AGENDA D-1
FEBRUARY 2007

MEMORANDUM

TO: Council, SSC and AP Members

FROM: Chris Oliver
Executive Director

DATE: January 30, 2007

SUBJECT: Groundfish Management

ESTIMATED TIME
4 HOURS

ACTION REQUIRED

(a) Initial review of Dark Rockfish management amendment package
(b) Review summary of CIE report on rockfish (SSC only)
(c) Review discussion paper on GOA arrowtooth MRA

BACKGROUND

(a) Dark rockfish EA/RIR/IRFA

An Environmental Assessment, Regulatory Impact Review and Initial Regulatory Flexibility Analysis (EA/RIR/IRFA) has been prepared which describes the proposed amendment to remove dark rockfish (*Sebastes ciliatus*) from the GOA and BSAI groundfish FMPs. This analysis was mailed to you on January 22nd. This species is currently contained in the pelagic shelf rockfish (PSR) assemblage in the GOA and in the other rockfish complex in the BSAI. It comprises a small proportion of the total biomass in each complex, is more often found in nearshore waters, and is caught in State fisheries. Removing this species from these FMPs would turn management for this species in both State and Federal waters over to the State of Alaska.

Two actions are analyzed in this document with two alternatives for each action: Action 1 refers to the GOA groundfish FMP. Under this action there are two alternatives: Alternative 1, to continue managing dark rockfish within the larger pelagic shelf rockfish complex; and Alternative 2, to remove dark rockfish from the GOA FMP and turn over to the State of Alaska for management. Action 2 refers to the BSAI groundfish FMP. Under this action there are also two alternatives: Alternative 1, to continue managing dark rockfish within the other rockfish complex; and Alternative 2, to remove dark rockfish from the BSAI FMP and turn over to the State of Alaska for management.

There is limited impact in the Federal fishery of removing this species from either FMP. Dark rockfish comprise a small proportion of the total biomass in the GOA PSR assemblage, which is dominated by the target species, dusky rockfish. Impacts to other PSR stocks as well as other groundfish stocks are minimal due to the relatively minor contribution to the overall exploitable biomass from the dark rockfish stock. In the BSAI Dark rockfish makes up a very minor component of the total biomass in the other rockfish complex. This is not a target fishery, and retained catch is dominated by shortspine thornyhead rockfish and dusky rockfish. These two species make up the majority of the biomass in the complex.

Management of dark rockfish by the State is anticipated to be an improvement over Federal management within the PSR complex due to the State's ability to manage this stock as a single stock and on smaller management areas to protect against the potential for localized depletion. There are no anticipated impacts to marine mammals, seabirds, threatened or endangered species, habitat or the ecosystem.

This action is scheduled for initial review at this meeting. The executive summary of the analysis is attached as **Item D-1(a)(1)**. A figure which was missing from the document (Figure 3-5(e)) is attached as **Item D-1(a)(2)** and a supplemental section for inclusion in the document is attached as **Item D-1(a)(3)**.

(b) CIE Report on rockfish (SSC only)

A review of the rockfish assessments was conducted by the Center for Independent Experts (CIE) in June 2006. A summary report is attached as **Item D-1(b)(1)**. Copies of reports by individual reviewers will be distributed to the SSC, and will be included in the reference books at the back of each meeting room. Comments on the CIE recommendations by the joint Groundfish Plan Teams were provided at the October 2006 meeting **Item D-1(b)(2)**. At that time, the SSC decided to schedule its discussion of these reviews for the February 2007 meeting. A response by the NMFS Alaska Fisheries Science Center Rockfish Working Group is under **Item D-1(b)(3)**.

(c) Discussion paper on GOA arrowtooth MRA

In October, 2006, the Council moved to evaluate a proposed change to the maximum retainable allowance (MRA) for the arrowtooth flounder target fishery in the GOA. This is the only fishery in the GOA where MRAs are set at zero for all species. The MRA was initially structured this way as there was limited targeting of arrowtooth flounder and measures put in place to prevent utilizing the arrowtooth fishery as a 'ballast' for retaining catch of other species. Since then, a fishery for arrowtooth flounder has developed in the GOA, but is still limited by the restrictive MRA. A discussion paper has been prepared by NMFS staff which evaluates proposed changes to the MRA for this fishery. This paper is attached as **Item D-1(c)**. NMFS staff will be available to review this paper.

