut, sablefish, and some rockfish species, all of which were taken to some extent by the foreign distant-water fleets. Harvest reductions, grounds preemption, and loss of gear were all tangible and documented results of the foreign fisheries operating in the Southeast Outside District. The expansion of the domestic trawl fleet and resulting competition for some of the traditional species and fishing grounds coupled with the more aggressive harvest strategy employed by the NPFMC in recent years is perceived by many hook-and-line fishermen as another threat to the resources they worked so hard to rebuild. This situation increases the potential for further conflicts until this issue is finally resolved.

2.9.2 Redistribution of Costs and Benefits and Other Economic Considerations

The two substantive alternatives, from a economic perspective, are Alternative 1, no action, and Alternative 2, a trawl closure in the expanded Southeast Outside Area. Alternative 3, which allows pelagic trawling only in the Southeast Outside area has essentially the same effects as a complete ban on trawling because of the limited opportunity to harvest pelagic species in the new Southeast Outside area. Alternative 4, separating the TACs by area, would likely change the distribution of fishing effort in the Eastern Gulf. Trawlers would probably forego the harvest of some species and increase their effort on other species in the new Southeast Outside area. This alternative also increases the risk that smaller TACs may be reached or exceeded, thus further impacting target harvest and bycatch in fisheries for other species.

The actual redistribution of benefits and costs as a result of any alternative presented in this analysis are unknown. Economic impacts depend upon future harvests by the different gears groups in the Eastern Gulf and elsewhere, in-season management regulations in all fisheries, costs of production, demand for groundfish products, and market prices. These factors directly determine net earnings to fishermen and processors. They indirectly determine net earnings to wholesale and retail buyers and sellers of seafood, earnings and employment in communities dependent on fisheries, and market price to consumers. Any changes in these factors impact the distribution of costs and benefits to the different groups, however, information to do a format benefit cost analysis was not available for this analysis.

A trawl closure imposes costs to the trawler in lost net revenues from groundfish formerly available to them in the new Southeast Outside area. The estimated gross revenues from catcher/processor trawler harvests by 6 vessels in this area in 1991 ranged from $3.0 million to $3.6 million. Approximately 90% of these losses are from sablefish, POP and shortraker and

rougheye rockfish. Trawlers can probably make up a portion of gross revenue losses from harvests of Pacific cod, flatfish, flathead sole, and arrowtooth flounder by redirecting their effort to underutilized TACs in the West Yakutat area. However, due to loss of the Southeast Outside/East Yakutat sablefish allocation and probable TAC reallocations in other species groups, losses from sablefish and rockfish harvests can only be recovered by harvests of other species groups in the West Yakutat area or by fishing activity outside the Eastern Gulf. In this case, the net loss as a result of the trawl closure is reduced only if trawlers earn income in another fishery in the U.S. without reducing the income to their competitors. If trawlers move to another area where CPUE is lower, the cost of producing the same seafood product increases (because it is more costly to harvest each fish) which further reduces trawlers net income and has a negative impact on overall efficiency. Finally, the proportion of revised TACs for pollock, flatfish, flounder, and Pacific Ocean perch that have historically been taken by the trawlers, or would be harvested by trawlers in the future, will likely go unharvested by the longliners. As long as these TACs are truly harvestable surplus, a loss to the nation is incurred by not fully utilizing these fish.

Benefits of a trawl closure accrue to a large hook-and-line fleet (1,100 vessels) which deliver groundfish to shore-based processors through Southeast and Southcentral Alaska. Increases in gross revenues to these processors can make up for a large proportion of the trawler's losses, particularly in sablefish and some rockfish harvests. The increase in gross revenues to shore-based processors from a trawl closure, based on 1991 harvests, could range from $1.9 million to $2.3 million. In addition to benefits from increased harvest, the hook-and-line fleet is assured that increased trawl effort in the future will not result in overfishing small rockfish TACs and curtailing other important groundfish and halibut fisheries. DSR and shortraker/rougheye rockfish were placed on bycatch-only status early in 1991 due to concern about overfishing. A trawl closure in the Southeast Outside area would reduce the possibility that hook-and-line harvests of these species groups would be curtailed due to overfishing concerns in the future.

Although market prices for groundfish may change significantly in the future, it is unlikely that most changes would be directly as a result of these alternatives. Yelloweye rockfish is the primary DSR species which has a unique domestic market and the supply and timing of this product probably will not be impacted much by the trawl closure. Other rockfish, cod, and flatfish supplied to the U.S. market are competing with so many other similar products form different sources that the Eastern Gulf supply probably does not influence price. It is possible, however, that if a trawl closure significantly changes the supply or timing of frozen, headed and gutted rockfish to the Japanese, market price could be adversely impacted.

The environmental impacts of trawling are very difficult to quantify, and the impacts on slow growing corals, marine mammals and seabirds in the Eastern Gulf do not appear to be a serious problem at current levels of effort. Lack of documentation of problems does not mean that they are not occurring or will not occur with increased trawl effort. Closure of the expanded Southeast Outside district to trawling eliminates the possibility that these problems will become serious in the future.

The most important issue of the problem statement is the perceived gear conflict in the Eastern Gulf and the fear of future expansion of the trawl fishery, real gear conflicts, and erosion of the economic base for coastal Alaskan communities. Although a real gear conflict does not appear

to exist at current levels of effort, increased trawl effort in the future could result in decreased harvests by the hook-and-line fleet due to direct competition, early fishing closures, direct gear conflicts, or reduced catch rates. Council documents contain information indicating that problems with grounds preemption, gear loss, and reduced hook-and-line catches occurred when a larger foreign fleet was operating in the Southeast Outside area. Although recent regulation changes reduce the opportunity for gear conflicts, these problems may occur again if there is a substantial increase in domestic trawl effort in the future.

2.9.2.1 Administrative, Enforcement, and Information Costs

All changes to regulations have associated costs. These include agency review, public review, notification, changes in procedures, and so forth. With one exception, the alternatives considered in this package are not anticipated to incur costs significantly in excess of these normal costs. If trawl gear in general or benthic trawls in particular are prohibited, however, there would be some increase in enforcement cost associated with checking gear on trawl vessels. Since agency budgets would not be increased directly by approval of these alternatives, the increase in costs would be funded by reducing monies spent on enforcing other regulations.

2.9.2.2 Reporting Costs

No significant change in reporting or paperwork costs are anticipated under any of these alternatives.

2.10 References

Literature Cited

Climberg, R.L. and T. Gerrodette. 1981. Habitat requirements and expected distribution of Alaska coral. Office of Marine Pollution Assessment Final Rep. Res. Unit No. 601. 83p.

Francis, R. C. 1985. Fisheries Research and Its Application to West Coast Groundfish Management. In: Proceedings of the Conference on Fisheries Management: Issues and Options: 285-304. T. Frady (editor). Alaska Sea Grant Report 85-2.

International Pacific Halibut Commission. 1992. "Review of the 1991 Fishery". Presented at the IPHC Annual Meeting, Seattle, WA. January, 1992.

Leaman, B.M. and R.J. Beamish. 1984. Ecological and management implications of longevity in some northeast Pacific groundfishes. Int. North Pac. Fish. Comm., Bull. 42:85-97.

National Marine Fisheries Service. 1990. Gulf of Alaska/Bering Sea Groundfish Inshore/Offshore Allocations Proposal, Requirements for Social Impact Assessment. F/CM1:PHF:427-2338:2/27/90.

NPFMC. 1991. Stock assessment and fishery evaluation report for the Gulf of Alaska groundfish fishery, 1992. North Pacific Fishery Management Council Report.

Perez, M.A. and T.R. Loughlin. 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. Rept. NMFS 104 (1991) 57p.

Tilmant, J.T. 1979. Observations on the impacts of shrimp roller frame trawls operated over hard-bottom communities, Biscayne Bay, Florida. Natl. Park Serv. Rep. Ser. No. P-533, 23p.

Van Dolah, R F., P.H. Wendt, and N. Nicholson. 1987. Effects of a research trawl on a hard-bottom assemblage of sponges and corals. Fish Res. 5 (1987):39-54.

Additional References

Adams, P.B. 1980. Life history patterns in marine fishes and their consequences for fisheries management. Fish Bull. 78(1):1-12.

Archibald, C.P., W. Shaw, and B.M. Leaman. 1981. Growth and mortality estimates of rockfish (*Scorpaenidae*) from B.C. coastal waters. 1977-1979. Can. Tech. Rep. Fish Aquat. Sc. No. 1048. 57p.

Aschan, M.M. 1991. Effects of scollop dredging on benthic communities in Northeast Atlantic. ICES Benthos Ecology Working Group Rep., Bedford Inst. of Oceanography. 10p.

Baker, F.G. 1980. Effects of foreign trawling on U.S. longline fishermen in the Eastern Sakhalin due to intensive fishery. Soviet Journal of Marine Bio. Vol. 10 (2):98-106.

Barytskaya, L.V. 1983. Changes in the composition of communities of bottom fishes on the shelf of Eastern Sakhalin due to intensive fishery. Soviet Journal of Marine Bio. Vol 10 (2): 98-106.

Bracken, B.E. 1983. The history of the U.S. sablefish fishery in the Gulf of Alaska, 1906-1982. In: Proceedings of the International Sablefish Symposium: 41-47. B.R. Melteff (editor). Alaska Sea Grant Rep. No. 83-8.

Bracken, B.E. 1987. The history of the rockfish fisheries in Alaskan waters. In: Proceedings of the International Rockfish Symposium: 51-59. B.R. Melteff (editor). Alaska Sea Grant Rep. No. 87-2.

Bracken, B.E. and V.M. O'Connell. 1986. Other rockfish. In: Condition of groundfish resources in the Gulf of Alaska region as assessed in 1986. R.L. Major (editor). (Document submitted to the annual meeting of the International North Pacific Fisheries Commission, Anchorage, Alaska, October 1986.) U.S. Dept. Comm., Natl. Oceanic Atmospheric Adm., Natl. Mar. Fish. Ser., Northwest and Alaska Fisheries Center, 7600 Sand Point Way NE. BIN C15700, Bldg. 4, Seattle, WA 98115

Bracken, B.E. and V.M. O'Connell. 1986. Longline fisheries monitoring in the eastern gulf of Alaska, 1980-1985. Ak. Dept. Fish and Game Info. Leaflet 258: 47p.

Gershanovich, D.E., B.N. Kotenev, and V.N. Novikov. 1986. Relief and bottom sediments of the Gulf of Alaska. In: Soviet Fisheries Investigations in the Northwest Pacific, Part III: 74-125. P.A. Moiseev (editor).

Gunderson, D.R. 1980. Using r-K selection theory to predict natural mortality. Can. J. Fish. Aquat. Sci. 37:1522-1530.

Groot, S.J. 1984. The impact of bottom trawling on benthic fauna of the North Sea. Ocean Management 9 (1984):177-190.

Hutchings, P. 1990. Review of the effects of trawling on macrobenthic epifaunal communities. Augt. J. Mar. Freshwater Res. 1990 (41):111-120.

Murawski, S.A. 1991. Can we manage our multispecies fisheries? Fisheries, A Bull. of the American Fisheries Soc., Vol. 16, No. 5:5-13.

NPFMC. 1991. Fisheries Management Plan for Alaska Groundfish Fishery. North Pacific Fishery Management Council Working Document.

NPFMC. 1991. History of the Gulf of Alaska Groundfish Plan. North Pacific Fishery Management Council working paper.

O'Connell, V.M. and J.T. Fujioka. 1991. Demersal Shelf Rockfish. In: Status of Living Marine Resources off Alaska as Assessed in 1991. NOAA Tech. Memo. NMFS-F/NWC-211:46-47.

O'Connell, V.M. and F.C. Funk. 1987. Age and growth of yelloweye rockfish (*Sebastes ruberrimus*) landed in Southeastern Alaska. In: Proceedings of the International Rockfish Symposium: 171-185. B.R. Melteff (editor). Alaska Sea Grant Report No. 87-2.

Overholtz, W.J., and A.V. Tyler. 1985. Long-term responses of the demersal fish assemblages of Georges Bank. Fishery Bull. Vol. 83, No. 4:507-520.

Rosenthal, R.J., L. Haldorson, L.J. Field, V.M. O'Connell, M. LaRiviere, J. Underwood, and M.C. Murphy. 1982. Inshore and shallow offshore bottomfish resources in the Southeastern Gulf of Alaska (1981-1982). Alaska Dept, Fish & Game, Juneau, Alaska. 166p.

Seeb, L.W. and D.R. Gunderson. 1988. Genetic variation and population structure of Pacific ocean perch (*Sebastes alutus*). Can. J. Fish. Aquat. Sci. 45 (1):78-88.

Shevtsov, V.V. 1968. Quantitative distribution and trophic groups of benthos in the Gulf of Alaska. In: Soviet Fisheries Investigations in the Northwest Pacific, Part III: 150-166. P.A. Moiseev (editor).

Van Doolah, R.F., P.H. Wendt, and M.V. Levisen. 1991. A study of the effects of shrimp trawling on benthic communities in two South Carolina sounds. Fisheries Research, 12 (1991): 139-156.

2.11 Consultation with Others

The following individuals were consulted for information and guidance at various times during this analysis, and this analysis would not have been as complete without their valuable contributions:

From the industry: George Anderson, Bill Atkinson, Linda Behnkin, Jay Bornstein, Phil Chitwood, Don Iverson, Rudy Petersen, Stan Simonson, Harold Thompson, and John Winther.

From the agencies: Dave Ackley, Alaska Department of Fish & Game; Elaine Dinneford, Commercial Fisheries Entry Commission; Ron Berg, Dave Clausen, Steve Freese, Jeff Fujioka, Jessie Gharrett, and Joe Terry, National Marine Fisheries Service; Jim Cornelius and Chris Oliver, North Pacific Fishery Management Council; and Will Daspit, Pacific Fisheries Information Network.

2.12 List of Preparers

Barry Bracken
Alaska Dept. Fish and Game
P.O. Box 667
Petersburg, AK 99833

Sally Bibb, Steve Davis, and Peggy Kircher
LGL Alaska Research Associates
4175 Tudor Centre Dr.
Anchorage, AK 99508

3.0 RE-ESTABLISH THE CRAB PROTECTION TIME/AREA CLOSURES AROUND KODIAK ISLAND

3.1 Description of and Need for the Action

In recent years, the bycatch of king crab off Kodiak Island has been a major management issue. Amendment 15 to the Gulf of Alaska FMP, adopted in 1986, established time and area restrictions on non-pelagic trawling around Kodiak Island to protect king crab resources for three years. This bycatch control measure was developed by the Council to provide an environment conducive to the recovery of king crab stocks around the island at a time of developing groundfish bottom trawl fisheries. The time/area closure scheme afforded protection to king crab in some areas during their molting or soft-shell period while in other areas it protected crab from bottom trawls year-round. These measures were considered vital if the severely depressed king crab stocks were to recover in this area.

Amendment 15 established two types of trawl closures. Type I areas are those king crab stock rebuilding areas where a high level of protection is provided to the king crab by closing the area year-round to bottom trawling. Type II areas are those areas sensitive for king crab populations and in which bottom trawling is prohibited during the softshell season. Fishing with bottom trawl gear is prohibited in Type II areas from February 15 to June 15.

Because Amendment 15 sunsetted on December 31, 1989, the Council and Secretary of Commerce renewed the trawl closure zones as part of Amendment 18 to the Gulf of Alaska FMP. In addition, Amendment 18 also added Type III trawl closure zones around Kodiak Island to protect juvenile king and Tanner crab when significant recruitment occurs. Type III areas are areas that have been identified as important juvenile crab rearing or migratory areas. The basis for such closures is the belief that the area inhabited by crab would increase if there is particularly strong recruitment and that protection would, thus, be appropriate for larger areas.

The area designations currently defined in the Gulf of Alaska FMP are as follows (See Figure 3.1):

Area Type	Definition
I	Type I areas are those king crab stock rebuilding areas where a high level of protection will be provided to the king crab by closing the area year-round to bottom trawling. Fishing with other gear would be allowed.
II	Type II areas are those areas sensitive for king crab populations and in which bottom trawling will be prohibited during the soft-shell season (February 15 - June 15). Fishing with other gear would be allowed and fishing with bottom trawl gear would be allowed from January 1 - February 14 and June 16 - December 31.
III	Type III areas are those geographic areas adjacent to a Type I or Type II area that have been identified as important juvenile king crab rearing or migratory areas. These areas only become operational following a determination that the "recruitment event criteria" has occurred. The NMFS Regional Director will classify the expanded area as either Type I or II depending on the information available.

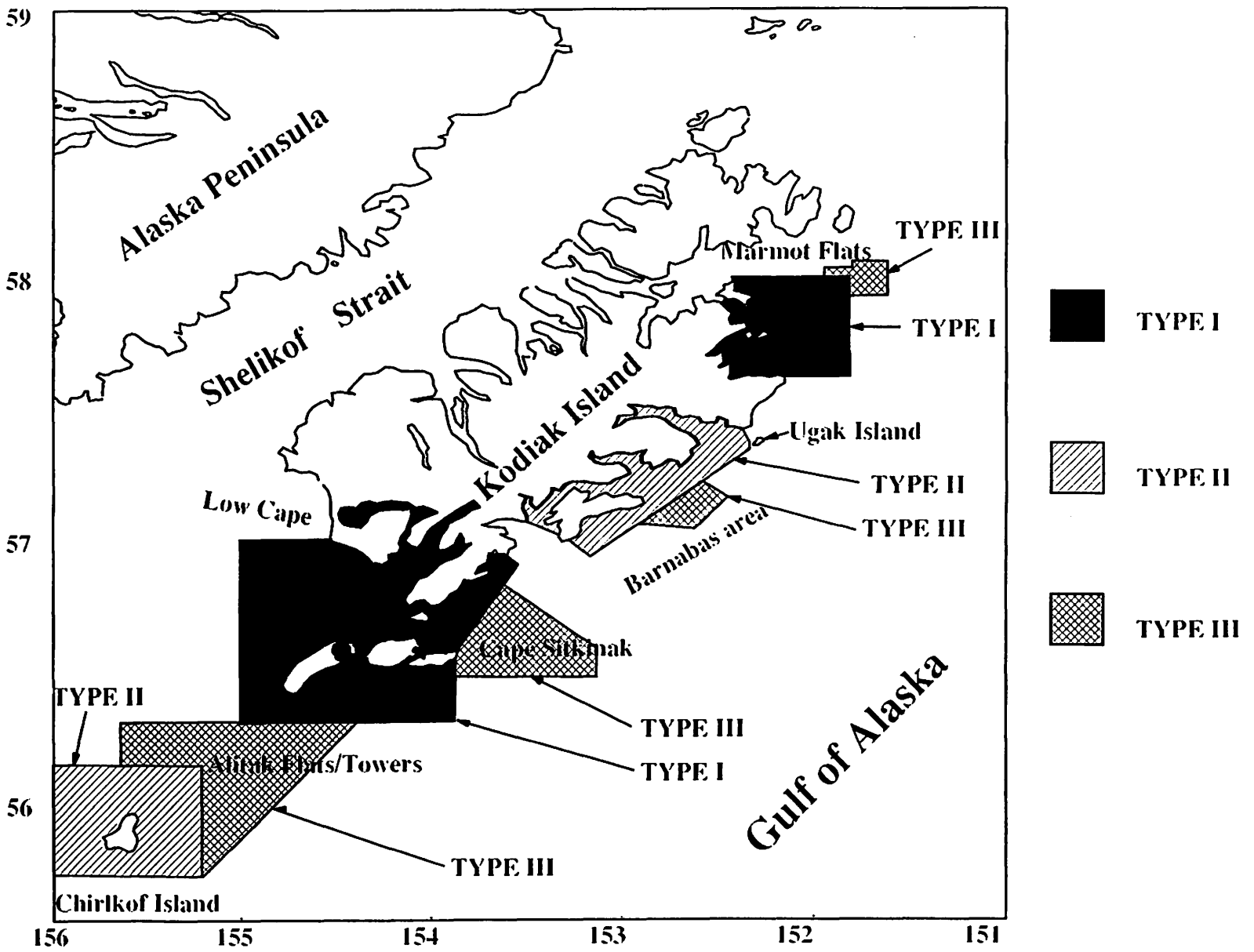


Figure 3.1 Areas around Kodiak Island closed to trawling except with pelagic trawls. TYPE I areas are closed year round. TYPE II areas are closed February 15 to June 15. TYPE III areas close when a significant recruitment event occurs.

For purposes of implementing a Type III area, a "recruitment event" is defined as the appearance of female king crab in substantially increased numbers. A substantially increased number is determined to have occured when the total number of females estimated for a given district equals the number of females established as a threshold criteria for opening that district to commercial crab fishing. The threshold levels determined by the Alaska Department of Fish and Game for the four Kodiak red king crab management districts are: Northeast District - 1.93 million crabs, Southeast District - 0.72 million crabs, Southwest District - 2.28 million crabs, and Shelikof District - 0.19 million crabs. In any given year a recruitment event may occur in one or more of the Kodiak management districts as indicated by the standardized Kodiak crab survey conducted by the Alaska Department of Fish and Game. A recruitment event closure will continue until either a commercial crab fishery opens for that district or the number of crab drops below the threshold level established for that district. The Type III area closures would be implemented by regulatory amendment. ADF&G currently conducts annual surveys in the districts encompassing the proposed Type III areas. Typically the survey would detect a recruitment event two years prior to the time that it would result in the opening of a king crab fishery. Because some Type III areas are adjacent to both Type I and Type II areas, the NMFS Regional Director will classify the expanded area as either Type I or II depending on the information available.

In developing these time/area closure measures, the Council recognized that the future of the king and Tanner crab resource is dependent on the ability of existing brood stock to successfully produce crab. Scientific data presented in both Amendment 15 and Amendment 18 show that the existing closure areas provide protection to 85% of the Kodiak red king crab stocks, protect about 75% of the Tanner crab stocks, protect the most highly concentrated crab areas all year round, yet may provide for groundfish fishing opportunities necessary to support the economic base of Kodiak communities. The Council also recognized that once areas have been closed to fishing, there is often a reluctance to open those areas when circumstances may have changed.

Additional action is being considered at this time because the crab protection time and area closures established under Amendment 18 will expire December 31, 1992 unless the FMP is amended. This bycatch control measure was developed and implemented by the Council and the Secretary in 1986 and reestablished in 1989 to provide an environment conductive to the recovery of king crab stocks around the island at a time of developing groundfish bottom trawl fisheries and also provide protection for Tanner crab stocks. The time/area closure scheme afforded protection to crab in some areas during their molting or soft-shell period, while in other areas it protected crab from bottom trawls year-round. The expiration date allows the Council to review the situation, the status of the crab resource, the effectiveness of the time/area closures, and any other relevant information. As requested by the Council, staff re-evaluated the time/area closures as a possible bycatch control measure for king and Tanner crab. Utilizing the analysis presented as part of this amendment package, the Council can determine whether this approach to the king and Tanner crab bycatch problem should be continued or abandoned.

3.2 The Alternatives

3.2.1 Alternative 1: Status Quo - Do nothing.

Under the status quo there would be no specific bycatch controls for the groundfish fishery in the EEZ of the Gulf of Alaska to protect king crab after December 31, 1992. The current time/area closure scheme would expire. The retention of king and Tanner crab would remain prohibited in all groundfish fisheries. This alternative would provide no specific protection to crab around Kodiak Island and, therefore, does not meet the Council's objective of continuing such protection in anticipation of king crab stock rebuilding in the Gulf of Alaska.

3.2.2 Alternative 2: Extend existing time/area closure measures for another three years.

This alternative would extend the Type I, II and III time/area closures implemented by Amendment 18 for another three years (until December 31, 1995). Type I areas are closed to bottom trawling year-round. Type II areas are closed to bottom trawling during the crab soft-shell period, identified as February 15 - June 15. Type III areas are closed to bottom trawling when a significant recruitment event occurs.

3.2.3 Alternative 3: Implement a permanent time/area closure scheme for non-pelagic trawling.

This alternative would renew the existing time/area closures indefinitely. Under this alternative, modifying or deleting this protection measure would require a change to the GOA FMP. This alternative would not necessitate a periodic review of these measures. The Council would need to direct staff to initiate an analysis of these closures through the annual FMP amendment process.

3.3 Biological and Physical Impacts

The Kodiak red king crab population remains at historic low levels, and most are old, sexually mature animals. There has been no sign of significant recruitment since 1979. As a result, the Kodiak commercial king crab fishery has been closed since 1983 in an attempt to rebuild the stocks. While the cause for the decline of king crab is not known, most researchers believe that the decline can be attributed to a variety of environmental factors which independently or in combination led to the depressed condition of the resource. Whether the king crab decline is due in part to commercial fishing, either directed or incidental, is unknown.

Beginning in 1987, ADF&G begin conducting an island-wide trawl survey to assess both king and Tanner crab stocks. The 1987 survey results indicated a continuation of the decline in red king crab abundance that had been noted since 1982. The annual surveys since 1987 have continued to document the depressed condition of red king crab abundance. Trawl surveys from 1989, 1990 and 1991 indicate the following red king crab population estimates:

Year	Population Estimate
1989	355,195 animals
1990	258,059
1991	219,420

Trawl survey data indicate that the stocks continue to experience little or no recruitment. However, the 1991 ADF&G trawl survey captured more small crab than in recent years.

King crab are known to concentrate in certain areas around Kodiak Island during the year. In the spring they migrate inshore to molt and mate. Approximately 70% of the female red king crab stocks are estimated to congregate in two areas, known as the Alitak/Towers and Marmot Flats. The Chirikof Island and Barnabas areas also possess concentrations of king crab but in lesser amounts. Past studies by ADF&G have shown that most king crab around Kodiak mate and molt in the March-May period, although some molting crab can be found from late-January through mid-June. Adult female king crabs must molt to mate and extrude eggs. After molting, their exoskeleton (shell) is soft, and crabs in this stage are known as soft-shell crabs. The new exoskeletons take 2-3 months to harden fully. During the soft-shell period, the crabs are particularly susceptible to injury and mortality from handling and from encounters with fishing gear. Because many of the present and potential groundfish trawling grounds overlap with the mating grounds of king crab, the potential exists for substantial king crab mortality.

While it is generally assumed that king crab mortality during the soft-shell phase can be high with any gear type, incidental mortality of hard-shell crab as a result of encounters with fishing gear is not known. Trawl fishing could kill or injure king crab in two ways. First, crabs caught in the net can be crushed during the tow or injured as the catch is unloaded in the fishing vessel. Study of survival and mortality of king and Tanner crabs taken as bycatch in a 1987 yellowfin sole Joint Venture trawl fishery in the eastern Bering Sea indicate overall survival was 21 percent for king crabs and 22 percent for Tanner crabs (Stevens, 1990). Second, crabs might be struck with parts of the gear (e.g., trawl doors, towing cables, groundlines, roller gear) as the trawl is towed along the bottom.

On December 31, 1992 time/area closures designed to protect king and Tanner crab in the vicinity of Kodiak Island expire. These measures may be necessary to permit the severely depressed king crab stocks to recover in this area. The stocks have experienced little or no recruitment in recent years, and are subject to high mortalities from bottom trawls while in the soft-shell condition. The expiration date was selected to necessitate a review of the status of the crab stocks, and determine whether these measures are effective and should be continued.

3.3.1 Alternative 1: Status Quo - Do nothing.

With this option, no specific management measure would be implemented in this plan for the control of king crab bycatch in the non-pelagic trawl groundfish fisheries within the EEZ of the Gulf of Alaska after December 31, 1992. Incidental catches and subsequent mortalities would continue wherever concentrations of king crab occur, and at all times of the year when non-pelagic trawling is conducted. This alternative affords very limited protection to the king crab resource in the EEZ. It is not known whether this would prevent a recovery of the king crab resources. Fewer king crab in the marine food system would be present as a prey species for predators. Known predators include halibut, Pacific cod, and sculpins, which feed on juvenile king crab; herring and capelin feed on larval king crab.

Predators also include marine mammals. Interaction between king crab and marine mammals is generally minimal. Exceptions are interactions with sea otters. The sea otter feeds on any size of king crab, including commercial sized crab. The sea otter is also a benthic feeder and regularly dives to 30 fathoms in search of food. Sea otters have been recorded at depths as great as 50 fathoms. No documentation exists on the importance of king crab in the sea otter diet, and sea otter mortality resulting from interactions with the crab fisheries is believed to be rare.

Also under this alternative, fewer king crab would be in the system to feed on other marine life. King crab are bottom foragers, feeding on a wide range of food items, including dead organisms. Crab larvae feed on sponges, hydroids, and algae during the transition to their demersal mode of life. Brittle stars are an important food item for newly molted king crab. King crab also feed on mollusks, polychaete worms, isopods, young Tanner crab, starfish, and sea urchins. With fewer king crab, more of these organisms would be available for consumption by other organisms.

With the status quo, commercial fishing for groundfish by trawl gear would be conducted in the areas proposed to be closed seasonally and year-round by Alternatives 2 and 3. Commercial fishing for groundfish in these closure areas by non-trawl gear types (hook & line and pots), currently occurs. Because of this, it is uncertain how much more, if any, groundfish will be removed from those areas by all gear types relative to Alternatives 2 and 3. Therefore, the long-term predator/prey relationships that exist in local areas which have adjusted to the low abundance of king crab and current level of groundfish fishing would not be expected to change. The overall environmental impacts of this alternative compared with Alternatives 2 and 3 are not well understood but are believed to be insignificant. The Gulf of Alaska ecosystem is so complex that the environmental impacts as a result of this amendment are undetectable

given the background variability of the system.

3.3.2 Alternative 2: Extend existing time/area closure measures for another three years.

Adoption of this alternative would provide the positive benefits of protecting the majority (85%) of Kodiak Island king crab resource from non-pelagic trawls during their soft-shell period (February 15-June 15); protecting the most concentrated king crab areas (Alitak Flats and Towers), or 70% of the existing resource year-round; and still providing non-pelagic trawl fishing opportunities close to established processing and support facilities (Dana Schmidt and Dave Jackson, ADF&G, personal communication). Injury or mortality as a result of non-pelagic trawling would be reduced.

Compared to the status quo alternative, Alternative 2 would increase the probability of a king crab population recovery. A review of 1985 non-pelagic trawl groundfish harvests (the last year before implementing the closure areas) indicate that only 1% of the harvest would have been lost if the time/area closures had been in effect. It is likely that the foregone groundfish catch consisting of sablefish, Pacific cod, and flatfish would have been taken from other areas around Kodiak Island. Therefore, the impacts of this alternative on groundfish stocks is insignificant.

As king crab stocks recover, more king crab will enter the ecosystem. The predator/prey relationship in the closed or restricted areas would change. More king crab would consume prey species that otherwise may have been consumed by other species. In turn, more king crab will be available to be preyed on by other predators, including marine mammals. Local fishing mortality would be reduced as groundfish fishing is closed or restricted.

Fewer or no groundfish would thus be removed from the system, which would then contribute to the current food web in these areas. The balanced predator/prey relationships that has adjusted to the low abundance of king crab and current level of groundfish fishing would change. The overall environmental impacts of this alternative compared with the status quo alternative are not well understood but are believed to be insignificant compared to natural perturbations in the environment.

This alternative would also afford protection to 75% of the known Tanner crab stocks in the Kodiak vicinity. This resource is also depressed, and only limited fisheries have been allowed. To the degree that time/area closures benefit Tanner crab, a more rapid rebuilding of this valuable resource might occur.

3.3.3 Alternative 3: Implement a permanent time/area closure scheme for non-pelagic trawling.

Adoption of this alternative would have all the conservation benefits as described for Alternative 2. The only difference from Alternative 2 is that, if recommended, Alternative 3 would not require Council review after three years because this alternative does not contain a sunset provision. If the Council, at a future date, would like to review the effectiveness of this protective measure, the Council would need to direct staff to initiate an analysis of these closures through the annual FMP amendment process.

3.4 Socioeconomic Impacts

The alternatives to the status quo will affect those who harvest and process groundfish and other species including king crab.

If areas in which bottom trawlers would normally fish are closed, fishermen would have to alter their fishing patterns. If we assume that the unconstrained distribution of effort is optimal for the bottom trawlers, they would face a potential decrease in profits as the result of not being able to fish in the most

preferred areas. The closure of preferred fishing areas will decrease profits if cost per unit of catch is higher in the areas that remain open, and/or if the catch that is foregone in the closed areas is not completely offset by increased catch in other areas.

The largest reduction would occur if none of the catch that would have been taken in the closed areas can be taken elsewhere. In this case, gross ex-vessel revenue would be reduced by an amount equal to that which would have been earned in the closed areas. However, profits would decrease by less than this because the cost of harvesting groundfish in the closed areas would also be foregone. There is not sufficient harvesting cost information to estimate to what extent the reduction in gross ex-vessel earnings would overstate the reduction in profits in this extreme case.

Because the no-trawl closures have been in effect since 1986, obtaining current estimates of groundfish catch within the closure zones is not possible. Therefore the best available catch information is from 1985, the last year uncontrolled bottom trawling was allowed around Kodiak Island. If the Types I and II closures had been in effect in 1985, and if the catch from these areas could not have been made up elsewhere, approximately $17,000 of gross ex-vessel earnings would have been foregone (Table 3.1). The percent of the Central GOA trawl catch taken from the closure areas prior to the closure implementation was quite small. Alaska Department of Fish and Game fish ticket data indicate that in 1985, only 0.56%, 1.42% and 13.28% for sablefish, Pacific cod and Rocksole, respectively, was taken from within the Types I and II no-trawl areas.

Given the increase in ex-vessel prices that has occured since 1985, and assuming the catch composition and amount for 1985 would be the same for 1991, the forgone value in 1991 due to the no-trawl closures would have been approximately $27,500.

Had the Type III closures been in effect during 1988, and had bottom trawl fishermen been unable to make up the catch from these areas, the additional foregone catch and value would have been approximately 2,200 mt and $692,000, or $943,705 for 1991, assuming 1988 catch from within the Type II closure areas (Table 3.2).

The catch figures used to estimate the potential reductions in catch and value are based on catch data by Alaska Department of Fish and Game Statistical Area. Because the proposed closures include only part of some statistical areas, and because catch is often not accurately reported by statistical area, the estimates of catch in the proposed closures may be very rough approximations of the actual catch.

As noted above, the potential foregone catch and value assuming no redirection of fishing effort to the areas that remain open are upper bounds on the adverse effects of the proposed closures. At the other extreme, all the catch would be made up in other areas without increasing fishing costs and the closures, therefore, would have no adverse effects on the bottom trawl fisheries. It is not known where the actual effects would fall within this range.

What is known is that the Central GOA TACs for the species historically caught within the closure areas have been taken since this measure has been implemented. This indicates that these crab conservation measures have not detracted from achieving OY, and the small percentages of the TACs harvested within the closure areas probably do not negatively impact the trawlers. In addition, other operations utilizing non-trawl gear types, notably hook & line and groundfish pots, fish within the closure areas for groundfish.

It is even more difficult to determine the probable benefits of the closures. The closures will tend to provide protection for king and Tanner crab stocks; however, it is not known how the probability or

Table 3.1 1985 and 1991 value of groundfish harvested within Type I and II trawl closures in 1985.

Species	Quantity (mt)	Percent of Central Gulf Trawl Catch	1985 Value	1991 Value
Sablefish	2	0.56%	$1,460	$3,959
Pacific Cod	27	1.42%	$7,799	$13,095
Rocksole	39	13.28%	$7,568	$10,489
			$16,827	$27,543

Catch figures in the area were provided by ADF&G and prices used were annual average trawl prices in the Central Gulf of Alaska as reported in the May 12, 1985 and December 11, 1991 PacFIN report.

Table 3.2 1988 and 1991 value of groundfish harvested in proposed Type III bottom trawl closures in 1988.

Species	Quantity (mt)	Percent of Central Gulf Trawl Catch	1988 Value	1991 Value
Pollock	416	0.81%	$71,000	$105,463
Pacific Cod	1341	6.10%	$438,000	$650,372
Flatfish	224	3.11%	$63,000	$74,071
Rockfish	192	2.35%	$111,000	$102,430
Other	27	9.64%	$9,000	$11,369
			$692,000	$943,705

Catch figures in the area were provided by ADF&G and prices used were annual average trawl prices in the Central Gulf of Alaska as reported in the February 10, 1989 PacFIN report for 1988 value and December 11, 1991 PacFIN report for 1991 value.

timing of recoveries by these stocks would be affected by these closures. The benefits of the closures would be minimal if the probability of recovery is very low whether or not the closures are implemented, or if a similar recovery would occur regardless of the closures. Conversely, the benefits would be substantial if a full recovery of the stocks would only be prevented by the absence of the proposed closures. The factors affecting the potential for stock recoveries are not sufficiently well understood to determine which case is more likely. The types of information needed to make more specific statements concerning the expected benefits of the closures include the following:

(1) The bycatch rate of king and Tanner crab in the bottom trawl fishery by area and season.

(2) The percent mortality of that bycatch as it is returned to the sea by area and season.

(3) The natural mortality and growth rates, migration patterns, reproductive potential of these "saved" crab.

(4) The natural mortality (including susceptibility to predation), growth rates, migration patterns, and recruitment of these offspring.

We are unable to estimate any of these four items with reliable precision, but can only infer that protection of some stocks of younger crab will eventually lead to additional recruitment.

A historical perspective implies that there would be significant benefits should the red king crab stocks recover to past levels of abundance. During the last five years that the fishery was open in the Kodiak region (1978-1983), annual catch averaged about 16 million pounds, which at $4/lb. (ex-vessel) was worth $64 million. The extent to which the proposed closures would enhance that recovery cannot be ascertained given our current knowledge of crab biology.

Since implementation of this protection measure in 1986, ADF&G survey data indicate that little or no recruitment has occurred to the red king crab stocks. The Kodiak red king crab population remains at historic low population levels. This does not indicate that these closures are not effective. Rather, it indicates the difficulty in managing this crab fishery and the high costs of foregone revenue when a stock is in a depressed state.

3.4.1 Reporting Costs

The proposed alternatives to the status quo would not increase the reporting burden on fishermen or processors. The closed areas have been in place for six years and are enforced using at-sea enforcement, not by catch reporting. Therefore, relative to the status quo, the proposed time/area closures should not change the reporting costs of any participant in the fishery.

3.4.2 Administrative, Enforcement, and Information Costs and Benefits

The proposed alternatives close areas to bottom trawling year-round or during part of the year. In response to this change, enforcement officials can do one of two things: (1) obtain an increase in funding to maintain the status quo enforcement capability by increasing surveillance flights and cruises, or (2) reallocate enforcement activity from other areas and, thus, decrease the enforcement capabilities elsewhere.

3.4.3 Impacts on Consumers

The potential decrease in trawl catches is such a small percentage of the Alaska groundfish total that consumer prices should not be affected by the closures. If the closures contributed to the return of healthy red king crab and Tanner crab stocks around Kodiak, there would be benefits to consumers who purchase these crab. The benefits would appear in the form of lower prices and/or increased availability.

3.4.4 Redistribution of Costs and Benefits

The costs of the proposed time and area closures are borne by the harvesters and processors of bottom trawl-caught groundfish. There may also be increased enforcement costs from the adoption of this regulation. The benefits will accrue to those who harvest, process, market, and consume king or Tanner crab.

3.4.5 Benefit-Cost Conclusion

There will be costs to the bottom trawl fisheries in terms of increased operating costs or slightly lower catches if effort patterns that include fishing within the closure zones are optimal. The benefits associated with the time/area closures depend upon the level of bycatch of prohibited species associated with the redistributed effort. Benefits also depend on the ability of the red king crab and Tanner crab stocks to recover given the protection afforded by the closures. The magnitudes of the potential costs and benefits are only known within large ranges.

Under Alternative 2, the closures would be in effect for three years only and will be reevaluated at the end of that period. If, at that time, the Council takes no further action with regard to the problem of king crab bycatch by non-pelagic trawlers in the vicinity of Kodiak Island the provisions of Alternative 2 will expire at the end of 1995. The benefits and costs of the closures that were established for 1986 through 1992 are difficult to evaluate. Although there are no clear signs of improved recruitment, such improvements may not be measurable for several years.

3.5 References

Alaska Department of Fish & Game (ADF&G). 1991. Annual Management Report for the Shellfish Fisheries of the Westward Region. Regional Information Report No. 4K92-9. Kodiak, Alaska.

Alaska Department of Fish & Game (ADF&G). 1991. A Bottom Trawl Survey of Crab and Groundfish in the Kodiak Island, Alaska Peninsula, and Dutch Harbor Areas. Draft Technical Fisheries Report 92-xx. Juneau, Alaska.

Alaska Department of Fish & Game (ADF&G). 1990. A Bottom Trawl Survey of Crab and Groundfish in the Kodiak Island, Alaska Peninsula, and Dutch Harbor Areas. Draft Regional Information Report No. 4K91-14. Juneau, Alaska.

Alaska Department of Fish & Game (ADF&G). 1991. A Bottom Trawl Survey of Crab and Groundfish in the Kodiak Island, Alaska Peninsula, and Dutch Harbor Areas. Regional Information Report No. 4K90-22. Juneau, Alaska.

North Pacific Fishery Management Council (NPFMC). 1989. Amendments 18 and 13 to the Gulf of Alaska and Bering Sea/Aleutian Islands Groundfish Fishery Management Plans and associated Environmental Assessment/Regulatory Impact Review/Initial Regulatory Flexibility Analysis. Anchorage, Alaska.

North Pacific Fishery Management Council (NPFMC). 1986. Amendment 15 to the Gulf of Alaska Groundfish Fishery Management Plan and associated Environmental Assessment/Regulatory Impact Review/Initial Regulatory Flexibility Analysis. Anchorage, Alaska.

Stevens, Bradley G. 1990. Survival of King and Tanner Crabs Captured by Commercial Sole Trawls. Fishery Bulletin, U.S. 88:731-744.

3.6 List of Preparers

Brent Paine
North Pacific Fishery Management Council
P.O. Box 103136
Anchorage, Alaska

APPENDIX 1

Alaska Longline Fishermen's Association

Request for Closure of the Eastern Gulf to Trawling

GROUNDFISH FISHERY MANAGEMENT PLAN AMENDMENT PROPOSAL
North Pacific Fishery Mangement Council

Name of Proposer: Alaska Longline Fishermen's Association (ALFA) **Date:** 4/4/91

Address: P.O. Box 1229
Sitka, Alaska 99835

Telephone: (907) 747-3400

Fishery Management Plan: Gulf of Alaska Groundfish

Brief Statement of Proposal: Out-of-cycle Plan Amendment to prohibit trawling in the Eastern Gulf of Alaska (waters east of 140 degrees West longitude).

Objectives of the Proposal: (What is the problem?) To protect the marine resources, the traditional fisheries, and the socioeconomic health of coastal communities in the Eastern Gulf by eliminating all forms of trawling in the Gulf of Alaska east of 140 degrees West longitude.

The intended level of effort by factory trawlers in the Eastern Gulf this year is unprecedented. Because the factory trawl fleet is over-capitalized and faced with early closures in western areas (due to excessive halibut bycatch rates), trawl effort in the Eastern Gulf can only be expected to increase in years to come. Only by prohibiting trawling in the Eastern Gulf <u>now</u> will a crisis be averted.

Factory trawlers in the Eastern Gulf are depleting rockfish stocks that have never recovered from the decimation wrought by the foreign trawl fleet during the 1960s, and placing undue pressure on fully-utilized groundfish species traditionally targeted by the hook and line fleet. Trawl bycatch of salmon in the Eastern Gulf is unacceptable; it is a form of interception as deplorable as that for which the high seas driftnet fleet has been condemned, and undermines state conservation and enhancement programs. The trawl fleet may be contributing to marine mammal and seabird population declines observed in the Bering Sea and the Western and Central Gulf; the trawl fleet should not be allowed to expand into the Eastern Gulf where Steller sea lion populations remain healthy. The Eastern Gulf is rich in slow-growing, deep water corals that are easily damaged by trawl impact, a vulnerability that is intensified by the narrowness of the shelf/slope region. Finally, the traditional hook and line fisheries support the coastal communities of the Eastern Gulf; factory trawlers threaten not only the resource but the socioeconomic health of the area.

Need and Justification for Council Action: (Why can't the problem be resolved through other channels?) The North Pacific Council has sole jurisdiction over gear-types authorized to fish in the Eastern Gulf.

Foreseeable Impacts of Proposal: (who wins, who loses?) In the short term, the few factory trawl vessels presently fishing in the Eastern Gulf will lose access to the area. If the Council delays in prohibiting trawling, the number of vessels affected will increase.

In the long term, the entire area will benefit from the elimination of bycatch inroads into fish populations that are currently harvested by tightly controlled longline fisheries, in the case of groundfish, and troll, seine, gillnet and sport fisheries in the case of salmon. Bottom habitat will be protected, hence the productivity of the Eastern Gulf will be maintained. Marine mammal and seabird populations will benefit from decreased competition for food. Coastal communities in the Eastern Gulf will remain healthy.

Are There Alternative Solutions? If so what are they and why do you consider your proposal the best way of solving them? ALFA, United Fishermen of Alaska, Alaska Trollers' Association, Ketchikan Trollers' Committee, Petersburg Vessel Owners' Association, Sitka Charter Vessels' Association, Sitka Sound Seafoods, Seafood Producers Cooperative, Hoonah Cold Storage, Sitka Conservation Society, City Assemblies in Sitka, Petersburg, Haines, Haines Borough and Pelican, Fish and Game Advisory Committees in Sitka, Petersburg, Sumner Strait and Tenakee Springs, and the over 1,000 individuals who have signed the petition requesting closure of the Eastern Gulf to trawling recognize that there are no viable alternatives. Trawl gear is non-selective and fatally stresses bycatch species during capture. It is destructive of bottom habitat and ecosystem productivity. Trawlers threaten the traditional fisheries of the Eastern Gulf, the socioeconomic health of coastal communities, and the ecosystem itself. Prohibiting trawling in the Eastern Gulf will eliminate these threats. Prohibiting trawling now will insure that the threats are eliminated before permanent damage is done.

Supportive Data & Other Information: What data are available and where can they be found? Information to document the concerns cited for requesting closure of the Eastern Gulf to trawling accompany this proposal for an out-of-cycle Plan Amendment. Because much of the information is undoubtedly familiar to Council members and/or comes from lengthy papers, only excerpts or abstracts are included in some cases. Additional information is available on request.

Signature: Linda Behnken, ALFA

Alaska Longline Fishermen's Association
P.O. Box 1229 Sitka, AK 99835
March.1991

REQUEST FOR CLOSURE OF THE EASTERN GULF TO TRAWLING

The Alaska Longline Fishermen's Association requests that all trawling be prohibited in the Gulf of Alaska east of 140 degrees West longitude. The request is made for the following reasons:

1 The foreign trawl fleet decimated slope rockfish stocks during the 1960s, an attack from which stocks in the Eastern Gulf have not yet recovered. Rougheye and shortraker rockfish stocks also remain depressed. Now the American factory trawl fleet is threatening the same rockfish stocks. The 1991 allowable biological catch (ABC) and total allowable catch (TAC) for rougheye/shortraker in the Eastern Gulf is only 580 MT; according to the new federal definition of "over fishing," if the ABC is reached or exceeded all fisheries having an impact on the "over fished" stock will be closed--in other words, the Eastern Gulf longline sablefish fishery could be cancelled before it is opened. Since rockfish are long-lived (up to 100 years), have a low rate of production, and are area-specific, the National Marine Fisheries Services' solution of "borrowing" rockfish quota from the Central Gulf is short-term at best. Rockfish stocks are highly vulnerable to exploitation and should not be subjected to increased fishing pressure.

2. The Eastern Gulf has been a hook and line zone for close to 100 years. Most fisheries are fully utilized by the hook and line fleet and have been since 1983 or before. The intended level of effort by factory trawlers in the Eastern Gulf this spring is unprecedented, but can only be expected to increase given the extent to which the factory trawl fleet is overcapitalized. The expansion of the trawl fleet into waters of the Eastern Gulf will place undue pressure on fish stocks and displace traditional users.

3. The bottom habitat in the Eastern Gulf is particularly vulnerable to on-bottom trawling due to the nature of the benthic community. This community contains an abundance of fragile corals, an ecosystem component recognized as being highly productive and critical to ecosystem health The vulnerability is compounded by the narrowness of the shelf/slope region, a physical limitation that concentrates effort, preventing damaged area from recovering. Increased trawl effort could permanently impoverish Eastern Gulf ecosystems.

4. At the recommendation of the International Pacific Halibut Commission, the North Pacific Fishery Management Council postponed the longline sablefish fishery until May 15, 1991 to reduce halibut bycatch. Factory trawlers, with a 100% halibut bycatch mortality rate, intend to target grey cod this spring in the Eastern Gulf (retaining their allowed 15% sablefish bycatch), working the same grounds closed to longliners in order to protect halibut stocks. Only by prohibiting trawling will the halibut stocks actually gain the intended protection.

5. NMFS observer data for 1990 substantiated concerns regarding trawler bycatch of salmon. In the Eastern Gulf, this bycatch consisted of both chinook and "other" salmon. Salmon taken in the Eastern Gulf originated from streams in Alaska, British Columbia, Washington or Oregon Runs in some of these states have been proposed for listing under the Endangered Species Act. Salmon interception undermines conservation and enhancement efforts at both the federal and the state level.

6. Steller sea lion populations in the Eastern Gulf are stable and possibly increasing. Evidence suggests that trawling may be implicated in the precipitous decline of Steller populations in all other parts of their range. The Steller Sea Lion Recovery Team has indicated the critical importance of comparing the effects of various fisheries on sea lion populations. Designating the Eastern Gulf a trawl-free zone will provide an ideal laboratory for researchers to conduct comparison studies; it will also provide maximum protection to the one area in which Steller populations remain healthy.

APPENDIX 2

PacFIN Catch Tables

Eastern Gulf of Alaska, by gear, 1981-1991

Appendix 2 -- Table 1. Domestic groundfish landed catch (metric tons) in the Southeast Area of the Eastern Gulf of Alaska, 1981-1991.

