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

MAR - 8 1999

To all Interested Government Agencies and Public Groups:

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

TITLE: Environmental Assessment for Amendment 6 to the Fishery Management Plan for the Scallop Fishery Off Alaska

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

SUMMARY: The subject amendments revise the current overfishing definitions for consistency with the Magnuson-Stevens Fishery Conservation and Management Act.

RESPONSIBLE OFFICIAL: Steven Pennoyer
Regional Administrator
Alaska Region
National Marine Fisheries Service
P.O. Box 21668
Juneau, AK 99802
Phone: 907-586-7221

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

Sincerely,

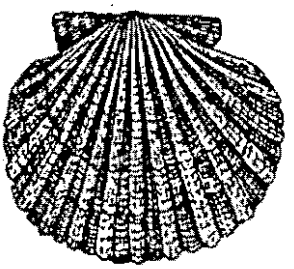
Director of the Office of Policy and Strategic Planning

Enclosure

FONSI 3-3-99

ENVIRONMENTAL ASSESSMENT
for
AMENDMENT 6
to the Fishery Management Plan for the
Scallop Fishery off Alaska
to

1. Revise Definitions of Overfishing, MSY, and OY
2. Add Additional Information on Bycatch Data Collection to FMP



Prepared by staff of the
North Pacific Fishery Management Council
Alaska Department of Fish and Game
National Marine Fisheries Service

February 10, 1999

TABLE OF CONTENTS

Executive Summary

This Environmental Assessment (EA) addresses alternatives for meeting the NMFS guidelines drafted to in response to the Magnuson-Stevens Act provisions for national standard 1. National standard 1 states that conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry. The Act did not change the standard, but did change the definition of optimum yield and overfishing.

The Magnuson-Stevens Act also requires the Secretary of Commerce to establish advisory guidelines (which shall not have the force and effect of law), based on the national standards, to assist in the development of fishery management plans. Proposed guidelines were published in the Federal Register on August 4, 1997 and the Final Rule was published on May 1, 1998. This document examines alternative definitions of overfishing, maximum sustainable yield (MSY), and optimum yield (OY), in accordance with the final rule guidelines.

Language from the Magnuson-Stevens Act 1996.

Optimum Yield: The term 'optimum', with respect to the yield from a fishery, means the amount of fish which --

(a) will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems;

(b) is prescribed as such on the basis of maximum sustainable yield from the fishery, as reduced by any relevant economic, social, or ecological factor; and

(c) in the case of an overfished fishery, provides for rebuilding to a level consistent with producing the maximum sustainable yield in such fishery.

Overfishing: The terms "overfishing" and "overfished" mean a rate or level of fishing mortality that jeopardizes the capacity of a fishery to produce the maximum sustainable yield on a continuing basis.

Two alternatives were considered:

Alternative 1: Status Quo. No revisions to the current MSY, OY, and overfishing definitions would be made.

Alternative 2: (preferred) Redefine overfishing, OY, and MSY, and update the FMP with additional information on bycatch data collection.

Alternative 2 would improve management of the scallop fisheries by instituting the following conservation measures:

1. Requirement that OY take into account protection of marine ecosystems, that OY be no greater than MSY, and the OY for an overfished fishery allow rebuilding to the MSY level.

2. Revised definitions for MSY based on prevailing ecological and environmental conditions; and

3. Revised definitions of overfishing that include both fishing mortality and biomass thresholds.

The following definitions would be established under Alternative 2. They were estimated for weathervane scallop stocks based on life history data and observed catch history.

MSY Control Rule (F_{msy}) = M = 0.13; hence F_{msy} = 0.13.
MSY = the average catch 1990-1997 (excluding 1995) = F_{msy} B_{msy} = 1.24 million pounds.
Overfishing Control Rule ($F_{overfishing}$) = F_{msy} = 0.13.
MSY Stock Size (B_{msy}) = $B_{1990\text{-}1997}$ = ½ B_0 = MSY/M =9.54 million pounds (meats).
Minimum Stock Size Threshold = ½ B_{msy} = 4.77 million pounds in terms of meats.

OY = 0-1.24 million pounds; the upper end is MSY.

These definitions are more conservative than currently in the FMP. The current OY is 0 - 1.8 million pounds, and the overfishing definition is simply landings exceeding OY. The proposed amendment would reduce OY to a maximum of 1.24 million pounds, establish MSY at 1.24 million pounds, and establish overfishing based on fishing mortality rates for weathervane scallops. OY, MSY, and overfishing would not be established for pink, spiny, or rock scallops as these are undeveloped fisheries that are managed through ADF&G via special permit.

None of the alternatives contain implementing regulations and therefore the Regulatory Flexibility Act does not apply and review under E.O. 12866 is not required.

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

1.0 INTRODUCTION

The scallop fishery in the EEZ and in Alaskan State waters has been managed by the State since a fishery began in 1968. Regulations are implemented by ADF&G at 5 ACC 38.076. These regulations establish guideline harvest levels (GHL) for different scallop registration areas, fishing seasons, open and closed fishing areas, observer coverage requirements, gear restrictions, and measures to limit the processing efficiency of undersized scallops that include a ban on the use of mechanical shucking machines and a limitation on crew size. A Federal FMP for the scallop fishery was recommended by the Council in April 1995 and approved by NMFS July 26, 1995. The only management measure implemented by the FMP was a total closure of the EEZ off Alaska to scallop fishing to prevent overfishing by unregulated harvesting. Amendment 1 allowed fishing to resume under federal management measures in July 1996. Amendment 2, adopted in March 1997, established a vessel moratorium for the scallop fishery. Amendment 3, adopted in June 1998, delegates to the State of Alaska authority to manage all aspects of the scallop fishery in Federal waters off Alaska except limited access.

What about amends 9 & 5

Actions taken to amend the FMPs or implement other regulations governing the fisheries must meet the requirements of Federal laws and regulations. In addition to the Magnuson-Stevens Act, the most important of these are the National Environmental Policy Act (NEPA), the Endangered Species Act (ESA), the Marine Mammal Protection Act (MMPA), Executive Order (E.O.) 12866, and the Regulatory Flexibility Act (RFA). None of the alternatives are expected to result in a "significant regulatory action" as defined in E.O. 12866. Because approval of any alternative does not require proposed and final rulemaking to implement the amendments, the Regulatory Flexibility act does not apply.

Section 1 contains a description of the purpose and need for the proposed action as well as a description of alternative actions which may address the problem. Section 2 contains information on the biological and environmental impacts of the alternatives as required by NEPA. Impacts on endangered species and marine mammals are also addressed in this section.

This Environmental Assessment (EA) addresses alternatives for meeting the NMFS guidelines drafted to in response to the revised Magnuson-Stevens Act provisions for national standard 1. In April 1998, the Council and its advisory bodies (the Advisory Panel and Scientific and Statistical Committee) reviewed a draft EA. A revised analysis was released for public review on May 4. In June 1998, the Council adopted Alternative 2, as detailed in this document, as its preferred alternative.

1.1 Stocks Covered by the Plan

The FMP covers all fisheries for weathervane scallops (*Patinopecten caurinus*), pink scallops (*Chlamys rubida*), spiny scallops (*Chlamys hastata*), rock scallops (*Crassadoma gigantea*), and all other scallop species in the EEZ waters off Alaska. Only weathervane scallops are harvested commercially at this time.

1.2 Purpose of and Need for the Action

The Magnuson-Stevens Act was amended in 1996. Section 301(a) of the Magnuson-Stevens Act contains 10 national standards for fishery conservation and management, with which all FMPs and amendments prepared by the Councils and the Secretary must comply. Section 303(b) requires that the Secretary establish advisory guidelines, based on the national standards, to assist in the development of FMPs. One major provision of the Act necessitates significant revisions to the guidelines for national standard 1 (optimum yield), which were published as a proposed rule in the Federal Register on August 4, 1997, and finalized on May 1, 1998. The guidelines are intended as an aid to decision making, with responsible conservation and management of valued national resources as the goal.

The new and revised national standards apply to all FMPs and implementing regulations, existing and future. However, as Congress recognized by allowing the Councils 2 years from enactment (i.e., until October 11, 1998) to submit FMP amendments to comply with the related new requirements in section 303(a), it will take considerable time and effort to bring all FMPs into compliance with the Magnuson-Stevens Act. NMFS will uses these guidelines to review all new FMPs and amendments to determine whether they comply with the new and revised national standards. The Councils are required to submit necessary amendments to comply with the standards by October 11, 1998.

National standard 1 guidelines were last revised in July 1989; that revision focused on establishing a conservation standard, with the requirement that specific, objective, and measurable definitions of overfishing be established for each fishery managed under the Magnuson- Stevens Act (then called the Magnuson Act). By 1993, more than 100 such definitions had been approved by NMFS. At that time, NMFS convened a panel of scientists from inside and outside the agency to review the approved definitions, investigate their strengths and shortcomings, and standardize, as much as possible, the criteria and basis for future evaluations of overfishing definitions. The goal of the review was to develop a scientific consensus as to the appropriateness of the definitions and the criteria used in their evaluation. The resulting analysis and report (Rosenberg et al. 1994) provided a set of scientific principles for defining overfishing. However, these principles were not incorporated into the national standard guidelines. The Sustainable Fisheries Act (SFA), which amended the Magnuson-Stevens Act, introduced or revised definitions for a number of terms and introduced several new requirements for contents of FMPs. As a consequence of the 1994 report and the statutory amendments, revisions to the national standard 1 guidelines are described below.

Overview of Issues

Revisions to the guidelines for national standard 1 center on the Magnuson-Stevens Act's definitions of ``overfishing,'' ``overfished,'' and ``optimum yield (OY);'' the requirement for the establishment of objective and measurable criteria for determining the status of a stock or stock complex; and the requirement for remedial action in the event that overfishing is occurring or that a stock or stock complex is overfished.

The Magnuson-Stevens Act, in section 3(29), defines both ``overfishing'' and ``overfished'' as a rate or level of fishing mortality that jeopardizes a fishery's capacity to produce maximum sustainable yield (MSY) on a continuing basis. Neither term was defined statutorily, prior to passage of the SFA. The existing national standard guidelines define overfishing somewhat differently, by qualifying ``capacity'' with the phrase ``long-term,'' and do not include a definition of ``overfished.'' The Magnuson-Stevens Act, in section 3(28), defines OY as the amount of fish that: (1) Will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems; (2) is prescribed on the basis of the MSY from the fishery, as reduced by any relevant economic, social, or ecological factors; and (3) in the case of an overfished fishery, provides for rebuilding to a level consistent with producing the MSY in such fishery. The main changes relative to the pre-SFA definition include the requirements that OY take into account protection of marine ecosystems, that OY be no greater than MSY, and that OY for an overfished fishery allow rebuilding to the MSY level. The Magnuson-Stevens Act, in section 303(a)(10), requires each FMP to specify objective and measurable criteria for identifying when the fishery to which the FMP applies is overfished (also referred to as ``criteria for overfishing''), with an analysis of how the criteria were determined and the relationship of the criteria to the reproductive potential of stocks of fish in that fishery. The Magnuson-Stevens Act also requires, in section 304(e), the Secretary to report annually to Congress and the Councils on the status of fisheries within each Council's geographical area of authority and identify those fisheries that are overfished or are approaching a condition of being overfished. For each fishery managed under an FMP or international agreement, the status is to be determined using the criteria for overfishing specified in that FMP or

agreement. A fishery is to be classified as approaching a condition of being overfished if, based on trends in fishing effort, fishery resource size, and other appropriate factors, the Secretary estimates that it will become overfished within 2 years.

If the Secretary determines at any time that a fishery is overfished or approaching an overfished condition or that existing remedial action taken for the purpose of ending any previously identified overfishing has not resulted in adequate progress, the Secretary must notify the Council and request that remedial action be taken. Section 304(e)(3) of the Magnuson-Stevens Act requires that the Council then, within 1 year of notification, prepare an FMP, FMP amendment, or proposed regulations for the purposes of ending (or preventing) overfishing and rebuilding (or sustaining) affected stocks of fish.

Overview of Approach

In developing the revised guidelines, policy guidance was taken from the Magnuson-Stevens Act and other applicable law. Because the guidelines deal with technical subject matter, guidance was also taken from the scientific literature. In particular, the report by Rosenberg et al. (1994) was used to the extent that it is consistent with the Magnuson-Stevens Act and other applicable law.

Sustainability

Sustainable fisheries is a key theme within the Magnuson-Stevens Act. The idea of sustainability is inherent in MSY, a quantity that is central to the Magnuson-Stevens Act's definitions of both overfishing and OY. Closely related to the idea of sustainability is the phrase "on a continuing basis," which is used both in the Magnuson-Stevens Act's definition of overfishing and in national standard 1. The appropriate interpretation of sustainability or the phrase "on a continuing basis" is the one generally accepted in the fishery science literature, which relates to an average stock level and/or average potential yield from a stock over a long period of time.

It is important to distinguish between the theoretical concept of MSY as an unconditional maximum independent of management practice, and actual estimates of MSY, which are necessarily conditional on some type of (perhaps hypothetical) management practice. Specifically, the guidelines, in Sec. 600.310(c), describe the role of "control rules" in estimating MSY, where an MSY control rule is any harvest strategy that, if implemented, would be expected to result in a long-term average catch close to MSY. A Council could choose an MSY control rule in which fishing mortality is held constant over time at an appropriate rate, one in which escapement is held constant over time at an appropriate level, or some other control rule, so long as that control rule is consistent with the Magnuson-Stevens Act.

Although the Magnuson-Stevens Act's definition of overfishing is expressed in terms of a stock's capacity to produce MSY on a continuing basis, nothing in the Magnuson-Stevens Act implies that such production, in the form of harvest, must actually occur. That is, a stock does not actually need to produce MSY on a continuing basis in order to have the capacity to do so.

Use of the Terms "Overfishing" and "Overfished"

The relationship between the terms "overfishing" and ``overfished" can be confusing. As used in the Magnuson-Stevens Act, the verb ``to overfish" means to fish at a rate or level that jeopardizes the capacity of a stock or stock complex to produce MSY on a continuing basis. ``Overfishing," then, occurs whenever a stock or stock complex is subjected to any such rate or level of fishing mortality. Interpreting the term ``overfished" is more complicated. In the Magnuson-Stevens Act, this term is used in two senses: First, to

describe any stock or stock complex that is subjected to overfishing; and second, to describe any stock or stock complex for which a change in management practices is required in order to achieve an appropriate level and rate of rebuilding. (See, for example, section 303(a)(1)(A) and section 304(e)(1)) To avoid confusion, the guidelines use ``overfished'' in the second sense only. Both terms would be defined in Sec. 600.310(d).

Status Determination Criteria

The Magnuson-Stevens Act, in section 303(a)(10), requires that each FMP specify objective and measurable criteria (status determination criteria) for identifying when stocks or stock complexes covered by the FMP are overfished. To fulfill the intent of the Magnuson-Stevens Act, such status determination criteria are comprised of two components: A maximum fishing mortality threshold and a minimum stock size threshold (see Sec. 600.310(d)(2)). The maximum fishing mortality threshold should be set at the fishing mortality rate or level defined by the chosen MSY control rule. The minimum stock size threshold should be set at one-half the MSY level, or the minimum stock size at which rebuilding to the MSY level would be expected to occur within 10 years if the stock or stock complex were exploited at the maximum fishing mortality threshold, whichever is greater. When data are insufficient to estimate any of these quantities, use of reasonable proxies would be required.

It is important to note that, even if no minimum stock size threshold were set, the maximum fishing mortality threshold would define a minimum limit on the rate of rebuilding for a stock that falls below its MSY level. The reason for requiring a minimum stock size threshold in addition to a maximum fishing mortality threshold is to define the point at which this minimum rebuilding rate is no longer prudent. For example, in the case of a slow-growing stock, a rebuilding rate that satisfies the statutory deadline of 10 years would be considered prudent management. However, for a fast-growing stock, it might be possible to fall to an extremely low level of abundance and still rebuild to the MSY level within 10 years, which would not be considered prudent management. Thus, the definition of the minimum stock size threshold includes a constraint, equal to one-half the MSY level, to ensure that the 10-year allowance is not abused in the case of fast-growing stocks.

Choosing an MSY control rule is thus key to satisfying national standard 1, because it defines the maximum fishing mortality threshold and plays a role in defining the minimum stock size threshold. Any MSY control rule defines a relationship between fishing mortality rate and stock size. This relationship is the maximum fishing mortality threshold, which may be a single number or a mathematical function. In addition, any MSY control rule defines a rate of rebuilding for stocks that are below the level that would produce MSY. The smallest stock size at which rebuilding to the level that would produce MSY is achieved within 10 years defines the minimum stock size threshold for that rule, unless such a stock size is less than one-half the MSY level. The MSY control rule also defines an upper bound on any OY control rule that might be specified.

The status determination criteria in Sec. 600.310(d)(2) play a fundamental role in developing the Secretary's annual report to Congress and the Councils, as required by section 304(e) of the Magnuson-Stevens Act. Under the guidelines, the Secretary's annual report would list all stocks or stock complexes for which the maximum fishing mortality rate has been exceeded or for which the minimum stock size has not been achieved. Thus, the Secretary's decision as to whether a stock or stock complex is listed in the annual report of overfished stocks would be based on either the current rate of fishing mortality or the current condition of the stock, regardless of whether that condition is associated with either previous or current overfishing.

Preventing Overfishing

The Magnuson-Stevens Act is clear in its requirement to prevent overfishing. Except under very limited conditions, discussed below, this requirement must be satisfied. The Magnuson-Stevens Act's requirement to take remedial action in the event that a stock becomes overfished is not a substitute for the requirement to prevent overfishing in the first place.

Previous versions of the national standard guidelines have described limited conditions under which some amount of overfishing is permissible. Some of these conditions are retained in Sec. 600.310(d)(6) in the guidelines, but they are tightened considerably. Although the Magnuson-Stevens Act requires that OY and overfishing criteria be specified for each fishery, it does not require a one-to-one relationship between the fisheries for which OYs are specified and the fisheries for which overfishing criteria are specified. For example, in a mixed-stock fishery, overfishing criteria may be specified for the individual stocks, even if OY is specified for the fishery as a whole (see Sec. 600.310(c)(2)(iii)). Thus, it is conceivable that OY could be achieved for the fishery as a whole, even while overfishing of an individual stock is occurring.

Ending Overfishing and Rebuilding Overfished Stocks

In the event that overfishing occurs or is projected to occur within 2 years, or in the event that a stock or stock complex is overfished or is projected to become overfished within 2 years, the Magnuson-Stevens Act, in section 304(e), gives detailed requirements for Council action that must be undertaken in response. As described in Sec. 600.310(e) of the guidelines, if overfishing is occurring, Council action must be designed to reduce fishing mortality to a rate or level no greater than the maximum fishing mortality threshold. If a stock or stock complex is overfished, fishing at a rate or level equal to the maximum fishing mortality threshold will not meet the required rate and level of rebuilding. In such cases, Council action must go beyond that required for situations involving only overfishing.

Although the Magnuson-Stevens Act implicitly sets the rebuilding target equal to the MSY stock size, this constitutes a minimum standard only. In general, management practices should be designed to achieve an average stock size equal to the stock size associated with OY (or the average OY, in cases where OY is determined annually), and rebuilding plans should be consistent with this goal. Because OY cannot exceed MSY on average, the stock size that would produce OY will generally be greater than the stock size that would produce MSY. Remedial action should do more than merely assure that the stock reaches the target level; rather, the goal should be to restore the stock's capacity to remain at that level on a continuing basis, consistent with the stock's natural variability. For example, a stock should not be considered rebuilt just because its current size matches the target level, which could result from a single good year class, if the stock's condition would not likely be sustained by succeeding year classes. In order to conclude that a stock has fully recovered, it may be necessary to rebuild the age structure, in addition to achieving a particular biomass target. This generally requires keeping fishing mortality at an appropriately low level for several years (approximately one generation of the species).

Remedial action should be designed to make consistent and reasonably rapid progress towards recovery. "Consistent progress" means that no grace period exists beyond the statutory timeframe of 1 year for taking remedial action, and that such action should include explicit milestones expressed in terms of measurable improvement of the stock with respect to its status determination criteria. The Magnuson- Stevens Act, in section 304(e)(4), requires that the time period for rebuilding be as short as possible, but always less than 10 years, except in cases where the biology of the stock of fish, other environmental conditions, or management measures under an international agreement in which the United States participates dictate otherwise.

Optimum Yield

One of the most significant changes made by the SFA is a requirement that OY not exceed MSY. Further, for overfished fisheries, OY must be based upon a rebuilding schedule that increases stock levels to those that would produce MSY. These changes are expressions of a precautionary approach, which should contain three features (see Sec. 600.310(f)(5)). First, target reference points, such as OY, should be set safely below limit reference points, such as the catch level associated with the maximum fishing mortality threshold. Second, a stock that is below its MSY level should be harvested at a lower rate or level of fishing mortality than if it were above its MSY level. Third, the criteria used to set target catch levels should be explicitly risk averse, so that greater uncertainty regarding a stock's status or productive capacity corresponds to greater caution in setting target catch levels. Because specification of a precautionary approach can be a complicated exercise, NMFS plans to supplement these guidelines in the near future with technical guidance for use in implementing such an approach. This additional guidance may be provided in a form similar to that developed to implement the 1994 amendments to the MMPA.

The Magnuson-Stevens Act is clear in its requirement that specification of OY take into account protection of marine ecosystems. This is reflected in the new provisions concerning the identification and description of essential fish habitat (EFH). Proposed guidelines for designation of EFH were published in the Federal Register on April 23, 1997, at 62 FR 19723. Final guidelines for designation of EFH were published in the Federal Register on May 1, 1998, at 63 FR 24230. Due to the complex nature of marine ecosystem structure and function, qualitative methods may be used to satisfy this requirement wherever data or scientific understanding are insufficient to permit use of quantitative methods.

NMFS recognizes the growing importance of non-consumptive uses of marine fishery resources. Such activities include ecotourism, fish watching, recreational diving, and marine education. The guidelines are intended to accommodate such uses in specifying OY.

1.3 NMFS Guidance on National Standard 1

Below is the Final Rule guidelines on National Standard 1 (Section 600.310), published in the Federal Register on May 1, 1998.

Sec. 600.310 National Standard 1--Optimum Yield.

(a) Standard 1. Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the OY from each fishery for the U.S. fishing industry.

(b) General. The determination of OY is a decisional mechanism for resolving the Magnuson-Stevens Act's multiple purposes and policies, implementing an FMP's objectives, and balancing the various interests that comprise the national welfare. OY is based on MSY, or on MSY as it may be reduced under paragraph (f)(3) of this section. The most important limitation on the specification of OY is that the choice of OY and the conservation and management measures proposed to achieve it must prevent overfishing.

(c) MSY. Each FMP should include an estimate of MSY as explained in this section.

(1) Definitions.

> (i) ''MSY" is the largest long-term average catch or yield that can be taken from a stock or stock complex under prevailing ecological and environmental conditions.
> (ii) ''MSY control rule" means a harvest strategy which, if implemented, would be expected to result in a long-term average catch approximating MSY.

(iii) ``MSY stock size'' means the long-term average size of the stock or stock complex, measured in terms of spawning biomass or other appropriate units, that would be achieved under an MSY control rule in which the fishing mortality rate is constant.

(2) Options in specifying MSY.

(i) Because MSY is a theoretical concept, its estimation in practice is conditional on the choice of an MSY control rule. In choosing an MSY control rule, Councils should be guided by the characteristics of the fishery, the FMP's objectives, and the best scientific information available. The simplest MSY control rule is to remove a constant catch in each year that the estimated stock size exceeds an appropriate lower bound, where this catch is chosen so as to maximize the resulting long-term average yield. Other examples include the following: Remove a constant fraction of the biomass in each year, where this fraction is chosen so as to maximize the resulting long-term average yield; allow a constant level of escapement in each year, where this level is chosen so as to maximize the resulting long-term average yield; vary the fishing mortality rate as a continuous function of stock size, where the parameters of this function are constant and chosen so as to maximize the resulting long- term average yield. In any MSY control rule, a given stock size is associated with a given level of fishing mortality and a given level of potential harvest, where the long-term average of these potential harvests provides an estimate of MSY.

(ii) Any MSY values used in determining OY will necessarily be estimates, and these will typically be associated with some level of uncertainty. Such estimates must be based on the best scientific information available (see Sec. 600.315) and must incorporate appropriate consideration of risk (see Sec. 600.335). Beyond these requirements, however, Councils have a reasonable degree of latitude in determining which estimates to use and how these estimates are to be expressed. For example, a point estimate of MSY may be expressed by itself or together with a confidence interval around that estimate.

(iii) In the case of a mixed-stock fishery, MSY should be specified on a stock-by-stock basis. However, where MSY cannot be specified for each stock, then MSY may be specified on the basis of one or more species as an indicator for the mixed stock as a whole or for the fishery as a whole.

(iv) Because MSY is a long-term average, it need not be estimated annually, but it must be based on the best scientific information available, and should be re-estimated as required by changes in environmental or ecological conditions or new scientific information.

(3) Alternatives to specifying MSY. When data are insufficient to estimate MSY directly, Councils should adopt other measures of productive capacity that can serve as reasonable proxies for MSY, to the extent possible. Examples include various reference points defined in terms of relative spawning per recruit. For instance, the fishing mortality rate that reduces the long-term average level of spawning per recruit to 30-40 percent of the long-term average that would be expected in the absence of fishing may be a reasonable proxy for the MSY fishing mortality rate. The long-term average stock size obtained by fishing year after year at this rate under average recruitment may be a reasonable proxy for the MSY stock size, and the long-term average catch so obtained may be a reasonable proxy for MSY. The natural mortality rate may also be a reasonable proxy for the MSY fishing mortality rate. If a reliable estimate of pristine stock size (i.e., the long-term average stock size that would be expected in the absence of fishing) is available, a stock size approximately 40 percent of this value may be a reasonable proxy for the MSY stock size, and the product of this stock size and the natural mortality rate may be a reasonable proxy for MSY.

(d) Overfishing--(1) Definitions.

(i) ``To overfish'' means to fish at a rate or level that jeopardizes the capacity of a stock or stock complex to produce MSY on a continuing basis.

(ii) ``Overfishing'' occurs whenever a stock or stock complex is subjected to a rate or level of fishing mortality that jeopardizes the capacity of a stock or stock complex to produce MSY on a continuing basis.

(iii) In the Magnuson-Stevens Act, the term ``overfished'' is used in two senses: First, to describe any stock or stock complex that is subjected to a rate or level of fishing mortality meeting the criterion in paragraph (d)(1)(i) of this section, and second, to describe any stock or stock complex whose size is sufficiently small that a change in management practices is required in order to achieve an appropriate level and rate of rebuilding. To avoid confusion, this section uses ``overfished'' in the second sense only.

(2) Specification of status determination criteria. Each FMP must specify, to the extent possible, objective and measurable status determination criteria for each stock or stock complex covered by that FMP and provide an analysis of how the status determination criteria were chosen and how they relate to reproductive potential. Status determination criteria must be expressed in a way that enables the Council and the Secretary to monitor the stock or stock complex and determine annually whether overfishing is occurring and whether the stock or stock complex is overfished. In all cases, status determination criteria must specify both of the following:

(i) A maximum fishing mortality threshold or reasonable proxy thereof. The fishing mortality threshold may be expressed either as a single number or as a function of spawning biomass or other measure of productive capacity. The fishing mortality threshold must not exceed the fishing mortality rate or level associated with the relevant MSY control rule. Exceeding the fishing mortality threshold for a period of 1 year or more constitutes overfishing.

(ii) A minimum stock size threshold or reasonable proxy thereof. The stock size threshold should be expressed in terms of spawning biomass or other measure of productive capacity. To the extent possible, the stock size threshold should equal whichever of the following is greater: One-half the MSY stock size, or the minimum stock size at which rebuilding to the MSY level would be expected to occur within 10 years if the stock or stock complex were exploited at the maximum fishing mortality threshold specified under paragraph (d)(2)(i) of this section. Should the actual size of the stock or stock complex in a given year fall below this threshold, the stock or stock complex is considered overfished.

(3) Relationship of status determination criteria to other national standards

(i) National standard 2. Status determination criteria must be based on the best scientific information available (see Sec. 600.315). When data are insufficient to estimate MSY, Councils should base status determination criteria on reasonable proxies thereof to the extent possible (also see paragraph (c)(3) of this section). In cases where scientific data are severely limited, effort should also be directed to identifying and gathering the needed data.

(ii) National standard 3. The requirement to manage interrelated stocks of fish as a unit or in close coordination notwithstanding (see Sec. 600.320), status determination criteria should generally be specified in terms of the level of stock aggregation for which the best scientific information is available (also see paragraph (c)(2)(iii) of this section).

(iii) National standard 6. Councils must build into the status determination criteria appropriate consideration of risk, taking into account uncertainties in estimating harvest, stock conditions, life history parameters, or the effects of environmental factors (see Sec. 600.335).

(4) Relationship of status determination criteria to environmental change. Some short-term environmental changes can alter the current size of a stock or stock complex without affecting the long-term productive capacity of the stock or stock complex. Other environmental changes affect both the current size of the stock or stock complex and the long-term productive capacity of the stock or stock complex.

(i) If environmental changes cause a stock or stock complex to fall below the minimum stock size threshold without affecting the long-term productive capacity of the stock or stock complex, fishing mortality must be constrained sufficiently to allow rebuilding within an acceptable time frame (also see paragraph (e)(4)(ii) of this section). Status determination criteria need not be respecified.

(ii) If environmental changes affect the long-term productive capacity of the stock or stock complex, one or more components of the status determination criteria must be respecified. Once status determination criteria have been respecified, fishing mortality may or may not have to be reduced, depending on the status of the stock or stock complex with respect to the new criteria.

(iii) If manmade environmental changes are partially responsible for a stock or stock complex being in an overfished condition, in addition to controlling effort, Councils should recommend restoration of habitat and other ameliorative programs, to the extent possible (see also the guidelines issued pursuant to section 305(b) of the Magnuson- Stevens Act for Council actions concerning essential fish habitat).

(5) Secretarial approval of status determination criteria. Secretarial approval or disapproval of proposed status determination criteria will be based on consideration of whether the proposal:

(i) Has sufficient scientific merit.
(ii) Contains the elements described in paragraph (d)(2) of this section.
(iii) Provides a basis for objective measurement of the status of the stock or stock complex against the criteria.
(iv) Is operationally feasible.

(6) Exceptions. There are certain limited exceptions to the requirement to prevent overfishing. Harvesting one species of a mixed- stock complex at its optimum level may result in the overfishing of another stock component in the complex. A Council may decide to permit this type of overfishing only if all of the following conditions are satisfied:

(i) It is demonstrated by analysis (paragraph (f)(6) of this section) that such action will result in long-term net benefits to the Nation.
(ii) It is demonstrated by analysis that mitigating measures have been considered and that a similar level of long-term net benefits cannot be achieved by modifying fleet behavior, gear selection/ configuration, or other technical characteristic in a manner such that no overfishing would occur.
(iii) The resulting rate or level of fishing mortality will not cause any species or evolutionary significant unit thereof to require protection under the ESA.

(e) Ending overfishing and rebuilding overfished stocks-- (1) Definition. A threshold, either maximum fishing mortality or minimum stock size, is being "approached" whenever it is projected that the threshold will be breached within 2 years, based on trends in fishing effort, fishery resource size, and other appropriate factors.

(2) Notification. The Secretary will immediately notify a Council and request that remedial action be taken whenever the Secretary determines that:

(i) Overfishing is occurring;
(ii) A stock or stock complex is overfished;
(iii) The rate or level of fishing mortality for a stock or stock complex is approaching the maximum fishing mortality threshold;
(iv) A stock or stock complex is approaching its minimum stock size threshold; or
(v) Existing remedial action taken for the purpose of ending previously identified overfishing or rebuilding a previously identified overfished stock or stock complex has not resulted in adequate progress.

(3) Council action. Within 1 year of such time as the Secretary may identify that overfishing is occurring, that a stock or stock complex is overfished, or that a threshold is being approached, or such time as a Council may be notified of the same under paragraph (e)(2) of this section, the Council must take remedial action by preparing an FMP, FMP amendment, or proposed regulations. This remedial action must be designed to accomplish all of the following purposes that apply:

(i) If overfishing is occurring, the purpose of the action is to end overfishing.
(ii) If the stock or stock complex is overfished, the purpose of the action is to rebuild the stock or stock complex to the MSY level within an appropriate time frame.
(iii) If the rate or level of fishing mortality is approaching the maximum fishing mortality threshold (from below), the purpose of the action is to prevent this threshold from being reached.
(iv) If the stock or stock complex is approaching the minimum stock size threshold (from above), the purpose of the action is to prevent this threshold from being reached.

(4) Constraints on Council action.

(i) In cases where overfishing is occurring, Council action must be sufficient to end overfishing.

(ii) In cases where a stock or stock complex is overfished, Council action must specify a time period for rebuilding the stock or stock complex that satisfies the requirements of section 304(e)(4)(A) of the Magnuson-Stevens Act.

(A) A number of factors enter into the specification of the time period for rebuilding:

(1) The status and biology of the stock or stock complex;
(2) Interactions between the stock or stock complex and other components of the marine ecosystem (also referred to as ``other environmental conditions'');
(3) The needs of fishing communities;
(4) Recommendations by international organizations in which the United States participates; and
(5) Management measures under an international agreement in which the United States participates.

(B) These factors enter into the specification of the time period for rebuilding as follows:

(1) The lower limit of the specified time period for rebuilding is determined by the status and biology of the stock or stock complex and its interactions with other components of the marine ecosystem, and is defined as the amount of time that would be required for rebuilding if fishing mortality were eliminated entirely.
(2) If the lower limit is less than 10 years, then the specified time period for rebuilding may be adjusted upward to the extent warranted by the needs of fishing communities and recommendations by international organizations in which the United States participates, except that no such upward adjustment can result in the specified time period exceeding 10 years, unless management measures under an international agreement in which the United States participates dictate otherwise.
(3) If the lower limit is 10 years or greater, then the specified time period for rebuilding may be adjusted upward to the extent warranted by the needs of fishing communities and recommendations by international organizations in which the United States participates, except that no such upward adjustment can exceed the rebuilding period calculated in the absence of fishing mortality, plus one mean generation time or equivalent period based on the species' life-history characteristics. For example, suppose a stock could be rebuilt within 12 years in the absence of any fishing mortality, and has a mean generation time of 8 years. The rebuilding period, in this case, could be as long as 20 years.

(C) A rebuilding program undertaken after May 1, 1998 commences as soon as the first measures to rebuild the stock or stock complex are implemented.

(D) In the case of rebuilding plans that were already in place as of May 1, 1998, such rebuilding plans must be reviewed to determine whether they are in compliance with all requirements of the Magnuson- Stevens Act, as amended by the Sustainable Fisheries Act.

(iii) For fisheries managed under an international agreement, Council action must reflect traditional participation in the fishery, relative to other nations, by fishermen of the United States.

(5) Interim measures. The Secretary, on his/her own initiative or in response to a Council request, may implement interim measures to reduce overfishing under section 305(c) of the Magnuson-Stevens Act, until such measures can be replaced by an FMP, FMP amendment, or regulations taking remedial action.

(i) These measures may remain in effect for no more than 180 days, but may be extended for an additional 180 days if the public has had an opportunity to comment on the measures and, in the case of Council-recommended measures, the Council is actively preparing an FMP, FMP amendment, or proposed regulations to address overfishing on a permanent basis. Such measures, if otherwise in compliance with the provisions of the Magnuson-Stevens Act, may be implemented even though they are not sufficient by themselves to stop overfishing of a fishery.
(ii) If interim measures are made effective without prior notice and opportunity for comment, they should be reserved for exceptional situations, because they affect fishermen without providing the usual procedural safeguards. A Council recommendation for interim measures without notice-and-comment rulemaking will

be considered favorably if the short-term benefits of the measures in reducing overfishing outweigh the value of advance notice, public comment, and deliberative consideration of the impacts on participants in the fishery.

(f) OY--(1) Definitions.

(i) The term ``optimum,'' with respect to the yield from a fishery, means the amount of fish that will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities and taking into account the protection of marine ecosystems; that is prescribed on the basis of the MSY from the fishery, as reduced by any relevant economic, social, or ecological factor; and, in the case of an overfished fishery, that provides for rebuilding to a level consistent with producing the MSY in such fishery.
(ii) In national standard 1, use of the phrase ``achieving, on a continuing basis, the OY from each fishery'' means producing, from each fishery, a long-term series of catches such that the average catch is equal to the average OY and such that status determination criteria are met.

(2) Values in determination. In determining the greatest benefit to the Nation, these values that should be weighed are food production, recreational opportunities, and protection afforded to marine ecosystems. They should receive serious attention when considering the economic, social, or ecological factors used in reducing MSY to obtain OY.

(i) The benefits of food production are derived from providing seafood to consumers, maintaining an economically viable fishery together with its attendant contributions to the national, regional, and local economies, and utilizing the capacity of the Nation's fishery resources to meet nutritional needs.
(ii) The benefits of recreational opportunities reflect the quality of both the recreational fishing experience and non-consumptive fishery uses such as ecotourism, fish watching, and recreational diving, and the contribution of recreational fishing to the national, regional, and local economies and food supplies.
(iii) The benefits of protection afforded to marine ecosystems are those resulting from maintaining viable populations (including those of unexploited species), maintaining evolutionary and ecological processes (e.g., disturbance regimes, hydrological processes, nutrient cycles), maintaining the evolutionary potential of species and ecosystems, and accommodating human use.

(3) Factors relevant to OY. Because fisheries have finite capacities, any attempt to maximize the measures of benefit described in paragraph (f)(2) of this section will inevitably encounter practical constraints. One of these is MSY. Moreover, various factors can constrain the optimum level of catch to a value less than MSY. The Magnuson-Stevens Act's definition of OY identifies three categories of such factors: Social, economic, and ecological. Not every factor will be relevant in every fishery. For some fisheries, insufficient information may be available with respect to some factors to provide a basis for corresponding reductions in MSY.

(i) Social factors. Examples are enjoyment gained from recreational fishing, avoidance of gear conflicts and resulting disputes, preservation of a way of life for fishermen and their families, and dependence of local communities on a fishery. Other factors that may be considered include the cultural place of subsistence fishing, obligations under Indian treaties, and worldwide nutritional needs.
(ii) Economic factors. Examples are prudent consideration of the risk of overharvesting when a stock's size or productive capacity is uncertain, satisfaction of consumer and recreational needs, and encouragement of domestic and export markets for U.S.-harvested fish. Other factors that may be considered include the value of fisheries, the level of capitalization, the decrease in cost per unit of catch afforded by an increase in stock size, and the attendant increase in catch per unit of effort, alternate employment opportunities, and economies of coastal areas.
(iii) Ecological factors. Examples are stock size and age composition, the vulnerability of incidental or unregulated stocks in a mixed-stock fishery, predator-prey or competitive interactions, and dependence of marine mammals and birds or endangered species on a stock of fish. Also important are ecological or environmental conditions that stress marine organisms, such as natural and manmade changes in wetlands or nursery grounds, and effects of pollutants on habitat and stocks.

(4) Specification.

(i) The amount of fish that constitutes the OY should be expressed in terms of numbers or weight of fish. However, OY may be expressed as a formula that converts periodic stock assessments into target harvest levels; in terms of an annual harvest of fish or shellfish having a minimum weight, length, or other measurement; or as an amount of fish taken only in certain areas, in certain seasons, with particular gear, or by a specified amount of fishing effort.
(ii) Either a range or a single value may be specified for OY. Specification of a numerical, fixed-value OY does not preclude use of annual target harvest levels that vary with stock size. Such target harvest levels may be prescribed on the basis of an OY control rule similar to the MSY control rule described in paragraph (c)(1)(ii) of this section, but designed to achieve OY on average, rather than MSY. The annual harvest level obtained under an OY control rule must always be less than or equal to the harvest level that would be obtained under the MSY control rule.
(iii) All fishing mortality must be *counted against* OY, *including* that resulting from bycatch, scientific research, and any other fishing activities.
(iv) The OY specification should be translatable into an annual numerical estimate for the purposes of establishing any TALFF and analyzing impacts of the management regime. There should be a mechanism in the FMP for periodic reassessment of the OY specification, so that it is responsive to changing circumstances in the fishery. (v) The determination of OY requires a specification of MSY, which may not always be possible or meaningful. However, even where sufficient scientific data as to the biological characteristics of the stock do not exist, or where the period of exploitation or investigation has not been long enough for adequate understanding of stock dynamics, or where frequent large-scale fluctuations in stock size diminish the meaningfulness of the MSY concept, the OY must still be based on the best scientific information available. When data are insufficient to estimate MSY directly, Councils should adopt other measures of productive capacity that can serve as reasonable proxies for MSY to the extent possible (also see paragraph (c)(3) of this section).
(vi) In a mixed-stock fishery, specification of a fishery-wide OY may be accompanied by management measures establishing separate annual target harvest levels for the individual stocks. In such cases, the sum of the individual target levels should not exceed OY.