AGENDA D-1(a)(1)
FEBRUARY 2007

EXECUTIVE SUMMARY

This Environmental Assessment, Regulatory Impact Review and Initial Regulatory Flexibility Analysis describes the proposed amendment to the Gulf of Alaska Groundfish and Bering Sea Aleutian Islands Groundfish Fishery Management Plans (FMPs). This amendment proposes to remove dark rockfish (*Sebastes ciliatus*) from the GOA and BSAI groundfish FMPs. This species is currently contained in the pelagic shelf rockfish (PSR) assemblage in the GOA and in the other rockfish complex in the BSAI. It makes up a small proportion of the total biomass in each complex, is more often found in nearshore waters, and is caught in State fisheries. Removing this species from these FMPs would turn management for this species in both State and Federal waters over to the State of Alaska.

The following problem statement is proposed for this analysis:

Dark rockfish are a nearshore, shallow water species which are rarely caught in offshore, Federal waters. For management purposes they are contained within the pelagic shelf rockfish complex in the GOA, whose OFL and ABC are based primarily on the stock assessment for dusky rockfish which makes up the majority of the total exploitable biomass estimate for the PSR complex. In the BSAI dark rockfish are contained within the other rockfish complex whose biomass is largely comprised of dusky rockfish and thornyhead rockfish. As dark rockfish have now been identified as a separate species, are found in nearshore, shallow waters, and could potentially be locally overfished within the larger PSR complex TAC in the GOA, the Council should consider removing this species from the GOA groundfish FMP thereby transferring their management to the State of Alaska. For consistency in management the Council should also consider removing this species from the BSAI FMP.

Two actions are analyzed in this document with two alternatives for each action: Action 1 refers to the GOA groundfish FMP. Under this action there are two alternatives: alternative 1, to continue managing dark rockfish within the larger pelagic shelf rockfish complex; and alternative 2, to remove dark rockfish from the GOA FMP and turn over to the State of Alaska for management. Action 2 refers to the BSAI groundfish FMP. Under this action there are two alternatives: alternative 1, to continue managing dark rockfish within the other rockfish complex; and alternative 2, to remove dark rockfish from the BSAI FMP and turn over to the State of Alaska for management.

Environmental Assessment

There is limited impact in the Federal fishery of removing this species from either FMP. Dark rockfish comprise a small proportion of the total biomass in the PSR assemblage, which is dominated by the target species, dusky rockfish. Impacts to other PSR stocks as well as other groundfish stocks are minimal due to the relatively minor contribution to the overall exploitable biomass from the dark rockfish stock. Dark rockfish makes up a very minor component of the total biomass in the other rockfish complex in the BSAI. This is not a target fishery, and retained catch is dominated by shortspine thornyhead rockfish and dusky rockfish. These two species make up the majority of the biomass in the complex.

Management of dark rockfish by the State is anticipated to be an improvement over Federal management within the PSR complex due to the State's ability to manage this stock as a single stock and on smaller management areas to protect against the potential for localized depletion. There are no anticipated impacts to marine mammals, seabirds, threatened or endangered species, habitat or the ecosystem.

Regulatory Impact Review

Removal of dark rockfish from the pelagic shelf rockfish complex in the GOA could result in minor decreases in the pelagic shelf rockfish TAC, but since dark rockfish are such a small part of the stock of the complex any decline in the TAC is likely to be nominal. Removal of dark rockfish from the other rockfish complex in the BSAI will result in a minimal decrease in the TAC for this complex.

Initial Regulatory Flexibility Analysis

Transfer of management of dark rockfish to the State is likely to result in some changes in regulation of catch. The State could develop a directed fishery for dark rockfish, most likely for fixed gear vessels. Since fixed gear vessels tend to be small, it is possible that the development of such a directed fishery would have a positive impact on small entities, by increasing fishing opportunities. The IRFA in this document is preliminary until the Council selects a preferred alternative. At that point, the potential impact on affected small entities of the action will be developed further in the analysis.