Species Group	Gear[1/]	Year										
		1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Pollock	Trawl	0.0	26.1	0.0	0.0	0.1	1.5	113.4	1.5	0.1	3.5	0.0
	Longline	0.0	0.0	0.0	0.0	0.2	0.6	0.6	0.0	0.1	5.0	5.7
	Pot	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	All Gears	0.0	26.1	0.0	0.0	0.3	2.2	114.1	1.5	0.2	8.5	5.7
Pacific Cod	Trawl	1.3	3.3	0.6	0.3	3.9	3.9	19.4	8.0	2.6	1.2	15.6
	Longline	27.1	16.8	17.1	33.5	70.1	181.3	368.5	245.0	199.7	158.4	254.2
	Pot	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.3	0.0	0.0	0.0
	All Gears	30.8	24.7	18.2	34.1	92.3	185.3	389.0	253.8	202.8	161.3	276.0
Flatfish	Trawl	326.5	202.5	351.3	179.7	183.6	232.9	491.4	315.8	125.2	64.3	106.9
	Longline	0.0	0.0	0.0	0.2	0.1	0.3	1.0	0.5	0.2	3.8	1.1
	Pot	0.0	0.1	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	All Gears	326.5	202.6	351.3	181.1	184.9	233.2	492.4	316.4	125.4	68.1	108.0
Sablefish	Trawl	0.0	0.0	0.0	0.4	6.7	81.2	132.2	62.0	99.1	107.0	142.3
	Longline	1,741.4	1,961.5	2,761.1	3,410.1	2,825.7	4,946.0	6,376.0	7,320.8	6,160.1	6,317.3	5,745.8
	Pot	65.3	61.2	0.3	100.5	184.6	19.7	0.0	8.5	4.9	0.0	0.5
	All Gears	1,811.8	2,022.7	2,761.6	3,511.2	3,066.0	5,046.8	6,508.2	7,391.4	6,264.1	6,424.4	5,888.8
Rockfish	Trawl	0.0	0.8	0.0	15.4	215.5	661.3	1,381.7	494.4	1,687.4	1,252.6	1,134.2
	Longline	203.5	199.5	357.5	795.4	719.0	1,105.6	1,342.1	876.4	717.4	620.1	588.6
	Pot	0.0	4.5	1.2	0.1	0.2	0.0	0.0	0.5	0.0	0.0	0.0
	All Gears	218.8	207.6	362.3	829.1	949.9	1,785.5	2,743.4	1,387.9	2,412.9	1,901.5	1,804.8
Ling Cod	Trawl	0.0	0.0	0.0	0.2	13.3	0.0	0.3	0.0	0.0	0.0	0.0
	Longline	7.6	7.2	13.0	44.7	55.7	107.7	123.3	140.2	133.4	132.4	123.2
	Pot	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	All Gears	20.2	23.5	32.3	74.3	86.7	127.0	195.5	253.5	221.9	297.1	365.2
All Groundfish	Trawl	327.9	245.4	352.8	195.9	423.3	980.8	2,138.7	882.4	1,915.3	1,434.3	1,402.1
	Longline	1,979.9	2,185.1	3,151.3	4,285.7	3,671.4	6,343.5	8,250.5	8,749.8	7,216.5	7,241.3	6,720.7
	Pot	80.8	66.0	1.5	106.0	184.8	19.7	0.0	9.8	4.9	0.0	6.7
	All Gears	2,431.4	2,521.7	3,529.3	4,656.1	4,380.6	7,382.1	10,487.0	9,777.8	9,234.2	8,880.6	8,459.6

[1/] All Gears is sum of landings by trawl, longline, pot, and any other gears not specifically listed.

Source: PacFIN, 1992

Appendix 2 -- Table 2. Domestic groundfish landed catch (metric tons) in the Yakutat Area of the Eastern Gulf of Alaska, 1981-1991.

Species Group	Gear[1/]	Year										
		1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Pollock	Trawl	0.0	0.0	0.0	0.0	0.0	70.0	0.0	0.5	32.8	0.0	3,389.7
	Longline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
	Pot	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	All Gears	0.0	0.0	0.0	0.0	0.0	70.0	0.0	0.6	32.8	0.0	3,389.7
Pacific Cod	Trawl	0.0	14.8	0.0	0.0	0.0	218.6	3.1	25.8	4.7	11.1	36.9
	Longline	1.1	22.8	0.6	0.7	0.2	3.1	26.5	13.8	13.4	18.2	39.5
	Pot	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	All Gears	1.1	37.6	1.0	0.7	0.2	221.7	29.6	39.6	18.1	29.3	78.2
Flatfish	Trawl	0.0	0.0	0.0	0.0	11.9	124.6	19.9	45.1	61.3	99.6	104.9
	Longline	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.1	2.7	3.4
	Pot	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	All Gears	0.0	0.0	0.0	0.0	11.9	124.6	20.1	45.1	61.4	102.3	108.3
Sablefish	Trawl	0.0	0.0	0.0	0.0	27.5	557.0	354.0	767.0	502.0	403.8	249.4
	Longline	89.1	826.6	691.5	1,905.3	2,542.7	4,337.2	5,179.9	5,988.2	6,718.0	5,552.1	5,351.1
	Pot	0.0	7.0	0.0	0.0	0.0	2.2	0.0	0.0	0.0	0.0	0.0
	All Gears	89.1	833.5	691.5	1,906.2	2,576.0	4,896.4	5,533.9	6,755.3	7,220.0	5,955.9	5,600.5
Rockfish	Trawl	0.0	0.0	0.0	0.0	767.9	2,986.8	4,457.2	4,727.6	5,433.2	4,586.8	2,083.7
	Longline	10.5	37.2	35.4	27.9	21.1	96.0	172.7	163.5	211.1	201.8	454.1
	Pot	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	All Gears	13.0	37.3	35.8	28.0	788.9	3,087.5	4,629.9	4,916.6	5,644.3	4,794.0	2,539.0
Ling Cod	Trawl	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Longline	0.9	0.7	0.7	1.3	3.0	1.6	15.6	24.3	43.3	51.1	111.4
	Pot	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
	All Gears	2.1	3.5	3.3	5.0	7.1	4.9	17.7	32.7	43.4	53.8	117.3
All Groundfish	Trawl	0.0	21.0	0.0	0.0	807.3	4,006.7	4,834.1	5,568.9	6,040.4	5,108.3	5,868.6
	Longline	101.8	887.3	728.2	1,935.2	2,566.9	4,437.9	5,396.1	6,198.9	6,987.2	5,864.0	5,962.6
	Pot	0.0	7.0	0.0	0.0	0.0	2.2	0.0	0.0	0.1	0.0	0.0
	All Gears	106.2	918.0	731.6	1,940.0	3,384.1	8,454.9	10,232.4	11,801.9	13,027.6	10,980.3	11,840.2

[1/] All Gears is sum of landings by trawl, longline, pot, and any other gears not specifically listed.

Source: PacFIN, 1992

Appendix 2 -- Table 3. Foreign and domestic groundfish landed catch (metric tons) in the Southeast Area of the Eastern Gulf of Alaska, 1981-1991.

Species Group	Gear[1/]	Year										
		1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Pollock	Trawl	1,000.8	26.1	0.0	0.0	0.1	1.5	113.4	1.5	0.1	3.5	0.0
	Longline	0.0	0.0	0.0	0.0	0.2	0.6	0.6	0.0	0.1	5.0	5.7
	Pot	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	All Gears	1,000.8	26.1	0.0	0.0	0.3	2.2	114.1	1.5	0.2	8.5	5.7
Pacific Cod	Trawl	79.7	3.3	0.6	0.3	3.9	3.9	19.4	8.0	2.6	1.2	15.6
	Longline	27.1	16.8	17.1	33.5	70.1	181.3	368.5	245.0	199.7	158.4	254.2
	Pot	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.3	0.0	0.0	0.0
	All Gears	109.2	24.7	18.2	34.1	92.3	185.3	389.0	253.8	202.8	161.3	276.0
Flatfish	Trawl	2,479.1	202.5	351.3	179.7	183.6	232.9	491.4	315.8	125.2	64.3	106.9
	Longline	0.0	0.0	0.0	0.2	0.1	0.3	1.0	0.5	0.2	3.8	1.1
	Pot	0.0	0.1	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	All Gears	2,479.1	202.6	351.3	181.1	184.9	233.2	492.4	316.4	125.4	68.1	108.0
Sablefish	Trawl	74.4	0.0	0.0	0.4	6.7	81.2	132.2	62.0	99.1	107.0	142.3
	Longline	1,741.4	1,961.5	2,761.1	3,410.1	2,825.7	4,946.0	6,376.0	7,320.8	6,160.1	6,317.3	5,745.8
	Pot	65.3	61.2	0.3	100.5	184.6	19.7	0.0	8.5	4.9	0.0	0.5
	All Gears	1,886.2	2,022.7	2,761.6	3,511.2	3,066.0	5,046.8	6,508.2	7,391.4	6,264.1	6,424.4	5,888.8
Rockfish	Trawl	3,131.4	0.8	0.0	15.4	215.5	661.3	1,381.7	494.4	1,687.4	1,252.6	1,134.2
	Longline	203.5	199.5	357.5	795.4	719.0	1,105.6	1,342.1	876.4	717.4	620.1	588.6
	Pot	0.0	4.5	1.2	0.1	0.2	0.0	0.0	0.5	0.0	0.0	0.0
	All Gears	3,350.2	207.6	362.3	829.1	949.9	1,785.5	2,743.4	1,387.9	2,412.9	1,901.5	1,804.8
Ling Cod	Trawl	0.0	0.0	0.0	0.2	13.3	0.0	0.3	0.0	0.0	0.0	0.0
	Longline	7.6	7.2	13.0	44.7	55.7	107.7	123.3	140.2	133.4	132.4	123.2
	Pot	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	All Gears	20.2	23.5	32.3	74.3	86.7	127.0	195.5	253.5	221.9	297.1	365.2
All Groundfish	Trawl	6,972.3	245.4	352.8	195.9	423.3	980.8	2,138.7	882.4	1,915.3	1,434.3	1,402.1
	Longline	1,979.9	2,185.1	3,151.3	4,285.7	3,671.4	6,343.5	8,250.5	8,749.8	7,216.5	7,241.3	6,720.7
	Pot	80.8	66.0	1.5	106.0	184.8	19.7	0.0	9.8	4.9	0.0	6.7
	All Gears	9,075.8	2,521.7	3,529.3	4,656.1	4,380.6	7,382.1	10,487.0	9,777.8	9,234.2	8,880.6	8,459.6

[1/] All Gears is sum of landings by trawl, longline, pot, and any other gears not specifically listed.

Source: PacFIN, 1992

Appendix 2 -- Table 4. Foreign and domestic groundfish landed catch (metric tons) in the Yakutat Area of the Eastern Gulf of Alaska, 1981-1991.

Species Group	Gear[1/]	Year										
		1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Pollock	Trawl	7,554.8	6.5	16.6	0.0	0.0	70.0	0.0	0.5	32.8	0.0	3,389.7
	Longline	19.0	19.2	24.6	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
	Pot	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	All Gears	7,573.9	25.7	41.3	0.0	0.0	70.0	0.0	0.6	32.8	0.0	3,389.7
Pacific Cod	Trawl	1,199.0	14.8	0.0	0.0	0.0	218.6	3.1	25.8	4.7	11.1	36.9
	Longline	1,049.4	2,092.8	1,962.0	0.7	0.2	3.1	26.5	13.8	13.4	18.2	39.5
	Pot	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	All Gears	2,248.4	2,107.6	1,962.4	0.7	0.2	221.7	29.6	39.6	18.1	29.3	78.2
Flatfish	Trawl	0.0	0.0	0.0	0.0	11.9	124.6	19.9	45.1	61.3	99.6	104.9
	Longline	73.6	58.2	49.8	0.0	0.0	0.0	0.2	0.0	0.1	2.7	3.4
	Pot	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	All Gears	3,307.9	58.2	50.3	0.0	11.9	124.6	20.1	45.1	61.4	102.3	108.3
Sablefish	Trawl	207.7	0.0	0.3	0.0	27.5	557.0	354.0	767.0	502.0	403.8	249.4
	Longline	2,794.1	2,093.1	1,773.3	1,905.3	2,542.7	4,337.2	5,179.9	5,988.2	6,718.0	5,552.1	5,351.1
	Pot	0.0	7.0	0.0	0.0	0.0	2.2	0.0	0.0	0.0	0.0	0.0
	All Gears	3,001.9	2,100.0	1,773.6	1,906.2	2,576.0	4,896.4	5,533.9	6,755.3	7,220.0	5,955.9	5,600.5
Rockfish	Trawl	5,290.2	3.2	1.7	0.0	767.9	2,986.8	4,457.2	4,727.6	5,433.2	4,586.8	2,083.7
	Longline	177.5	211.3	133.7	27.9	21.1	96.0	172.7	163.5	211.1	201.8	454.1
	Pot	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	All Gears	5,470.2	214.6	135.8	28.0	788.9	3,087.5	4,629.9	4,916.6	5,644.3	4,794.0	2,539.0
Ling Cod	Trawl	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Longline	0.9	0.7	0.7	1.3	3.0	1.6	15.6	24.3	43.3	51.1	111.4
	Pot	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
	All Gears	2.1	3.5	3.3	5.0	7.1	4.9	17.7	32.7	43.4	53.8	117.3
All Groundfish	Trawl	19,632.8	30.6	20.3	0.0	807.3	4,006.7	4,834.1	5,568.9	6,040.4	5,108.3	5,868.6
	Longline	4,158.4	4,505.3	4,002.9	1,935.2	2,566.9	4,437.9	5,396.1	6,198.9	6,987.2	5,864.0	5,962.6
	Pot	0.0	7.0	0.0	0.0	0.0	2.2	0.0	0.0	0.1	0.0	0.0
	All Gears	23,795.5	4,545.7	4,026.6	1,940.0	3,384.1	8,454.9	10,232.4	11,801.9	13,027.6	10,980.3	11,840.2

[1/] All Gears is sum of landings by trawl, longline, pot, and any other gears not specifically listed.

Source: PacFIN, 1992

APPENDIX 3

NMFS Auke Bay Laboratory

A Reanalysis of the 1987 and 1990 Triennial Trawl Surveys of the Eastern Gulf of Alaska, in Response to a Proposal to Prohibit Trawling East of 140°W. Longitude

A Re-analysis of the 1987 and 1990 Triennial Trawl Surveys of the Eastern Gulf of Alaska, in Response to a Proposal to Prohibit Trawling East of 140° W. Longitude

By
David M. Clausen

Auke Bay Laboratory
March 1992

Two divisions of the NMFS Alaska Fisheries Science Center, the Auke Bay Laboratory (ABL) and the RACE Division, jointly conducted comprehensive trawl surveys of groundfish resources in the Gulf of Alaska in 1987 and 1990. In each year's survey, most of the North Pacific Fishery Management Council's (NPFMC) Eastern Regulatory Area (Gulf of Alaska east of 147° W. longitude) was surveyed by the Auke Bay Laboratory; a smaller portion of the Eastern Area between 144° 30' and 147° was surveyed by RACE. Results of these surveys have been reported in various Stock Assessment and Fishery Evaluation (SAFE) documents since 1987.

In a letter dated February 4, 1992, Alaska Department of Fish and Game Commissioner Carl Rosier requested that Steven Pennoyer, Director, NMFS Alaska Region, ask ABL to re-analyze the trawl survey results for the eastern Gulf of Alaska. This re-analysis was needed to assess the impacts of a proposed amendment to the NPFMC's groundfish Fishery Management Plan that would prohibit trawling in the eastern Gulf of Alaska east of 140° W. longitude. The trawl survey results that were reported in previous SAFE documents did not use 140° as a boundary line in their data summaries. A re-analysis of the eastern Gulf trawl surveys, therefore, was needed to evaluate potential effects of the amendment. In this report, I present the results of ABL's re-analysis of the trawl surveys.

A brief discussion of the survey design is needed to better understand the results presented here. In the 1987 and 1990 surveys, the eastern Gulf of Alaska was divided into 21 subareas based on depth, topography (gully vs. slope), and geographic location. Presumably, a subarea represented a somewhat common habitat for a groundfish species, in at least a gross sense, when compared with other subareas. Each subarea formed a sampling stratum in the survey; data from individual hauls were pooled within a subarea in the computations of catch per unit effort (CPUE) and biomass. The subareas were located in either the Yakutat or the Southeastern International North Pacific Fisheries Commission (INPFC) statistical areas. The 140° line is located within the Yakutat INPFC area, and many of the Yakutat subareas straddled this line. This makes it impossible to compute precise biomass estimates for areas east and west of 140° using the old subarea definitions. Consequently, in this re-analysis, I had to create a new scheme of subareas that were based on a boundary of 140°, rather than on the old INPFC boundaries.

In the new scheme, the NPFMC's Eastern Regulatory Area is divided into two areas: West Yakutat, located between 147° and 140° W. longitude, and East Yakutat/Southeastern, extending from 140° W. southeastward to the U.S.-Canada boundary in Dixon Entrance. I created a total of 23 subareas within these two areas, 11 in the West Yakutat area, and 12 in the East Yakutat/Southeastern area. Table 1 lists these new subareas, along with their areal sizes in nm^2. In the remainder of this report, all estimates of biomass, CPUE and acceptable biological catch (ABC) are presented in terms of a West Yakutat - East Yakutat/Southeastern breakdown.

As an alternative to the above scheme, I had originally planned to also compute separate CPUE and estimates of biomass for the East Yakutat area alone (area between 140° and 137°). A preliminary analysis, however, indicated that separate estimates of biomass for East Yakutat would likely be invalid because of the small number of successful hauls completed there in either 1987 or 1990. Virtually all the East Yakutat area deeper than 200 m. was untrawlable using our survey nets. The only good trawling areas were in Alsek Canyon and on the continental shelf between 100 and 200 m. Because of the poor sampling density in the East Yakutat area, pooling the hauls in this area with those in Southeastern (i.e., creating an East Yakutat/Southeastern area as discussed in the previous paragraph) appeared to be the best approach in re-analyzing the trawl surveys.

The re-analyzed values of mean CPUE and estimated biomass are listed in Tables 2 through 5 for all species or species groups that are presently assigned an ABC in the Gulf of Alaska. Several cautionary remarks should be mentioned concerning the data in these tables:

1. In the eastern Gulf of Alaska, the 1987 survey was unable to sample any depths >700 m; similarly, the 1990 survey did not sample any depths >500 m. The data listed in the tables only pertain to the depths sampled, and no attempt was made to estimate what the CPUE or biomass in the unsampled deeper depths might have been. Therefore, the biomasses for deep water species such as sablefish, shortspine thornyhead, and Dover sole are considered to be an underestimate.

2. The 301-500 m slope was poorly sampled in both surveys, especially in the East Yakutat/Southeastern area, because much of the bottom was untrawlable using the standard survey nets. This causes an additional uncertainty in the biomass estimates for the three species listed in the paragraph above. Biomass for shortraker and rougheye rockfish, whose prime habitat is rough bottom on the 301-500 m slope, is also highly uncertain and is probably underestimated.

3. Longline survey results show a high relative abundance of shortraker and rougheye rockfish in the eastern Gulf of Alaska

when compared with the trawl survey results. This is additional evidence that the trawl survey biomass estimates for these two rockfish species are underestimated in the eastern Gulf.

4. A species' total biomass in the eastern Gulf of Alaska in Tables 2 through 5 (i.e., adding the biomass in West Yakutat with that in East Yakutat/Southeastern) does not equal its eastern Gulf biomass listed in previous SAFE documents. This difference is caused by the new subarea scheme used in the present reanalysis. The biomass computations used in both the old and new analyses are heavily influenced by how the individual hauls are grouped into subareas; for any given species, a change in the subareas will result in a different estimate of total biomass.

New values of ABC are shown in Tables 6 and 7 for slope and pelagic shelf rockfish in the eastern Gulf of Alaska. The method for computing ABC is similar to that used in the 1991 SAFE document for these two species assemblages: exploitable biomass for each species, based on the average of the 1987 and 1990 surveys, is multiplied by an appropriate F=M exploitation rate to calculate a value of ABC. Similar to the analysis used in previous SAFE documents, exploitable biomass for slope rockfish is defined as the biomass in waters >100 m depth; slope rockfish caught in depths <100 m are assumed to be small juveniles, and hence, not exploitable. In the West Yakutat area, ABC values are as follows: Pacific ocean perch, 1,284 mt; shortraker/rougheye, 239 mt; other slope rockfish, 407 mt; and pelagic shelf rockfish, 876 mt. In the East Yakutat/Southeastern area ABC values are: Pacific ocean perch, 2,380 mt; shortraker/rougheye, 314 mt; other slope rockfish, 5,860 mt; and pelagic shelf rockfish, 224 mt.

The reader should note that the new rockfish ABC's listed in this report (when the West Yakutat ABC's are added to the East Yakutat/Southeastern ABC's) do not equal the ABC's for the eastern Gulf listed in the SAFE documents. There are two reasons for this difference. First, the rockfish ABC's in the SAFE documents were calculated using Gulfwide estimates of exploitable biomass. These Gulfwide ABC's were then apportioned amongst the regulatory areas based on the percentage of biomass in each area. In this report, I have directly computed ABC's for the Eastern area using the just the exploitable biomass for this area. This procedure results in different values of ABC than would be calculated using the procedure in the SAFE document. Second, as previously explained in item #4 above, the re-analyzed biomass estimates for the eastern Gulf of Alaska do not equal the old biomass estimates reported in the SAFE documents. Because ABC values are computed using biomass estimates as a basic parameter, the new ABC's will obviously be different than the old values.

The eastern Gulf of Alaska ABC value for Pacific ocean perch in the SAFE document and those computed here differ considerably

from the eastern Gulf ABC value adopted by the NPFMC Scientific and Statistical Committee (SSC) for the 1992 fishery. The difference is due to a different interpretation of the application of overfishing definitions.

ABC's for flatfish species groups in the West Yakutat and East Yakutat/Southeastern areas are shown in Table 8. ABC values for Dover sole in the deep water flatfish complex are not comparable to the value given in the SAFE document, which was done making an assumption of biomass change in depths unsampled in 1990.

ABC values in the SAFE document for other species such as walleye pollock and Pacific cod are based on model projections scaled to trawl surveys, and are not readily computed with only biomass data. Sablefish ABC values in the SAFE document are based on model projections which use longline survey results and trawl/longline comparisons; thus, ABC values for sablefish also cannot be readily computed with biomass data alone.

ABC values for shortspine thornyhead in the most recent SAFE document are calculated by first adjusting the 1990 biomass estimates upward by 49.3% to account for the unsampled biomass in waters >500 m depth. The SSC then multiplied this adjusted biomass by an F=M exploitation rate of 0.07 to compute ABC. Applying this same procedure to the 1990 biomass estimates for shortspine thornyhead listed in Table 5 yields the following values of ABC: West Yakutat, 293 mt; East Yakutat/Southeastern, 735 mt. It should be noted, however, that thornyheads are presently managed on a Gulfwide basis, and are not assigned a separate ABC for each regulatory area.

Table 1.-- Subareas used in the March 1992 re-analysis of the 1987 and 1990 triennial trawl surveys of the eastern Gulf of Alaska.

Depth Stratum (m)	Subarea Name	Computer Code	Area (nm^2)
	West Yakutat (140° - 147° W Longitude)		
0-100	Middleton Shallows	064	2,291
0-100	Yakataga Shallows	060	1,240
101-200	Middleton Shelf	160	2,132
101-200	Yakataga Shelf	161	1,566
101-200	West Yakutat Flats	162	1,253
201-300	West Yakutat Gullies	260	768
201-300	West Yakutat Slope	261	221
301-500	West Yakutat Deep Gullies	360	341
301-500	West Yakutat Slope	361	347
501-700	West Yakutat Slope	460	322
701-1000	West Yakutat Slope	560	561
		total =	11,042
	East Yakutat/Southeastern (East of 140° W Longitude)		
0-100	Fairweather/Southeastern Shallows	080	2,295
101-100	East Yakutat Flats	182	1,188
101-200	Fairweather Shelf	183	2,213
101-200	Baranof-Chichagof Shelf	180	1,196
101-200	Prince of Wales Shelf	181	1,682
201-300	Alsek and Spencer Gullies	282	386
201-300	E. Yakutat and Baranof-Chichagof Slope	280	348
201-300	Prince of Wales Slope and Gullies	281	1,166
301-500	West Spencer Gully and Southeastern Deep Gullies	380	699
301-500	East Yakutat-Southeastern Slope	381	317
501-700	East Yakutat-Southeastern Slope	480	364
701-1000	East Yakutat-Southeastern Slope	580	602
		total =	12,456

Table 2.--Mean catch per unit effort (CPUE) and estimated biomass of slope and pelagic shelf rockfish in the eastern Gulf of Alaska, based on a March 1992 re-analysis of results of the 1987 triennial trawl survey. The eastern Gulf of Alaska is divided into two subregions: West Yakutat (area between 147° and 140° W. longitude), and East Yakutat/Southeastern (area east of 140° W. longitude extending to the U.S.-Canada boundary in Dixon Entrance). For all species, CPUE and biomass were computed assuming no fishing power differences between survey vessels.

	West Yakutat (n = 88 hauls)			East Yakutat/Southeastern (n = 72 hauls)		
Species	# hauls with catch	CPUE (kg/km^2)	Biomass (mt)	# hauls with catch	CPUE (kg/km^2)	Biomass (mt)
		Slope Rockfish				
Pacific ocean perch	38	720.5	25,902	38	1,322.1	53,753
Shortraker rockfish	7	112.2	4,032	11	88.5	3,596
Rougheye rockfish	55	174.6	6,275	23	394.3	16,030
Northern rockfish	4	14.5	523	0	0.0	0
Sharpchin rockfish	17	53.8	1,936	27	1,638.7	66,627
Harlequin rockfish	11	69.4	2,493	26	867.9	35,288
Yellowmouth rockfish	0	0.0	0	2	4.1	166
Greenstriped rockfish	0	0.0	0	4	1.5	62
Darkblotched rockfish	0	0.0	0	2	0.7	27
Pygmy rockfish	0	0.0	0	3	4.3	176
Splitnose rockfish	0	0.0	0	1	0.1	2
Redstripe rockfish	0	0.0	0	13	505.9	20,571
Silvergray rockfish	13	14.1	505	11	98.0	3,983
		Pelagic Shelf Rockfish				
Dusky rockfish	22	412.3	14,823	10	75.2	3,059
Widow rockfish	1	1.3	47	2	2.4	96

SUPPLEMENTAL INFORMATION

for the

PROPOSED EASTERN GULF TRAWL CLOSURE

and

FUTURE MANAGEMENT OF ROCKFISH

in the

GULF OF ALASKA

September 8, 1992

TABLE OF CONTENTS

INTRODUCTION 1

1.0 HABITAT ISSUES 2
1.1 Gear Impacts on the Benthic Environment 2
1.1.1 Amendment I to the Snapper/Grouper Plan 2
1.1.2 New Zealand Review on Trawling Impacts 3
1.1.3 Other Sources 5
1.1.4 Non-trawl gear impacts 6
1.2 Importance of Coral Habitat to Rockfish Stocks 6
1.3 Coral Distributions in the Eastern Gulf and Gear Interactions 8
1.3.1 Observer and logbook information 8
1.3.2 NMFS Resource Survey Information 8
1.3.3 Expected Distributions of Alaska Coral 9

2.0 ALLOCATION ISSUES 11
2.1 History of Eastern Gulf Gear Allocations 11
2.1.1 Foreign fisheries closures 11
2.1.2 Amendment 10 to the Gulf FMP 11
2.1.3 Amendment 14 to the Gulf FMP 13
2.2 Current information on gear conflict, grounds preempting and gear loss 13
2.3 Other Information 17

3.0 ROCKFISH ASSESSMENT 25

4.0 MANAGEMENT ISSUES 39
4.1 Current status of rockfish management 39
4.2 Rockfish mortality in other fisheries 42
4.3 Alternative approaches to rockfish management in the Gulf of Alaska 42

INTRODUCTION

This report has been prepared to provide supplemental information to the Council regarding a proposed ban on trawling in the Eastern Gulf of Alaska. At their June 1992 meeting in Sitka the Council was scheduled to take action on a proposed ban on trawling in the Eastern Gulf. The Council had before them an EA/RIR/IRFA prepared by the Alaska Department of Fish and Game and LGL Research Associates. The Council was unable to make a decision at that time and requested that additional information be provided regarding this proposal, with particular emphasis on gear interactions with benthic habitat, rationale from previous Amendments relevant to gear conflicts and foreign trawl closures, and overall rockfish management strategies. The Council appointed a Rockfish Committee to review this additional information prior to the Council's September meeting at which they are scheduled to make a final decision on this issue. The Council also requested that this supplemental information provide the basis for a long range, comprehensive rockfish management strategy for the Gulf of Alaska.

The list of data requested by the Council was aggregated under four major topic headings: habitat issues, allocation issues, rockfish stock assessment, and rockfish management issues. The original list is reiterated below and keyed to the section of the report where it is discussed:

1. Amendment 10 to the Gulf plan and associated logbook information documenting trawl/longline gear conflicts in the Eastern Gulf, and the impact of foreign trawl effort on longline CPUE. (Section 2.1.2)

2. Amendment 1 to the Snapper Grouper plan in the South Atlantic which prohibited trawling in coral areas. (Section 1.1.1)

3. Data from the 1990 Eastern Gulf of Alaska Triennial Trawl Survey that may describe the distribution and abundance of coral and other invertebrates in Southeast Outside. Particular attention needs to be paid to rougheye rockfish habitat, and whether research surveys are conducted so differently from commercial operations, that observations of bottom impacts cannot be extrapolated from one to the other. (Section 1.3.2)

4. Accuracy of trawl survey estimates of Pacific Ocean Perch and other rockfish species. (Section 3)

5. Logbook data that may show overlap of longline and trawl operations and the impacts of one gear type on another's CPUE. (Section 2.2)

6. Descriptive information on substrate type and benthic communities derived from logbooks, sea-floor maps, observer reports on bycatch of benthic invertebrates and prohibited species such as salmon.

7. Longline and trawl impacts on coral habitat. (Section 1.1)

8. Ability of managers to control harvest within TACs and to prevent localized depletion. (Section 4.1)

9. Smaller areas that might be closed to protect rockfish stocks. (Section 4)

10. Unobserved rockfish mortality in the trawl and longline fisheries. (Section 4.2)

11. Preliminary assessments of rockfish abundance, population dynamics, and possible rebuilding schedules. (Section 3 and in SAFE documents)

12. Impacts of lost gear on habitat and marine mammal and fish populations.

13. Amendment 14 analysis of gear conflicts and grounds preemption. (Section 2.1.3)

The third and fourth sections of this report deal specifically with stock assessment and management of rockfish species in the Gulf of Alaska. Though the information in these sections may be relevant to the proposals under Amendment 26, the information is primarily intended to form the basis for further development of a long-term comprehensive rockfish management strategy.

1.0 HABITAT ISSUES

The purpose of this section is three-fold: One purpose is to review any available information regarding gear impacts to the benthic environment. Secondly, we attempt to address the importance of coral habitat off Alaska to rockfish stocks themselves. Thirdly, this section contains information available on coral distributions in the Gulf of Alaska, including reported occurrences of coral from observer samples and NMFS resource surveys.

1.1 Gear Impacts on the Benthic Environment

This section of this report deals in a generic sense with the issue of gear impacts to the bottom habitat. Various studies or documents were referenced in an attempt to consolidate available information on the possible damage inflicted by fishing gears on the benthic environment. Little or no information is available, specifically, regarding gear damage to cold water corals, such as exist in the waters of Southeast Alaska. We have therefore summarized findings from other studies which may have relevance to the issue at hand.

1.1.1 Amendment I to the Snapper/Grouper Plan

In September of 1988 the South Atlantic Council approved Amendment I to their Snapper/Grouper FMP which prohibited the use of trawl gear to harvest fish in the directed snapper/grouper fishery. The reason for this prohibition was "to address problems of habitat damage and growth overfishing". The Council had considered such a prohibition in the original FMP (1983) for this fishery but did not take action due to the lack of quantitative information available concerning habitat damage by trawl gear. Instead, a four-inch minimum mesh size was instituted, which was intended to at least address the issue of growth overfishing. Amendment I was approved based on recent studies which provided information on habitat damage associated with trawl gear.

The nets typically utilized in this trawl fishery were "high-rise" trawls characterized by high vertical openings and heavy, roller rigged ground lines. The Source document for the original FMP described conflicts between domestic fishermen resulting from a large increase in trawl effort during 1979 and 1980. Longline fishermen claimed trawlers were taking large numbers of small fish (a form of growth overfishing) and also complained about the non-selectivity of trawl gear and the possibility of bottom habitat destruction. In 1987, a snapper/grouper Committee was established and began investigating further the issue of a trawl gear prohibition. Numerous longline fishery organizations, as well as the Georgia Department of Natural Resources, petitioned the Council to proceed with a trawl ban. In its decision, the Council relied partly upon the results of study titled "Effects of a Research Trawl on a Hard-Bottom Assemblage of Sponges and Corals (Van Dolah et al 1987). This study was conducted in a shallow-water, hard bottom area off the Atlantic coast. The Council felt that this study offered

some of the first quantitative evidence that trawl gear does indeed damage bottom habitat. However, it is worth quoting from the abstract, to the extent that the study offers some conflicting conclusions:

"The density of undamaged corals and sponges was assessed in trawled and non-trawled (control) portions of each transect immediately before, after, and twelve months after a 40\54 roller-rigged trawl was dragged through the alley once. Some damage to individuals of all target species was observed immediately after trawling, but only density of barrel sponges was significantly reduced. The extent of damage to the other sponges, octocorals, and hard corals varied depending on the species, but changes in density were not statistically significant. Twelve months after trawling the abundance of specimens counted in the trawled quadrants had increased to pre-trawl densities or greater, and damage to the sponges and corals could no longer be detected due to healing and growth. Trawl damage observed in this study was less severe than damage reported for a similar habitat in a previous study."

The authors pointed to a previous study (Tilmant 1979) which utilized a solid, rectangular, frame trawl designed to use in grass beds. The Tilmant study noted severe damage to corals as a result of being subjected to this trawl frame. Amendment I to the snapper/grouper FMP notes that the Van Dolah study likely underestimates the extent of damage which may occur from roller gear trawls. The habitat damage described by Van Dolah et al resulted from one tow of the gear through the study area. Under commercial trawling conditions, a live bottom area may be trawled through over and over, and habitat damage would be expected to be much greater than that described in the study.

The Council concluded that over the long-term there would be a net loss of existing habitat, which is counter to the Council's habitat policy and the Magnuson Act. The Council further concluded that the level of damage to the live-bottom habitat in the South Atlantic is significant and that the available knowledge was not sufficient to risk impacting the long-term abundance of snapper and groupers by reducing their habitat. Based on the economic analysis contained in Amendment I, the Council determined that the impacts to the affected individuals were not significant and the opportunity exists for the (trawl) vessels to make up this lost income elsewhere. This particular trawl fishery was not a major source of income to the participants, who relied primarily on shrimping. The Council concluded that the overall net benefit to the nation would be positive when the non-quantified, positive benefits of eliminating the habitat destruction, and the quantified benefits of increasing snapper yield-per-recruit (not habitat related, but gear related), and a reduction in enforcement costs were factored against the initial negative costs.

1.1.2 New Zealand Review on Trawling Impacts

An article from the January 1992 New Zealand Journal of Marine and Freshwater Research, titled "Environmental Impact of Trawling on the Seabed: A Review" (Jones 1992) attempts to review available knowledge on the subject of trawl impacts on the benthic environment. Much of the information synthesized in this publication stems from an International Council for Exploration of the Seas (ICES) meeting in 1970 which resulted in ongoing studies to determine fishing impacts on the sea-floor. Much of the work is contained in unpublished working papers, though an ICES work group was established in 1990 to pull together available information. Much of that information is synthesized in the Jones publication referenced here. The paper categorizes the effects of trawling into four major areas: (1) scraping and ploughing effects on the sea-floor, (2) sediment resuspension, (3) destruction of non-target benthos, and (4) dumping of processing waste.

In terms of scraping and ploughing, the report does not offer any conclusions other than to say that evidence of trawling, such as furrows from the trawl doors, varies in its depth into the sea-floor and its duration depending upon the "softness" of the bottom being trawled. Potential effects of this bottom alteration are not directly addressed in this report.

In terms of sediment resuspension, the report notes that there are two facets to this issue: (1) increased, and usually temporary turbidity and (2) vertical redistribution of sediment layers. Both of these results of bottom disturbance by trawl gear were noted to vary in their duration, primarily dependent upon the depths at which they occurred. In one study of an experimental plot at a depth of 4,000 m, the effects of sediment redeposition had not recovered six months later. Such sediment redeposition could effect light penetration (though at extreme depths this is not likely to be relevant) and subsequent productivity of the area.

In addressing destruction of non-target benthos, the report summarizes findings that describe the effects as depending upon the bottom which is trawled, as would logically be expected. For example, one study indicated that the use of tickler chains had no effect on the catches of epibenthic animals over a mud substrate, but at sandy bottom stations, the number of chains used did correlate to catch of these animals. Interestingly, one study referenced (Wilson 1979) indicated that patches of the deep water coral Lophelia would be broken up by trawling and thus provide new settlement substrate, increasing the rate of colonization. However, he also noted that the coral grows at only 6 mm per year at the depth studied (250-350 m) and that the coral dies when in contact with the substrate. Repeated trawling over the same area would therefore be expected to eradicate, not spread, the coral. Though not directly referencing any specific studies, the report makes the general ascertation that a general decrease in productivity can be predicted as long-lived, slow growing species are removed or killed by human activities. The studies referenced in the report confirmed that recovery rates on the continental shelf and deep ocean are much slower than in shallow-water, temperate communities and that communities in less constant environments are more resistant to disturbance.

Rather than reiterate the results of each of the studies discussed in the report, it is likely more appropriate to restate here the conclusions from the report:

"From the work performed under the aegis of ICES, it would appear that beam trawls, otter trawls, and dredges are all basically similar in their effects. Generally, the heavier the gear in contact with the seabed, the greater the damage. The effects vary greatly, depending on the amount of gear contact with the bottom, together with the depth, nature of the seabed, and the strengths of the currents or tides.

...The removal of the macrobenthos has variable effects. In shallow water areas where the damage is intermittent, recolonization soon occurs. However, where the macrobenthos is substantially removed and recovery is not permitted, the change is permanent....The predicted changes in shallow-water communities, a relative increase in r-strategists (where population size is determined by the intrinsic rate of population growth) and a decrease in k-strategists (where population size is determined by carrying capacity of the environment) have been observed in the Wadden Sea and in the English Channel. There is however great difficulty in attributing such long-term changes in the benthos to the effects of trawl gear alone since natural fluctuations and other changes have undoubtably occurred....The North Sea is not the best place for detecting environmental changes resulting from trawling, but this is where most of the studies have been done.

...The evidence is that bottom trawling has an impact on the environment, but that the extent and duration of that impact varies depending on local conditions. There is an urgent need to carry out trawling impact studies in deeper water (>500 m) since this is where studies indicate that effects could be severe and that recovery may be measured in decades. Changes to the seabed, by whatever cause, can effect the fisheries above the seabed. To what extent this is a factor in observed "fisheries declines" has seldom been addressed in the literature on fisheries management."

1.1.3 Other Sources

Other sources of information on habitat damage by fishing gears is, as previously noted, limited. However, we will include those references here that we have uncovered. For example, the Gulf of Alaska Fishery Management Plan does contain a section titled "Benthic habitat damage by fishing gear" (page 5-64). Though this section is not based on any recent studies of gear impacts and does not specifically address corals, we felt it worth including in this report. The following is excerpted from the Gulf FMP:

"Any effect of gear dragged along the bottom depends on the type of gear, its rigging, and the type of bottom and its biota. In addition to the target species, the movement of a bottom trawl through an area primarily affects the slow-moving macrobenthic fauna such as seastars and seaurchins. Some bivalves can also be damaged. Although little is known of the effects of these disturbances and damages have on the affected species or their local communities, only minor impacts are suspected.

Numerous studies to determine these impacts have been conducted (notably in European waters) since World War II. Most of the studies and their results have been summarized in a report by Natural Resource Consultants (1984) titled "Trawl Evaluation Study". The consensus of these investigators is that the overall effect of trawling on the sea bottom may not be harmful, and may, in fact, be beneficial. They found, for example, that trawl doors on sand and soft bottom stir up sand and silt which settle quickly. On muddy bottoms, the stirred up mud settles in a few hours, depending on the current speed and resulting turbulence near the bottom. Trawls have not been observed to kill flatfishes (directly). The damaged organisms, as well as the infauna which may have been dug up by the trawl are quickly preyed upon by fish and crabs. Several researchers observe that fishing by trawls with tickler chains has not resulted in any apparent effects on the sea bed or its biota."

Again, the studies referenced in the FMP section above did not make any specific references to coral habitat.

A report prepared by the Washington Department of Fisheries (1985), titled "Final EIS for the Continued Harvest of Bottomfish in Puget Sound by Commercial Otter Trawl Gears", evaluates the potential adverse effects of otter trawl gear on the marine species, associated biota, marine substrate, water quality, and human activities. This EIS notes negative impacts of trawling including: disturbance of substrate such as otter board tracks, silt suspension, shearing of eel grass and other large algaes, some wastage of bottomfish and crab, and net negative impact on recreational bottomfish fisheries. In the conclusions section of the EIS, which addresses effects on long-term productivity, the document state that "Trawling does not cause permanent habitat damage. Biota potentially impacted by trawling show the capability to naturally repopulate a harvested area." However, it should again be noted that these studies dealt with an area lacking a high concentration of cold-water, slow growing corals. The EIS noted beneficial aspects of continued harvesting by trawl gear which included: providing several million pounds of fresh, high quality seafood to consumers annually, $1.7 million in exvessel value generated annually, provides direct employment of 250 persons and more than that indirectly, and aids in removal of millions of pounds of "nuisance fish" annually, such as dogfish and ratfish.

Another source of information on trawl impacts was discovered in conversations with NMFS scientist/divers involved in direct, underwater observations of trawl gear being deployed. Many of these observations were on nets at a single location near Seattle. The bottom condition was observed after repeated trawl passes on a single day and over repeated days of trawling. Doors made small indentations (2-4") in the substrate which became obscure over several hours or days depending upon the currents and substrate type. After about 20 years of intermittent but intensive trawling at this

site no damage was noted. Fish, sea cucumbers, sea pens, geoducks, etc... appeared abundant. (Note that corals were not discussed anywhere in this study) Many of the fish beyond the trawl path quickly move onto the affected sea bed after the trawl passes to feed upon the disturbed items.

1.1.4 Non-trawl gear impacts

Regarding impacts on the benthic environment of gear types other then trawl gear, little or no published documentation is available. However, observations by NMFS scientists during submersible dives off Southeast Alaska do provide some information. Between 1978 and 1983 direct observations of halibut longline gear were made during submersible cruises off Sitka, in Frederick Sound and adjacent waters, and off Kodiak Island. The following observations were noted (Hye, 1992, personal communication): Setline gear often lies slack on the sea-floor and meanders considerably along the bottom. During the retrieval process the line sweeps the bottom for considerable distances before lifting off the bottom. It snags on whatever objects are in its path, including rocks and corals. Smaller rocks are upended, hard corals are broken, and soft corals appear unaffected by the passing line. Invertebrates and other light weight objects are dislodged and pass over or under the line. Fish, notably halibut, frequently moved the groundline numerous feet along the bottom and up into the water column during escape runs disturbing objects in their path. This line motion was noted for distances of 50 feet or more on either side of the hooked fish.

1.2 Importance of Coral Habitat to Rockfish Stocks

Observations of Rockfish Habitat and Trawl Marks from a Submersible

A manned submersible was used in the eastern Gulf of Alaska to observe spatial distribution of rockfish, and to compare counts of rockfish made from the submersible to bottom trawl catches of rockfish. Eighty submersible dives were completed in 1988, 1989, 1991, and 1992 at depths of 188-365 m. Dive sites were on, or near, the shelf break from Yakutat to Dixon Entrance. About 15,000 m^2 of sea-floor were observed at each dive site. During the dives, observations were made on coral, rockfish habitat, trawl marks, and derelict fishing gear. In this report I review these observations and comment on trawl door indentations in bottom substrate.

Coral

Extensive areas (forests) of red tree coral (Primnoa) were encountered on six dives. These forests were located on rugged habitat consisting of boulders and bedrock. The coral was abundant and reached heights of approximately 2 m. Individual pieces of red tree coral were also observed interspersed at some sites with boulders or other solid, rocky habitat. Other corals (hydrocorals, soft corals, etc.) were also observed from the submersible, but time did not permit any further observations of these corals other than noting their presence.

Rockfish Habitat

Pacific ocean perch (Sebastes alutus) and shortraker rockfish (Sebastes borealis) were the two target species of these studies. For this report, rockfish are separated into four categories: adult Pacific ocean perch, shortraker rockfish, small red rockfish (consisting mostly of sharpchin rockfish (S. zacentrus), harlequin rockfish (S. variegatus), and juvenile Pacific ocean perch), and "other rockfish" that includes seven species of solitary, demersal rockfish.

Adult Pacific ocean perch

During July and August 1988, 1989, and 1991, adult Pacific ocean perch (POP) were concentrated over flat, pebble substrate at depths <230 m. All schools of more than 30 perch were observed over this type of habitat, which is common off Cape Ommaney. Adult POP were associated with a wide variety of other habitats, but the more rugged the habitat the fewer the numbers of adult POP. Adult POP were uncommon in rugged habitats where high quantities of red tree coral Primnoa sp. were observed.

The habitat and behavior of adult POP observed in May 1992 was different than that of adult POP observed in July and August. In May, adult POP were abundant to 300 m depth in steep slope areas on the shelf break. They ranged further above the bottom and seemed more active than the POP observed in July and August. The association of adult POP with coral forests in May is not known because these forests were not encountered during the May dives.

Shortraker rockfish

Shortraker rockfish were observed in 1991 and 1992 at depths between 250 m and 365 m -- the maximum depth limit of the submersible. Shortraker rockfish were observed on 3-12° sloping terrain of either silt or pebbles interspersed with boulders (0.5 - 4.0 m diameter). The submersible targeted the shelf break in 1992, and shortraker rockfish were abundant on the shelf break between 300 and 365 m depth. The habitat along the shelf break ranged from 5 - 60° sloping terrain containing mixtures of clay, sand, pebble, cobble, boulders, and bedrock. Occasional pieces of tree coral were observed on the shelf break.

Small red rockfish

Most small red rockfish were associated with habitat ranging from cobble fields to coral forests. They appeared to use rugged habitat for protection. Sharpchin rockfish and juvenile POP were the most common rockfish sampled with bottom trawls in rugged areas of boulders and cobble.

Other rockfish

Other species of solitary large rockfish were observed in a variety of smooth and rugged habitats. These rockfish were usually associated with some type of habitat boundary change, such as the edge of a coral forest.

Trawl marks and derelict gear

Substrate indentations caused by trawl doors were common at many of the dive sites. The depth of the indentations ranged from a few inches on hard, pebble substrate to three feet on soft sand. Trawl marks were numerous on hard substrate. No obvious differences were noticed in kinds or amounts of fauna and flora within or without the trawl paths.

Trawl marks were also common at some soft bottom sites off Yakutat (videos shown at council meeting in Sitka). These marks were probably of recent origin because silt had not filled in the furrows dug by the trawl doors, and displaced habitat was evident -- boulders and cobble were displaced, silt was brushed off the habitat, and flora were knocked down or missing. Displaced habitat and flora between the trawl door marks were obvious at these sites. Some red tree coral was observed on rocky ridges at these sites. Two broken pieces of red tree coral were observed near trawl door marks. These sites contained sparse populations of shortraker rockfish and other rockfish.

A few pieces of trawl net and rope were seen on smooth bottom. Derelict longline gear was seen in coral forests and other rugged rocky areas.

The information presented in this report is substantiated by videos collected during the dives. The information on rockfish habitat is presented in two papers. The habitat of rockfish, except shortraker rockfish, is presented in a paper submitted to the Fishery Bulletin (U.S.) and is currently in second review by the editor. The habitat of shortraker rockfish is presented in a paper submitted to Marine Fisheries Review and should be published within two months.

1.3 Coral Distributions in the Eastern Gulf and Gear Interactions

1.3.1 Observer and logbook information

In the 1990 and 1991 domestic operations in the Southeastern Gulf of Alaska, observers reported a combined coral catch of 0.047 metric tons. All of the catch was reported by one observer aboard a trawler in 1990. No coral was reported by observers in 1991. Observers are given explicit instructions on how to use keys to identify groundfish and invertebrates down to species, and are to do so whenever possible. However some misidentification or lack of identification does occur. Coral might have been included in either the miscellaneous or unidentified invertebrates categories, or accidently in the sponge category, thus observer reports of these species categories were also checked. No amounts of miscellaneous or sponge were recorded at all, and unidentified invertebrates accounted for only 0.079 metric tons in the 1991 trawl fishery and were not recorded in any of the 1990 fisheries.

To verify that observers did in fact frequently report catches of coral in other areas, trawl catches for the entire Gulf of Alaska were examined. In 1990, observers aboard trawlers reported 206 occurrences of coral (4 of them in the southeastern Gulf of Alaska). In 1991, observers reported 170 occurrences of coral (none of them in the southeastern Gulf of Alaska). Thus observers do report occurrences of coral. The frequency of occurrence in the southeastern Gulf of Alaska just doesn't appear to be very great.

These data need to be used with caution, because many of the observed vessels are "30% boats" and can choose where and when observers monitor their fishing activity. As can be seen in the accompanying charts (Appendix I), a fair amount of fishing occurred east of 140° with no observer coverage.

Observer data from 1980 and 1981 were also checked for reports of coral. These were the only two years in the 1980's in which foreign operations were allowed in Southeast Alaska (and longliners were not allowed even in these two years). Only 0.003 mt of coral were reported. No unidentified invertebrates were found, but miscellaneous and sponge accounted for 0.414 mt and 0.420 mt, respectively. Coverage in those years was very spotty.

1.3.2 NMFS Resource Survey Information

The available information on RACEBASE for coral catches east of 140° is unfortunately very sparse. The main reason is that in the past when coral was encounter with the trawl gear, the result was usually a badly damaged net. In these cases, the tow was coded "unsatisfactory performance" and the catch was sometimes neither weighed nor enumerated. Only in recent years do we automatically record the catch information from these bad performance tows. In fact, there are only 28 recorded catches of coral east of 140° to Dixon Entrance, 19 of these being good performances tows and 9 from bad performance tows.