(5) OY and the precautionary approach. In general, Councils should adopt a precautionary approach to specification of OY. A precautionary approach is characterized by three features:

(i) Target reference points, such as OY, should be set safely below limit reference points, such as the catch level associated with the fishing mortality rate or level defined by the status determination criteria. Because it is a target reference point, OY does not constitute an absolute ceiling, but rather a desired result. An FMP must contain conservation and management measures to achieve OY, and provisions for information collection that are designed to *determine the degree* to which OY is achieved on a continuing basis--that is, to result in a long-term average catch equal to the long-term average OY, while meeting the status determination criteria. These measures should allow for practical and effective implementation and enforcement of the management regime, so that the harvest is allowed to reach OY, but not to exceed OY by a substantial amount. The Secretary has an obligation to implement and enforce the FMP so that OY is achieved. If management measures prove unenforceable--or too restrictive, or not rigorous enough to realize OY--they should be modified; an alternative is to reexamine the adequacy of the OY specification. Exceeding OY does not necessarily constitute overfishing. However, even if no overfishing resulted from exceeding OY, continual harvest at a level above OY would violate national standard 1, because OY was not achieved on a continuing basis.
(ii) A stock or stock complex that is below the size that would produce MSY should be harvested at a lower rate or level of fishing mortality than if the stock or stock complex were above the size that would produce MSY.
(iii) Criteria used to set target catch levels should be explicitly risk averse, so that greater uncertainty regarding the status or productive capacity of a stock or stock complex corresponds to greater caution in setting target catch levels. Part of the OY may be held as a reserve to allow for factors such as uncertainties in estimates of

stock size and DAH. If an OY reserve is established, an adequate mechanism should be included in the FMP to permit timely release of the reserve to domestic or foreign fishermen, if necessary.

(6) Analysis. An FMP must contain an assessment of how its OY specification was determined (section 303(a)(3) of the Magnuson-Stevens Act). It should relate the explanation of overfishing in paragraph (d) of this section to conditions in the particular fishery and explain how its choice of OY and conservation and management measures will prevent overfishing in that fishery. A Council must identify those economic, social, and ecological factors relevant to management of a particular fishery, then evaluate them to determine the amount, if any, by which MSY exceeds OY. The choice of a particular OY must be carefully defined and documented to show that the OY selected will produce the greatest benefit to the Nation. If overfishing is permitted under paragraph (d)(6) of this section, the assessment must contain a justification in terms of overall benefits, including a comparison of benefits under alternative management measures, and an analysis of the risk of any species or ecologically significant unit thereof reaching a threatened or endangered status, as well as the risk of any stock or stock complex falling below its minimum stock size threshold.

(7) OY and foreign fishing. Section 201(d) of the Magnuson-Stevens Act provides that fishing by foreign nations is limited to that portion of the OY that will not be harvested by vessels of the United States.

(i) DAH. Councils must consider the capacity of, and the extent to which, U.S. vessels will harvest the OY on an annual basis. Estimating the amount that U.S. fishing vessels will actually harvest is required to determine the surplus.
(ii) DAP. Each FMP must assess the capacity of U.S. processors. It must also assess the amount of DAP, which is the sum of two estimates: The estimated amount of U.S. harvest that domestic processors will process, which may be based on historical performance or on surveys of the expressed intention of manufacturers to process, supported by evidence of contracts, plant expansion, or other relevant information; and the estimated amount of fish that will be harvested by domestic vessels, but not processed (e.g., marketed as fresh whole fish, used for private consumption, or used for bait).
(iii) JVP. When DAH exceeds DAP, the surplus is available for JVP. JVP is derived from DAH.

1.4 Current Scallop FMP Definitions of Overfishing, OY, and MSY

The current definition of MSY, Optimum Yield, and Overfishing contained in the FMP was implemented under Amendment 1. Prior to Amendment 1, the FMP specified a long-term OY for the scallop fishery in the EEZ as a numerical range of zero to 1.1 million pounds of shucked scallop meats. Under the interim FMP, OY was set at zero to prevent unregulated fishing by non-licensed vessels. Amendment 1 revised the OY range to 0-1.8 million pounds to reflect landings in State waters.

The FMP was originally based on the Magnuson-Stevens Act 602 guidelines for FMP's, whereby overfishing is a level or rate of fishing mortality that jeopardizes the long-term capacity of a stock or stock complex to provide maximum sustainable yield (MSY) on a continuing basis. Overfishing definitions for existing FMP have been based on stock abundance levels, fishing mortality rate, or both (Rosenberg et al. 1993). Optimum Yield (OY) is that which provides the greatest overall benefit to the nation with particular reference to food production and recreational fisheries. OY is based upon the maximum sustainable yield for a given fishery, modified by relevant economic, social or biological factors.

Biomass estimates for scallops are lacking, such that numerical estimation of MSY for weathervane and other scallop species not possible at this time. NOAA recognizes that there are cases where the specification of MSY may either be impossible or irrelevant. This may be due to lack of assessment data ... or because biological resiliency or high fecundity of some stocks or other fishery characteristic may allow OY to become a descriptive statement only, making calculation of MSY unnecessary (602 Guidelines Final Rule 1989). Pectinids in general exhibit extreme variations in year class strength (Orensanz et al. 1991), and effort and landings from the Alaskan scallop fishery have varied widely. In addition, the lack of biomass

estimates suggest that numerical specification of these fishery reference points was premature when the FMP was implemented.

Instead of a specifying OY as a fishing rate or constant catch level, OY is specified as a numerical range for Alaskan scallops. **The OY range established under Amendment 1 was zero to 1,800,000 pounds of shucked scallop meats, and was derived from historical catches.** The low end of the range is the lowest catch on record (0 pounds, 1978). The high end of the OY range was defined as the highest catch recorded since the 'fishing up' period (1,800,000 pounds, 1992). The OY includes landings from state waters. Quotas, or *guideline harvest ranges* (GHRs), may be set for individual scallop species, so long as the total GHLs are less than or equal to the upper end of the OY range.

In the current FMP, overfishing is defined as landings that exceed optimum yield. Although overfishing could have been defined as a fishing mortality rate for weathervane scallops, based on existing life history data, the lack of stock assessment information (surveys, population age or size structure) limit the use of an overfishing rate. The FMP notes that as data collected from the fisheries and/or assessment surveys of the scallop resource are analyzed, overfishing for scallops may be defined on a fishing mortality rate basis. The FMP further notes that until better information becomes available, overfishing is defined as landings that exceed optimum yield.

1.5 Alternatives Considered

1.5.1 Alternative 1: Status Quo

The current FMP specifies OY to be a range from 0 - 1,800,000 pounds of shucked scallop meats, and was derived from historical catches. The low end of the range is the lowest catch on record (0 pounds, 1978). The high end of the OY range was defined as the highest catch recorded since the 'fishing up' period (1,800,000 pounds, 1992). The OY includes landings from state waters. Overfishing is defined as landings that exceed optimum yield. No estimates of MSY or biomass thresholds are provided.

1.5.2 Alternative 2 : (Preferred) Redefine overfishing, OY, and MSY.

The Magnuson- Stevens Act redefines OY to be less than or equal to MSY. Further, the Act provides for guidelines for national standard 1. These guidelines assist the Councils with amending the FMPs to comply with Magnuson Stevens Act provisions. Alternative 2 is proposed to amend the scallop FMP by redefining overfishing, OY, and MSY. This amendment also adds additional language to the FMP to comply with another Act requirement to monitor bycatch.

1.6 Analysis of Overfishing, OY, and MSY

Many of the recommendations from the national standard guidelines can not be applied to the scallop fishery off Alaska because biomass has not been estimated for most local stocks. The guidelines note that the MSY control rule can be based on removing a constant catch; remove a constant fraction of the biomass in each year, where this fraction is chosen so as to maximize the resulting long-term average yield; allow a constant level of escapement in each year, where this level is chosen so as to maximize the resulting long-term average yield; vary the fishing mortality rate as a continuous function of stock size, where the parameters of this function are constant and chosen so as to maximize the resulting long- term average yield. In any MSY control rule, a given stock size is associated with a given level of fishing mortality and a given level of potential harvest, where the long-term average of these potential harvests provides an estimate of MSY.

Unfortunately, comprehensive surveys for weathervane scallops are lacking (as are age data from the fishery). In rare cases, biomass has been estimated using Leslie depletion estimates.

Maximum Sustainable Yield (MSY)

The guidelines define MSY as the largest long-term average catch or yield that can be taken from a stock or stock complex under prevailing ecological and environmental conditions. The guidelines further note that the long-term average stock size obtained by fishing year after year at this rate under average recruitment may be a reasonable proxy for the MSY stock size, and the long-term average catch so obtained may be a reasonable proxy for MSY

MSY could be estimated based on the average catch from 1990-1997, which reflects prevailing ecological conditions. The fishery was fully capitalized during this time period, and all areas of the state were where scallops could be harvested were being exploited. Prior to that time period, vessels moved into and out of the scallop fishery, in part in response to economic opportunities available in other fisheries (Shirley and Kruse, 1995). Note however, that since 1993, the fishery has been somewhat limited by crab bycatch, closure areas, and season length. The average landings, 1990-1997 (1995 data not included as fishery was closed most of the year), was 1,240,000 pounds of shucked meats.

Landings and effort in the Alaska weathervane scallop fishery, 1980 - 1997.

Year	# of Vessels	Landings (pounds)	Price ($/lb)
1980	8	633,000	4.32
1981	18	924,000	4.05
1982	13	914,000	3.77
1983	6	194,000	4.88
1984	10	390,000	4.47
1985	8	648,000	3.12
1986	9	683,000	3.66
1987	4	583,000	3.38
1988	4	341,000	3.49
1989	7	526,000	3.68
1990	9	1,489,000	3.37
1991	7	1,191,000	3.76
1992	7	1,811,000	3.88
1993	15	1,429,000	5.00
1994	16	1,235,000	6.00
1995	10	283,000	n/a
1996	9	732,424	6.38
1997	9	786,043	6.50

As there really is no stable period during the history of this fishery, MSY estimation by averaging catches is problematic, but there does not appear to be a better solution at this point. It seems appropriate to exclude 1995 due to the Mr. Big incident (the entire fishery was closed in February 1995 when an unregistered vessel continued to catch scallops). However, there was some latent effect of this snafu in 1996. That year, there was a harvest of 55,000 pounds from state waters only in January, and the federal waters opening was delayed until August 1 after the FMP problems were fixed. The late start could have inhibited the fishery. Additionally, the sustainable level of catches from the Bering Sea is an important issue. Note that the fishery in the Bering Sea did not start until 1993. Thus, by averaging catches from 1990-1992, it is assumed that no catches were sustainable from the Bering Sea during those three years. This will lead to an underestimate of MSY. On the other hand, the Bering Sea catches in 1993 and 1994 exceeded 600,000 pounds and 500,000 pounds respectively. These high catches are probably not sustainable as a result of the fishing-up process. Including these catches will tend to overestimate MSY. So, on the one hand, the 1990-1997 period of averaging unfairly excludes Bering Sea catches that could have been taken in 1990-1992, and on the other hand, this period includes two years of fishing-up (1993-1994) that are likely unsustainable. Indeed, catches in 1996 and 1997 have fallen off (1997 catches were severely constrained by snow and Tanner crab bycatch rates).

Another option for defining MSY for scallops can be calculated based on a formula developed by Gulland (1971), who proposed that MSY = 0.5 M B_0, where M is instantaneous natural mortality and B_0 is virgin biomass. This equation assumes that the population grows according to the logistic population model, which does not account for spatial or temporal variability in the environment, nor for age or size structure in the

population. This equation also assumes that the proportion of the population that can be harvested be equivalent to the proportion that would succumb naturally (M) in the absence of fishing.

Instantaneous natural mortality (M) for weathervane scallops has been estimated by Kruse and Funk (1995), based on data presented in published papers (Kaiser 1986, Hennick 1973). A median M value of 0.13 was estimated using the methodology of Alverson and Carney (1975) based on growth parameters, Robson and Chapman (1961) based on catch curves, and Hoenig (1983) and Beverton (1963) based on maximum age.

Using the formula of Gulland (1971) maximum sustainable yield for weathervane scallops can thus be estimated using the following formula: MSY = 0.5 (0.13) B0. The product of these factors is 0.065 B_0. In other words, maximum allowable annual yield is estimated to be 6.5% of the virgin population size.

MSY Control Rule (F_{msy})

The guidelines define the MSY control rule as a harvest strategy which, if implemented, would be expected to result in a long-term average catch approximating MSY. The MSY control rule establishes a maximum fishing mortality threshold, which may be expressed either as a single number or as a function of spawning biomass or other measure of productive capacity. The fishing mortality threshold should be set at the fishing mortality rate or level associated with the relevant MSY control rule. Exceeding the fishing mortality threshold for a period of 1 year or more constitutes overfishing

In choosing an MSY control rule, Councils should be guided by the characteristics of the fishery, the FMP's objectives, and the best scientific information available. The simplest MSY control rule is to remove a constant catch in each year that the estimated stock size exceeds an appropriate lower bound, where this catch is chosen so as to maximize the resulting long-term average yield. Other examples include the following: Remove a constant fraction of the biomass in each year, where this fraction is chosen so as to maximize the resulting long-term average yield; allow a constant level of escapement in each year, where this level is chosen so as to maximize the resulting long-term average yield; vary the fishing mortality rate as a continuous function of stock size, where the parameters of this function are constant and chosen so as to maximize the resulting long- term average yield. In any MSY control rule, a given stock size is associated with a given level of fishing mortality and a given level of potential harvest, where the long-term average of these potential harvests provides an estimate of MSY. The natural mortality rate may also be a reasonable proxy for the MSY fishing mortality rate.

The national standard guidelines note alternatives to specifying MSY. When data are insufficient to estimate MSY directly, Councils should adopt other measures of productive capacity that can serve as reasonable proxies for MSY, to the extent possible. Examples include various reference points defined in terms of relative spawning per recruit, or simply the natural mortality rate. If a reliable estimate of pristine stock size (i.e., the long-term average stock size that would be expected in the absence of fishing) is available, a stock size somewhere in the range of 25-75 percent of this value may be a reasonable proxy for the MSY stock size, and the product of this stock size and the natural mortality rate may be a reasonable proxy for MSY.

Kruse and Funk (1995) estimated $F_{35\%} = 0.15$ for weathervane scallops off Alaska. Their estimate was conservative in that it estimated handling mortality rates of 20-40% for non-retained small scallops. They also proposed that overfishing be defined based on $F_{30\%}=0.25$.

An MSY control rule based on natural mortality might also be reasonable for weathervane scallops. Using the estimate of M = 0.13 (Kruse and Funk 1995), F_{msy} = M, or F_{msy} = 0.13. This estimate is more

conservative than the rate generated by $F_{35\%}$. No control rule for spiny, pink, or rock scallops is recommended at this time.

MSY Stock Size (B_{msy})

The guidelines define the MSY stock size as the long term average size of the stock or stock complex , measured in terms of spawning biomass or other appropriate units, associated with the production of MSY. It is the stock size that would be achieved under an appropriate MSY control rule. It is also the minimum standard for a rebuilding target when remedial management action is required.

As noted earlier MSY for weathervane scallops could be established at 1.24 million pounds of shucked adductor muscles. Therefore, MSY stock size can be estimated as MSY/M = 9.54 million pounds of shucked meat biomass. In terms of whole animals (including shells and gurry) Bmsy would be 95.4 million pounds, as expanded by a product recovery rate of 10%.

Bmsy could be established based on the MSY biomass, as follows: MSY Stock Size (B_{msy}) = $B_{1990\text{-}1997}$ = ½ B_0 = MSY/M =9.54 million pounds (meats). This assumes that the stock was at B_{msy} and that catches were at MSY during 1990-1997, and that the logistic equation holds.

Minimum Stock Size Threshold

The guidelines state that the minimum stock size threshold, to the extent possible, should equal whichever is greater: one half the MSY stock size, or the minimum stock size at which rebuilding to the MSY level would be expected to occur within 10 years if the stock or stock complex were exploited at the maximum fishing mortality threshold. Should the actual size of the stock or stock complex in a given year fall below this threshold, the stock or stock complex is considered overfished. The minimum stock size threshold should be expressed in terms of spawning biomass or other measure of reproductive capacity. Based on the guidelines, a minimum stock size threshold for weathervane scallops could be established based on ½ MSY stock size = ½B_{msy} = 4.77 million pounds of shucked adductor muscles.

Overfishing Control Rule ($F_{overfishing}$)

The guidelines define the terms "overfishing" and "overfished" to mean a rate or level of fishing mortality that jeopardizes the capacity of a fishery to produce the maximum sustainable yield on a continuing basis.

Overfishing could be established for weathervane scallop stocks as a fishing rate in excess of the natural mortality rate. Hence, $F_{overfishing}$ = M = 0.13.

Optimum Yield (OY)

The definition of optimum yield proposed by Alternative 2, is simply the definition contained in the Magnuson-Stevens Act. The term 'optimum', with respect to the yield from a fishery, means the amount of fish which --

(a) will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems;

(b) is prescribed as such on the basis of maximum sustainable yield from the fishery, as reduced by any relevant economic, social, or ecological factor; and

(c) in the case of an overfished fishery, provides for rebuilding to a level consistent with producing the maximum sustainable yield in such fishery.

Optimum yield should be established on the basis of MSY. OY is upper bounded by MSY = F_{msy} B_{msy} = M B_{msy} (= 1,240,000 pounds). Hence, a numerical range for OY of 0-1,240,000 pounds can thus be established for Alaska weathervane scallops. Because MSY cannot be estimated for the other scallop species, OY cannot be quantified for rock scallops, pink scallops, or spiny scallops. The ADF&G manages fisheries for these species through special permits. Note however, that no commercial harvest of these species has been made since 1992.

There is sufficient conservatism built into establishing an annual OY cap of 1.24 million pounds for the following reasons:

1. the years of averaging include years when no fishing occurred in the Bering Sea, but obviously some sustainable harvest was possible,
2. the period of averaging includes other areas and years when the harvest was constrained by fishery controls, such as recently by bycatch PSCs, and therefore the resulting catch underestimates the productivity of scallop stocks,
3. substantial areas are closed to scallop dredging due to concerns about bycatch, yet these areas have substantial productivity -- these areas can almost be thought of as marine refuges and potential yields from these areas are not factored into MSY estimates,
4. there are years during the history of the fishery when effort was low due to market (not abundance) conditions,
5. $F_{30\%}$ is probably a better estimator of $F_{overfishing}$ than is F=M, yet M<$F_{30\%}$ so the overfishing rule is conservative, and
6. when good recruitment comes along, the stocks are likely greater than B_{msy}, thus we will fish at F<$F_{overfishing}$ to achieve OY=MSY (recall MSY = F_{msy} B_{msy}, so if B>B_{msy}, then F<F_{msy}).

It should be noted that, if you add up all the upper ends of the GHL ranges for each area at present, you get 1.6 million pounds compared to the potential upper bound of OY of 1.24 million pounds. If the proposed amendment is adopted and implemented, then the state will need to cut off fishing when the 1.24 million pound level is hit. In practice this may mean that the managers will need to tally the catches along the way, and if the Bering Sea fishery comes last, for instance, then the GHL for the Bering Sea will have to be set accordingly to come in under the OY cap. Alternatively, all the area-specific GHLs could be adjusted so their upper ends add up to 1.24 million pounds. Essentially, the summed GHLs will have to be reduced by 360,000 pounds. This may not be too difficult nor unjustified. Preliminary fishery information suggests that the upper ends on the GHLs for Kodiak (400,000 pounds), Dutch Harbor (170,000 pounds), and Bering Sea (600,000 pounds) may be too optimistic. For example, if the GHL for Kodiak was reduced by 100,000, Dutch Harbor by 60,000, and Bering Sea by 200,000 pounds, the sum of all GHLs would equal the OY cap.

In the future, better quantitative estimates of appropriate scallop yields by area may be generated based on observer data analysis. Additional information on biomass and long-term potential yield of pink, spiny and rock scallops may also be available in the future. At such time, MSY and OY would be re-estimated and the FMP amended.

1.7 Information on Bycatch

The Magnuson-Stevens Act amendments emphasized the importance of bycatch effects on achieving sustainable fisheries. National Standard 9 mandates that conservation and management measures shall, to

the extent practicable: (1) minimize bycatch; and (2) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.

1.7.1 NMFS Guidance on National Standard 9

The following are excerpts from the national standard guidelines.

The term ``bycatch'' means fish that are harvested in a fishery (i.e., removed permanently from the population as a result of fishing), but that are not sold or kept for personal use. Bycatch includes economic discards, regulatory discards, and fishing mortality due to an encounter with fishing gear that does not result in capture of fish (i.e., unobserved fishing mortality). Bycatch does not include any fish that legally are retained in a fishery and kept for personal, tribal, or cultural use, or that enter commerce through sale, barter, or trade.

The priority for reducing bycatch under this standard is to minimize or avoid catching bycatch species where possible. Fish that are bycatch and cannot be avoided should, to the extent practicable, be returned to the sea alive. To evaluate conservation and management measures relative to this and other national standards, as well as to evaluate total fishing mortality, Councils should:

(1) Promote development of a database on bycatch and bycatch mortality in the fishery to the extent practicable. A review and, where necessary, improvement of data collection methods, data sources, and applications of data should be initiated for each fishery to determine the amount, type, disposition, and other characteristics of bycatch and bycatch mortality in each fishery for purposes of this standard and of section 303(a)(11) and (12) of the Magnuson-Stevens Act. Bycatch should be categorized to focus on management responses necessary to minimize bycatch and bycatch mortality to the extent practicable. When appropriate, management measures, such as at-sea monitoring programs, should be developed to meet these information needs.

(2) For each management measure, assess the effects on the amount and type of bycatch and bycatch mortality in the fishery. Most conservation and management measures can affect the amounts of bycatch or bycatch mortality in a fishery, as well as the extent to which further reductions in bycatch are practicable. In analyzing measures, including the status quo, Councils should assess the impacts of minimizing bycatch and bycatch mortality, as well as consistency of the selected measure with other national standards and applicable laws. The benefits of minimizing bycatch to the extent practicable should be identified and an assessment of the impact of the selected measure on bycatch and bycatch mortality provided. Due to limitations on the information available, fishery managers may not be able to generate precise estimates of bycatch and bycatch mortality or other effects for each alternative. In the absence of quantitative estimates of the impacts of each alternative, Councils may use qualitative estimates.

(3) Select measures that, to the extent practicable, will minimize bycatch and bycatch mortality. A determination of whether a conservation and management measure minimizes bycatch or bycatch mortality to the extent practicable, consistent with other national standards, should consider the following factors:

(i) Population effects for the bycatch species.
(ii) Ecological effects due to changes in the bycatch of that species (effects on other species in the ecosystem).
(iii) Changes in the bycatch of other species of fish and the resulting population and ecosystem effects.
(iv) Effects on marine mammals and birds.

(v) Changes in fishing, processing, disposal, and marketing costs.
(vi) Changes in fishing practices and behavior of fishermen.
(vii) Changes in research, administration, and enforcement costs and management effectiveness.
(viii) Changes in the economic, social, or cultural value of fishing activities and nonconsumptive uses of fishery resources.
(ix) Changes in the distribution of benefits and costs.
(x) Social effects.

(4) Implement and monitor selected management measures. Effects of implemented measures should be evaluated routinely. Monitoring systems should be established prior to fishing under the selected management measures. Where applicable, implementation plans should be developed and coordinated with industry and other concerned organizations to identify opportunities for cooperative data collection, coordination of data management for cost efficiency and avoidance of duplicative effort.

1.7.2 Bycatch Monitoring in the Alaska Scallop Fishery

An influx of scallop boats from the East Coast of the United States into the weathervane scallop fishery during the early 1990s and corresponding concerns about crab bycatch in the scallop fishery prompted Alaska Department of Fish and Game Commissioner Rosier to declare the scallop fishery a high impact emerging fishery on May 21, 1993. The resulting management plan included an observer program to monitor crab bycatch as well as collect biological and fishery based information on weathervane scallops. The plan contained provisions for king and Tanner crab bycatch caps for most areas. The weathervane scallop onboard observer program has been in place since July 1, 1993.

Data collection has evolved and expanded since 1993 to focus on scallop biology and stock assessment in an effort to answer critical management questions. Efforts are underway to use observer collected data to estimate abundance of scallops using a fishery based stock assessment model. The analysis of biological reference points based on historical scallop data has been recently updated using observer collected data. Ongoing work with scallop age analysis from shells collected by onboard observers is expected to increase the departments understanding of population dynamics and fishery effects. Other data is collected to define the biological season, define the time period of highest quality and quantity of product, gain insights into scallop recruitment and maturity, estimate the number and weight of discarded scallops, map scallop beds, determine extent of bottom area dredged, calculate catch per unit effort, etc.

Daily crab bycatch counts from sampled tows are used inseason to estimate crab bycatch. Management areas are closed by emergency order if established crab bycatch limits are reached. Crab bycatch is examined in detail to determine mortality, size frequency, shell-age, and injuries.

At-Sea Catch Sampling

Scallop observers are given detailed instructions to collect a variety of biological data on a daily basis. The daily goal is to sample a single dredge from one tow for species haul composition and a single dredge from six different tows for crab and halibut bycatch and discarded scallop catch as well as sampling two tows for scallop meat (adductor muscle) recovery data.

Haul composition sampling is used to document all species of bycatch by weight. Dredge contents, including noncommercial species, are sorted into baskets by species and weighed. Observer haul composition samples are summarized and reported by management area and district. An example is table one, which contains a

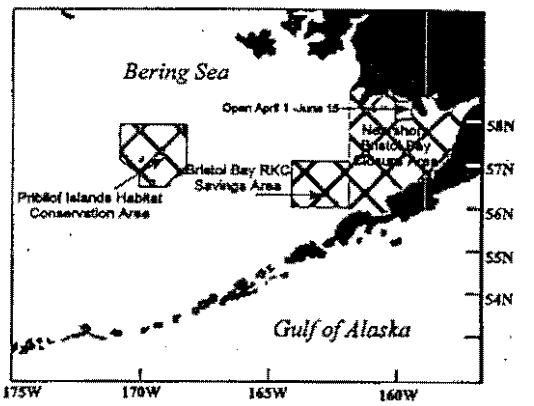
list of the twenty most frequently caught species by weight from the Alaska Peninsula Area. Data from each management area and district is then summarized into one table, as in table 2.

From each of the six tows sampled daily for crab and halibut bycatch, one dredge per tow is examined. Observers identify, count, and record the number of crab and halibut encountered as well as examining both the retained and discarded scallop catch. In addition to enumerating crab, carapace measurements, shell age, sex, injuries and mortality are recorded. All Pacific halibut encountered are measured for length and examined for injuries and overall body condition. The discarded scallop catch is collected from the deck and weighed. A subsample is examined to determine the weight and number of broken and intact scallops, and shell heights. From the retained scallop catch; shell height, sex, and gonad development is collected. Shells are collected from both the retained and discarded scallop catch for shell aging. Tables 3 - 9 and Figures 1 - 3 are examples of a few tables based on observer collected data from the 6 bycatch and scallop discard tows sampled daily.

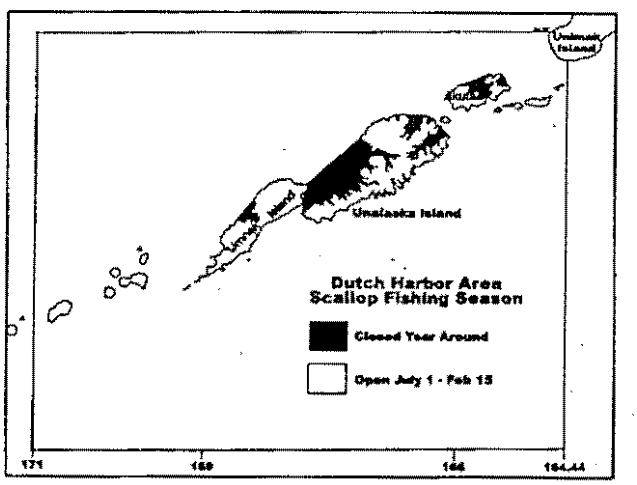
1.7.3 Review of Measures to Reduce Bycatch in the Alaska Scallop Fishery

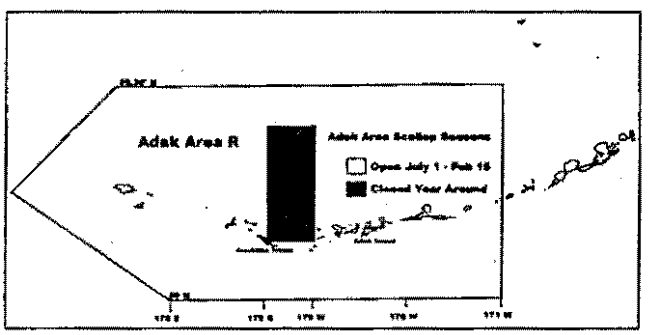
Area Closures

Several areas of the Bering Sea have been closed to groundfish trawling and scallop dredging to reduce potential adverse impacts on the habitat for crab and other resources. In 1995, the Pribilof Islands Conservation Area was closed to all trawling and dredging year-round to protect blue king crab habitat (primarily shell hash). Also in 1995, the Red King Crab Savings Area was established as a year-round bottom trawl and dredge closure area. This area is known to have high densities of adult red king crab. To protect juvenile red king crab and critical rearing habitat (stalked ascidians and other living substrate), another year-round closure to all trawling was implemented for the nearshore waters of Bristol Bay. Specifically, the area east of 162° W (i.e., all of Bristol Bay) is closed to trawling and dredging, with the exception of an area bounded by 159° to 160° W and 58° to 58°43' N that remains open to trawling during the period April 1 to June 15 each year. The figures below show locations of other areas in the BSAI closed to scallop dredging



Location of trawl and dredge closure areas to protect red and blue king crab.

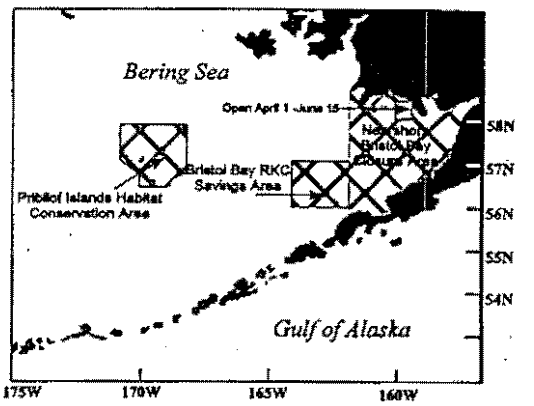




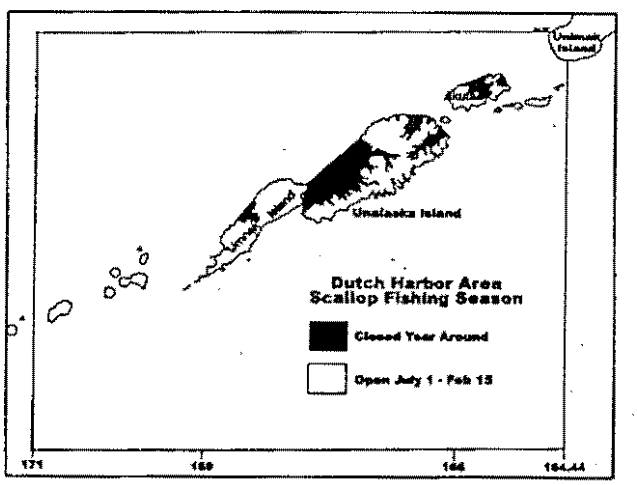
1.7.3 Review of Measures to Reduce Bycatch in the Alaska Scallop Fishery

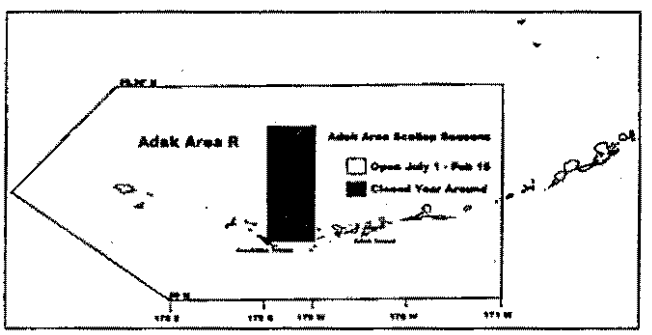
Area Closures

Several areas of the Bering Sea have been closed to groundfish trawling and scallop dredging to reduce potential adverse impacts on the habitat for crab and other resources. In 1995, the Pribilof Islands Conservation Area was closed to all trawling and dredging year-round to protect blue king crab habitat (primarily shell hash). Also in 1995, the Red King Crab Savings Area was established as a year-round bottom trawl and dredge closure area. This area is known to have high densities of adult red king crab. To protect juvenile red king crab and critical rearing habitat (stalked ascidians and other living substrate), another year-round closure to all trawling was implemented for the nearshore waters of Bristol Bay. Specifically, the area east of 162° W (i.e., all of Bristol Bay) is closed to trawling and dredging, with the exception of an area bounded by 159° to 160° W and 58° to 58°43' N that remains open to trawling during the period April 1 to June 15 each year. The figures below show locations of other areas in the BSAI closed to scallop dredging



Location of trawl and dredge closure areas to protect red and blue king crab.





Bycatch Limits

Crabs are a prohibited species in scallop fisheries, meaning that they must be returned to the water immediately with a minimum of injury. Bycatch limits have been established for the Alaska scallop fisheries to minimize this fisheries impact on the crab resource. Annual crab bycatch limits (CBLs) are specified for red king crab and Tanner crab species in each registration area or district thereof. In Registration Area Q (the Bering Sea), the annual CBLs shall equal the following amounts:

1. The CBL of red king crab caught while conducting any fishery for scallops shall be within the range of 500 to 3,000 crab based on specific considerations.
2. The CBL of *C. opilio* Tanner crab caught while conducting any fishery for scallops is 0.003176 percent of the most recent estimate of *C. opilio* abundance in Registration Area Q.
3. The CBL of *C. bairdi* Tanner crab caught while conducting any fishery for scallops is 0.13542 percent of the most recent estimate of *C. bairdi* abundance in Registration Area Q.

In other Registration Areas (Gulf of Alaska and Aleutian Islands), CBLs will be based on the biological condition of each crab species, historical bycatch rates in the scallop fishery, and other socioeconomic considerations that are consistent with the goals and objectives of the FMP.

Weathervane scallop registration areas, seasons, GHL's (pounds, shucked), and crab bycatch limits established for the 1997 scallop fishery, by area.

			Crab Bycatch Limits		
Area	GHL (pounds)	Fishing Season	king crab	Tanner crab	Snow crab
D - District 16	0 - 35,000	Jan 10 - Dec 31	n/a	n/a	n/a
D - Yakutat	0 - 250,000	Jan 10 - Dec 31	n/a	n/a	n/a
E - Eastern PWS	0 - 50,000	Jan 10 - Dec 31	n/a	500	n/a
Western PWS	combined	Jan 10 - Dec 31	n/a	130	n/a
H - Cook Inlet (Kamishak)	0 - 20,000	Aug 15 - Oct 31	60	24,992	n/a
Cook Inlet (Outer area)	combined	Jan 1 - Dec 31	98	2,170	n/a
K - Kodiak (Shelikof)	0 - 400,000	July 1 - Feb 15	35	51,000	n/a
Kodiak (Northeast)	combined	July 1 - Feb 15	50	91,600	n/a
M - AK Peninsula	0 - 200,000	July 1 - Feb 15	79	45,300	n/a
O - Dutch Harbor	0 - 170,000	July 1 - Feb 15	10	10,700	n/a
Q - Bering Sea	0 - 600,000	July 1 - Feb 15	500	238,000	172,000
R - Adak	0 - 75,000	July 1 - Feb 15	50	10,000	n/a

Gear Restrictions

In the Alaska weathervane scallop fishery, dredge size is limited to a maximum width of 15 feet, and only 2 dredges may be used at any one time. In the Kamishak District of Cook Inlet, only 1 dredge with a 6' maximum width is allowed. Dredges are required to have rings with a 4" minimum inside diameter to reduce the catch of small, immature scallops.

2.0 NEPA REQUIREMENTS: ENVIRONMENTAL IMPACTS OF THE ALTERNATIVES

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

An EA must include a brief discussion of the need for the proposal, the alternatives considered, the environmental impacts of the proposed action and the alternatives, and a list of document preparers. The purpose and alternatives were discussed in Sections 1.1 and 1.2, and the list of preparers is in Section 6. This section contains the discussion of the environmental impacts of the alternatives including impacts on threatened and endangered species and marine mammals.

2.1 Environmental Impacts of the Alternatives

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

The effects of scallop fishing on the biological environment and associated impacts on marine mammals, seabirds, and other threatened or endangered species are analyzed in the final EA/RIR/FRFA for Amendments 1 and 2 to the FMP (NMFS 1997a). The alternatives to the status quo are not expected to allow substantial damage to the ocean and coastal habitats, or to jeopardize the long-term productive capability of crab, herring, or groundfish stocks in any manner not previously analyzed in the EA for Amendment 1. Scallop dredges may have potential, in some situations, to affect other organisms comprising benthic communities; however, these effects are not likely to be substantial for the relatively small scale scallop fisheries in Alaska. In addition, the alternatives under consideration are not expected to change the manner in which the scallop fishery is currently conducted in the Federal waters off Alaska

2.2 Potential Impacts on Benthic Communities and the Physical Environment

Determination of significance requires evaluation whether any fishery management plan or amendment may reasonably be expected to allow substantial damage to the ocean and coastal habitats (NOAA Administrative Order 216-6). It has been estimated that up to 133 square nautical miles of ocean bottom area were dredged for Alaskan scallops in 1996 (Barnhart and Sagalkin 1998). Like trawl gear, scallop dredges may have some potential to affect adversely other organisms comprising benthic communities. Studies on the potential effects dredging are summarized below.

Although small amounts of coral are caught or damaged by groundfish trawls (NPFMC 1992), distribution data and limited observer information suggest that little or none is taken by scallop dredges in Alaska. Generally, corals do not have the same habitat requirements as weathervane scallops. Most corals, such as fan corals, bamboo corals, cup corals, soft corals, and hydrocorals occur at greater depths than scallops. The two more abundant species of coral that live at similar depths as scallops occur in habitat consisting of boulders and bedrock, habitats that are not inhabited by most scallop species.

Current regulations limit bycatch and interaction of crabs and the scallop fishery. King and Tanner crab bycatch limits for Alaskan scallop fisheries were instituted by the State in July 1993 and by NMFS under Amendment 1 in 1996. With the exception of Yakutat and Southeast areas, crab bycatch limits were specified for scallop fisheries in all registration areas. In addition, large areas in State and Federal waters have been closed to scallop fishing, as these areas have showed high concentrations of crabs.

Bycatch data collected by State observers in the 1993 scallop fishery (Urban et al. 1994) can be used to analyze bycatch rates of crabs and other species. During the 1993 Bering Sea area scallop fishery (occurring over a 4 month period), a total of 10 vessels made 7,208 tows, to harvest 598,093 lb (271.3 mt) of scallop meat, with a bycatch of 276,500 Tanner crab and 212 king crab (Morrison 1994). On a rate basis, this equates to 83 lb (0.038 mt) of scallops and 38 Tanner crab per tow, or put another way, about 0.46 Tanner crabs per pound (1 Tanner crab per kilogram) of scallop meat harvested. At an average exvessel price of $6.02 per pound for scallops, gross exvessel value was $500 per tow. Bycatch rates varied greatly among vessels fishing in the 1993 Bering Sea scallop fishery (Urban et al. 1994). Catch of Tanner crabs per tow-hour ranged from 17 crabs to 203 crabs per tow-hour (median=53, mean=90). Length frequency of Tanner crabs taken as bycatch was not reported, but likely consisted primarily of small juvenile crab.

2.4 Endangered Species Act

The Endangered Species Act of 1973 as amended [16 U.S.C. 1531 *et seq*; ESA], provides for the conservation of endangered and threatened species of fish, wildlife, and plants. The program is administered jointly by the NMFS for most marine mammal species, marine and anadromous fish species, and marine plants species and by the USFWS for bird species, and terrestrial and freshwater wildlife and plant species.