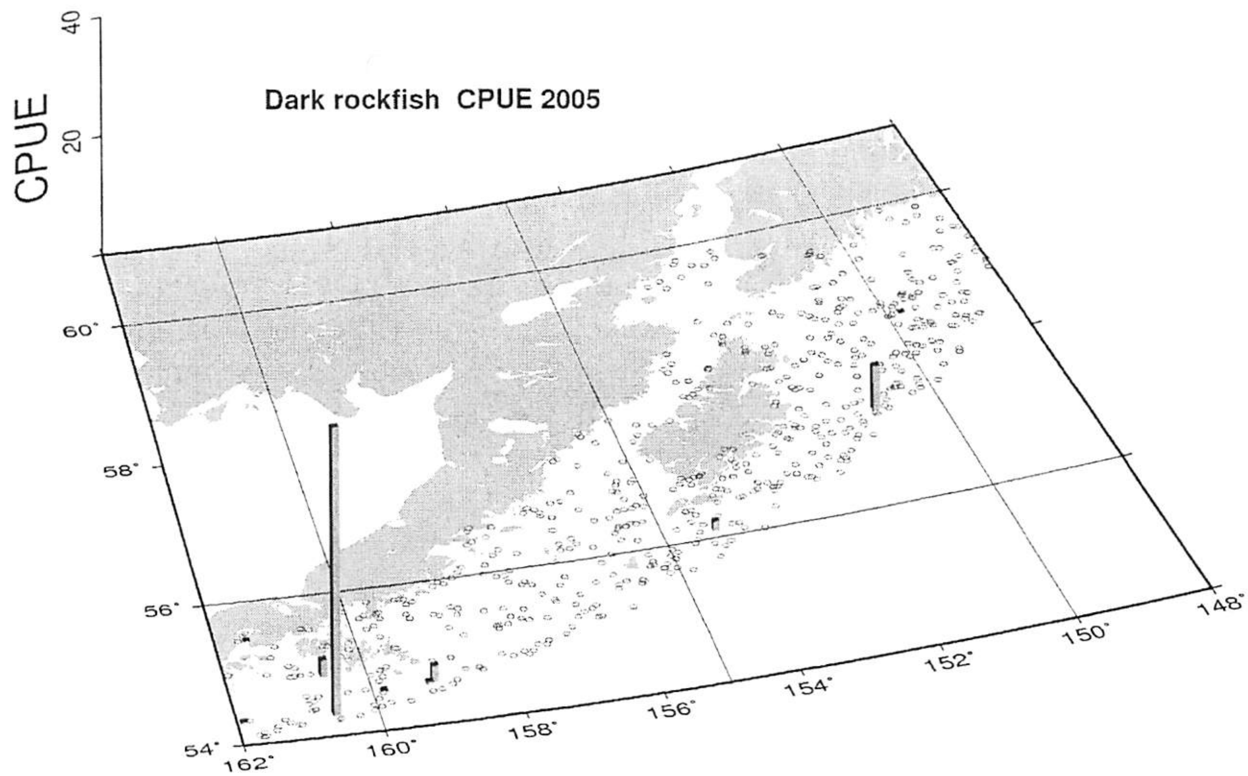

Figure 3-5(e) Dark rockfish CPUE from GOA survey (2005)

Supplemental section to be included after second paragraph under section 3.1.2.1 GOA Pelagic shelf rockfish complex:

Both widow and yellowtail rockfish species are patchily distributed and occasionally encountered in nearshore areas, shown by GOA bottom trawl survey catches of yellowtail in 1999 and of widow in 1996. These species make up a small percentage overall of the survey biomass in the PSR complex. Unlike dark rockfish, however, they are not recommended for removal to State management at this time. In contrast to dark rockfish, widow and yellowtail rockfish tend to have the bulk of their distribution in offshore areas, despite occasional high CPUE in sporadic tows nearshore throughout the survey. While these species can be found nearshore, they are not believed to be a true nearshore species as with dark rockfish and black rockfish. For example, Allen and Smith (1988) say that over their entire range the most common occurrence of yellowtail is on the outer shelf between 100 and 150m and of widow on the outer shelf between 150m and 200m. Love (2002) says yellowtails migrate into deeper water as they mature but in the more northern part of their range they are occasionally found in kelp beds. Widow rockfish are most abundant from British Columbia to northern California and yellowtail rockfish are found from about southeast Alaska to central California (Love, 2002). In the GOA, both species are likely at the northern extent of their range of distribution and have limited abundance in the areas surveyed by the bottom trawl survey (C. Lunsford, pers comm.). These species are more common in the pelagic shelf region further south, such as in British Columbia where trawl fisheries have existed historically for both species. Widow rockfish are an important component of the rockfish catch in offshore trawl fisheries in British Columbia (DFO 1999a). Yellowtail rockfish are also caught in conjunction with widow rockfish as both species tend to favor high relief bottom substrate near the edge of the continental shelf (DFO, 1999b). Commercial catches in B.C. tend to be made in depths of 100-200 meters for both species (DFO, 1999a,b).