The second problem with interpreting the data is the level and accuracy of identifying the coral species encountered. Eighteen catches were listed as unidentified stony coral which may or may not have been a correct identification given the fact that some common soft corals are hard or stony in appearance (Primnoa sp.). Seven catches were recorded as being Primnoa sp. or Primnoa willeyi (red tree) which is generally an abundant and common species inhabiting this geographic region. The two remaining coral catches were identified as Eunephtya sp. (sea raspberry).

The data spans a period of almost 30 years between 1961 and 1990. Two catches are from 1961, one from 1966 and thirteen from 1978. Seven catches are from the 1980's and five from surveys conducted in 1990. Of the 28 catches, 27 were deeper than 100 fm (102-221 fm) with one catch occurring at 72 fm. The 27 catches deeper that 100 fm range were relatively evenly distributed throughout the depth range. The deepest catch for sea raspberrys were 104 fm while red trees were recorded from 125 to 202 fm.

The largest recorded catch was 2,722 kg of sea raspberrys taken at 100 fm and 907 kg of red trees taken at 202 fm. Five catches were less than 1 kg, seven were between 1 and 10 kg, ten from 10 to 50 kg and two each between 50 and 100 kg and 100 to 200 kg. The two remaining catches were 907 to 2,721 kg.

The catches were distributed within three general areas. Nineteen catches were in the immediate vicinity of Dixon Entrance, another six were distributed around Cape Ommaney while the remaining three stations were adjacent to Alsek Valley.

1.3.3 Expected Distributions of Alaska Coral

Information on coral distribution has proven to be very limited. The following discussion relies on a 1981 report by R. Cimberg, T. Gerrodette, and K. Muzik titled "Habitat Requirements and Expected Distribution of Alaska Coral". Though this report was written in the context of potential impacts of oil and gas exploration and development, information on habitat and distribution is relevant for our purposes. Though the report discusses coral distributions throughout Alaska, we will focus on the information contained relevant to Southeast Alaska.

The study notes that this Region probably has the largest number of coral species due to the variety of habitats in terms of depth, substrate, temperature, and currents. Primnoa, or red tree corals are more abundant in southeast Alaska than in any other region. Other species of fan corals have been observed as well as bamboo corals, cup corals, soft corals, and hydrocorals. The greatest number of distributional records for red tree corals are from the Gulf of Alaska, in particular from the inside waters of Southeast Alaska. In southeast Alaska, red tree corals have frequently been reported in Chatham Strait, Frederick Sound, and Behm Canal. The frequency of occurrences increases towards the ocean entrances and further away from the fjords. This trend is likely due to swifter currents near the entrances and/or greater turbidity and lower salinities in the fjords. Areas of highest densities are found in regions where currents are 3-4 knots.

Distributional records were additionally analyzed relative to the depths at which they occurred. Red tree corals have been reported at depths from 10 to 800 m. The lower depth limit varied in different regions of Alaska, increasing along a geographic gradient from the Aleutians to southeast Alaska. The lower depth limit of these corals in each area corresponds with a mean spring temperature of 3.7 degrees C. The report indicates that in southeast Alaska there is a difference in the lower depth limit exhibited north of 57° latitude and that experienced south of that line (roughly running through Sitka). The data from the report indicate that, in the area of Southeast Alaska north of 57°, red tree corals are predominately found between 50 and 150 meters in depth. Significant occurrences

continue to exist from 150 to 250 m, and taper off rapidly beyond 250 m. South of the 57° line, they occur over a broader depth range with equal occurrences from 50 to 450 m. The report indicates that other species of sea fans may be found deeper than Primnoa, at depths up to 2,000 m.

Bamboo corals also occur in the waters of both the inside passages of southeast Alaska and in the southeast Gulf of Alaska. These corals have a lower temperature tolerance, about 3.0 degrees C, and exist in depths from 300-3,500 m. These corals are also expected to exist in a rocky, stable substrate and have a low tolerance for sediments.

The depth distribution of soft corals is, like the red tree corals, expected to range from 10-800 m, though they may exist on a much wider range of substrates. Hydrocorals, also occurring in southeast Alaska, have a depth range of 700-950 m, though they may occur at shallower depths in southeast Alaska than in the more northern, colder waters.

The reports notes (again in the context of potential disturbance by oil and gas exploration and development) that recolonization of tropical coral communities requires at least several decades to recover from major perturbations. Alaskan corals would likely take much longer to recolonize following similar disturbances. For example, given a predicted growth rate of 1 cm/year for Primnoa, a colony 1 m high would require at least 100 years to return to the pre-impacted state. This, of course, is regardless of the origin of the impact.

2.0 ALLOCATION ISSUES

2.1 History of Eastern Gulf Gear Allocations

2.1.1 Foreign fisheries closures

In developing the original FMP for Gulf of Alaska groundfish, the Secretary approved the Council recommendation to establish three areas in the Eastern Gulf which would be closed to foreign trawling. The three areas - Cross Sound Gully, Fairweather Gully, and Salisbury/Edgecumbe - were closed to foreign trawling in order to prevent gear conflicts between foreign trawlers and domestic longliners targeting primarily on sablefish. The foreign trawlers were not allowed a directed trawl fishery on sablefish anyway; however, the Rule implementing this measure stated that the development of the domestic sablefish longline fishery was being impeded by the presence of foreign trawl effort in these areas. The rule states this gear conflict as the sole reason for the closure areas. They were not implemented for any conservation reasons relative to sablefish or any other species including rockfish. Additional to the three specified areas closed to foreign trawling, the entire area east of 140° was closed to foreign longlining. This measure was implemented in order to eliminate gear conflicts between foreign and domestic fishermen, and was approved, noting that such measure may have adverse impacts (economically) on the foreign longliner fleet. Again, the measure was explicitly made in reaction to gear conflicts and not for sablefish conservation reasons. Other gear restrictions included the requirement for the use of pelagic trawls by foreign fisheries from December 1 through May 31 (1980-1988) in order to reduce the incidence of halibut bycatch.

2.1.2 Amendment 10 to the Gulf FMP

On June 1, 1982 Amendment 10 to the Gulf FMP implemented the following four measures for fisheries in the Gulf of Alaska:

1. Closed the area East of 140° to all foreign fishing (foreign longlining was already prohibited in this area.

2. Deleted the three U.S. sanctuaries as no longer necessary.

3. Permitted mid-water trawling only by foreign vessels between 140° and 147° W. (year round).

4. Substantially reduced the ABC/OY for Pacific Ocean Perch (POP) in the Eastern Gulf to allow for recovery of severely depressed stocks.

With respect to Item 1 above, the closure to all foreign fishing East of 140° was in response to a long history of gear conflicts between foreign and domestic fishermen. Originally closed to foreign longlining, the area had become increasingly plagued with gear conflicts between foreign trawl vessels and domestic longline fishermen. In addition to the direct costs associated with such gear conflict, domestic fishermen reported a decrease in CPUE in their longline operations, particularly notable immediately after a grounds preemption conflict. Data from fishing logs indicated a 42% decline in CPUE and a 12% reduction in average weight (by sablefish longline fishermen) after such a grounds preemption conflict. This measure was approved in order to aid in development of the domestic groundfish fishery; the EA/RIR for the Amendment noted that domestic trawl fishermen may decide to expand their fishery if there is less foreign effort in the area.

While the primary reason for this measure, as stated in the EA/RIR, was due to gear and grounds conflicts, there also appear to be underlying conservation reasons for the prohibition on foreign trawling. In a report submitted to the Council by Greg Baker of ALFA, titled "Effects of Foreign Trawling on U.S. Longline Fishermen in the Eastern Regulatory Area", the authors cite evidence of both biological and economic overfishing for sablefish and POP. A steady decline in CPUE for sablefish fisheries occurred from 1977 through 1980 (the time of this report), as well as a decline in average size of the sablefish. The analyses in this report indicate a possibility of recruitment overfishing of this stock. Regarding POP, various reports from 1976-1978 estimated that the POP stocks had been reduced to 10% of their virgin biomass. Coupled with a steadily declining CPUE the information indicated that POP had been biologically overfished, perhaps severely so.

This report also held that the sablefish and POP resources in this area had been economically overfished; i.e., had been reduced to a level which no longer supported maximum economic yield and, further, would prohibit the development of an economically viable domestic fishery for these species in the future, particularly for POP. The report also discusses the possibility that foreign trawlers were actually targeting (illegally) on sablefish during this period, thereby exacerbating the effects of their fishing on domestic longliners' CPUE. The relevance of these impacts to the longline fishery by the foreign trawl effort (to the current proposal under Amendment 26) is unclear, and should probably be viewed in the context of how the current domestic trawl fishery is impacting CPUE in the longline fishery. Regarding Item 2 above, the three sanctuary areas were deleted, since the prohibition of all foreign fishing mad them unnecessary.

Regarding Item 3 above, the prohibition of on-bottom trawling by foreign fishermen was to reduce the levels of incidental catch of non-target species, particularly halibut and other PSC species. The rationale for this measure is supported by both the ALFA report referenced above and the EA/RIR for Amendment 10. For example, the amounts of halibut bycatch discarded by the foreign trawl fisheries in this area equaled about 25% of the directed fishery quota for the area in 1978 and 1979.

Item 4 above, the reduction of the POP ABC was in response to severe conservation concerns over the status of the POP stocks in the Eastern Gulf. The effect of this measure was to eliminate a directed foreign fishery for POP in this area, but allow enough to cover bycatch while conducting other groundfish fisheries. The remainder of the quota was allocated to domestic fisheries to allow for development of that fishery, while the overall measure was intended to rebuild stocks to a level which would support a future domestic fishery.

In summary, the relation of the measures contained in Amendment 10 to the current proposal to prohibit trawling in the Eastern Gulf seem to be two-fold: (1) the issue of gear conflict - at the time of Amendment 10, the effects of gear conflict and grounds preemption were hampering the prosecution of domestic sablefish fisheries. The logbook information used in the ALFA report and in the Amendment 10 analysis are available and have only been summarized as to their indications here. Again, these indications are that longline CPUE and average size of sablefish were reduced when foreign trawlers were operating in the area, noting that these trawlers were operating in the same depth and contour zone as the longliners. The extent of current gear conflicts and grounds preemption between longline fishermen and domestic trawlers in the Eastern Gulf is covered in another section of this report. (2) Conservation of POP - under Amendment 10, the measures to protect POP were not gear specific, but were specific to a user group, to some extent, in that the majority of the small quota was allocated to the domestic fishery, with only bycatch amounts allocated to the foreign fishery. The primary tool of Amendment 10 was a significant reduction in the overall quota, a tool now available to the Council during the annual specifications process.

2.1.3 Amendment 14 to the Gulf FMP

It should be mentioned that Amendment 12 to the Gulf FMP, which would eliminate pot gear for sablefish in the Eastern Gulf, was submitted for approval by the Council in 1982 but was later withdrawn with attention being refocused on development of Amendment 14. The primary focus of Amendment 14, for purposes of this report, was to establish gear and area restrictions and OY (now TAC) apportionments to specific gear types for sablefish in the Gulf of Alaska (However, it is worth noting that the amendment also reduced the OY levels for POP in the western and Central gulf and reduced the Gulfwide OY for "other rockfish" for conservation and rebuilding reasons. Also part of this amendment was adoption of the NMFS Habitat Policy which advocates emphatic consideration of habitat concerns in the development or amendment of FMPs).

The OY for sablefish was achieved by U.S. fishermen in the Southeast Outside area in 1982 and 1983, and throughout the Gulf in 1984. It became apparent at that time that there would be insufficient resource to accommodate all user groups, particularly if one gear group increased its efforts. This situation hit home early in 1985 when three vessels using pot gear in the Eastern Gulf took about 34% of the total quota for the area, even before fishing began by traditional longline fishermen. The use of pot gear on the narrow band of sablefish fishing grounds caused immediate and sever gear conflict and grounds preemption problems. The pot gear, much heavier than the longline gear in use, became the cause of frequent gear loss by longliners attempting to fish in the same areas. At the same time, the presence of the pot gear on the grounds itself prevented much of the fishing areas from being utilized by longline fishermen, due to fears of gear loss. With the fishing power exhibited by the pot gear, there was also the situation of ever-shortening seasons and potential socioeconomic impacts to the coastal communities of Southeast Alaska who rely heavily on the sablefish longline fishery.

In this case, the Council elected to allocate the sablefish harvest among gear types in the Gulf, which basically consisted of phasing pot gear out altogether as a legal gear and dividing the quota between trawl and longline fisheries. In the Eastern Gulf, for example, the TAC is almost wholly allocated to hook and line gear. The issues underlying this measure had to do with gear conflicts, grounds preemption, and with the socioeconomic impacts to traditional user groups of the harvest of sablefish with pot gear. In comparing this Amendment with the currently proposed Amendment 26, it is relevant to weigh the extent to which the user groups currently at issue compete with one another for the same groundfish resource. Information on this interaction was detailed in the EA/RIR prepared for Amendment 26 and discussed at the June 1992 Council meeting in Sitka. Not only present interaction, but future potential interaction as well, might be taken into account.

2.2 Current information on gear conflict, grounds preempting and gear loss

Open access has led to increased competition for fishery resources and fishing areas. Conflicts are both physical (grounds preemption and catch-per-unit (CPUE) decreases), and allocative, as in priority uses of groundfish and prohibited species (PSC) (i.e., directed fisheries vs. bycatch needs). Although anecdotal reports are common, physical conflicts infrequently result in "official" or written reports to the U.S. Coast Guard (USCG), National Marine Fisheries Service (NMFS), the NOAA Office of Enforcement (Enforcement), or the Alaska Department of Fish and Game (ADF&G).

The body of anecdotal and "official" evidence indicates that trawl and hook-and-line gear occasionally fish the same Southeast Alaska areas at the same time, although usually for different species. More commonly, gear conflicts in this area arise between hook-and-line vessels and between hook-and-line vessels and unretrieved or derelict hook-and-line gear. Since most conflicts are undocumented and the extent of gear loss is usually not assessable, it is unclear what this means in terms of damage and cost to fishing vessels, safety, and undocumented fishing mortality.

Grounds Preemption

Grounds preemption is interactions involving vessels and/or fishing gear. Reports are most frequent among vessels participating in "derby-style" fisheries characterized by a combination of short duration, high effort, and confined fishing areas, such as the Southeast sablefish and halibut fisheries. Most reports involve loss, retrievals, or entanglements with like gear.

Vessel-vessel interactions: There were no reports of collisions, near collisions, or sinkings involving two fishing vessels. The USCG reported one sinking in 1992 (with loss of two lives) due to a vessel becoming snagged on the bottom. Additionally, the USCG reported that a navigation problem arose between cruise ships maneuvering and small boats fishing within the Sitka harbor area in 1991.

NMFS observer data for 1990 and 1991, and 1990 logbook data were examined for evidence of simultaneous time/area fishing by trawl and hook-and-line gear in the Southeast Gulf of Alaska. Other than April and May of 1990 and May of 1991, there appears to be little overlap between trawl and hook-and-line gear in time and area.

Plots of observed trawl and longline catches for 1990 and 1991 by target in the southeastern Gulf of Alaska were created, and vessel positions were plotted as reported in the 1990 vessel logbooks (Appendix I). Further, rockfish targets were identified as to primary species occurring in the catch.

The logbook data shows bottom trawling in January, March, April, May, and July. Observer reports show trawling for rockfish in March, April, and May, primarily for rougheye and Pacific ocean perch.

During the first quarter of 1990, domestic operations occurred primarily in the western and central Gulf, targeting Pacific cod and pollock. Fifty thousand tons of groundfish were taken in the first quarter in the western and central Gulf (including Shelikof Straits), compared to only 600 tons of groundfish in the eastern Gulf. Attainment of the second quarter Pacific halibut cap curtailed bottom trawling in the Gulf of Alaska between May 29 through June 30. Fishing for "Other Rockfish" in the eastern Gulf remained closed from June 30 until August 3. Some catcher/processor activity occurred in July. Otherwise, no bottom trawling occurred in the eastern Gulf during the second half of the year. Instead, operations were conducted in the western and central Gulf until November 21, when the Gulf of Alaska was closed to bottom trawling due to attainment of the Pacific halibut cap.

In 1990, in the Gulf of Alaska, longlining for sablefish was closed January 1 through March 31, and all longlining was closed July 1 through December 31. Logbook information for longline vessels less than 60 feet (no required observer coverage) shows activity east of 140° from January through June and September through December. Logbook information from longline vessels greater than 60 feet but less than 125 feet shows fishing activity east of 140° in March, April, June, August, and September. April is the only month with any appreciable activity, and was the only month in which this area was open to longlining for sablefish. Observers' data bear this out. In April, a few sets targeted thornyhead rockfish, and a few sets targeted rockfish other than dusky, POP, rougheye, shortraker, shortspine thornyhead (i.e., "other rockfish"). Otherwise, all of the observed longline activity east of 140° was targeted on sablefish.

In 1991, in the eastern Gulf, the shortraker/rougheye group closed Feb. 25, and the POP group closed April 22. Sablefish closed to trawlers April 12, and to longliners May 25. All longlining in the Gulf of Alaska closed July 8. Trawling east of 137° closed July 26. Trawling for pelagic rockfish closed east of 140° on October 5. All of these closures were for the rest of the year. Parts of the eastern Gulf were closed to trawling for demersal rockfish from Feb. 4 to July 1. Bottom trawling was closed May 8 to July 1. Observer coverage of bottom trawl operations occurred March through

May, about the only time of the year that trawling operations were allowed. Observer coverage of longline operations occurred in May, during the sablefish fishery. The 1991 logbook data are not yet available, but are not expected to reflect anything other than what has been presented here.

Vessel-gear and gear-gear interactions: The USCG reported five instances in which gillnets were run over by cruise ships in 1991. Enforcement reported one troller lost gear due to entanglement with derelict trawl web in 1992. ADF&G reported four anecdotal cases in which derelict trawl gear of unknown age was recovered by sablefish hook-and-line vessels between 1980 and May, 1990. In all four instances, trawls were reported to contain "large" quantities of sablefish, and in at least one case, arrowtooth flounder. In one instance, a videotape taken by ADF&G showed no rockfish although the trawler was presumably targeting on rockfish. Gear damage from "layered" sets and encounters with "ghost" gear is apparently common within the sablefish and halibut fisheries in Southeast Alaska. Although this has been the most common preemption complaint, there are no "official" reports for recent fisheries.

Estimates of gear loss by travel and pot vessels in Southeast Alaska were not available. Barry Bracken of ADF&G provided estimates based on skipper interviews of gear loss by hook-and-line sablefish vessels fishing in inside waters of Southeast Alaska. Barry was unsure of the relationship of these figures and gear loss in offshore sablefish, halibut, and rockfish fisheries, but he feels that gear loss is somewhat higher in the former two fisheries than for the inside waters sablefish fishery, and for the nearshore rockfish fishery is at the lower end of the range observed in inside sablefish fisheries. ADF&G routinely receives requests to retrieve gear left on fishing grounds from vessels participating in the offshore sablefish and halibut fisheries. Although data are sketchy, the assumption is that lost gear and gear for which retrieval is delayed continue to catch target species and rockfish bycatch at an equivalent per-hook rate as for gear retrieved during the fishing season.

Between 1989 and 1991, the percent of gear set which was lost during the same time in the Northern Southeast Inside Area (NSEI) and the Southern Southeast Inside Area (SSEI) was between 1.17% and 3.24%, and between 0.24% and 0.89% respectively. Three-year averages for the areas were 2.4% and 0.5%, respectively. The following table shows the actual numbers of hooks and the average percent lost.

HOOKS LOST 1989-1991 NSEI and SSEI SABLEFISH

YEAR	AREA	SAMPLE SIZE	HOOKS SET	HOOKS RETRIEVED	HOOKS LOST	% LOST
1989	NSEI	105	2,343,388	2,267,476	75,912	3.24%
	SSEI	23	1,390,669	1,387,269	3,400	0.24%
1990	NSEI	68	1,580,868	1,541,218	39,650	2.51%
	SSEI	28	1,264,398	1,253,098	11,300	0.89%
1991	NSEI	70	1,854,126	1,832,351	21,775	1.17%
	SSEI	22	1,038,655	1,034,157	4,498	0.43%

Catch Per Unit Effort (CPUE) Effects

NMFS logbooks and observer files were not examined for the effect on CPUE of fishing by one fishing vessel or gear type on others. In addition to the lack of sufficient time, this type of analysis presents several problems:

- there is an expectation of lower CPUE in the presence of or immediately after any additional fishing activity due to localized depletion from removals or scattering of fish.

- it is difficult to assess whether any observed change in CPUE is a transitory or more permanent phenomenon, and to estimate a normal "recovery" time of fish populations.

- difficulty in identifying appropriate "before" and "after" comparisons in which fishing was conducted in the same geographic location, under similar conditions of gear use, weather, and expertise.

- it is difficult to distinguish between an increase or decrease in CPUE due to additional fishing activity and that due to factors such as differences in amount of gear deployed, weather conditions, and fishing techniques.

Resource use priority

Conflicts among and within gears also arise as a result of differing priorities for resource use. Management has been evolving toward a state of increased "protectionism" by allocating groundfish and prohibited species (PSC) among gears (sablefish), areas, seasons (halibut bycatch), and between directed fisheries and bycatch uses (sablefish and halibut). The ultimate form of this is an individual fishing quota system (IFQ), currently in preparation for sablefish and halibut fisheries.

Management responses to gear conflicts in Southeast Alaska

Management actions in the Eastern Gulf have been successful in reducing or resolving many gear conflicts by reducing effort within a time period, an area, and within a target fishery.

- regulatory delay of trawling for rockfish until July 1 has provided almost complete temporal and spatial segregation of the gears.

- preferential gear allocation of sablefish to trawl and hook-and-line gear, and termination of the directed fishery for trawl gear have effectively reduced grounds preemption and resource competition.

- allocation of halibut PSC between hook-and-line fisheries for demersal rockfish and all other fisheries has provided protection for the directed fishery for demersal rockfish.

- allocation of halibut PSC between hook-and-line and trawl gear and among seasons has resulted in reduced resource and physical competition between gears and within species groups by dispersing fishing effort over time.

- closures to directed fishing prior to achievement of TAC reduce effort in a fishery.

- regulatory reduction of the DFS for demersal shelf rockfishes for trawl gear to 1 percent has reduced resource competition and overlapping fishing activity by discouraging additional targeting on species groups after fishery closures.

- the proposed IFQ system is expected to eliminate most spatial competition, grounds preemption, and gear loss, reduce resource waste, and improve safety among hook-and-line fishermen by attenuating sablefish and halibut seasons, and placing them under control of each vessel operator.

2.3 Other Information

Participation of Southeast Alaska Groundfish Fleets in Other Fisheries

This section provides supplementary information to Chapter 2 of the EA/RIR for Amendment 26 to the GOA Groundfish Fishery Management Plan which addresses closure of the Eastern Gulf east of 140° W. longitude to trawling. This area is subsequently referred to as the Southeast Outside area and was formerly known as the Southeast Outside (650) and the East Yakutat (680) areas. Section 2.5.4.1 and Table 13 of the draft EA/RIR (page 2-31) provides information about the number of vessels participating in groundfish fisheries in the Eastern Gulf of Alaska by gear type in 1990 and 1991. However, no information was presented in the EA/RIR about the relative importance of groundfish fisheries in the Southeast Outside areas to the different gear groups.

The proposed trawl closure directly impacts two components of the groundfish fleet: the catcher/processor trawlers and the portion of the shore based longline fleet harvesting primarily sablefish and groundfish in this area. The catcher/processor longliners operating in the Eastern Gulf are fishing primarily in the West Yakutat area which is not directly affected by the proposed trawl closure.

Catcher/Processor Trawlers

Seven catcher/processor trawlers reported harvests of groundfish in the Southeast Outside in 1990 and six in 1991. Tables 1 and 2 summarize total harvests by these vessels in both the Gulf of Alaska and the Bering Sea/Aleutian Islands, total harvests in the Southeast Outside, and the percent that the retained harvest in the Southeast Outside represented of total retained landings. This information was provided by NMFS and based on Processor Weekly Production Report data.

A true measure of the relative importance of different species groups would compare their net values to processors, thereby accounting for the differences in wholesale value, product recovery, product forms, costs of production, and other factors. However, these tables only provide information to compare the quantities landed, not values. It is probably appropriate only to compare the importance of the Southeast Outside fisheries on a species by species basis.

In 1990, harvests of pollock, Pacific cod, Atka mackerel, flounder, and flatfish by catcher/processor trawlers in the Southeast Outside represented either zero or less than one percent of statewide harvests of these species groups. However, Southeast Outside sablefish harvests represented nearly 10% of all sablefish harvests; slope rockfish harvests represented nearly 15% of all slope rockfish harvests and nearly 10% of all sebastes rockfish harvests; and, thornyhead rockfish harvests represented 21% of thornyhead harvests statewide.

Table 2 shows that the importance of Southeast Outside harvests of sablefish and rockfish to the catcher/processor trawlers, on average, increased in 1991. Sablefish harvests in the Southeast Outside

represented about 33% of total sablefish harvests. The importance of Southeast Outside harvests of rockfish ranged from 27% for thornyhead rockfish to 37% for all sebastes rockfish combined.[1]

Shore-based Longline Fleet

Table 13 of the EA/RIR divided the hook-and-line fleet by gear type and listed the number of vessels landing any amount of groundfish in 1990 or 1991 in the three areas of the Eastern Gulf of Alaska. Many of these vessels landed less than 100 pounds of groundfish annually. The information presented in this supplementary analysis applies only to a subset of these vessels. The Commercial Fisheries Entry Commission was asked to provide information about participation in other fisheries by longline vessels harvesting sablefish (Table 3), halibut (Table 4), or demersal shelf rockfish (Table 5) in Southeast Alaska areas in 1990.[2] Similar information for 1991 is not yet available.

The CFEC report is based on the landings of individual vessels in a particular "fishery of interest". In this case we defined three fisheries of interest based on the vessels associated with commercial fisheries limited entry permits for sablefish, halibut, and DSR. The CFEC first identified each vessel reporting harvest in the fishery of interest in 1990 and then summarized information about that fishery and all other harvests by this vessel in Alaska waters. Differences between the information presented in these tables and that presented in the EA/RIR occur because the geographic areas of the harvests differ (in the case of halibut and demersal shelf rockfish) and because Tables 3 through 5 refer only to those landings by longline gear and do not include jig harvests or incidental harvests with salmon gear.

The exact number of vessels reporting landings in other fisheries is difficult to determine in some cases. A range of vessel numbers is presented when information on several fisheries was aggregated or confidentiality requirement prevented publishing information. Confidentiality problems also resulted in a significant proportion of total harvests being unclassified. This information is presented in each table under the category "Other/confidential/unknown". In many cases, the confidential harvests occurred in a primary fishery such as sablefish or halibut, thus, the estimated gross earnings figures listed for each fishery should be considered the minimum amount.

The sablefish segment of the fleet was defined as those longliners harvesting sablefish in the Southeast Outside area (federal management areas 650 and 680). Fishermen harvesting sablefish exclusively in the inside waters of Southeast or in other areas of the state will not be included. Table 3 shows that 297 vessels reported sablefish harvests in the Southeast Outside area in 1990. The total ex-vessel value of all harvests in Alaska by these vessels was about $55 million. Sablefish harvests in the Southeast Outside represented 20% of total ex-vessel value, and sablefish harvests elsewhere in the state represented an additional 12.6% of ex-vessel value. Halibut harvests were the second most important component of total ex-vessel value (nearly 30%) followed by salmon (about 23%). Demersal shelf rockfish represented less than 1% of the ex-vessel value of harvests by this segment of the longline fleet.

---

[1]Comparison of individual *sebastes* rockfish species groups may not be appropriate because of the different species group classifications in the Gulf and Bering Sea/Aleutians.

[2]Commercial Fisheries Entry Commission. 1992. "Southeast Longline Halibut and Sablefish Vessel Diversification Tables for 1990". Project 92166 prepared by Laura Kurt. Juneau, AK. August 7, 1992.

The halibut fleet was defined as those vessels harvesting halibut in all areas of Southeast Alaska and part of the Yakutat area.[3] In 1990, an estimated 1,600 vessels harvested halibut in Southeast Alaska. The total ex-vessel value of all harvests by these vessels was about $100 million. Southeast Alaska halibut harvests represented about 22% of these earnings, and statewide halibut harvests about slightly over 25%. Salmon harvests were the most important component of ex-vessel earnings for these vessels (44%), followed by sablefish (14.5%). Again, demersal shelf rockfish harvests represented less than 1% of total ex-vessel earnings.

Table 5 summarizes harvests reported under the demersal shelf rockfish longline permits for Southeast Alaska (Y06A and Y61A), including both inside and outside waters. This does not represent all DSR landings in Southeast Alaska because it excludes landings with jig and troll gear. In 1990, 136 vessels reported DSR harvests. The total ex-vessel value of all harvests by these vessels was about $11 million. DSR represented 3.5% of total ex-vessel value. Salmon was the most important species group, representing about 31% of total ex-vessel value, followed by halibut (28%) and sablefish (17%).

[3]This is "Southeast Alaska including all waters of Yakutat except waters defined as IPHC statistical area 000210". The southern boundary of IPHC statistical area 210 is at approximately 141° W. longitude.

Table 1. 1990 total Alaska groundfish harvests by catcher/processor trawlers operating in the Southeast Outside area, harvests in the Southeast Outside, and percent Southeast Outside retained harvest are of total harvests (round weight equivalent).

Species Group	All GOA/BSAI Harvests Retain (mt)	Discard (mt)	Total (mt)	Harvests in SE Outside Retain (mt)	Discard (mt)	Total (mt)	% SEO is of Total Retain
Pollock	11,856	8,642	20,499	0	69	69	0.0%
Pacific Cod	5,196	522	5,717	0	0	0	0.0%
Atka Mackerel	2,453	179	2,632	0	0	0	0.0%
Flounder	238	2,027	2,265	0	0	0	0.0%
Deepwater Flatfish	818	672	1,490	0.4	96	96	0.0%
Total Deep Flatfish	1,055	2,699	3,755	0.4	96	96	0.0%
Rock Sole	3,165	1,908	5,074	0	0	0	0.0%
Yellowfin Sole	1,384	721	2,105	0	0	0	0.0%
Greenland Turbot	566	3	568	0	0	0	0.0%
Shallow Water Flatfish	35	348	384	0.3	23	23	0.8%
Total Shallow Flatfish	5,151	2,980	8,131	0	23	23	0.0%
Arrowtooth Flounder	406	6,492	6,898	1	503	504	0.2%
Sablefish	1,369	295	1,664	132	0	132	9.6%
Pacific Ocean Perch	3,311	181	3,492				
Other Slope Rockfish	8,991	1,867	10,858	1,318	221	1,540	14.7%
Pelagic Shelf Rockfish	987	76	1,063	0.4	0.1	0.5	0.0%
Unspecified Rockfish	21	71	92	0	0	0	0.0%
All Sebastes Rockfish	13,310	2,195	15,505	1,319	221	1,540	9.9%
Thornyhead Rockfish	493	1	494	106	0	106	21.4%

Note: Species group composition differs between the Gulf of Alaska (GOA) and the Bering Sea/Aleutian Islands (BSAI). Both areas have separate species groups for pollock, Pacific cod, arrowtooth flounder, and sablefish. Rock sole, yellowfin sole, and Greenland turbot are separate species groups in the BSAI but included with shallow water flatfish in the GOA. Flathead sole is a flounder in the BSAI, but a deepwater flatfish in the GOA. Pacific ocean perch was a separate species group in the BSAI. POP, shortraker, rougheye, and demersal shelf rockfish were included with other slope rockfish in the GOA. Similar species groups have been placed together in this table.

Table 2. 1991 total Alaska groundfish harvests by catcher/processor trawlers operating in the Southeast Outside area, harvests in the Southeast Outside, and percent Southeast Outside retained harvests are of total harvests (round weight equivalent).

Species Group	All GOA/SBAI Harvests Retain (mt)	Discard (mt)	Total (mt)	Harvests in SE Outside Retain (mt)	Discard (mt)	Total (mt)	% SEO is of Total Retain
Pollock	11,189	6,471	17,660	0	31	31	0.0%
Pacific Cod	2,430	232	2,662	12	1	13	0.5%
Atka Mackerel	2,479	61	2,540	0	0	0	0.0%
Deepwater Flatfish	657	284	941	23	51	74	3.5%
Greenland Turbot	787	117	904	0	0	0	0.0%
Rock Sole	2,351	2,324	4,675	0	0	0	0.0%
Yellowfin Sole	7,582	2,532	10,114	0	0	0	0.0%
Shallow Water Flatfish	33	8	41	3	1	3	7.7%
Total Shallow Flatfish	9,965	4,865	14,830	3	1	3	0.0%
Arrowtooth Flounder	968	2,121	3,089	15	120	135	1.6%
Flounder	1,671	1,485	3,156	0	0	0	0.0%
Flathead Sole	58	7	65	1	0	1	1.0%
Sablefish	522	29	551	172	2	174	32.9%
Pacific Ocean Perch	3,200	283	3,483	1,074	130	1,204	33.5%
Shortraker/Rougheye	556	3	558	229	2	231	41.2%
Other Slope Rockfish	27	157	184	11	25	36	40.8%
Pelagic Shelf Rockfish	164	31	195	44	0	44	26.8%
Demersal Shelf Rock.	40	20	61	9	13	21	21.3%
Unspecified Rockfish	5	9	14	0	0	0	0.0%
All Sebastes Rockfish (except POP)	792	220	1,012	292	39	331	36.9%
Thornyhead Rockfish	162	8	170	43	5	49	26.8%

Note: Species group composition differs between the Gulf of Alaska (GOA) and the Bering Sea/Aleutian Islands (BSAI). Both areas have separate species groups for pollock Pacific cod, arrowtooth flounder, Atka mackerel, sablefish, and POP. Rock sole and yellowfin sole are separate species groups in the BSAI, but included with shallow water flatfish in the GOA. Greenland turbot is included with deepwater flatfish in the GOA. Flathead sole is a flounder in the BSAI but a separate group in the GOA. Many of the separate rockfish groups in the GOA, including thornyheads, are aggregated into "rockfish" in the BSAI. Similar species groups have been placed together in this table.

Table 3. Estimated gross earnings in all fisheries in Alaska by longline vessels harvesting sablefish in the Southeast Outside area in 1990.

Fishery	Number of Vessels	Estimated Gross Earnings ($)	% of Estimated Gross Earn.
Sablefish in Southeast Outside	297	11,054,441	20.1%
Sablefish, other areas	83-165	6,934,089	12.6%
Halibut, statewide	284-297	16,352,628	29.8%
Demersal shelf rockfish	62	224,016	0.4%
Salmon (purse seine)	49-53	6,717,646	12.2%
Salmon (gillnet)	22	753,352	1.4%
Salmon (hand troll)	12	95,594	0.2%
Salmon (power troll)	131	4,956,602	9.0%
All Salmon		12,523,194	22.8%
Herring	8-18	446,279	0.8%
Misc. Finfish	87-106	380,603	0.7%
Dungeness crab	19	841,161	1.5%
King/tanner crab (pot)	16-24	1,333,704	2.4%
Tanner (other gear)	16	38,641	0.1%
Shrimp	17	267,920	0.5%
Abalone	11	59,284	0.1%
Other/confidential/unknown 1/		4,439,413	8.1%
Total	297	54,895,373	100.0%

1/ Includes confidential harvests (less than 4 vessels reporting) and harvests of unknown species.

Source: CFEC, 1992

Table 4. Estimated gross earnings in all fisheries in Alaska by longline vessels harvesting halibut in Southeast Alaska in 1990.

Fishery	Number of Vessels	Estimated Gross Earnings ($)	% of Estimated Gross Earn.
Halibut in Southeast	1644	21,666,246	21.6%
Halibut, other areas	78-99	3,544,734	3.5%
Sablefish, statewide	254-345	14,539,203	14.5%
Salmon (purse seine)	116-119	12,916,487	12.9%
Salmon (gillnet)	255-298	12,711,441	12.7%
Salmon (set net)	4	161,096	0.2%
Salmon (hand troll)	259	1,982,603	2.0%
Salmon (power troll)	483	16,413,213	16.3%
All Salmon		44,184,840	44.0%
Herring	35-94	1,517,927	1.5%
Dungeness Crab	154-166	3,464,767	3.4%
King/Tanner crab	63-128	4,066,964	4.0%
Shrimp	87-107	985,251	1.0%
Abalone	20	105,358	0.1%
Clams	5	27,021	0.0%
Misc Finfish	137-199	414,523	0.4%
Demersal shelf rockfish	108-128	363,460	0.4%
Other/confidential/unknown[1/]		5,596,835	5.6%
Total	1644	100,477,129	100.0%

1/ Includes confidential harvests (less than 4 vessels reporting and harvests of unknown species.

Source: CFEC, 1992

Table 5. Estimated gross earnings in all fisheries in Alaska by longline vessels harvesting demersal shelf rockfish in the Southeast Outside area in 1990.

Fishery	Number of Vessels	Estimated Gross Earnings ($)	% of Estimated Gross Earn.
Demersal shelf rockfish	136	374,913	3.5%
Sablefish, statewide	62-82	1,854,107	17.2%
Halibut, statewide	105-129	3,011,994	28.0%
Salmon (purse seine)	4-7	516,691	4.8%
Salmon (gillnet)	14	548,176	5.1%
Salmon (hand troll)	20	179,442	1.7%
Salmon (power troll)	59	2,036,116	18.9%
All Salmon		3,280,425	30.5%
Misc. Finfish	70-87	202,984	1.9%
Dungeness	10-17	139,239	1.3%
Tanner crab	5	2,542	0.0%
Shrimp (pot)	9	96,360	0.9%
Abalone	5-8	23,318	0.2%
Other/confidential/unknown 1/		1,782,609	16.6%
Total	136	10,768,491	100.0%

1/ Includes confidential harvests (less than 4 vessels reporting) and harvests of unknown species.

Source: CFEC, 1992

3.0 ROCKFISH ASSESSMENT

Summary of Stock Assessment Methods and Resulting Abundance Trends

The condition of the rockfish (Sebastes sp.) resource in the Gulf of Alaska has been monitored with a variety of stock assessment techniques. The more common approaches have included catch per unit effort analyses, trawl surveys, cohort-type analyses, stock reduction analysis, and more recently, stock synthesis. Each method has its own inherent advantages, disadvantages, and biases associated with its use. Some assessment methods are very detailed and involved, requiring a thorough understanding of population dynamics to fully comprehend. It is beyond the scope of this paper, however, to describe in detail the assumptions and methodologies of each assessment technique. Rather, the following sections will describe, in a very general terms, the major types of stock assessment methods that have been employed and their resulting abundance trends.

Catch Per Unit Effort (CPUE) Analyses

Analysis of commercial CPUE data has been used to monitor relative changes in rockfish stock abundance. This approach is most useful under situations where a species is the target of a directed fishery and when a long time series of detailed catch and effort information exists. Pacific ocean perch, the most abundant rockfish species in the Gulf of Alaska, is the only species in the slope rockfish assemblage for which such a data series exists.

Commercial catch and effort statistics supplied by Japan have been the primary data source for most CPUE-type analyses of Alaskan Pacific ocean perch stocks (e.g., Balsiger et al. 1985; Chikuni 1975; Ito 1986). This information is detailed and complete, in temporal and geographic sequence, and is perhaps among the best on demersal fisheries anywhere in the world. The data are reported by year, by month, by species, by gear type, and by vessel size category for each 1° longitude by 1/2° latitude statistical block. An examination of these data indicate that Pacific ocean perch declined to extremely low levels by 1978 (Figure 1). The total catch of Pacific ocean perch dropped to about 5,000 mt, the contribution of Pacific ocean perch to the Japanese all-species trawl catch had decreased to less than 15%, and the CPUE had decreased to less than 0.2 t/h from nearly 5.8 t/h in 1965. Catch per unit effort data after 1978 indicate a severely depressed stock condition. This time series of CPUE data ended in 1984 when Japanese trawl fisheries in the Gulf of Alaska were terminated.

In more recent years, commercial CPUE data have become increasingly difficult to interpret as an index of stock abundance. Bias associated with more recent CPUE-type assessments have been related primarily to the estimation of effective fishing effort. Standardizing and partitioning total trawl effort into effort directed solely toward Pacific ocean perch has been difficult, due to the multi-species and multi-gear nature of the trawl fishery. Moreover, quota restrictions, effort shifts to different target species, and rapid improvements in fishing technology and fishing skill have confounded the analysis of CPUE data. Unless these factors can be carefully accounted for in an assessment, CPUE statistics will not accurately reflect changes in stock abundance.

Detailed commercial CPUE statistics for other rockfish species are lacking. There is no direct information on relative abundance of pelagic shelf rockfish (Clausen and Heifetz 1991) nor on demersal shelf rockfish (O'Connell et al. 1991). However, information from two longline surveys, designed to assess the stock condition of sablefish along the continental slope, provide relative abundance data on two important slope rockfish species: rougheye rockfish (S. aleutianus) and shortraker rockfish (S. borealis). Both surveys compute relative population numbers (RPN's) and relative population weights (RPW's) for each species as indices of stock abundance.

The U.S.-Japan cooperative longline survey, has been conducted annually since 1979, but RPN's for the two rockfish species are only available for the years 1979-87 (Sasaki and Teshima 1988). These data are highly variable and difficult to interpret, but suggest that the abundance of rougheye and shortraker rockfish has remained stable in the Gulf of Alaska (Clausen and Heifetz 1989). The data also indicate that rougheye and shortraker rockfish are most abundant in the eastern Gulf of Alaska.

A domestic longline survey has been conducted annually since 1988. Gulfwide rockfish RPN values increased 35% from 1988 to 1989, decreased slightly in 1990, and increased 17% in 1991; however, none of these annual changes were statistically significant (Zenger and Sigler 1990; M. Sigler, pers. comm. 1991). Annual changes in RPN for each International North Pacific Fisheries Commission (INPFC) statistical area, although sometimes apparently large, also were not statistically significant. Similar to the results of the cooperative longline survey, rockfish RPN's in the domestic survey show that abundance of rougheye and shortraker rockfish is highest in the eastern Gulf of Alaska. The survey's RPW values indicate that rougheye rockfish are consistently most abundant in the Southeastern area, and shortraker consistently most abundant in the Yakutat area.

Trawl Surveys

Commercial fishery statistics are not the only data available for assessing the status of the rockfish resource; data collected by research trawl surveys have been used to provide fishery-independent assessments of the abundance, distribution, and biological characteristics of a number of Alaskan rockfish stocks. Comprehensive triennial surveys were conducted by the Alaska Fisheries Science Center (AFSC) in the Gulf of Alaska in 1984, 1987, and 1990. These surveys covered all areas of the Gulf and provide exploitable biomass estimates of the major rockfish species.

Biomass estimates for slope rockfish from each of the triennial trawl surveys are provided in Table 1. The estimates for 1987 and 1990 are considered more reliable than those for 1984, because the 1984 survey had problems concerning both standardization and differences in fishing power between vessels (Heifetz and Clausen 1991). Generally, however, the biomass for most species appeared to increase between 1984 and 1987 (for a discussion see Heifetz and Clausen 1990).

Biomass estimates for most species of slope rockfish declined substantially in 1990 when compared with 1987. The biomass for the entire assemblage showed a statistically significant decrease of 54% during this period, from 816,448 mt in 1987 to 372,046 mt in 1990. Large, statistically significant decreases were seen for Pacific ocean perch, shortraker rockfish, and harlequin rockfish (S. variegatus). The reductions in biomass for rougheye, northern (S. polyspinis), sharpchin (S. zacentrus), and redstripe (S. proriger) rockfishes were not as great, and these changes were not statistically significant. Most of the decline in biomass for Pacific ocean perch was caused by large decreases in the central and western Gulf of Alaska. The 1987 biomass for this region was 264,991 mt, whereas in 1990 the corresponding biomass was only 59,044 mt.

The reasons for the large declines in slope rockfish biomass in 1990 are unclear. The species in the assemblage have low rates of natural mortality and slow growth, which would make large fluctuations in biomass unlikely over a relatively short period of time. It is also unlikely that large numbers of the fish emigrated from the Gulf of Alaska. Furthermore, after the 1987 survey, stock condition of Pacific ocean perch was thought to be improving because of the apparent success of a number of identified year classes (Clausen and Heifetz 1989). All these factors cast some doubt as to the validity of the large decreases in biomass observed in 1990 or reported catch as a measure of fishing mortality. A reduced availability of slope rockfish to the trawl survey, because of some unknown change in their behavior or pattern of distribution, may be an alternative explanation for the low biomass estimates. More research into the biology and interannual distribution of slope rockfish is needed to better assess the stock condition of these species.

The triennial trawl surveys also provide biomass estimates for the pelagic shelf rockfish assemblage (Table 2). Biomass of pelagic shelf rockfish in the 1990 triennial trawl survey was estimated at 26,217 mt, with a 95% confidence interval of 11,629-40,805 mt. Dusky rockfish (S. ciliatus) was by far the most abundant species in the assemblage, comprising 92% of the gulfwide biomass. Most of the dusky rockfish biomass was centered in the Kodiak area. Comparative biomass estimates for the three triennial surveys show wide fluctuations in the abundance of pelagic shelf rockfish. The 1987 and 1990 estimates are considered more reliable than those for 1984, because of standardization problems in the 1984 survey. Dusky rockfish biomass increased from 37,313 mt in 1984 to 163,188 mt in 1987, and then declined precipitously in 1990 to only 24,141 mt. The decrease from 1987 to 1990 was statistically significant.

These variations in biomass between surveys seem unreasonably large for a species such as dusky rockfish. Although age and growth information on dusky rockfish is limited, the fish are relatively long-lived, and similar to other species of Sebastes, are slow growing with low rates of natural mortality. Fishing mortality of dusky rockfish in recent years has apparently also been low, based on the relatively small catches in the commercial fishery. These factors suggest that an extreme decrease in abundance over a relatively short period of time, such as that seen between the 1987 and 1990 surveys, is unlikely. The low biomass estimate in 1990 may have been caused by a reduced availability of dusky rockfish to the survey's bottom trawls, rather than a true decline in abundance. Perhaps in 1990 more of the fish were distributed off-bottom, and hence were not captured by the trawls. Clearly, more research is needed to evaluate the appropriateness of using bottom trawls to survey stock condition of dusky rockfish.

Trawl survey estimates of rockfish biomass are typically characterized by large variances. In some instances the 95% confidence intervals have encompassed plus or minus 100% of the point estimate. Such large variances are probably due to the highly contagious distribution of this resource. Other factors such as inadequate sampling, inappropriate sampling gear, and fish behavior may also contribute to the wide confidence intervals about the point estimates. Furthermore, trawl surveys may underestimate the true population size of some rockfish species and overestimate the abundance of others. Some species are known to occupy the water column above that sampled by most bottom trawls (e.g., pelagic shelf rockfish) and also are known to inhabit areas of rough bottom which are usually avoided during surveys to prevent damage to the trawls. Unfortunately, that portion of the population unavailable to the trawl gear cannot be determined at this time.

Cohort-Type Analyses

Cohort-type analyses provide an alternative to commercial CPUE and trawl survey stock assessments. These techniques have been developed to circumvent the need for reliable effort statistics and to provide abundance estimates in terms of absolute values rather than as an index. Abundance estimates are presented in terms of historical population numbers and biomass at age. Age-specific rates of instantaneous fishing mortality are estimated as well. Conducting this type of an assessment requires historical catch-at-age data, an estimate of natural mortality, and an estimate of fishing mortality for each year class. To date, the only rockfish species in the Gulf of Alaska amenable to this type of assessment technique is Pacific ocean perch.

Gunderson (1979, 1981) was the first to apply cohort analysis to Pacific ocean perch populations. His assessment covered the major stocks within the West Coast region. Ito (1982) and Balsiger et al. (1985) also employed cohort analysis techniques to assess the status of the Pacific ocean perch resource in Alaskan waters. The results of these assessments indicated that Pacific ocean perch in the Gulf of Alaska underwent precipitous declines in abundance during the period of heavy foreign exploitation (Figure 2).

A major problem with the cohort analysis assessments of Pacific ocean perch is that the age data used, derived from surface readings of scales and otoliths, are now thought to be incorrect. Ages derived by the relatively new "break and burn" technique of reading otoliths indicate much higher ages than previously thought (Beamish 1979; Chilton and Beamish 1982). Ages in excess of 80 years have been recorded for some specimens. Such longevity generally corresponds with natural mortality estimates much lower than those used in the previous cohort analyses (Archibald et al. 1981; Hoenig 1983; Shaw and Archibald 1981). A lower natural mortality would have the effect of decreasing the cohort analysis abundance estimates.

Stock Reduction Analysis (SRA)

Stock reduction analysis (SRA) is a relatively new stock assessment method (Kimura and Tagart 1982; Kimura et al. 1984; Kimura 1985). Essentially, SRA is a solution to the set of catch equations that does not require age composition data; it is also flexible and it has the ability to incorporate different sources of information and examine them for consistency. Furthermore, SRA does not require effort data, a requisite in CPUE-type analyses. This method provides useful assessment information, including estimates of instantaneous rates of fishing mortality, historical biomass, and maximum sustainable yield (MSY).

Heifetz and Clausen (1991) employed SRA techniques to assess the condition of the Pacific ocean perch resource in Alaskan waters. Their approach was to perform SRA using three Beverton and Holt stock-recruitment scenarios. The shape parameters for these scenarios were A = 0.889, 0.750, and 0.571 which represent 90, 80, and 70% of the recruitment to the unexploited biomass when the stock has been reduced to 50% of the unexploited biomass. For each recruitment scenario, the best fit to the data was found by minimizing the sum of squared (SSQ) deviations between the observed trawl survey biomass estimates in 1987 and 1990 and the biomass predicted by the SRA model. The different recruitment scenarios and estimates of exploitable biomass were necessary because of the uncertainty regarding Pacific ocean perch exploitable biomass and recruitment relationships.

The resulting biomass trace from SRA is depicted in Figure 3. Assuming that the stock was unexploited in 1960, SRA estimated that virgin biomass ranged from 1,340,000 mt to 1,465,000 mt, MSY ranged from 15,000 mt to 27,700 mt, and fishing mortality spanned from 0.024 to 0.080. Current biomass predicted by the SRA model is approximately 16 to 19 percent of virgin biomass and well below that which produced MSY. The least productive recruitment scenario (A= 0.571) produced the "best fit" (smallest SSQ) to the data because of the large decrease in the trawl survey biomass estimate in 1990.