The designation of an ESA listed species is based on the biological health of that species. The status determination is either threatened or endangered. Threatened species are those likely to become endangered in the foreseeable future [16 U.S.C. § 1532(20)]. Endangered species are those in danger of becoming extinct throughout all or a significant portion of their range [16 U.S.C. § 1532(20)]. Species can be listed as endangered without first being listed as threatened. The Secretary of Commerce, acting through NMFS, is authorized to list marine fish, plants, and mammals (except for walrus and sea otter) and anadromous fish species. The Secretary of the Interior, acting through the USFWS, is authorized to list walrus and sea otter, seabirds, terrestrial plants and wildlife, and freshwater fish and plant species.

In addition to listing species under the ESA, the critical habitat of a newly listed species must be designated concurrent with its listing to the "maximum extent prudent and determinable" [16 U.S.C. § 1533(b)(1)(A)]. The ESA defines critical habitat as those specific areas that are essential to the conservation of a listed species and that may be in need of special consideration. Federal agencies are prohibited from undertaking actions that destroy or adversely modify designated critical habitat. Some species, primarily the cetaceans, which were listed in 1969 under the Endangered Species Conservation Act and carried forward as endangered under the ESA, have not received critical habitat designations.

2.5 Impacts on Endangered, Threatened or Candidate Species

Species listed as endangered and threatened under the ESA that may be present in the Federal waters off Alaska include:

Endangered

Northern right whale	*Balaena glacialis*

Sei whale	*Balaenoptera borealis*
Blue whale	*Balaenoptera musculus*
Fin whale	*Balaenoptera physalus*
Humpback whale	*Megaptera novaeangliae*
Sperm whale	*Physeter macrocephalus*
Snake River sockeye salmon	*Oncorhynchus nerka*
Short-tailed albatross	*Diomedea albatrus*
Steller sea lion (western stock)	*Eumetopias jubatus*

Threatened

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

The scallop fishery off Alaska (which consists of a small fleet of vessels, and uses gear less likely to generate bycatch of finfish, seabirds or marine mammals) is not expected to affect ESA-listed species, seabirds or marine mammals in any manner or extent not already addressed under previous consultations for the groundfish fisheries. NMFS operates from the presumption that the scallop fishery has no effect on the threatened or endangered species that occur in the GOA or BSAI management area. There has never been an assumption that there is an effect, therefore, there has never been a consultation for the FMP for the Scallop Fishery off Alaska. The impact of the groundfish fisheries off Alaska on endangered and threatened species has been addressed extensively in a series of formal and informal consultations.

Pursuant to section 7 of the Endangered Species Act, NMFS has completed a consultation on the effects of the pollock and Atka mackerel fisheries on listed species, including the Steller sea lion, and designated critical habitat. The Biological Opinion prepared for this consultation, dated December 3, 1998, and revised on December 16, 1998, concludes that NMFS actions that authorize the pollock fisheries in the BSAI and the GOA jeopardize the continued existence of Steller sea lions and adversely modify their designated critical habitat. The Biological Opinion contains reasonable and prudent alternatives (RPAs) to mitigate the adverse impacts of the pollock fisheries on Steller sea lions. An emergency rule to implement the RPAs was published on January 22, 1999 (64 FR 3437) with an effective date of January 20, 1999, through July 19, 1999. NMFS anticipates extending this emergency rule for an additional 180 days with revisions to the provisions for the pollock B and C seasons consistent with the Biological Opinion. The Biological Opinion concluded that NMFS actions that authorize the Atka mackerel fisheries in the BSAI would not likely jeopardize the continued existence of Steller sea lions or adversely modify their designated critical habitat.

On December 22, 1998, NMFS completed a consultation on the effects of the 1999 BSAI groundfish fisheries on listed and candidate species, including the Steller sea lion and listed seabirds, and on designated critical habitat. The Biological Opinion concluded that this action is not likely to jeopardize the continued existence of the Steller sea lion or adversely modify its critical habitat. The opinion is contingent upon development and implementation of reasonable and prudent alternatives as outlined in the December 16, 1998, Biological Opinion.

2.6 Potential Impacts on ESA-listed Pacific Salmon

Capture of salmon by the scallop dredges is reported to be extremely rare (Hennick 1973), as scallop dredges are small in size, and remain within one meter of the ocean bottom. Bycatch of all fish species by scallop dredges is composed primarily of flounders and skates (Kruse et al. 1993; Urban et al. 1994). No salmon bycatch was reported during the 1993 ADF&G observer program, with nearly 900 days fishing observed (Urban et al. 1994), and there have been no other reports of salmon bycatch in the scallop fishery off Alaska. None of the alternatives will affect the continued existence of listed species of Pacific salmon, or result in disturbance or adverse modification of critical salmon habitat.

2.7 Potential Impacts on Seabirds

Since scallop dredges are small in size, and remain within one meter of the ocean bottom, interactions with seabirds are much less likely in the scallop fishery than in the groundfish fishery, which consists of a much larger fleet of vessels using large nets or baited hooks or pots. In addition, there are no reported takes of seabirds by the scallop fishery off Alaska. Therefore, none of the alternatives will affect endangered or threatened seabirds or their critical habitat.

Many seabirds occur in Alaskan waters and have the potential for interaction with scallop fisheries. The most numerous seabirds in Alaska are northern fulmars, storm petrels, kittiwakes, murres, auklets, and puffins. These groups, and others, represent 38 species of seabirds that breed in Alaska. Eight species of Alaska seabirds breed only in Alaska and in Siberia. Populations of five other species are concentrated in Alaska but range throughout the North Pacific region. Marine waters off Alaska provide critical feeding grounds for these species as well as others that do not breed in Alaska but migrate to Alaska during summer, and for other species that breed in Canada or Eurasia and overwinter in Alaska. Additional discussion about seabird life history, predator-prey relationships, and interactions with commercial fisheries can be found in the 1998 FSEIS for the Groundfish Total Allowable Catch Specifications and Prohibited Species Catch Limits Under the Authority of the FIshery of the Bering Sea and Aleutian Islands Area and Groundfish of the Gulf of Alaska (NMFS 1998).

2.8 Potential Impacts on Marine Mammals

Cetacean and pinniped species are unlikely to have potential for interaction with scallop fisheries in the GOA and BSAI. Interactions of the scallop fishery with Steller sea lions and other pinnipeds, and sea otters are thought to be rare and less common than in the groundfish fisheries. In addition, there are no reported takes of marine mammals by the scallop fishery off Alaska. Therefore, none of the alternatives will have an adverse effect on marine mammals.

2.9 Coastal Zone Management Act

Implementation of each of the alternatives would be conducted in a manner consistent, to the maximum extent practicable, with the Alaska Coastal Management Program within the meaning of Section 30(c)(1) of the Coastal Zone Management Act of 1972 and its implementing regulations.

2.10 Conclusions or Finding of No Significant Impact

None of the alternatives in Amendment 6 to the scallop FMP are likely to significantly affect the quality of the human environment, and the preparation of an environmental impact statement for the proposed action is not required by Section 102(2)(C) of the National Environmental Policy Act or its implementing regulations.

Assistant Administrator for Fisheries, NOAA

MAR 3 1999

Date

4.0 REFERENCES

Aschan, M.M. 1991. Effects of Iceland scallop dredging on benthic communities in the Northeast Atlantic. Special international workshop on the effects of physical disturbance on the sea floor on benthic and epibenthic ecosystems. Conseil International pour L'Exploration de la Mer, Benthos Working Group, Unpublished Manuscript

Alverson, D.L., and M.J. Carney. 1975. A graphic review of the growth and decay of population cohorts. Journal du Conseil, Conseil International pour l'Exploration de la Mer 36(2):133-143.

Barnhart, J.P., and N. Sagalkin. 1998. Summary and analysis of onboard collected data from the 1996/97 statewide commercial weathervane scallop fishery. Alaska Department of Fish and Game. Division of Commercial Fisheries, Regional Information Report. Kodiak.

Bourne, N. 1991. Fisheries and Aquaculture: West Coast of North America. *in* S.E. Shumway, (ed.), Scallops: biology, ecology, and aquaculture. Elsevier, N.Y. 1991.

Caddy, J.F. 1968. Underwater observations on scallop (*Placopecten magellanicus*) behavior and drag efficiency. Journal of the Fisheries Research Board of Canada 25: 2123-2141.

Eleftheriou, A., and M.R. Robertson. 1992. The effects of experimental scallop dredging on the fauna and physical environment of a shallow sandy community. Netherlands Journal of Sea Research 30:289-299.

Fish and Wildlife Service (FWS). 1997. Letter from Ann G. Rappoport to Steven Pennoyer, February 19, 1997, on effects of the 1997 Total Allowable Catch Specifications and Environmental Assessment for groundfish fisheries in the Gulf of Alaska and Bering Sea-Aleutian Islands on short-tailed albatrosses. USDI FWS, 605 West 4th Avenue, Room 62, Anchorage, AK 99501.

Fonseca, M.S., G.W. Thayer, A.J. Chester, and C. Foltz. 1984. Impact of scallop harvesting on eelgrass (*Zostera marina*) meadows: implications for management. North American Journal of Fisheries Management 4.

FWS. 1995. Endangered Species Act. Section 7. Reinitiation of Consultation on the Effects of the Groundfish Fisheries Conducted under the Bering Sea and Aleutian Islands and Gulf of Alaska Fishery Management Plans of the North Pacific Fishery Management Council. (Seabirds; amended Biological Opinion from July 3, 1989). USDI FWS, 605 West 4th Avenue, Room 62, Anchorage, AK 99501.

FWS. 1993. Alaska Seabird Management Plan. Report of the US Fish and Wildlife Service. Anchorage. 102 pp.

FWS. 1989. Endangered Species Act. Section 7 Consultation on the Effects of the Groundfish Fisheries Conducted under the Bering Sea and Aleutian Islands and Gulf of Alaska Fishery Management Plans of the North Pacific Fishery Management Council. (Seabirds; Biological Opinion.) USDI FWS, 605 West 4th Avenue, Room 62, Anchorage, AK 99501.

Gulland, J.A. 1971. Science and Fishery Management. J. Cons. Int. Explor. Mer. 33:471-477.

Hammarstom, L.F., and M.F. Merritt. 1985. A survey of Pacific weathervane scallops (*Pecten caurinus*) in Kamishak Bay, Alaska. Alaska Department of Fish and Game, Division of Commercial Fisheries, Informational Leaflet 252, Juneau.

Haynes, E.B., and G.C. Powell. 1968. A preliminary report on the Alaska sea scallop - fishery exploration, biology, and commercial processing. Alaska Department of Fish and Game, Division of Commercial Fisheries, Informational Leaflet 125, Juneau.

Hennick, D.P. 1970a. The weathervane scallop fishery of Alaska with notes on occurrence in Washington and Oregon. Pacific Marine Fisheries Commission, Annual Report for the Year 1969: 33-34.

Hennick, D.P. 1970b. Reproductive cycle, size at maturity, and sexual composition of commercially harvested weathervane scallops (Patinopecten caurinus) in Alaska. Journal of the Fisheries Research Board of Canada 27: 2112-2119.

Hennick, D.P. 1973. Sea scallop, Patinopecten caurinus, investigations in Alaska. Alaska Department of Fish and Game, Division of Commercial Fisheries, Completion Report 5-23-R, Juneau.

Hoenig, J.M. 1983. Empirical use of longevity data to estimate mortality rates. Fishery Bulletin 82(1): 898-902.

Kaiser, R.J. 1986. Characteristics of the Pacific weathervane scallop (Pecten [Patinopecten] caurinus, Gould 1850) fishery in Alaska, 1967-1981. Alaska Department of Fish and Game, Division of Commercial Fisheries (Unpublished Report, Catalog RUR-5J86-01), Juneau.

Kruse, G.H., E. Krygier, R.D. Mecum, and M.C. Murphy. 1993. Synopsis of ADF&G scallop meeting, Anchorage, Alaska, July 15, 1993. ADF&G Regional Information Report No. 5J93-07.

Kruse, G.H., and F.C. Funk. 1995. Biological Reference Points for Weathervane Scallops in Alaska, a poster presented to North Pacific Symposium on Invertebrate Stock Assessment and Management, Nanaimo, British Columbia, March 1995

Mayer, L.M., D.F. Schick, R.H. Findlay, and D.L. Rice. 1991. Effects of commercial dragging on sedimentary organic matter. Marine Environmental Research 31:249-261.

Morrison, R. 1994. Bering Sea Aleutian Islands Scallops. In: Westward Region Reports to the Board of Fisheries. March 1994.

National Marine Fisheries Service (NMFS). 1998. "Final Supplemental Environmental Impact Statement for the Groundfish Total Allowable Catch Specifications and Prohibited Species Catch Limits Under the Authority of the Fishery of the Bering Sea and Aleutian Islands Area and Groundfish of the Gulf of Alaska." NMFS- Alaska Region, PO Box 21668, Juneau, AK 99802-1668.

National Marine Fisheries Service (NMFS). 1997a. Final Environmental Assessment/Regulatory Impact Review/Final Regulatory Flexibility Analysis for Amendments 1 and 2 to the Fishery Management Plan for the Scallop Fishery off Alaska. NMFS-Alaska Region, PO Box 21668, Juneau, AK 99802-1668.

National Marine Fisheries Service (NMFS). 1997b. Final Environmental Assessment for 1997 Total Allowable Catch Specifications. NMFS-Alaska Region, P.O. Box 21668, Juneau, Alaska 99802-1668.

NMFS. 1996. Endangered Species Act. Section 7. Biological Opinion--Fishery Management Plan for the Bering Sea and Aleutian Islands and Gulf of Alaska Groundfish Fisheries and the Total Allowable Catch Specification and its effects to Steller Sea Lions. NMFS Alaska Region, P.O. Box 21668, Juneau, Alaska, January 26, 1996.

NMFS. 1995. Endangered Species Act. Section 7. Reinitiation of Consultation on the Effects of the Groundfish Fisheries Conducted under the Bering Sea and Aleutian Islands and Gulf of Alaska Fishery Management Plans of the North Pacific Fishery Management Council. (Pacific salmon; amended Biological Opinion from January 14, 1994) NMFS Northwest Region, 7600 Sand Point Way, NE, BIN 15700, Seattle, Washington, December 7, 1995.

NMFS. 1994. Endangered Species Act Section 7. Biological Opinion--Pacific Salmon. *Reinitiation of* Consultation on the Effects of the Groundfish Fisheries Conducted under the Bering Sea and Aleutian Islands and Gulf of Alaska Fishery Management Plans of the North Pacific Fishery Management Council. (Pacific Salmon) NMFS Northwest Region, 7600 Sand Point Way, NE, BIN 15700, Seattle, Washington, January 14, 1994.

NMFS. 1992. Endangered Species Act. Section 7. Biological Opinion--Amendment 18 to the Fishery Management Plan for the Groundfish Fishery of the Bering Sea and Aleutian Islands (Steller Sea Lions). NMFS Alaska Region, P.O. Box 21668, Juneau, Alaska, March 4, 1992.

NMFS. 1991. Endangered Species Act. Section 7. Biological Opinion--Fishery Management Plan for the Bering Sea and Aleutian Islands and Gulf of Alaska Groundfish Fisheries and the Total Allowable Catch Specification and its effects to Steller Sea Lions. NMFS Alaska Region, P.O. Box 21668, Juneau, Alaska, April 18, 1991.

North Pacific Fishery Management Council (NPFMC). 1992. Final Supplemental Environmental Impact Statement and Regulatory Impact Review/Initial Regulatory Flexibility Analysis of Proposed Inshore/Offshore Allocation Alternatives (Amendment 18/23) to the Fishery Management Plans for the Groundfish Fishery of the Bering Sea and Aleutian Islands and the Gulf of Alaska. March 5, 1992.

Orensanz, J.M. 1986. Size, environment, and density: the regulation of a scallop stock and its management implications. Pages 195-227 *in* G.S. Jamieson and N. Bourne, editors. North Pacific workshop on stock assessment and management of invertebrates. Canadian Special Publication of Fisheries and Aquatic Sciences 92.

Oresanz, J.M., A.M. Parma, and O.O. Iribarne. 1991. Population dynamics and management of natural stocks. Pp. 625-713. In S.E. Shumway (ed.). Scallops: Biology, Ecology and Aquaculture. Developments in Aquaculture and Fisheries Science, 21. Elsevier, Amsterdam.

Rosenberg, A.P., P. Mace, G. Thompson, G. Darcy, W. Clark, J. Collies, W. Gabriel, A. MacCall, R. Methot, J. Powers, V. Restrepo, T. Wainwright, L. Botsford, J. Hoenig, K. Stokes. 1994. Scientific review of definitions of overfishing in U.S. fishery management plans. NOAA Tech. Memo. NMFS-F/SPO-17, 105p.

Shirley, S.M., and G.H. Kruse. 1995. Development of the fishery for weathervane scallops, Patinopecten caurinus (Gould 1850), in Alaska. Journal of Shellfish Research 14:71-78.

Starr, R.M., and J.E. McCrae. 1983. Weathervane scallop (*Patinopecten caurinus*) investigations in Oregon, 1981-1983. Oregon Department of Fish and Wildlife, Information Reports 83-10, Newport.

Urban, D., D. Pengilly, and I. Vining, 1994. The scallop observer program and statewide data analysis summary to the Board of Fisheries. Alaska Department of Fish and Game, Kodiak, Alaska. 54p.

5.0 AGENCIES AND INDIVIDUALS CONSULTED

Loh-lee Low
NMFS-AFSC

Kent Lind
NMFS-AKRO

Al Spalinger, Dan Urban, Dave Jackson, Doug Pengilly
ADF&G Kodiak

6.0 LIST OF PREPARERS

Dave Witherell
NPFMC
Anchorage, AK

Jeff Barnhart
ADF&G Kodiak

Gordon Kruse
ADF&G
Juneau, AK

Gretchen Harrington
NMFS
Juneau, AK

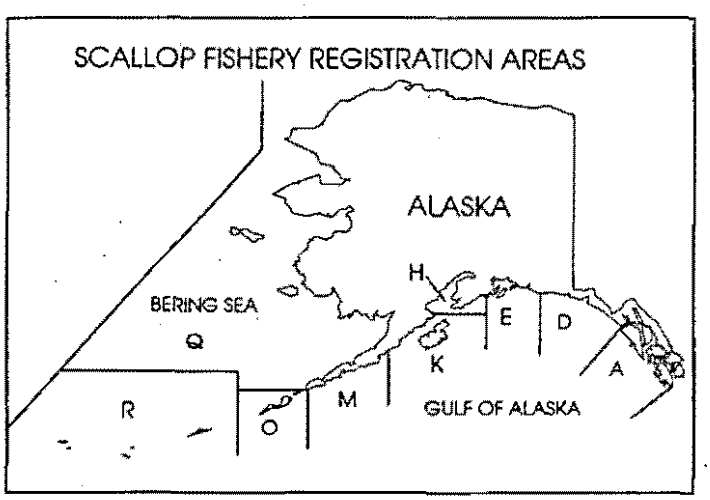
7.0 SCALLOP SPECIES SUMMARY

Scallops

Biology: Weathervane scallops (*Patinopectin caurinus*),are distributed from Point Reyes, California, to the Pribilof Islands, Alaska. The highest known densities in Alaska have been found to occur in the Bering Sea, off Kodiak Island, and along the eastern gulf coast from Cape Spencer to Cape St. Elias. Weathervane scallops are found from intertidal waters to depths of 300 m, but abundance tends to be greatest between depths of 40-130 m on beds of mud, clay, sand, and gravel. Sexes are separate and mature male and female scallops are distinguishable based on gonad color. Although spawning time varies with latitude and depth, weathervane scallops in Alaska spawn in May to July depending on location. Eggs and spermatozoa are released into the water, where the eggs become fertilized. After a few days, eggs hatch, and larvae rise into the water column and drift with ocean currents. Larvae are pelagic and drift for about one month until metamorphosis to the juvenile stage when they settle to the bottom. Weathervane scallops begin to mature by age 3 at about 7.6 cm (3 inches) in shell height (SH), and virtually all scallops are mature by age 4. Growth, maximum size, and size at maturity vary significantly within and between beds and geographic areas. Weathervane scallops are long-lived; individuals may live 28 years old or more. Scallops are likely prey to various fish and invertebrates during the early part of their life cycle. Flounders are known to prey on juvenile weathervane scallops, and seastars may also be important predators.

Several other species of scallop found in the EEZ off Alaska have commercial potential. These scallops grow to smaller sizes than weathervanes, and thus have not been extensively exploited in Alaska. Pink scallops, Chlamys rubida, range from California to the Pribilof Islands. Pink scallops are found in deep waters (to 200 m) in areas with soft bottom, whereas spiny scallop occur in shallower (to 150 m) areas characterized by hard bottom and strong currents. Pink scallops mature at age 2, and spawn in the winter (January-March). Maximum age for this species is 6 years. Spiny scallops, Chlamys hastata, are found in coastal regions from California to the Gulf of Alaska. Spiny scallops grow to slightly larger sizes (75 mm) than pink scallops (60 mm). Spiny scallops also mature at age 2 (35 mm) and spawn in the autumn (August-October). Rock scallops, Crassadoma gigantea, range from Mexico to Unalaska Island. Rock scallops are found in relatively shallower water (0-80 m) with strong currents. Apparently, distribution of these animals is discontinuous, and the abundance in most areas is low. These scallops attach themselves to rocks, attain a large size (to 250 mm), and exhibit fast growth rates. Rock scallops are thought to spawn during two distinct periods, one in the autumn (October -January), and one in the spring-summer (March-August).

Management: The weathervane scallop resource consists of multiple, discrete, self sustaining populations that are managed as separate stock units. Scallop stocks in Alaska have been managed under a federal fishery management plan (FMP) since July 26, 1995, which established a 1 year interim closure of federal waters to scallop fishing to prevent uncontrolled fishing. Amendment 1, which allowed scallop fishing under a federal management regime, was approved July 10, 1996 and fishing resumed on August 1. Amendment 1 provided for fishery management through permits, registration areas and districts, seasons, closed waters, gear restrictions, efficiency limits, crab bycatch limits, scallop catch limits, inseason adjustments, and observer monitoring.



A summary of management measures established under amendments to the federal scallop FMP.

Amendment	Date	Action
1	July 1996	Allowed fishing after a 1 year closure of Federal waters.
2	July 1997	Established a federal scallop vessel moratorium.
3	Dec 1997	If approved, would defer all management (except limited access) to State.
4	1999?	Would establish a permanent limited access system.
5	1998	Essential Fish Habitat

Most of these regulations were developed by the State prior to 1995. Dredge size is limited to a maximum width of 15 feet, and only 2 dredges may be used at any one time. In the Kamishak District of Cook Inlet, only 1 dredge with a 6' maximum width is allowed. Dredges are required to have rings with a 4" minimum inside diameter. To reduce incentives to harvest small scallops, crew size on scallop vessels is limited to 12 persons and all scallops must be manually shucked. Dredging is prohibited in areas designated as crab habitat protection areas, similar to

the groundfish FMPs. In June 1995, the Council adopted a 3-year vessel moratorium to restrict new entry into the scallop fishery while a more comprehensive plan was being developed. The moratorium approved as Amendment 2, effective August 1, 1997. To qualify under the proposed moratorium, a vessel must have made at least one landing in 1991, 1992, or 1993, or must have participated for at least 4 years between 1980 and 1993. The moratorium also limits reconstruction and replacement of vessels to a 20% maximum increase in original qualifying length overall.

Weathervane scallop registration areas, seasons, GHL's (pounds, shucked), and crab bycatch limits established for the 1997 scallop fishery, by area.

			Crab Bycatch Limits		
Area	GHL (pounds)	Fishing Season	king crab	Tanner crab	Snow crab
D - District 16	0 - 35,000	Jan 10 - Dec 31	n/a	n/a	n/a
D - Yakutat	0 - 250,000	Jan 10 - Dec 31	n/a	n/a	n/a
E - Eastern PWS	0 - 50,000	Jan 10 - Dec 31	n/a	500	n/a
Western PWS	combined	Jan 10 - Dec 31	n/a	130	n/a
H - Cook Inlet (Kamishak)	0 - 20,000	Aug 15 - Oct 31	60	24,992	n/a
Cook Inlet (Outer area)	combined	Jan 1 - Dec 31	98	2,170	n/a
K - Kodiak (Shelikof)	0 - 400,000	July 1 - Feb 15	35	51,000	n/a
Kodiak (Northeast)	combined	July 1 - Feb 15	50	91,600	n/a
M - AK Peninsula	0 - 200,000	July 1 - Feb 15	79	45,300	n/a
O - Dutch Harbor	0 - 170,000	July 1 - Feb 15	10	10,700	n/a
Q - Bering Sea	0 - 600,000	July 1 - Feb 15	500	238,000	172,000
R - Adak	0 - 75,000	July 1 - Feb 15	50	10,000	n/a

Fishery: In 1996, a total of 9 vessels participated in the scallop fishery statewide. Scallop vessels average 90-110 ft long. Scallops are harvested using dredges of standard design. Weathervane scallops are processed at sea by manual shucking, with only the meats (adductor muscles) retained. Scallops harvested in Cook Inlet are bagged and iced, whereas scallops harvested from other areas are generally block frozen at sea. The fishery has occurred almost exclusively in the EEZ in recent years, but some fishing in State waters occurs off Yakatat, Dutch Harbor, and Adak.

Catch History: Since 1967, when the first landings were made, fishing effort and total scallop harvest (weight of shucked meats) have varied annually. Total commercial harvest of weathervane scallops has fluctuated from a high of 157 landings totaling 1,850,187 pounds of shucked meats by 19 vessels in 1969 to no landings in 1978. Prices and demand for scallop have remained high since fishery inception. Prior to 1990, about two-thirds of the scallop harvest has been taken off Kodiak Island and about one-third has come from the Yakutat area; other areas had made minor contributions to overall landings. Harvests in 1990 and 1991 were the highest on record since the early 1970's. The 1992 scallop harvest was even higher at 1,810,788 pounds. The increased harvests in the 1990's occurred with new exploitation in the Bering Sea. The reduced 1995 catch was due to implementation of an interim closure in the EEZ from 2/23/95 to 8/1/96.

The 1996 and 1997 fishery can be summarized as follows:

AREA	1996	1997
Cook Inlet		
No. of vessels	4*	3
Landings (lbs)	28,228	20,336
Outside		
No. of vessels	4	6
Landings (lbs)	704,196	765,707

*one additional vessel fished in state waters only.

Landings and effort in the Alaska weathervane scallop fishery, 1980 - 1997.

Year	# of Vessels	Landings (pounds)	Price ($/lb)
1980	8	633,000	4.32
1981	18	924,000	4.05
1982	13	914,000	3.77
1983	6	194,000	4.88
1984	10	390,000	4.47
1985	8	648,000	3.12
1986	9	683,000	3.66
1987	4	583,000	3.38
1988	4	341,000	3.49
1989	7	526,000	3.68
1990	9	1,489,000	3.37
1991	7	1,191,000	3.76
1992	7	1,811,000	3.88
1993	15	1,429,000	5.00
1994	16	1,235,000	6.00
1995	10	283,000	n/a
1996	9	732,424	6.38
1997	9	786,043	6.50

Table 1. Twenty most frequently caught species by weight as recorded by scallop observers during the 1996/97 Alaska Peninsula Area scallop season. Non target commercial species[a] accounted for 8.6% of the twenty most frequently caught species by weight.

Rank	Species	Scientific Name	% of Total Catch
1	weathervane scallops	*Patinopecten caurinus*	70.3%
2	starfish	Class Stelleroidea	11.4%
3	arrowtooth flounder	*Atheresthes stomias*	4.8%
4	basket starfish	*Gorgonocephalus caryi*	4.6%
5	weathervane shells	*P. caurinus*	2.9%
6	sea urchin	Family Strongyocentrotidae	1.6%
7	Pacific Cod	*Gadus macrocephalus*	0.7%
8	snails	Class Gastropoda	0.5%
9	Tanner crab	*Chionoecetes bairdi*	0.5%
10	kelp, rocks, etc.		0.5%
11	flathead sole	*Hippoglossoides elassodon*	0.3%
12	walleye pollock	*Theragra chalcogramma*	0.2%
13	hermit crab	Family Paguridae	0.2%
14	Greenland turbot	*Reinhardtius hippoglossoides*	0.2%
15	bay scallops	Chlamys spp	0.2%
16	brown box crab	*Lopholithodes foraminatus*	0.1%
17	snail eggs	Class Gastropoda	0.1%
18	man-made debris		0.1%
19	worms unident	Class Polychaeta	0.1%
20	shrimp	*Family Pandalidae*	0.1%

[a]Commercial species caught in declining order of poundage: arrowtooth flounder, sea urchin, Pacific cod, *Chionoecetes bairdi*, flathead sole, walleye pollock, Greenland turbot, bay scallops, and shrimp.

Table 2. Summary of the most frequently caught species, by percent weight in sampled dredges, as recorded by scallop observers during the 1996/97 scallop fishery.

	Management Area / District					
		Kodiak			Alaska	Bering
Species Catergory	Yakutat	Northeast	Chelikof	Semidi	Peninsula	Sea
weathervane scallops	84.7	54.1	76.8	51.8	70.3	87.5
PROHIBITED SPECIES BYCATCH						
Tanner crab	<.1	0.9	0.1	0.9	0.5	0.8
snow crab, opilio	0	0	0	0	0	3.7
king crab	0	0	0	<.1	0	0
Dungeness crab	<.1	0	<.1	0.8	0	0
Pacific halibut	0.2	0.5	0.2	<.1	0	<.1
OTHER COMMERCIAL SPECIES						
skates	1.9	4.9	3.1	2.5	0	1.0
arrowtooth flounder	0.3	0.3	0.4	0.3	4.8	0.8
rock sole	<.1	0.2	<.1	0.5	0.1	0.2
Dover sole	0.2	0.1	<.1	0.1	0	0.1
yellowfin sole	0	0	<.1	0.7	0	<.1
rex sole	0.1	0.6	0	0	0.1	0
flathead sole	0.2	0.5	0.5	1.2	0.3	0.3
butter sole	<.1	0.4	0	0.8	0	<.1
Pacific cod	0.1	1.2	<.1	0.9	0.7	0.4
starry flounder	<.1	0	0	1.6	0	0
walleye pollock	<.1	0	<.1	<.1	0.2	0.4
bay scallops	<.1	0	<.1	<.1	0.2	0
sea urchins	0	0	<.1	<.1	1.6	<.1
octopus	0	0	0.1	0	<.1	<.1
Alaska plaice	0	0	0.6	0.1	0	0
sea cucumber	<.1	0.1	<.1	<.1	0	0.2
MISCELLANEOUS						
starfish	4.5	32.4	2.7	15.7	11.4	0.1
basket star	<.1	<.1	<.1	3.8	4.6	0
weathervane shells	3.7	1.8	5.5	8.0	2.9	2.1
kelp, rocks, etc.	1.2	1.4	5.5	9.0	0.5	0.9
man-made debris	<.1	0.1	0.2	0.2	0.1	0.6
Misc. invertebrates	1.7	0.3	0.8	0.1	1.4	0.9
Mis. fish	0.3	0	0.1	0.2	0.3	< 1

Table 3. Estimated bycatch , in numbers of individuals, and confidence intervals for *C. opilio*, *C. bairdi*, Dungeness, and king crab, and halibut from the 1996/97 statewide scallop fishery.

Management Area	n[b]	Bycatch Estimates by Species[a]									
		C. opilio		*C. bairdi*		Dungeness		king crab		halibut	
		Bycatch	95% CI	Bycatch	95% CI	Bycatch	95% CI	Bycatch[c]	95% CI	Bycatch	95% CI
Yakutat	82	0	NA	6,872	4,641-9,588	38	7-77	0	NA	150	91-151
District 16	26	0	NA	669	274-1,123	9	NA	0	NA	68	30-68
Kodiak											
Northeast District	28	0	NA	27,722	10,298-48,407	0	NA	0	NA	202	79-384
Shelikof District	104	0	NA	11,285	9,408-13,257	1,008	584-1,508	0	NA	440	318-569
Semidi District	38	0	NA	8,902	3,798-15,750	4,554	2,504-7,068	9	NA	79	5-176
Alaska Peninsula	13	0	NA	19,045	12,604-26,362	10	NA	0	NA	25	NA
Bering Sea	63	106,935	98,033-116,196	16,642	14,227-19,373	0	NA	0	NA	124	49-229

[a]Estimates were calculated as bycatch per hour per boat per day x total hours dredged x number of dredges fished.
[b]Number of vessel days.
[c]Actual count, not an estimate.

Table 4. Condition of halibut as recorded by scallop observers during the1996/97 fishing season.

MANAGEMENT AREA	CONDITION[a] Of HALIBUT (Number of Halibut)						
	Excellent	Good	Fair	Poor	Dead	Previously dead	Total
District 16	4	0	1	1	0	1	7
Yakutat	13	5	2	1	1	0	22
Kodiak, Northeast District	4	2	4	6	2	0	18
Kodiak, Shelikof District	20	10	8	11	4	2	55
Kodiak, Semidi District	1	4	1	3	0	0	9
Alaska Peninsula	1	0	0	1	1	0	3
Bering Sea	2	4	4	1	2	0	13
Total all Areas	45	25	20	24	10	3	127

[a]Condition Codes

Excellent: Vigorous body movement before and after release; could close operculum tightly; minor external injuries, if any.
Good: Feeble body movements; could close operculum tightly; minor external injuries, if any.
Fair: No body movement; could close operculum tightly; minor external injuries, if any.
Poor: No body movement; could move operculum but not tightly; severe injuries (eg. bleeding).
Dead: No body or opercular movement; probably killed in sampled haul.
Previously dead: Obviously not killed in the current haul (incidentally caught).

Table 5. Tanner crab bycatch mortality as recorded by scallop observers during the 1996/97 fishing season.

MANAGEMENT AREA	NUMBER OF TANNER CRAB OBSERVED		
	Dead	Alive	Percent Dead
District 16	34	38	47.2
Yakutat	537	373	58.9
Kodiak, Northeast District	262	1,361	16.1
Kodiak, Shelikof District	587	1,013	36.6
Kodiak, Semidi District	271	464	36.9
Alaska Peninsula	735	1,541	32.3
Bering Sea *C. opilio*	1,675	8,674	16.2
Bering Sea *C. bairdi*	210	1,454	12.6
Total all Areas	4,311	14,918	28.9

Table 6. Number and weight of discarded scallops as recorded by scallop observers during the 1996/97 fishing season.

MANAGEMENT AREA	Number of Sampled Scallops		Weight of Sampled Scallop	
	Intact	Broken	Intact	Broken
Yakutat	35, 697	19, 595	8, 376	7, 212
District 16	19, 239	2, 684	4, 031	735
Yakutat Total	54, 936	22, 279	12, 407	7, 947
Kodiak, Northeast District	908	982	228	493
Kodiak, Shelikof District	34, 398	29, 337	7, 722	9, 314
Kodiak, Semidi District	254	974	126	531
Kodiak Total	35, 560	31, 293	8, 076	10, 338
Alaska Peninsula	1, 858	2, 546	281	711
Bering Sea	1, 397	2, 174	588	1, 097
Total	93, 751	58, 292	21, 352	20, 093

Table 8. Average weight of intact and broken scallops from observer sampled discarded scallop catch during the 1996/97 fishing season.

MANAGEMENT AREA	WEIGHT[a]		
	Intact Scallops	Broken Scallops	Average
Yakutat	0.24	0.29	0.27
District 16	0.21	0.28	0.25
Yakutat Average	0.22	0.28	
Kodiak, Northeast District	0.38	0.52	0.45
Kodiak, Shelikof District	0.25	0.34	0.30
Kodiak, Semidi District	0.46	0.54	0.50
Kodiak Average	0.37	0.46	
Alaska Peninsula	0.15	0.26	0.21
Bering Sea	0.44	0.51	0.47
Overall Average	0.31	0.39	

[a]Weight in pounds.

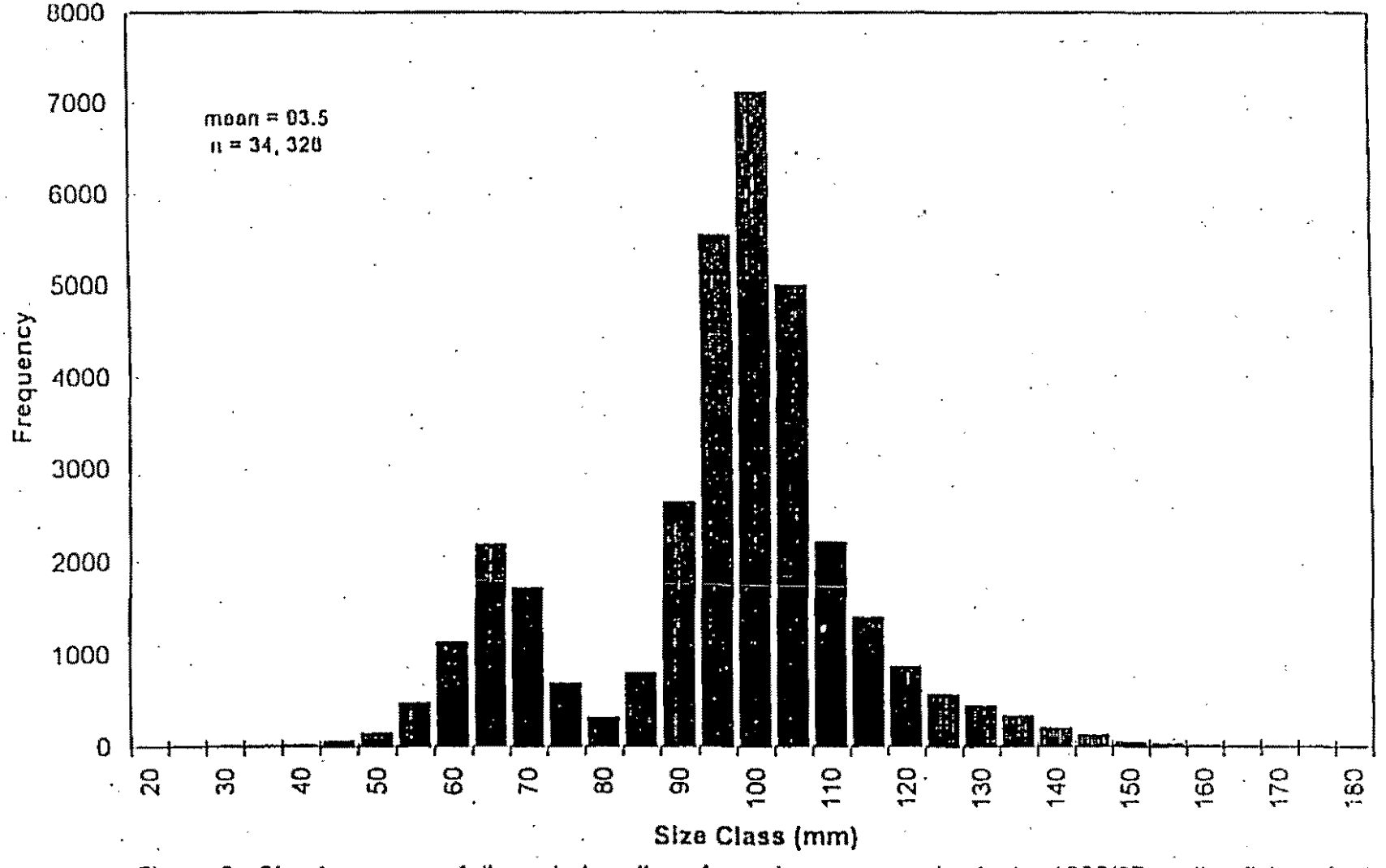
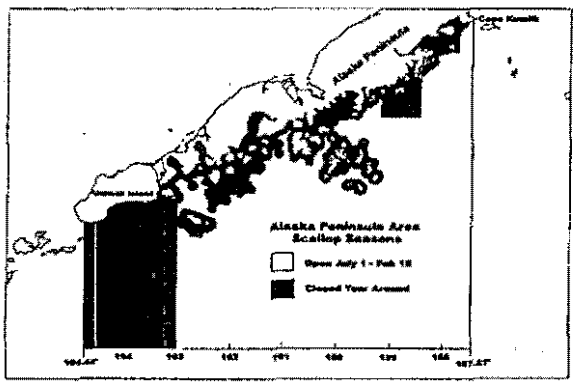
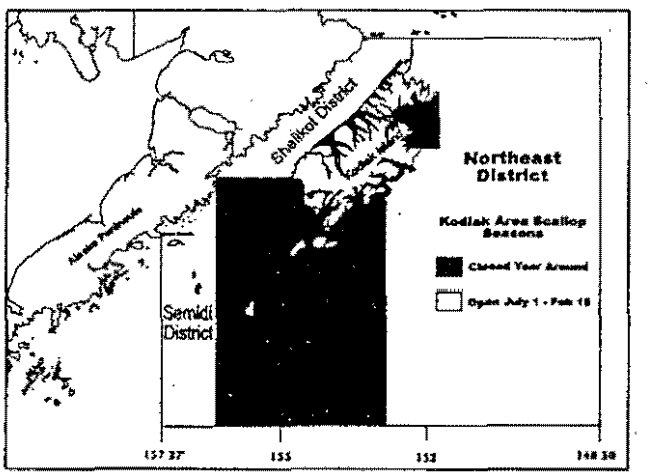


Figure 2. Size frequency of discarded scallops from observer samples in the 1996/97 scallop fishery in the Shelikof District of the Kodiak Area.