In the GOA PSR complex, both yellowtail and widow rockfish are minor components of the overall complex biomass. Moving yellowtail and widow rockfish to State management along with dark rockfish does not seem logical given the combination of their tendency for offshore distribution as well as potentially being at the northern extent of their range of distribution in the GOA. However, both species would be likely candidates for alternative management measures such as those under consideration by the Council's non-target species initiative. The goal of non-target management is to protect incidentally-caught species from fishing effects. Management options would include prohibiting directed fishing and Maximum Retainable Allowances (MRAs). This initiative is a long-term effort under consideration by the Council. Yellowtail and widow rockfish as minor components of the PSR complex in the GOA, may be considered for these alternative management measures in the future.

References:

DFO, 1999a. Widow Rockfish. DFO Science Stock Status Report A6-01

DFO 1999b. Yellowtail Rockfish. DFO Science Stock Status Report A6-07

Allen, M. James, and Gary B. Smith. 1900. Atlas and Zoogeography of Common Fishes in the Bering Sea Northeastern Pacific. NOAA Tech. Rep. NMFS 66. 151 pp.

Love, Milton S., M.Yoklavich, and L. Thorsteinson. 2002. The rockfishes of the northeast Pacific. University of California Press, Ltd. Los Angeles, CA. 405pp.

Center for Independent Experts (CIE) summary report for the 2006 Alaska rockfish review

This report presents the summary views of Drs. Patrick Cordue, Cynthia Jones, and Robert Mohn on each of three terms of reference, as the reviewers were required to generate under the review statement of work. As such, the report only collates the summary views to generate a concise set of summaries, and it does not otherwise alter the reviewers' text. For a more detailed discussion on each term, the reader should refer to the reviewers' full reports.

a. A statement of the strengths and weaknesses of the input data and analytical approach used to assess stock condition and stock status and methods used for addressing uncertainty in the assessment.

Dr. Patrick Cordue

The stock assessment methods used in the rockfish assessments are generally appropriate given the available data.

Strengths:

- The simple stock hypotheses are appropriate given the lack of detailed information.
- Good ageing data are available for estimating growth parameters.
- There is a wealth of trawl survey data.
- There is a strong observer program.
- Assumed population dynamics are consistent with current knowledge.
- Estimation methods are adequate.
- Modeling of uncertainty is adequate.

Weaknesses:

- Stock hypotheses are not well founded as little is known about stock structure.
- Estimation of M is often done using the oldest otolith ever read – better methods are available.
- The trawl surveys have undergone some changes in standardization of gear setup and operation.
- Trawl survey indices take no account of the proportion of untrawlable ground in each stratum (a particular problem for the GOA survey).
- Little is known about migration and distribution patterns associated with mating and parturition – so assumed population dynamics are necessarily simple.
- More sensitivity tests could be done and estimation methods could be refined.

Dr. Cynthia Jones

The quality of input data and the appropriateness of analytical approaches have been reviewed extensively in previous workshops and reports. Nonetheless, the quality of the harvest recommendations rely on good data and methods and additional review can be justified. For the most part, the input data appears to be reliable, although some data collection can be fine-tuned further. The methods used for ageing are well respected and should produce very reliable data. The methods to measure maturity are also standard, but would benefit from surveys timed to evaluate maturity closer to parturition. Estimation of M is notoriously difficult and the methods used are commonplace and accepted, built on reliable ageing. The only suggestion that I offer is that age-distribution be winsorized to test the effects of unusually old fish on "rule of thumb" estimates of M. I am more concerned about the estimates of biomass obtained from the fishery-independent trawl survey because of how density is integrated over untrawlable ground. Dr. Patrick Cordue developed bias estimators from expected values and these showed that there is potential for bias as the survey biomass is now estimated. It is advisable to do a complete review of the trawl-biomass estimators in a workshop or review format where Dr. Cordue's calculations can be studied further.

Dr. Robert Mohn

Although none were explicitly reviewed, the assessments appear to estimate stock status to usual assessment standards. Input and supporting data have been handled with care, especially recently, as is evidenced by the Observer coverage. The GOA and BSAI stocks are analysed with similar but not identical formulations. Stock-recruit relationships are not estimated. Trials leading to standardization should be developed. More attention should be given to the formulation of informative priors and the balance of the likelihood function. The uncertainty is not handled quite so well and more care should be expended in improving this aspect of the generation of biological advice to management.

b. A statement of the strengths and weaknesses of the simulation models, and the analytical approaches used in estimating future harvest levels.