Stock Synthesis (SS)

Recent stock assessments of Pacific ocean perch in the Gulf of Alaska have relied in part on SRA to provide historical trends in the fishery. One limitation of SRA is that the underlying age-structure of the population and other auxiliary information are not directly incorporated into the analysis. The stock synthesis model (SS, Methot 1989, 1990) is a form of catch-at-age analysis that has been designed to incorporate age composition and a diversity of other information into a single computational framework. The main difference between the two models is that SRA does not keep track of abundance of fish at age. By explicitly tracking age structure, stock synthesis allows information on age composition to be used in the estimation process.

Stock synthesis functions by simulating both the dynamics of the population and the processes by which the population is observed. This simulation, which incorporates both imprecision and bias in the observations, is used to predict expected values for the observations. These expected values are

then compared to the actual observations (data) from surveys and the fishery. Model parameters are estimated by maximizing the log likelihood (l) of the predicted observations given the data. Data are classified into different components. For example, age composition from a survey and catch per unit effort (CPUE) from a fishery are different components. The total l is a sum of the likelihoods for each component. The total l may also include a component for a stock-recruitment relationship (Methot 1990) and penalty functions to help stabilize parameter estimates (Ianelli and Ito 1991). The likelihood components may be weighted by an emphasis factor.

Heifetz and Ianelli (1992) have incorporated age-composition information from a variety of data sources into a SS model of Pacific ocean perch in the Gulf of Alaska. The methods and preliminary results of this model have been summarized by Heifetz and Clausen (1992). The data sets used in their analysis included total catch biomass from 1961 to 1992; size compositions from the fishery during the period from 1963 to 1978; fishery CPUE information for 1964-79; survey age compositions based on surface readings of otoliths (biased ages) for 1963-67 and 1978-79; survey size composition data for 1978-90, survey "break and burn" age data (unbiased ages) for 1980-82, 84, 87, and 90; and survey biomass estimates for 1984, 87, and 90. Ageing error, transformations from biased to unbiased ages, and standard errors of the survey abundance estimates were also included in the model. Finally, low emphasis was placed on a stock recruitment relationship so that recruitments were individually estimated for most years.

Initial exploratory runs of the model indicated that estimates of survey biomass were inconsistent with survey age and size compositions and fishery CPUE. In addition, there also appeared to be inconsistencies between the three years of survey biomass estimates. Even with extremely high emphasis on the survey biomass estimates, the steep decline in biomass suggested by the 1987 and 1990 estimates could not be adequately modeled by stock synthesis. To address this problem four alternative models were constructed that differed in their emphasis on survey biomass overall and between survey years (refer to Heifetz and Ianelli 1992 for specific details of each model).

Model 4 which resulted from moderate emphasis on the 1990 survey biomass and exclusion of the 1984 and 1987 biomass estimates was judged to be the best model. This conclusion was based on a comparison of individual likelihood components for the alternative models. Model 4 was consistent with more likelihood components than the other models. The 1990 survey biomass estimate was consistent with survey age, survey size composition, and fishery CPUE likelihood components. Thus the observation that survey biomass estimates were inconsistent with other components was mostly due to the 1984 and 1987 surveys. Presently, survey biomass estimates from the 1984 and 1987 triennial surveys are being reanalyzed (E. Brown, pers. comm.).

The preliminary results of SS model 4 shows that exploitable biomass is at a low level compared to historical levels but has been showing signs of increasing since 1985 (Figure 4). The uncertainty in the estimate of biomass in 1993 depends mostly on the uncertainty of recent year-class strength. There is little information in the data to reliably estimate strengths of year classes after 1986 because the last year of age composition data was 1990. To address the uncertainty in recruitment, the recruitments after 1986 were sampled with replacement from the estimated levels of the 1970-1984 year classes. It was felt that use of recruitments prior to 1970 was unreasonable since the stock was at such anomalously high levels at this time. The mean 1993 biomass level for 500 simulation runs was 83,500 mt for exploitable biomass and 63,800 mt for available biomass. Pacific ocean perch exploitable biomass is defined as the biomass of age 6 and greater at the beginning of the year and available biomass is defined as the biomass at the midpoint of the year modified by age specific fishery selectivity.

Historical Estimates of Allowable Biological Catch (ABC)

Historical estimates of Acceptable Biological Catch for rockfish are listed in Table 3 for the years 1983- 1992.

Prior to 1988, rockfish were managed in two groupings, the "Pacific ocean perch (POP) complex" and "other rockfish". The Pacific ocean complex consisted of Pacific ocean perch (Sebastes alutus) and four other species: northern (S. polyspinis), rougheye (S. aleutianus), shortraker (S. borealis), and sharpchin (S. zacentrus) rockfish. All other Sebastes species were classified as "other rockfish." The Maximum Sustainable Yield of the POP complex had been estimated to range from 125,000-150,000 mt, and MSY of other rockfish estimated to range from 7,600-10,200 mt which was equivalent to the range of catches from 1973-75 (FMP 1984). The ABC for the other rockfish category was set equal to the low end of the MSY range. The Gulf of Alaska FMP (1984) states if the abundance of a stock is below that required to produce MSY, equilibrium yield (EY) is then the maximum production that can be sustained under current population conditions. The equilibrium yield for POP complex had been set at 50,000 mt, or only 33-40% of MSY. In order to rebuild the stock to a level that would produce MSY, it was determined that catch be held below the EY. The ABCs for the POP complex and other rockfish were set accordingly for the years 1983-1985. The 1986-87 ABCs for the POP complex were based on revised estimates of EY from a stock reduction analysis. In 1986, it was determined that an estimate of ABC could not be determined for other rockfish due to lack of biomass estimates; sustained yield was considered to be very low. In 1987, an ABC of 3,350 mt was estimated for other rockfish based on fisheries performance.

Amendments 14 and 16 separated rockfish into 3 new complexes effective in 1988: slope rockfish, pelagic shelf rockfish, and demersal shelf rockfish. The 1988 slope rockfish ABC was determined from SRA analyses on Sebastes alutus (POP). The yield which produced a constant biomass trend for POP was expanded to the entire slope assemblage. The fishing mortality rate associated with MSY (F_{msy}) for POP was applied to pelagic shelf biomass estimates to determine the 1988 ABC for the pelagic shelf complex. Estimates of biomass were not available for demersal shelf rockfish therefore no yield estimates have been calculated for the years 1988-1990.

The 1989 ABC estimates for slope and pelagic shelf rockfish are based on exploitation rates determined from SRA analysis. A range of F_{msy}-based exploitation rates were determined based on different stock-recruitment assumptions. An ABC for POP was determined from an exploitation rate at the midpoint of the range due to concern of over-exploitation of deep-water slope species (POP, shortraker and rougheye rockfish). An exploitation rate from the upper end of the range of estimates was deemed appropriate for pelagic shelf rockfish, and the 1989 ABC was doubled relative to the 1988 ABC.

The F_{msy}-based exploitation rates determined for POP encompassed a rate of 5%, equal to the natural mortality rate for POP. Due to concern over the uncertainty regarding the stock-recruitment relationship, it was recommended that the upper bound of the range of appropriate exploitation rates be constrained to an F=M policy. Beginning in 1990, an exploitation rate equal to the natural mortality rate was applied to the species comprising the slope complex. The sum of the resulting yields were adjusted downward by 50% to protect shortraker and rougheye rockfish from over-exploitation. The 1990 ABC for pelagic shelf rockfish was determined by applying a 5% exploitation rate (determined for POP) to the exploitable biomass.

The proportion of shortraker and rougheye at depths greater than 200 m was twice as high as their proportion in the total assemblage exploitable biomass (NPFMC SAFE report 1989). Thus, there was concern that the effective exploitation rate on shortraker and rougheye would be at least twice

as large as the intended assemblage exploitation rate. To prevent exploitation of these species from exceeding the intended fishing rate, required either separate ABCs for subgroups within the assemblage or adjustment of the assemblage ABC downward by 50% (NPFMC SAFE report 1989).

Effective for the 1991 fishery, the slope rockfish category was split into 3 new categories: POP, shortraker/rougheye rockfish combined, and other (slope) rockfish. The 1991 and 1992 POP ABCs were determined by applying a 2.5% exploitation rate (1/2 the preferred exploitation rate of F=M=0.5) to exploitable biomass. The exploitation rate was adjusted downward based on results of the SRA analysis which showed current biomass to be about 50% of the estimated biomass associated with MSY (B_{msy}). Given the low level of abundance, the Council's overfishing definition required lowering the preferred exploitation rate by half.

Natural mortality rates of 0.03 and 0.025 were determined for shortraker and rougheye rockfish, respectively. These rates were applied to the exploitable biomasses to determine 1991 and 1992 shortraker and rougheye ABCs. The 1991 ABC for the other slope rockfish category was determined by applying the 5% exploitation rate to exploitable biomass. Species specific natural mortality rates for the other slope rockfish category became available and these rates were used to determine the 1992 other rockfish ABC.

The 1991 pelagic shelf ABC was again determined by applying a 5% exploitation rate to exploitable biomass. Relative to the 1990 ABC, revised estimates of biomass (average of 1987 and 1990 survey estimates) were utilized due to new survey information from the 1990 Gulf trawl survey. A natural mortality rate of 0.09 for dusky rockfish (the main component of this assemblage) was determined for 1992. This new rate of exploitation was applied to the average exploitable biomass estimates from the 1984, 1987, and 1990 surveys to determine the 1992 pelagic shelf ABCs.

No new information was available for demersal shelf rockfish for 1991, but an ABC was set which was calculated to accommodate a directed fishery and bycatch needs. For 1992, biomass information was available for the East Yakutat area. An ABC for this area was determined based on the yelloweye rockfish (S. ruberrimus) natural mortality rate applied to the corresponding biomass estimate. This value was summed with catch levels for other areas determined to accommodate a directed fishery and bycatch needs, to calculate the 1992 ABC for demersal shelf rockfish.

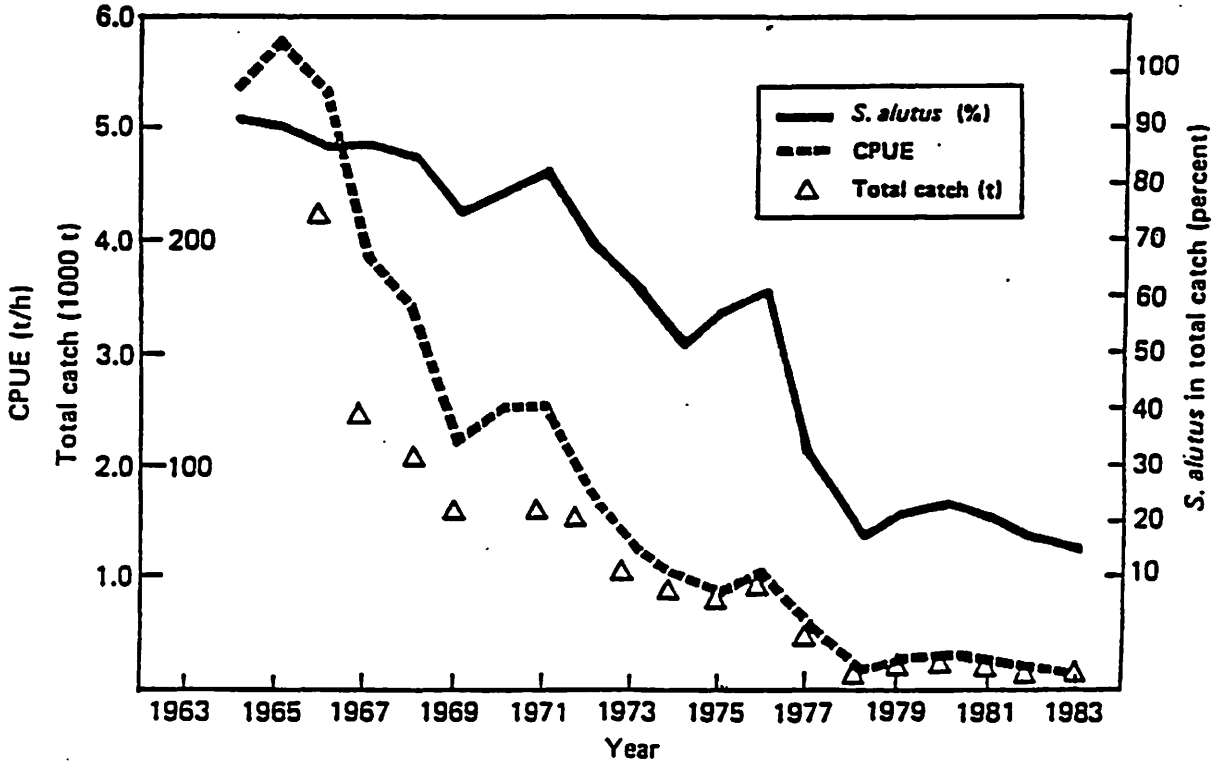


Figure 1.--Catch, percentage of all-species catch, and CPUE of Pacific ocean perch, Sebastes alutus, in the Japanese trawl fishery in the Gulf of Alaska, 1964-83. (Figure adapted from Carlson et al. 1986).

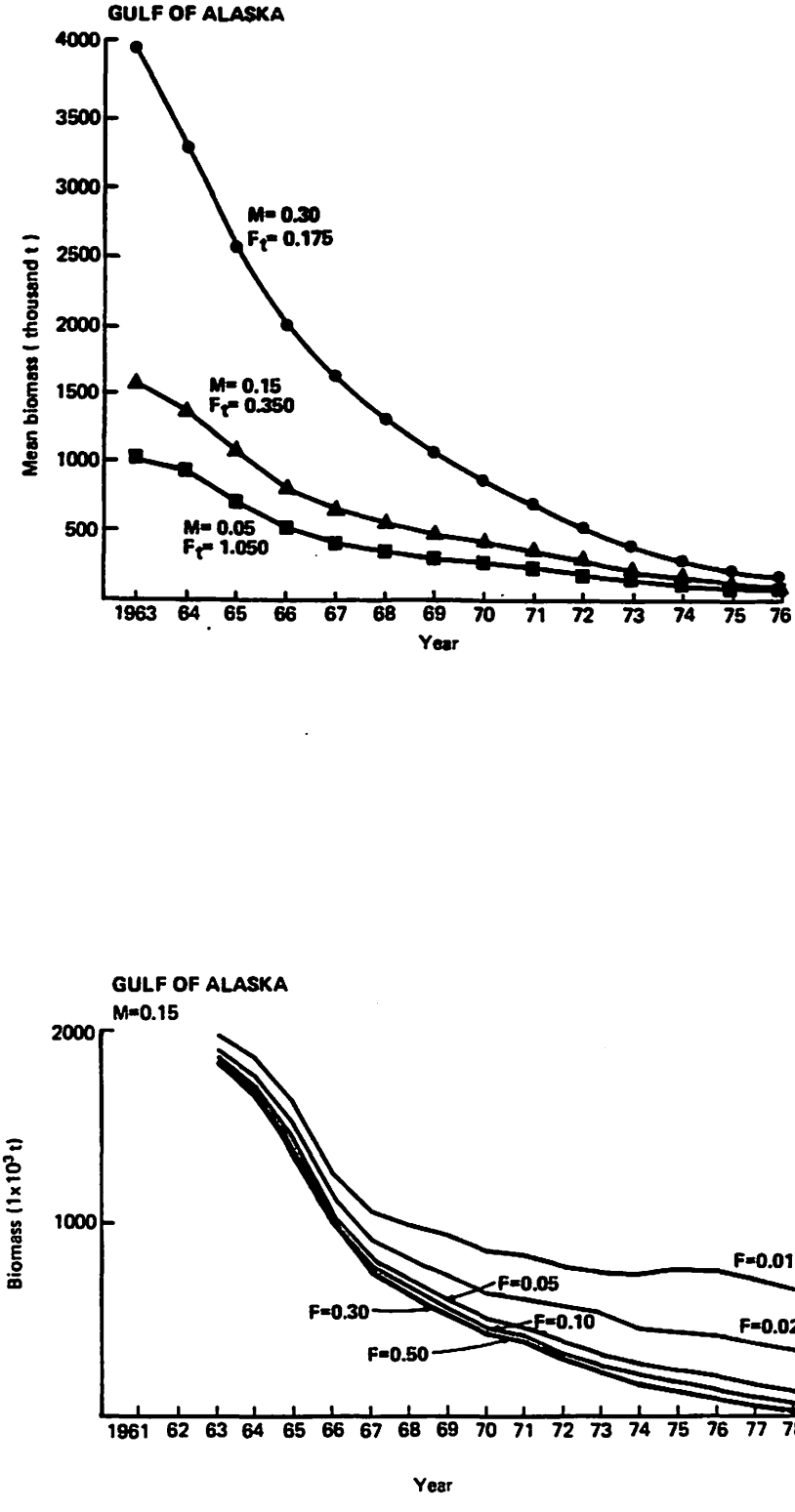


Figure 2.--Biomass trends from cohort-type analyses for Pacific ocean perch in the Gulf of Alaska region. The top panel is from Ito (1982) and the bottom panel is from Balsiger et al. (1985).

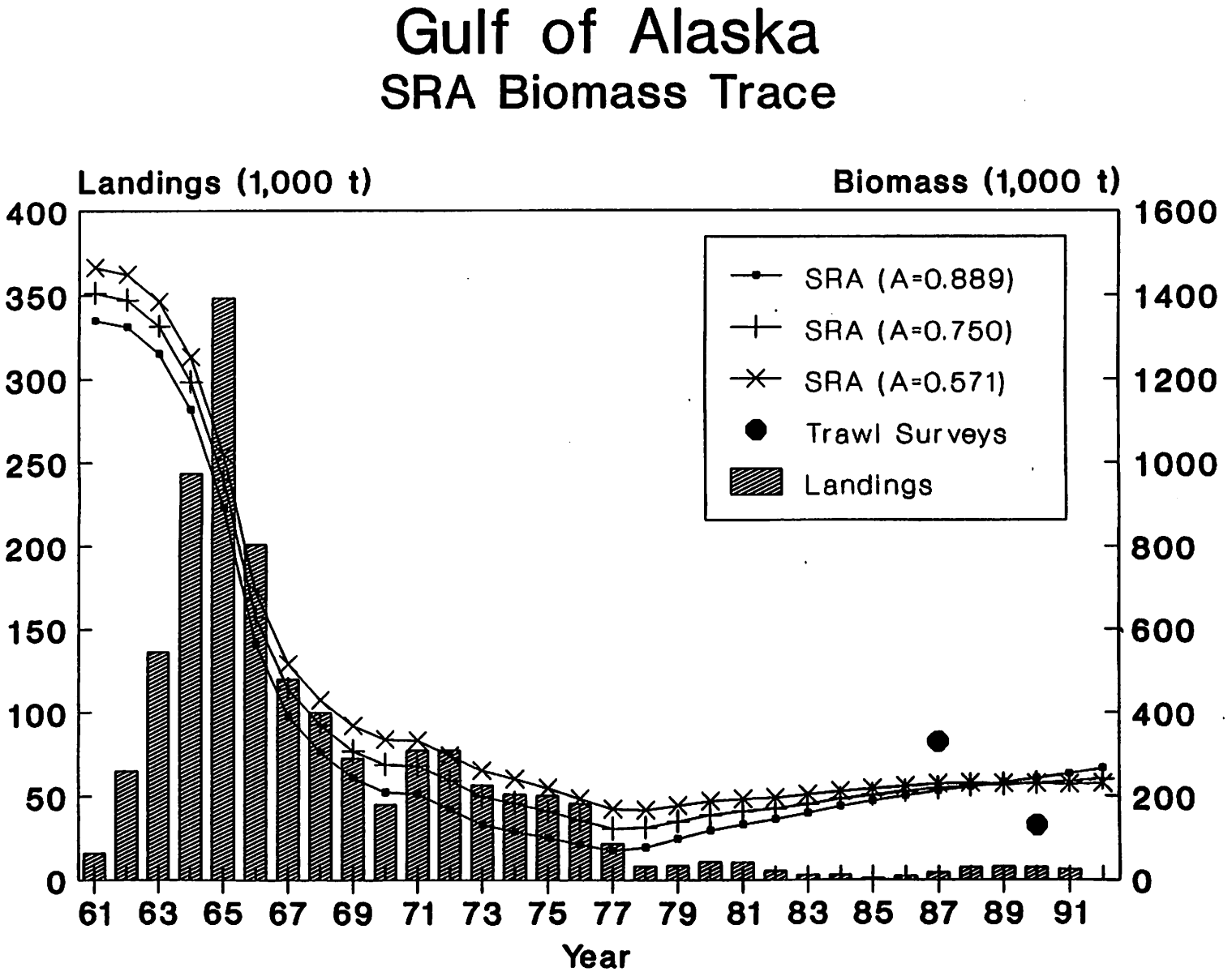


Figure 3.--Estimated removals and population biomass of Pacific ocean perch from the Gulf of Alaska region, based on stock reduction analysis (SRA) with three recruitment scenarios.

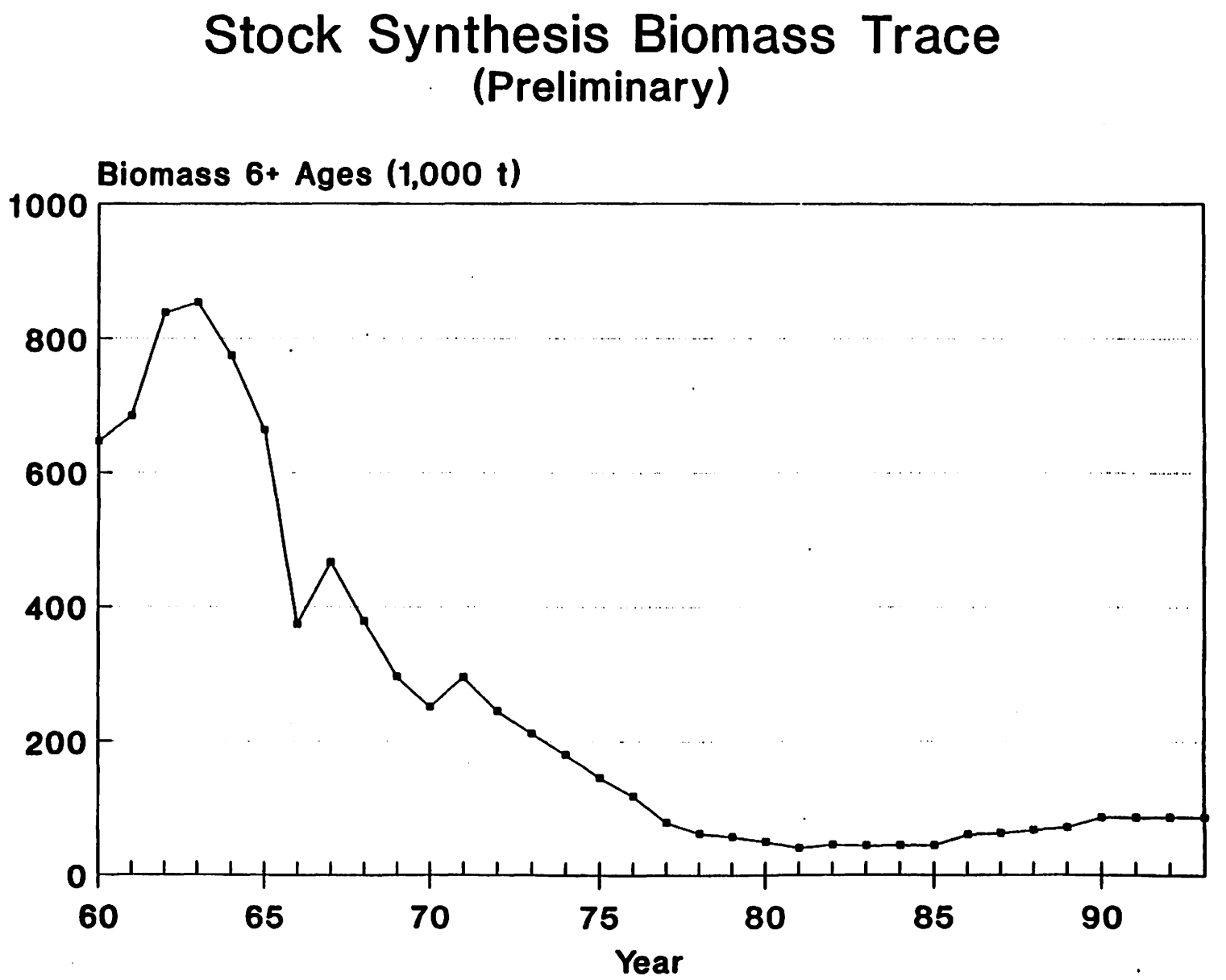


Figure 4.--Estimated biomass trend of Pacific ocean perch in the Gulf of Alaska, based on preliminary stock synthesis model runs.

Table 1.--Comparison of biomass estimates for slope rockfish species in the Gulf of Alaska in the 1984, 1987, and 1990 triennial trawl surveys. For the 1984 and 1987 surveys, biomass estimates were adjusted to the most efficient vessel/trawl combination each year. No adjustments between vessels were made to the 1990 data.

	Biomass (t)			% of assemblage biomass		
Species	1984	1987	1990	1984	1987	1990
Pacific ocean perch	370,673	352,736	132,369	63.9	43.2	35.6
Shortraker rockfish	53,661	47,702	9,449	9.2	5.8	2.5
Rougheye rockfish	74,368	53,225	44,470	12.8	6.5	12.0
Northern rockfish	75,731	172,619	99,330	13.0	21.1	26.7
Sharpchin rockfish	5,989	70,155	33,412	1.0	8.6	9.0
Redstripe rockfish	n.a.	23,706	22,877	n.a.	2.9	6.1
Harlequin rockfish	1,777	90,879	15,040	0.3	11.1	4.0
Silvergrey rockfish	n.a.	4,684	12,749	n.a.	0.6	3.4
Other species	449	742	2,350	0.1	0.1	0.6
Total	582,648	816,448	372,046	100.0	100.0	100.0

n.a. = not available

Table 2.--Comparison of biomass estimates for pelagic shelf rockfish species in the Gulf of Alaska in the 1984, 1987, and 1990 triennial trawl surveys.

Species	Biomass (t) 1984	1987	1990
Dusky rockfish	37,313	163,188	24,141
Black rockfish	n.a.	1,018	1,756
Widow rockfish	n.a.	143	273
Blue rockfish	n.a.	3	47
Assemblage total	n.a.	164,352	26,217

Table 3. Historical estimates of Acceptable Biological Catch (ABC) in metric tons for rockfish, 1983-92.

Year	POP complex[a]	Other Rockfish	Slope Rockfish	Pelagic shelf Rockfish	Demersal shelf Rockfish
1983	25,000	7,600			
1984	21,875	7,600			
1985	11,474	7,600			
1986	10,500	b/			
1987	10,500	3,350			
1988			16,800	3,300	b/
1989			20,000	6,600	b/
1990			17,700	8,200	b/
1991				4,800	445
1992				6,886	550

Year	Pacific ocean perch[c]	Other Slope Rockfish	Shortraker/Rougheye Rockfish
1983			
1984			
1985			
1986			
1987			
1988			
1989			
1990			
1991	5,800	10,100	2,000
1992	5,730	14,060	1,960

a/ POP (Pacific ocean perch) complex includes Sebastes alutus, S. polyspinis, S. aleutianus, S. borealis, and S. zacentrus.
b/ ABCs were not determined.
c/ True POP, Sebastes alutus only.
d/ Includes POP complex as shown in footnote a.

4.0 MANAGEMENT ISSUES

4.1 Current status of rockfish management

Rockfish fisheries share all the concerns of other groundfish fisheries, many of which are overcapitalized and share problems in high and unpredictable effort, inadequate or untimely data collection, and a slow administrative process. Recent management and policy changes have made significant inroads in dealing with these issues. For data collection and accuracy, stability in reporting categories from 1991 to 1992 has led to a significant increase in data availability. Planned changes in reporting for 1993 will introduce consistency in reporting between the Bering Sea and Aleutian Islands (BSAI) and Gulf of Alaska (GOA), and with Alaska fish tickets. Refinements in observer training to stress rockfish identification, and presence of NMFS agents in Kodiak and Dutch Harbor has made training and assistance in rockfish identification more available to fishers. Increased coordination among observer, ADF&G and NMFS data should help identify reporting and species identification errors more rapidly. Sufficient observer data are now available for examination of "natural" bycatch rates of rockfishes in various fisheries, and should improve fishery closure projections. Finally, a core of enforcement agents is specifically tasked with improving reporting performance. For internal administrative issues, NMFS has improved standardization and decreased length of Federal Register notices for inseason actions, and in 1992 initiated most closure actions well in advance of need.

Because of their unique biology, rockfishes represent an extreme management challenge. As with other groundfishes, rockfishes suffer from over-capitalization and increasing demand, escalating value, and lack of accurate harvest records. But rockfishes have slower growth and recruitment, are the least understood in terms of life history and biomass estimates, and suffer higher, largely unreported, fishing mortality than other species. Traditional stock assessment and data collection tools are generally inappropriate for rockfishes, so that levels of overfishing (OF), acceptable biological catch (ABC), and total allowable catch (TAC) are not well supported by survey data, and fishing mortality is underestimated.

Rockfish management has met with varying success in recent years, particularly in areas where fishing effort is large and volatile, and largely comprised of factory trawlers (FT), such as the Central GOA. A combination of species groupings, area allocations, and halibut bycatch controls has been employed for rockfish management in recent years. In 1992, a reduction in retainable bycatch of rockfishes when closed, and time constraints on have further assisted in managing fishing effort. In Southeast Alaska (SE) the diversity of rockfishes is greatest, and many areas are suitable to trawling by large vessels. But trawl effort has been consistently low (fewer than 10 vessels participating), due to the degree of expertise necessary and risk of gear loss and because few other fisheries are of a magnitude to attract large vessels. Hook-and-line rockfish fisheries are composed of small vessels which are limited in range; with the exception of demersal shelf rockfishes have not developed significantly for most species. The smallest EG rockfish allocation, to demersal shelf rockfishes, is managed by ADF&G through a program of intensive port sampling and interviews.
Following are management issues applicable to all GOA groundfish fisheries, with some examples relevant to Eastern GOA rockfishes.

- Management has conflicting goals. "Efficient" management would result in complete utilization of a species group without unwelcome discards. Priorities need to be clarified for alternatives of achieving a TAC versus insuring that we remain under a TAC.

  NMFS managers have attempted to maximize harvest under directed fisheries. The

uncertainty about bycatch requirements for remaining fisheries, particularly after start of halibut PSC accountability, has resulted in substantial amounts of fish unharvested, or has led to TAC overruns. In 1991 Eastern GOA rockfish fisheries, amounts of fish remaining at the end of the year were: Pacific Ocean perch (POP), 407 metric tons (mt), 17 percent of TAC, and shortraker/rougheye (SRRE), 107 mt, 29 percent of TAC. The pelagic shelf (PELS) TAC was exceeded by 36 mt, 4 percent of TAC. In 1992, both POP and SRRE are over TAC by 4 and 12 percent, respectively, but PELS is under TAC by 665 mt, 52 percent as of mid-August.

- Harvest effort is unpredictable. Competition and value for most rockfishes is increasing. In most cases, effort is unrestricted. Past performance is frequently a limited indicator of current year harvest strategy due to a fluctuating market, increasing displacement from other groundfish targets, and a generally unstable management atmosphere (for example, because of PSC bycatch controls).

  The high capacity of a factory trawler increases importance of each participant in making closure projections. However, in SE, the consistency of rockfish effort and improved accountability has assisted NMFS in "keeping track" of harvesters and monitoring TACs. For 1992, CHECKIN notices for at-sea processors now require prospective target information, and daily reports by observers contributed greatly in identifying effort and containing harvests. A new regulatory delay of rockfish trawling until July 1 may concentrate effort in time, but will relieve NMFS from uncertainty about effort earlier in the year. In contrast to other rockfishes, the demersal shelf rockfish (DSR) fishery has been allocated to hook-and-line gear by ADF&G, who intensively manages the large number of participants through port sampling.

- Harvest data are insufficiently accurate/timely. A fundamental inability and/or unwillingness to accurately identify rockfish species is supported by market forces which drive harvest strategies by color and size. This is occasionally in contradiction to management assemblages currently designed to reflect species that coexistent within a habitat. Frequent changes in species groups further increase confusion and decrease data quality.

  Improved observer training and presence of a NMFS port agent in Kodiak has improved rockfish identifications within the FT fleet. Stability of the rockfish groupings from 1991 to 1992 was a particular contributor to improved reporting, according to the observer program. Closer coordination between processor and observer data should eliminate occurrences of misreporting such as that in 1991, in which misidentification by a factory trawler could potentially have curtailed fisheries for groundfish and halibut in SE. Harvest data are normally provided by processors and observers weekly, but in 1992, daily reporting by observers was reasonably effective in managing rockfish fisheries in SE. NMFS is proceeding with plans to require empirical methods on at-sea processors for measuring "total catch".

- Directed fishing standards are often inappropriate. Current management allows three "statuses" for a fishery: an open directed fishery, a prohibition to all retention, or retention as Directed fishing standards have been designed to avoid non-retainable discard, and as such are inflexible. A lack of information about "natural" bycatch rates among fisheries often results in standards that are too high (allowing "topping-off"), or too low (causing excessive discards) after directed fisheries are closed. Single, inflexible standards prevent their use as a control on harvest rates.

A 1992 change in directed fishing standards allows trawlers to retain only 1 percent of "bycatch" rockfish relative to "open" rockfishes. NMFS anticipates this will discourage covert targeting and increase predictability of fishing closures. However, flexibility in setting directed fishing standards would have allowed an earlier closure with allowable retention and minimal discards for POP (POP) and shortraker and rougheye rockfishes (SRRE).

- Management units are too broad (include too many species). Price differentials encourage selective targeting and possible overharvesting of species within groups.

  After 1990 in the GOA, POP and SRRE have been managed separately from the remainder of "slope" species. This has greatly reduced harvest of POP and SRRE, for which stock assessments are not encouraging and demand is high relative to that for other slope species. In 1992, POP and SRRE were slightly overharvested in the Eastern GOA. However, over 5,600 mt of slope species remain unharvested, amounts that would have been taken as POP and SRRE in earlier years. In 1990 when slope species had a single TAC, over 5,900 mt were harvested.

- Some TACs are too close to OF. Low biomass estimates, and an apparent overestimation of management's ability to control harvest result in small TACs which are frequently close to ABC and overfishing levels.

  Small TACs with high effort are difficult to manage, unless effort can be anticipated and catch rates are available contemporaneous to fishing activity. Participation of trawlers in SE rockfish fisheries has been consistent, and for reasons stated in the Environmental Assessment (EA) and above, are not expected to increase. In 1992, required notification of intended targets and the delay of rockfish trawling to July 1 were useful in determining effort and established a rockfish "season". Increased (daily) observer reporting during that season prevented significant overruns in SE fisheries for POP and SRRE. When TACs are close to overfishing, an inherent margin of error in projecting closures can lead to OF as with 1992 POP. Inflexibility of management tools in controlling the harvest rate of fisheries has been a major contributor to the problem, resulting in overly- or insufficiently-conservative management strategies.

- Gulf-wide overfishing levels yield are not appropriate. In the short term this strategy relieves the possibility of overfishing within a localized TAC but more severe consequences result from attaining the overfishing level. Additionally, this approach is inappropriate considering the lack of accurate fishing mortality and is contrary to the current understanding of limited rockfish stock mobility.

  In 1992, harvest of POP has attained the OF level and widespread fishery closures are contemplated. If all fishing for rockfishes and deep water flatfish is curtailed in the GOA, as much as 25,000 mt of groundfish would not be harvestable during 1992. If overfishing for POP were area rather than GOA wide, estimated amounts foregone in the Eastern Gulf would only be 8,607 mt. (These figures assume remaining "other rockfish" are desirable).

- Standard biomass assessments may be inappropriate. Rockfishes populations are considered intractable to traditional population survey methods; many rockfishes are cryptic, or populate areas too deep or irregular for historical survey methods. Most

hook-and-line vessels engaged in fisheries for rockfishes, and for sablefish and halibut (which have high bycatches of rockfishes) are unobserved; significant unreported fishing mortality may be causing "hidden" overfishing. "Ghost fishing" from lost gear may also be a factor. Accurate estimates of such mortality are presently unavailable and are not accounted for in stock assessments.

Methods to improve accuracy in rockfish biomass estimation are currently under development at AKC and ABL. Research with submersible vessels and concentration on innovative population models are improving population assessment. Data from the IPHC on rockfish discards in the halibut fishery are anticipated soon, and ADF&G has recently provided estimates of hook-and-line gear loss in some SE sablefish fisheries.

- Management response is frequently slow. Inseason actions require about 3 days, "Emergency" rules require at least a month, regulatory amendments four to six months, and plan amendments six to 12 months.

  In 1992, most of the inseason actions affecting fisheries were drafted and processing was initiated prior to need. Increased staffing within the Fish Management Division and General Council are reducing delays in regulatory activities.

4.2 Rockfish mortality in other fisheries

Information available thru mid-August on bycatch of demersal shelf rockfish (DSR) indicates a bycatch of 9 mt in the trawl fisheries. During the June 1992 halibut opening the IPHC collected information in order to try to estimate the bycatch mortality of DSR in the halibut hook and line fisheries. Preliminary analysis of this data indicate a bycatch rate of between 10% and 15% of weight of halibut. Based on halibut landings from the Southeast Outside Area in 1991, the preliminary report estimates an unreported DSR bycatch mortality in that fishery of 209 mt (at 10% assumed rate), with an additional 98 mt reported on fish tickets.

4.3 Alternative approaches to rockfish management in the Gulf of Alaska

Previous sections describe current strategies used for rockfish management in the Gulf of Alaska. Additional information on rockfish management is also contained the 1992 SAFE report.

The following section outlines some possible alternative approaches to managing rockfish fisheries in the Gulf of Alaska. Some of the options involve measures which may be viewed as alternatives to a complete ban on trawling in the Eastern Gulf of Alaska east of 140° W. longitude as discussed in Amendment 26, while others may be considered as alternatives to status quo for managing at least some rockfish species throughout the entire Gulf. This section is not intended to provide specific management recommendations, but rather to identify possible alternatives and suggest options which may warrant further consideration.

Alternative 1. More Conservative Applications of Current management Strategies

This alternative presumes that at least some of the Gulf of Alaska rockfish populations are severely depressed and are well below optimum levels. It also presumes that status quo is not achieving the desired conservation mandates required under the MFCMA and that there is evidence that some stocks are continuing to decline rather dramatically at current harvest levels. Most of these options can be advanced for Council consideration during the annual stock status review and would not require further amendments for implementation.

Option: Apply a conservative exploitation rate to the lower bound of the most recent biomass estimate

Most of the Gulf of Alaska rockfish harvest levels have been set by applying an agreed upon exploitation rate to the point estimate of recent biomass estimates. In recent years the exploitation rate has been applied to the point estimate of the average biomass over several years of survey data. This may not be appropriate if stocks are severely depressed or if stocks are continuing to decline under present harvest levels as indicated in recent biomass estimates for POP, shortraker/ rougheye, and thornyhead rockfish populations.

A more conservative approach uses the lower 90% confidence interval of the most recent survey data as the best estimate of the current biomass level. This approach has been used for walleye management in Wisconsin (Hansen, 1989) and is used by the Alaska Department of Fish and Game for setting harvest guidelines in the Southeast sea cucumber and red urchin fisheries (personal communication with Doug Woodby ADF&G). It is also the approach being recommended by ADF&G for setting the 1993 ABC and TAC for demersal shelf rockfish. ADF&G applies F=M to the lower 90% confidence interval of the biomass estimate to establish ABC.

This approach greatly reduces the risk of overexploitation. It is appropriate when data is incomplete, there is a high level of uncertainty regarding the stock condition, or when declining stock conditions suggest that a more conservative management strategy is warranted. Virtually all of those situations exist with some of the GOA rockfish stocks.

Option: Manage for the greatest common denominator

This option can be applied when a mixed aggregation of species is managed under a single TAC. Rather than attempting to determine the harvest level for the entire aggregation, the assemblage is managed based on the strongest species component of the complex and all other species within the assemblage are considered to be incidental to the fishery for the most abundant species. ADF&G currently uses this approach for managing the DSR fishery where the entire assemblage is managed according to the condition of the yelloweye rockfish component. In other words, the ABC is set based solely on the condition of the yelloweye rockfish stock and all other species are considered to be merely bycatch in the directed fishery for yelloweye.

One possible option for slope rockfish would be to manage the entire fishery based on POP with all other species considered to be incidental to the POP fishery.

Option: Manage for the least common denominator

This option is similar to the option described above, but assumes that each component of an assemblage is equally important. In this approach, the lesser species are evaluated and protected even if it results in an "underutilization" of more plentiful species within the assemblage.

In this instance, perhaps the shortraker and rougheye stock status or the status of some other lesser species would drive the management of all slope rockfish. In other words, if this approach were used, slope rockfish harvests would not be allowed above

the level which would provide reasonable protection to the shortraker/rougheye species group or the other species or species group determined to be in need of special protection.

Alternative 2. Develop Explicit Rebuilding Schedules for Rockfish Stocks

While many rockfish populations are considered to be depressed in the Gulf of Alaska, explicit rebuilding schedules have not been adopted to return the populations to desired levels. In fact, in many cases, the optimal population levels have not been identified. The F_{msy} concept assumes that if fish stocks are managed at a conservative exploitation rate, they will eventually return to the level which produces the greatest possible annual yield. Unfortunately, there is some doubt that the MSY management concept is appropriate for long-lived marine species such as rockfish where the variable recruitment functions may be driven more by environmental conditions that by a particular stock size or spawner recruit relationship.

Estimation of MSY is also problematic for those species or species groups where stock parameters are poorly known. Size and age distribution of long-lived species such as rockfish may be an important aspect of their "reproductive strategy" and if the age distribution or stock size are compromised, the impact may be greater than suggested by simply monitoring overall stock size (Adams, 1980). If this is the case, it may be advantageous to maintain a higher population level than MSY modeling suggests and to assure that the population retains a broad cross section of age classes to take advantage of favorable environmental conditions when they occur.

Option: Bycatch only until optimal stock level is reached

One way of rebuilding populations is to relegate fishing mortality to bycatch only until the desired stock level is reached. This approach is most appropriately used when stocks are severely depressed and it is determined that continued levels of directed fishing will jeopardize future production or will hamper stock rebuilding. This strategy may be necessary for POP and shortraker/rougheye populations where survey data suggests that there has been a continued decline in abundance over the past ten years.

Option: Continued harvest with specific time lines to achieve a particular stock level

Specific rebuilding strategies are not included in this report nor are specific management recommendations needed to obtain the desired results. The intent is to identify rockfish stock rebuilding as a possible management objective to be considered in future management deliberations. This concept is not new and has been used by the Pacific Council for POP stocks off Oregon and Washington. It has also been used in the Atlantic for haddock management (Overholtz, et. al., 1986).

Alternative 3. Time and/or Area Closures

Adoption of this alternative would establish specific areas closed to fishing. Several options from complete year-round closures to temporary closures for certain gear types are suggested for consideration. Again, no specific recommendations are made, rather a range of possibilities are advanced. Many of the options suggested in this section would require a plan amendment and a supplemental EA/RIR prior to implementation.

Option: Areas closed year-round to all fishing (Marine Fishery Reserves)

This approach has been suggested for reef fishes in the South Atlantic (Plan Development Team, 1990). The idea of marine fisheries reserves is to establish zones where all reef fish stocks are protected from consumptive use. The older and larger fish are protected within those zones which benefits fisheries in adjacent areas by "protecting critical spawning stock biomass, intra-specific genetic diversity, population age structure, recruitment supply, and ecosystem balance while maintaining reef fish fisheries." This approach also allows for control areas which are useful for evaluating natural fluctuations and for monitoring stock rebuilding rates.

Much thought would have to go in to defining appropriate areas before implementation. This approach may have some merit particularly for demersal shelf rockfish management and for those populations of slope rockfish presumed to be non-migratory. It should be recognized that there are some costs associated with enforcing fishing restrictions in smaller closed areas.

Option: Closed areas only to certain gear types

This type of management approach was the main idea behind Amendment 26 which seeks to ban all trawling for groundfish in the Eastern Gulf east of 140° W. longitude. A gear closure can be strictly allocative or it can have biological implications. Amendment 26 includes elements of both. The closed areas can be quite large as in the Amendment 26 request, or much smaller such as the trawl exclusion areas initially adopted with the GOA groundfish FMP.

Other examples of area closures and gear allocation include the complete ban on pot gear for sablefish in the Gulf of Alaska, the differential trawl bycatch allowance for sablefish in various parts of the gulf and Bering Sea. In addition, halibut have been allocated exclusively to hook-and-line gear, and crab have been allocated exclusively to pot gear. Target fisheries for various salmon species have been allocated to specific gear types and the gear types allowed often vary by area.

Adopting regulations which would ban trawling from smaller areas than the one already proposed in Amendment 26 or providing areas where only trawl gear is allowed to operate would likely require development of a separate Amendment which would identify and evaluate specific areas for consideration.

Option: Seasonal closures to avoid gear conflicts and/or protect areas considered to be biologically critical on a seasonal basis

As discussed in Amendment 26, this approach could be implemented through a modification of the Regional Director's "hot spot" authority. It could also be approached by identifying specific areas and times when curtailing fishing by certain gear types or all gear types may be advantageous. These areas would need to be identified and an EA/RIR written to examine the merits of seasonal closures.

Alternative 4. Depth Restrictions

Depth restrictions were used extensively for regulating the foreign trawl and longline fleets, but have not been used to restrict the domestic fleet. One of the biggest arguments for exempting the

domestic fleet has been the lack of accountability and difficulty of enforcement. With observers aboard the larger vessels, the possibility of expanded observer coverage aboard smaller vessels, and alternative enforcement possibilities, depth restriction regulations may become a more attractive alternative.

If, for example, trawling for slope rockfish could be restricted to the area between 120 FA and 200 FA, perhaps much of the conflict between trawl and hook-and-line gear might be avoided. Also restricting fishing to within that depth zone would minimize the bycatch of DSR which normally occurs shallower than 120 FA and sablefish which normally occur deeper than 200 FA in the slope rockfish trawl fishery. If the desire is to allow harvest of POP while reducing harvest of shortraker and rougheye rockfish, even a more restrictive zone might be considered.

While not necessarily part of the discussion on rockfish management, depth restrictions imposed on longline gear might also be beneficial in reducing the bycatch of halibut during the sablefish fishery and the bycatch of sablefish during the halibut fishery, etc.

Implementation of such regulations would likely require the development of a Plan Amendment and a subsequent EA/RIR. Major considerations for a successful depth restrictive program are that all vessels would have to use the same chart for reference and the observers would need unrestricted access to the wheelhouse to verify compliance.

Literature Cited

Adams, P.B. 1980. Life history patterns in marine fishes and their consequences for fisheries management. Fishery Bulletin 78:1-12.

Hanson, M.J. 1989. A walleye population model for setting harvest quotas. Fish Management Report 143. Wisconsin Dept. of Natural Resources, Madison Wisconsin, 53707. 11 pp.

Overholtz, W.J., M. P. Sissenwine, and S. H. Clark, 1986. Recruitment variability and its implication for managing and rebuilding the Georges Bank haddock (Melanogrammus aeglefinus) stock. Can. J. Fish. Aquat. Sci. 43:748-753.

Plan Development Team, 1990. The potential of marine fishery reserves for reef fish management in the U.S. Southern Atlantic. NOAA Technical Memorandum NMFS-SEFC-261, 40 p.