There are also trawl and dredge closure areas in the Gulf of Alaska to protect king crab and crab habitat. In the Kodiak Island area, closure areas were designed based on the use of areas by crab life stage and level of recruitment. The figures below show areas closed to scallop dredging in the Gulf of Alaska.





Bycatch Limits

Crabs are a prohibited species in scallop fisheries, meaning that they must be returned to the water immediately with a minimum of injury. Bycatch limits have been established for the Alaska scallop fisheries to minimize this fisheries impact on the crab resource. Annual crab bycatch limits (CBLs) are specified for red king crab and Tanner crab species in each registration area or district thereof. In Registration Area Q (the Bering Sea), the annual CBLs shall equal the following amounts:

1. The CBL of red king crab caught while conducting any fishery for scallops shall be within the range of 500 to 3,000 crab based on specific considerations.
2. The CBL of *C. opilio* Tanner crab caught while conducting any fishery for scallops is 0.003176 percent of the most recent estimate of *C. opilio* abundance in Registration Area Q.
3. The CBL of *C. bairdi* Tanner crab caught while conducting any fishery for scallops is 0.13542 percent of the most recent estimate of *C. bairdi* abundance in Registration Area Q.

In other Registration Areas (Gulf of Alaska and Aleutian Islands), CBLs will be based on the biological condition of each crab species, historical bycatch rates in the scallop fishery, and other socioeconomic considerations that are consistent with the goals and objectives of the FMP.

Weathervane scallop registration areas, seasons, GHL's (pounds, shucked), and crab bycatch limits established for the 1997 scallop fishery, by area.

			Crab Bycatch Limits		
Area	GHL (pounds)	Fishing Season	king crab	Tanner crab	Snow crab
D - District 16	0 - 35,000	Jan 10 - Dec 31	n/a	n/a	n/a
D - Yakutat	0 - 250,000	Jan 10 - Dec 31	n/a	n/a	n/a
E - Eastern PWS	0 - 50,000	Jan 10 - Dec 31	n/a	500	n/a
Western PWS	combined	Jan 10 - Dec 31	n/a	130	n/a
H - Cook Inlet (Kamishak)	0 - 20,000	Aug 15 - Oct 31	60	24,992	n/a
Cook Inlet (Outer area)	combined	Jan 1 - Dec 31	98	2,170	n/a
K - Kodiak (Shelikof)	0 - 400,000	July 1 - Feb 15	35	51,000	n/a
Kodiak (Northeast)	combined	July 1 - Feb 15	50	91,600	n/a
M - AK Peninsula	0 - 200,000	July 1 - Feb 15	79	45,300	n/a
O - Dutch Harbor	0 - 170,000	July 1 - Feb 15	10	10,700	n/a
Q - Bering Sea	0 - 600,000	July 1 - Feb 15	500	238,000	172,000
R - Adak	0 - 75,000	July 1 - Feb 15	50	10,000	n/a

Gear Restrictions

In the Alaska weathervane scallop fishery, dredge size is limited to a maximum width of 15 feet, and only 2 dredges may be used at any one time. In the Kamishak District of Cook Inlet, only 1 dredge with a 6' maximum width is allowed. Dredges are required to have rings with a 4" minimum inside diameter to reduce the catch of small, immature scallops.

2.0 NEPA REQUIREMENTS: ENVIRONMENTAL IMPACTS OF THE ALTERNATIVES

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

An EA must include a brief discussion of the need for the proposal, the alternatives considered, the environmental impacts of the proposed action and the alternatives, and a list of document preparers. The purpose and alternatives were discussed in Sections 1.1 and 1.2, and the list of preparers is in Section 6. This section contains the discussion of the environmental impacts of the alternatives including impacts on threatened and endangered species and marine mammals.

2.1 Environmental Impacts of the Alternatives

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

The effects of scallop fishing on the biological environment and associated impacts on marine mammals, seabirds, and other threatened or endangered species are analyzed in the final EA/RIR/FRFA for Amendments 1 and 2 to the FMP (NMFS 1997a). The alternatives to the status quo are not expected to allow substantial damage to the ocean and coastal habitats, or to jeopardize the long-term productive capability of crab, herring, or groundfish stocks in any manner not previously analyzed in the EA for Amendment 1. Scallop dredges may have potential, in some situations, to affect other organisms comprising benthic communities; however, these effects are not likely to be substantial for the relatively small scale scallop fisheries in Alaska. In addition, the alternatives under consideration are not expected to change the manner in which the scallop fishery is currently conducted in the Federal waters off Alaska

2.2 Potential Impacts on Benthic Communities and the Physical Environment

Determination of significance requires evaluation whether any fishery management plan or amendment may reasonably be expected to allow substantial damage to the ocean and coastal habitats (NOAA Administrative Order 216-6). It has been estimated that up to 133 square nautical miles of ocean bottom area were dredged for Alaskan scallops in 1996 (Barnhart and Sagalkin 1998). Like trawl gear, scallop dredges may have some potential to affect adversely other organisms comprising benthic communities. Studies on the potential effects dredging are summarized below.

Although small amounts of coral are caught or damaged by groundfish trawls (NPFMC 1992), distribution data and limited observer information suggest that little or none is taken by scallop dredges in Alaska. Generally, corals do not have the same habitat requirements as weathervane scallops. Most corals, such as fan corals, bamboo corals, cup corals, soft corals, and hydrocorals occur at greater depths than scallops. The two more abundant species of coral that live at similar depths as scallops occur in habitat consisting of boulders and bedrock, habitats that are not inhabited by most scallop species.

Current regulations limit bycatch and interaction of crabs and the scallop fishery. King and Tanner crab bycatch limits for Alaskan scallop fisheries were instituted by the State in July 1993 and by NMFS under Amendment 1 in 1996. With the exception of Yakutat and Southeast areas, crab bycatch limits were specified for scallop fisheries in all registration areas. In addition, large areas in State and Federal waters have been closed to scallop fishing, as these areas have showed high concentrations of crabs.

Bycatch data collected by State observers in the 1993 scallop fishery (Urban et al. 1994) can be used to analyze bycatch rates of crabs and other species. During the 1993 Bering Sea area scallop fishery (occurring over a 4 month period), a total of 10 vessels made 7,208 tows, to harvest 598,093 lb (271.3 mt) of scallop meat, with a bycatch of 276,500 Tanner crab and 212 king crab (Morrison 1994). On a rate basis, this equates to 83 lb (0.038 mt) of scallops and 38 Tanner crab per tow, or put another way, about 0.46 Tanner crabs per pound (1 Tanner crab per kilogram) of scallop meat harvested. At an average exvessel price of $6.02 per pound for scallops, gross exvessel value was $500 per tow. Bycatch rates varied greatly among vessels fishing in the 1993 Bering Sea scallop fishery (Urban et al. 1994). Catch of Tanner crabs per tow-hour ranged from 17 crabs to 203 crabs per tow-hour (median=53, mean=90). Length frequency of Tanner crabs taken as bycatch was not reported, but likely consisted primarily of small juvenile crab.

2.4 Endangered Species Act

The Endangered Species Act of 1973 as amended [16 U.S.C. 1531 *et seq*; ESA], provides for the conservation of endangered and threatened species of fish, wildlife, and plants. The program is administered jointly by the NMFS for most marine mammal species, marine and anadromous fish species, and marine plants species and by the USFWS for bird species, and terrestrial and freshwater wildlife and plant species.

The designation of an ESA listed species is based on the biological health of that species. The status determination is either threatened or endangered. Threatened species are those likely to become endangered in the foreseeable future [16 U.S.C. § 1532(20)]. Endangered species are those in danger of becoming extinct throughout all or a significant portion of their range [16 U.S.C. § 1532(20)]. Species can be listed as endangered without first being listed as threatened. The Secretary of Commerce, acting through NMFS, is authorized to list marine fish, plants, and mammals (except for walrus and sea otter) and anadromous fish species. The Secretary of the Interior, acting through the USFWS, is authorized to list walrus and sea otter, seabirds, terrestrial plants and wildlife, and freshwater fish and plant species.

In addition to listing species under the ESA, the critical habitat of a newly listed species must be designated concurrent with its listing to the "maximum extent prudent and determinable" [16 U.S.C. § 1533(b)(1)(A)]. The ESA defines critical habitat as those specific areas that are essential to the conservation of a listed species and that may be in need of special consideration. Federal agencies are prohibited from undertaking actions that destroy or adversely modify designated critical habitat. Some species, primarily the cetaceans, which were listed in 1969 under the Endangered Species Conservation Act and carried forward as endangered under the ESA, have not received critical habitat designations.

2.5 Impacts on Endangered, Threatened or Candidate Species

Species listed as endangered and threatened under the ESA that may be present in the Federal waters off Alaska include:

Endangered

Northern right whale	*Balaena glacialis*

Sei whale	*Balaenoptera borealis*
Blue whale	*Balaenoptera musculus*
Fin whale	*Balaenoptera physalus*
Humpback whale	*Megaptera novaeangliae*
Sperm whale	*Physeter macrocephalus*
Snake River sockeye salmon	*Oncorhynchus nerka*
Short-tailed albatross	*Diomedea albatrus*
Steller sea lion (western stock)	*Eumetopias jubatus*

Threatened

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

The scallop fishery off Alaska (which consists of a small fleet of vessels, and uses gear less likely to generate bycatch of finfish, seabirds or marine mammals) is not expected to affect ESA-listed species, seabirds or marine mammals in any manner or extent not already addressed under previous consultations for the groundfish fisheries. NMFS operates from the presumption that the scallop fishery has no effect on the threatened or endangered species that occur in the GOA or BSAI management area. There has never been an assumption that there is an effect, therefore, there has never been a consultation for the FMP for the Scallop Fishery off Alaska. The impact of the groundfish fisheries off Alaska on endangered and threatened species has been addressed extensively in a series of formal and informal consultations.

Pursuant to section 7 of the Endangered Species Act, NMFS has completed a consultation on the effects of the pollock and Atka mackerel fisheries on listed species, including the Steller sea lion, and designated critical habitat. The Biological Opinion prepared for this consultation, dated December 3, 1998, and revised on December 16, 1998, concludes that NMFS actions that authorize the pollock fisheries in the BSAI and the GOA jeopardize the continued existence of Steller sea lions and adversely modify their designated critical habitat. The Biological Opinion contains reasonable and prudent alternatives (RPAs) to mitigate the adverse impacts of the pollock fisheries on Steller sea lions. An emergency rule to implement the RPAs was published on January 22, 1999 (64 FR 3437) with an effective date of January 20, 1999, through July 19, 1999. NMFS anticipates extending this emergency rule for an additional 180 days with revisions to the provisions for the pollock B and C seasons consistent with the Biological Opinion. The Biological Opinion concluded that NMFS actions that authorize the Atka mackerel fisheries in the BSAI would not likely jeopardize the continued existence of Steller sea lions or adversely modify their designated critical habitat.

On December 22, 1998, NMFS completed a consultation on the effects of the 1999 BSAI groundfish fisheries on listed and candidate species, including the Steller sea lion and listed seabirds, and on designated critical habitat. The Biological Opinion concluded that this action is not likely to jeopardize the continued existence of the Steller sea lion or adversely modify its critical habitat. The opinion is contingent upon development and implementation of reasonable and prudent alternatives as outlined in the December 16, 1998, Biological Opinion.

2.6 Potential Impacts on ESA-listed Pacific Salmon

Capture of salmon by the scallop dredges is reported to be extremely rare (Hennick 1973), as scallop dredges are small in size, and remain within one meter of the ocean bottom. Bycatch of all fish species by scallop dredges is composed primarily of flounders and skates (Kruse et al. 1993; Urban et al. 1994). No salmon bycatch was reported during the 1993 ADF&G observer program, with nearly 900 days fishing observed (Urban et al. 1994), and there have been no other reports of salmon bycatch in the scallop fishery off Alaska. None of the alternatives will affect the continued existence of listed species of Pacific salmon, or result in disturbance or adverse modification of critical salmon habitat.

2.7 Potential Impacts on Seabirds

Since scallop dredges are small in size, and remain within one meter of the ocean bottom, interactions with seabirds are much less likely in the scallop fishery than in the groundfish fishery, which consists of a much larger fleet of vessels using large nets or baited hooks or pots. In addition, there are no reported takes of seabirds by the scallop fishery off Alaska. Therefore, none of the alternatives will affect endangered or threatened seabirds or their critical habitat.

Many seabirds occur in Alaskan waters and have the potential for interaction with scallop fisheries. The most numerous seabirds in Alaska are northern fulmars, storm petrels, kittiwakes, murres, auklets, and puffins. These groups, and others, represent 38 species of seabirds that breed in Alaska. Eight species of Alaska seabirds breed only in Alaska and in Siberia. Populations of five other species are concentrated in Alaska but range throughout the North Pacific region. Marine waters off Alaska provide critical feeding grounds for these species as well as others that do not breed in Alaska but migrate to Alaska during summer, and for other species that breed in Canada or Eurasia and overwinter in Alaska. Additional discussion about seabird life history, predator-prey relationships, and interactions with commercial fisheries can be found in the 1998 FSEIS for the Groundfish Total Allowable Catch Specifications and Prohibited Species Catch Limits Under the Authority of the FIshery of the Bering Sea and Aleutian Islands Area and Groundfish of the Gulf of Alaska (NMFS 1998).

2.8 Potential Impacts on Marine Mammals

Cetacean and pinniped species are unlikely to have potential for interaction with scallop fisheries in the GOA and BSAI. Interactions of the scallop fishery with Steller sea lions and other pinnipeds, and sea otters are thought to be rare and less common than in the groundfish fisheries. In addition, there are no reported takes of marine mammals by the scallop fishery off Alaska. Therefore, none of the alternatives will have an adverse effect on marine mammals.

2.9 Coastal Zone Management Act

Implementation of each of the alternatives would be conducted in a manner consistent, to the maximum extent practicable, with the Alaska Coastal Management Program within the meaning of Section 30(c)(1) of the Coastal Zone Management Act of 1972 and its implementing regulations.

2.10 Conclusions or Finding of No Significant Impact

None of the alternatives in Amendment 6 to the scallop FMP are likely to significantly affect the quality of the human environment, and the preparation of an environmental impact statement for the proposed action is not required by Section 102(2)(C) of the National Environmental Policy Act or its implementing regulations.

Assistant Administrator for Fisheries, NOAA

MAR 3 1999

Date

4.0 REFERENCES

Aschan, M.M. 1991. Effects of Iceland scallop dredging on benthic communities in the Northeast Atlantic. Special international workshop on the effects of physical disturbance on the sea floor on benthic and epibenthic ecosystems. Conseil International pour L'Exploration de la Mer, Benthos Working Group, Unpublished Manuscript

Alverson, D.L., and M.J. Carney. 1975. A graphic review of the growth and decay of population cohorts. Journal du Conseil, Conseil International pour l'Exploration de la Mer 36(2):133-143.

Barnhart, J.P., and N. Sagalkin. 1998. Summary and analysis of onboard collected data from the 1996/97 statewide commercial weathervane scallop fishery. Alaska Department of Fish and Game. Division of Commercial Fisheries, Regional Information Report. Kodiak.

Bourne, N. 1991. Fisheries and Aquaculture: West Coast of North America. *in* S.E. Shumway, (ed.), Scallops: biology, ecology, and aquaculture. Elsevier, N.Y. 1991.

Caddy, J.F. 1968. Underwater observations on scallop (*Placopecten magellanicus*) behavior and drag efficiency. Journal of the Fisheries Research Board of Canada 25: 2123-2141.

Eleftheriou, A., and M.R. Robertson. 1992. The effects of experimental scallop dredging on the fauna and physical environment of a shallow sandy community. Netherlands Journal of Sea Research 30:289-299.

Fish and Wildlife Service (FWS). 1997. Letter from Ann G. Rappoport to Steven Pennoyer, February 19, 1997, on effects of the 1997 Total Allowable Catch Specifications and Environmental Assessment for groundfish fisheries in the Gulf of Alaska and Bering Sea-Aleutian Islands on short-tailed albatrosses. USDI FWS, 605 West 4th Avenue, Room 62, Anchorage, AK 99501.

Fonseca, M.S., G.W. Thayer, A.J. Chester, and C. Foltz. 1984. Impact of scallop harvesting on eelgrass (*Zostera marina*) meadows: implications for management. North American Journal of Fisheries Management 4.

FWS. 1995. Endangered Species Act. Section 7. Reinitiation of Consultation on the Effects of the Groundfish Fisheries Conducted under the Bering Sea and Aleutian Islands and Gulf of Alaska Fishery Management Plans of the North Pacific Fishery Management Council. (Seabirds; amended Biological Opinion from July 3, 1989). USDI FWS, 605 West 4th Avenue, Room 62, Anchorage, AK 99501.

FWS. 1993. Alaska Seabird Management Plan. Report of the US Fish and Wildlife Service. Anchorage. 102 pp.

FWS. 1989. Endangered Species Act. Section 7 Consultation on the Effects of the Groundfish Fisheries Conducted under the Bering Sea and Aleutian Islands and Gulf of Alaska Fishery Management Plans of the North Pacific Fishery Management Council. (Seabirds; Biological Opinion.) USDI FWS, 605 West 4th Avenue, Room 62, Anchorage, AK 99501.

Gulland, J.A. 1971. Science and Fishery Management. J. Cons. Int. Explor. Mer. 33:471-477.

Hammarstom, L.F., and M.F. Merritt. 1985. A survey of Pacific weathervane scallops (*Pecten caurinus*) in Kamishak Bay, Alaska. Alaska Department of Fish and Game, Division of Commercial Fisheries, Informational Leaflet 252, Juneau.

Haynes, E.B., and G.C. Powell. 1968. A preliminary report on the Alaska sea scallop - fishery exploration, biology, and commercial processing. Alaska Department of Fish and Game, Division of Commercial Fisheries, Informational Leaflet 125, Juneau.

Hennick, D.P. 1970a. The weathervane scallop fishery of Alaska with notes on occurrence in Washington and Oregon. Pacific Marine Fisheries Commission, Annual Report for the Year 1969: 33-34.

Hennick, D.P. 1970b. Reproductive cycle, size at maturity, and sexual composition of commercially harvested weathervane scallops (Patinopecten caurinus) in Alaska. Journal of the Fisheries Research Board of Canada 27: 2112-2119.

Hennick, D.P. 1973. Sea scallop, Patinopecten caurinus, investigations in Alaska. Alaska Department of Fish and Game, Division of Commercial Fisheries, Completion Report 5-23-R, Juneau.

Hoenig, J.M. 1983. Empirical use of longevity data to estimate mortality rates. Fishery Bulletin 82(1): 898-902.

Kaiser, R.J. 1986. Characteristics of the Pacific weathervane scallop (Pecten [Patinopecten] caurinus, Gould 1850) fishery in Alaska, 1967-1981. Alaska Department of Fish and Game, Division of Commercial Fisheries (Unpublished Report, Catalog RUR-5J86-01), Juneau.

Kruse, G.H., E. Krygier, R.D. Mecum, and M.C. Murphy. 1993. Synopsis of ADF&G scallop meeting, Anchorage, Alaska, July 15, 1993. ADF&G Regional Information Report No. 5J93-07.

Kruse, G.H., and F.C. Funk. 1995. Biological Reference Points for Weathervane Scallops in Alaska, a poster presented to North Pacific Symposium on Invertebrate Stock Assessment and Management, Nanaimo, British Columbia, March 1995

Mayer, L.M., D.F. Schick, R.H. Findlay, and D.L. Rice. 1991. Effects of commercial dragging on sedimentary organic matter. Marine Environmental Research 31:249-261.

Morrison, R. 1994. Bering Sea Aleutian Islands Scallops. In: Westward Region Reports to the Board of Fisheries. March 1994.

National Marine Fisheries Service (NMFS). 1998. "Final Supplemental Environmental Impact Statement for the Groundfish Total Allowable Catch Specifications and Prohibited Species Catch Limits Under the Authority of the Fishery of the Bering Sea and Aleutian Islands Area and Groundfish of the Gulf of Alaska." NMFS- Alaska Region, PO Box 21668, Juneau, AK 99802-1668.

National Marine Fisheries Service (NMFS). 1997a. Final Environmental Assessment/Regulatory Impact Review/Final Regulatory Flexibility Analysis for Amendments 1 and 2 to the Fishery Management Plan for the Scallop Fishery off Alaska. NMFS-Alaska Region, PO Box 21668, Juneau, AK 99802-1668.

National Marine Fisheries Service (NMFS). 1997b. Final Environmental Assessment for 1997 Total Allowable Catch Specifications. NMFS-Alaska Region, P.O. Box 21668, Juneau, Alaska 99802-1668.

NMFS. 1996. Endangered Species Act. Section 7. Biological Opinion--Fishery Management Plan for the Bering Sea and Aleutian Islands and Gulf of Alaska Groundfish Fisheries and the Total Allowable Catch Specification and its effects to Steller Sea Lions. NMFS Alaska Region, P.O. Box 21668, Juneau, Alaska, January 26, 1996.

NMFS. 1995. Endangered Species Act. Section 7. Reinitiation of Consultation on the Effects of the Groundfish Fisheries Conducted under the Bering Sea and Aleutian Islands and Gulf of Alaska Fishery Management Plans of the North Pacific Fishery Management Council. (Pacific salmon; amended Biological Opinion from January 14, 1994) NMFS Northwest Region, 7600 Sand Point Way, NE, BIN 15700, Seattle, Washington, December 7, 1995.

NMFS. 1994. Endangered Species Act Section 7. Biological Opinion--Pacific Salmon. *Reinitiation of* Consultation on the Effects of the Groundfish Fisheries Conducted under the Bering Sea and Aleutian Islands and Gulf of Alaska Fishery Management Plans of the North Pacific Fishery Management Council. (Pacific Salmon) NMFS Northwest Region, 7600 Sand Point Way, NE, BIN 15700, Seattle, Washington, January 14, 1994.

NMFS. 1992. Endangered Species Act. Section 7. Biological Opinion--Amendment 18 to the Fishery Management Plan for the Groundfish Fishery of the Bering Sea and Aleutian Islands (Steller Sea Lions). NMFS Alaska Region, P.O. Box 21668, Juneau, Alaska, March 4, 1992.

NMFS. 1991. Endangered Species Act. Section 7. Biological Opinion--Fishery Management Plan for the Bering Sea and Aleutian Islands and Gulf of Alaska Groundfish Fisheries and the Total Allowable Catch Specification and its effects to Steller Sea Lions. NMFS Alaska Region, P.O. Box 21668, Juneau, Alaska, April 18, 1991.

North Pacific Fishery Management Council (NPFMC). 1992. Final Supplemental Environmental Impact Statement and Regulatory Impact Review/Initial Regulatory Flexibility Analysis of Proposed Inshore/Offshore Allocation Alternatives (Amendment 18/23) to the Fishery Management Plans for the Groundfish Fishery of the Bering Sea and Aleutian Islands and the Gulf of Alaska. March 5, 1992.

Orensanz, J.M. 1986. Size, environment, and density: the regulation of a scallop stock and its management implications. Pages 195-227 *in* G.S. Jamieson and N. Bourne, editors. North Pacific workshop on stock assessment and management of invertebrates. Canadian Special Publication of Fisheries and Aquatic Sciences 92.

Oresanz, J.M., A.M. Parma, and O.O. Iribarne. 1991. Population dynamics and management of natural stocks. Pp. 625-713. In S.E. Shumway (ed.). Scallops: Biology, Ecology and Aquaculture. Developments in Aquaculture and Fisheries Science, 21. Elsevier, Amsterdam.

Rosenberg, A.P., P. Mace, G. Thompson, G. Darcy, W. Clark, J. Collies, W. Gabriel, A. MacCall, R. Methot, J. Powers, V. Restrepo, T. Wainwright, L. Botsford, J. Hoenig, K. Stokes. 1994. Scientific review of definitions of overfishing in U.S. fishery management plans. NOAA Tech. Memo. NMFS-F/SPO-17, 105p.

Shirley, S.M., and G.H. Kruse. 1995. Development of the fishery for weathervane scallops, Patinopecten caurinus (Gould 1850), in Alaska. Journal of Shellfish Research 14:71-78.

Starr, R.M., and J.E. McCrae. 1983. Weathervane scallop (*Patinopecten caurinus*) investigations in Oregon, 1981-1983. Oregon Department of Fish and Wildlife, Information Reports 83-10, Newport.

Urban, D., D. Pengilly, and I. Vining, 1994. The scallop observer program and statewide data analysis summary to the Board of Fisheries. Alaska Department of Fish and Game, Kodiak, Alaska. 54p.

5.0 AGENCIES AND INDIVIDUALS CONSULTED

Loh-lee Low
NMFS-AFSC

Kent Lind
NMFS-AKRO

Al Spalinger, Dan Urban, Dave Jackson, Doug Pengilly
ADF&G Kodiak

6.0 LIST OF PREPARERS

Dave Witherell
NPFMC
Anchorage, AK

Jeff Barnhart
ADF&G Kodiak

Gordon Kruse
ADF&G
Juneau, AK

Gretchen Harrington
NMFS
Juneau, AK

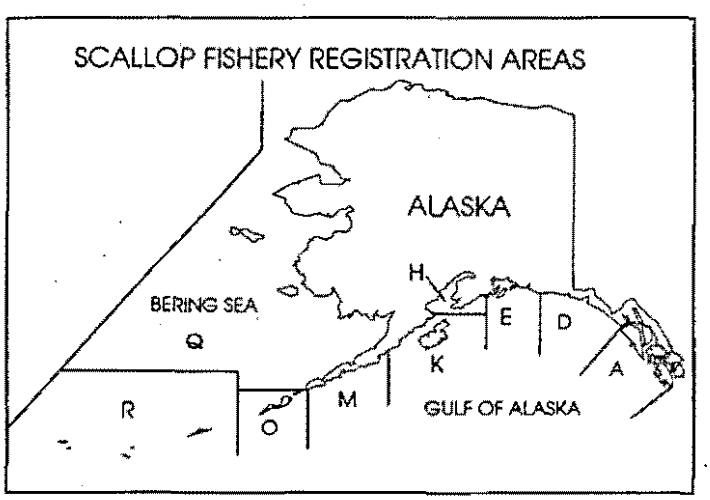
7.0 SCALLOP SPECIES SUMMARY

Scallops

Biology: Weathervane scallops (*Patinopectin caurinus*),are distributed from Point Reyes, California, to the Pribilof Islands, Alaska. The highest known densities in Alaska have been found to occur in the Bering Sea, off Kodiak Island, and along the eastern gulf coast from Cape Spencer to Cape St. Elias. Weathervane scallops are found from intertidal waters to depths of 300 m, but abundance tends to be greatest between depths of 40-130 m on beds of mud, clay, sand, and gravel. Sexes are separate and mature male and female scallops are distinguishable based on gonad color. Although spawning time varies with latitude and depth, weathervane scallops in Alaska spawn in May to July depending on location. Eggs and spermatozoa are released into the water, where the eggs become fertilized. After a few days, eggs hatch, and larvae rise into the water column and drift with ocean currents. Larvae are pelagic and drift for about one month until metamorphosis to the juvenile stage when they settle to the bottom. Weathervane scallops begin to mature by age 3 at about 7.6 cm (3 inches) in shell height (SH), and virtually all scallops are mature by age 4. Growth, maximum size, and size at maturity vary significantly within and between beds and geographic areas. Weathervane scallops are long-lived; individuals may live 28 years old or more. Scallops are likely prey to various fish and invertebrates during the early part of their life cycle. Flounders are known to prey on juvenile weathervane scallops, and seastars may also be important predators.

Several other species of scallop found in the EEZ off Alaska have commercial potential. These scallops grow to smaller sizes than weathervanes, and thus have not been extensively exploited in Alaska. Pink scallops, Chlamys rubida, range from California to the Pribilof Islands. Pink scallops are found in deep waters (to 200 m) in areas with soft bottom, whereas spiny scallop occur in shallower (to 150 m) areas characterized by hard bottom and strong currents. Pink scallops mature at age 2, and spawn in the winter (January-March). Maximum age for this species is 6 years. Spiny scallops, Chlamys hastata, are found in coastal regions from California to the Gulf of Alaska. Spiny scallops grow to slightly larger sizes (75 mm) than pink scallops (60 mm). Spiny scallops also mature at age 2 (35 mm) and spawn in the autumn (August-October). Rock scallops, Crassadoma gigantea, range from Mexico to Unalaska Island. Rock scallops are found in relatively shallower water (0-80 m) with strong currents. Apparently, distribution of these animals is discontinuous, and the abundance in most areas is low. These scallops attach themselves to rocks, attain a large size (to 250 mm), and exhibit fast growth rates. Rock scallops are thought to spawn during two distinct periods, one in the autumn (October -January), and one in the spring-summer (March-August).

Management: The weathervane scallop resource consists of multiple, discrete, self sustaining populations that are managed as separate stock units. Scallop stocks in Alaska have been managed under a federal fishery management plan (FMP) since July 26, 1995, which established a 1 year interim closure of federal waters to scallop fishing to prevent uncontrolled fishing. Amendment 1, which allowed scallop fishing under a federal management regime, was approved July 10, 1996 and fishing resumed on August 1. Amendment 1 provided for fishery management through permits, registration areas and districts, seasons, closed waters, gear restrictions, efficiency limits, crab bycatch limits, scallop catch limits, inseason adjustments, and observer monitoring.



A summary of management measures established under amendments to the federal scallop FMP.

Amendment	Date	Action
1	July 1996	Allowed fishing after a 1 year closure of Federal waters.
2	July 1997	Established a federal scallop vessel moratorium.
3	Dec 1997	If approved, would defer all management (except limited access) to State.
4	1999?	Would establish a permanent limited access system.
5	1998	Essential Fish Habitat

Most of these regulations were developed by the State prior to 1995. Dredge size is limited to a maximum width of 15 feet, and only 2 dredges may be used at any one time. In the Kamishak District of Cook Inlet, only 1 dredge with a 6' maximum width is allowed. Dredges are required to have rings with a 4" minimum inside diameter. To reduce incentives to harvest small scallops, crew size on scallop vessels is limited to 12 persons and all scallops must be manually shucked. Dredging is prohibited in areas designated as crab habitat protection areas, similar to

the groundfish FMPs. In June 1995, the Council adopted a 3-year vessel moratorium to restrict new entry into the scallop fishery while a more comprehensive plan was being developed. The moratorium approved as Amendment 2, effective August 1, 1997. To qualify under the proposed moratorium, a vessel must have made at least one landing in 1991, 1992, or 1993, or must have participated for at least 4 years between 1980 and 1993. The moratorium also limits reconstruction and replacement of vessels to a 20% maximum increase in original qualifying length overall.

Weathervane scallop registration areas, seasons, GHL's (pounds, shucked), and crab bycatch limits established for the 1997 scallop fishery, by area.

			Crab Bycatch Limits		
Area	GHL (pounds)	Fishing Season	king crab	Tanner crab	Snow crab
D - District 16	0 - 35,000	Jan 10 - Dec 31	n/a	n/a	n/a
D - Yakutat	0 - 250,000	Jan 10 - Dec 31	n/a	n/a	n/a
E - Eastern PWS	0 - 50,000	Jan 10 - Dec 31	n/a	500	n/a
Western PWS	combined	Jan 10 - Dec 31	n/a	130	n/a
H - Cook Inlet (Kamishak)	0 - 20,000	Aug 15 - Oct 31	60	24,992	n/a
Cook Inlet (Outer area)	combined	Jan 1 - Dec 31	98	2,170	n/a
K - Kodiak (Shelikof)	0 - 400,000	July 1 - Feb 15	35	51,000	n/a
Kodiak (Northeast)	combined	July 1 - Feb 15	50	91,600	n/a
M - AK Peninsula	0 - 200,000	July 1 - Feb 15	79	45,300	n/a
O - Dutch Harbor	0 - 170,000	July 1 - Feb 15	10	10,700	n/a
Q - Bering Sea	0 - 600,000	July 1 - Feb 15	500	238,000	172,000
R - Adak	0 - 75,000	July 1 - Feb 15	50	10,000	n/a

Fishery: In 1996, a total of 9 vessels participated in the scallop fishery statewide. Scallop vessels average 90-110 ft long. Scallops are harvested using dredges of standard design. Weathervane scallops are processed at sea by manual shucking, with only the meats (adductor muscles) retained. Scallops harvested in Cook Inlet are bagged and iced, whereas scallops harvested from other areas are generally block frozen at sea. The fishery has occurred almost exclusively in the EEZ in recent years, but some fishing in State waters occurs off Yakatat, Dutch Harbor, and Adak.

Catch History: Since 1967, when the first landings were made, fishing effort and total scallop harvest (weight of shucked meats) have varied annually. Total commercial harvest of weathervane scallops has fluctuated from a high of 157 landings totaling 1,850,187 pounds of shucked meats by 19 vessels in 1969 to no landings in 1978. Prices and demand for scallop have remained high since fishery inception. Prior to 1990, about two-thirds of the scallop harvest has been taken off Kodiak Island and about one-third has come from the Yakutat area; other areas had made minor contributions to overall landings. Harvests in 1990 and 1991 were the highest on record since the early 1970's. The 1992 scallop harvest was even higher at 1,810,788 pounds. The increased harvests in the 1990's occurred with new exploitation in the Bering Sea. The reduced 1995 catch was due to implementation of an interim closure in the EEZ from 2/23/95 to 8/1/96.

The 1996 and 1997 fishery can be summarized as follows:

AREA	1996	1997
Cook Inlet		
No. of vessels	4*	3
Landings (lbs)	28,228	20,336
Outside		
No. of vessels	4	6
Landings (lbs)	704,196	765,707

*one additional vessel fished in state waters only.

Landings and effort in the Alaska weathervane scallop fishery, 1980 - 1997.

Year	# of Vessels	Landings (pounds)	Price ($/lb)
1980	8	633,000	4.32
1981	18	924,000	4.05
1982	13	914,000	3.77
1983	6	194,000	4.88
1984	10	390,000	4.47
1985	8	648,000	3.12
1986	9	683,000	3.66
1987	4	583,000	3.38
1988	4	341,000	3.49
1989	7	526,000	3.68
1990	9	1,489,000	3.37
1991	7	1,191,000	3.76
1992	7	1,811,000	3.88
1993	15	1,429,000	5.00
1994	16	1,235,000	6.00
1995	10	283,000	n/a
1996	9	732,424	6.38
1997	9	786,043	6.50

Table 1. Twenty most frequently caught species by weight as recorded by scallop observers during the 1996/97 Alaska Peninsula Area scallop season. Non target commercial species[a] accounted for 8.6% of the twenty most frequently caught species by weight.

Rank	Species	Scientific Name	% of Total Catch
1	weathervane scallops	*Patinopecten caurinus*	70.3%
2	starfish	Class Stelleroidea	11.4%
3	arrowtooth flounder	*Atheresthes stomias*	4.8%
4	basket starfish	*Gorgonocephalus caryi*	4.6%
5	weathervane shells	*P. caurinus*	2.9%
6	sea urchin	Family Strongyocentrotidae	1.6%
7	Pacific Cod	*Gadus macrocephalus*	0.7%
8	snails	Class Gastropoda	0.5%
9	Tanner crab	*Chionoecetes bairdi*	0.5%
10	kelp, rocks, etc.		0.5%
11	flathead sole	*Hippoglossoides elassodon*	0.3%
12	walleye pollock	*Theragra chalcogramma*	0.2%
13	hermit crab	Family Paguridae	0.2%
14	Greenland turbot	*Reinhardtius hippoglossoides*	0.2%
15	bay scallops	Chlamys spp	0.2%
16	brown box crab	*Lopholithodes foraminatus*	0.1%
17	snail eggs	Class Gastropoda	0.1%
18	man-made debris		0.1%
19	worms unident	Class Polychaeta	0.1%
20	shrimp	*Family Pandalidae*	0.1%

[a]Commercial species caught in declining order of poundage: arrowtooth flounder, sea urchin, Pacific cod, *Chionoecetes bairdi*, flathead sole, walleye pollock, Greenland turbot, bay scallops, and shrimp.

Table 2. Summary of the most frequently caught species, by percent weight in sampled dredges, as recorded by scallop observers during the 1996/97 scallop fishery.

	Management Area / District					
		Kodiak			Alaska	Bering
Species Catergory	Yakutat	Northeast	Chelikof	Semidi	Peninsula	Sea
weathervane scallops	84.7	54.1	76.8	51.8	70.3	87.5
PROHIBITED SPECIES BYCATCH						
Tanner crab	<.1	0.9	0.1	0.9	0.5	0.8
snow crab, opilio	0	0	0	0	0	3.7
king crab	0	0	0	<.1	0	0
Dungeness crab	<.1	0	<.1	0.8	0	0
Pacific halibut	0.2	0.5	0.2	<.1	0	<.1
OTHER COMMERCIAL SPECIES						
skates	1.9	4.9	3.1	2.5	0	1.0
arrowtooth flounder	0.3	0.3	0.4	0.3	4.8	0.8
rock sole	<.1	0.2	<.1	0.5	0.1	0.2
Dover sole	0.2	0.1	<.1	0.1	0	0.1
yellowfin sole	0	0	<.1	0.7	0	<.1
rex sole	0.1	0.6	0	0	0.1	0
flathead sole	0.2	0.5	0.5	1.2	0.3	0.3
butter sole	<.1	0.4	0	0.8	0	<.1
Pacific cod	0.1	1.2	<.1	0.9	0.7	0.4
starry flounder	<.1	0	0	1.6	0	0
walleye pollock	<.1	0	<.1	<.1	0.2	0.4
bay scallops	<.1	0	<.1	<.1	0.2	0
sea urchins	0	0	<.1	<.1	1.6	<.1
octopus	0	0	0.1	0	<.1	<.1
Alaska plaice	0	0	0.6	0.1	0	0
sea cucumber	<.1	0.1	<.1	<.1	0	0.2
MISCELLANEOUS						
starfish	4.5	32.4	2.7	15.7	11.4	0.1
basket star	<.1	<.1	<.1	3.8	4.6	0
weathervane shells	3.7	1.8	5.5	8.0	2.9	2.1
kelp, rocks, etc.	1.2	1.4	5.5	9.0	0.5	0.9
man-made debris	<.1	0.1	0.2	0.2	0.1	0.6
Misc. invertebrates	1.7	0.3	0.8	0.1	1.4	0.9
Mis. fish	0.3	0	0.1	0.2	0.3	< 1

Table 3. Estimated bycatch , in numbers of individuals, and confidence intervals for *C. opilio*, *C. bairdi*, Dungeness, and king crab, and halibut from the 1996/97 statewide scallop fishery.

Management Area	n[b]	Bycatch Estimates by Species[a]									
		C. opilio		*C. bairdi*		Dungeness		king crab		halibut	
		Bycatch	95% CI	Bycatch	95% CI	Bycatch	95% CI	Bycatch[c]	95% CI	Bycatch	95% CI
Yakutat	82	0	NA	6,872	4,641-9,588	38	7-77	0	NA	150	91-151
District 16	26	0	NA	669	274-1,123	9	NA	0	NA	68	30-68
Kodiak											
Northeast District	28	0	NA	27,722	10,298-48,407	0	NA	0	NA	202	79-384
Shelikof District	104	0	NA	11,285	9,408-13,257	1,008	584-1,508	0	NA	440	318-569
Semidi District	38	0	NA	8,902	3,798-15,750	4,554	2,504-7,068	9	NA	79	5-176
Alaska Peninsula	13	0	NA	19,045	12,604-26,362	10	NA	0	NA	25	NA
Bering Sea	63	106,935	98,033-116,196	16,642	14,227-19,373	0	NA	0	NA	124	49-229

[a]Estimates were calculated as bycatch per hour per boat per day x total hours dredged x number of dredges fished.
[b]Number of vessel days.
[c]Actual count, not an estimate.