Dr. Patrick Cordue

The simulation or projection model is used to achieve standardized projection results for all stock assessments (seven standard scenarios are done for each assessment run).

Strengths:

- Standard set of scenarios available for each run in each stock assessment.

- Two of the scenarios provide output for determining stock status according to the current definition of MSST ("overfished" and "approaching overfished").
- Recruitment variability is incorporated into the projections.

Weaknesses:

- Only recruitment variability is incorporated into the projections despite parameter uncertainty also being available for some assessments (i.e., MCMC runs).
- The population dynamics (e.g., annual cycle) of each stock assessment model must be implemented in the projection model to avoid a mis-match of assumptions (this is a future implementation issue – current dynamics are identical).

Dr. Cynthia Jones

The projection model appears to be providing reasonable evaluations of the impact of harvest targets on long-term sustainable rockfish populations. There is some fine tuning that can improve the projection model, such as estimating parameters within the model rather than providing external-fixed parameters (e.g. M). Moreover, when we were presented with preliminary results based on such fine tuning the new results differed insubstantially.

Dr. Robert Mohn

Projections are produced by separate programs from the assessment model and only uncertainty in the recruitment process is carried into them. Uncertainty in the starting standing stock for the projections as well as key parameters should be carried through to the projection phase. In Tier 3 stocks this could be done by capturing the MCMC replicates or by parametrically approximating key distributions for bootstrapping.

c. An evaluation of the level of conservatism required to sustain Alaskan rockfish fisheries (e.g. what is the optimal spawning biomass per recruit level? Are additional spatial management measures required?).

Dr. Patrick Cordue

The current harvest strategies for Alaskan rockfish are not fully defined since several subjective choices are involved in setting TACs and, for structural reasons, the subsequent catches will often not reach the TAC. Nevertheless, there are identifiable strengths and weaknesses in the current management system:

Strengths:

- There are multiple and cumulative layers of conservatism in the tier system which will conserve rockfish stocks at high levels of biomass.
- The tier system is comprehensive and familiar.
- Tier 1 is supported by sound research.

Weaknesses:

- The multiple layers of conservatism may result in unnecessarily low yields for groundfish stocks in general.
- Tiers 2-6 are not supported by substantive research.
- Tiers 4-5 require a reliable point estimate of B – for rockfish, such estimates are only available in tier 3 – the assumption that *q* is known *a priori* for a trawl survey is untenable.
- Scientists are required to act as managers since their ABC recommendations limit the level at which the TAC can be set.

With regard to the specific questions in the TOR:

- Current harvest strategies favor conservation over use. If the fishing industry is happy with this circumstance then the strategies do provide an appropriate level of conservatism.
- At the next opportunity the tier structure should be simplified and based on the availability of reliable abundance indices.
- In the long term the tier structure should be tailored to modern stock assessment results (between run and within run uncertainty for multiple runs).
- Current spatial management appears appropriate. Finer scale management is ill-advised until much more is known about stock structure, migration patterns associated with mating and parturition, and the location and stability of any important sources of production.

Dr. Cynthia Jones

Harvest control strategies are best judged in against a statement of management objectives. Without having one for Alaskan rockfish, one can look to the potential results from the stated harvest control rules to comment on their adequacy. For most of the tiers, control rules are quite precautionary when put into practice. The Optimum Yield (OY) was been set conservatively to a level appropriate for the relatively unproductive environment of the 1970's. Next the ABC is set so that it is always below OY. Further TAC is set below ABC for rockfish and in most instances recently catch is well below the TAC. It is not surprising that several species have exhibited biomass increases –where reliable measures of biomass are known as is the case for rockfish. Hence even though there is some evidence to support a harvest control of $F_{50\%}$ or greater for West Coast rockfish, Alaskan stocks appear to be more resilient because of a more productive environment, stock differences, or the built in precautions of the harvest control rules in this region.

Dr. Robert Mohn

The harvest strategies are cast in a 6 tier system which range from complete statistical models of the stock and reference points (Tier 1) down to stocks for which there is essentially no data (Tier 6). The rockfish stocks in this review were all Tier 3 or 5. The harvest control rules for the Tier 3, and above, stocks have a constant fishing mortality for stocks that are above Bmsy or proxy with a linearly decreasing ramp as biomass falls, a commonly accepted form. Although setting Bmsy as a limit rather than a target is fairly conservative. Tiers 4-6 do not have a biomass reference point. The tier system is a qualitative attempt to incorporate precautionary considerations as the amount of information decreases. Generation of advice within AFSC framework requires the assessment authors and the Plan Team (an internal review panel) to recommend a buffer between the biologically defined maximum ABC and the advised ABC, apparently using subjective criteria. This sort of 'precautionary science' is not permitted in most forums for the generation of harvest advice with which I am familiar. A move to more quantitative and objective linkages between uncertainty and precautionary advice should be developed.