APPENDIX I

PLOTS OF VESSEL ACTIVITY BASED ON OBSERVER AND LOGBOOK INFORMATION

1990 Observer data - Longline and Trawler targeting rockfish in the same month 1A

1990 Observer data - Trawler only - targeting rockfish 2A-14A

1990 Observer data - Longliners - targeting rockfish 15A-17A

1990 Logbook data - Catcher vessels (trawlers) 18A

1990 Logbook data - CP - Catcher processors (trawlers) 19A-22A

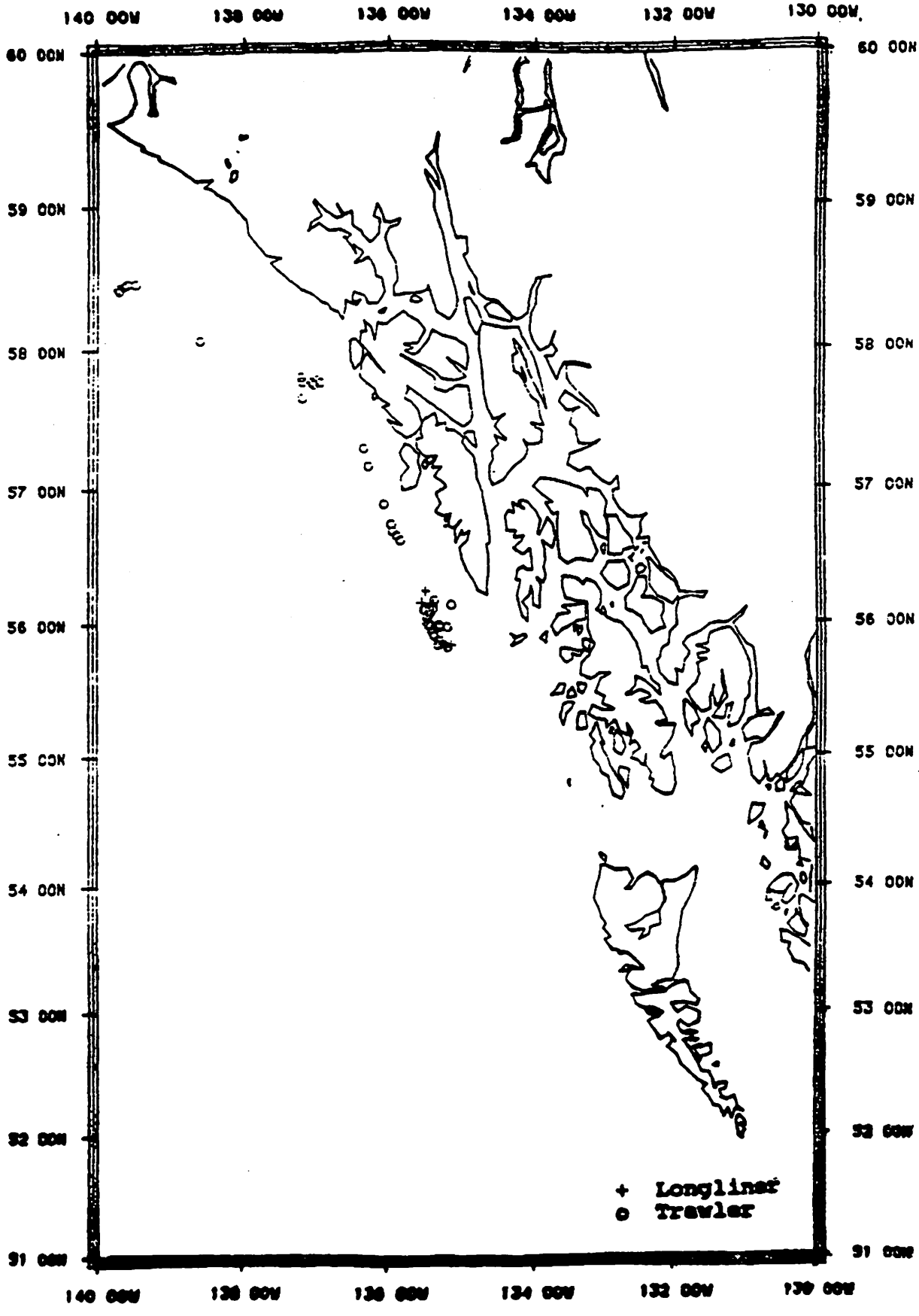
1990 Logbook data - Catcher vessels (longliners) 23A-37A

1990 Logbook data - CP - catcher/processors data (longliners) 38A-39A

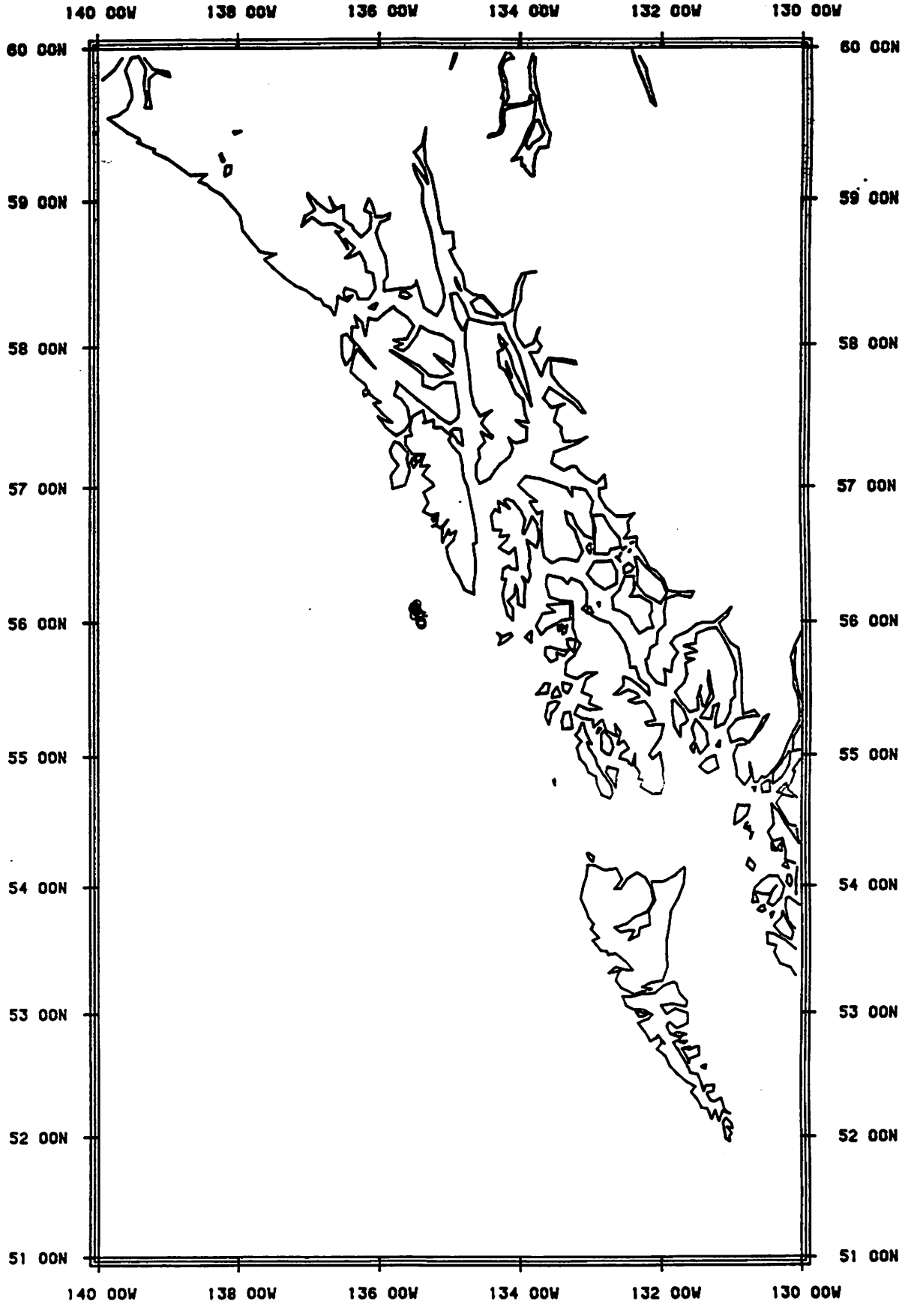
1991 Observer data - Longliners and Trawlers targeting rockfish in the same month 40A

1991 Observer data - Trawlers targeting rockfish 41A-49A

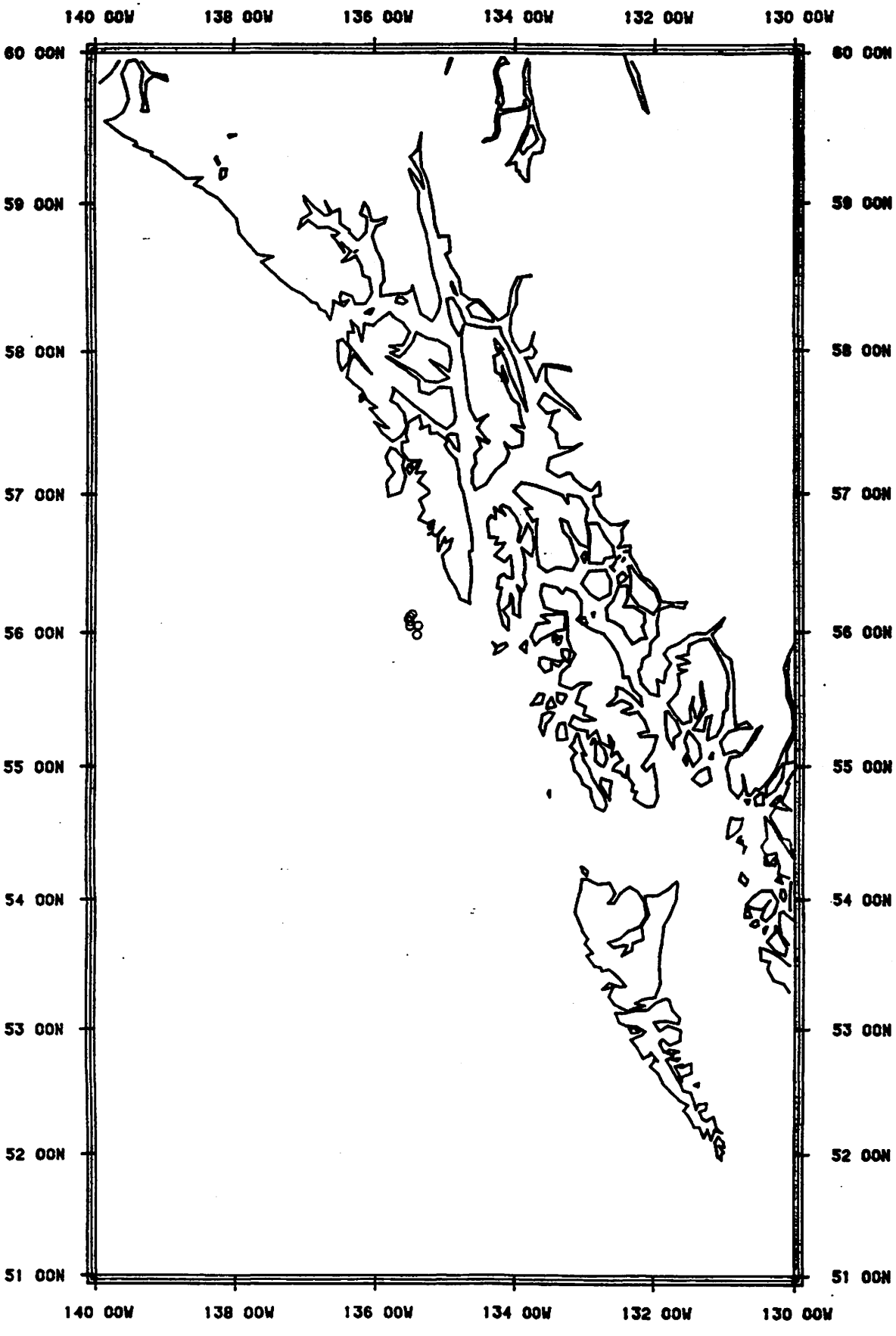
1991 Observer data - Longliners targeting rockfish 50A-53A



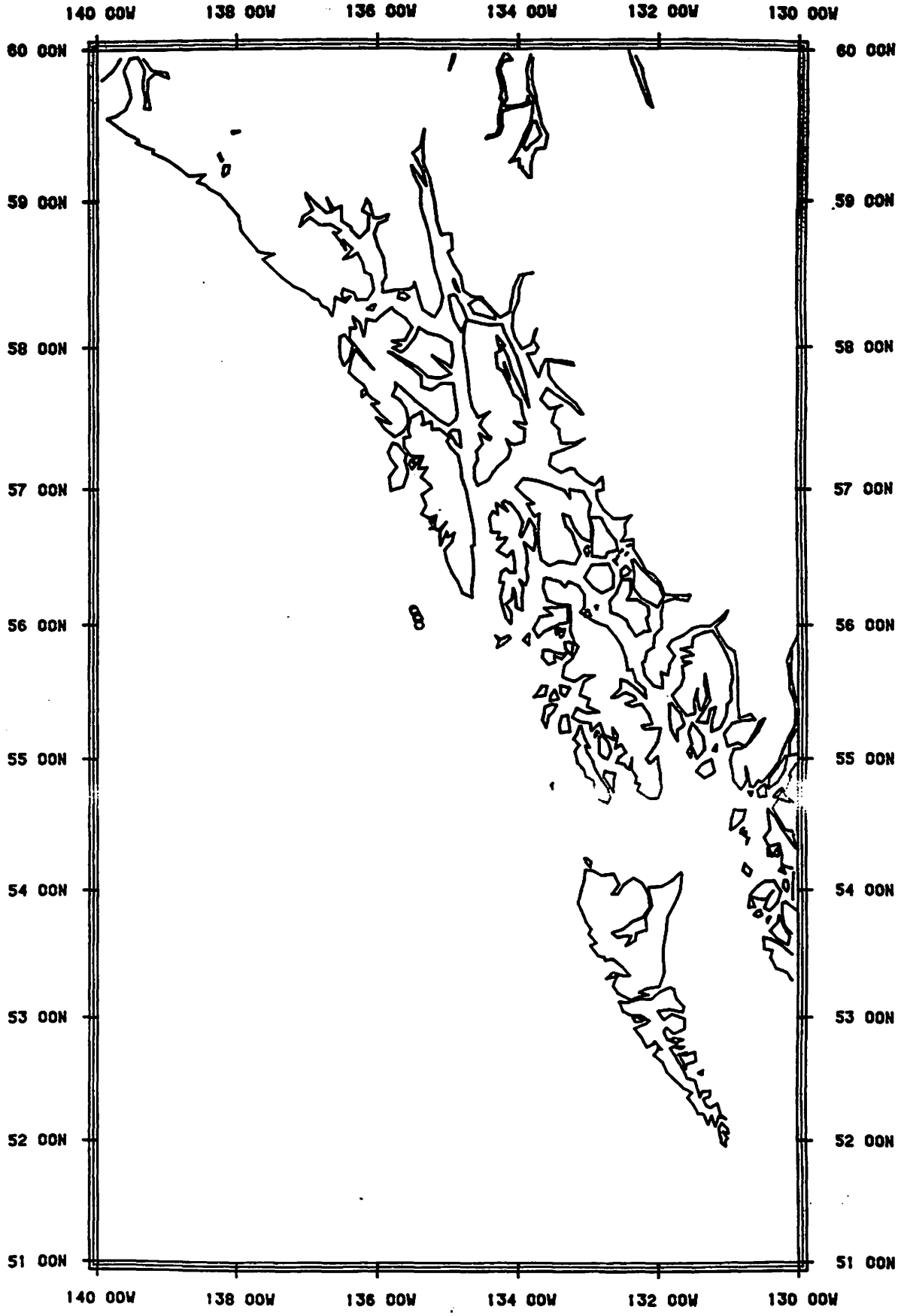
APRIL 90 GULF OF ALASKA VESSELS TARGETING ROCKFISH



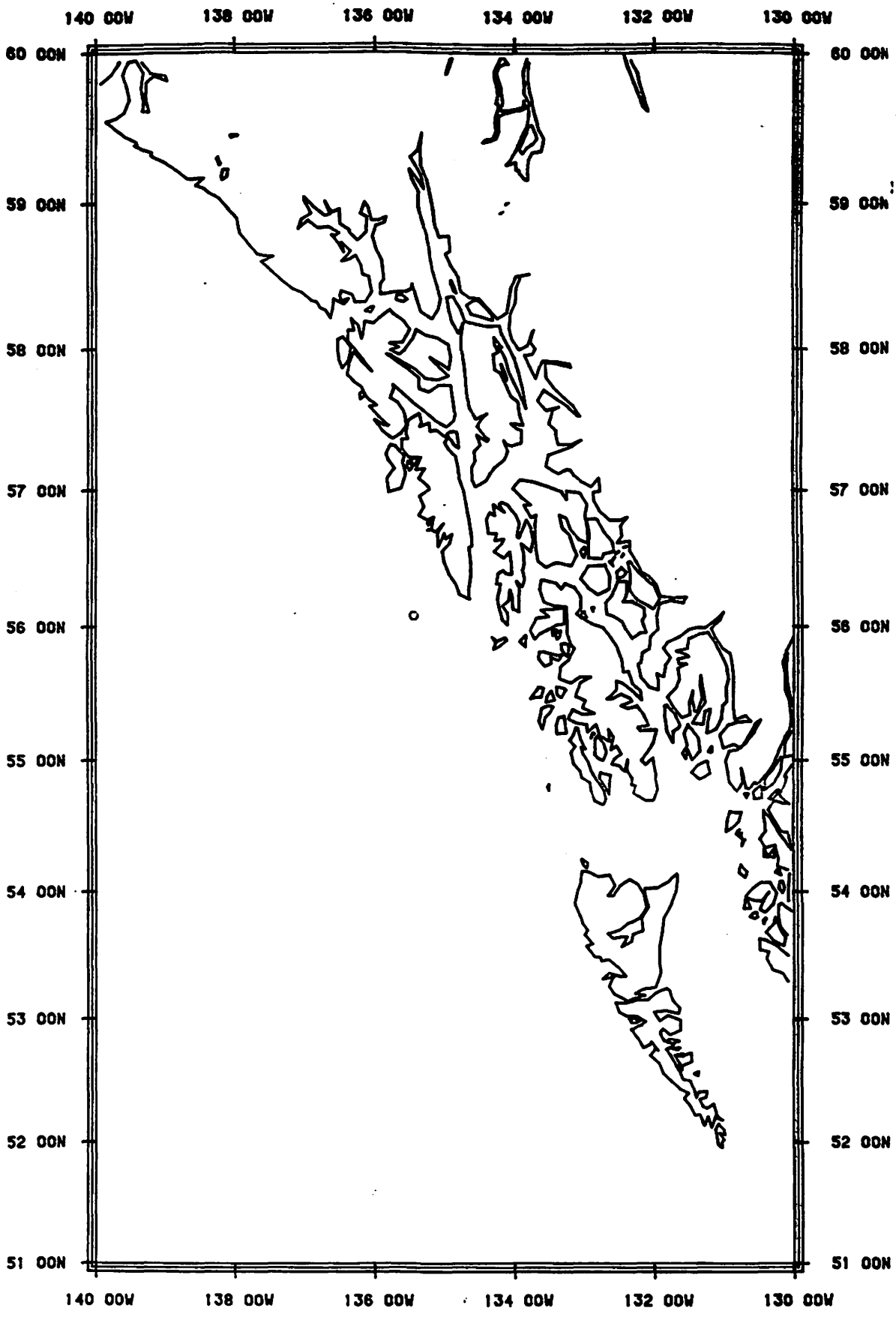
MARCH 90 GULF OF ALASKA TRAWLERS TARGETING ROCKFISH



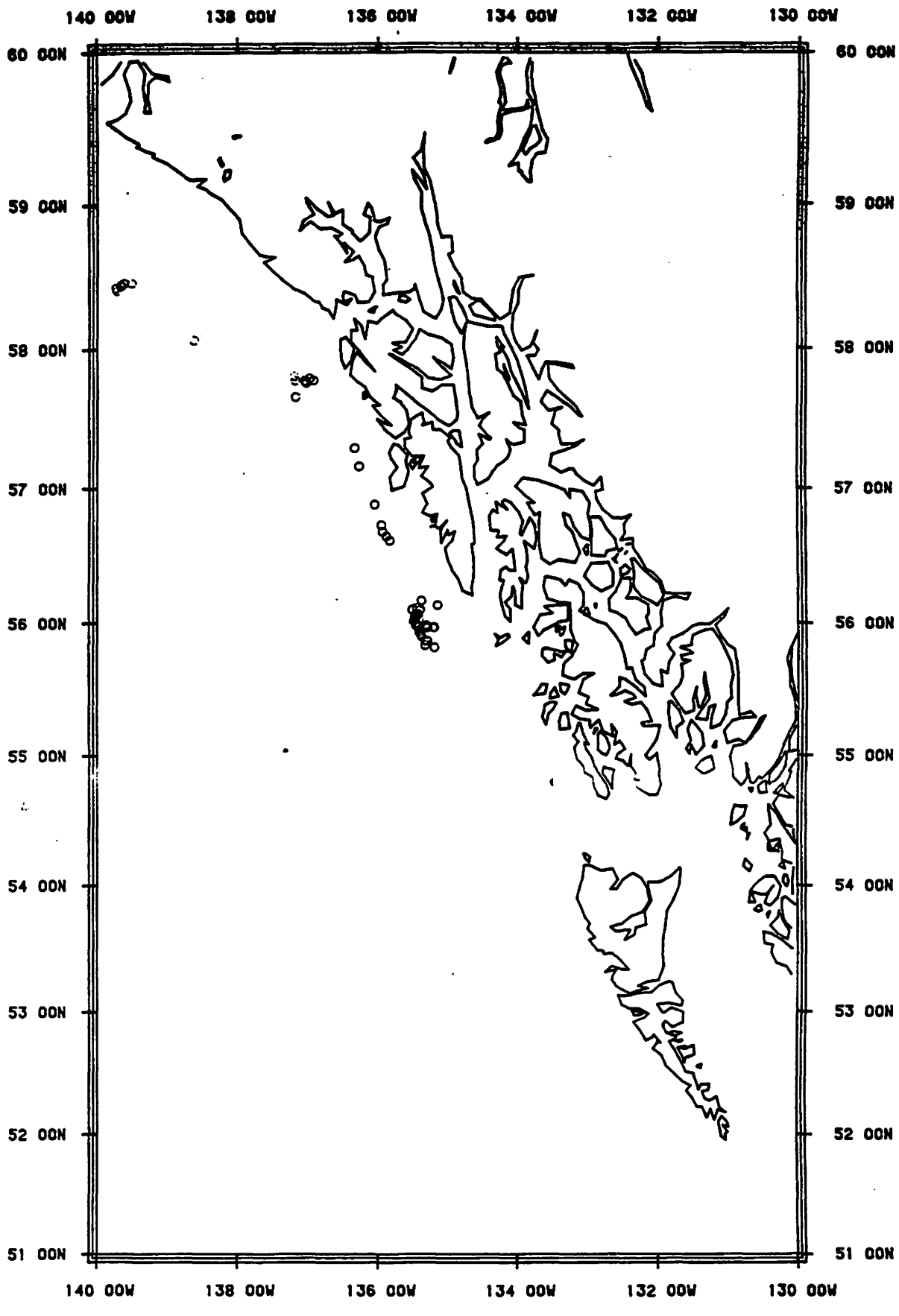
MARCH 90 GULF OF ALASKA TRAWLERS TARGETING POP



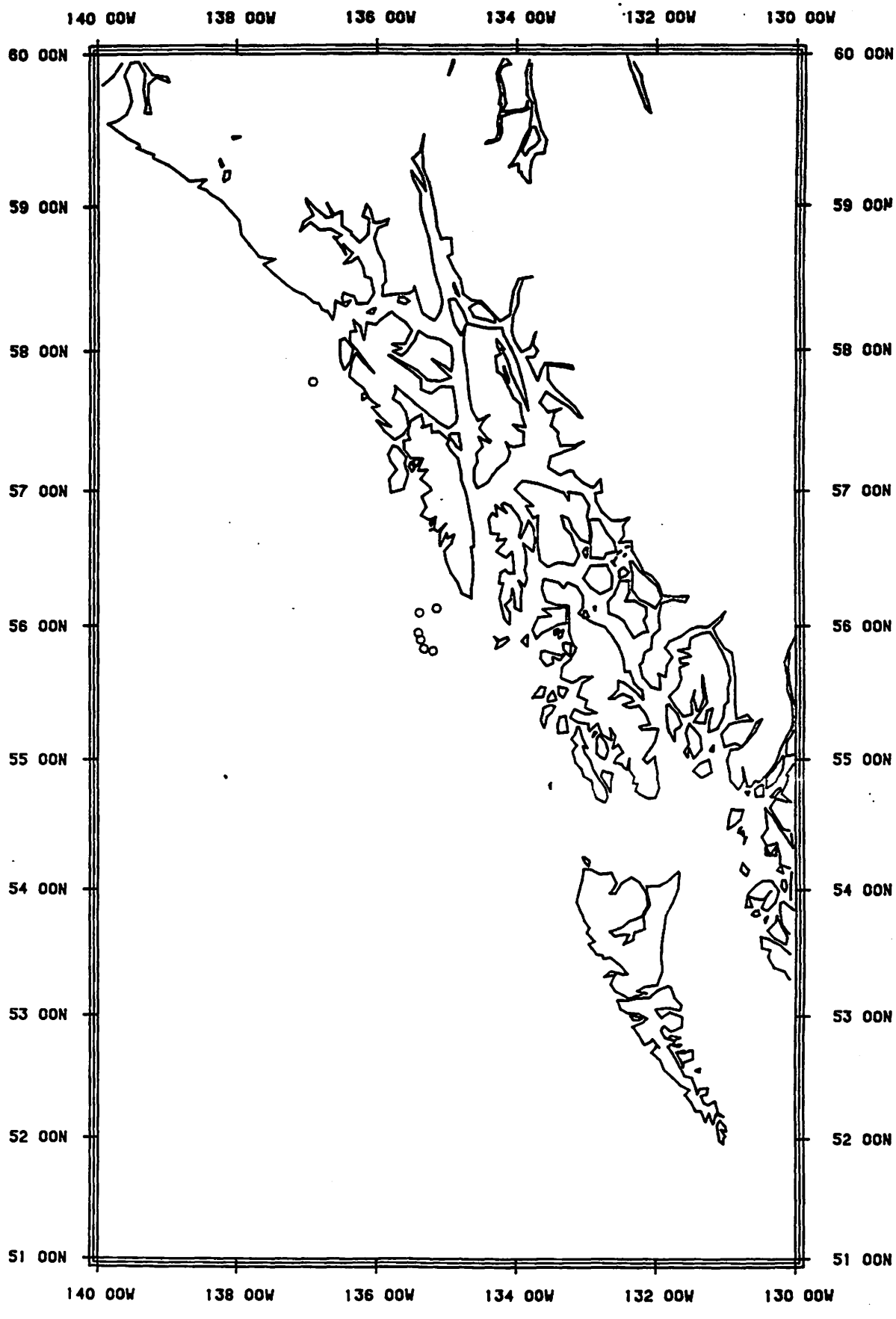
MARCH 90 GULF OF ALASKA TRAWLERS TARGETING SHORTRAKER



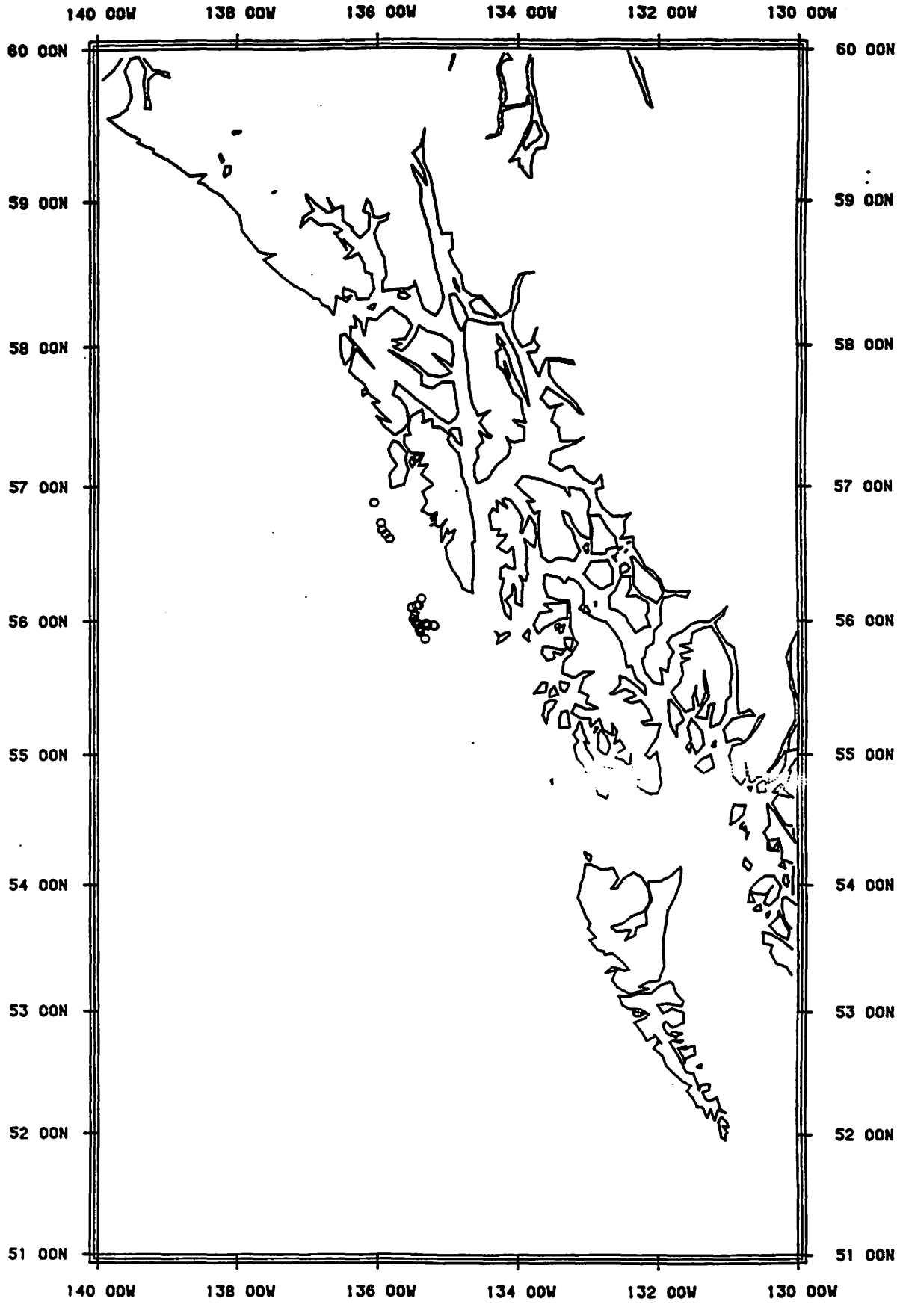
MARCH 90 GULF OF ALASKA TRAWLERS TARGETING ROUGHEYE



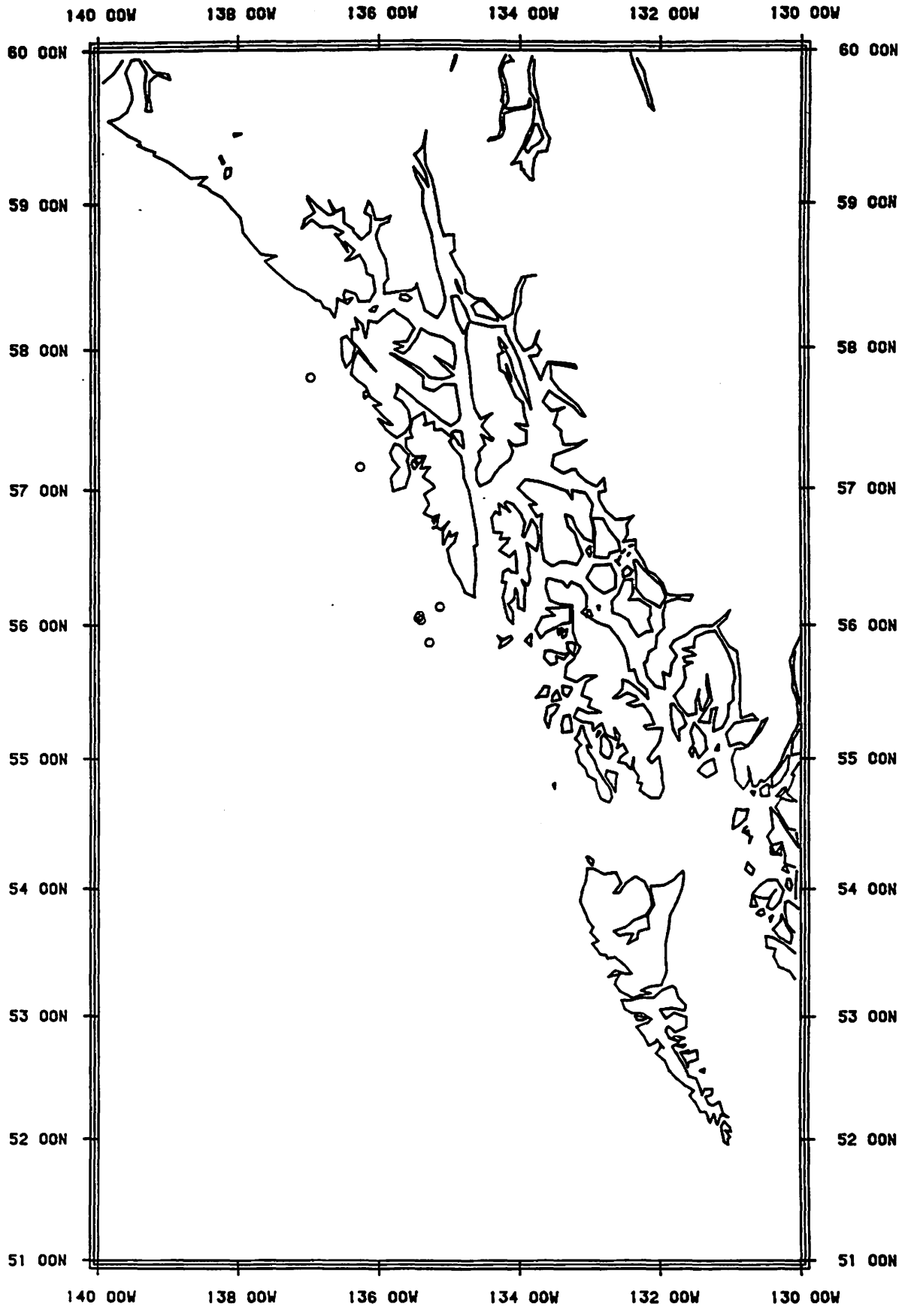
APRIL 90 GULF OF ALASKA TRAWLERS TARGETING ROCKFISH



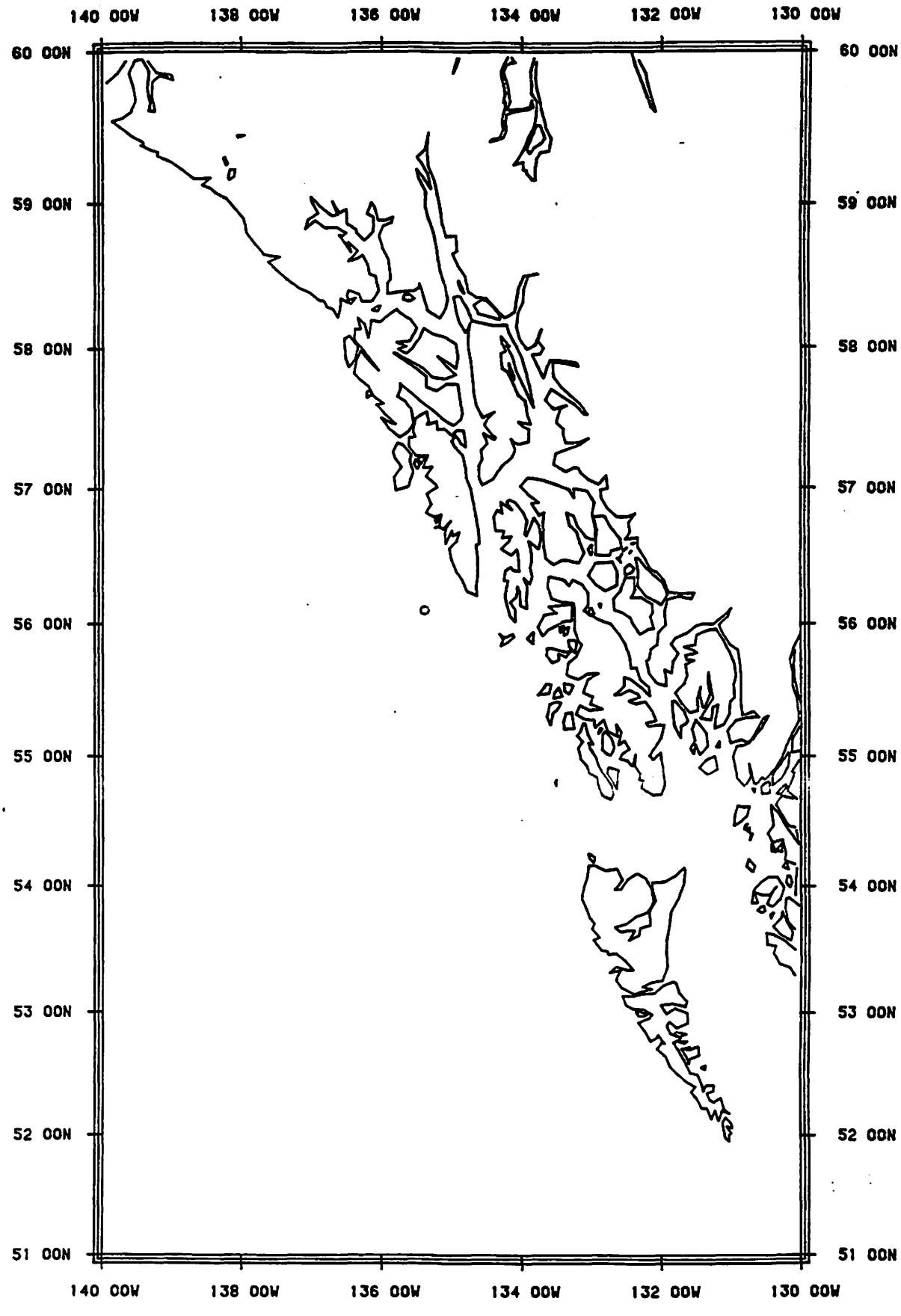
APRIL 90 GULF OF ALASKA TRAWLERS TARGETING ROUGHEYE



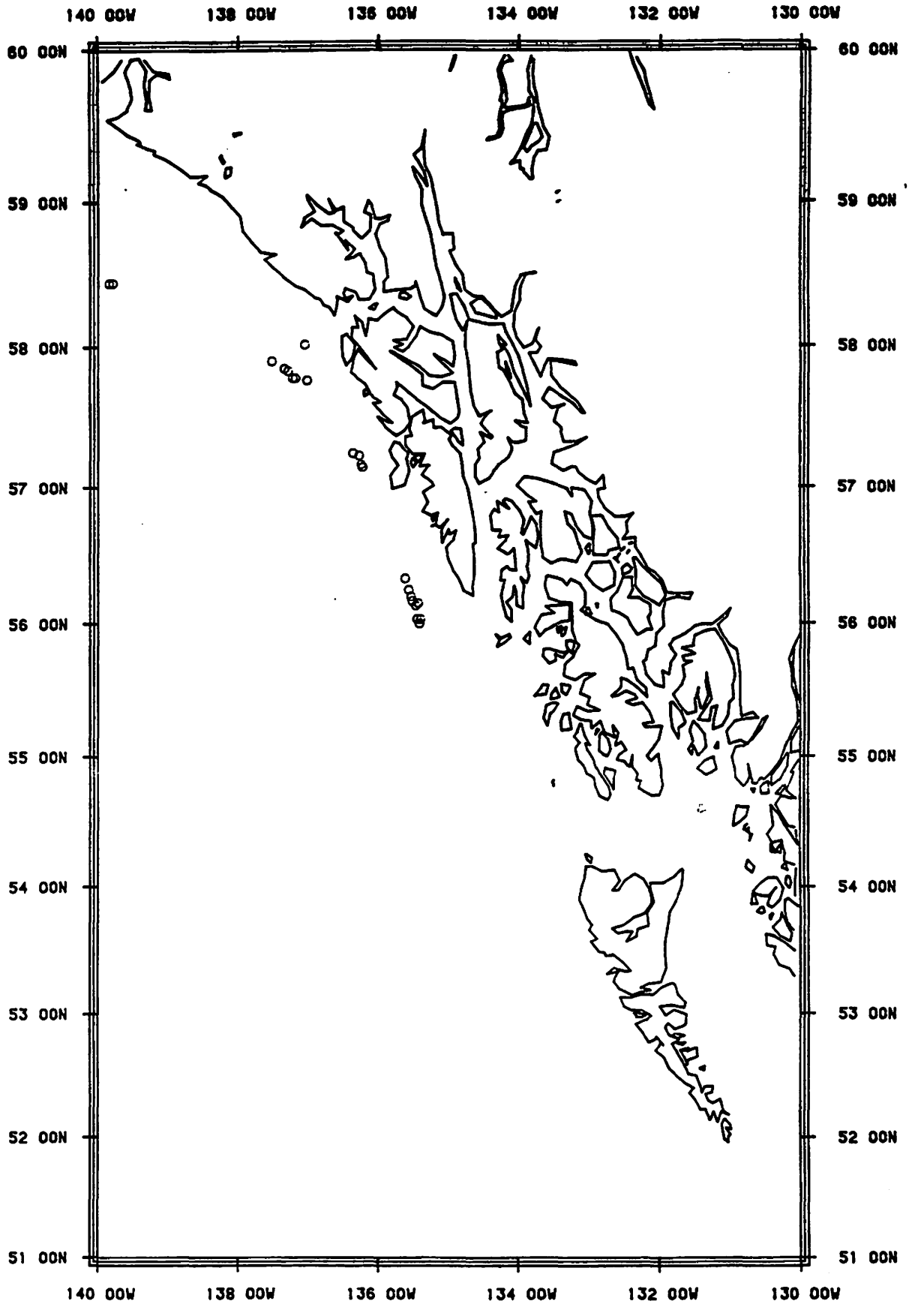
APRIL 90 GULF OF ALASKA TRAWLERS TARGETING POP