Table 4. Condition of halibut as recorded by scallop observers during the1996/97 fishing season.

MANAGEMENT AREA	CONDITION[a] Of HALIBUT (Number of Halibut)						
	Excellent	Good	Fair	Poor	Dead	Previously dead	Total
District 16	4	0	1	1	0	1	7
Yakutat	13	5	2	1	1	0	22
Kodiak, Northeast District	4	2	4	6	2	0	18
Kodiak, Shelikof District	20	10	8	11	4	2	55
Kodiak, Semidi District	1	4	1	3	0	0	9
Alaska Peninsula	1	0	0	1	1	0	3
Bering Sea	2	4	4	1	2	0	13
Total all Areas	45	25	20	24	10	3	127

[a]Condition Codes

Excellent: Vigorous body movement before and after release; could close operculum tightly; minor external injuries, if any.
Good: Feeble body movements; could close operculum tightly; minor external injuries, if any.
Fair: No body movement; could close operculum tightly; minor external injuries, if any.
Poor: No body movement; could move operculum but not tightly; severe injuries (eg. bleeding).
Dead: No body or opercular movement; probably killed in sampled haul.
Previously dead: Obviously not killed in the current haul (incidentally caught).

Table 5. Tanner crab bycatch mortality as recorded by scallop observers during the 1996/97 fishing season.

MANAGEMENT AREA	NUMBER OF TANNER CRAB OBSERVED		
	Dead	Alive	Percent Dead
District 16	34	38	47.2
Yakutat	537	373	58.9
Kodiak, Northeast District	262	1,361	16.1
Kodiak, Shelikof District	587	1,013	36.6
Kodiak, Semidi District	271	464	36.9
Alaska Peninsula	735	1,541	32.3
Bering Sea *C. opilio*	1,675	8,674	16.2
Bering Sea *C. bairdi*	210	1,454	12.6
Total all Areas	4,311	14,918	28.9

Table 6. Number and weight of discarded scallops as recorded by scallop observers during the 1996/97 fishing season.

MANAGEMENT AREA	Number of Sampled Scallops		Weight of Sampled Scallop	
	Intact	Broken	Intact	Broken
Yakutat	35, 697	19, 595	8, 376	7, 212
District 16	19, 239	2, 684	4, 031	735
Yakutat Total	54, 936	22, 279	12, 407	7, 947
Kodiak, Northeast District	908	982	228	493
Kodiak, Shelikof District	34, 398	29, 337	7, 722	9, 314
Kodiak, Semidi District	254	974	126	531
Kodiak Total	35, 560	31, 293	8, 076	10, 338
Alaska Peninsula	1, 858	2, 546	281	711
Bering Sea	1, 397	2, 174	588	1, 097
Total	93, 751	58, 292	21, 352	20, 093

Table 8. Average weight of intact and broken scallops from observer sampled discarded scallop catch during the 1996/97 fishing season.

MANAGEMENT AREA	WEIGHT[a]		
	Intact Scallops	Broken Scallops	Average
Yakutat	0.24	0.29	0.27
District 16	0.21	0.28	0.25
Yakutat Average	0.22	0.28	
Kodiak, Northeast District	0.38	0.52	0.45
Kodiak, Shelikof District	0.25	0.34	0.30
Kodiak, Semidi District	0.46	0.54	0.50
Kodiak Average	0.37	0.46	
Alaska Peninsula	0.15	0.26	0.21
Bering Sea	0.44	0.51	0.47
Overall Average	0.31	0.39	

[a]Weight in pounds.

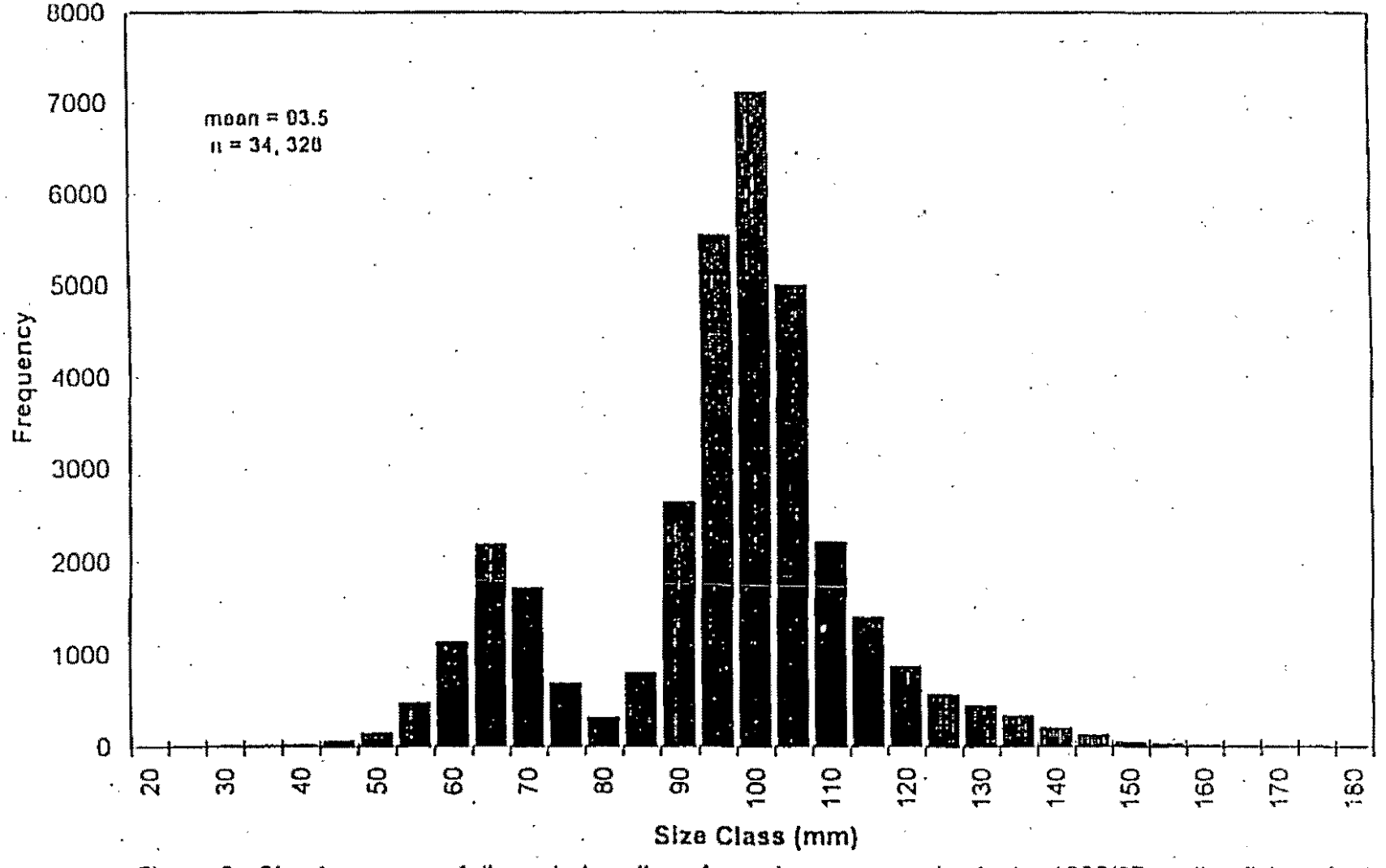


Figure 2. Size frequency of discarded scallops from observer samples in the 1996/97 scallop fishery in the Shelikof District of the Kodiak Area.

Similar to trawling, dredging may place fine sediments into suspension, bury gravel below the surface and overturn large rocks that are embedded in the substrate. Dredging can also result in dislodgement of buried shell material, burying of gravel under re-suspended sand, and overturning of larger rocks with an appreciable roughening of the sediment surface (Caddy 1968). A study of scallop dredging in Scotland showed that dredging caused significant physical disturbance to the sediments, as indicated by furrows and dislodgement of shell fragments and small stones (Eleftheriou and Robertson 1992). However, the authors note that these changes in bottom topography did not change sediment disposition, sediment size, organic carbon content, or chlorophyll content. Observations of the Icelandic scallop fishery off Norway indicated that dredging changed the bottom substrate from shell-sand to clay with large stones within a 3-year period (Aschan 1991). For some scallop species, it has been demonstrated that dredges may adversely affect substrate required for settlement of young to the bottom (Fonseca et al. 1984; Orensanz 1986). Mayer et al. (1991), investigating the effects of a New Bedford scallop dredge on sedimentology at a site in coastal Maine, found that vertical redistribution of bottom sediments had greater implications than the horizontal translocation associated with scraping and ploughing the bottom. The scallop dredge tended to bury surficial metabolizable organic matter below the surface, causing a shift in sediment metabolism away from aerobic respiration that occurred at the sediment-water interface and instead toward subsurface anaerobic respiration by bacteria (Mayer et al. 1991). Dredge marks on the sea floor tend to be short-lived in areas of strong bottom currents, but may persist in low energy environments.

Two studies have indicated that intensive scallop dredging may have some direct impacts on the benthic community. Eleftheriou and Robertson (1992), conducted an experimental scallop dredging in a small sandy bay in Scotland to assess the effects of scallop dredging on the benthic fauna. They concluded that while dredging on sandy bottom has a limited effect on the physical environment and the smaller infauna, large numbers of the larger infauna (mollusks) and some epifaunal organisms (echinoderms and crustaceans) were killed or damaged after only a few hauls of the dredge. However, long term and cumulative effects were not examined. Aschan (1991) examined the effects of dredging for islandic scallops on macrobenthos off Norway. Aschan found that the faunal biomass declined over a 4-year period of heavy dredging. Several species, including *Stronylocentrotus droebachiensis*, *Pagurus pubescens*, *Ophiura robusta*, and polychaetes showed an increase in abundance over the time period. In summary, scallop gear, like other gear used to harvest living aquatic resources, may impact the benthic community and physical environment relative to the intensity of the fishery.

Current State and Federal regulation of the scallop fishery is designed to reduce potential impacts. Fishing seasons are established, in part, to protect scallop during the spawning portions of their life cycle, and protect young during critical periods. In addition, many areas have been closed to dredging to protect important benthic communities. Weathervane scallops occur at depths ranging from intertidal waters to 300 m, with highest abundance at depths between 45 and 130 m on substrates consisting of mud, clay, sand, or gravel (Hennick 1970a, 1973). In addition to weathervane scallops, such substrates are likely to support populations of starfish, skates, crabs, snails, flatfish, and other groundfish species. Other scallop species are found in different habitats.

Based on the available information detailed above, the alternatives to the status quo are not reasonably expected to allow substantial damage to the ocean and coastal habitats (NOAA Administrative Order 216-6). Scallop dredges may have some potential to affect other organisms comprising benthic communities; however, these effects are not likely to be substantial for the relatively small scale scallop fisheries in Alaska.

2.3 Potential Impacts on Bycatch of Non-target Species

The environmental impacts of the alternatives are not expected to differ from the status quo. Given the best available information, as summarized below, none of the alternatives are expected to jeopardize the long-term productive capability of crab, herring or groundfish stocks.

As with trawl and other gear, scallop dredges have some potential to catch non-target species, particularly those that are slow moving or stationary. Limited data have been collected in past years on incidental catches of crab by dredges targeting weathervane and other scallop species, but the information remains confidential. In some areas, the catches of king and Tanner crabs may be high, and many captured crabs may be lethally damaged (Haynes and Powell 1968; Hennick 1973; Kaiser 1986). Some catches from scallop dredges contain small amounts of other species of crabs, shrimps, octopi, and fishes such as flatfishes, cod, and others (Hennick 1973, Kruse et al. 1993). Starfish, a scallop predator (Bourne 1991), was found to be the primary bycatch in weathervane scallop fisheries off Yakutat (Kruse et al. 1993). Seasonal and area-specific differences in bycatch rates exist. For example, in some areas incidental catches of king crabs may increase in spring as adult crabs migrate inshore for molting and mating, whereas other areas of dense scallop concentrations may possess few king crabs (Hennick 1973) and bycatch may be of little concern in these locations.

More recent bycatch data were collected during the 1996 ADF&G observer program (Barnhart and Sagalkin 1998). By weight, the catch consisted primarily of weathervane scallops in all management districts. Catch of starfish and shells were also common in the Gulf of Alaska, and C. opilio were taken in the Bering Sea. Flatfish and other invertebrate species comprised the remaining bycatch. No salmon bycatch was reported. Total bycatch of prohibited species statewide included 106,935 opilio, 91,137 bairdi, 5,619 dungeness crab, 9 king crab, and 1,088 halibut. Most of the halibut were observed to be in excellent or good condition, but about 27% were classified as in poor or dead condition. Tanner crab (C. bairdi and C. opilio) had higher mortality, with 22.4%

Other studies have also enumerated mortality and injury of crab taken as bycatch in the Alaska scallop fisheries. During a scallop survey of Cook Inlet in August 1984, a total of 5 red king crabs and more than 399 Tanner crabs were taken as bycatch in 47 tows (Hammarstom and Merritt 1985). Of the crab taken as bycatch, 19 percent of the Tanner crabs were injured and mortality was estimated at 8 percent, with most injuries and mortality occurring when the catch was dumped on deck (Hammarstom and Merritt 1985). Another scallop survey conducted around Kodiak Island in January 1968 had an unspecified bycatch (up to 33 per tow) of red king crabs, with an estimated mortality rate of 79 percent (Haynes and Powell 1968). Observations of the 1968-1972 scallop fishery around Kodiak Island indicated an average bycatch of 4.1 red king crab and 42.5 Tanner crab per tow (Kaiser 1986), with mortality estimated at 19 percent for Tanner crab and 48 percent for red king crab. An average of 0.6 Dinginess crabs per tow were also captured with mortality estimated to be 8 percent.

Bycatch of crab may vary by area, season, and depth. Off Yakutat, Hennick (1973) noted no king crab bycatch. Around Kodiak, king crab catches tended to increase in spring as adults migrated inshore for molting and mating (Hennick 1973). Consistent with other handling studies, newly molted crabs experience higher rates of injury and mortality than hard shelled crab, as a result of scallop dredges (Starr and McCrae 1983). Bycatch rates, injury rates, and mortality estimates do not take into account that scallop vessels dredge over the same bottom, tow after tow. Therefore, impacts of scallop fishing on crab bycatch may be overestimated in some situations.

Current regulations limit bycatch and interaction of crabs and the scallop fishery. King and Tanner crab bycatch limits for Alaskan scallop fisheries were instituted by the State in July 1993 and by NMFS under Amendment 1 in 1996. With the exception of Yakutat and Southeast areas, crab bycatch limits were specified for scallop fisheries in all registration areas. In addition, large areas in State and Federal waters have been closed to scallop fishing, as these areas have showed high concentrations of crabs.

Bycatch data collected by State observers in the 1993 scallop fishery (Urban et al. 1994) can be used to analyze bycatch rates of crabs and other species. During the 1993 Bering Sea area scallop fishery (occurring over a 4 month period), a total of 10 vessels made 7,208 tows, to harvest 598,093 lb (271.3 mt) of scallop meat, with a bycatch of 276,500 Tanner crab and 212 king crab (Morrison 1994). On a rate basis, this equates to 83 lb (0.038 mt) of scallops and 38 Tanner crab per tow, or put another way, about 0.46 Tanner crabs per pound (1 Tanner crab per kilogram) of scallop meat harvested. At an average exvessel price of $6.02 per pound for scallops, gross exvessel value was $500 per tow. Bycatch rates varied greatly among vessels fishing in the 1993 Bering Sea scallop fishery (Urban et al. 1994). Catch of Tanner crabs per tow-hour ranged from 17 crabs to 203 crabs per tow-hour (median=53, mean=90). Length frequency of Tanner crabs taken as bycatch was not reported, but likely consisted primarily of small juvenile crab.

2.4 Endangered Species Act

The Endangered Species Act of 1973 as amended [16 U.S.C. 1531 *et seq*; ESA], provides for the conservation of endangered and threatened species of fish, wildlife, and plants. The program is administered jointly by the NMFS for most marine mammal species, marine and anadromous fish species, and marine plants species and by the USFWS for bird species, and terrestrial and freshwater wildlife and plant species.

The designation of an ESA listed species is based on the biological health of that species. The status determination is either threatened or endangered. Threatened species are those likely to become endangered in the foreseeable future [16 U.S.C. § 1532(20)]. Endangered species are those in danger of becoming extinct throughout all or a significant portion of their range [16 U.S.C. § 1532(20)]. Species can be listed as endangered without first being listed as threatened. The Secretary of Commerce, acting through NMFS, is authorized to list marine fish, plants, and mammals (except for walrus and sea otter) and anadromous fish species. The Secretary of the Interior, acting through the USFWS, is authorized to list walrus and sea otter, seabirds, terrestrial plants and wildlife, and freshwater fish and plant species.

In addition to listing species under the ESA, the critical habitat of a newly listed species must be designated concurrent with its listing to the "maximum extent prudent and determinable" [16 U.S.C. § 1533(b)(1)(A)]. The ESA defines critical habitat as those specific areas that are essential to the conservation of a listed species and that may be in need of special consideration. Federal agencies are prohibited from undertaking actions that destroy or adversely modify designated critical habitat. Some species, primarily the cetaceans, which were listed in 1969 under the Endangered Species Conservation Act and carried forward as endangered under the ESA, have not received critical habitat designations.

2.5 Impacts on Endangered, Threatened or Candidate Species

Species listed as endangered and threatened under the ESA that may be present in the Federal waters off Alaska include:

Endangered

Northern right whale	*Balaena glacialis*

Sei whale	*Balaenoptera borealis*
Blue whale	*Balaenoptera musculus*
Fin whale	*Balaenoptera physalus*
Humpback whale	*Megaptera novaeangliae*
Sperm whale	*Physeter macrocephalus*
Snake River sockeye salmon	*Oncorhynchus nerka*
Short-tailed albatross	*Diomedea albatrus*
Steller sea lion (western stock)	*Eumetopias jubatus*

Threatened

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

The scallop fishery off Alaska (which consists of a small fleet of vessels, and uses gear less likely to generate bycatch of finfish, seabirds or marine mammals) is not expected to affect ESA-listed species, seabirds or marine mammals in any manner or extent not already addressed under previous consultations for the groundfish fisheries. NMFS operates from the presumption that the scallop fishery has no effect on the threatened or endangered species that occur in the GOA or BSAI management area. There has never been an assumption that there is an effect, therefore, there has never been a consultation for the FMP for the Scallop Fishery off Alaska. The impact of the groundfish fisheries off Alaska on endangered and threatened species has been addressed extensively in a series of formal and informal consultations.

Pursuant to section 7 of the Endangered Species Act, NMFS has completed a consultation on the effects of the pollock and Atka mackerel fisheries on listed species, including the Steller sea lion, and designated critical habitat. The Biological Opinion prepared for this consultation, dated December 3, 1998, and revised on December 16, 1998, concludes that NMFS actions that authorize the pollock fisheries in the BSAI and the GOA jeopardize the continued existence of Steller sea lions and adversely modify their designated critical habitat. The Biological Opinion contains reasonable and prudent alternatives (RPAs) to mitigate the adverse impacts of the pollock fisheries on Steller sea lions. An emergency rule to implement the RPAs was published on January 22, 1999 (64 FR 3437) with an effective date of January 20, 1999, through July 19, 1999. NMFS anticipates extending this emergency rule for an additional 180 days with revisions to the provisions for the pollock B and C seasons consistent with the Biological Opinion. The Biological Opinion concluded that NMFS actions that authorize the Atka mackerel fisheries in the BSAI would not likely jeopardize the continued existence of Steller sea lions or adversely modify their designated critical habitat.

On December 22, 1998, NMFS completed a consultation on the effects of the 1999 BSAI groundfish fisheries on listed and candidate species, including the Steller sea lion and listed seabirds, and on designated critical habitat. The Biological Opinion concluded that this action is not likely to jeopardize the continued existence of the Steller sea lion or adversely modify its critical habitat. The opinion is contingent upon development and implementation of reasonable and prudent alternatives as outlined in the December 16, 1998, Biological Opinion.

2.6 Potential Impacts on ESA-listed Pacific Salmon

Capture of salmon by the scallop dredges is reported to be extremely rare (Hennick 1973), as scallop dredges are small in size, and remain within one meter of the ocean bottom. Bycatch of all fish species by scallop dredges is composed primarily of flounders and skates (Kruse et al. 1993; Urban et al. 1994). No salmon bycatch was reported during the 1993 ADF&G observer program, with nearly 900 days fishing observed (Urban et al. 1994), and there have been no other reports of salmon bycatch in the scallop fishery off Alaska. None of the alternatives will affect the continued existence of listed species of Pacific salmon, or result in disturbance or adverse modification of critical salmon habitat.

2.7 Potential Impacts on Seabirds

Since scallop dredges are small in size, and remain within one meter of the ocean bottom, interactions with seabirds are much less likely in the scallop fishery than in the groundfish fishery, which consists of a much larger fleet of vessels using large nets or baited hooks or pots. In addition, there are no reported takes of seabirds by the scallop fishery off Alaska. Therefore, none of the alternatives will affect endangered or threatened seabirds or their critical habitat.

Many seabirds occur in Alaskan waters and have the potential for interaction with scallop fisheries. The most numerous seabirds in Alaska are northern fulmars, storm petrels, kittiwakes, murres, auklets, and puffins. These groups, and others, represent 38 species of seabirds that breed in Alaska. Eight species of Alaska seabirds breed only in Alaska and in Siberia. Populations of five other species are concentrated in Alaska but range throughout the North Pacific region. Marine waters off Alaska provide critical feeding grounds for these species as well as others that do not breed in Alaska but migrate to Alaska during summer, and for other species that breed in Canada or Eurasia and overwinter in Alaska. Additional discussion about seabird life history, predator-prey relationships, and interactions with commercial fisheries can be found in the 1998 FSEIS for the Groundfish Total Allowable Catch Specifications and Prohibited Species Catch Limits Under the Authority of the FIshery of the Bering Sea and Aleutian Islands Area and Groundfish of the Gulf of Alaska (NMFS 1998).

2.8 Potential Impacts on Marine Mammals

Cetacean and pinniped species are unlikely to have potential for interaction with scallop fisheries in the GOA and BSAI. Interactions of the scallop fishery with Steller sea lions and other pinnipeds, and sea otters are thought to be rare and less common than in the groundfish fisheries. In addition, there are no reported takes of marine mammals by the scallop fishery off Alaska. Therefore, none of the alternatives will have an adverse effect on marine mammals.

2.9 Coastal Zone Management Act

Implementation of each of the alternatives would be conducted in a manner consistent, to the maximum extent practicable, with the Alaska Coastal Management Program within the meaning of Section 30(c)(1) of the Coastal Zone Management Act of 1972 and its implementing regulations.

2.10 Conclusions or Finding of No Significant Impact

None of the alternatives in Amendment 6 to the scallop FMP are likely to significantly affect the quality of the human environment, and the preparation of an environmental impact statement for the proposed action is not required by Section 102(2)(C) of the National Environmental Policy Act or its implementing regulations.

Assistant Administrator for Fisheries, NOAA

MAR 3 1999

Date

4.0 REFERENCES

Aschan, M.M. 1991. Effects of Iceland scallop dredging on benthic communities in the Northeast Atlantic. Special international workshop on the effects of physical disturbance on the sea floor on benthic and epibenthic ecosystems. Conseil International pour L'Exploration de la Mer, Benthos Working Group, Unpublished Manuscript

Alverson, D.L., and M.J. Carney. 1975. A graphic review of the growth and decay of population cohorts. Journal du Conseil, Conseil International pour l'Exploration de la Mer 36(2):133-143.

Barnhart, J.P., and N. Sagalkin. 1998. Summary and analysis of onboard collected data from the 1996/97 statewide commercial weathervane scallop fishery. Alaska Department of Fish and Game. Division of Commercial Fisheries, Regional Information Report. Kodiak.

Bourne, N. 1991. Fisheries and Aquaculture: West Coast of North America. *in* S.E. Shumway, (ed.), Scallops: biology, ecology, and aquaculture. Elsevier, N.Y. 1991.

Caddy, J.F. 1968. Underwater observations on scallop (*Placopecten magellanicus*) behavior and drag efficiency. Journal of the Fisheries Research Board of Canada 25: 2123-2141.

Eleftheriou, A., and M.R. Robertson. 1992. The effects of experimental scallop dredging on the fauna and physical environment of a shallow sandy community. Netherlands Journal of Sea Research 30:289-299.

Fish and Wildlife Service (FWS). 1997. Letter from Ann G. Rappoport to Steven Pennoyer, February 19, 1997, on effects of the 1997 Total Allowable Catch Specifications and Environmental Assessment for groundfish fisheries in the Gulf of Alaska and Bering Sea-Aleutian Islands on short-tailed albatrosses. USDI FWS, 605 West 4th Avenue, Room 62, Anchorage, AK 99501.

Fonseca, M.S., G.W. Thayer, A.J. Chester, and C. Foltz. 1984. Impact of scallop harvesting on eelgrass (*Zostera marina*) meadows: implications for management. North American Journal of Fisheries Management 4.

FWS. 1995. Endangered Species Act. Section 7. Reinitiation of Consultation on the Effects of the Groundfish Fisheries Conducted under the Bering Sea and Aleutian Islands and Gulf of Alaska Fishery Management Plans of the North Pacific Fishery Management Council. (Seabirds; amended Biological Opinion from July 3, 1989). USDI FWS, 605 West 4th Avenue, Room 62, Anchorage, AK 99501.

FWS. 1993. Alaska Seabird Management Plan. Report of the US Fish and Wildlife Service. Anchorage. 102 pp.

FWS. 1989. Endangered Species Act. Section 7 Consultation on the Effects of the Groundfish Fisheries Conducted under the Bering Sea and Aleutian Islands and Gulf of Alaska Fishery Management Plans of the North Pacific Fishery Management Council. (Seabirds; Biological Opinion.) USDI FWS, 605 West 4th Avenue, Room 62, Anchorage, AK 99501.

Gulland, J.A. 1971. Science and Fishery Management. J. Cons. Int. Explor. Mer. 33:471-477.

Hammarstom, L.F., and M.F. Merritt. 1985. A survey of Pacific weathervane scallops (*Pecten caurinus*) in Kamishak Bay, Alaska. Alaska Department of Fish and Game, Division of Commercial Fisheries, Informational Leaflet 252, Juneau.

Haynes, E.B., and G.C. Powell. 1968. A preliminary report on the Alaska sea scallop - fishery exploration, biology, and commercial processing. Alaska Department of Fish and Game, Division of Commercial Fisheries, Informational Leaflet 125, Juneau.

Hennick, D.P. 1970a. The weathervane scallop fishery of Alaska with notes on occurrence in Washington and Oregon. Pacific Marine Fisheries Commission, Annual Report for the Year 1969: 33-34.

Hennick, D.P. 1970b. Reproductive cycle, size at maturity, and sexual composition of commercially harvested weathervane scallops (Patinopecten caurinus) in Alaska. Journal of the Fisheries Research Board of Canada 27: 2112-2119.

Hennick, D.P. 1973. Sea scallop, Patinopecten caurinus, investigations in Alaska. Alaska Department of Fish and Game, Division of Commercial Fisheries, Completion Report 5-23-R, Juneau.

Hoenig, J.M. 1983. Empirical use of longevity data to estimate mortality rates. Fishery Bulletin 82(1): 898-902.

Kaiser, R.J. 1986. Characteristics of the Pacific weathervane scallop (Pecten [Patinopecten] caurinus, Gould 1850) fishery in Alaska, 1967-1981. Alaska Department of Fish and Game, Division of Commercial Fisheries (Unpublished Report, Catalog RUR-5J86-01), Juneau.

Kruse, G.H., E. Krygier, R.D. Mecum, and M.C. Murphy. 1993. Synopsis of ADF&G scallop meeting, Anchorage, Alaska, July 15, 1993. ADF&G Regional Information Report No. 5J93-07.

Kruse, G.H., and F.C. Funk. 1995. Biological Reference Points for Weathervane Scallops in Alaska, a poster presented to North Pacific Symposium on Invertebrate Stock Assessment and Management, Nanaimo, British Columbia, March 1995

Mayer, L.M., D.F. Schick, R.H. Findlay, and D.L. Rice. 1991. Effects of commercial dragging on sedimentary organic matter. Marine Environmental Research 31:249-261.

Morrison, R. 1994. Bering Sea Aleutian Islands Scallops. In: Westward Region Reports to the Board of Fisheries. March 1994.

National Marine Fisheries Service (NMFS). 1998. "Final Supplemental Environmental Impact Statement for the Groundfish Total Allowable Catch Specifications and Prohibited Species Catch Limits Under the Authority of the Fishery of the Bering Sea and Aleutian Islands Area and Groundfish of the Gulf of Alaska." NMFS- Alaska Region, PO Box 21668, Juneau, AK 99802-1668.

National Marine Fisheries Service (NMFS). 1997a. Final Environmental Assessment/Regulatory Impact Review/Final Regulatory Flexibility Analysis for Amendments 1 and 2 to the Fishery Management Plan for the Scallop Fishery off Alaska. NMFS-Alaska Region, PO Box 21668, Juneau, AK 99802-1668.

National Marine Fisheries Service (NMFS). 1997b. Final Environmental Assessment for 1997 Total Allowable Catch Specifications. NMFS-Alaska Region, P.O. Box 21668, Juneau, Alaska 99802-1668.

NMFS. 1996. Endangered Species Act. Section 7. Biological Opinion--Fishery Management Plan for the Bering Sea and Aleutian Islands and Gulf of Alaska Groundfish Fisheries and the Total Allowable Catch Specification and its effects to Steller Sea Lions. NMFS Alaska Region, P.O. Box 21668, Juneau, Alaska, January 26, 1996.

NMFS. 1995. Endangered Species Act. Section 7. Reinitiation of Consultation on the Effects of the Groundfish Fisheries Conducted under the Bering Sea and Aleutian Islands and Gulf of Alaska Fishery Management Plans of the North Pacific Fishery Management Council. (Pacific salmon; amended Biological Opinion from January 14, 1994) NMFS Northwest Region, 7600 Sand Point Way, NE, BIN 15700, Seattle, Washington, December 7, 1995.

NMFS. 1994. Endangered Species Act Section 7. Biological Opinion--Pacific Salmon. *Reinitiation of* Consultation on the Effects of the Groundfish Fisheries Conducted under the Bering Sea and Aleutian Islands and Gulf of Alaska Fishery Management Plans of the North Pacific Fishery Management Council. (Pacific Salmon) NMFS Northwest Region, 7600 Sand Point Way, NE, BIN 15700, Seattle, Washington, January 14, 1994.

NMFS. 1992. Endangered Species Act. Section 7. Biological Opinion--Amendment 18 to the Fishery Management Plan for the Groundfish Fishery of the Bering Sea and Aleutian Islands (Steller Sea Lions). NMFS Alaska Region, P.O. Box 21668, Juneau, Alaska, March 4, 1992.

NMFS. 1991. Endangered Species Act. Section 7. Biological Opinion--Fishery Management Plan for the Bering Sea and Aleutian Islands and Gulf of Alaska Groundfish Fisheries and the Total Allowable Catch Specification and its effects to Steller Sea Lions. NMFS Alaska Region, P.O. Box 21668, Juneau, Alaska, April 18, 1991.

North Pacific Fishery Management Council (NPFMC). 1992. Final Supplemental Environmental Impact Statement and Regulatory Impact Review/Initial Regulatory Flexibility Analysis of Proposed Inshore/Offshore Allocation Alternatives (Amendment 18/23) to the Fishery Management Plans for the Groundfish Fishery of the Bering Sea and Aleutian Islands and the Gulf of Alaska. March 5, 1992.

Orensanz, J.M. 1986. Size, environment, and density: the regulation of a scallop stock and its management implications. Pages 195-227 *in* G.S. Jamieson and N. Bourne, editors. North Pacific workshop on stock assessment and management of invertebrates. Canadian Special Publication of Fisheries and Aquatic Sciences 92.

Oresanz, J.M., A.M. Parma, and O.O. Iribarne. 1991. Population dynamics and management of natural stocks. Pp. 625-713. In S.E. Shumway (ed.). Scallops: Biology, Ecology and Aquaculture. Developments in Aquaculture and Fisheries Science, 21. Elsevier, Amsterdam.

Rosenberg, A.P., P. Mace, G. Thompson, G. Darcy, W. Clark, J. Collies, W. Gabriel, A. MacCall, R. Methot, J. Powers, V. Restrepo, T. Wainwright, L. Botsford, J. Hoenig, K. Stokes. 1994. Scientific review of definitions of overfishing in U.S. fishery management plans. NOAA Tech. Memo. NMFS-F/SPO-17, 105p.

Shirley, S.M., and G.H. Kruse. 1995. Development of the fishery for weathervane scallops, Patinopecten caurinus (Gould 1850), in Alaska. Journal of Shellfish Research 14:71-78.

Starr, R.M., and J.E. McCrae. 1983. Weathervane scallop (*Patinopecten caurinus*) investigations in Oregon, 1981-1983. Oregon Department of Fish and Wildlife, Information Reports 83-10, Newport.

Urban, D., D. Pengilly, and I. Vining, 1994. The scallop observer program and statewide data analysis summary to the Board of Fisheries. Alaska Department of Fish and Game, Kodiak, Alaska. 54p.

5.0 AGENCIES AND INDIVIDUALS CONSULTED

Loh-lee Low
NMFS-AFSC

Kent Lind
NMFS-AKRO

Al Spalinger, Dan Urban, Dave Jackson, Doug Pengilly
ADF&G Kodiak

6.0 LIST OF PREPARERS

Dave Witherell
NPFMC
Anchorage, AK

Jeff Barnhart
ADF&G Kodiak

Gordon Kruse
ADF&G
Juneau, AK

Gretchen Harrington
NMFS
Juneau, AK

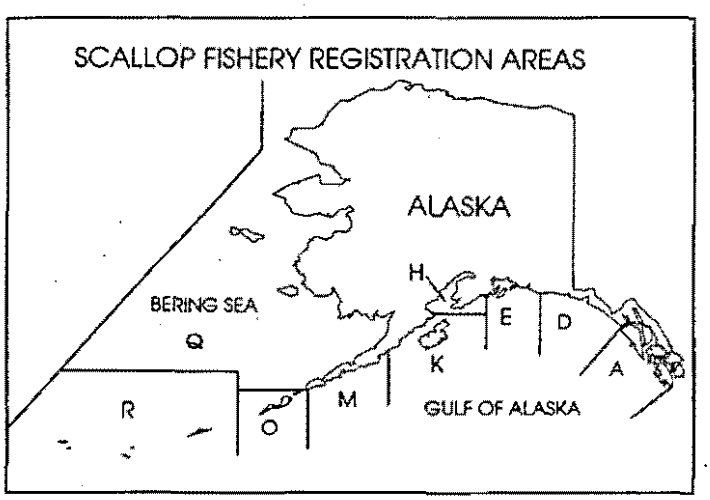
7.0 SCALLOP SPECIES SUMMARY

Scallops

Biology: Weathervane scallops (*Patinopectin caurinus*),are distributed from Point Reyes, California, to the Pribilof Islands, Alaska. The highest known densities in Alaska have been found to occur in the Bering Sea, off Kodiak Island, and along the eastern gulf coast from Cape Spencer to Cape St. Elias. Weathervane scallops are found from intertidal waters to depths of 300 m, but abundance tends to be greatest between depths of 40-130 m on beds of mud, clay, sand, and gravel. Sexes are separate and mature male and female scallops are distinguishable based on gonad color. Although spawning time varies with latitude and depth, weathervane scallops in Alaska spawn in May to July depending on location. Eggs and spermatozoa are released into the water, where the eggs become fertilized. After a few days, eggs hatch, and larvae rise into the water column and drift with ocean currents. Larvae are pelagic and drift for about one month until metamorphosis to the juvenile stage when they settle to the bottom. Weathervane scallops begin to mature by age 3 at about 7.6 cm (3 inches) in shell height (SH), and virtually all scallops are mature by age 4. Growth, maximum size, and size at maturity vary significantly within and between beds and geographic areas. Weathervane scallops are long-lived; individuals may live 28 years old or more. Scallops are likely prey to various fish and invertebrates during the early part of their life cycle. Flounders are known to prey on juvenile weathervane scallops, and seastars may also be important predators.

Several other species of scallop found in the EEZ off Alaska have commercial potential. These scallops grow to smaller sizes than weathervanes, and thus have not been extensively exploited in Alaska. Pink scallops, Chlamys rubida, range from California to the Pribilof Islands. Pink scallops are found in deep waters (to 200 m) in areas with soft bottom, whereas spiny scallop occur in shallower (to 150 m) areas characterized by hard bottom and strong currents. Pink scallops mature at age 2, and spawn in the winter (January-March). Maximum age for this species is 6 years. Spiny scallops, Chlamys hastata, are found in coastal regions from California to the Gulf of Alaska. Spiny scallops grow to slightly larger sizes (75 mm) than pink scallops (60 mm). Spiny scallops also mature at age 2 (35 mm) and spawn in the autumn (August-October). Rock scallops, Crassadoma gigantea, range from Mexico to Unalaska Island. Rock scallops are found in relatively shallower water (0-80 m) with strong currents. Apparently, distribution of these animals is discontinuous, and the abundance in most areas is low. These scallops attach themselves to rocks, attain a large size (to 250 mm), and exhibit fast growth rates. Rock scallops are thought to spawn during two distinct periods, one in the autumn (October -January), and one in the spring-summer (March-August).

Management: The weathervane scallop resource consists of multiple, discrete, self sustaining populations that are managed as separate stock units. Scallop stocks in Alaska have been managed under a federal fishery management plan (FMP) since July 26, 1995, which established a 1 year interim closure of federal waters to scallop fishing to prevent uncontrolled fishing. Amendment 1, which allowed scallop fishing under a federal management regime, was approved July 10, 1996 and fishing resumed on August 1. Amendment 1 provided for fishery management through permits, registration areas and districts, seasons, closed waters, gear restrictions, efficiency limits, crab bycatch limits, scallop catch limits, inseason adjustments, and observer monitoring.



A summary of management measures established under amendments to the federal scallop FMP.

Amendment	Date	Action
1	July 1996	Allowed fishing after a 1 year closure of Federal waters.
2	July 1997	Established a federal scallop vessel moratorium.
3	Dec 1997	If approved, would defer all management (except limited access) to State.
4	1999?	Would establish a permanent limited access system.
5	1998	Essential Fish Habitat

Most of these regulations were developed by the State prior to 1995. Dredge size is limited to a maximum width of 15 feet, and only 2 dredges may be used at any one time. In the Kamishak District of Cook Inlet, only 1 dredge with a 6' maximum width is allowed. Dredges are required to have rings with a 4" minimum inside diameter. To reduce incentives to harvest small scallops, crew size on scallop vessels is limited to 12 persons and all scallops must be manually shucked. Dredging is prohibited in areas designated as crab habitat protection areas, similar to

the groundfish FMPs. In June 1995, the Council adopted a 3-year vessel moratorium to restrict new entry into the scallop fishery while a more comprehensive plan was being developed. The moratorium approved as Amendment 2, effective August 1, 1997. To qualify under the proposed moratorium, a vessel must have made at least one landing in 1991, 1992, or 1993, or must have participated for at least 4 years between 1980 and 1993. The moratorium also limits reconstruction and replacement of vessels to a 20% maximum increase in original qualifying length overall.

Weathervane scallop registration areas, seasons, GHL's (pounds, shucked), and crab bycatch limits established for the 1997 scallop fishery, by area.

			Crab Bycatch Limits		
Area	GHL (pounds)	Fishing Season	king crab	Tanner crab	Snow crab
D - District 16	0 - 35,000	Jan 10 - Dec 31	n/a	n/a	n/a
D - Yakutat	0 - 250,000	Jan 10 - Dec 31	n/a	n/a	n/a
E - Eastern PWS	0 - 50,000	Jan 10 - Dec 31	n/a	500	n/a
Western PWS	combined	Jan 10 - Dec 31	n/a	130	n/a
H - Cook Inlet (Kamishak)	0 - 20,000	Aug 15 - Oct 31	60	24,992	n/a
Cook Inlet (Outer area)	combined	Jan 1 - Dec 31	98	2,170	n/a
K - Kodiak (Shelikof)	0 - 400,000	July 1 - Feb 15	35	51,000	n/a
Kodiak (Northeast)	combined	July 1 - Feb 15	50	91,600	n/a
M - AK Peninsula	0 - 200,000	July 1 - Feb 15	79	45,300	n/a
O - Dutch Harbor	0 - 170,000	July 1 - Feb 15	10	10,700	n/a
Q - Bering Sea	0 - 600,000	July 1 - Feb 15	500	238,000	172,000
R - Adak	0 - 75,000	July 1 - Feb 15	50	10,000	n/a

Fishery: In 1996, a total of 9 vessels participated in the scallop fishery statewide. Scallop vessels average 90-110 ft long. Scallops are harvested using dredges of standard design. Weathervane scallops are processed at sea by manual shucking, with only the meats (adductor muscles) retained. Scallops harvested in Cook Inlet are bagged and iced, whereas scallops harvested from other areas are generally block frozen at sea. The fishery has occurred almost exclusively in the EEZ in recent years, but some fishing in State waters occurs off Yakatat, Dutch Harbor, and Adak.