Excerpt from 9/26/06 Joint Groundfish Plan Team meeting

CIE Review of rockfish assessments

A review of the rockfish assessments was conducted by the Center for Independent Experts over the summer. Reports from the CIE findings were made available for the Plan Team meeting. Jon Heifetz provided an overview of the CIE findings with respect to strengths and weaknesses of the rockfish assessments.

The Teams discussed some of the criticisms put forward by CIE reviewers. It was noted that the AFSC will likely produce a response to the CIE review. In the short-term many comments may be addressed in the stock assessments produced for November. The issue of exceeding area-specific TACs for some rockfish in the GOA (but below the Gulfwide OFL) was presented to the reviewers yet comments or resolutions were not provided in their reports. The Team noted that it would be useful for to highlight this omission so that potential problems can be averted.

The Teams discussed the scope of work and what information was provided prior to the meeting. A website was provided for the distribution of background materials to the reviewers in advance of the meeting (ftp://ftp.afsc.noaa.gov/afsc/public/rockfish/rfwg.html). Presentations were made by AFSC scientists over the course of the review. It was noted that while the statement of work could have potentially been more precise, that there is obviously a great deal of information and background necessary for adequate review of rockfish assessments. Team members discussed that the overall breadth of the review and complicated the focus. Phil Rigby commented that the charge for the CIE to review the degree of conservatism inherent in rockfish assessments was unusual, but was designed to address concerns about being sufficiently precautionary in managing rockfish.

The Teams discussed the CIE review in relation to the Goodman report and the current instructions to the stock assessment authors. The Teams encourage the authors to address comments as appropriate to the stock assessments. The Team felt that many of the comments were general to trawl survey and stock assessment and could be equally applicable to most groundfish species. Research in these aspects is encouraged and has been previously noted in research priorities. Phil Rigby noted that the AFSC has discussed evaluating the trawl survey protocol (and problems with untrawlable grounds) and its implication for rockfish species in 2007. Jim Ianelli commented that consistency in applying catchability estimates for rockfish is necessary and should be included in any further review of this issue. While potential funding may limit the ability to conduct extensive workshops or review of this issue, an estimate of survey trawlable grounds would represent a first step and could potentially be done with some of the available data. The Team supported a workshop to analyze untrawlable grounds and review potential solutions to this problem.

The Teams commented on some specific points, including natural mortality estimates. The Teams recommend that some guidelines be prepared for consistent treatment of the maximum age used in computing these estimates. Further evaluation of stock structure is being conducted already by stock assessment authors and will continue. The Teams discussed the issues noted by the CIE with respect to the link with assessment results and quota setting and the potential conflict in establishing bounded TACs in the assessment. It was noted that this is not an assessment issue but rather a policy issue for the Council. The Teams commented that this is representative of the North Pacific quota setting system rather than something that is specifically related to rockfish stock assessments.

Draft Response of Rockfish Working Group to June, 2006, Center of Independent Experts Review of Alaskan Rockfish Harvest Strategies and Stock Assessment Methods.

Paul Spencer, Dana Hanselman, Kalei Shotwell, Chris Lunsford, Mark Zimmermann, Michael Martin, Chris Rooper

Alaska Fisheries Science Center

Table of Contents

Introduction

In June, 2006, the Alaska Fisheries Science Center (AFSC) arranged for a review of Alaska rockfish harvest strategies and stock assessment methods by the Center of Independent Experts (CIE). The CIE is a group of independent experts that serves to provide peer review of NOAA science programs and scientific products, and is managed cooperatively through the University of Miami and NOAA. The review panel consisted of Dr. Patrick Cordue (fisheries consultant, New Zealand), Dr. Bob Mohn (Bedford Institute of Oceanography) and Dr. Cynthia Jones (Old Dominion University), and each panelist produced a separate review without collaboration with other panelists or NMFS staff.

The review was motivated by the increased attention rockfish stock assessment and management has received in the north Pacific, and each member of the review panel was asked to provide the following items:

1. A statement of the strengths and weaknesses of the input data and analytical approach used to assess stock condition and stock status and methods used for addressing uncertainty in the assessment.
2. A statement of the strengths and weaknesses of the simulation models, and the analytical approaches used in estimating future harvest levels.
3. An analysis of current harvest strategies. Specifically do they provide appropriate levels of conservation for Alaskan rockfish fisheries? What harvest control rules might be more appropriate? Are additional spatial management measures required?