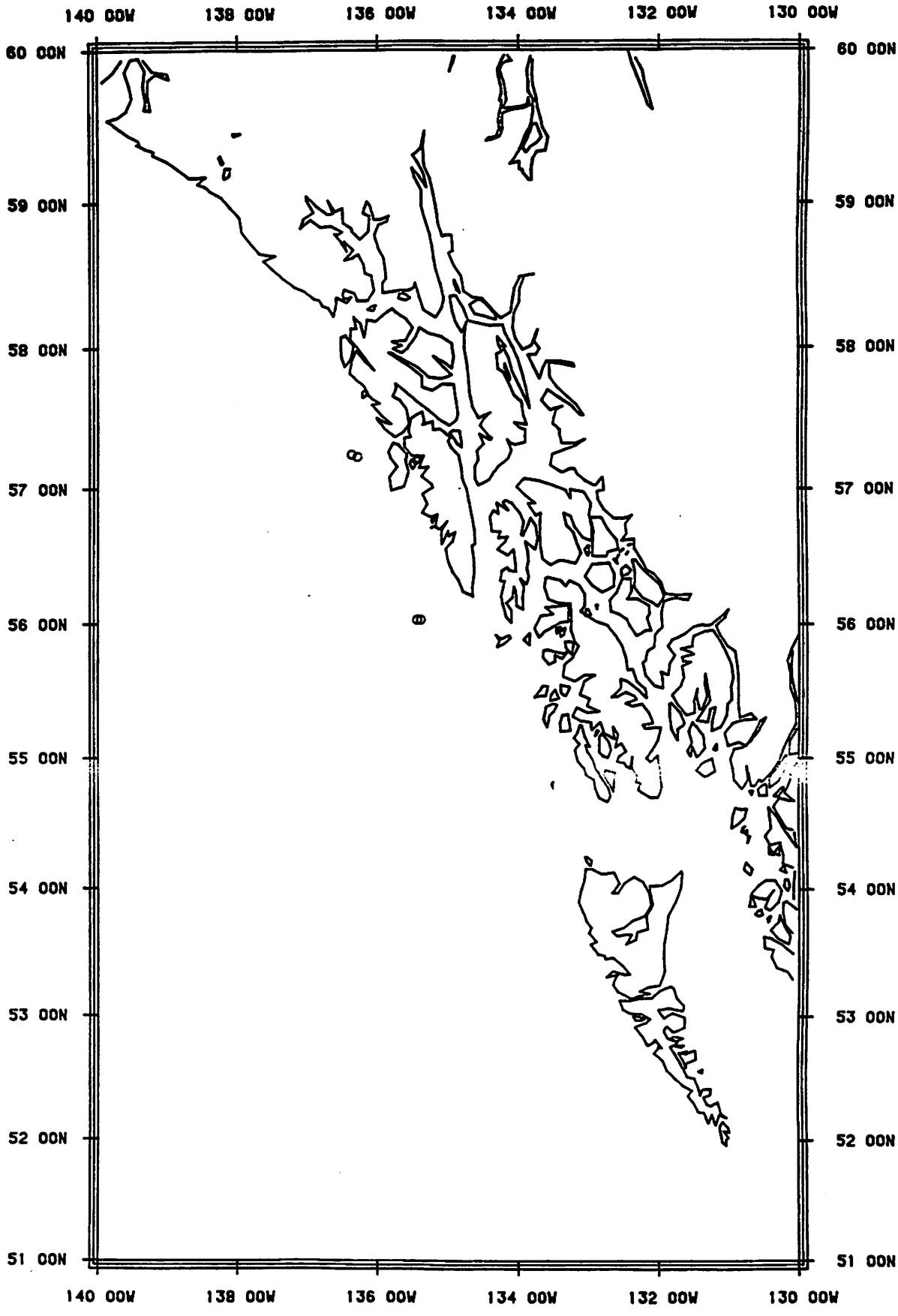
APRIL 90 GULF OF ALASKA TRAWLERS TARGETING SHORTRAKER



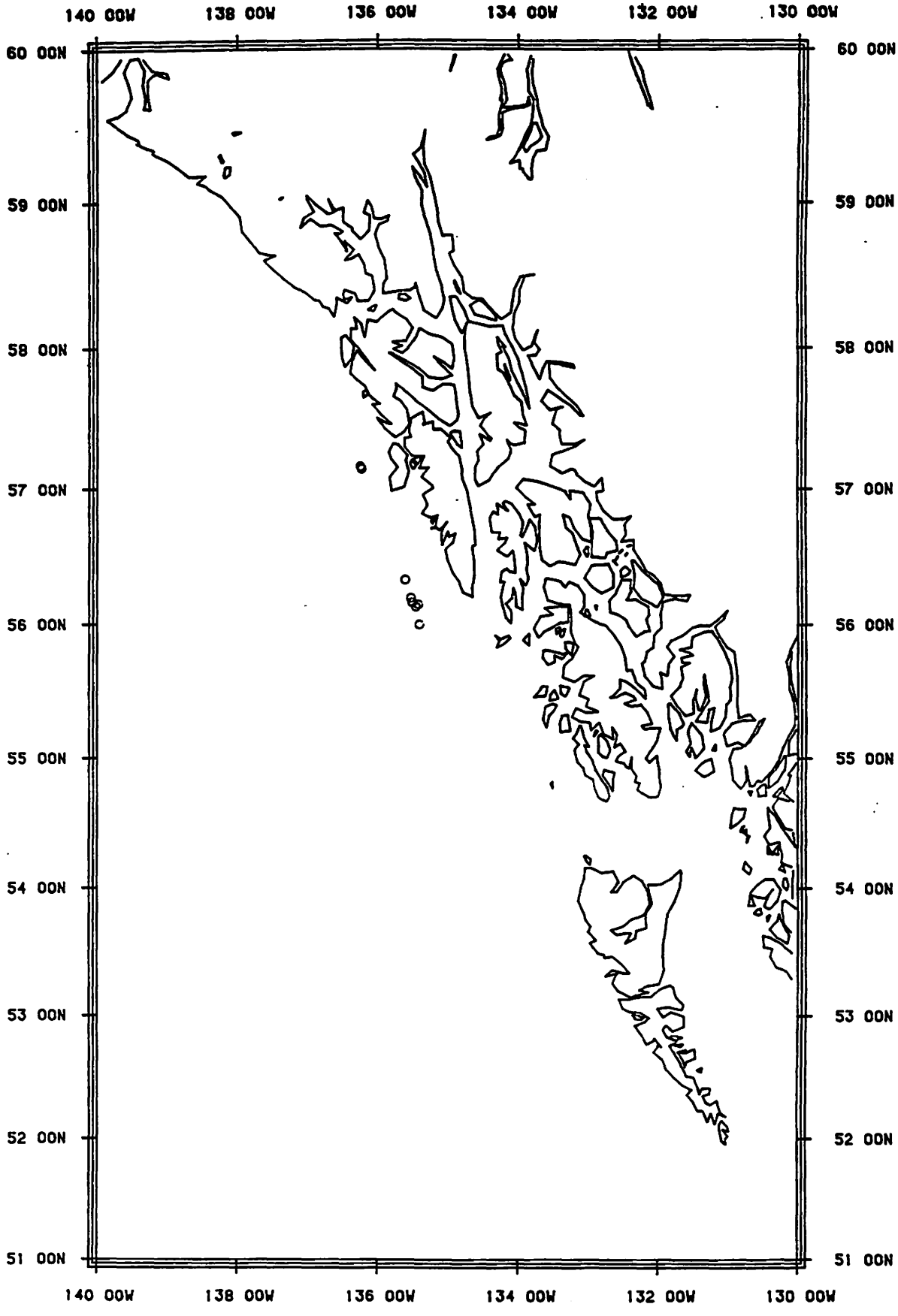
APRIL 90 GULF OF ALASKA TRAWLERS TARGETING THORNYHEAD



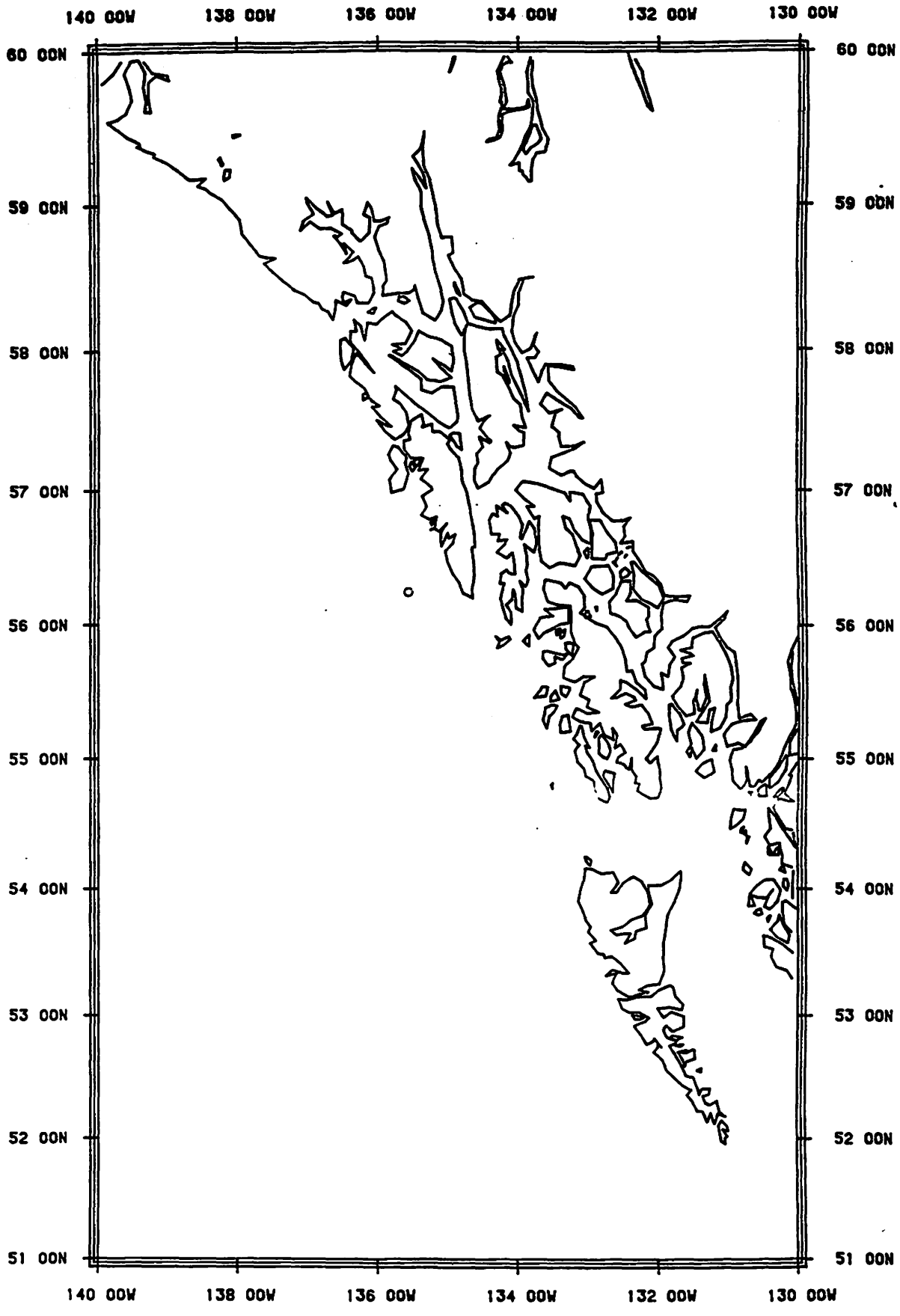
MAY 90 GULF OF ALASKA TRAWLERS TARGETING ROCKFISH



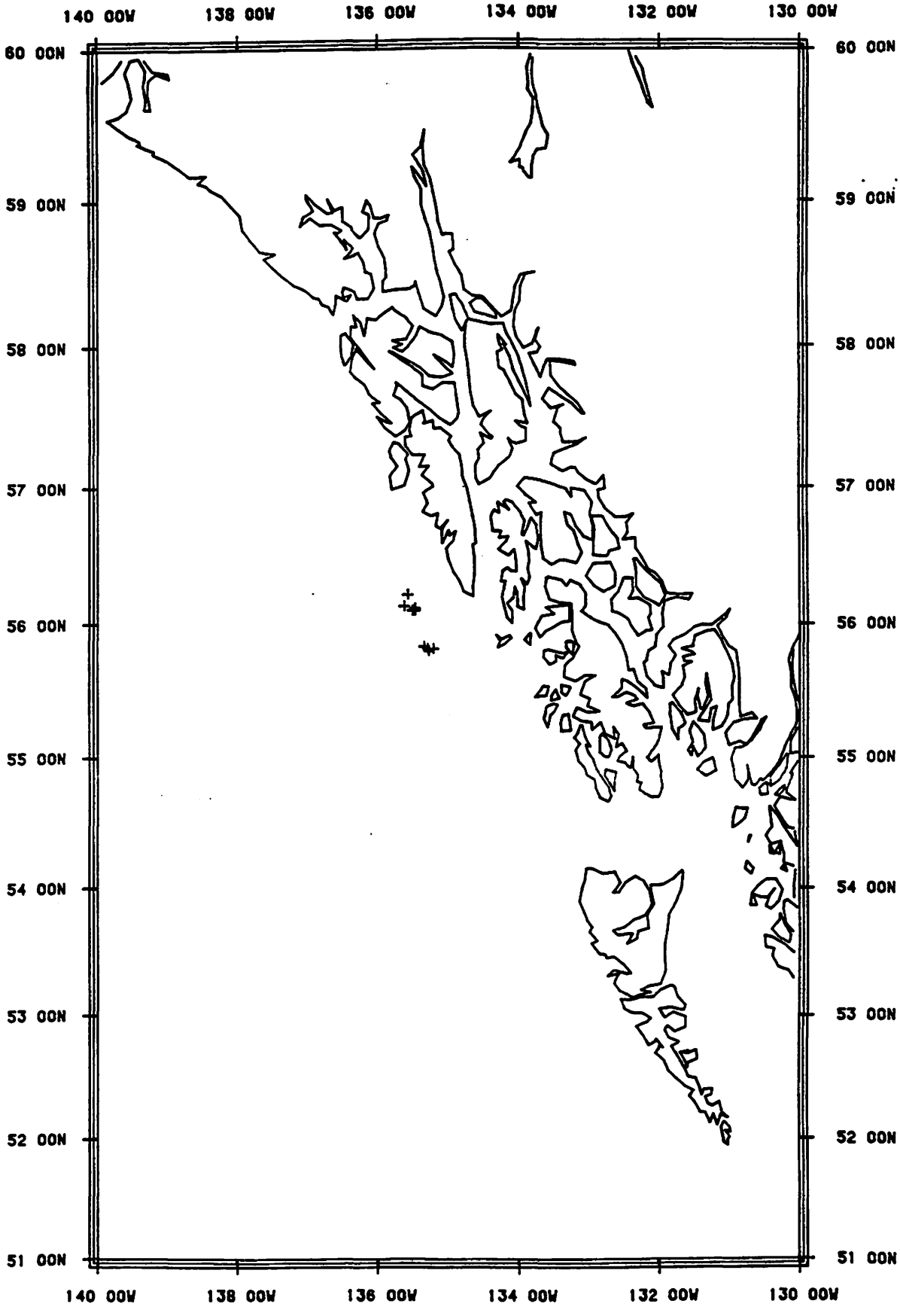
MAY 90 GULF OF ALASKA TRAWLERS TARGETING ROUGHEYE



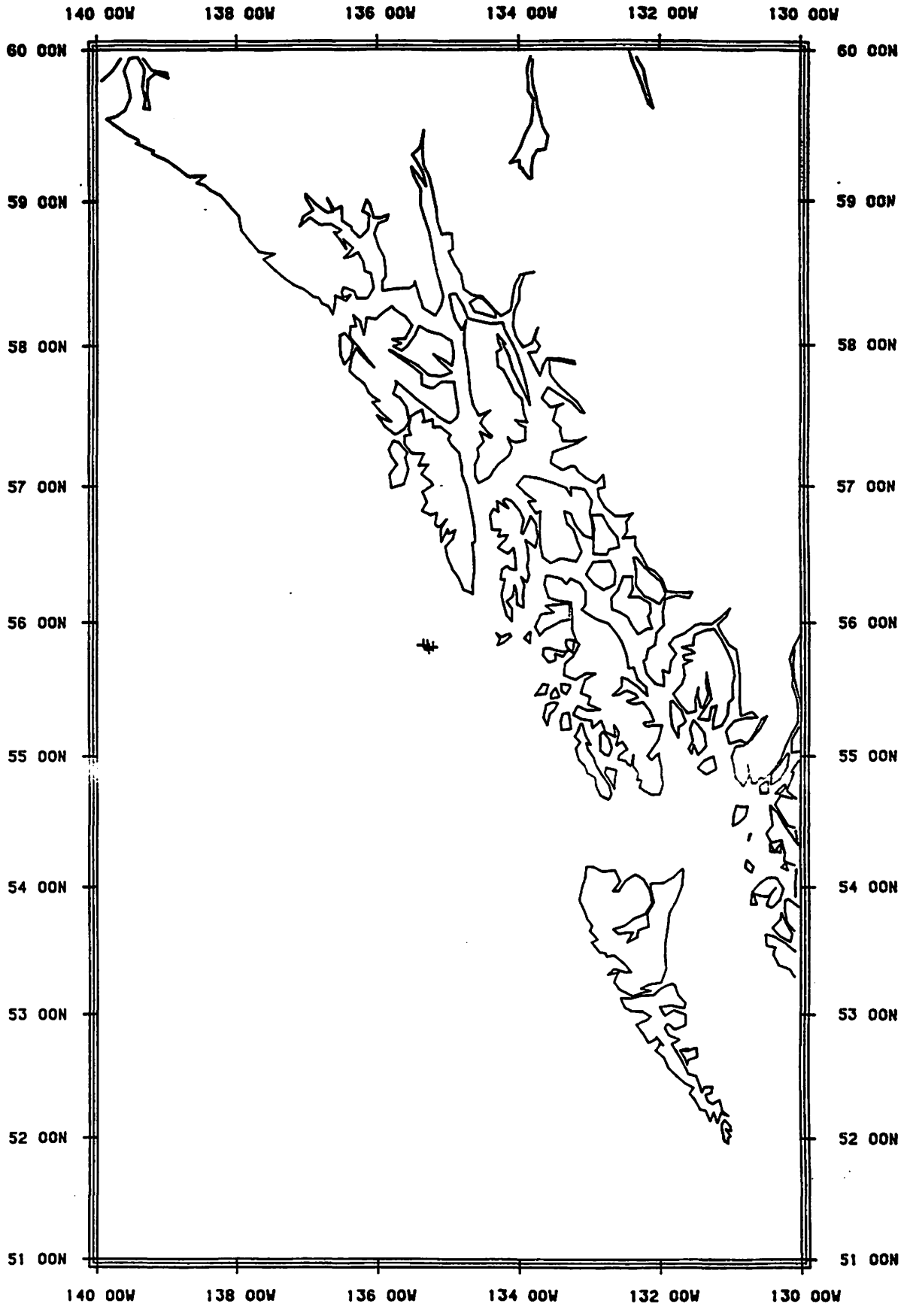
MAY 90 GULF OF ALASKA TRAWLERS TARGETING POP



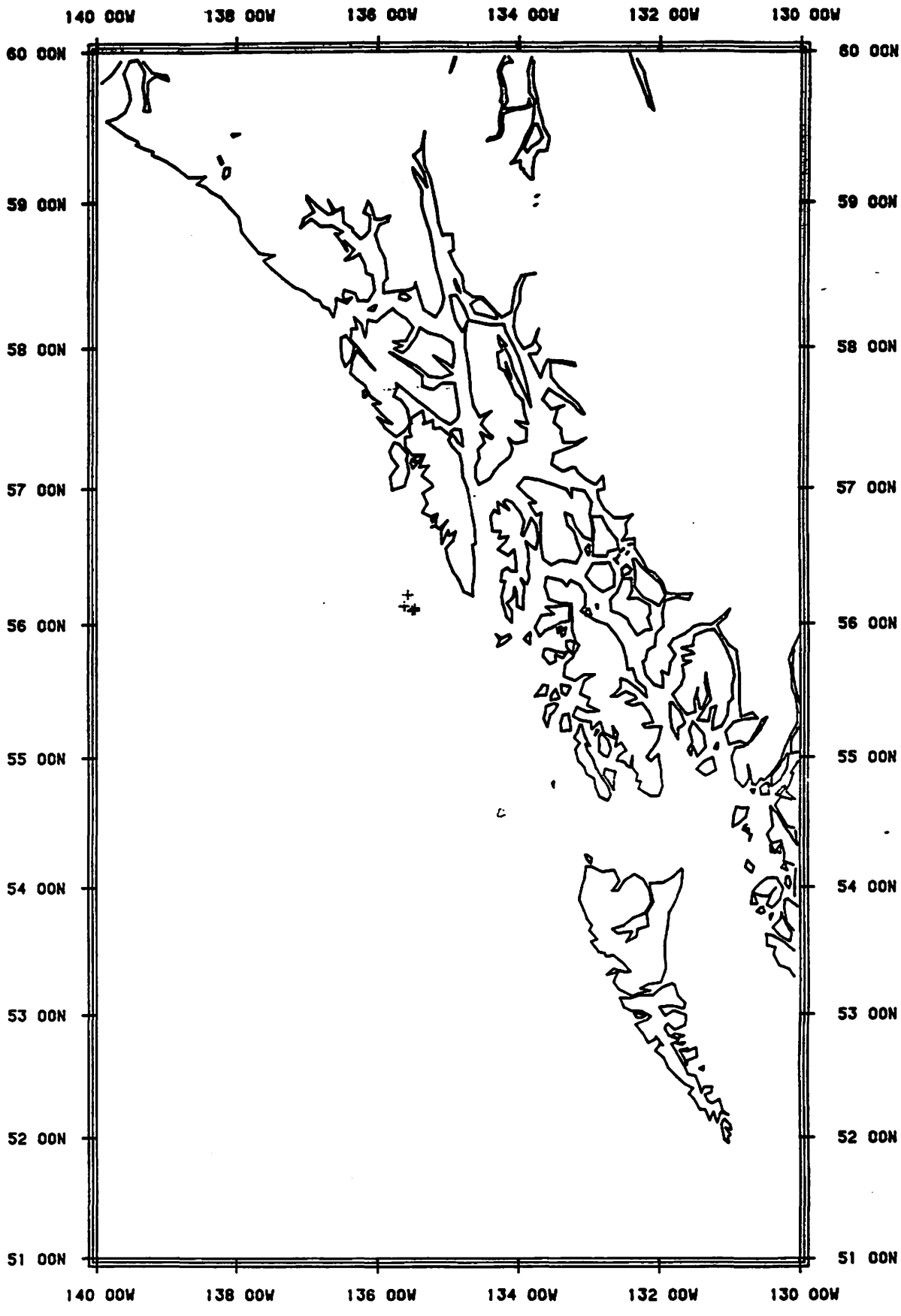
MAY 90 GULF OF ALASKA TRAWLERS TARGETING SHORTRAKER



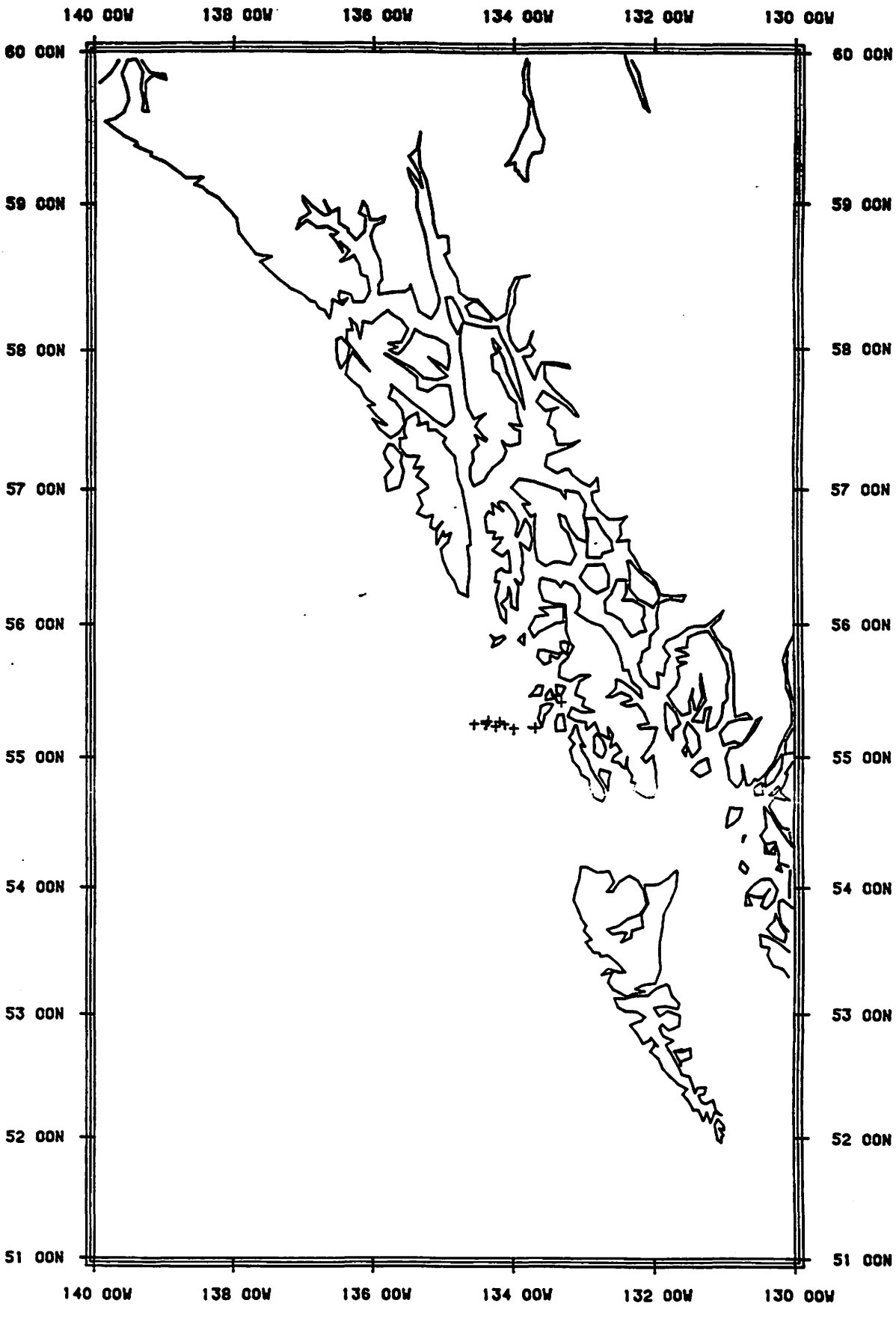
APRIL 90 GULF OF ALASKA LONGLINE TARGETING ON ROCKFISH



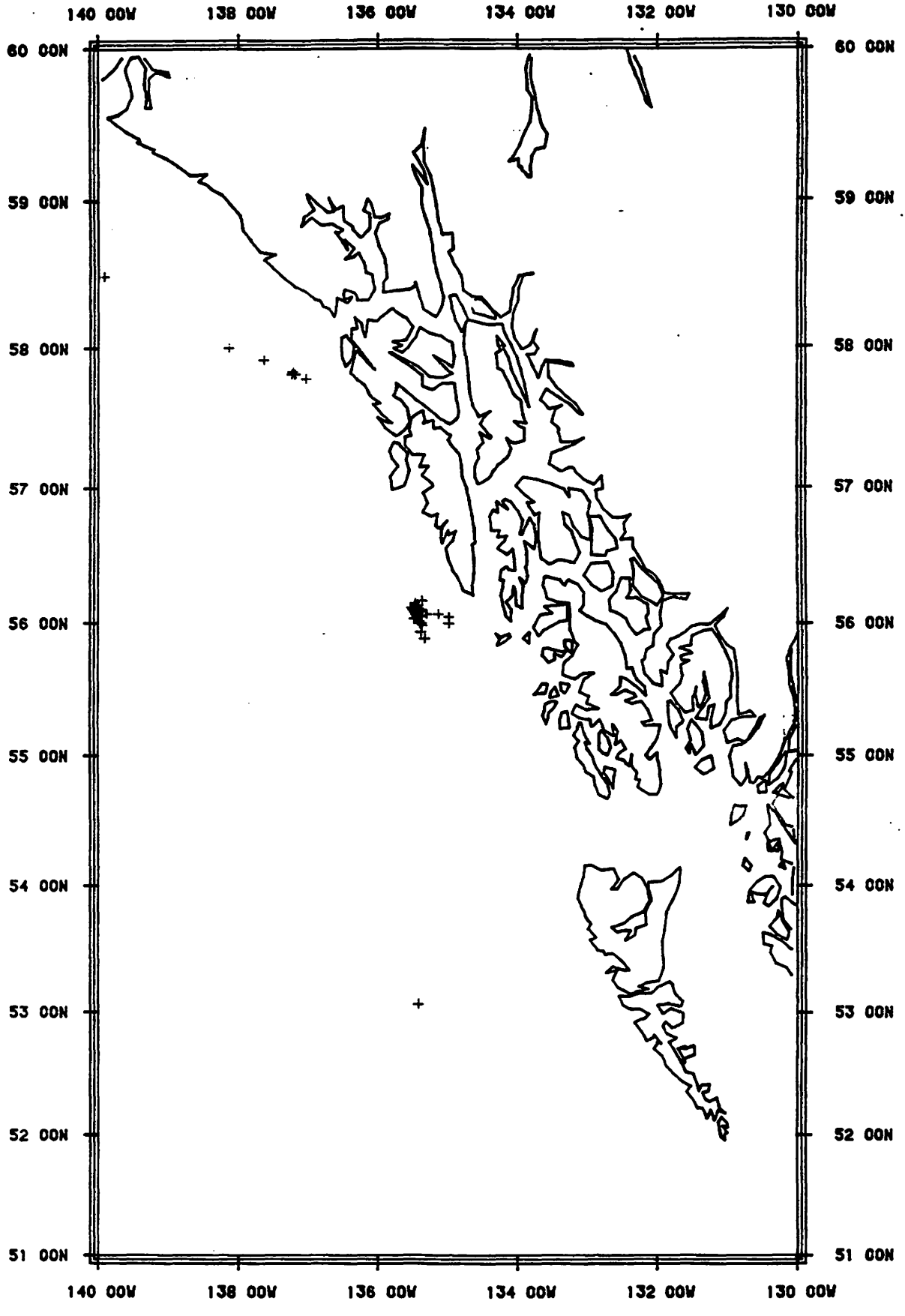
APRIL 90 GULF OF ALASKA LONGLINERS TARGETING THORNYHEAD



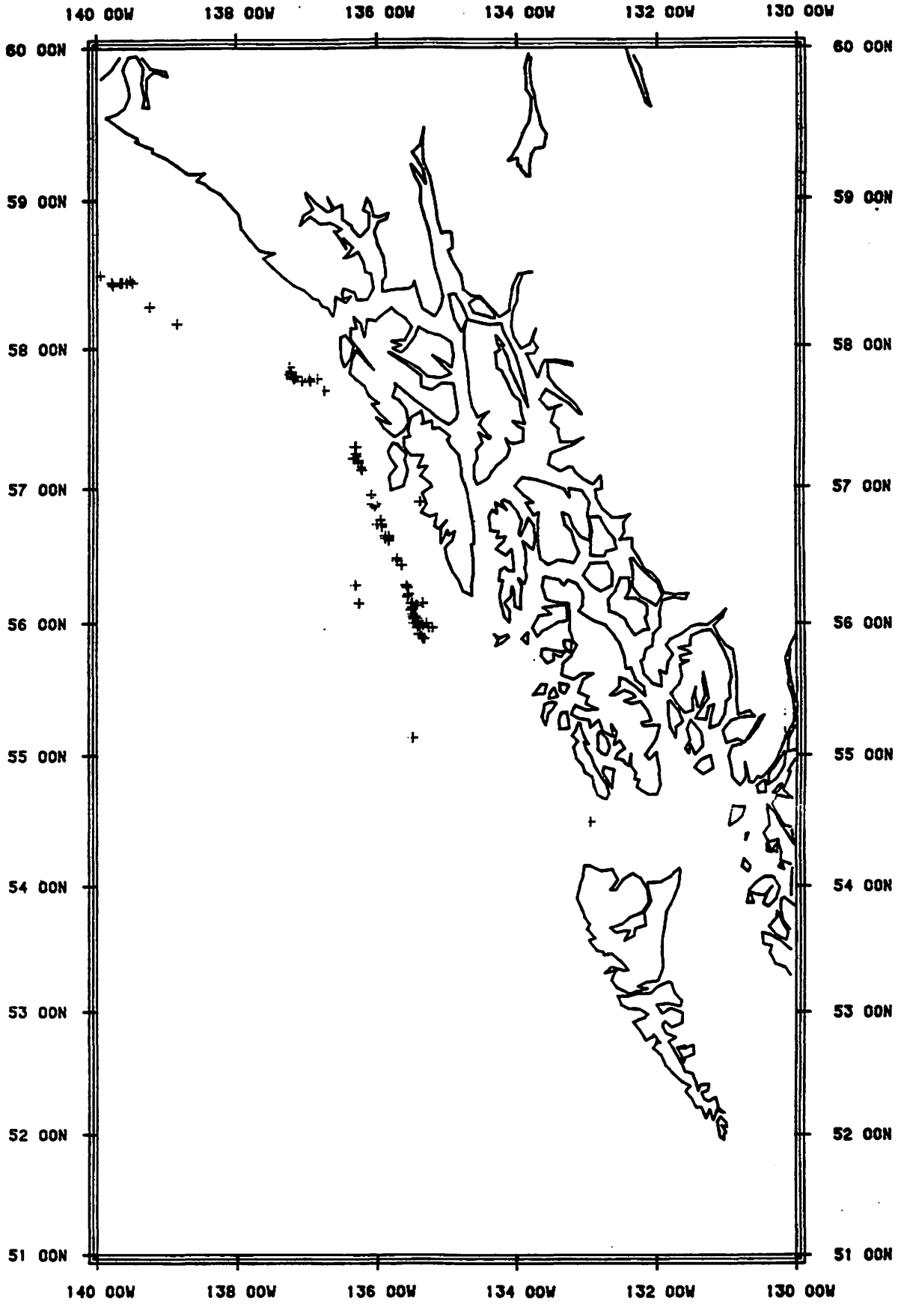
APRIL 90 GULF OF ALASKA LONGLINERS TARGETING OTHER ROCKFISH



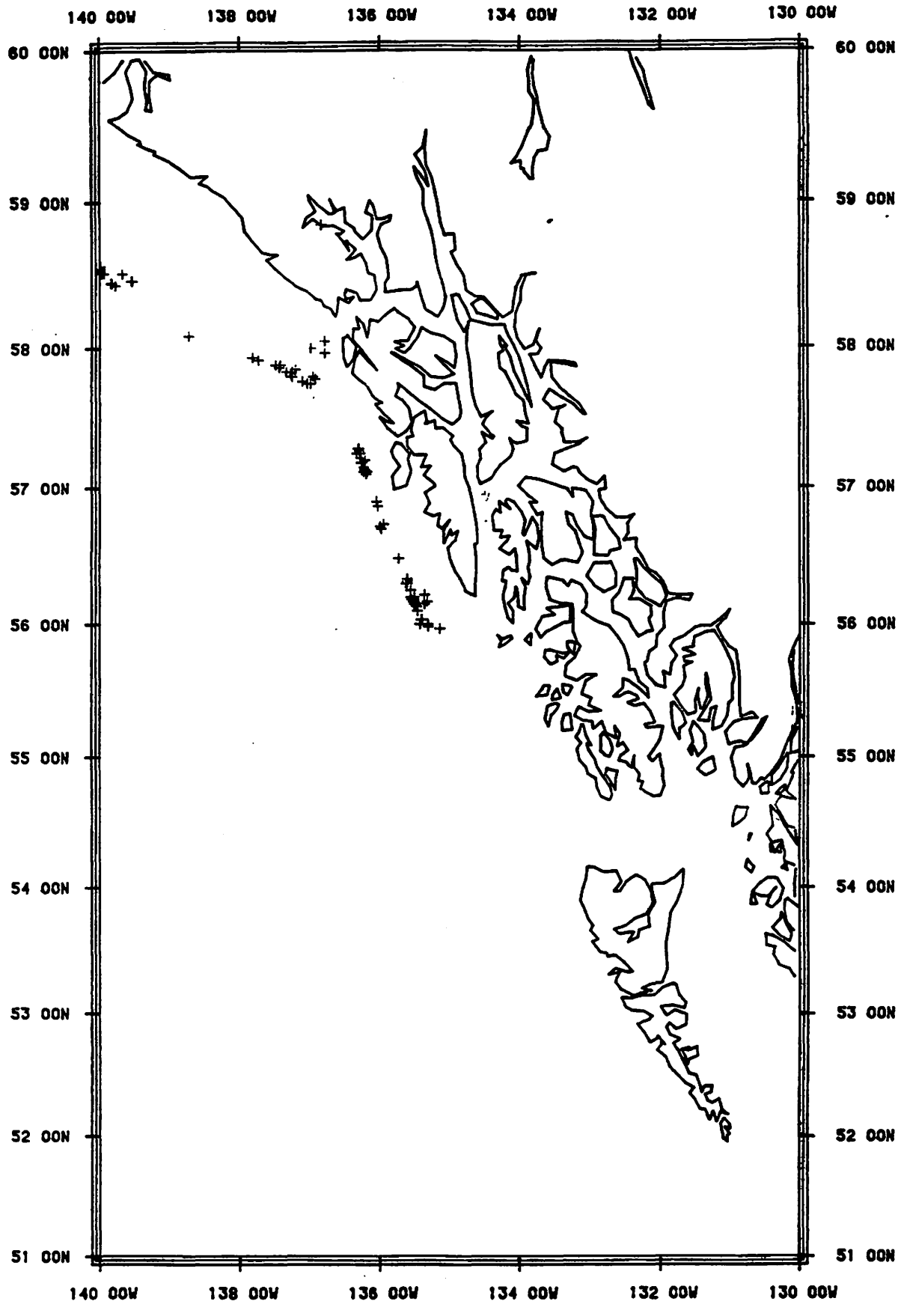
JANUARY 90 LOGBOOK BOTTOM TRAWL VESSELS 60-124 FT



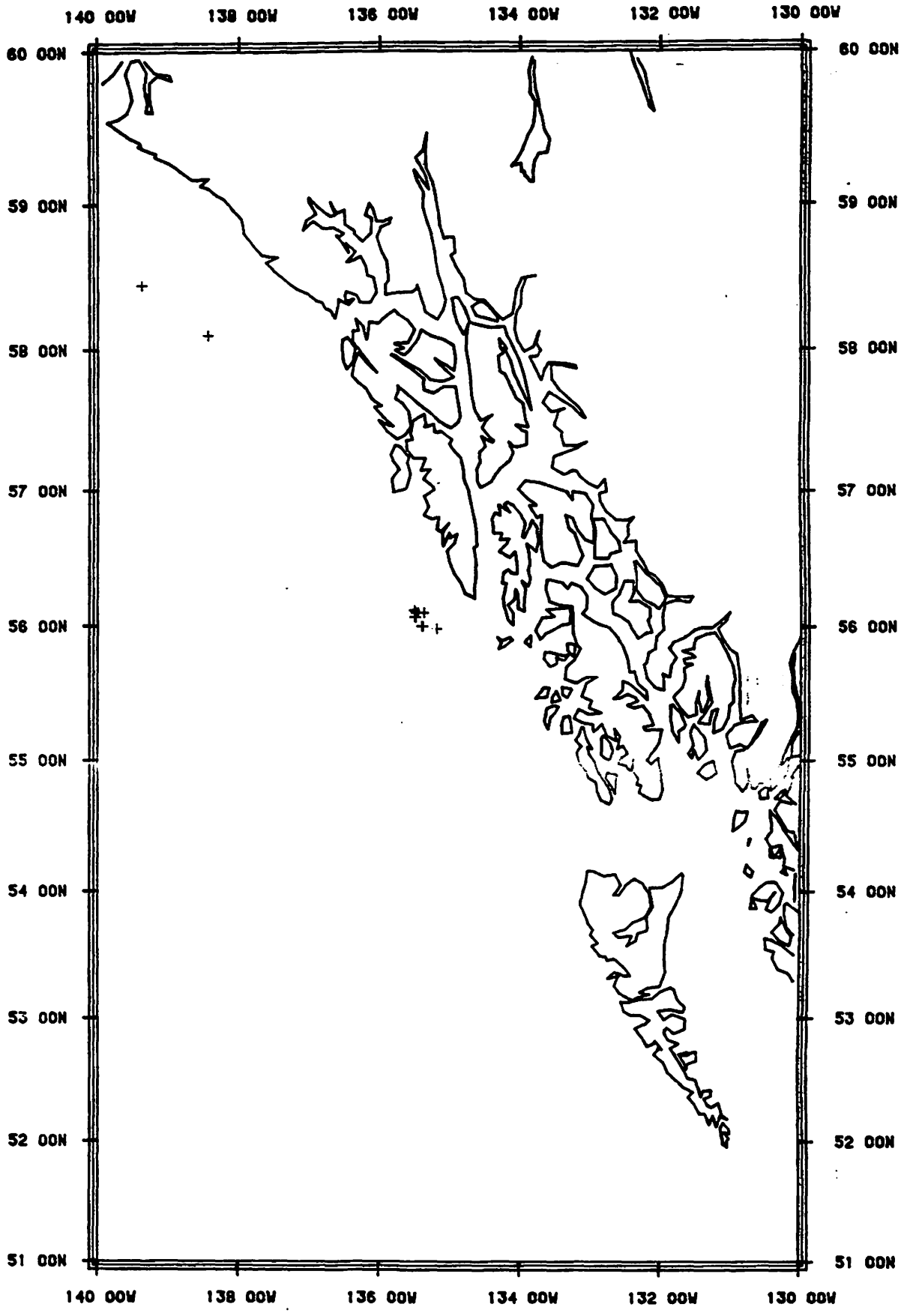
MARCH 90 LOGBOOK(CP) BOTTOM TRAWL VESSELS 125+ FT



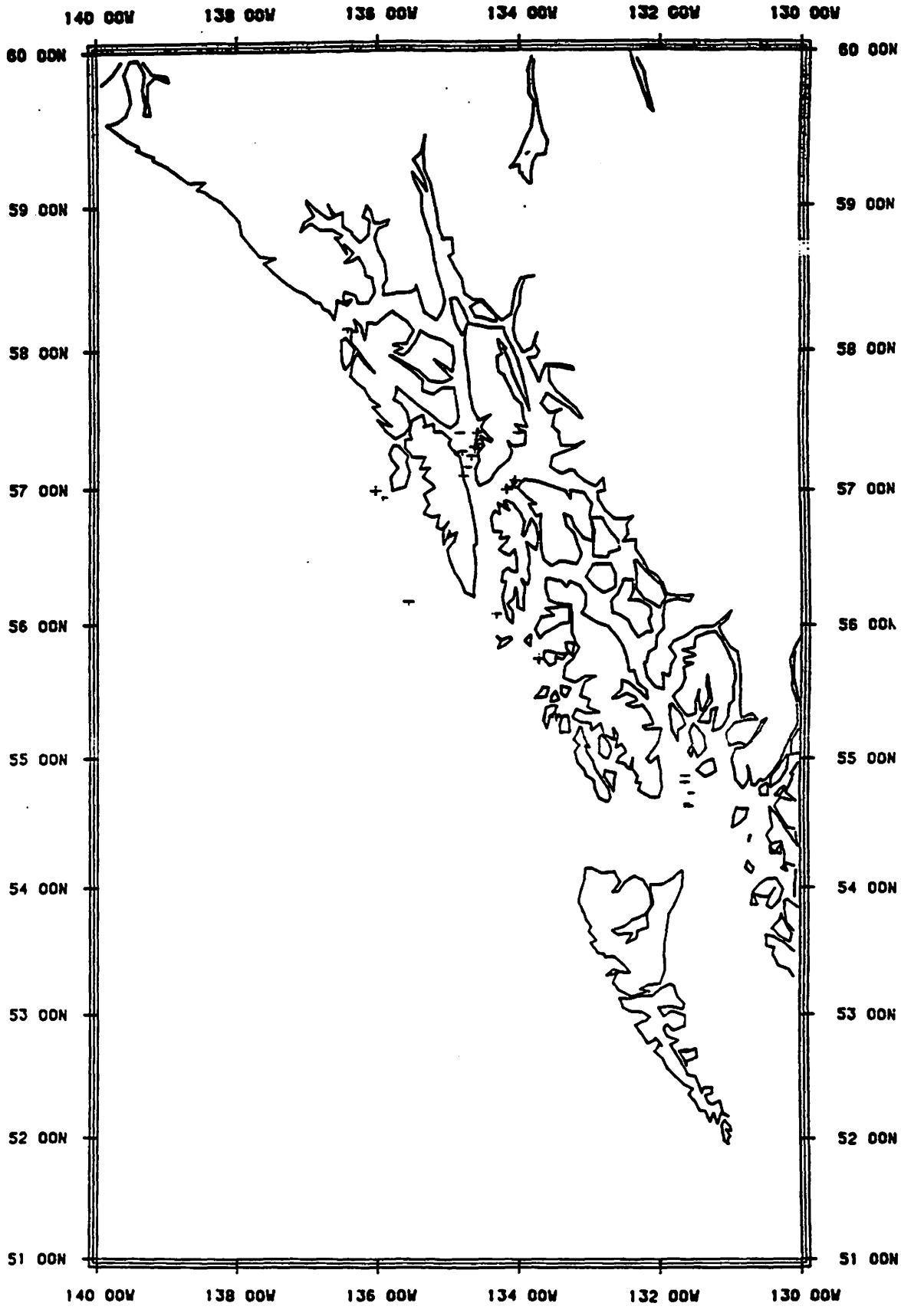
APRIL 90 LOGBOOK(CP) BOTTOM TRAWL VESSELS 125+ FT



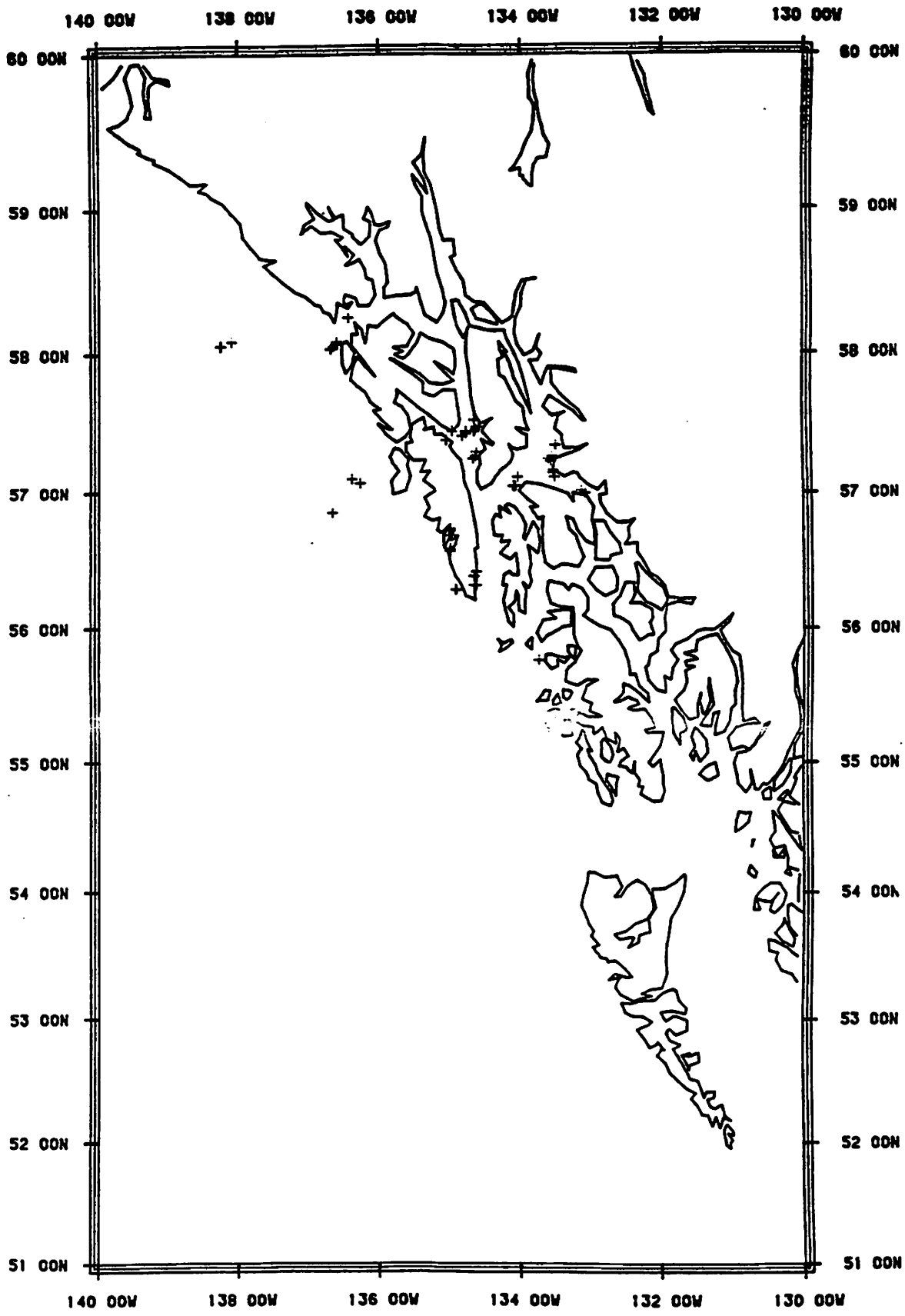
MAY 90 LOGBOOK(CP) BOTTOM TRAWL VESSELS 125+ FT



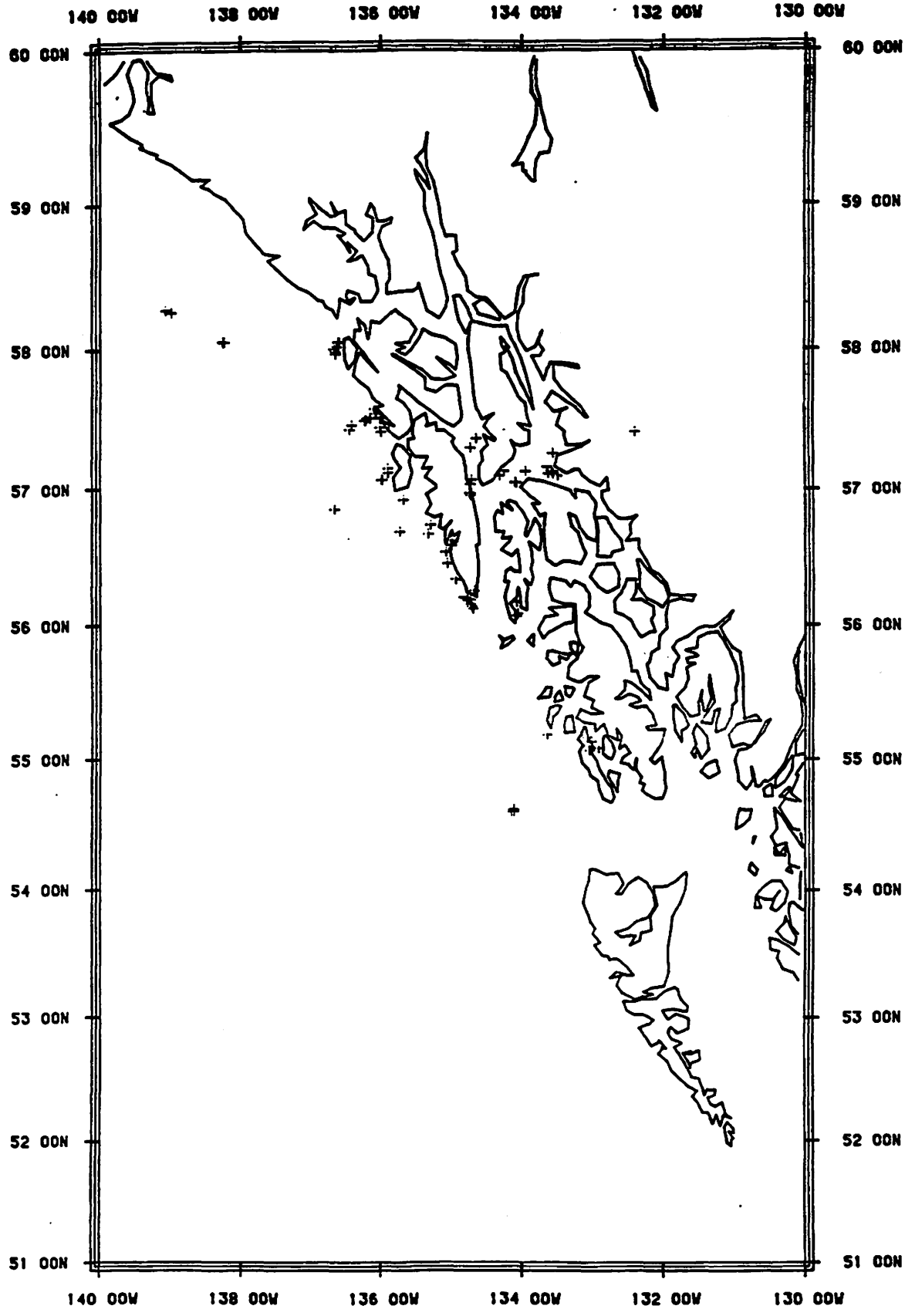
JULY 90 LOGBOOK(CP) BOTTOM TRAWL VESSELS 125+ FT



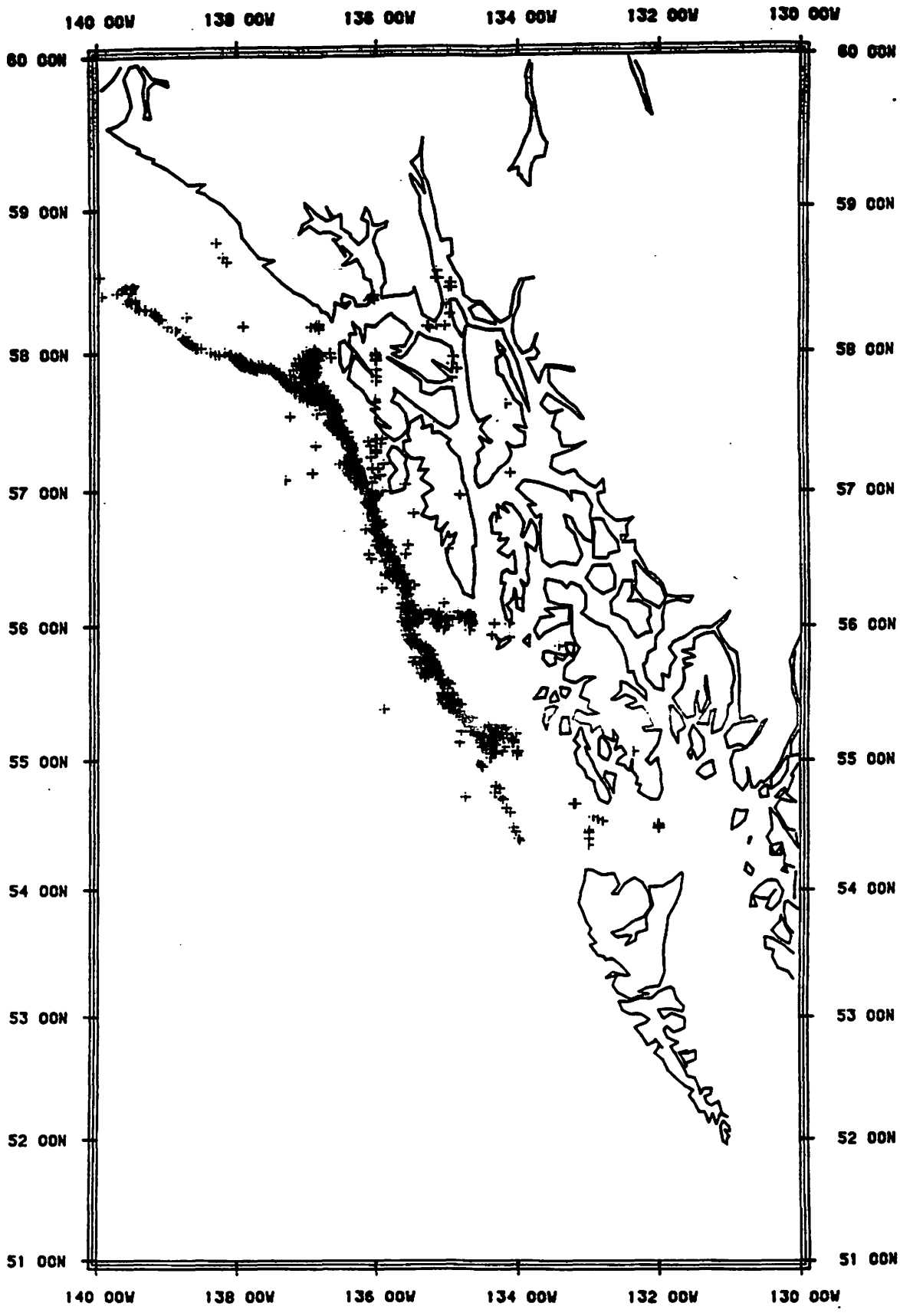
JANUARY 90 LOGBOOK LONGLINE VESSELS <60 FT



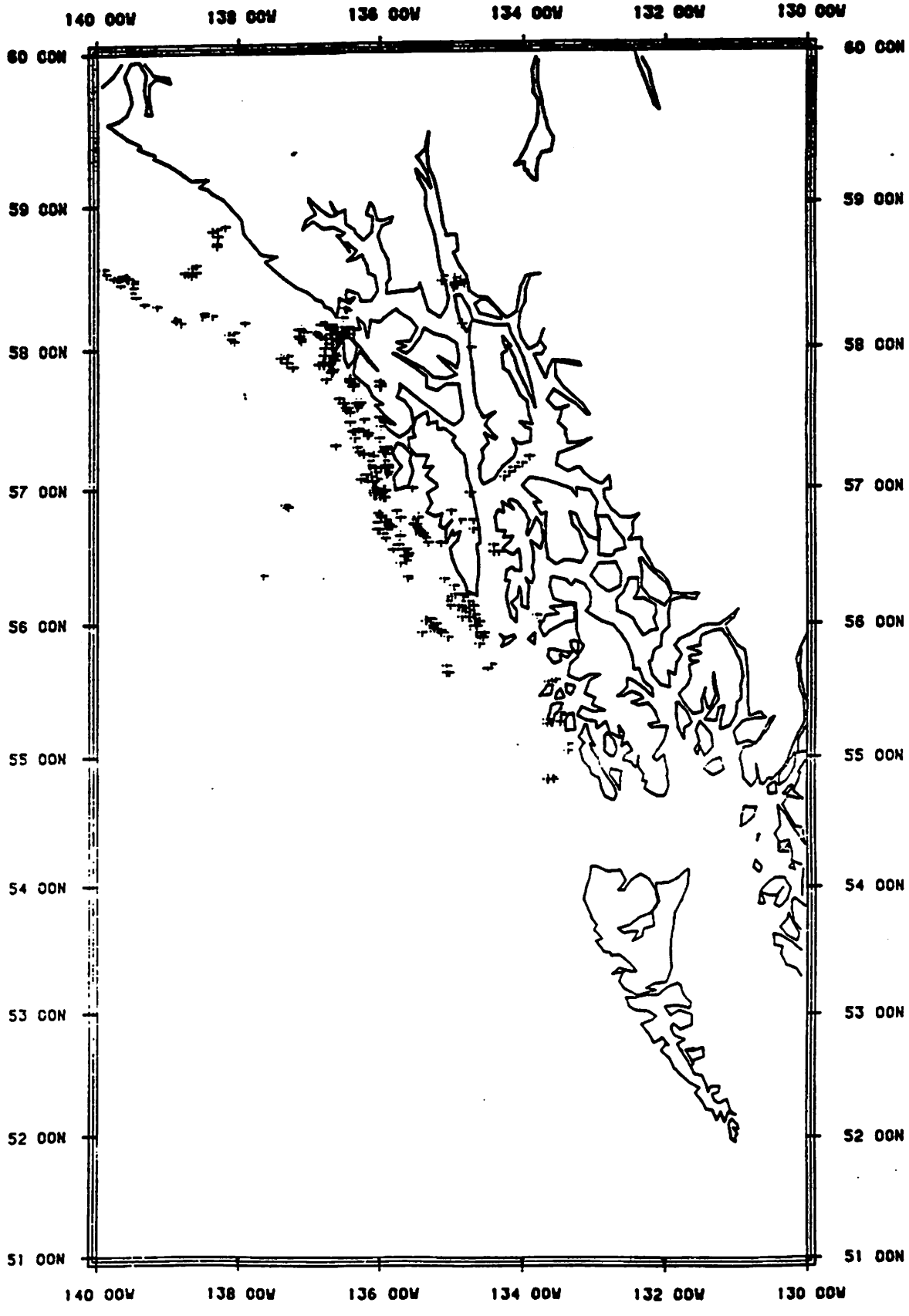
FEBRUARY 90 LOGBOOK LONGLINE VESSELS <60 FT