Catch History: Since 1967, when the first landings were made, fishing effort and total scallop harvest (weight of shucked meats) have varied annually. Total commercial harvest of weathervane scallops has fluctuated from a high of 157 landings totaling 1,850,187 pounds of shucked meats by 19 vessels in 1969 to no landings in 1978. Prices and demand for scallop have remained high since fishery inception. Prior to 1990, about two-thirds of the scallop harvest has been taken off Kodiak Island and about one-third has come from the Yakutat area; other areas had made minor contributions to overall landings. Harvests in 1990 and 1991 were the highest on record since the early 1970's. The 1992 scallop harvest was even higher at 1,810,788 pounds. The increased harvests in the 1990's occurred with new exploitation in the Bering Sea. The reduced 1995 catch was due to implementation of an interim closure in the EEZ from 2/23/95 to 8/1/96.

The 1996 and 1997 fishery can be summarized as follows:

AREA	1996	1997
Cook Inlet		
No. of vessels	4*	3
Landings (lbs)	28,228	20,336
Outside		
No. of vessels	4	6
Landings (lbs)	704,196	765,707

*one additional vessel fished in state waters only.

Landings and effort in the Alaska weathervane scallop fishery, 1980 - 1997.

Year	# of Vessels	Landings (pounds)	Price ($/lb)
1980	8	633,000	4.32
1981	18	924,000	4.05
1982	13	914,000	3.77
1983	6	194,000	4.88
1984	10	390,000	4.47
1985	8	648,000	3.12
1986	9	683,000	3.66
1987	4	583,000	3.38
1988	4	341,000	3.49
1989	7	526,000	3.68
1990	9	1,489,000	3.37
1991	7	1,191,000	3.76
1992	7	1,811,000	3.88
1993	15	1,429,000	5.00
1994	16	1,235,000	6.00
1995	10	283,000	n/a
1996	9	732,424	6.38
1997	9	786,043	6.50

Table 1. Twenty most frequently caught species by weight as recorded by scallop observers during the 1996/97 Alaska Peninsula Area scallop season. Non target commercial species[a] accounted for 8.6% of the twenty most frequently caught species by weight.

Rank	Species	Scientific Name	% of Total Catch
1	weathervane scallops	*Patinopecten caurinus*	70.3%
2	starfish	Class Stelleroidea	11.4%
3	arrowtooth flounder	*Atheresthes stomias*	4.8%
4	basket starfish	*Gorgonocephalus caryi*	4.6%
5	weathervane shells	*P. caurinus*	2.9%
6	sea urchin	Family Strongyocentrotidae	1.6%
7	Pacific Cod	*Gadus macrocephalus*	0.7%
8	snails	Class Gastropoda	0.5%
9	Tanner crab	*Chionoecetes bairdi*	0.5%
10	kelp, rocks, etc.		0.5%
11	flathead sole	*Hippoglossoides elassodon*	0.3%
12	walleye pollock	*Theragra chalcogramma*	0.2%
13	hermit crab	Family Paguridae	0.2%
14	Greenland turbot	*Reinhardtius hippoglossoides*	0.2%
15	bay scallops	Chlamys spp	0.2%
16	brown box crab	*Lopholithodes foraminatus*	0.1%
17	snail eggs	Class Gastropoda	0.1%
18	man-made debris		0.1%
19	worms unident	Class Polychaeta	0.1%
20	shrimp	*Family Pandalidae*	0.1%

[a]Commercial species caught in declining order of poundage: arrowtooth flounder, sea urchin, Pacific cod, *Chionoecetes bairdi*, flathead sole, walleye pollock, Greenland turbot, bay scallops, and shrimp.

Table 2. Summary of the most frequently caught species, by percent weight in sampled dredges, as recorded by scallop observers during the 1996/97 scallop fishery.

	Management Area / District					
		Kodiak			Alaska	Bering
Species Catergory	Yakutat	Northeast	Chelikof	Semidi	Peninsula	Sea
weathervane scallops	84.7	54.1	76.8	51.8	70.3	87.5
PROHIBITED SPECIES BYCATCH						
Tanner crab	<.1	0.9	0.1	0.9	0.5	0.8
snow crab, opilio	0	0	0	0	0	3.7
king crab	0	0	0	<.1	0	0
Dungeness crab	<.1	0	<.1	0.8	0	0
Pacific halibut	0.2	0.5	0.2	<.1	0	<.1
OTHER COMMERCIAL SPECIES						
skates	1.9	4.9	3.1	2.5	0	1.0
arrowtooth flounder	0.3	0.3	0.4	0.3	4.8	0.8
rock sole	<.1	0.2	<.1	0.5	0.1	0.2
Dover sole	0.2	0.1	<.1	0.1	0	0.1
yellowfin sole	0	0	<.1	0.7	0	<.1
rex sole	0.1	0.6	0	0	0.1	0
flathead sole	0.2	0.5	0.5	1.2	0.3	0.3
butter sole	<.1	0.4	0	0.8	0	<.1
Pacific cod	0.1	1.2	<.1	0.9	0.7	0.4
starry flounder	<.1	0	0	1.6	0	0
walleye pollock	<.1	0	<.1	<.1	0.2	0.4
bay scallops	<.1	0	<.1	<.1	0.2	0
sea urchins	0	0	<.1	<.1	1.6	<.1
octopus	0	0	0.1	0	<.1	<.1
Alaska plaice	0	0	0.6	0.1	0	0
sea cucumber	<.1	0.1	<.1	<.1	0	0.2
MISCELLANEOUS						
starfish	4.5	32.4	2.7	15.7	11.4	0.1
basket star	<.1	<.1	<.1	3.8	4.6	0
weathervane shells	3.7	1.8	5.5	8.0	2.9	2.1
kelp, rocks, etc.	1.2	1.4	5.5	9.0	0.5	0.9
man-made debris	<.1	0.1	0.2	0.2	0.1	0.6
Misc. invertebrates	1.7	0.3	0.8	0.1	1.4	0.9
Mis. fish	0.3	0	0.1	0.2	0.3	< 1

Table 3. Estimated bycatch , in numbers of individuals, and confidence intervals for *C. opilio*, *C. bairdi*, Dungeness, and king crab, and halibut from the 1996/97 statewide scallop fishery.

Management Area	n[b]	Bycatch Estimates by Species[a]									
		C. opilio		*C. bairdi*		Dungeness		king crab		halibut	
		Bycatch	95% CI	Bycatch	95% CI	Bycatch	95% CI	Bycatch[c]	95% CI	Bycatch	95% CI
Yakutat	82	0	NA	6,872	4,641-9,588	38	7-77	0	NA	150	91-151
District 16	26	0	NA	669	274-1,123	9	NA	0	NA	68	30-68
Kodiak											
Northeast District	28	0	NA	27,722	10,298-48,407	0	NA	0	NA	202	79-384
Shelikof District	104	0	NA	11,285	9,408-13,257	1,008	584-1,508	0	NA	440	318-569
Semidi District	38	0	NA	8,902	3,798-15,750	4,554	2,504-7,068	9	NA	79	5-176
Alaska Peninsula	13	0	NA	19,045	12,604-26,362	10	NA	0	NA	25	NA
Bering Sea	63	106,935	98,033-116,196	16,642	14,227-19,373	0	NA	0	NA	124	49-229

[a]Estimates were calculated as bycatch per hour per boat per day x total hours dredged x number of dredges fished.
[b]Number of vessel days.
[c]Actual count, not an estimate.

Table 4. Condition of halibut as recorded by scallop observers during the1996/97 fishing season.

MANAGEMENT AREA	CONDITION[a] Of HALIBUT (Number of Halibut)						
	Excellent	Good	Fair	Poor	Dead	Previously dead	Total
District 16	4	0	1	1	0	1	7
Yakutat	13	5	2	1	1	0	22
Kodiak, Northeast District	4	2	4	6	2	0	18
Kodiak, Shelikof District	20	10	8	11	4	2	55
Kodiak, Semidi District	1	4	1	3	0	0	9
Alaska Peninsula	1	0	0	1	1	0	3
Bering Sea	2	4	4	1	2	0	13
Total all Areas	45	25	20	24	10	3	127

[a]Condition Codes

Excellent: Vigorous body movement before and after release; could close operculum tightly; minor external injuries, if any.
Good: Feeble body movements; could close operculum tightly; minor external injuries, if any.
Fair: No body movement; could close operculum tightly; minor external injuries, if any.
Poor: No body movement; could move operculum but not tightly; severe injuries (eg. bleeding).
Dead: No body or opercular movement; probably killed in sampled haul.
Previously dead: Obviously not killed in the current haul (incidentally caught).

Table 5. Tanner crab bycatch mortality as recorded by scallop observers during the 1996/97 fishing season.

MANAGEMENT AREA	NUMBER OF TANNER CRAB OBSERVED		
	Dead	Alive	Percent Dead
District 16	34	38	47.2
Yakutat	537	373	58.9
Kodiak, Northeast District	262	1,361	16.1
Kodiak, Shelikof District	587	1,013	36.6
Kodiak, Semidi District	271	464	36.9
Alaska Peninsula	735	1,541	32.3
Bering Sea *C. opilio*	1,675	8,674	16.2
Bering Sea *C. bairdi*	210	1,454	12.6
Total all Areas	4,311	14,918	28.9

Table 6. Number and weight of discarded scallops as recorded by scallop observers during the 1996/97 fishing season.

MANAGEMENT AREA	Number of Sampled Scallops		Weight of Sampled Scallop	
	Intact	Broken	Intact	Broken
Yakutat	35, 697	19, 595	8, 376	7, 212
District 16	19, 239	2, 684	4, 031	735
Yakutat Total	54, 936	22, 279	12, 407	7, 947
Kodiak, Northeast District	908	982	228	493
Kodiak, Shelikof District	34, 398	29, 337	7, 722	9, 314
Kodiak, Semidi District	254	974	126	531
Kodiak Total	35, 560	31, 293	8, 076	10, 338
Alaska Peninsula	1, 858	2, 546	281	711
Bering Sea	1, 397	2, 174	588	1, 097
Total	93, 751	58, 292	21, 352	20, 093

Table 8. Average weight of intact and broken scallops from observer sampled discarded scallop catch during the 1996/97 fishing season.

MANAGEMENT AREA	WEIGHT[a]		
	Intact Scallops	Broken Scallops	Average
Yakutat	0.24	0.29	0.27
District 16	0.21	0.28	0.25
Yakutat Average	0.22	0.28	
Kodiak, Northeast District	0.38	0.52	0.45
Kodiak, Shelikof District	0.25	0.34	0.30
Kodiak, Semidi District	0.46	0.54	0.50
Kodiak Average	0.37	0.46	
Alaska Peninsula	0.15	0.26	0.21
Bering Sea	0.44	0.51	0.47
Overall Average	0.31	0.39	

[a]Weight in pounds.

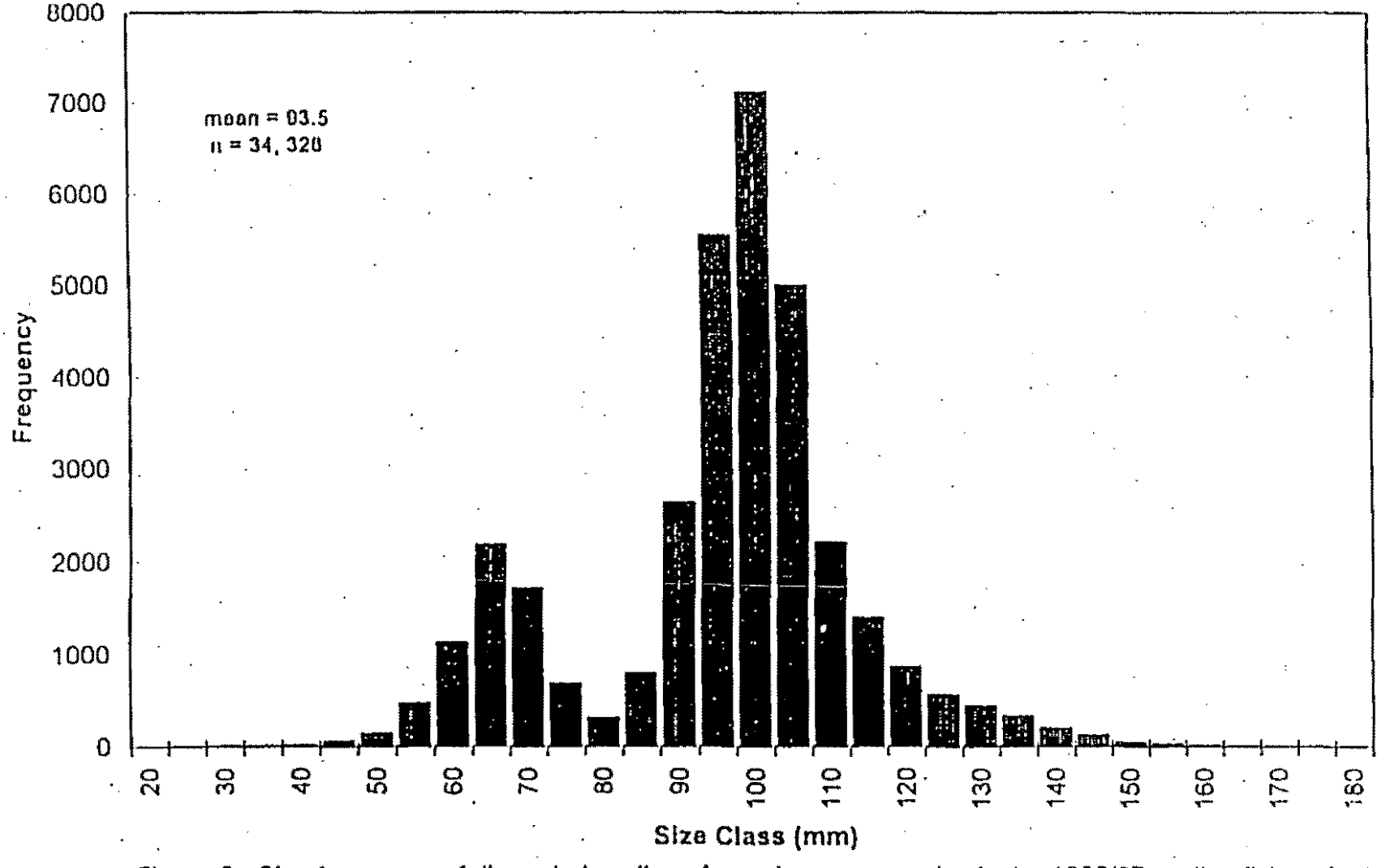


Figure 2. Size frequency of discarded scallops from observer samples in the 1996/97 scallop fishery in the Shelikof District of the Kodiak Area.

4.0 REFERENCES

Aschan, M.M. 1991. Effects of Iceland scallop dredging on benthic communities in the Northeast Atlantic. Special international workshop on the effects of physical disturbance on the sea floor on benthic and epibenthic ecosystems. Conseil International pour L'Exploration de la Mer, Benthos Working Group, Unpublished Manuscript

Alverson, D.L., and M.J. Carney. 1975. A graphic review of the growth and decay of population cohorts. Journal du Conseil, Conseil International pour l'Exploration de la Mer 36(2):133-143.

Barnhart, J.P., and N. Sagalkin. 1998. Summary and analysis of onboard collected data from the 1996/97 statewide commercial weathervane scallop fishery. Alaska Department of Fish and Game. Division of Commercial Fisheries, Regional Information Report. Kodiak.

Bourne, N. 1991. Fisheries and Aquaculture: West Coast of North America. *in* S.E. Shumway, (ed.), Scallops: biology, ecology, and aquaculture. Elsevier, N.Y. 1991.

Caddy, J.F. 1968. Underwater observations on scallop (*Placopecten magellanicus*) behavior and drag efficiency. Journal of the Fisheries Research Board of Canada 25: 2123-2141.

Eleftheriou, A., and M.R. Robertson. 1992. The effects of experimental scallop dredging on the fauna and physical environment of a shallow sandy community. Netherlands Journal of Sea Research 30:289-299.

Fish and Wildlife Service (FWS). 1997. Letter from Ann G. Rappoport to Steven Pennoyer, February 19, 1997, on effects of the 1997 Total Allowable Catch Specifications and Environmental Assessment for groundfish fisheries in the Gulf of Alaska and Bering Sea-Aleutian Islands on short-tailed albatrosses. USDI FWS, 605 West 4th Avenue, Room 62, Anchorage, AK 99501.

Fonseca, M.S., G.W. Thayer, A.J. Chester, and C. Foltz. 1984. Impact of scallop harvesting on eelgrass (*Zostera marina*) meadows: implications for management. North American Journal of Fisheries Management 4.

FWS. 1995. Endangered Species Act. Section 7. Reinitiation of Consultation on the Effects of the Groundfish Fisheries Conducted under the Bering Sea and Aleutian Islands and Gulf of Alaska Fishery Management Plans of the North Pacific Fishery Management Council. (Seabirds; amended Biological Opinion from July 3, 1989). USDI FWS, 605 West 4th Avenue, Room 62, Anchorage, AK 99501.

FWS. 1993. Alaska Seabird Management Plan. Report of the US Fish and Wildlife Service. Anchorage. 102 pp.

FWS. 1989. Endangered Species Act. Section 7 Consultation on the Effects of the Groundfish Fisheries Conducted under the Bering Sea and Aleutian Islands and Gulf of Alaska Fishery Management Plans of the North Pacific Fishery Management Council. (Seabirds; Biological Opinion.) USDI FWS, 605 West 4th Avenue, Room 62, Anchorage, AK 99501.

Gulland, J.A. 1971. Science and Fishery Management. J. Cons. Int. Explor. Mer. 33:471-477.

Hammarstom, L.F., and M.F. Merritt. 1985. A survey of Pacific weathervane scallops (*Pecten caurinus*) in Kamishak Bay, Alaska. Alaska Department of Fish and Game, Division of Commercial Fisheries, Informational Leaflet 252, Juneau.

Haynes, E.B., and G.C. Powell. 1968. A preliminary report on the Alaska sea scallop - fishery exploration, biology, and commercial processing. Alaska Department of Fish and Game, Division of Commercial Fisheries, Informational Leaflet 125, Juneau.

Hennick, D.P. 1970a. The weathervane scallop fishery of Alaska with notes on occurrence in Washington and Oregon. Pacific Marine Fisheries Commission, Annual Report for the Year 1969: 33-34.

Hennick, D.P. 1970b. Reproductive cycle, size at maturity, and sexual composition of commercially harvested weathervane scallops (Patinopecten caurinus) in Alaska. Journal of the Fisheries Research Board of Canada 27: 2112-2119.

Hennick, D.P. 1973. Sea scallop, Patinopecten caurinus, investigations in Alaska. Alaska Department of Fish and Game, Division of Commercial Fisheries, Completion Report 5-23-R, Juneau.

Hoenig, J.M. 1983. Empirical use of longevity data to estimate mortality rates. Fishery Bulletin 82(1): 898-902.

Kaiser, R.J. 1986. Characteristics of the Pacific weathervane scallop (Pecten [Patinopecten] caurinus, Gould 1850) fishery in Alaska, 1967-1981. Alaska Department of Fish and Game, Division of Commercial Fisheries (Unpublished Report, Catalog RUR-5J86-01), Juneau.

Kruse, G.H., E. Krygier, R.D. Mecum, and M.C. Murphy. 1993. Synopsis of ADF&G scallop meeting, Anchorage, Alaska, July 15, 1993. ADF&G Regional Information Report No. 5J93-07.

Kruse, G.H., and F.C. Funk. 1995. Biological Reference Points for Weathervane Scallops in Alaska, a poster presented to North Pacific Symposium on Invertebrate Stock Assessment and Management, Nanaimo, British Columbia, March 1995

Mayer, L.M., D.F. Schick, R.H. Findlay, and D.L. Rice. 1991. Effects of commercial dragging on sedimentary organic matter. Marine Environmental Research 31:249-261.

Morrison, R. 1994. Bering Sea Aleutian Islands Scallops. In: Westward Region Reports to the Board of Fisheries. March 1994.

National Marine Fisheries Service (NMFS). 1998. "Final Supplemental Environmental Impact Statement for the Groundfish Total Allowable Catch Specifications and Prohibited Species Catch Limits Under the Authority of the Fishery of the Bering Sea and Aleutian Islands Area and Groundfish of the Gulf of Alaska." NMFS- Alaska Region, PO Box 21668, Juneau, AK 99802-1668.

National Marine Fisheries Service (NMFS). 1997a. Final Environmental Assessment/Regulatory Impact Review/Final Regulatory Flexibility Analysis for Amendments 1 and 2 to the Fishery Management Plan for the Scallop Fishery off Alaska. NMFS-Alaska Region, PO Box 21668, Juneau, AK 99802-1668.

National Marine Fisheries Service (NMFS). 1997b. Final Environmental Assessment for 1997 Total Allowable Catch Specifications. NMFS-Alaska Region, P.O. Box 21668, Juneau, Alaska 99802-1668.

NMFS. 1996. Endangered Species Act. Section 7. Biological Opinion--Fishery Management Plan for the Bering Sea and Aleutian Islands and Gulf of Alaska Groundfish Fisheries and the Total Allowable Catch Specification and its effects to Steller Sea Lions. NMFS Alaska Region, P.O. Box 21668, Juneau, Alaska, January 26, 1996.

NMFS. 1995. Endangered Species Act. Section 7. Reinitiation of Consultation on the Effects of the Groundfish Fisheries Conducted under the Bering Sea and Aleutian Islands and Gulf of Alaska Fishery Management Plans of the North Pacific Fishery Management Council. (Pacific salmon; amended Biological Opinion from January 14, 1994) NMFS Northwest Region, 7600 Sand Point Way, NE, BIN 15700, Seattle, Washington, December 7, 1995.

NMFS. 1994. Endangered Species Act Section 7. Biological Opinion--Pacific Salmon. *Reinitiation of* Consultation on the Effects of the Groundfish Fisheries Conducted under the Bering Sea and Aleutian Islands and Gulf of Alaska Fishery Management Plans of the North Pacific Fishery Management Council. (Pacific Salmon) NMFS Northwest Region, 7600 Sand Point Way, NE, BIN 15700, Seattle, Washington, January 14, 1994.

NMFS. 1992. Endangered Species Act. Section 7. Biological Opinion--Amendment 18 to the Fishery Management Plan for the Groundfish Fishery of the Bering Sea and Aleutian Islands (Steller Sea Lions). NMFS Alaska Region, P.O. Box 21668, Juneau, Alaska, March 4, 1992.

NMFS. 1991. Endangered Species Act. Section 7. Biological Opinion--Fishery Management Plan for the Bering Sea and Aleutian Islands and Gulf of Alaska Groundfish Fisheries and the Total Allowable Catch Specification and its effects to Steller Sea Lions. NMFS Alaska Region, P.O. Box 21668, Juneau, Alaska, April 18, 1991.

North Pacific Fishery Management Council (NPFMC). 1992. Final Supplemental Environmental Impact Statement and Regulatory Impact Review/Initial Regulatory Flexibility Analysis of Proposed Inshore/Offshore Allocation Alternatives (Amendment 18/23) to the Fishery Management Plans for the Groundfish Fishery of the Bering Sea and Aleutian Islands and the Gulf of Alaska. March 5, 1992.

Orensanz, J.M. 1986. Size, environment, and density: the regulation of a scallop stock and its management implications. Pages 195-227 *in* G.S. Jamieson and N. Bourne, editors. North Pacific workshop on stock assessment and management of invertebrates. Canadian Special Publication of Fisheries and Aquatic Sciences 92.

Oresanz, J.M., A.M. Parma, and O.O. Iribarne. 1991. Population dynamics and management of natural stocks. Pp. 625-713. In S.E. Shumway (ed.). Scallops: Biology, Ecology and Aquaculture. Developments in Aquaculture and Fisheries Science, 21. Elsevier, Amsterdam.

Rosenberg, A.P., P. Mace, G. Thompson, G. Darcy, W. Clark, J. Collies, W. Gabriel, A. MacCall, R. Methot, J. Powers, V. Restrepo, T. Wainwright, L. Botsford, J. Hoenig, K. Stokes. 1994. Scientific review of definitions of overfishing in U.S. fishery management plans. NOAA Tech. Memo. NMFS-F/SPO-17, 105p.

Shirley, S.M., and G.H. Kruse. 1995. Development of the fishery for weathervane scallops, Patinopecten caurinus (Gould 1850), in Alaska. Journal of Shellfish Research 14:71-78.

Starr, R.M., and J.E. McCrae. 1983. Weathervane scallop (*Patinopecten caurinus*) investigations in Oregon, 1981-1983. Oregon Department of Fish and Wildlife, Information Reports 83-10, Newport.

Urban, D., D. Pengilly, and I. Vining, 1994. The scallop observer program and statewide data analysis summary to the Board of Fisheries. Alaska Department of Fish and Game, Kodiak, Alaska. 54p.

5.0 AGENCIES AND INDIVIDUALS CONSULTED

Loh-lee Low
NMFS-AFSC

Kent Lind
NMFS-AKRO

Al Spalinger, Dan Urban, Dave Jackson, Doug Pengilly
ADF&G Kodiak

6.0 LIST OF PREPARERS

Dave Witherell
NPFMC
Anchorage, AK

Jeff Barnhart
ADF&G Kodiak

Gordon Kruse
ADF&G
Juneau, AK

Gretchen Harrington
NMFS
Juneau, AK

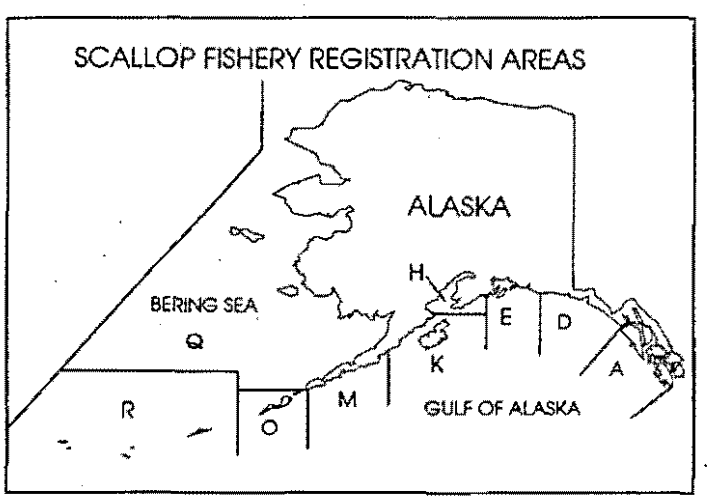
7.0 SCALLOP SPECIES SUMMARY

Scallops

Biology: Weathervane scallops (*Patinopectin caurinus*),are distributed from Point Reyes, California, to the Pribilof Islands, Alaska. The highest known densities in Alaska have been found to occur in the Bering Sea, off Kodiak Island, and along the eastern gulf coast from Cape Spencer to Cape St. Elias. Weathervane scallops are found from intertidal waters to depths of 300 m, but abundance tends to be greatest between depths of 40-130 m on beds of mud, clay, sand, and gravel. Sexes are separate and mature male and female scallops are distinguishable based on gonad color. Although spawning time varies with latitude and depth, weathervane scallops in Alaska spawn in May to July depending on location. Eggs and spermatozoa are released into the water, where the eggs become fertilized. After a few days, eggs hatch, and larvae rise into the water column and drift with ocean currents. Larvae are pelagic and drift for about one month until metamorphosis to the juvenile stage when they settle to the bottom. Weathervane scallops begin to mature by age 3 at about 7.6 cm (3 inches) in shell height (SH), and virtually all scallops are mature by age 4. Growth, maximum size, and size at maturity vary significantly within and between beds and geographic areas. Weathervane scallops are long-lived; individuals may live 28 years old or more. Scallops are likely prey to various fish and invertebrates during the early part of their life cycle. Flounders are known to prey on juvenile weathervane scallops, and seastars may also be important predators.

Several other species of scallop found in the EEZ off Alaska have commercial potential. These scallops grow to smaller sizes than weathervanes, and thus have not been extensively exploited in Alaska. Pink scallops, Chlamys rubida, range from California to the Pribilof Islands. Pink scallops are found in deep waters (to 200 m) in areas with soft bottom, whereas spiny scallop occur in shallower (to 150 m) areas characterized by hard bottom and strong currents. Pink scallops mature at age 2, and spawn in the winter (January-March). Maximum age for this species is 6 years. Spiny scallops, Chlamys hastata, are found in coastal regions from California to the Gulf of Alaska. Spiny scallops grow to slightly larger sizes (75 mm) than pink scallops (60 mm). Spiny scallops also mature at age 2 (35 mm) and spawn in the autumn (August-October). Rock scallops, Crassadoma gigantea, range from Mexico to Unalaska Island. Rock scallops are found in relatively shallower water (0-80 m) with strong currents. Apparently, distribution of these animals is discontinuous, and the abundance in most areas is low. These scallops attach themselves to rocks, attain a large size (to 250 mm), and exhibit fast growth rates. Rock scallops are thought to spawn during two distinct periods, one in the autumn (October -January), and one in the spring-summer (March-August).

Management: The weathervane scallop resource consists of multiple, discrete, self sustaining populations that are managed as separate stock units. Scallop stocks in Alaska have been managed under a federal fishery management plan (FMP) since July 26, 1995, which established a 1 year interim closure of federal waters to scallop fishing to prevent uncontrolled fishing. Amendment 1, which allowed scallop fishing under a federal management regime, was approved July 10, 1996 and fishing resumed on August 1. Amendment 1 provided for fishery management through permits, registration areas and districts, seasons, closed waters, gear restrictions, efficiency limits, crab bycatch limits, scallop catch limits, inseason adjustments, and observer monitoring.



A summary of management measures established under amendments to the federal scallop FMP.

Amendment	Date	Action
1	July 1996	Allowed fishing after a 1 year closure of Federal waters.
2	July 1997	Established a federal scallop vessel moratorium.
3	Dec 1997	If approved, would defer all management (except limited access) to State.
4	1999?	Would establish a permanent limited access system.
5	1998	Essential Fish Habitat

Most of these regulations were developed by the State prior to 1995. Dredge size is limited to a maximum width of 15 feet, and only 2 dredges may be used at any one time. In the Kamishak District of Cook Inlet, only 1 dredge with a 6' maximum width is allowed. Dredges are required to have rings with a 4" minimum inside diameter. To reduce incentives to harvest small scallops, crew size on scallop vessels is limited to 12 persons and all scallops must be manually shucked. Dredging is prohibited in areas designated as crab habitat protection areas, similar to

the groundfish FMPs. In June 1995, the Council adopted a 3-year vessel moratorium to restrict new entry into the scallop fishery while a more comprehensive plan was being developed. The moratorium approved as Amendment 2, effective August 1, 1997. To qualify under the proposed moratorium, a vessel must have made at least one landing in 1991, 1992, or 1993, or must have participated for at least 4 years between 1980 and 1993. The moratorium also limits reconstruction and replacement of vessels to a 20% maximum increase in original qualifying length overall.

Weathervane scallop registration areas, seasons, GHL's (pounds, shucked), and crab bycatch limits established for the 1997 scallop fishery, by area.

			Crab Bycatch Limits		
Area	GHL (pounds)	Fishing Season	king crab	Tanner crab	Snow crab
D - District 16	0 - 35,000	Jan 10 - Dec 31	n/a	n/a	n/a
D - Yakutat	0 - 250,000	Jan 10 - Dec 31	n/a	n/a	n/a
E - Eastern PWS	0 - 50,000	Jan 10 - Dec 31	n/a	500	n/a
Western PWS	combined	Jan 10 - Dec 31	n/a	130	n/a
H - Cook Inlet (Kamishak)	0 - 20,000	Aug 15 - Oct 31	60	24,992	n/a
Cook Inlet (Outer area)	combined	Jan 1 - Dec 31	98	2,170	n/a
K - Kodiak (Shelikof)	0 - 400,000	July 1 - Feb 15	35	51,000	n/a
Kodiak (Northeast)	combined	July 1 - Feb 15	50	91,600	n/a
M - AK Peninsula	0 - 200,000	July 1 - Feb 15	79	45,300	n/a
O - Dutch Harbor	0 - 170,000	July 1 - Feb 15	10	10,700	n/a
Q - Bering Sea	0 - 600,000	July 1 - Feb 15	500	238,000	172,000
R - Adak	0 - 75,000	July 1 - Feb 15	50	10,000	n/a

Fishery: In 1996, a total of 9 vessels participated in the scallop fishery statewide. Scallop vessels average 90-110 ft long. Scallops are harvested using dredges of standard design. Weathervane scallops are processed at sea by manual shucking, with only the meats (adductor muscles) retained. Scallops harvested in Cook Inlet are bagged and iced, whereas scallops harvested from other areas are generally block frozen at sea. The fishery has occurred almost exclusively in the EEZ in recent years, but some fishing in State waters occurs off Yakatat, Dutch Harbor, and Adak.

Catch History: Since 1967, when the first landings were made, fishing effort and total scallop harvest (weight of shucked meats) have varied annually. Total commercial harvest of weathervane scallops has fluctuated from a high of 157 landings totaling 1,850,187 pounds of shucked meats by 19 vessels in 1969 to no landings in 1978. Prices and demand for scallop have remained high since fishery inception. Prior to 1990, about two-thirds of the scallop harvest has been taken off Kodiak Island and about one-third has come from the Yakutat area; other areas had made minor contributions to overall landings. Harvests in 1990 and 1991 were the highest on record since the early 1970's. The 1992 scallop harvest was even higher at 1,810,788 pounds. The increased harvests in the 1990's occurred with new exploitation in the Bering Sea. The reduced 1995 catch was due to implementation of an interim closure in the EEZ from 2/23/95 to 8/1/96.

The 1996 and 1997 fishery can be summarized as follows:

AREA	1996	1997
Cook Inlet		
No. of vessels	4*	3
Landings (lbs)	28,228	20,336
Outside		
No. of vessels	4	6
Landings (lbs)	704,196	765,707

*one additional vessel fished in state waters only.

Landings and effort in the Alaska weathervane scallop fishery, 1980 - 1997.

Year	# of Vessels	Landings (pounds)	Price ($/lb)
1980	8	633,000	4.32
1981	18	924,000	4.05
1982	13	914,000	3.77
1983	6	194,000	4.88
1984	10	390,000	4.47
1985	8	648,000	3.12
1986	9	683,000	3.66
1987	4	583,000	3.38
1988	4	341,000	3.49
1989	7	526,000	3.68
1990	9	1,489,000	3.37
1991	7	1,191,000	3.76
1992	7	1,811,000	3.88
1993	15	1,429,000	5.00
1994	16	1,235,000	6.00
1995	10	283,000	n/a
1996	9	732,424	6.38
1997	9	786,043	6.50

Table 1. Twenty most frequently caught species by weight as recorded by scallop observers during the 1996/97 Alaska Peninsula Area scallop season. Non target commercial species[a] accounted for 8.6% of the twenty most frequently caught species by weight.

Rank	Species	Scientific Name	% of Total Catch
1	weathervane scallops	*Patinopecten caurinus*	70.3%
2	starfish	Class Stelleroidea	11.4%
3	arrowtooth flounder	*Atheresthes stomias*	4.8%
4	basket starfish	*Gorgonocephalus caryi*	4.6%
5	weathervane shells	*P. caurinus*	2.9%
6	sea urchin	Family Strongyocentrotidae	1.6%
7	Pacific Cod	*Gadus macrocephalus*	0.7%
8	snails	Class Gastropoda	0.5%
9	Tanner crab	*Chionoecetes bairdi*	0.5%
10	kelp, rocks, etc.		0.5%
11	flathead sole	*Hippoglossoides elassodon*	0.3%
12	walleye pollock	*Theragra chalcogramma*	0.2%
13	hermit crab	Family Paguridae	0.2%
14	Greenland turbot	*Reinhardtius hippoglossoides*	0.2%
15	bay scallops	Chlamys spp	0.2%
16	brown box crab	*Lopholithodes foraminatus*	0.1%
17	snail eggs	Class Gastropoda	0.1%
18	man-made debris		0.1%
19	worms unident	Class Polychaeta	0.1%
20	shrimp	*Family Pandalidae*	0.1%

[a]Commercial species caught in declining order of poundage: arrowtooth flounder, sea urchin, Pacific cod, *Chionoecetes bairdi*, flathead sole, walleye pollock, Greenland turbot, bay scallops, and shrimp.

Table 2. Summary of the most frequently caught species, by percent weight in sampled dredges, as recorded by scallop observers during the 1996/97 scallop fishery.

	Management Area / District					
		Kodiak			Alaska	Bering
Species Catergory	Yakutat	Northeast	Chelikof	Semidi	Peninsula	Sea
weathervane scallops	84.7	54.1	76.8	51.8	70.3	87.5
PROHIBITED SPECIES BYCATCH						
Tanner crab	<.1	0.9	0.1	0.9	0.5	0.8
snow crab, opilio	0	0	0	0	0	3.7
king crab	0	0	0	<.1	0	0
Dungeness crab	<.1	0	<.1	0.8	0	0
Pacific halibut	0.2	0.5	0.2	<.1	0	<.1
OTHER COMMERCIAL SPECIES						
skates	1.9	4.9	3.1	2.5	0	1.0
arrowtooth flounder	0.3	0.3	0.4	0.3	4.8	0.8
rock sole	<.1	0.2	<.1	0.5	0.1	0.2
Dover sole	0.2	0.1	<.1	0.1	0	0.1
yellowfin sole	0	0	<.1	0.7	0	<.1
rex sole	0.1	0.6	0	0	0.1	0
flathead sole	0.2	0.5	0.5	1.2	0.3	0.3
butter sole	<.1	0.4	0	0.8	0	<.1
Pacific cod	0.1	1.2	<.1	0.9	0.7	0.4
starry flounder	<.1	0	0	1.6	0	0
walleye pollock	<.1	0	<.1	<.1	0.2	0.4
bay scallops	<.1	0	<.1	<.1	0.2	0
sea urchins	0	0	<.1	<.1	1.6	<.1
octopus	0	0	0.1	0	<.1	<.1
Alaska plaice	0	0	0.6	0.1	0	0
sea cucumber	<.1	0.1	<.1	<.1	0	0.2
MISCELLANEOUS						
starfish	4.5	32.4	2.7	15.7	11.4	0.1
basket star	<.1	<.1	<.1	3.8	4.6	0
weathervane shells	3.7	1.8	5.5	8.0	2.9	2.1
kelp, rocks, etc.	1.2	1.4	5.5	9.0	0.5	0.9
man-made debris	<.1	0.1	0.2	0.2	0.1	0.6
Misc. invertebrates	1.7	0.3	0.8	0.1	1.4	0.9
Mis. fish	0.3	0	0.1	0.2	0.3	< 1

Table 3. Estimated bycatch , in numbers of individuals, and confidence intervals for *C. opilio*, *C. bairdi*, Dungeness, and king crab, and halibut from the 1996/97 statewide scallop fishery.

Management Area	n[b]	Bycatch Estimates by Species[a]									
		C. opilio		*C. bairdi*		Dungeness		king crab		halibut	
		Bycatch	95% CI	Bycatch	95% CI	Bycatch	95% CI	Bycatch[c]	95% CI	Bycatch	95% CI
Yakutat	82	0	NA	6,872	4,641-9,588	38	7-77	0	NA	150	91-151
District 16	26	0	NA	669	274-1,123	9	NA	0	NA	68	30-68
Kodiak											
Northeast District	28	0	NA	27,722	10,298-48,407	0	NA	0	NA	202	79-384
Shelikof District	104	0	NA	11,285	9,408-13,257	1,008	584-1,508	0	NA	440	318-569
Semidi District	38	0	NA	8,902	3,798-15,750	4,554	2,504-7,068	9	NA	79	5-176
Alaska Peninsula	13	0	NA	19,045	12,604-26,362	10	NA	0	NA	25	NA
Bering Sea	63	106,935	98,033-116,196	16,642	14,227-19,373	0	NA	0	NA	124	49-229

[a]Estimates were calculated as bycatch per hour per boat per day x total hours dredged x number of dredges fished.
[b]Number of vessel days.
[c]Actual count, not an estimate.