The purpose of this document is to characterize the major comments from the review panel, and describe ongoing and planned research activities to address selected review comments. In particular, two comments are addressed in some greater detail: 1) the effect that untrawlable habitat may have on trawl survey biomass estimates; and 2) potential biases in estimation of natural mortality rates. AFSC is in the initial stages of planning research to respond to the review comments, and this draft is intended to solicit SSC input on CIE comments and planned research activities.

Summary of Comments from the CIE Panel

The comments from the review panel were wide-ranging, corresponding to the broad terms of reference listed above. Regarding the use of our standard projection model for estimating future harvest levels, all three reviewers recommended including parameter uncertainty in addition to recruitment variability. Dr. Cordue also recommended, as a matter of efficiency, including the projection within the stock assessment model rather than as a separate program. Strengths of the projection model identified by Dr. Cordue included the standardized set of scenarios, incorporation of recruitment variability, and two scenarios which allow determination of stock status relative to minimum stock size threshold.

Regarding evaluation of current harvest strategies, all reviewers noted the multiple layers of conservation inherent in the NPFMC system, in which ABC is lower that OFL, TAC lower than ABC, etc. All reviewers concluded that the current Tier system provided sufficient conservation for rockfish, and a move to policies more conservative than $F_{40\%}$ were not warranted based upon the available data. All reviewers also took issue with the concept of an "author's recommended ABC" and suggested that this, in effect, allows the stock analyst to recommend harvest policy and thus blurs the line between science and policy. Dr. Cordue, in particular, recommended that the buffer between F_{abc} and F_{ofl} be prescribed based on stock assessment uncertainty, this removing subjective recommendation of F_{abc}.

The comments from the CIE panel on items 2 and 3 generally pertain to all Alaska groundfish, and in some cases involve policy issues beyond the scope of the RWG. The major task of this response is focused on the specific comments and recommendations regarding the rockfish assessments their input data and assumptions, which formed the bulk of the CIE reviews.

The reviewers commented favorably on the quality and quantity of the input data, noting that the relative high level of observer coverage and high quality of production age reading of otoliths. Several of the recommendations referred to stock assessment model improvements that could be made rather quickly, such as 1) using deviations from the mean rather than the median in the survey likelihood equation; 2) exploring alternative formulations for modeling initial numbers at age; 3) recommendations for assessing the standard deviations of log recruits; 4) calculating the standardized residuals for time series; 5) exploring biomass trajectories relative to B_0 or $B_{100\%}$, and 6) in general, making more sensitivity runs.

Two issues all reviewers identified were the estimation of natural mortality (M) and the degree to which the presence of untrawlable grounds may affect our survey biomass estimates. For some stocks, such as POP, estimates of M were obtained from catch curve analysis from unexploited stocks, whereas for other stocks estimates of M were based upon observations of long-lived fish from fishery or survey data. In the latter case, the use of unusually old fish, which may not be representative of the population, to compute M may produce biased results, and the reviewers recommended a "winsorized" estimate of maximum age in which the upper tail of the distribution is truncated.

The untrawlable grounds issue stems from the fact that our trawl surveys are, by definition, conducted on trawlable grounds, but the observed trawl densities of fish biomass are expanded to both trawlable and untrawlable grounds. Thus, if the densities differ between the trawlable and untrawlable grounds, then the density observed from the trawl samples would not be expected to be representative of the population density. Specific recommendations on this issue are to: 1) analyze the existing survey indices with respect to the effect that untrawlable ground may have on the estimated biomass; and 2) develop informative priors on the trawl survey catchability (q). In fact, the untrawlable ground issue motivated Dr. Cordue to recommend evaluation of the utility of using fishery catch-per-unit effort (CPUE) indices in stock assessments.

In the 2006 BSAI POP assessment, several changes were made in response to CIE comments. For example, the formulation for modeling the numbers at age in the first year was changed, the sensitivity of the model to inclusion/exclusion of a CPUE index was evaluated, standardized residuals were computed, and time series of spawner biomass was expressed as proportion of B_0. A preliminary response to the issue of model-independent estimates of M was to estimate this parameter within the model (albeit with a tight prior). Similarly, the survey catchability was not assumed to be 1, but estimated within the model.