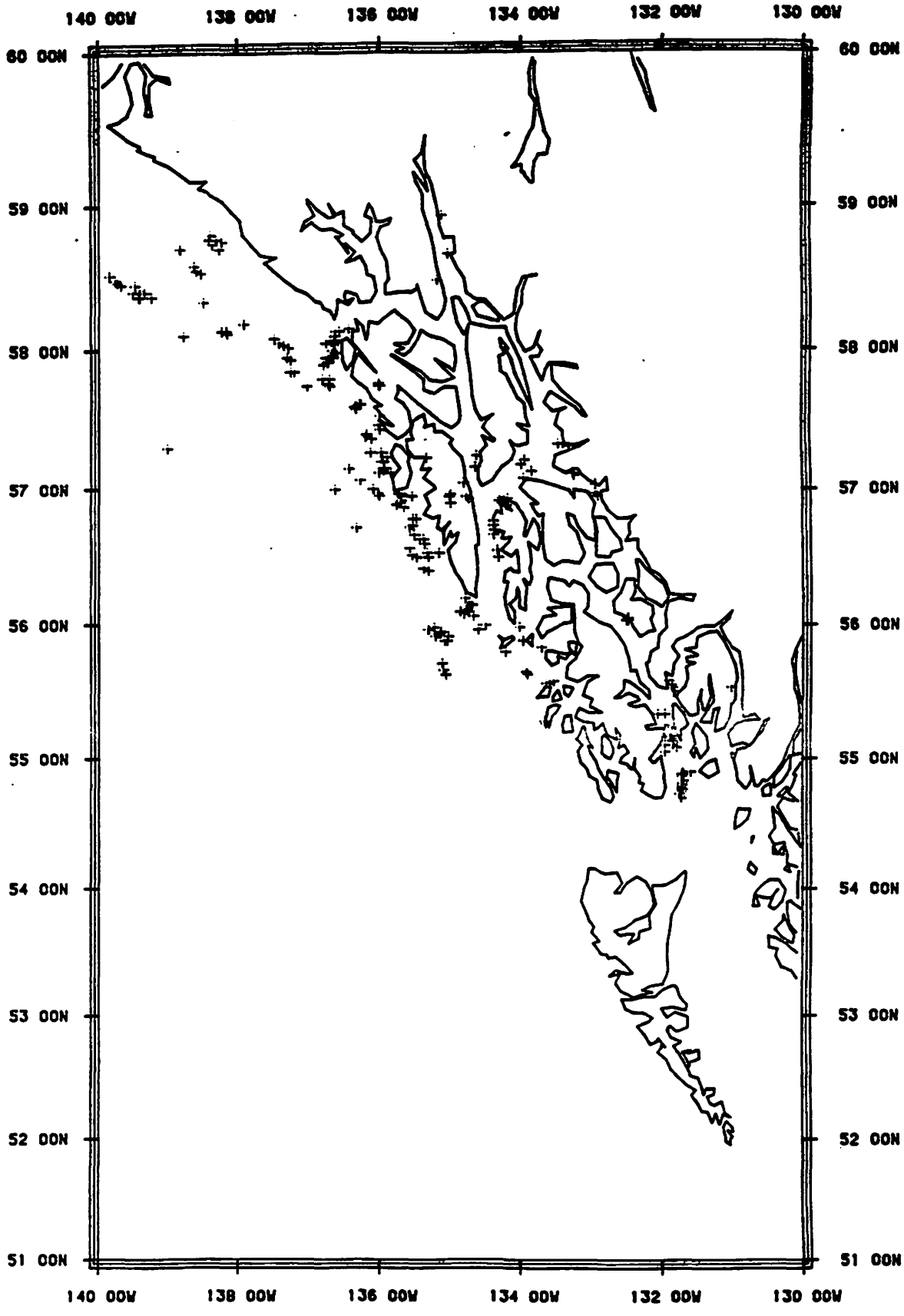
MARCH 90 LOGBOOK LONGLINE VESSELS <60 FT



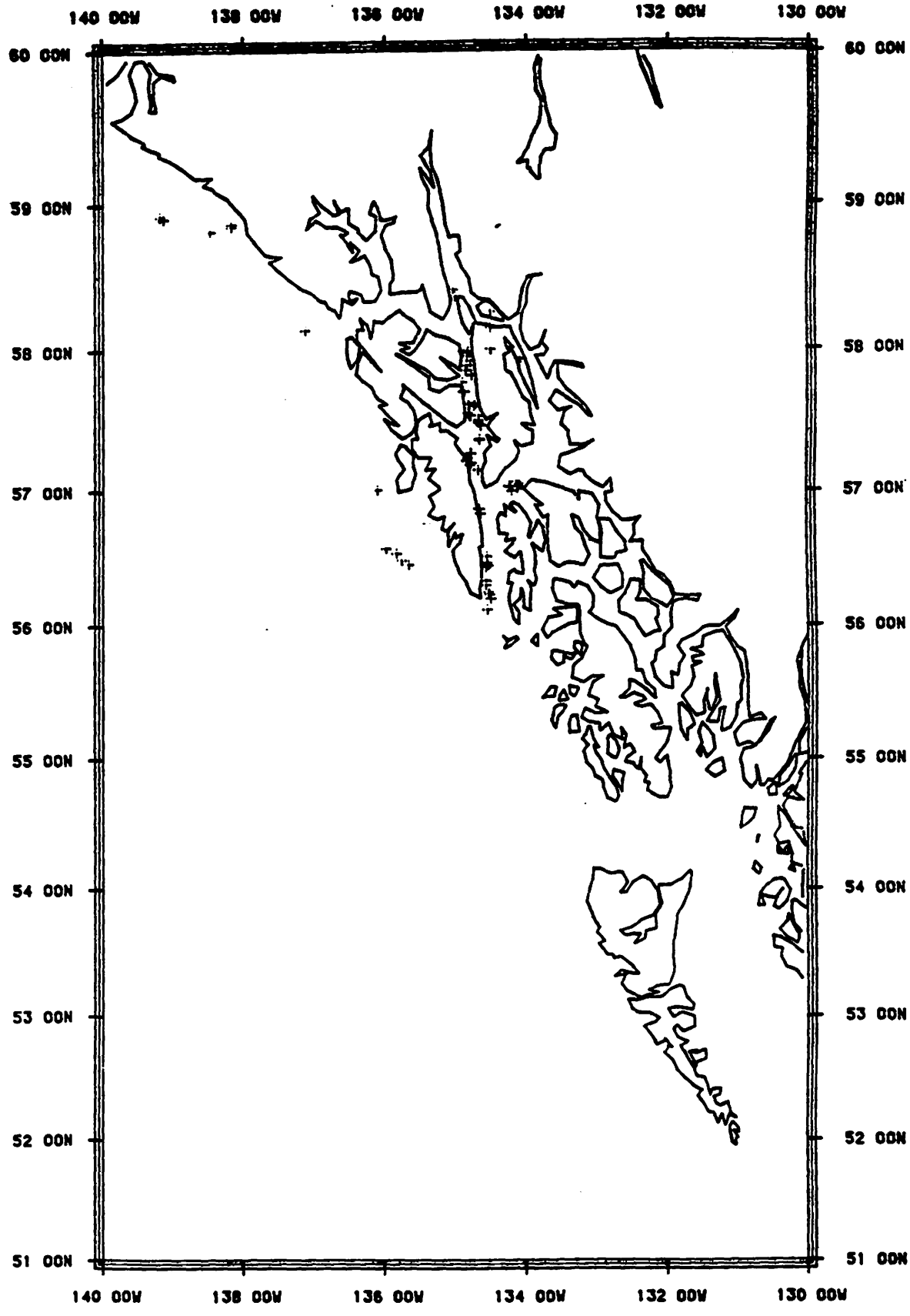
APRIL 90 LOGBOOK LONGLINE VESSELS <60 FT



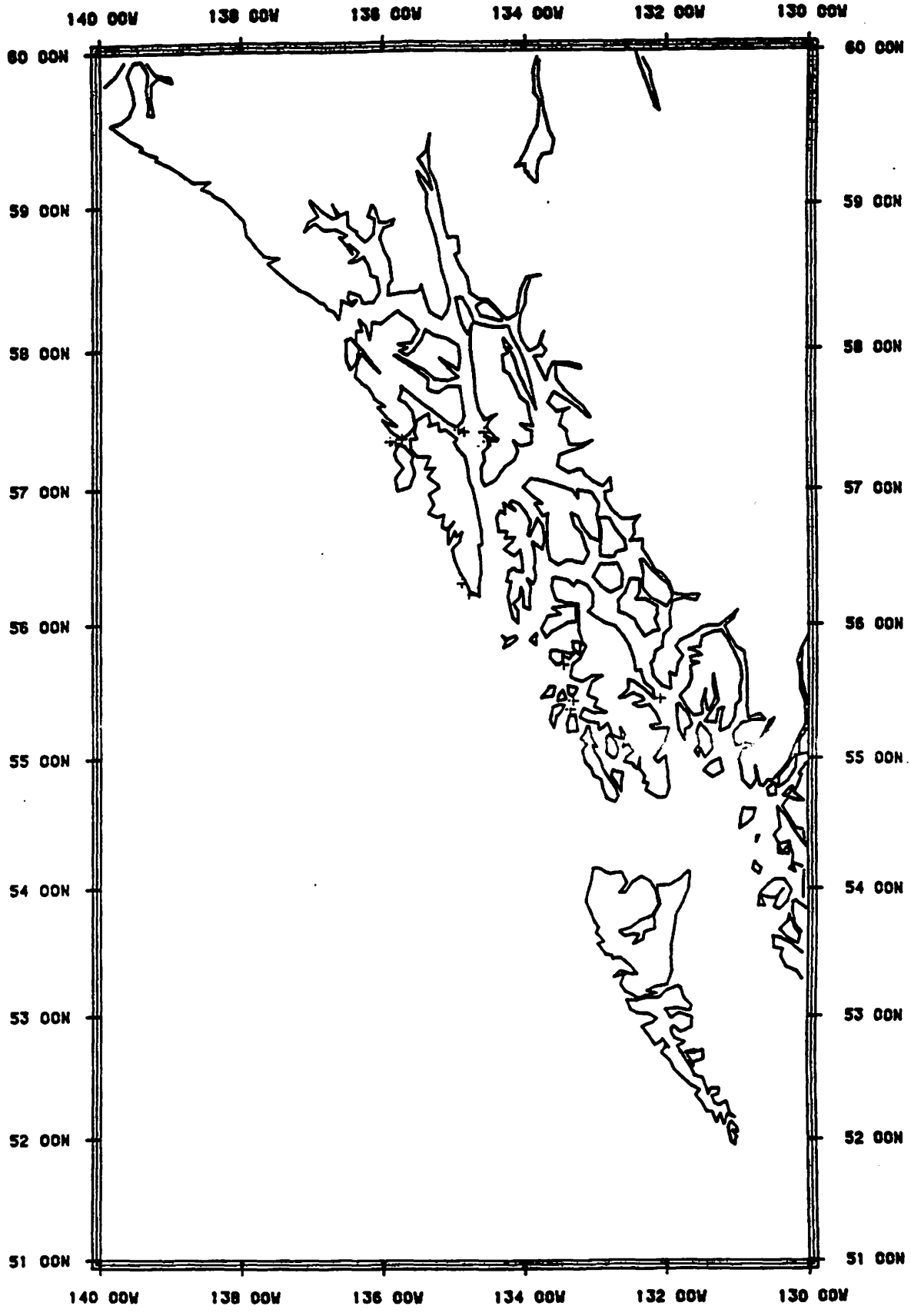
MAY 90 LOGBOOK LONGLINE VESSELS <60 FT



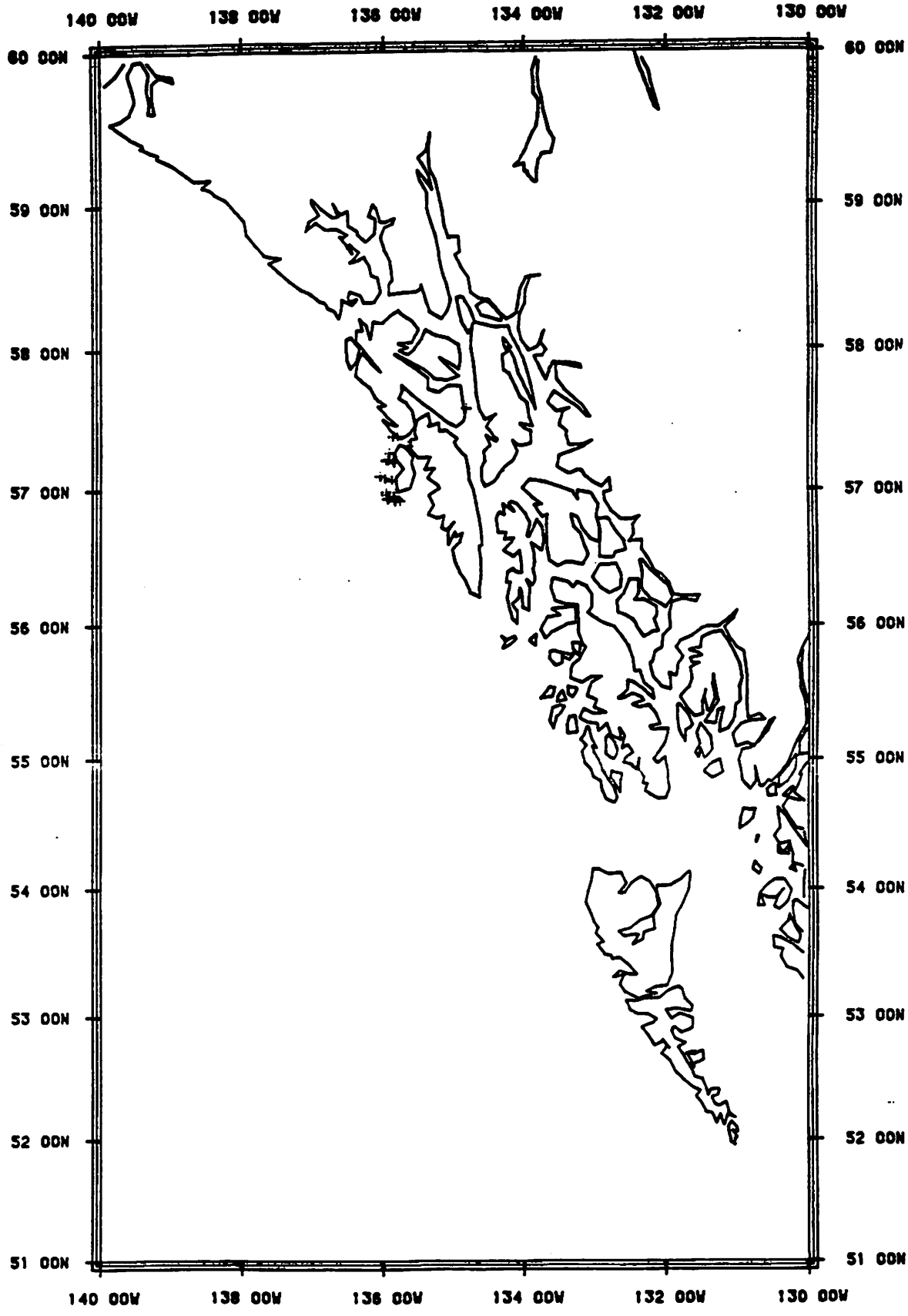
JUNE 90 LOGBOOK LONGLINE VESSELS <60 FT



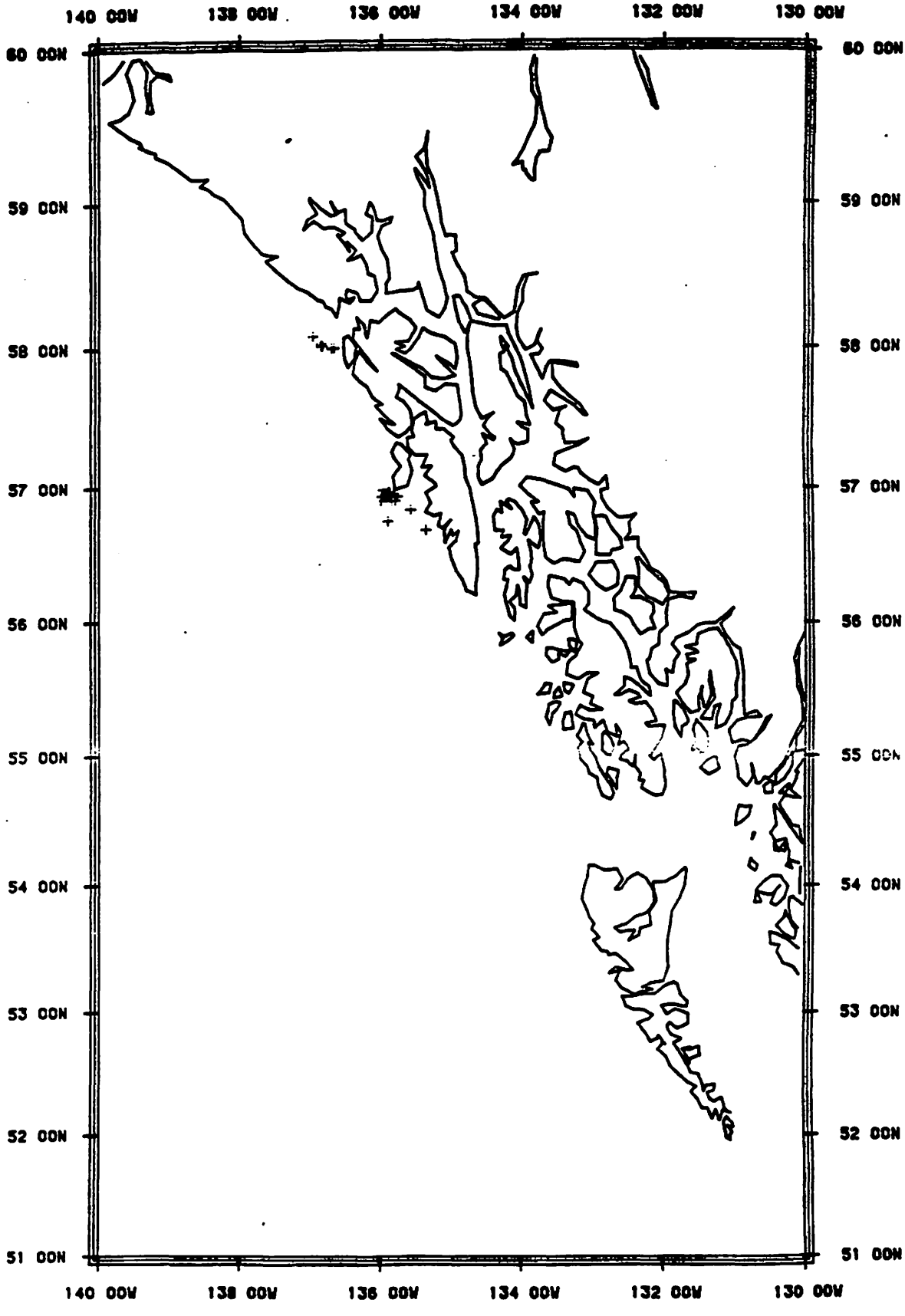
SEPTEMBER 90 LOGBOOK LONGLINE VESSELS <60 FT



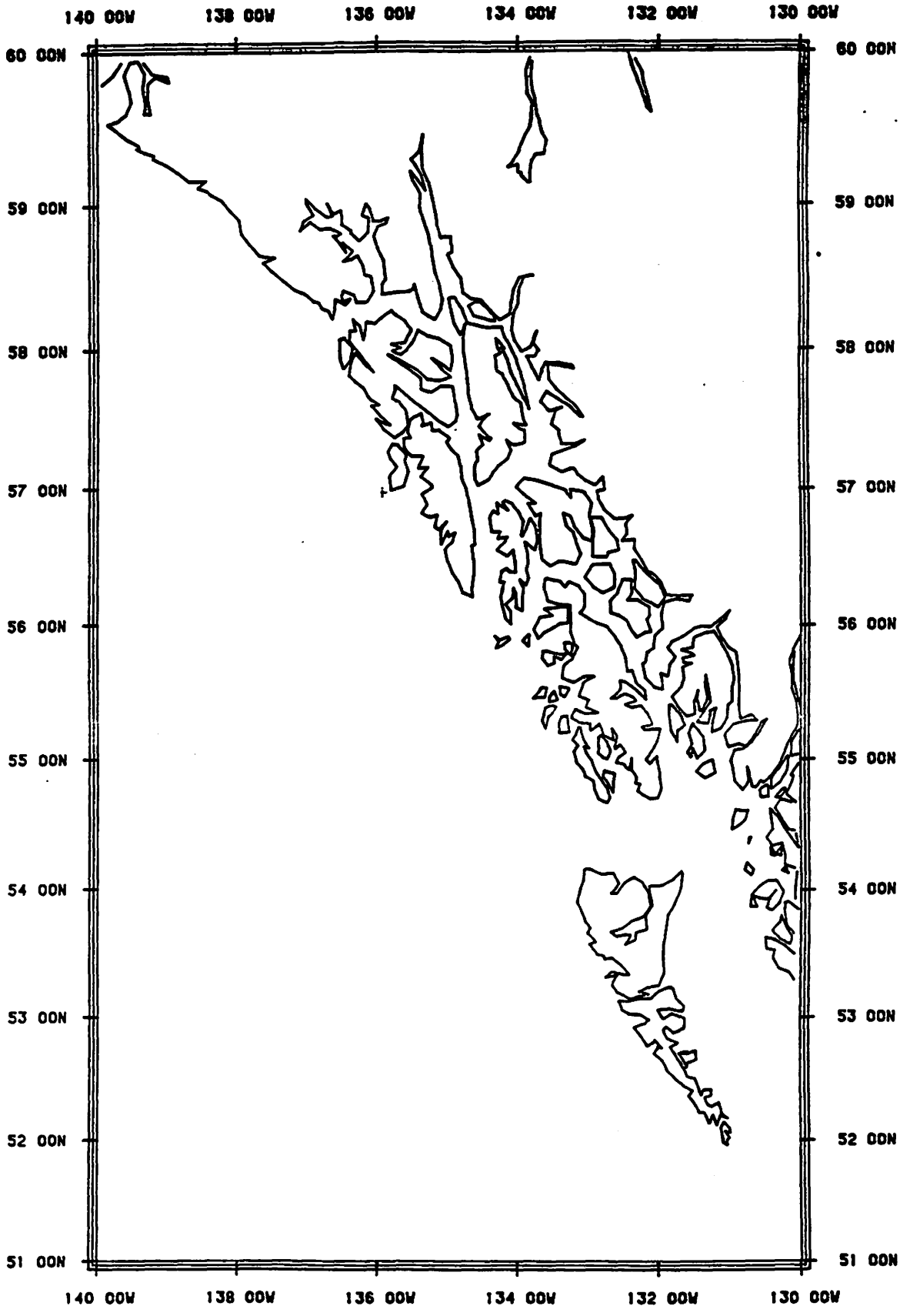
OCTOBER 90 LOGBOOK LONGLINE VESSELS <60 FT



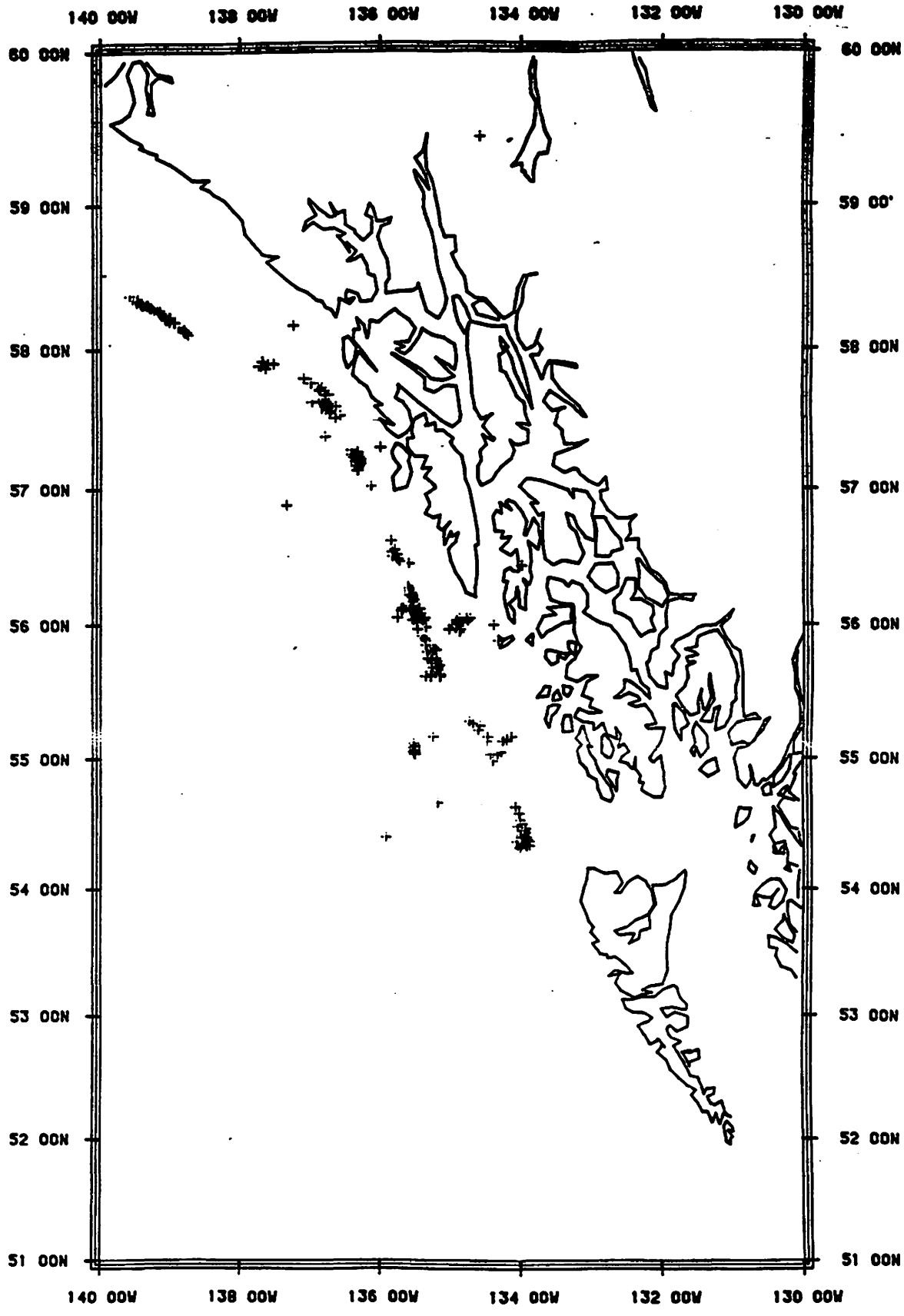
NOVEMBER 90 LOGBOOK LONGLINE VESSELS <60 FT



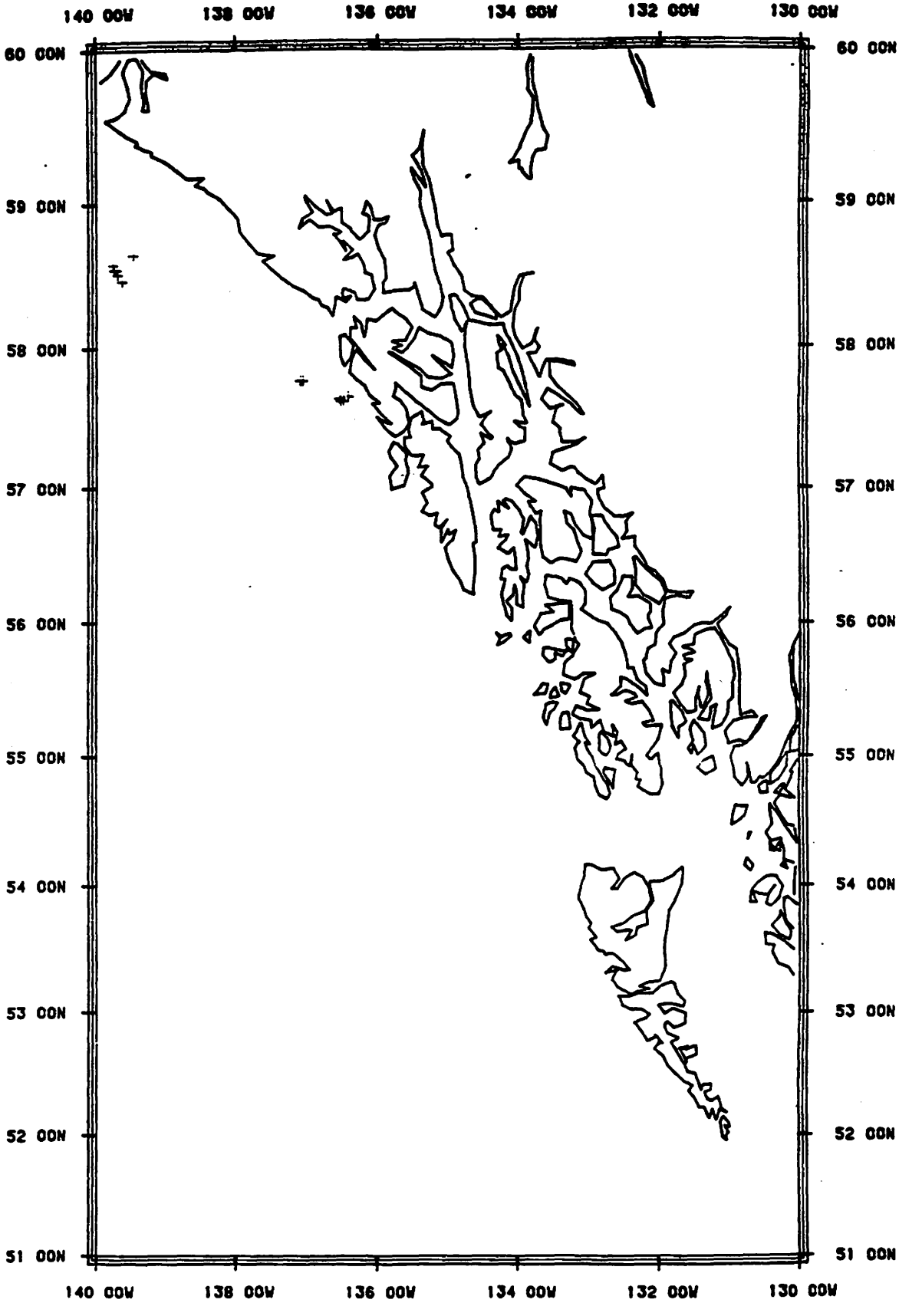
DECEMBER 90 LOGBOOK LONGLINE VESSELS <60 FT



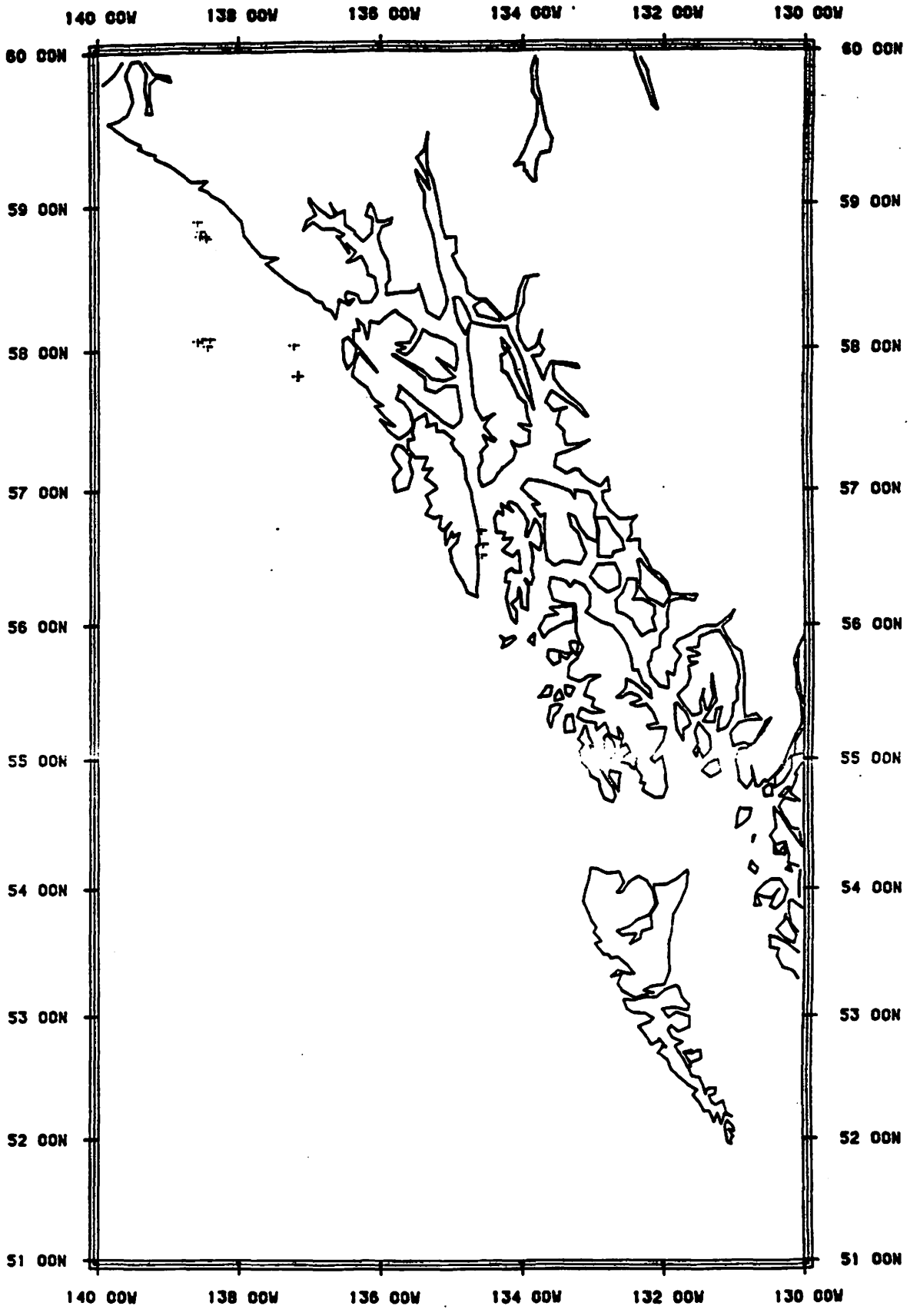
MARCH 90 LOGBOOK LONGLINE VESSELS 60-124 FT



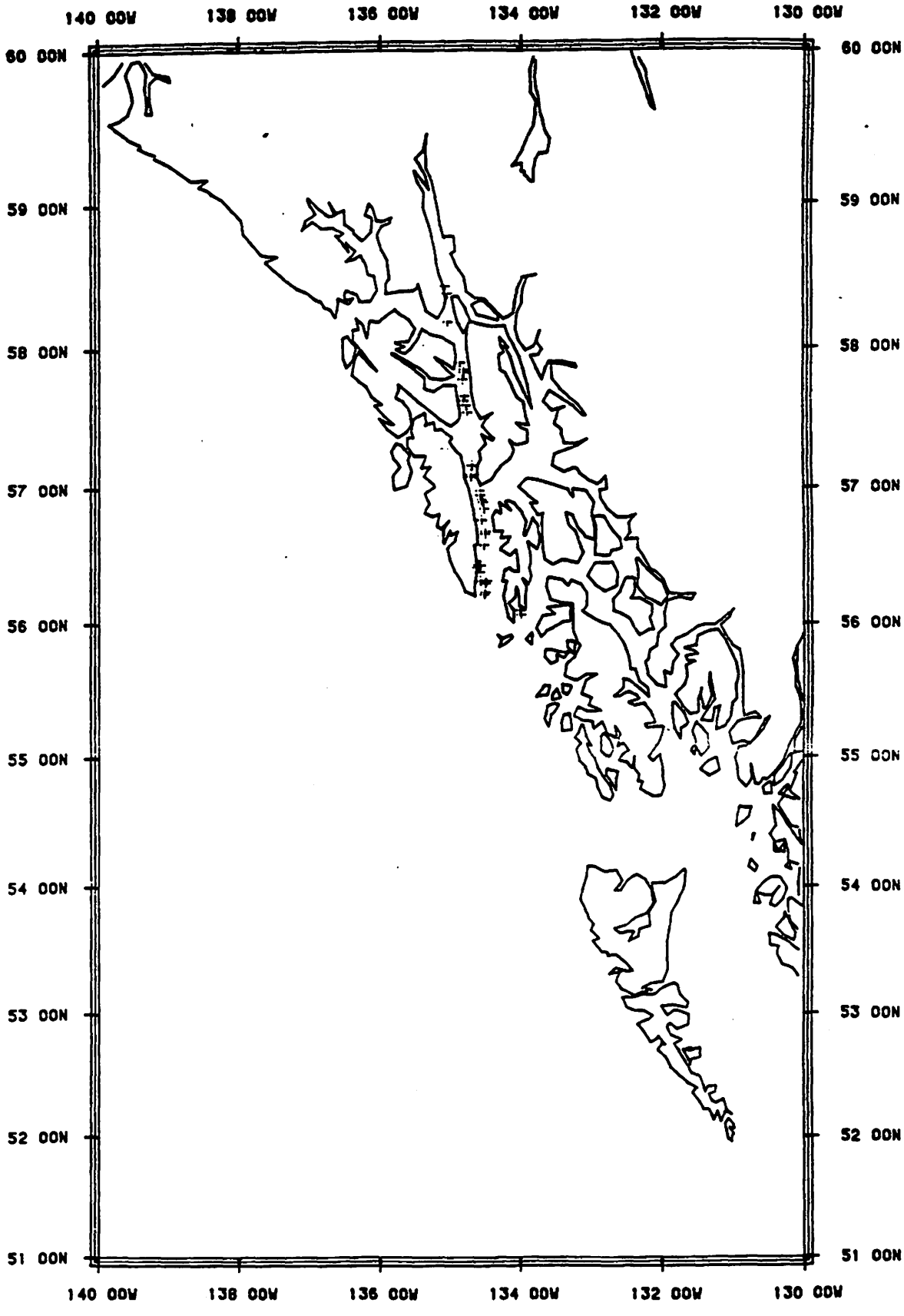
APRIL 90 LOGBOOK LONGLINE VESSELS 60-124 FT



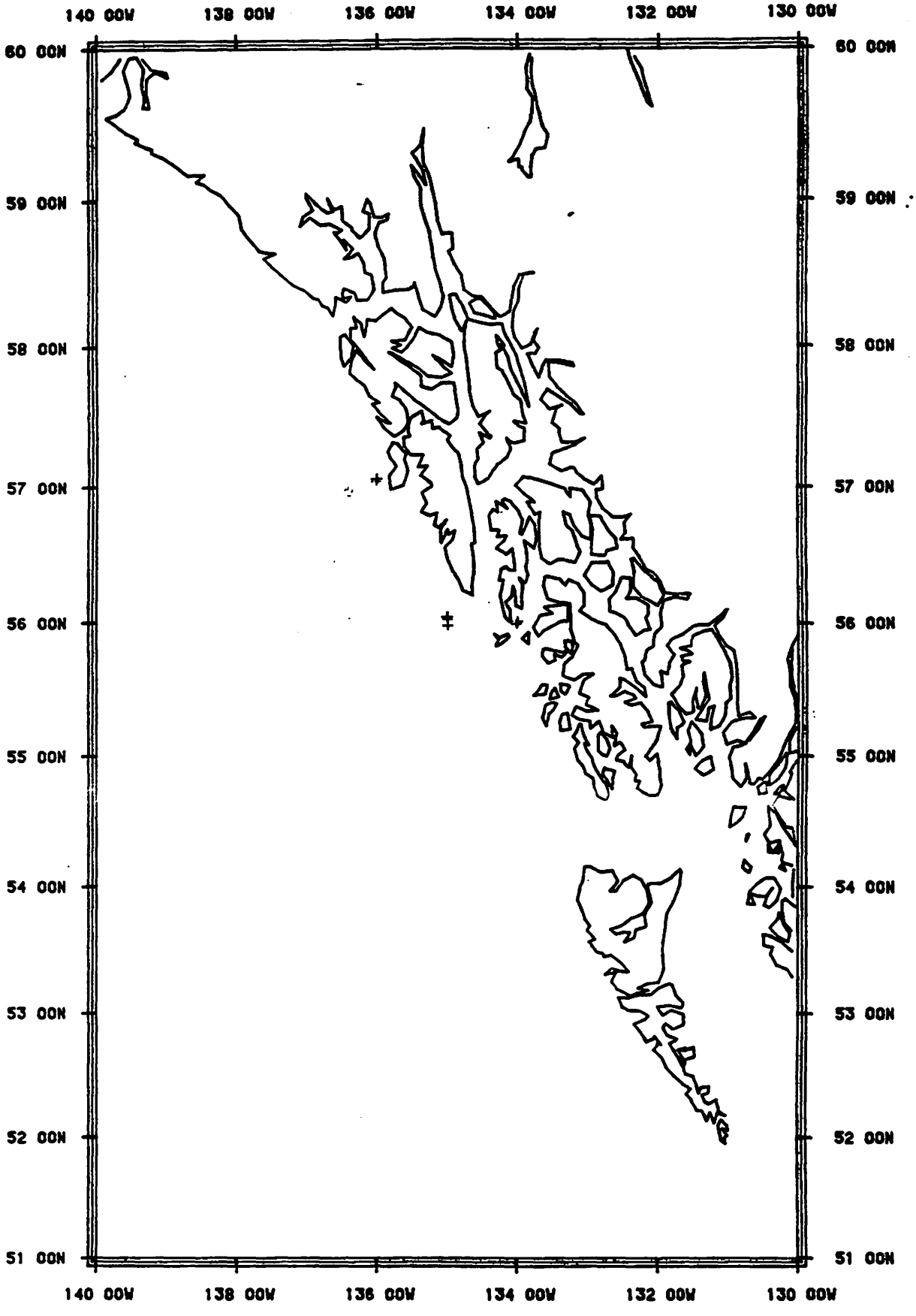
JUNE 90 LOGBOOK LONGLINE VESSELS 60-124 FT



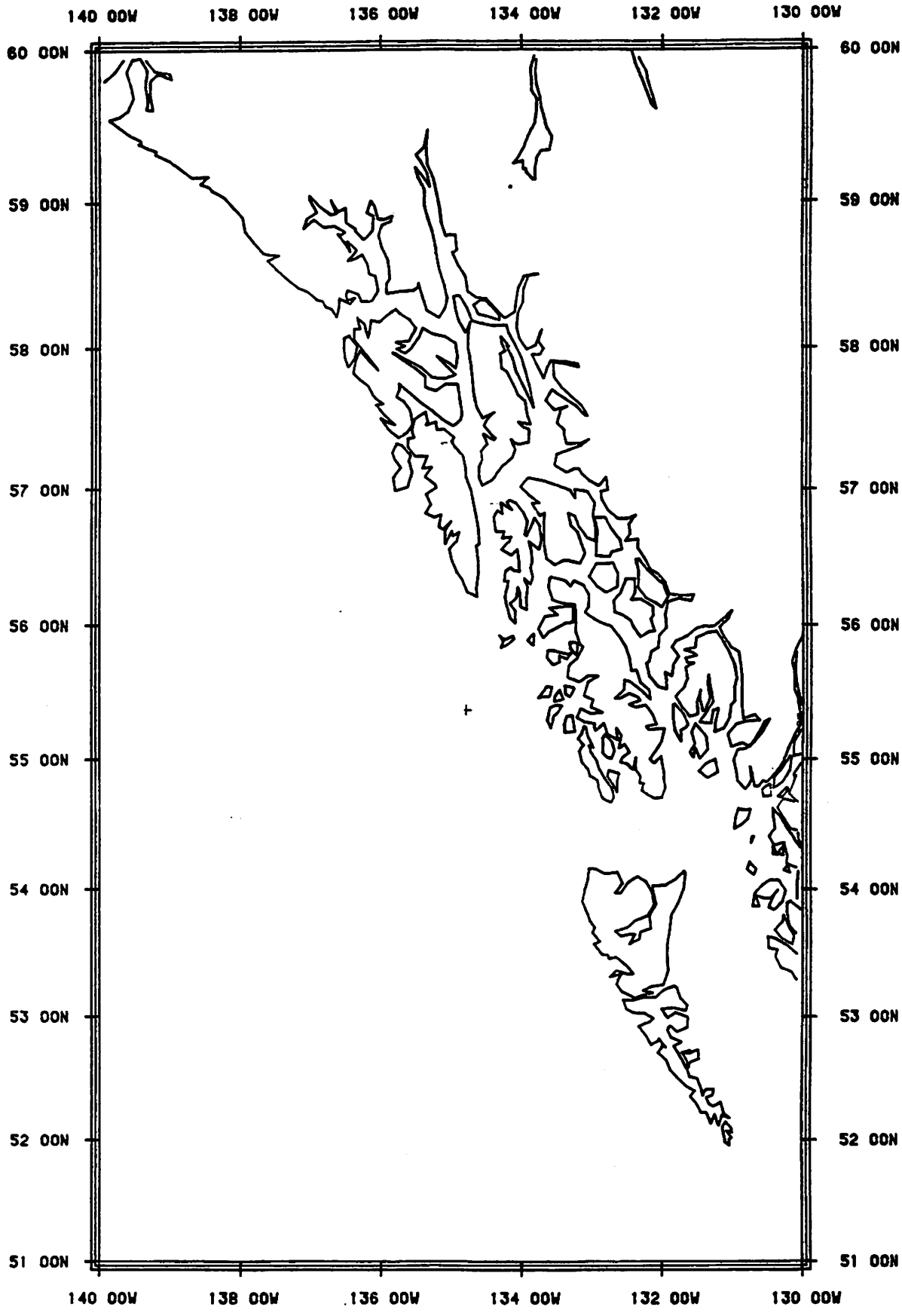
AUGUST 90 LOGBOOK LONGLINE VESSELS 60-124 FT



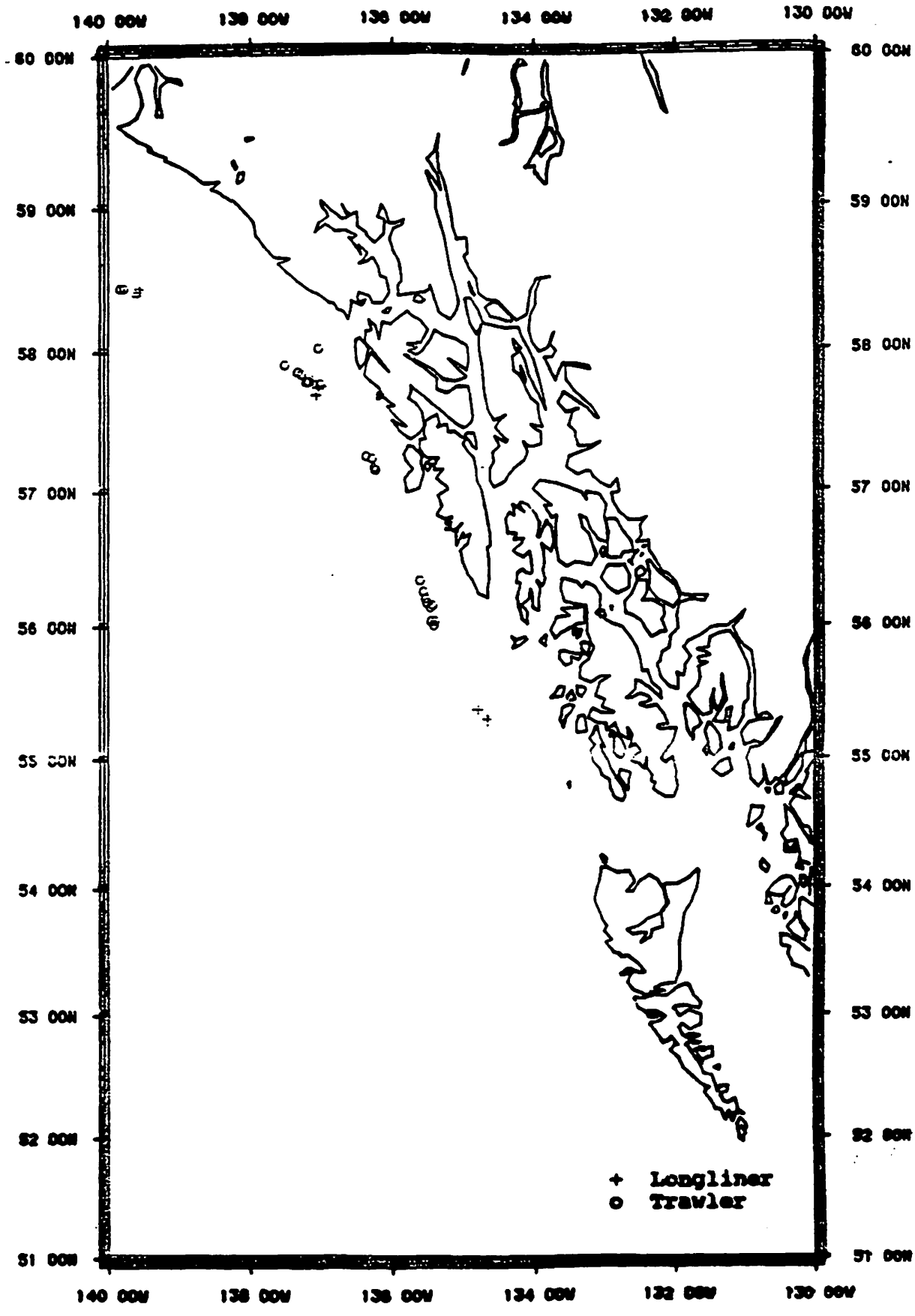
SEPTEMBER 90 LOGBOOK LONGLINE VESSELS 60-124 FT