Table 4. Condition of halibut as recorded by scallop observers during the1996/97 fishing season.

MANAGEMENT AREA	CONDITION[a] Of HALIBUT (Number of Halibut)						
	Excellent	Good	Fair	Poor	Dead	Previously dead	Total
District 16	4	0	1	1	0	1	7
Yakutat	13	5	2	1	1	0	22
Kodiak, Northeast District	4	2	4	6	2	0	18
Kodiak, Shelikof District	20	10	8	11	4	2	55
Kodiak, Semidi District	1	4	1	3	0	0	9
Alaska Peninsula	1	0	0	1	1	0	3
Bering Sea	2	4	4	1	2	0	13
Total all Areas	45	25	20	24	10	3	127

[a]Condition Codes

Excellent: Vigorous body movement before and after release; could close operculum tightly; minor external injuries, if any.
Good: Feeble body movements; could close operculum tightly; minor external injuries, if any.
Fair: No body movement; could close operculum tightly; minor external injuries, if any.
Poor: No body movement; could move operculum but not tightly; severe injuries (eg. bleeding).
Dead: No body or opercular movement; probably killed in sampled haul.
Previously dead: Obviously not killed in the current haul (incidentally caught).

Table 5. Tanner crab bycatch mortality as recorded by scallop observers during the 1996/97 fishing season.

MANAGEMENT AREA	NUMBER OF TANNER CRAB OBSERVED		
	Dead	Alive	Percent Dead
District 16	34	38	47.2
Yakutat	537	373	58.9
Kodiak, Northeast District	262	1,361	16.1
Kodiak, Shelikof District	587	1,013	36.6
Kodiak, Semidi District	271	464	36.9
Alaska Peninsula	735	1,541	32.3
Bering Sea *C. opilio*	1,675	8,674	16.2
Bering Sea *C. bairdi*	210	1,454	12.6
Total all Areas	4,311	14,918	28.9

Table 6. Number and weight of discarded scallops as recorded by scallop observers during the 1996/97 fishing season.

MANAGEMENT AREA	Number of Sampled Scallops		Weight of Sampled Scallop	
	Intact	Broken	Intact	Broken
Yakutat	35, 697	19, 595	8, 376	7, 212
District 16	19, 239	2, 684	4, 031	735
Yakutat Total	54, 936	22, 279	12, 407	7, 947
Kodiak, Northeast District	908	982	228	493
Kodiak, Shelikof District	34, 398	29, 337	7, 722	9, 314
Kodiak, Semidi District	254	974	126	531
Kodiak Total	35, 560	31, 293	8, 076	10, 338
Alaska Peninsula	1, 858	2, 546	281	711
Bering Sea	1, 397	2, 174	588	1, 097
Total	93, 751	58, 292	21, 352	20, 093

Table 8. Average weight of intact and broken scallops from observer sampled discarded scallop catch during the 1996/97 fishing season.

MANAGEMENT AREA	WEIGHT[a]		
	Intact Scallops	Broken Scallops	Average
Yakutat	0.24	0.29	0.27
District 16	0.21	0.28	0.25
Yakutat Average	0.22	0.28	
Kodiak, Northeast District	0.38	0.52	0.45
Kodiak, Shelikof District	0.25	0.34	0.30
Kodiak, Semidi District	0.46	0.54	0.50
Kodiak Average	0.37	0.46	
Alaska Peninsula	0.15	0.26	0.21
Bering Sea	0.44	0.51	0.47
Overall Average	0.31	0.39	

[a]Weight in pounds.

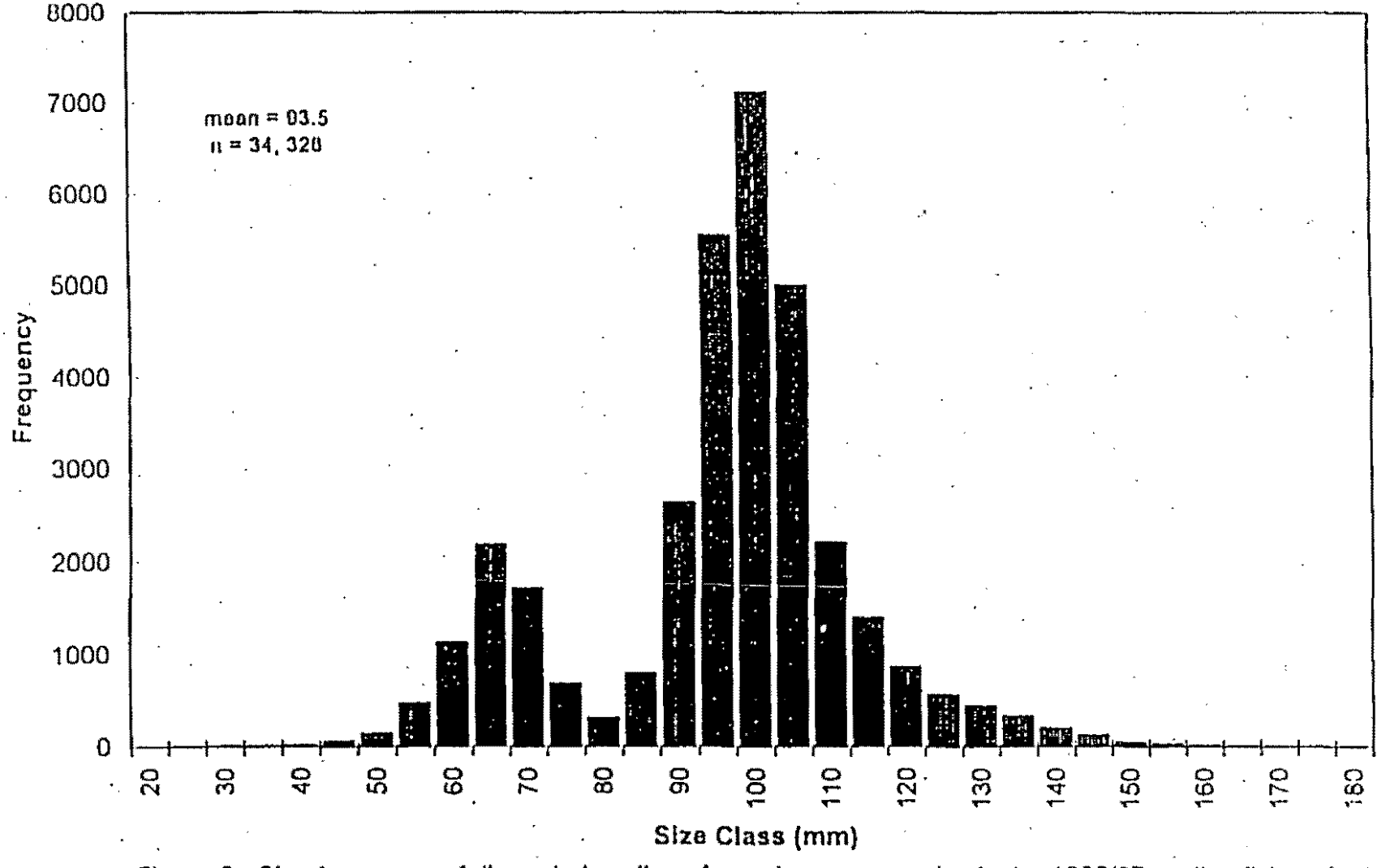


Figure 2. Size frequency of discarded scallops from observer samples in the 1996/97 scallop fishery in the Shelikof District of the Kodiak Area.

Hammarstom, L.F., and M.F. Merritt. 1985. A survey of Pacific weathervane scallops (*Pecten caurinus*) in Kamishak Bay, Alaska. Alaska Department of Fish and Game, Division of Commercial Fisheries, Informational Leaflet 252, Juneau.

Haynes, E.B., and G.C. Powell. 1968. A preliminary report on the Alaska sea scallop - fishery exploration, biology, and commercial processing. Alaska Department of Fish and Game, Division of Commercial Fisheries, Informational Leaflet 125, Juneau.

Hennick, D.P. 1970a. The weathervane scallop fishery of Alaska with notes on occurrence in Washington and Oregon. Pacific Marine Fisheries Commission, Annual Report for the Year 1969: 33-34.

Hennick, D.P. 1970b. Reproductive cycle, size at maturity, and sexual composition of commercially harvested weathervane scallops (Patinopecten caurinus) in Alaska. Journal of the Fisheries Research Board of Canada 27: 2112-2119.

Hennick, D.P. 1973. Sea scallop, Patinopecten caurinus, investigations in Alaska. Alaska Department of Fish and Game, Division of Commercial Fisheries, Completion Report 5-23-R, Juneau.

Hoenig, J.M. 1983. Empirical use of longevity data to estimate mortality rates. Fishery Bulletin 82(1): 898-902.

Kaiser, R.J. 1986. Characteristics of the Pacific weathervane scallop (Pecten [Patinopecten] caurinus, Gould 1850) fishery in Alaska, 1967-1981. Alaska Department of Fish and Game, Division of Commercial Fisheries (Unpublished Report, Catalog RUR-5J86-01), Juneau.

Kruse, G.H., E. Krygier, R.D. Mecum, and M.C. Murphy. 1993. Synopsis of ADF&G scallop meeting, Anchorage, Alaska, July 15, 1993. ADF&G Regional Information Report No. 5J93-07.

Kruse, G.H., and F.C. Funk. 1995. Biological Reference Points for Weathervane Scallops in Alaska, a poster presented to North Pacific Symposium on Invertebrate Stock Assessment and Management, Nanaimo, British Columbia, March 1995

Mayer, L.M., D.F. Schick, R.H. Findlay, and D.L. Rice. 1991. Effects of commercial dragging on sedimentary organic matter. Marine Environmental Research 31:249-261.

Morrison, R. 1994. Bering Sea Aleutian Islands Scallops. In: Westward Region Reports to the Board of Fisheries. March 1994.

National Marine Fisheries Service (NMFS). 1998. "Final Supplemental Environmental Impact Statement for the Groundfish Total Allowable Catch Specifications and Prohibited Species Catch Limits Under the Authority of the Fishery of the Bering Sea and Aleutian Islands Area and Groundfish of the Gulf of Alaska." NMFS- Alaska Region, PO Box 21668, Juneau, AK 99802-1668.

National Marine Fisheries Service (NMFS). 1997a. Final Environmental Assessment/Regulatory Impact Review/Final Regulatory Flexibility Analysis for Amendments 1 and 2 to the Fishery Management Plan for the Scallop Fishery off Alaska. NMFS-Alaska Region, PO Box 21668, Juneau, AK 99802-1668.

National Marine Fisheries Service (NMFS). 1997b. Final Environmental Assessment for 1997 Total Allowable Catch Specifications. NMFS-Alaska Region, P.O. Box 21668, Juneau, Alaska 99802-1668.

NMFS. 1996. Endangered Species Act. Section 7. Biological Opinion--Fishery Management Plan for the Bering Sea and Aleutian Islands and Gulf of Alaska Groundfish Fisheries and the Total Allowable Catch Specification and its effects to Steller Sea Lions. NMFS Alaska Region, P.O. Box 21668, Juneau, Alaska, January 26, 1996.

NMFS. 1995. Endangered Species Act. Section 7. Reinitiation of Consultation on the Effects of the Groundfish Fisheries Conducted under the Bering Sea and Aleutian Islands and Gulf of Alaska Fishery Management Plans of the North Pacific Fishery Management Council. (Pacific salmon; amended Biological Opinion from January 14, 1994) NMFS Northwest Region, 7600 Sand Point Way, NE, BIN 15700, Seattle, Washington, December 7, 1995.

NMFS. 1994. Endangered Species Act Section 7. Biological Opinion--Pacific Salmon. *Reinitiation of* Consultation on the Effects of the Groundfish Fisheries Conducted under the Bering Sea and Aleutian Islands and Gulf of Alaska Fishery Management Plans of the North Pacific Fishery Management Council. (Pacific Salmon) NMFS Northwest Region, 7600 Sand Point Way, NE, BIN 15700, Seattle, Washington, January 14, 1994.

NMFS. 1992. Endangered Species Act. Section 7. Biological Opinion--Amendment 18 to the Fishery Management Plan for the Groundfish Fishery of the Bering Sea and Aleutian Islands (Steller Sea Lions). NMFS Alaska Region, P.O. Box 21668, Juneau, Alaska, March 4, 1992.

NMFS. 1991. Endangered Species Act. Section 7. Biological Opinion--Fishery Management Plan for the Bering Sea and Aleutian Islands and Gulf of Alaska Groundfish Fisheries and the Total Allowable Catch Specification and its effects to Steller Sea Lions. NMFS Alaska Region, P.O. Box 21668, Juneau, Alaska, April 18, 1991.

North Pacific Fishery Management Council (NPFMC). 1992. Final Supplemental Environmental Impact Statement and Regulatory Impact Review/Initial Regulatory Flexibility Analysis of Proposed Inshore/Offshore Allocation Alternatives (Amendment 18/23) to the Fishery Management Plans for the Groundfish Fishery of the Bering Sea and Aleutian Islands and the Gulf of Alaska. March 5, 1992.

Orensanz, J.M. 1986. Size, environment, and density: the regulation of a scallop stock and its management implications. Pages 195-227 *in* G.S. Jamieson and N. Bourne, editors. North Pacific workshop on stock assessment and management of invertebrates. Canadian Special Publication of Fisheries and Aquatic Sciences 92.

Oresanz, J.M., A.M. Parma, and O.O. Iribarne. 1991. Population dynamics and management of natural stocks. Pp. 625-713. In S.E. Shumway (ed.). Scallops: Biology, Ecology and Aquaculture. Developments in Aquaculture and Fisheries Science, 21. Elsevier, Amsterdam.

Rosenberg, A.P., P. Mace, G. Thompson, G. Darcy, W. Clark, J. Collies, W. Gabriel, A. MacCall, R. Methot, J. Powers, V. Restrepo, T. Wainwright, L. Botsford, J. Hoenig, K. Stokes. 1994. Scientific review of definitions of overfishing in U.S. fishery management plans. NOAA Tech. Memo. NMFS-F/SPO-17, 105p.

Shirley, S.M., and G.H. Kruse. 1995. Development of the fishery for weathervane scallops, Patinopecten caurinus (Gould 1850), in Alaska. Journal of Shellfish Research 14:71-78.

Starr, R.M., and J.E. McCrae. 1983. Weathervane scallop (*Patinopecten caurinus*) investigations in Oregon, 1981-1983. Oregon Department of Fish and Wildlife, Information Reports 83-10, Newport.

Urban, D., D. Pengilly, and I. Vining, 1994. The scallop observer program and statewide data analysis summary to the Board of Fisheries. Alaska Department of Fish and Game, Kodiak, Alaska. 54p.

5.0 AGENCIES AND INDIVIDUALS CONSULTED

Loh-lee Low
NMFS-AFSC

Kent Lind
NMFS-AKRO

Al Spalinger, Dan Urban, Dave Jackson, Doug Pengilly
ADF&G Kodiak

6.0 LIST OF PREPARERS

Dave Witherell
NPFMC
Anchorage, AK

Jeff Barnhart
ADF&G Kodiak

Gordon Kruse
ADF&G
Juneau, AK

Gretchen Harrington
NMFS
Juneau, AK

5.0 AGENCIES AND INDIVIDUALS CONSULTED

Loh-lee Low
NMFS-AFSC

Kent Lind
NMFS-AKRO

Al Spalinger, Dan Urban, Dave Jackson, Doug Pengilly
ADF&G Kodiak

6.0 LIST OF PREPARERS

Dave Witherell
NPFMC
Anchorage, AK

Jeff Barnhart
ADF&G Kodiak

Gordon Kruse
ADF&G
Juneau, AK

Gretchen Harrington
NMFS
Juneau, AK

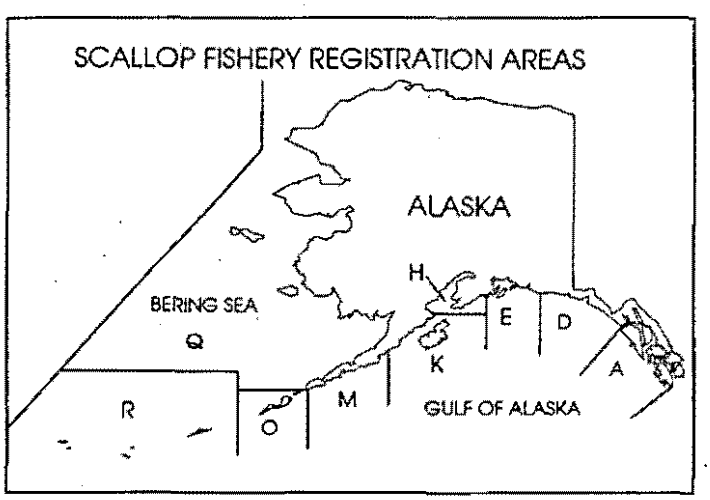
7.0 SCALLOP SPECIES SUMMARY

Scallops

Biology: Weathervane scallops (*Patinopectin caurinus*),are distributed from Point Reyes, California, to the Pribilof Islands, Alaska. The highest known densities in Alaska have been found to occur in the Bering Sea, off Kodiak Island, and along the eastern gulf coast from Cape Spencer to Cape St. Elias. Weathervane scallops are found from intertidal waters to depths of 300 m, but abundance tends to be greatest between depths of 40-130 m on beds of mud, clay, sand, and gravel. Sexes are separate and mature male and female scallops are distinguishable based on gonad color. Although spawning time varies with latitude and depth, weathervane scallops in Alaska spawn in May to July depending on location. Eggs and spermatozoa are released into the water, where the eggs become fertilized. After a few days, eggs hatch, and larvae rise into the water column and drift with ocean currents. Larvae are pelagic and drift for about one month until metamorphosis to the juvenile stage when they settle to the bottom. Weathervane scallops begin to mature by age 3 at about 7.6 cm (3 inches) in shell height (SH), and virtually all scallops are mature by age 4. Growth, maximum size, and size at maturity vary significantly within and between beds and geographic areas. Weathervane scallops are long-lived; individuals may live 28 years old or more. Scallops are likely prey to various fish and invertebrates during the early part of their life cycle. Flounders are known to prey on juvenile weathervane scallops, and seastars may also be important predators.

Several other species of scallop found in the EEZ off Alaska have commercial potential. These scallops grow to smaller sizes than weathervanes, and thus have not been extensively exploited in Alaska. Pink scallops, Chlamys rubida, range from California to the Pribilof Islands. Pink scallops are found in deep waters (to 200 m) in areas with soft bottom, whereas spiny scallop occur in shallower (to 150 m) areas characterized by hard bottom and strong currents. Pink scallops mature at age 2, and spawn in the winter (January-March). Maximum age for this species is 6 years. Spiny scallops, Chlamys hastata, are found in coastal regions from California to the Gulf of Alaska. Spiny scallops grow to slightly larger sizes (75 mm) than pink scallops (60 mm). Spiny scallops also mature at age 2 (35 mm) and spawn in the autumn (August-October). Rock scallops, Crassadoma gigantea, range from Mexico to Unalaska Island. Rock scallops are found in relatively shallower water (0-80 m) with strong currents. Apparently, distribution of these animals is discontinuous, and the abundance in most areas is low. These scallops attach themselves to rocks, attain a large size (to 250 mm), and exhibit fast growth rates. Rock scallops are thought to spawn during two distinct periods, one in the autumn (October -January), and one in the spring-summer (March-August).

Management: The weathervane scallop resource consists of multiple, discrete, self sustaining populations that are managed as separate stock units. Scallop stocks in Alaska have been managed under a federal fishery management plan (FMP) since July 26, 1995, which established a 1 year interim closure of federal waters to scallop fishing to prevent uncontrolled fishing. Amendment 1, which allowed scallop fishing under a federal management regime, was approved July 10, 1996 and fishing resumed on August 1. Amendment 1 provided for fishery management through permits, registration areas and districts, seasons, closed waters, gear restrictions, efficiency limits, crab bycatch limits, scallop catch limits, inseason adjustments, and observer monitoring.



A summary of management measures established under amendments to the federal scallop FMP.

Amendment	Date	Action
1	July 1996	Allowed fishing after a 1 year closure of Federal waters.
2	July 1997	Established a federal scallop vessel moratorium.
3	Dec 1997	If approved, would defer all management (except limited access) to State.
4	1999?	Would establish a permanent limited access system.
5	1998	Essential Fish Habitat

Most of these regulations were developed by the State prior to 1995. Dredge size is limited to a maximum width of 15 feet, and only 2 dredges may be used at any one time. In the Kamishak District of Cook Inlet, only 1 dredge with a 6' maximum width is allowed. Dredges are required to have rings with a 4" minimum inside diameter. To reduce incentives to harvest small scallops, crew size on scallop vessels is limited to 12 persons and all scallops must be manually shucked. Dredging is prohibited in areas designated as crab habitat protection areas, similar to

the groundfish FMPs. In June 1995, the Council adopted a 3-year vessel moratorium to restrict new entry into the scallop fishery while a more comprehensive plan was being developed. The moratorium approved as Amendment 2, effective August 1, 1997. To qualify under the proposed moratorium, a vessel must have made at least one landing in 1991, 1992, or 1993, or must have participated for at least 4 years between 1980 and 1993. The moratorium also limits reconstruction and replacement of vessels to a 20% maximum increase in original qualifying length overall.

Weathervane scallop registration areas, seasons, GHL's (pounds, shucked), and crab bycatch limits established for the 1997 scallop fishery, by area.

			Crab Bycatch Limits		
Area	GHL (pounds)	Fishing Season	king crab	Tanner crab	Snow crab
D - District 16	0 - 35,000	Jan 10 - Dec 31	n/a	n/a	n/a
D - Yakutat	0 - 250,000	Jan 10 - Dec 31	n/a	n/a	n/a
E - Eastern PWS	0 - 50,000	Jan 10 - Dec 31	n/a	500	n/a
Western PWS	combined	Jan 10 - Dec 31	n/a	130	n/a
H - Cook Inlet (Kamishak)	0 - 20,000	Aug 15 - Oct 31	60	24,992	n/a
Cook Inlet (Outer area)	combined	Jan 1 - Dec 31	98	2,170	n/a
K - Kodiak (Shelikof)	0 - 400,000	July 1 - Feb 15	35	51,000	n/a
Kodiak (Northeast)	combined	July 1 - Feb 15	50	91,600	n/a
M - AK Peninsula	0 - 200,000	July 1 - Feb 15	79	45,300	n/a
O - Dutch Harbor	0 - 170,000	July 1 - Feb 15	10	10,700	n/a
Q - Bering Sea	0 - 600,000	July 1 - Feb 15	500	238,000	172,000
R - Adak	0 - 75,000	July 1 - Feb 15	50	10,000	n/a

Fishery: In 1996, a total of 9 vessels participated in the scallop fishery statewide. Scallop vessels average 90-110 ft long. Scallops are harvested using dredges of standard design. Weathervane scallops are processed at sea by manual shucking, with only the meats (adductor muscles) retained. Scallops harvested in Cook Inlet are bagged and iced, whereas scallops harvested from other areas are generally block frozen at sea. The fishery has occurred almost exclusively in the EEZ in recent years, but some fishing in State waters occurs off Yakatat, Dutch Harbor, and Adak.

Catch History: Since 1967, when the first landings were made, fishing effort and total scallop harvest (weight of shucked meats) have varied annually. Total commercial harvest of weathervane scallops has fluctuated from a high of 157 landings totaling 1,850,187 pounds of shucked meats by 19 vessels in 1969 to no landings in 1978. Prices and demand for scallop have remained high since fishery inception. Prior to 1990, about two-thirds of the scallop harvest has been taken off Kodiak Island and about one-third has come from the Yakutat area; other areas had made minor contributions to overall landings. Harvests in 1990 and 1991 were the highest on record since the early 1970's. The 1992 scallop harvest was even higher at 1,810,788 pounds. The increased harvests in the 1990's occurred with new exploitation in the Bering Sea. The reduced 1995 catch was due to implementation of an interim closure in the EEZ from 2/23/95 to 8/1/96.

The 1996 and 1997 fishery can be summarized as follows:

AREA	1996	1997
Cook Inlet		
No. of vessels	4*	3
Landings (lbs)	28,228	20,336
Outside		
No. of vessels	4	6
Landings (lbs)	704,196	765,707

*one additional vessel fished in state waters only.

Landings and effort in the Alaska weathervane scallop fishery, 1980 - 1997.

Year	# of Vessels	Landings (pounds)	Price ($/lb)
1980	8	633,000	4.32
1981	18	924,000	4.05
1982	13	914,000	3.77
1983	6	194,000	4.88
1984	10	390,000	4.47
1985	8	648,000	3.12
1986	9	683,000	3.66
1987	4	583,000	3.38
1988	4	341,000	3.49
1989	7	526,000	3.68
1990	9	1,489,000	3.37
1991	7	1,191,000	3.76
1992	7	1,811,000	3.88
1993	15	1,429,000	5.00
1994	16	1,235,000	6.00
1995	10	283,000	n/a
1996	9	732,424	6.38
1997	9	786,043	6.50

Table 1. Twenty most frequently caught species by weight as recorded by scallop observers during the 1996/97 Alaska Peninsula Area scallop season. Non target commercial species[a] accounted for 8.6% of the twenty most frequently caught species by weight.

Rank	Species	Scientific Name	% of Total Catch
1	weathervane scallops	*Patinopecten caurinus*	70.3%
2	starfish	Class Stelleroidea	11.4%
3	arrowtooth flounder	*Atheresthes stomias*	4.8%
4	basket starfish	*Gorgonocephalus caryi*	4.6%
5	weathervane shells	*P. caurinus*	2.9%
6	sea urchin	Family Strongyocentrotidae	1.6%
7	Pacific Cod	*Gadus macrocephalus*	0.7%
8	snails	Class Gastropoda	0.5%
9	Tanner crab	*Chionoecetes bairdi*	0.5%
10	kelp, rocks, etc.		0.5%
11	flathead sole	*Hippoglossoides elassodon*	0.3%
12	walleye pollock	*Theragra chalcogramma*	0.2%
13	hermit crab	Family Paguridae	0.2%
14	Greenland turbot	*Reinhardtius hippoglossoides*	0.2%
15	bay scallops	Chlamys spp	0.2%
16	brown box crab	*Lopholithodes foraminatus*	0.1%
17	snail eggs	Class Gastropoda	0.1%
18	man-made debris		0.1%
19	worms unident	Class Polychaeta	0.1%
20	shrimp	*Family Pandalidae*	0.1%

[a]Commercial species caught in declining order of poundage: arrowtooth flounder, sea urchin, Pacific cod, *Chionoecetes bairdi*, flathead sole, walleye pollock, Greenland turbot, bay scallops, and shrimp.

Table 2. Summary of the most frequently caught species, by percent weight in sampled dredges, as recorded by scallop observers during the 1996/97 scallop fishery.

	Management Area / District					
		Kodiak			Alaska	Bering
Species Catergory	Yakutat	Northeast	Chelikof	Semidi	Peninsula	Sea
weathervane scallops	84.7	54.1	76.8	51.8	70.3	87.5
PROHIBITED SPECIES BYCATCH						
Tanner crab	<.1	0.9	0.1	0.9	0.5	0.8
snow crab, opilio	0	0	0	0	0	3.7
king crab	0	0	0	<.1	0	0
Dungeness crab	<.1	0	<.1	0.8	0	0
Pacific halibut	0.2	0.5	0.2	<.1	0	<.1
OTHER COMMERCIAL SPECIES						
skates	1.9	4.9	3.1	2.5	0	1.0
arrowtooth flounder	0.3	0.3	0.4	0.3	4.8	0.8
rock sole	<.1	0.2	<.1	0.5	0.1	0.2
Dover sole	0.2	0.1	<.1	0.1	0	0.1
yellowfin sole	0	0	<.1	0.7	0	<.1
rex sole	0.1	0.6	0	0	0.1	0
flathead sole	0.2	0.5	0.5	1.2	0.3	0.3
butter sole	<.1	0.4	0	0.8	0	<.1
Pacific cod	0.1	1.2	<.1	0.9	0.7	0.4
starry flounder	<.1	0	0	1.6	0	0
walleye pollock	<.1	0	<.1	<.1	0.2	0.4
bay scallops	<.1	0	<.1	<.1	0.2	0
sea urchins	0	0	<.1	<.1	1.6	<.1
octopus	0	0	0.1	0	<.1	<.1
Alaska plaice	0	0	0.6	0.1	0	0
sea cucumber	<.1	0.1	<.1	<.1	0	0.2
MISCELLANEOUS						
starfish	4.5	32.4	2.7	15.7	11.4	0.1
basket star	<.1	<.1	<.1	3.8	4.6	0
weathervane shells	3.7	1.8	5.5	8.0	2.9	2.1
kelp, rocks, etc.	1.2	1.4	5.5	9.0	0.5	0.9
man-made debris	<.1	0.1	0.2	0.2	0.1	0.6
Misc. invertebrates	1.7	0.3	0.8	0.1	1.4	0.9
Mis. fish	0.3	0	0.1	0.2	0.3	< 1

Table 3. Estimated bycatch , in numbers of individuals, and confidence intervals for *C. opilio*, *C. bairdi*, Dungeness, and king crab, and halibut from the 1996/97 statewide scallop fishery.

Management Area	n[b]	Bycatch Estimates by Species[a]									
		C. opilio		*C. bairdi*		Dungeness		king crab		halibut	
		Bycatch	95% CI	Bycatch	95% CI	Bycatch	95% CI	Bycatch[c]	95% CI	Bycatch	95% CI
Yakutat	82	0	NA	6,872	4,641-9,588	38	7-77	0	NA	150	91-151
District 16	26	0	NA	669	274-1,123	9	NA	0	NA	68	30-68
Kodiak											
Northeast District	28	0	NA	27,722	10,298-48,407	0	NA	0	NA	202	79-384
Shelikof District	104	0	NA	11,285	9,408-13,257	1,008	584-1,508	0	NA	440	318-569
Semidi District	38	0	NA	8,902	3,798-15,750	4,554	2,504-7,068	9	NA	79	5-176
Alaska Peninsula	13	0	NA	19,045	12,604-26,362	10	NA	0	NA	25	NA
Bering Sea	63	106,935	98,033-116,196	16,642	14,227-19,373	0	NA	0	NA	124	49-229

[a]Estimates were calculated as bycatch per hour per boat per day x total hours dredged x number of dredges fished.
[b]Number of vessel days.
[c]Actual count, not an estimate.

Table 4. Condition of halibut as recorded by scallop observers during the1996/97 fishing season.

MANAGEMENT AREA	CONDITION[a] Of HALIBUT (Number of Halibut)						
	Excellent	Good	Fair	Poor	Dead	Previously dead	Total
District 16	4	0	1	1	0	1	7
Yakutat	13	5	2	1	1	0	22
Kodiak, Northeast District	4	2	4	6	2	0	18
Kodiak, Shelikof District	20	10	8	11	4	2	55
Kodiak, Semidi District	1	4	1	3	0	0	9
Alaska Peninsula	1	0	0	1	1	0	3
Bering Sea	2	4	4	1	2	0	13
Total all Areas	45	25	20	24	10	3	127

[a]Condition Codes

Excellent: Vigorous body movement before and after release; could close operculum tightly; minor external injuries, if any.
Good: Feeble body movements; could close operculum tightly; minor external injuries, if any.
Fair: No body movement; could close operculum tightly; minor external injuries, if any.
Poor: No body movement; could move operculum but not tightly; severe injuries (eg. bleeding).
Dead: No body or opercular movement; probably killed in sampled haul.
Previously dead: Obviously not killed in the current haul (incidentally caught).

Table 5. Tanner crab bycatch mortality as recorded by scallop observers during the 1996/97 fishing season.

MANAGEMENT AREA	NUMBER OF TANNER CRAB OBSERVED		
	Dead	Alive	Percent Dead
District 16	34	38	47.2
Yakutat	537	373	58.9
Kodiak, Northeast District	262	1,361	16.1
Kodiak, Shelikof District	587	1,013	36.6
Kodiak, Semidi District	271	464	36.9
Alaska Peninsula	735	1,541	32.3
Bering Sea *C. opilio*	1,675	8,674	16.2
Bering Sea *C. bairdi*	210	1,454	12.6
Total all Areas	4,311	14,918	28.9

Table 6. Number and weight of discarded scallops as recorded by scallop observers during the 1996/97 fishing season.

MANAGEMENT AREA	Number of Sampled Scallops		Weight of Sampled Scallop	
	Intact	Broken	Intact	Broken
Yakutat	35, 697	19, 595	8, 376	7, 212
District 16	19, 239	2, 684	4, 031	735
Yakutat Total	54, 936	22, 279	12, 407	7, 947
Kodiak, Northeast District	908	982	228	493
Kodiak, Shelikof District	34, 398	29, 337	7, 722	9, 314
Kodiak, Semidi District	254	974	126	531
Kodiak Total	35, 560	31, 293	8, 076	10, 338
Alaska Peninsula	1, 858	2, 546	281	711
Bering Sea	1, 397	2, 174	588	1, 097
Total	93, 751	58, 292	21, 352	20, 093

Table 8. Average weight of intact and broken scallops from observer sampled discarded scallop catch during the 1996/97 fishing season.

MANAGEMENT AREA	WEIGHT[a]		
	Intact Scallops	Broken Scallops	Average
Yakutat	0.24	0.29	0.27
District 16	0.21	0.28	0.25
Yakutat Average	0.22	0.28	
Kodiak, Northeast District	0.38	0.52	0.45
Kodiak, Shelikof District	0.25	0.34	0.30
Kodiak, Semidi District	0.46	0.54	0.50
Kodiak Average	0.37	0.46	
Alaska Peninsula	0.15	0.26	0.21
Bering Sea	0.44	0.51	0.47
Overall Average	0.31	0.39	

[a]Weight in pounds.

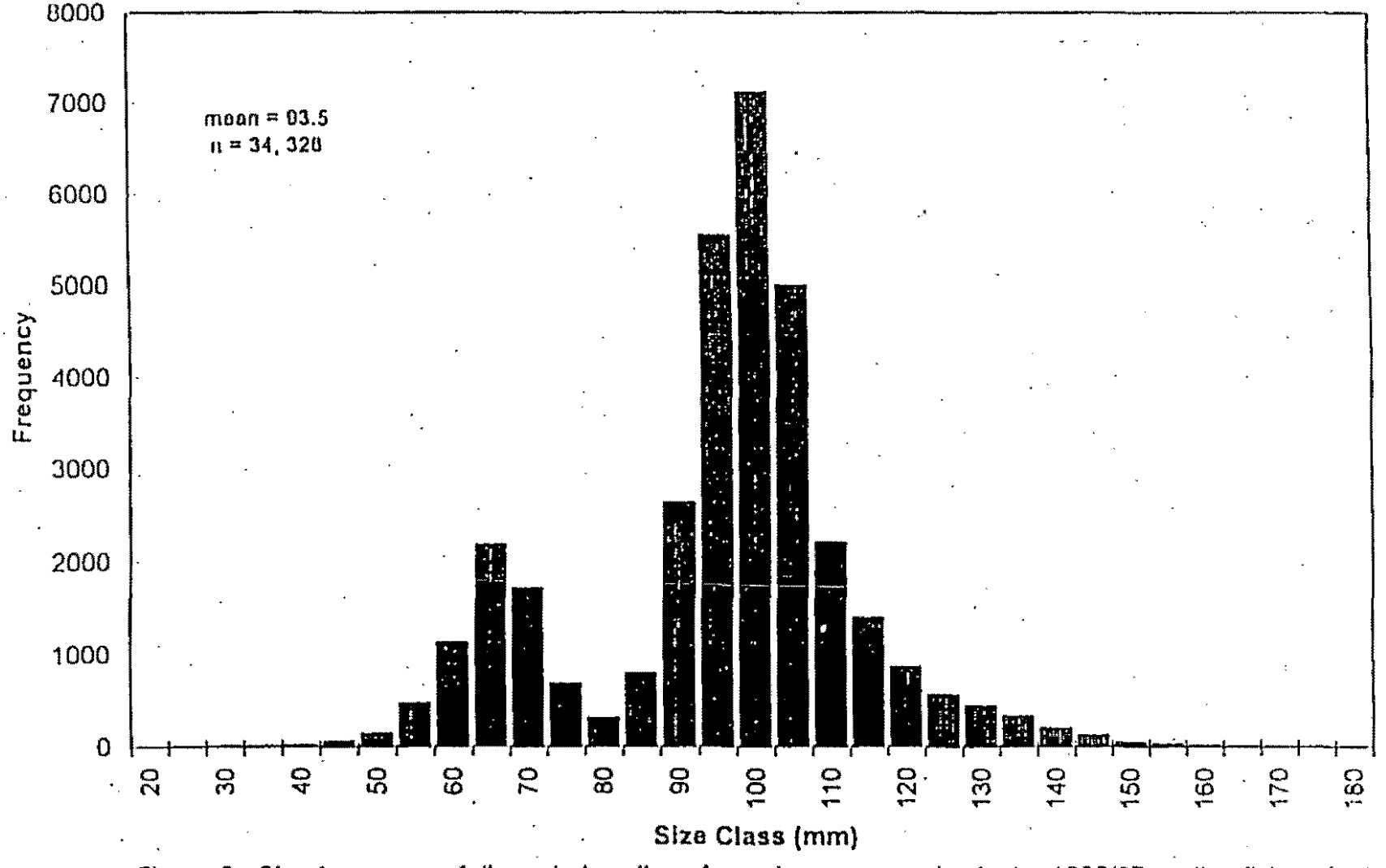


Figure 2. Size frequency of discarded scallops from observer samples in the 1996/97 scallop fishery in the Shelikof District of the Kodiak Area.

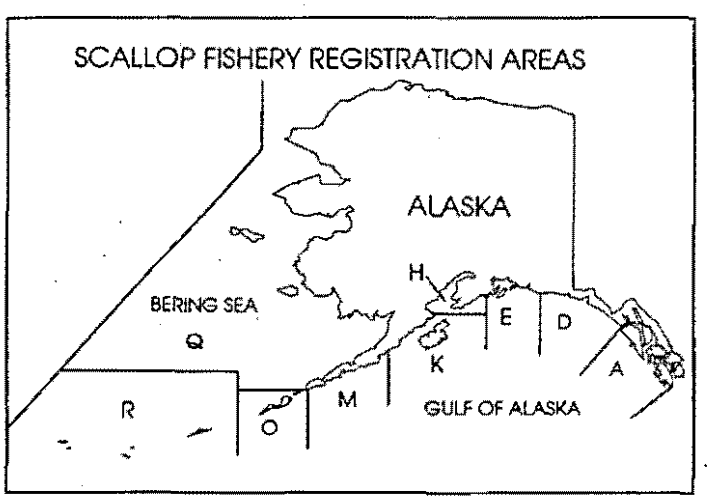
7.0 SCALLOP SPECIES SUMMARY

Scallops

Biology: Weathervane scallops (*Patinopectin caurinus*),are distributed from Point Reyes, California, to the Pribilof Islands, Alaska. The highest known densities in Alaska have been found to occur in the Bering Sea, off Kodiak Island, and along the eastern gulf coast from Cape Spencer to Cape St. Elias. Weathervane scallops are found from intertidal waters to depths of 300 m, but abundance tends to be greatest between depths of 40-130 m on beds of mud, clay, sand, and gravel. Sexes are separate and mature male and female scallops are distinguishable based on gonad color. Although spawning time varies with latitude and depth, weathervane scallops in Alaska spawn in May to July depending on location. Eggs and spermatozoa are released into the water, where the eggs become fertilized. After a few days, eggs hatch, and larvae rise into the water column and drift with ocean currents. Larvae are pelagic and drift for about one month until metamorphosis to the juvenile stage when they settle to the bottom. Weathervane scallops begin to mature by age 3 at about 7.6 cm (3 inches) in shell height (SH), and virtually all scallops are mature by age 4. Growth, maximum size, and size at maturity vary significantly within and between beds and geographic areas. Weathervane scallops are long-lived; individuals may live 28 years old or more. Scallops are likely prey to various fish and invertebrates during the early part of their life cycle. Flounders are known to prey on juvenile weathervane scallops, and seastars may also be important predators.

Several other species of scallop found in the EEZ off Alaska have commercial potential. These scallops grow to smaller sizes than weathervanes, and thus have not been extensively exploited in Alaska. Pink scallops, Chlamys rubida, range from California to the Pribilof Islands. Pink scallops are found in deep waters (to 200 m) in areas with soft bottom, whereas spiny scallop occur in shallower (to 150 m) areas characterized by hard bottom and strong currents. Pink scallops mature at age 2, and spawn in the winter (January-March). Maximum age for this species is 6 years. Spiny scallops, Chlamys hastata, are found in coastal regions from California to the Gulf of Alaska. Spiny scallops grow to slightly larger sizes (75 mm) than pink scallops (60 mm). Spiny scallops also mature at age 2 (35 mm) and spawn in the autumn (August-October). Rock scallops, Crassadoma gigantea, range from Mexico to Unalaska Island. Rock scallops are found in relatively shallower water (0-80 m) with strong currents. Apparently, distribution of these animals is discontinuous, and the abundance in most areas is low. These scallops attach themselves to rocks, attain a large size (to 250 mm), and exhibit fast growth rates. Rock scallops are thought to spawn during two distinct periods, one in the autumn (October -January), and one in the spring-summer (March-August).

Management: The weathervane scallop resource consists of multiple, discrete, self sustaining populations that are managed as separate stock units. Scallop stocks in Alaska have been managed under a federal fishery management plan (FMP) since July 26, 1995, which established a 1 year interim closure of federal waters to scallop fishing to prevent uncontrolled fishing. Amendment 1, which allowed scallop fishing under a federal management regime, was approved July 10, 1996 and fishing resumed on August 1. Amendment 1 provided for fishery management through permits, registration areas and districts, seasons, closed waters, gear restrictions, efficiency limits, crab bycatch limits, scallop catch limits, inseason adjustments, and observer monitoring.



A summary of management measures established under amendments to the federal scallop FMP.

Amendment	Date	Action
1	July 1996	Allowed fishing after a 1 year closure of Federal waters.
2	July 1997	Established a federal scallop vessel moratorium.
3	Dec 1997	If approved, would defer all management (except limited access) to State.
4	1999?	Would establish a permanent limited access system.
5	1998	Essential Fish Habitat

Most of these regulations were developed by the State prior to 1995. Dredge size is limited to a maximum width of 15 feet, and only 2 dredges may be used at any one time. In the Kamishak District of Cook Inlet, only 1 dredge with a 6' maximum width is allowed. Dredges are required to have rings with a 4" minimum inside diameter. To reduce incentives to harvest small scallops, crew size on scallop vessels is limited to 12 persons and all scallops must be manually shucked. Dredging is prohibited in areas designated as crab habitat protection areas, similar to

the groundfish FMPs. In June 1995, the Council adopted a 3-year vessel moratorium to restrict new entry into the scallop fishery while a more comprehensive plan was being developed. The moratorium approved as Amendment 2, effective August 1, 1997. To qualify under the proposed moratorium, a vessel must have made at least one landing in 1991, 1992, or 1993, or must have participated for at least 4 years between 1980 and 1993. The moratorium also limits reconstruction and replacement of vessels to a 20% maximum increase in original qualifying length overall.

Weathervane scallop registration areas, seasons, GHL's (pounds, shucked), and crab bycatch limits established for the 1997 scallop fishery, by area.

			Crab Bycatch Limits		
Area	GHL (pounds)	Fishing Season	king crab	Tanner crab	Snow crab
D - District 16	0 - 35,000	Jan 10 - Dec 31	n/a	n/a	n/a
D - Yakutat	0 - 250,000	Jan 10 - Dec 31	n/a	n/a	n/a
E - Eastern PWS	0 - 50,000	Jan 10 - Dec 31	n/a	500	n/a
Western PWS	combined	Jan 10 - Dec 31	n/a	130	n/a
H - Cook Inlet (Kamishak)	0 - 20,000	Aug 15 - Oct 31	60	24,992	n/a
Cook Inlet (Outer area)	combined	Jan 1 - Dec 31	98	2,170	n/a
K - Kodiak (Shelikof)	0 - 400,000	July 1 - Feb 15	35	51,000	n/a
Kodiak (Northeast)	combined	July 1 - Feb 15	50	91,600	n/a
M - AK Peninsula	0 - 200,000	July 1 - Feb 15	79	45,300	n/a
O - Dutch Harbor	0 - 170,000	July 1 - Feb 15	10	10,700	n/a
Q - Bering Sea	0 - 600,000	July 1 - Feb 15	500	238,000	172,000
R - Adak	0 - 75,000	July 1 - Feb 15	50	10,000	n/a

Fishery: In 1996, a total of 9 vessels participated in the scallop fishery statewide. Scallop vessels average 90-110 ft long. Scallops are harvested using dredges of standard design. Weathervane scallops are processed at sea by manual shucking, with only the meats (adductor muscles) retained. Scallops harvested in Cook Inlet are bagged and iced, whereas scallops harvested from other areas are generally block frozen at sea. The fishery has occurred almost exclusively in the EEZ in recent years, but some fishing in State waters occurs off Yakatat, Dutch Harbor, and Adak.

Catch History: Since 1967, when the first landings were made, fishing effort and total scallop harvest (weight of shucked meats) have varied annually. Total commercial harvest of weathervane scallops has fluctuated from a high of 157 landings totaling 1,850,187 pounds of shucked meats by 19 vessels in 1969 to no landings in 1978. Prices and demand for scallop have remained high since fishery inception. Prior to 1990, about two-thirds of the scallop harvest has been taken off Kodiak Island and about one-third has come from the Yakutat area; other areas had made minor contributions to overall landings. Harvests in 1990 and 1991 were the highest on record since the early 1970's. The 1992 scallop harvest was even higher at 1,810,788 pounds. The increased harvests in the 1990's occurred with new exploitation in the Bering Sea. The reduced 1995 catch was due to implementation of an interim closure in the EEZ from 2/23/95 to 8/1/96.

The 1996 and 1997 fishery can be summarized as follows:

AREA	1996	1997
Cook Inlet		
No. of vessels	4*	3
Landings (lbs)	28,228	20,336
Outside		
No. of vessels	4	6
Landings (lbs)	704,196	765,707

*one additional vessel fished in state waters only.

Landings and effort in the Alaska weathervane scallop fishery, 1980 - 1997.

Year	# of Vessels	Landings (pounds)	Price ($/lb)
1980	8	633,000	4.32
1981	18	924,000	4.05
1982	13	914,000	3.77
1983	6	194,000	4.88
1984	10	390,000	4.47
1985	8	648,000	3.12
1986	9	683,000	3.66
1987	4	583,000	3.38
1988	4	341,000	3.49
1989	7	526,000	3.68
1990	9	1,489,000	3.37
1991	7	1,191,000	3.76
1992	7	1,811,000	3.88
1993	15	1,429,000	5.00
1994	16	1,235,000	6.00
1995	10	283,000	n/a
1996	9	732,424	6.38
1997	9	786,043	6.50

Table 1. Twenty most frequently caught species by weight as recorded by scallop observers during the 1996/97 Alaska Peninsula Area scallop season. Non target commercial species[a] accounted for 8.6% of the twenty most frequently caught species by weight.

Rank	Species	Scientific Name	% of Total Catch
1	weathervane scallops	*Patinopecten caurinus*	70.3%
2	starfish	Class Stelleroidea	11.4%
3	arrowtooth flounder	*Atheresthes stomias*	4.8%
4	basket starfish	*Gorgonocephalus caryi*	4.6%
5	weathervane shells	*P. caurinus*	2.9%
6	sea urchin	Family Strongyocentrotidae	1.6%
7	Pacific Cod	*Gadus macrocephalus*	0.7%
8	snails	Class Gastropoda	0.5%
9	Tanner crab	*Chionoecetes bairdi*	0.5%
10	kelp, rocks, etc.		0.5%
11	flathead sole	*Hippoglossoides elassodon*	0.3%
12	walleye pollock	*Theragra chalcogramma*	0.2%
13	hermit crab	Family Paguridae	0.2%
14	Greenland turbot	*Reinhardtius hippoglossoides*	0.2%
15	bay scallops	Chlamys spp	0.2%
16	brown box crab	*Lopholithodes foraminatus*	0.1%
17	snail eggs	Class Gastropoda	0.1%
18	man-made debris		0.1%
19	worms unident	Class Polychaeta	0.1%
20	shrimp	*Family Pandalidae*	0.1%

[a]Commercial species caught in declining order of poundage: arrowtooth flounder, sea urchin, Pacific cod, *Chionoecetes bairdi*, flathead sole, walleye pollock, Greenland turbot, bay scallops, and shrimp.

Table 2. Summary of the most frequently caught species, by percent weight in sampled dredges, as recorded by scallop observers during the 1996/97 scallop fishery.

	Management Area / District					
		Kodiak			Alaska	Bering
Species Catergory	Yakutat	Northeast	Chelikof	Semidi	Peninsula	Sea
weathervane scallops	84.7	54.1	76.8	51.8	70.3	87.5
PROHIBITED SPECIES BYCATCH						
Tanner crab	<.1	0.9	0.1	0.9	0.5	0.8
snow crab, opilio	0	0	0	0	0	3.7
king crab	0	0	0	<.1	0	0
Dungeness crab	<.1	0	<.1	0.8	0	0
Pacific halibut	0.2	0.5	0.2	<.1	0	<.1
OTHER COMMERCIAL SPECIES						
skates	1.9	4.9	3.1	2.5	0	1.0
arrowtooth flounder	0.3	0.3	0.4	0.3	4.8	0.8
rock sole	<.1	0.2	<.1	0.5	0.1	0.2
Dover sole	0.2	0.1	<.1	0.1	0	0.1
yellowfin sole	0	0	<.1	0.7	0	<.1
rex sole	0.1	0.6	0	0	0.1	0
flathead sole	0.2	0.5	0.5	1.2	0.3	0.3
butter sole	<.1	0.4	0	0.8	0	<.1
Pacific cod	0.1	1.2	<.1	0.9	0.7	0.4
starry flounder	<.1	0	0	1.6	0	0
walleye pollock	<.1	0	<.1	<.1	0.2	0.4
bay scallops	<.1	0	<.1	<.1	0.2	0
sea urchins	0	0	<.1	<.1	1.6	<.1
octopus	0	0	0.1	0	<.1	<.1
Alaska plaice	0	0	0.6	0.1	0	0
sea cucumber	<.1	0.1	<.1	<.1	0	0.2
MISCELLANEOUS						
starfish	4.5	32.4	2.7	15.7	11.4	0.1
basket star	<.1	<.1	<.1	3.8	4.6	0
weathervane shells	3.7	1.8	5.5	8.0	2.9	2.1
kelp, rocks, etc.	1.2	1.4	5.5	9.0	0.5	0.9
man-made debris	<.1	0.1	0.2	0.2	0.1	0.6
Misc. invertebrates	1.7	0.3	0.8	0.1	1.4	0.9
Mis. fish	0.3	0	0.1	0.2	0.3	< 1

Table 2. Summary of the most frequently caught species, by percent weight in sampled dredges, as recorded by scallop observers during the 1996/97 scallop fishery.

	Management Area / District					
		Kodiak			Alaska	Bering
Species Catergory	Yakutat	Northeast	Chelikof	Semidi	Peninsula	Sea
weathervane scallops	84.7	54.1	76.8	51.8	70.3	87.5
PROHIBITED SPECIES BYCATCH						
Tanner crab	<.1	0.9	0.1	0.9	0.5	0.8
snow crab, opilio	0	0	0	0	0	3.7
king crab	0	0	0	<.1	0	0
Dungeness crab	<.1	0	<.1	0.8	0	0
Pacific halibut	0.2	0.5	0.2	<.1	0	<.1
OTHER COMMERCIAL SPECIES						
skates	1.9	4.9	3.1	2.5	0	1.0
arrowtooth flounder	0.3	0.3	0.4	0.3	4.8	0.8
rock sole	<.1	0.2	<.1	0.5	0.1	0.2
Dover sole	0.2	0.1	<.1	0.1	0	0.1
yellowfin sole	0	0	<.1	0.7	0	<.1
rex sole	0.1	0.6	0	0	0.1	0
flathead sole	0.2	0.5	0.5	1.2	0.3	0.3
butter sole	<.1	0.4	0	0.8	0	<.1
Pacific cod	0.1	1.2	<.1	0.9	0.7	0.4
starry flounder	<.1	0	0	1.6	0	0
walleye pollock	<.1	0	<.1	<.1	0.2	0.4
bay scallops	<.1	0	<.1	<.1	0.2	0
sea urchins	0	0	<.1	<.1	1.6	<.1
octopus	0	0	0.1	0	<.1	<.1
Alaska plaice	0	0	0.6	0.1	0	0
sea cucumber	<.1	0.1	<.1	<.1	0	0.2
MISCELLANEOUS						
starfish	4.5	32.4	2.7	15.7	11.4	0.1
basket star	<.1	<.1	<.1	3.8	4.6	0
weathervane shells	3.7	1.8	5.5	8.0	2.9	2.1
kelp, rocks, etc.	1.2	1.4	5.5	9.0	0.5	0.9
man-made debris	<.1	0.1	0.2	0.2	0.1	0.6
Misc. invertebrates	1.7	0.3	0.8	0.1	1.4	0.9
Mis. fish	0.3	0	0.1	0.2	0.3	< 1

Table 3. Estimated bycatch , in numbers of individuals, and confidence intervals for *C. opilio*, *C. bairdi*, Dungeness, and king crab, and halibut from the 1996/97 statewide scallop fishery.

Management Area	n[b]	Bycatch Estimates by Species[a]									
		C. opilio		*C. bairdi*		Dungeness		king crab		halibut	
		Bycatch	95% CI	Bycatch	95% CI	Bycatch	95% CI	Bycatch[c]	95% CI	Bycatch	95% CI
Yakutat	82	0	NA	6,872	4,641-9,588	38	7-77	0	NA	150	91-151
District 16	26	0	NA	669	274-1,123	9	NA	0	NA	68	30-68
Kodiak											
Northeast District	28	0	NA	27,722	10,298-48,407	0	NA	0	NA	202	79-384
Shelikof District	104	0	NA	11,285	9,408-13,257	1,008	584-1,508	0	NA	440	318-569
Semidi District	38	0	NA	8,902	3,798-15,750	4,554	2,504-7,068	9	NA	79	5-176
Alaska Peninsula	13	0	NA	19,045	12,604-26,362	10	NA	0	NA	25	NA
Bering Sea	63	106,935	98,033-116,196	16,642	14,227-19,373	0	NA	0	NA	124	49-229

[a]Estimates were calculated as bycatch per hour per boat per day x total hours dredged x number of dredges fished.
[b]Number of vessel days.
[c]Actual count, not an estimate.

Table 4. Condition of halibut as recorded by scallop observers during the1996/97 fishing season.

MANAGEMENT AREA	CONDITION[a] Of HALIBUT (Number of Halibut)						
	Excellent	Good	Fair	Poor	Dead	Previously dead	Total
District 16	4	0	1	1	0	1	7
Yakutat	13	5	2	1	1	0	22
Kodiak, Northeast District	4	2	4	6	2	0	18
Kodiak, Shelikof District	20	10	8	11	4	2	55
Kodiak, Semidi District	1	4	1	3	0	0	9
Alaska Peninsula	1	0	0	1	1	0	3
Bering Sea	2	4	4	1	2	0	13
Total all Areas	45	25	20	24	10	3	127

[a]Condition Codes

Excellent: Vigorous body movement before and after release; could close operculum tightly; minor external injuries, if any.
Good: Feeble body movements; could close operculum tightly; minor external injuries, if any.
Fair: No body movement; could close operculum tightly; minor external injuries, if any.
Poor: No body movement; could move operculum but not tightly; severe injuries (eg. bleeding).
Dead: No body or opercular movement; probably killed in sampled haul.
Previously dead: Obviously not killed in the current haul (incidentally caught).

Table 5. Tanner crab bycatch mortality as recorded by scallop observers during the 1996/97 fishing season.

MANAGEMENT AREA	NUMBER OF TANNER CRAB OBSERVED		
	Dead	Alive	Percent Dead
District 16	34	38	47.2
Yakutat	537	373	58.9
Kodiak, Northeast District	262	1,361	16.1
Kodiak, Shelikof District	587	1,013	36.6
Kodiak, Semidi District	271	464	36.9
Alaska Peninsula	735	1,541	32.3
Bering Sea *C. opilio*	1,675	8,674	16.2
Bering Sea *C. bairdi*	210	1,454	12.6
Total all Areas	4,311	14,918	28.9

Table 6. Number and weight of discarded scallops as recorded by scallop observers during the 1996/97 fishing season.

MANAGEMENT AREA	Number of Sampled Scallops		Weight of Sampled Scallop	
	Intact	Broken	Intact	Broken
Yakutat	35, 697	19, 595	8, 376	7, 212
District 16	19, 239	2, 684	4, 031	735
Yakutat Total	54, 936	22, 279	12, 407	7, 947
Kodiak, Northeast District	908	982	228	493
Kodiak, Shelikof District	34, 398	29, 337	7, 722	9, 314
Kodiak, Semidi District	254	974	126	531
Kodiak Total	35, 560	31, 293	8, 076	10, 338
Alaska Peninsula	1, 858	2, 546	281	711
Bering Sea	1, 397	2, 174	588	1, 097
Total	93, 751	58, 292	21, 352	20, 093

Table 8. Average weight of intact and broken scallops from observer sampled discarded scallop catch during the 1996/97 fishing season.

MANAGEMENT AREA	WEIGHT[a]		
	Intact Scallops	Broken Scallops	Average
Yakutat	0.24	0.29	0.27
District 16	0.21	0.28	0.25
Yakutat Average	0.22	0.28	
Kodiak, Northeast District	0.38	0.52	0.45
Kodiak, Shelikof District	0.25	0.34	0.30
Kodiak, Semidi District	0.46	0.54	0.50
Kodiak Average	0.37	0.46	
Alaska Peninsula	0.15	0.26	0.21
Bering Sea	0.44	0.51	0.47
Overall Average	0.31	0.39	

[a]Weight in pounds.

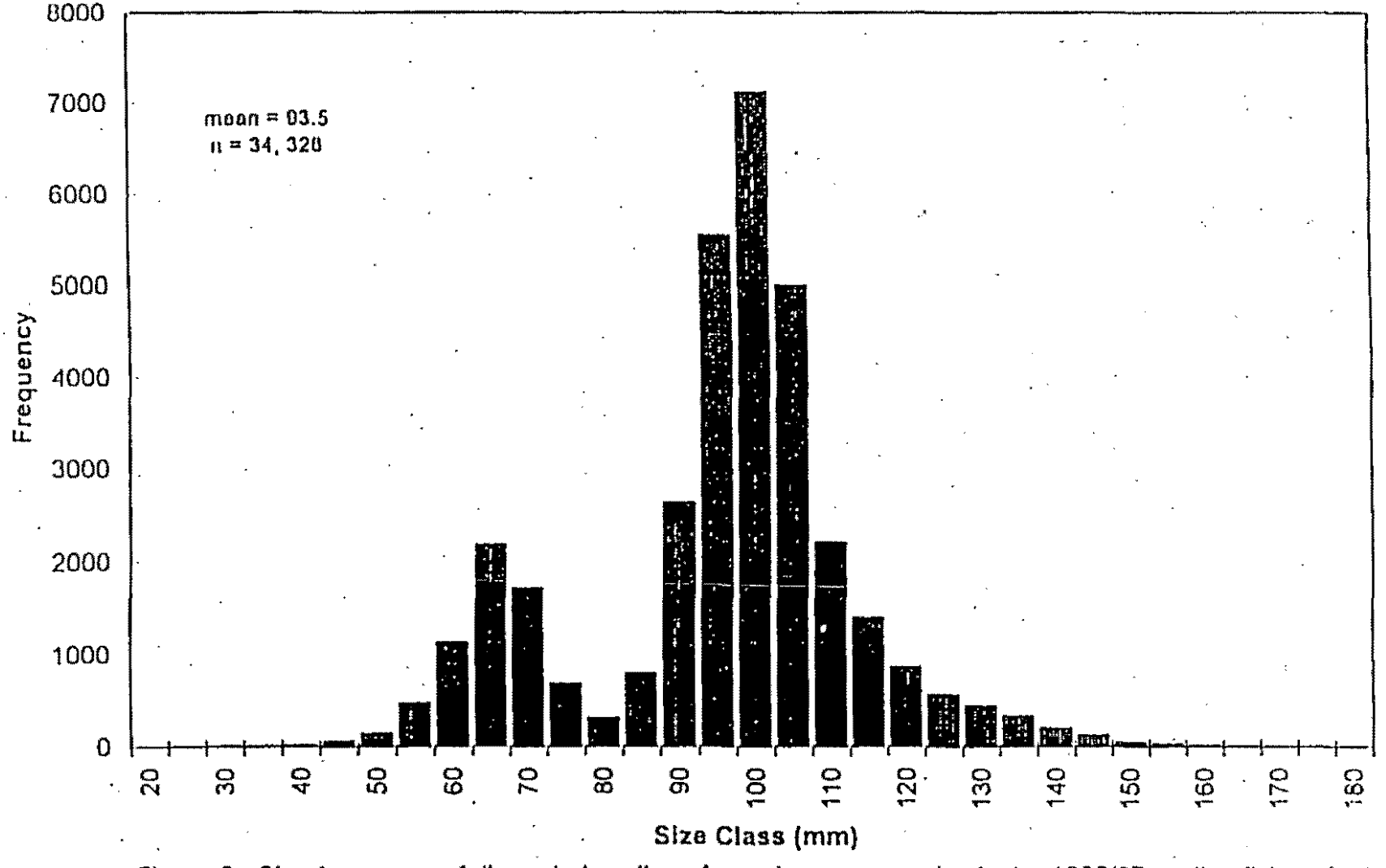


Figure 2. Size frequency of discarded scallops from observer samples in the 1996/97 scallop fishery in the Shelikof District of the Kodiak Area.

Table 3. Estimated bycatch , in numbers of individuals, and confidence intervals for *C. opilio*, *C. bairdi*, Dungeness, and king crab, and halibut from the 1996/97 statewide scallop fishery.

Management Area	n[b]	Bycatch Estimates by Species[a]									
		C. opilio		*C. bairdi*		Dungeness		king crab		halibut	
		Bycatch	95% CI	Bycatch	95% CI	Bycatch	95% CI	Bycatch[c]	95% CI	Bycatch	95% CI
Yakutat	82	0	NA	6,872	4,641-9,588	38	7-77	0	NA	150	91-151
District 16	26	0	NA	669	274-1,123	9	NA	0	NA	68	30-68
Kodiak											
Northeast District	28	0	NA	27,722	10,298-48,407	0	NA	0	NA	202	79-384
Shelikof District	104	0	NA	11,285	9,408-13,257	1,008	584-1,508	0	NA	440	318-569
Semidi District	38	0	NA	8,902	3,798-15,750	4,554	2,504-7,068	9	NA	79	5-176
Alaska Peninsula	13	0	NA	19,045	12,604-26,362	10	NA	0	NA	25	NA
Bering Sea	63	106,935	98,033-116,196	16,642	14,227-19,373	0	NA	0	NA	124	49-229

[a]Estimates were calculated as bycatch per hour per boat per day x total hours dredged x number of dredges fished.
[b]Number of vessel days.
[c]Actual count, not an estimate.

Table 4. Condition of halibut as recorded by scallop observers during the1996/97 fishing season.

MANAGEMENT AREA	CONDITION[a] Of HALIBUT (Number of Halibut)						
	Excellent	Good	Fair	Poor	Dead	Previously dead	Total
District 16	4	0	1	1	0	1	7
Yakutat	13	5	2	1	1	0	22
Kodiak, Northeast District	4	2	4	6	2	0	18
Kodiak, Shelikof District	20	10	8	11	4	2	55
Kodiak, Semidi District	1	4	1	3	0	0	9
Alaska Peninsula	1	0	0	1	1	0	3
Bering Sea	2	4	4	1	2	0	13
Total all Areas	45	25	20	24	10	3	127

[a]Condition Codes

Excellent: Vigorous body movement before and after release; could close operculum tightly; minor external injuries, if any.
Good: Feeble body movements; could close operculum tightly; minor external injuries, if any.
Fair: No body movement; could close operculum tightly; minor external injuries, if any.
Poor: No body movement; could move operculum but not tightly; severe injuries (eg. bleeding).
Dead: No body or opercular movement; probably killed in sampled haul.
Previously dead: Obviously not killed in the current haul (incidentally caught).

Table 5. Tanner crab bycatch mortality as recorded by scallop observers during the 1996/97 fishing season.

MANAGEMENT AREA	NUMBER OF TANNER CRAB OBSERVED		
	Dead	Alive	Percent Dead
District 16	34	38	47.2
Yakutat	537	373	58.9
Kodiak, Northeast District	262	1,361	16.1
Kodiak, Shelikof District	587	1,013	36.6
Kodiak, Semidi District	271	464	36.9
Alaska Peninsula	735	1,541	32.3
Bering Sea *C. opilio*	1,675	8,674	16.2
Bering Sea *C. bairdi*	210	1,454	12.6
Total all Areas	4,311	14,918	28.9

Table 6. Number and weight of discarded scallops as recorded by scallop observers during the 1996/97 fishing season.

MANAGEMENT AREA	Number of Sampled Scallops		Weight of Sampled Scallop	
	Intact	Broken	Intact	Broken
Yakutat	35, 697	19, 595	8, 376	7, 212
District 16	19, 239	2, 684	4, 031	735
Yakutat Total	54, 936	22, 279	12, 407	7, 947
Kodiak, Northeast District	908	982	228	493
Kodiak, Shelikof District	34, 398	29, 337	7, 722	9, 314
Kodiak, Semidi District	254	974	126	531
Kodiak Total	35, 560	31, 293	8, 076	10, 338
Alaska Peninsula	1, 858	2, 546	281	711
Bering Sea	1, 397	2, 174	588	1, 097
Total	93, 751	58, 292	21, 352	20, 093

Table 7. Estimated number and weight of intact and broken scallops in the discarded scallop catch during the 1996/97 scallop fishery.

Management Area	Intact Number		Intact Weight		Broken Number		Broken Weight		Total Number Intact+broken	Total Weight Intact+broken
	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI		
Yakutat	654,403	545,808-772,828	152,144	127,471-170,510	512,010	432,103-597,075	143,789	122,602-166,680	1,166,422	295,933
District 16	594,598	465,351-716,840	124,860	98,939-150,262	112,638	82,188-148,605	35,039	23,600-49,970	707,236	159,899
Yakutat Total	1,249,001		277,004		624,657		178,828		1,873,658	455,832
Kodiak										
Northeast District	9,404	5,921-13,683	2,307	1,339-3,412	12,672	7,728-19,940	6,048	3,767-9,091	22,076	8,355
Shelikof District	412,477	312,151-531,298	91,600	69,853-114,774	340,815	265,838-424,070	105,574	29,444-85,174	753,292	197,174
Semidi District	2,477	1,343-3,772	1,245	637-1,957	6,734	7,263-10,185	4,755	3,930-5,549	11,211	6,000
Kodiak Total	424,358		95,152		362,221		116,377		786,579	211,529
Alaska Peninsula	16,301	9,550-22,795	2,646	1,526-3,656	17,383	9,071-27,292	4,738	2,407-7,636	33,684	7,384
Bering Sea	12,939	11,101-15,009	5,381	4,537-6,390	21,473	18,822-24,331	10,737	9,402-12,077	34,412	16,118
TOTAL	1,702,599		380,183		1,025,734		310,680		2,728,333	690,863

*Weight in pounds of unshucked scallops

Table 8. Average weight of intact and broken scallops from observer sampled discarded scallop catch during the 1996/97 fishing season.

MANAGEMENT AREA	WEIGHT[a]		
	Intact Scallops	Broken Scallops	Average
Yakutat	0.24	0.29	0.27
District 16	0.21	0.28	0.25
Yakutat Average	0.22	0.28	
Kodiak, Northeast District	0.38	0.52	0.45
Kodiak, Shelikof District	0.25	0.34	0.30
Kodiak, Semidi District	0.46	0.54	0.50
Kodiak Average	0.37	0.46	
Alaska Peninsula	0.15	0.26	0.21
Bering Sea	0.44	0.51	0.47
Overall Average	0.31	0.39	

[a]Weight in pounds.

Table 9. Scallop meat recovery by management area during the 1996/97 fishing season.

MANAGEMENT AREA	Number of Samples	PERCENT RECOVERY		
		Mean	Median	95% Confidence Interval
Yakutat	52	0.09	0.09	0.088 to 0.093
District 16	17	0.09	0.09	0.084 to 0.098
Kodiak, Northeast District	11	0.10	0.11	0.097 to 0.108
Kodiak, Shelikof District	137	0.12	0.12	0.118 to 0.122
Kodiak, Semidi District	11	0.12	0.13	0.110 to 0.131
Alaska Peninsula	13	0.11	0.11	0.108 to 0.112
Bering Sea	37	0.10	0.10	0.099 to 0.103

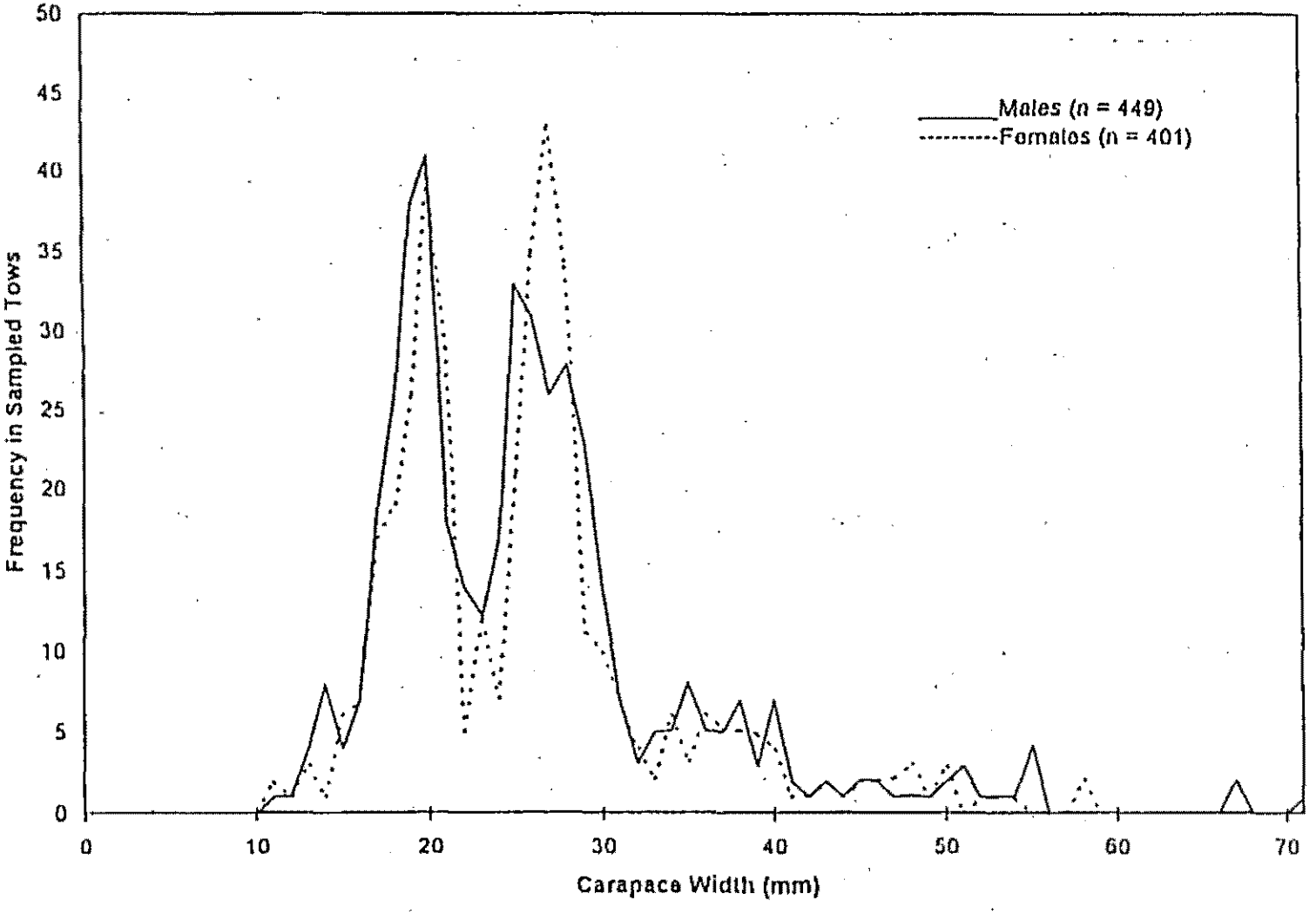


Figure 1. Tanner crab width frequency as determined from bycatch samples in the 1996/97 scallop fishery in Yakutat.

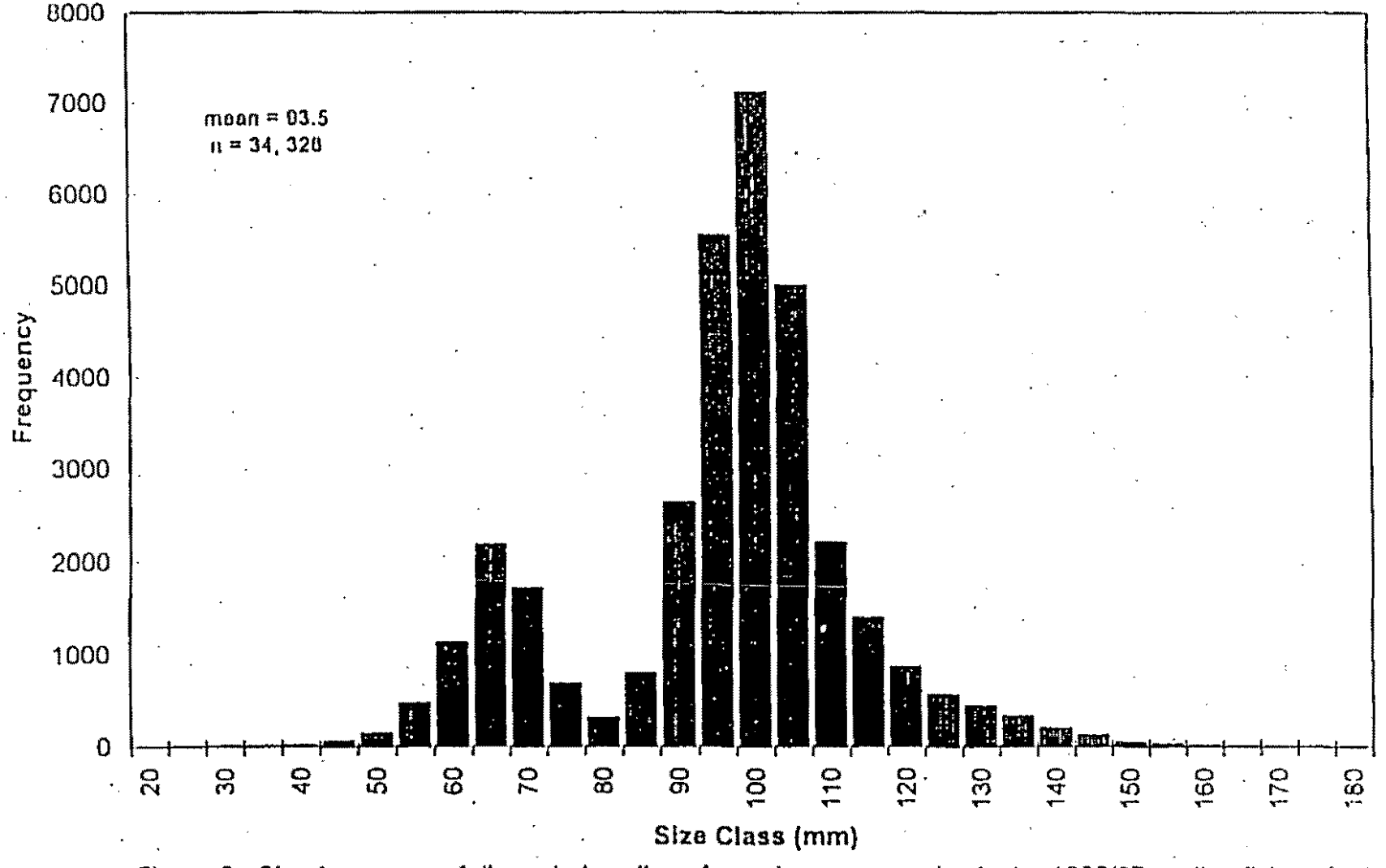


Figure 2. Size frequency of discarded scallops from observer samples in the 1996/97 scallop fishery in the Shelikof District of the Kodiak Area.

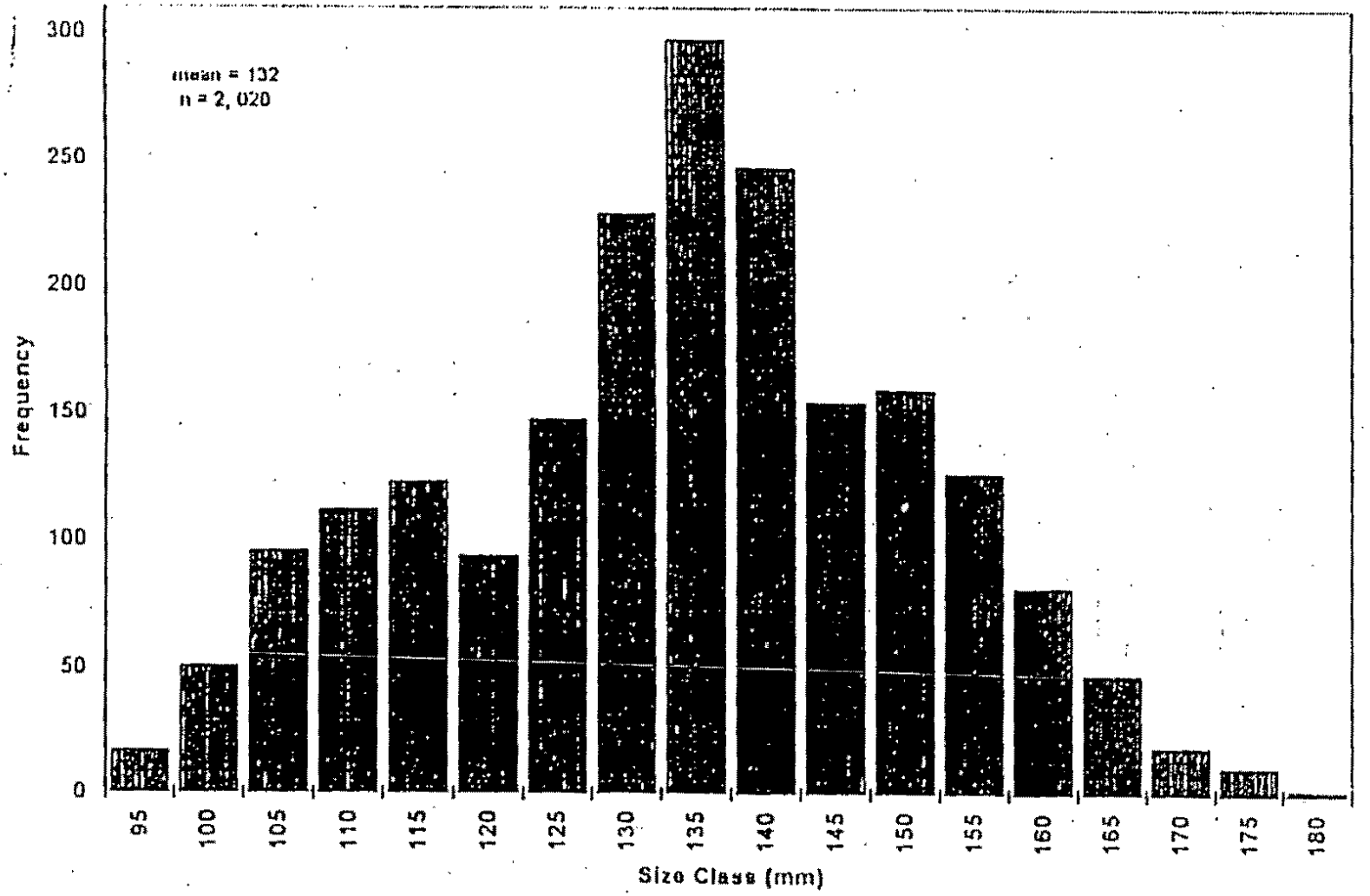


Figure 3. Size frequency of observer sampled retained scallop catch (males, females, and unknown) from the 1996/97 scallop fishery in District 16.