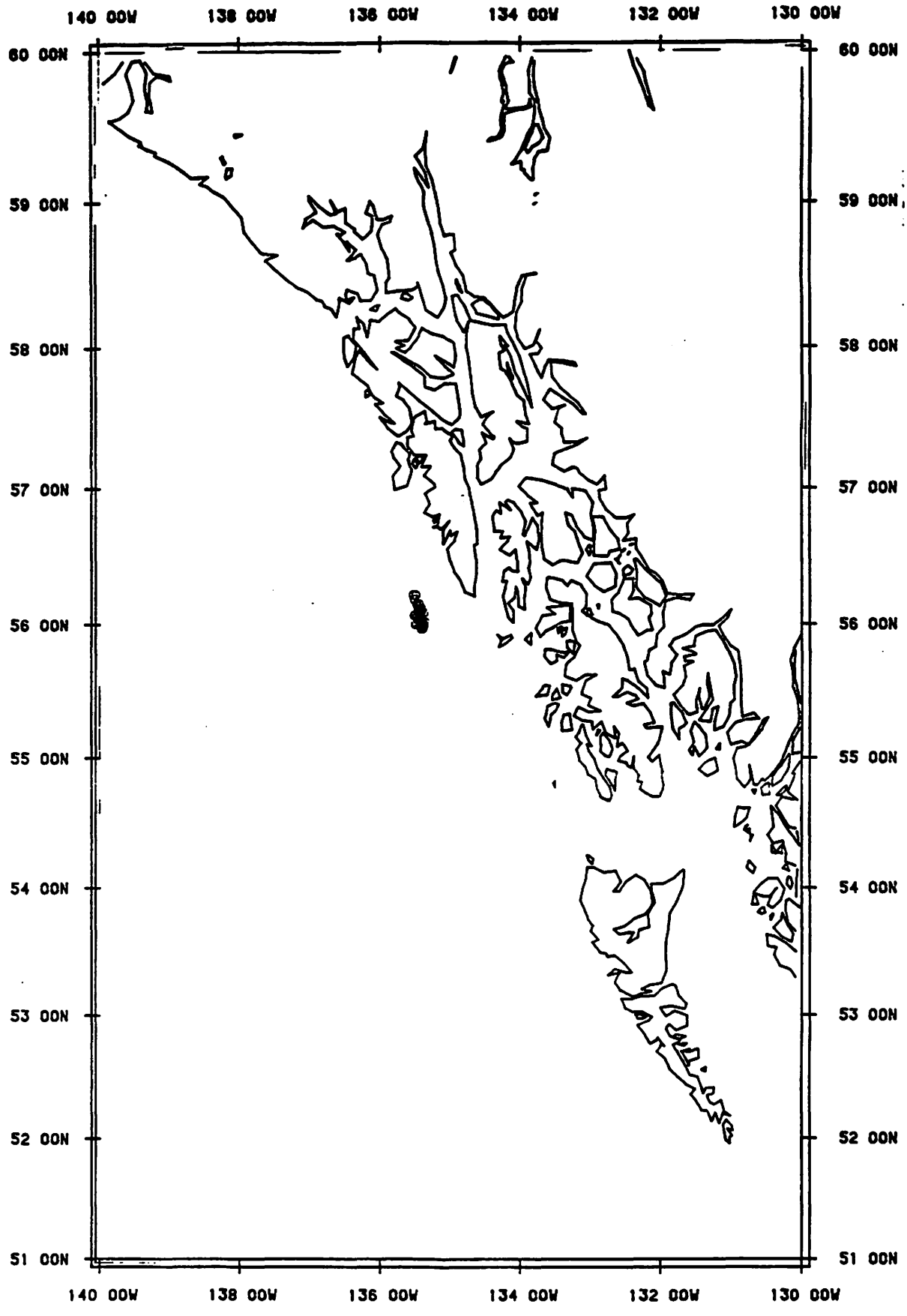
APRIL 90 LOGBOOK(CP) LONGLINE VESSELS <60 FT



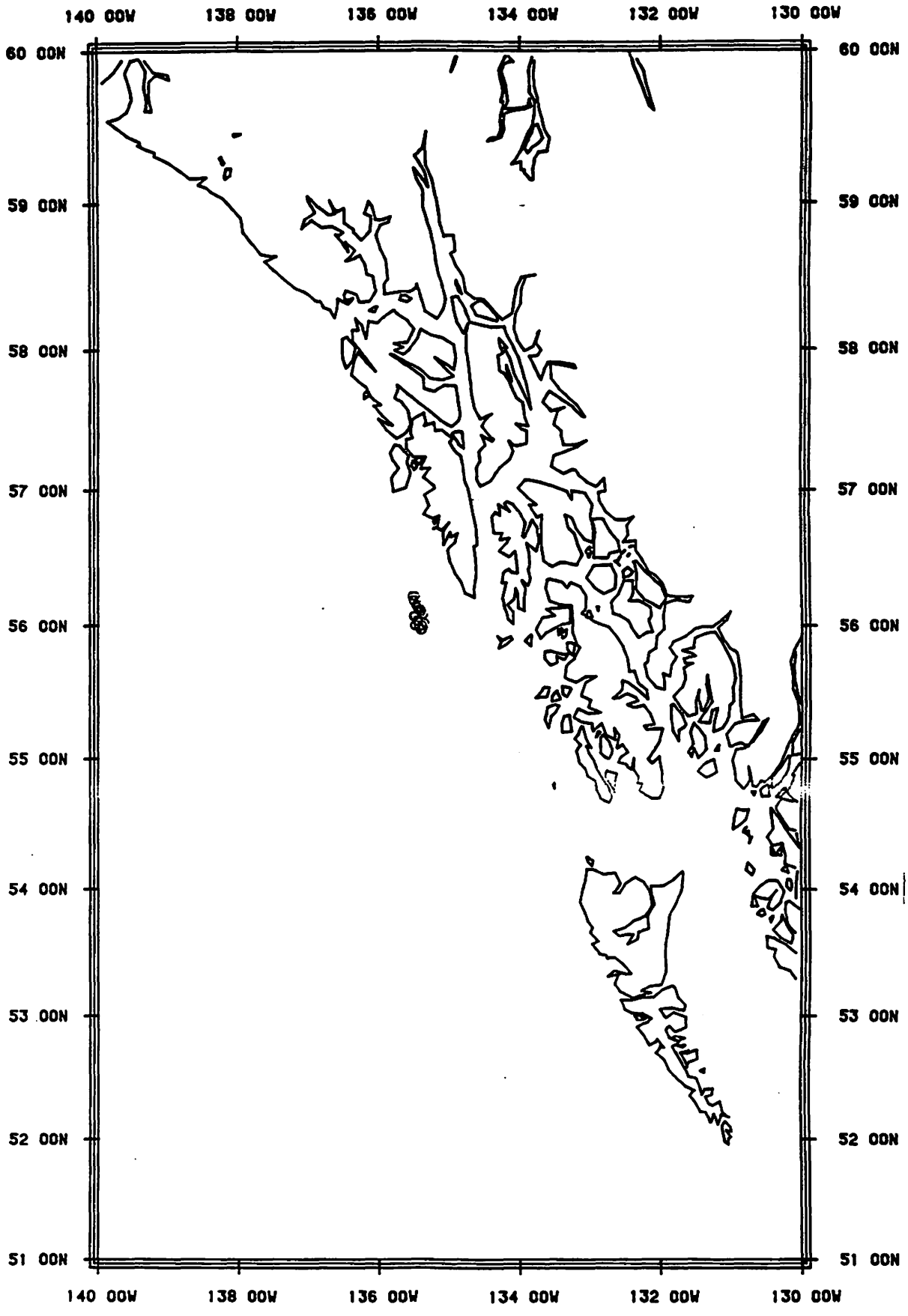
APRIL 90 LOGBOOK(CP) LONGLINE VESSELS 125+ FT



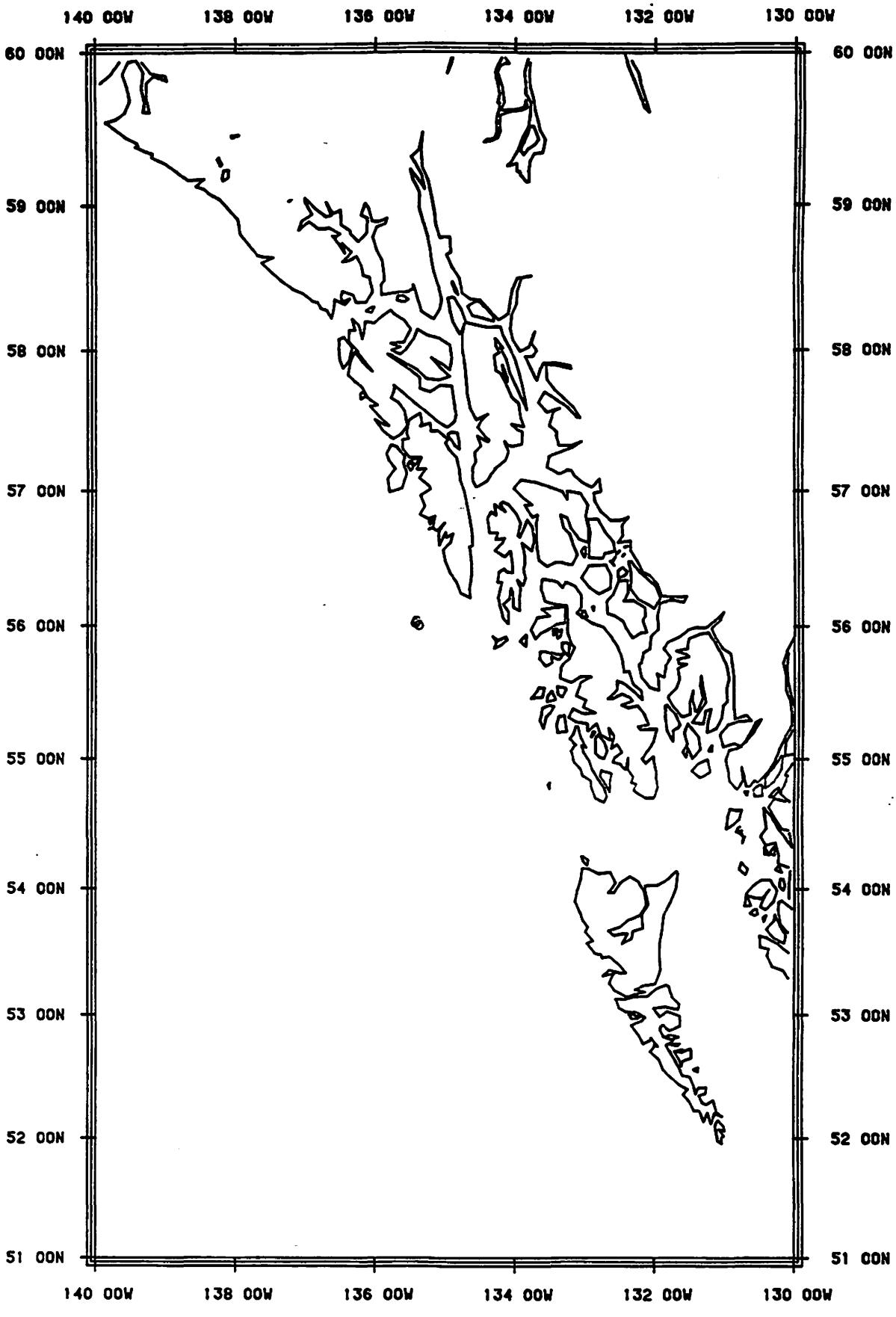
MAY 91 GULF OF ALASKA VESSELS TARGETING ROCKFISH



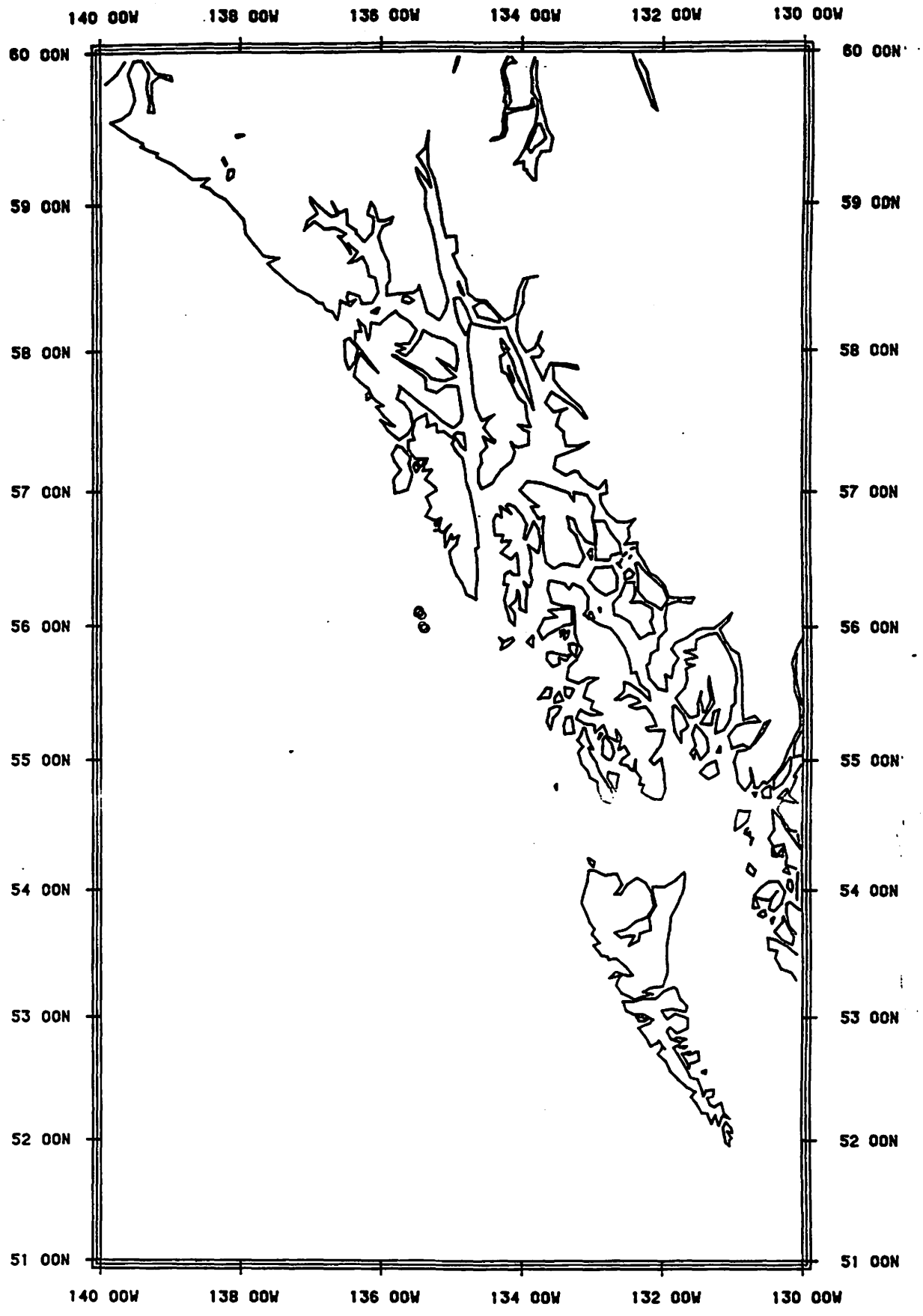
MARCH 91 GULF OF ALASKA TRAWLERS TARGETING ROCKFISH



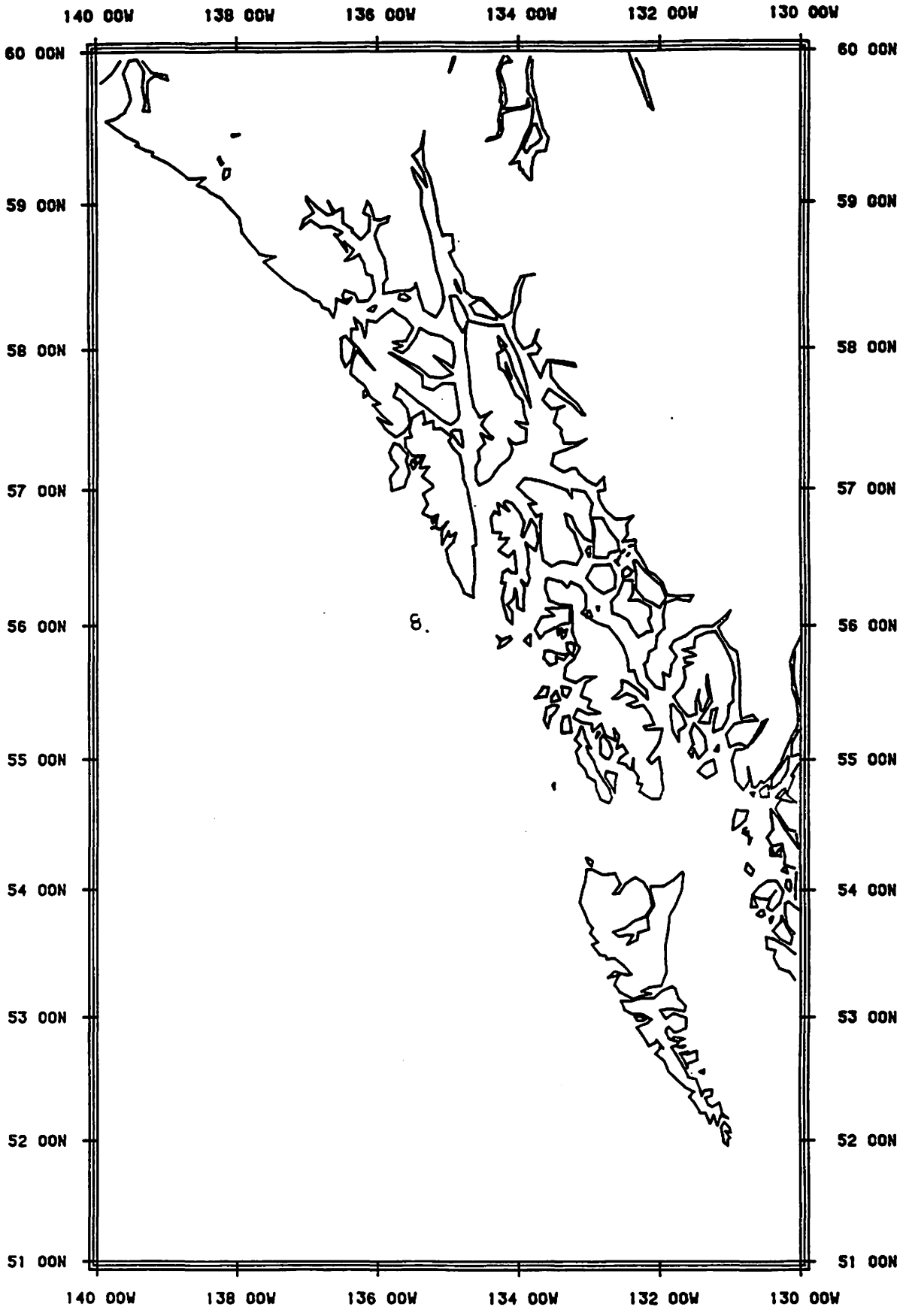
MARCH 91 GULF OF ALASKA TRAWLERS TARGETING POP



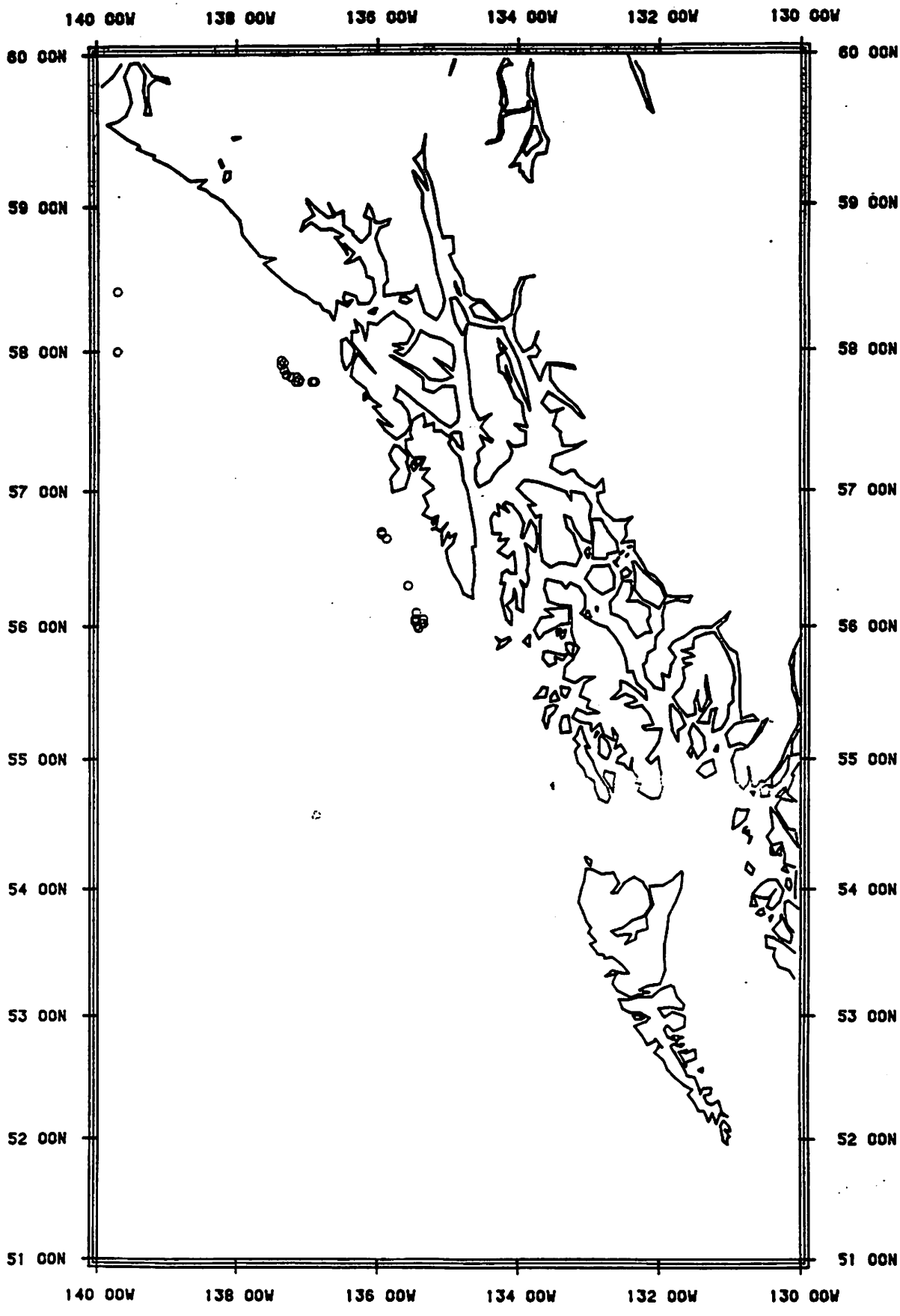
MARCH 91 GULF OF ALASKA TRAWLERS TARGETING ROUGHEYE



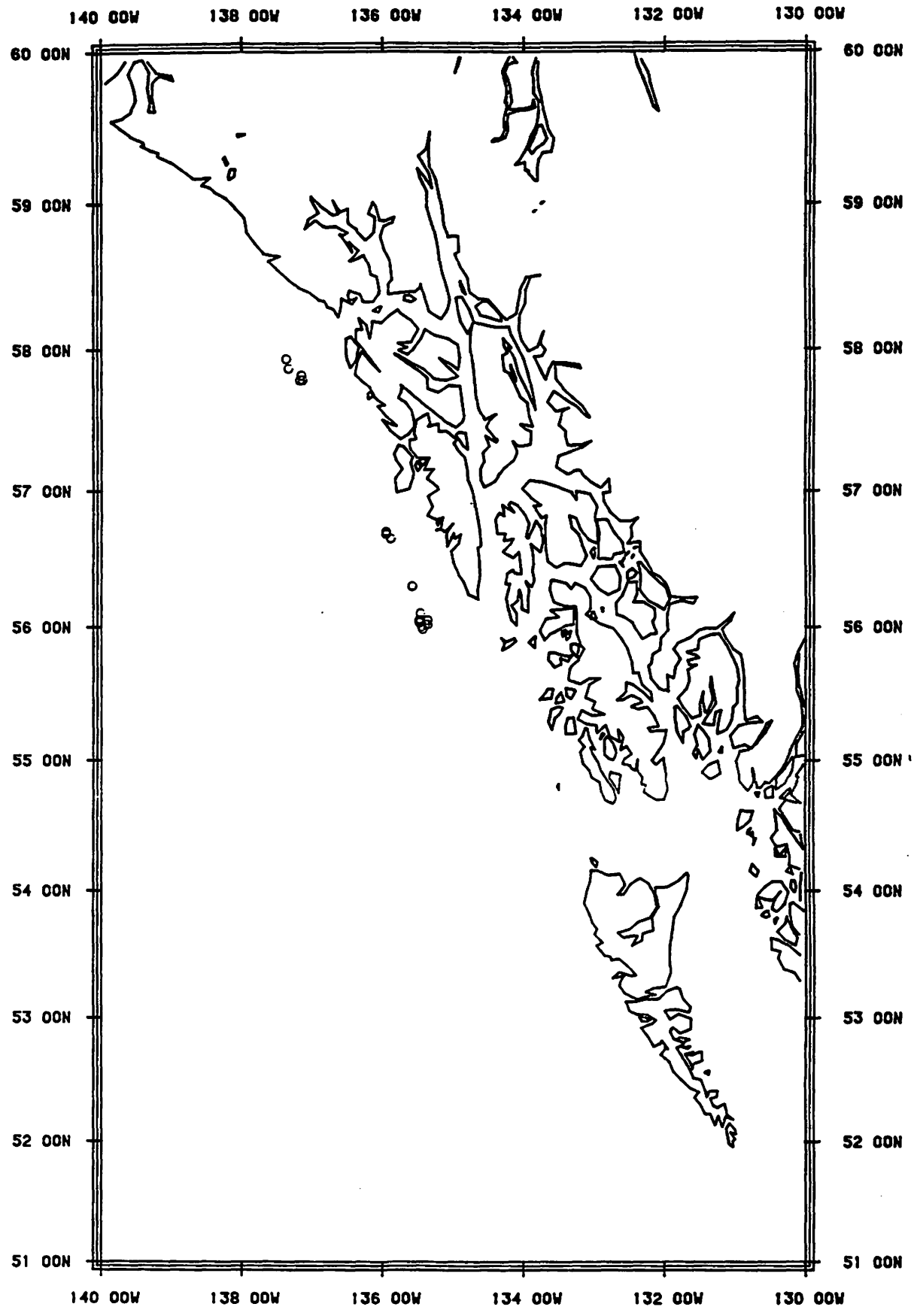
MARCH 91 GULF OF ALASKA TRAWLERS TARGETING SHORTRAKER



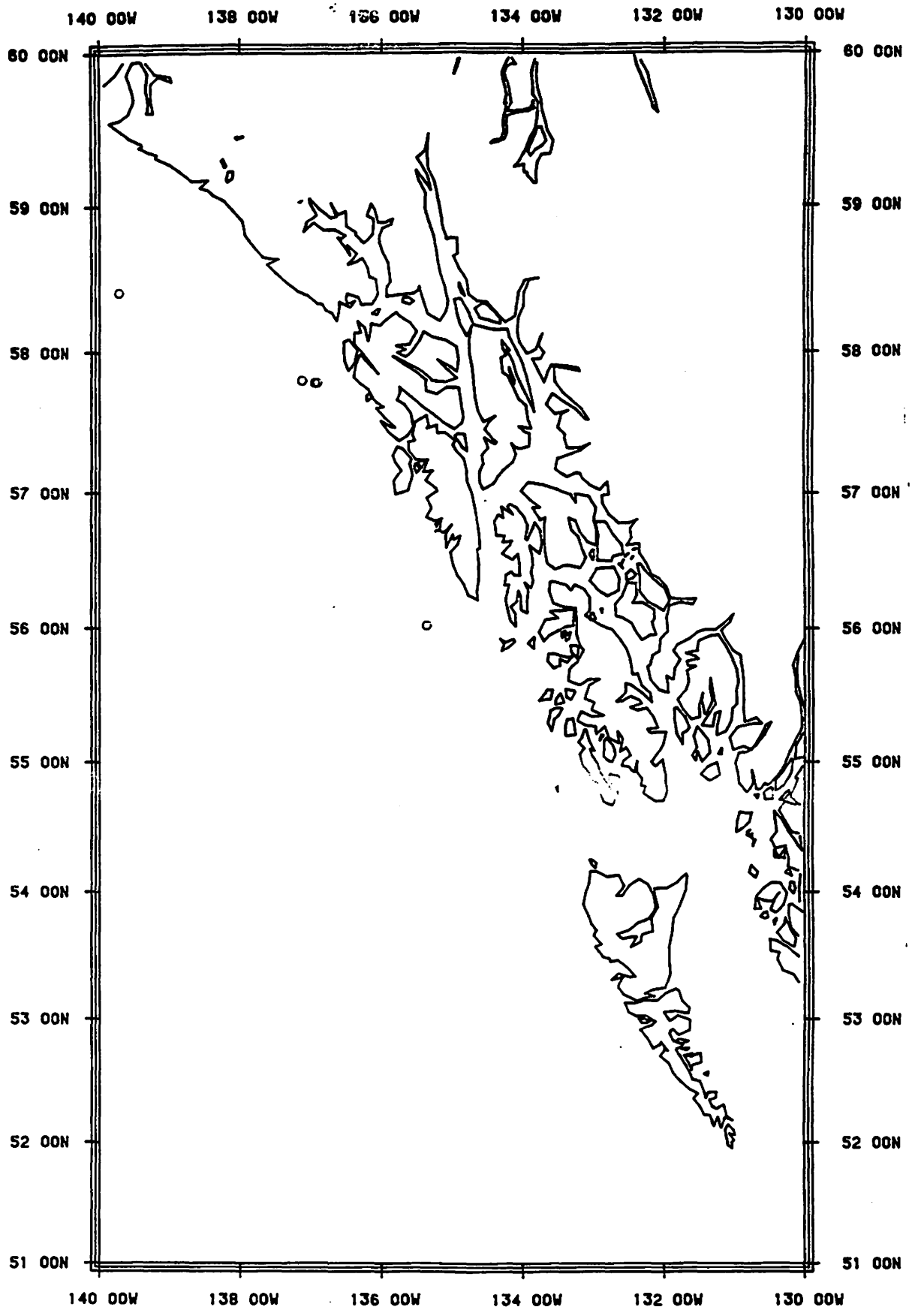
MARCH 91 GULF OF ALASKA TRAWLERS TARGETING THORNYHEAD



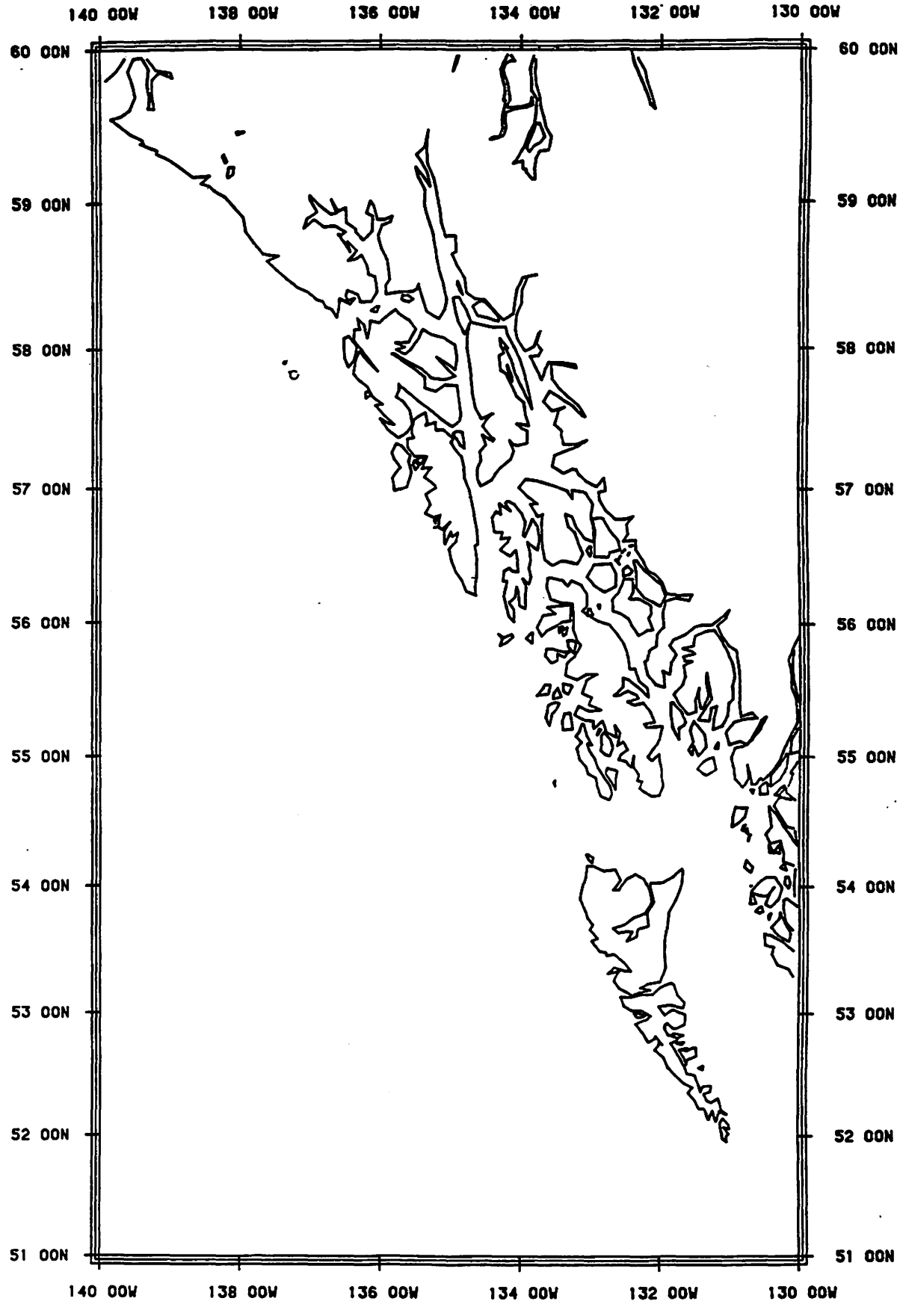
APRIL 91 GULF OF ALASKA TRAWLERS TARGETING ROCKFISH



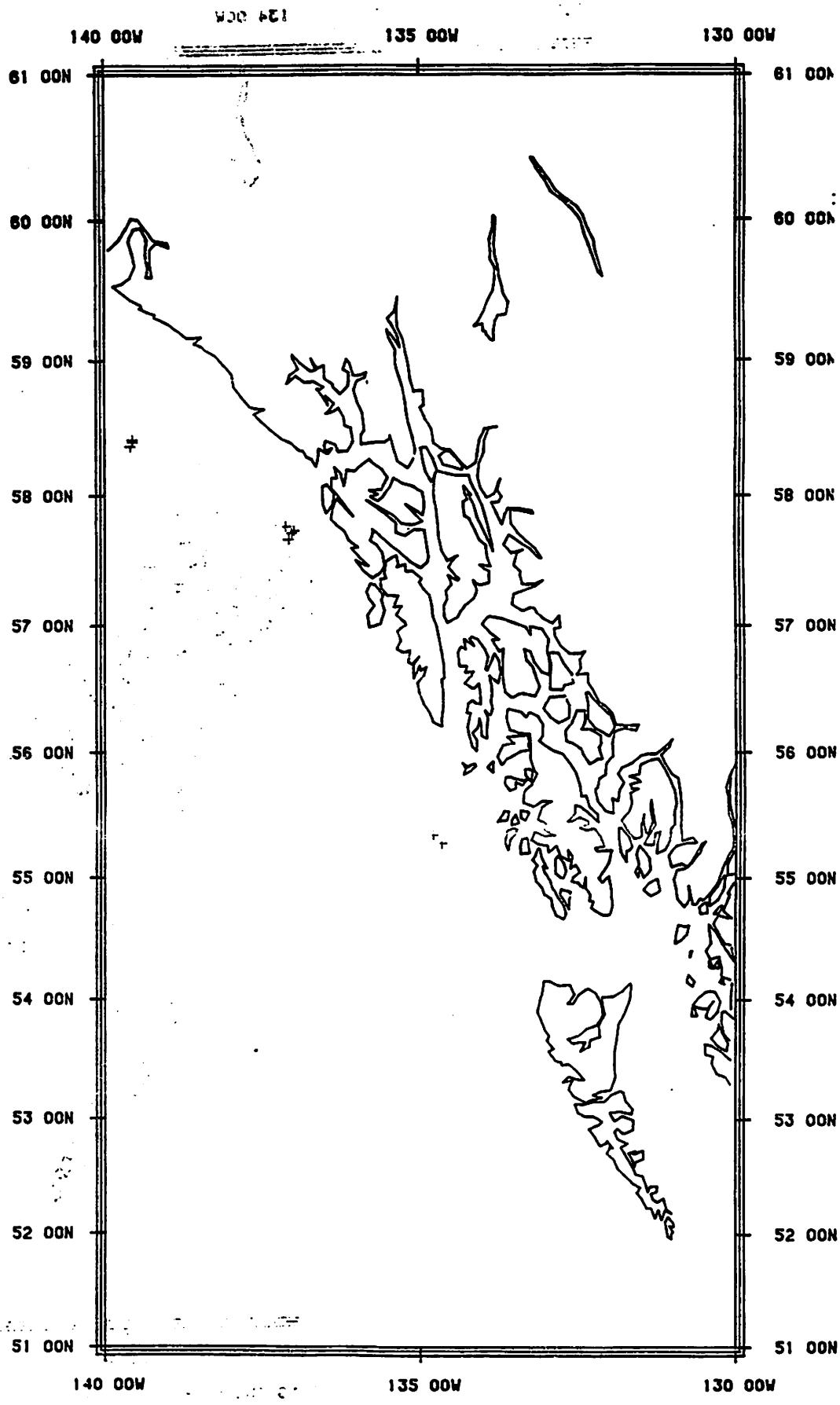
APRIL 91 GULF OF ALASKA TRAWLERS TARGETING POP



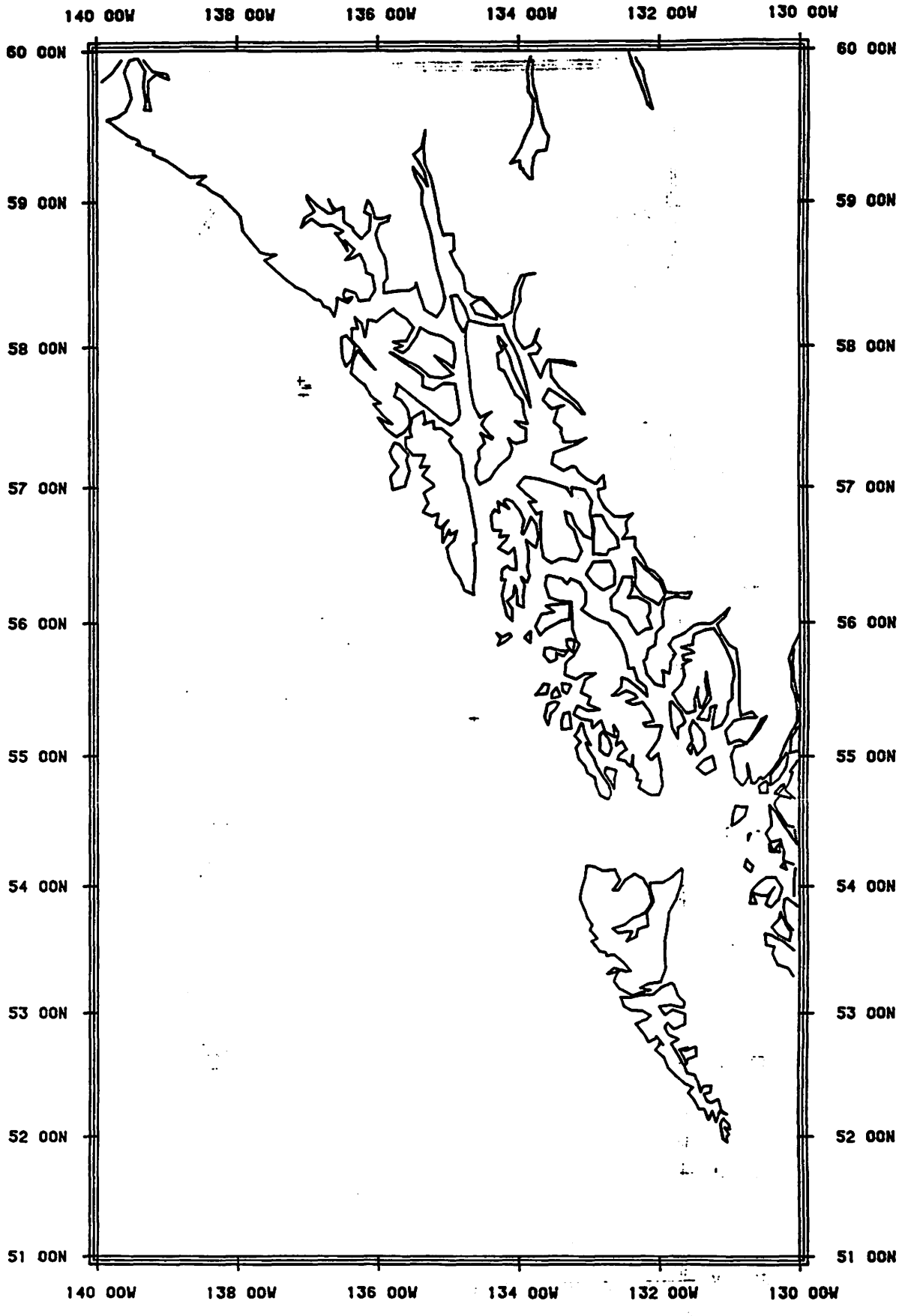
APRIL 91 GULF OF ALASKA TRAWLERS TARGETING SHORTRAKER



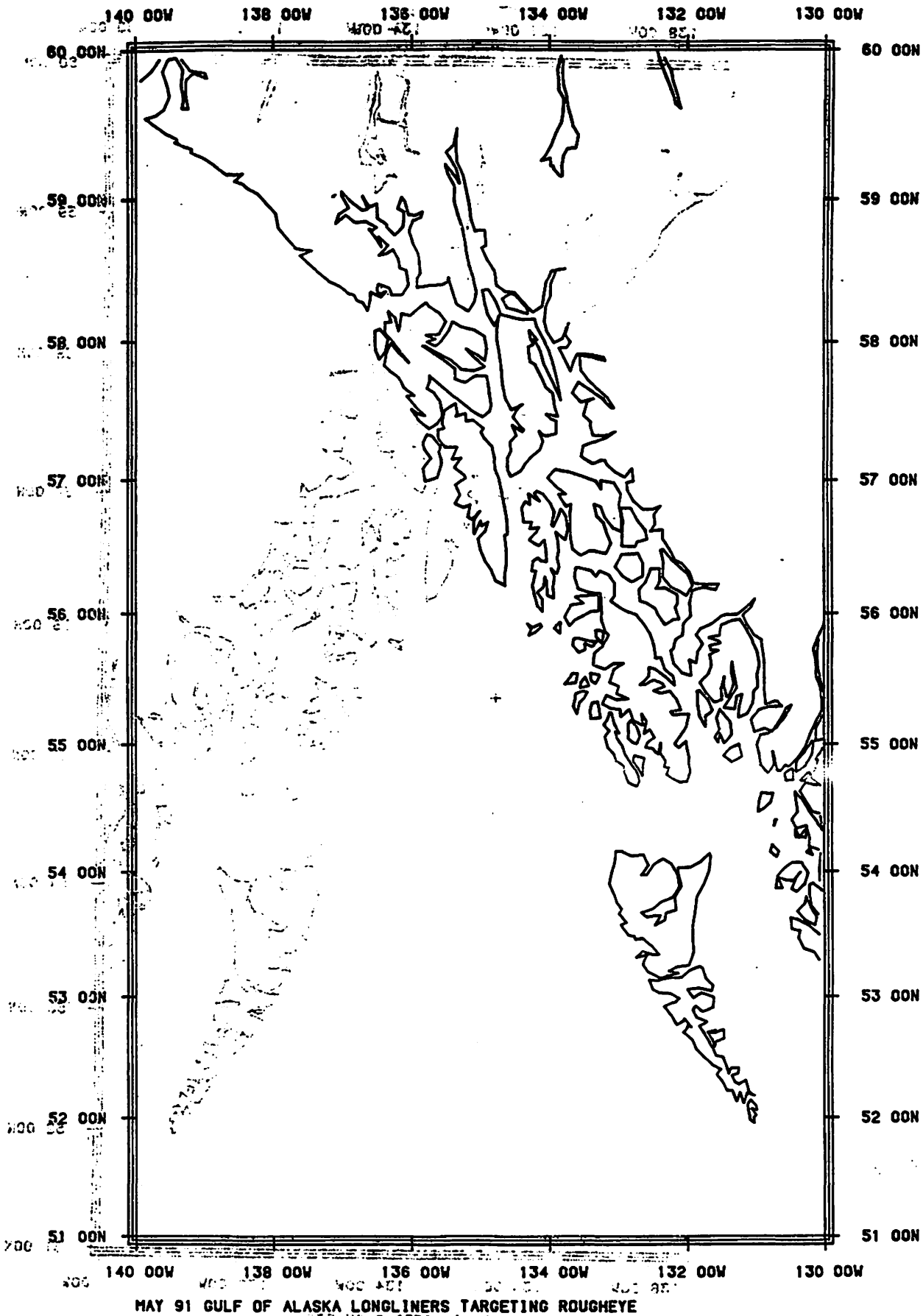
APRIL 91 GULF OF ALASKA TRAWLERS TARGETING DUSKY



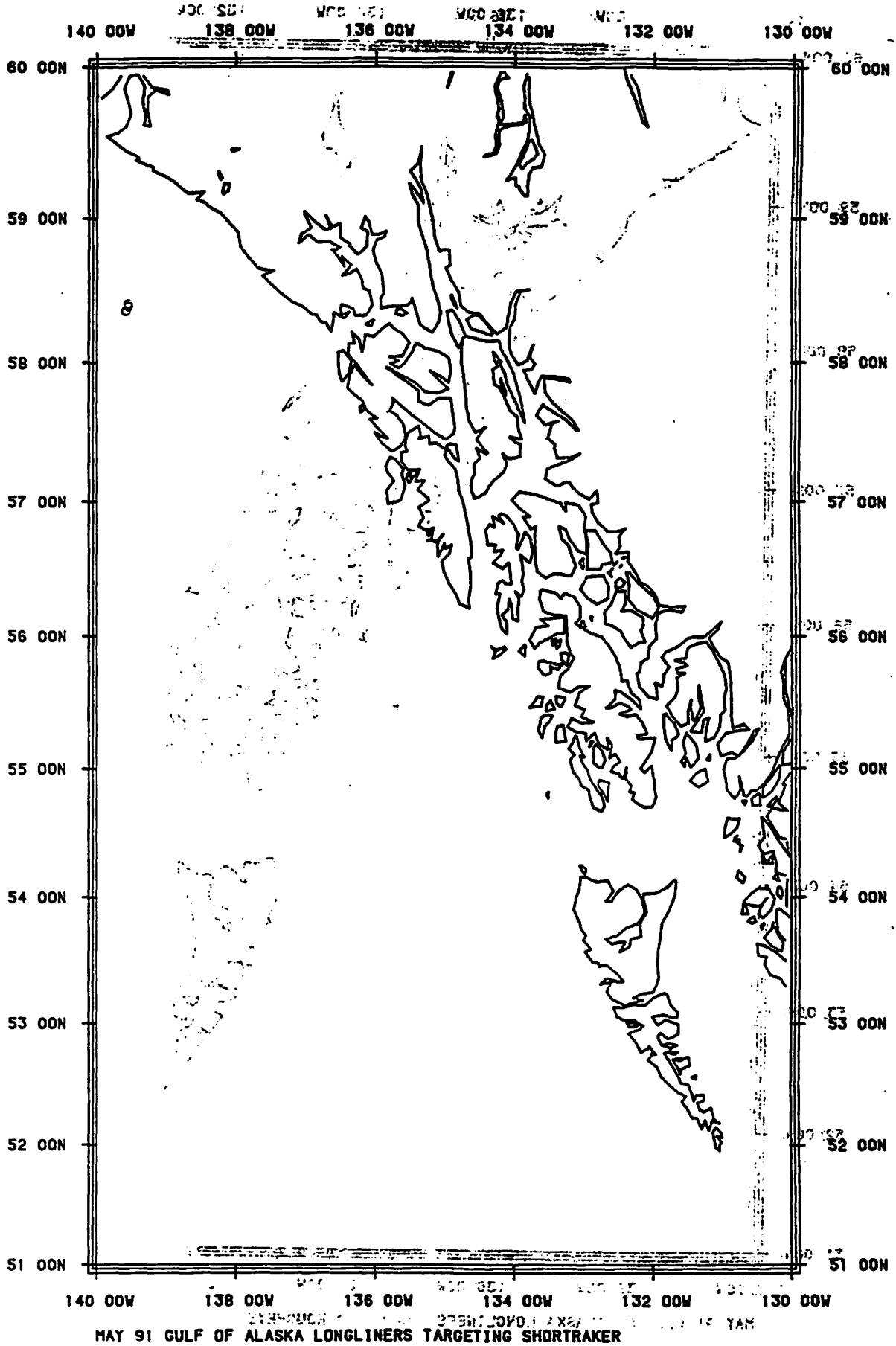
MAY 91 GULF OF ALASKA LONGLINE TARGETING ON ROCKFISH



MAY 91 GULF OF ALASKA LONGLINERS TARGETING THORNYHEAD



MAY 91 GULF OF ALASKA LONGLINERS TARGETING ROUGHEYE



MAY 91 GULF OF ALASKA LONGLINERS TARGETING SHORTRAKER