Fully addressing the issues of estimation of M and the effect of untrawlable grounds will require additional research. The remainder of this document presents current work on these topics, and goals for future research. The discussion of estimation of M presents the sources for our current estimates, and potential application of alternative estimation methods to our data. The discussion of the effect of untrawlable grounds presents some simulation modeling designed to help characterize the expected extent of the problem, current work with existing data, and plans for future modeling and field research.

Research on the Effect of Untrawlable Grounds on Trawl Survey Estimates

Simulation Modeling of Estimation of Survey Catchability
(Dana Hanselman)

The issue of untrawlable grounds could potentially lead to situations where the survey biomass index is not proportional to stock biomass and/or the survey q is not 1.0. Three simulation modeling exercises, conducted by Dr. Dana Hanselman of the Auke Bay Laboratory, provide information on how well standard stock assessment models can estimate q under a variety of situations.

In the first experiment, a population similar to the life history and catch history of Gulf of Alaska (GOA) Pacific ocean perch (POP) was simulated. Selectivity and maturity were modeled with logistic functions to values similar to those estimated in the 2005 GOA POP assessment. The table below shows the parameters of the simulated population, where *F_early* is the fishing mortality for first 10 years, *F_late* the fishing mortality for rest of simulation, $m_{a50\%}$ the age of 50% maturity, $s_{a50\%}$ the age at 50% selection, and survey CVs is the range of precision assumed for survey biomass estimates.

Parameter	M	*F_early*	*F_late*	$m_{a50\%}$	$s_{a50\%}$ (Survey)	$s_{a50\%}$ (Fishery)
	0.06	0.30	0.06	7	9	11

The simulated population was then sampled under the same conditions of the GOA POP population (triennial, then biennial biomass and ages from 1984-2005, and fishery ages from 1998-2004). In order to test the ability of the GOA POP assessment model to accurately estimate catchability, biomass and other parameters, given age data inputs, five levels of q were used to scale the simulated survey biomass to the simulated true biomass. Survey biomass estimates were assigned four different CV levels (5%, 10%, 25%, and 50%) to test importance of survey precision. This resulted in twenty simulated trajectories for the assessment to see the range of effect.

The results indicate that in the absence of other errors in the model, survey error had little effect on the ability of the model to estimate the appropriate catchability coefficient (Figure 1). When the survey biomass estimates ranged from 1/3rd to 3 times the true biomass, the model was able to gain sufficient information from the age and catch data to estimate close to the correct value of catchability. In the current configuration of the GOA POP model, there is a prior distribution placed on survey catchability with a CV of 45%. This causes some influence on the resulting biomass trajectories, but in general the model still performs well in terms of estimating the true biomass trajectory. These results indicate that if the time series of the survey biomass estimates all have the same q, then the model can still estimate the correct biomass trajectory given that the other data in the assessment model is of good quality.

The second experiment examines the stock assessment output when survey CPUE is used as an index of abundance instead of the estimate of absolute survey population biomass. Estimation of absolute survey abundance requires expansion of the CPUE density to area, and if the expansion is made to untrawlable areas which are different in density than the trawlable areas, then this will bias biomass estimates. Instead, here we deconstruct the actual survey biomass estimates, and simply use the grand mean of the strata CPUE means expanded by an arbitrary scalar to reach a similar order of magnitude as the original estimates. When the biomass index is scaled to the appropriate order of magnitude (100*MeanCPUEs), models perform similarly for both the index and the absolute biomass (Figure 2). The estimate of catchability changes from 1.88 to 0.76 to compensate for the change in the biomass index used. When the index is scaled to an order of magnitude below the absolute biomass estimates (10*MeanCPUEs), the prior distribution placed on catchability does not allow the estimate of catchability to change enough to compensate for the large difference between the index and the standard survey biomass estimates (Figure 2).

This simplistic simulation showed that if we consider the mean of stratum CPUEs as an index, the trend remains intact and biomass is estimated to be very close to the model using standard survey estimates. This is somewhat surprising because the mean CPUEs are not a simple random sample of the survey area. Also, the standard survey estimates can be considered a weighted sum in which the mean CPUE in each stratum is multiplied by the stratum area, which differs between strata. In contrast, a simple mean of strata CPUE gives equal weight to all strata regardless of strata size. This simulation suggests, in this case, that much of the information the model uses to estimate total biomass is contained within the catch, age, and length data. We also showed that if the numerical values for the biomass index are within an order of magnitude, the model can compensate with its estimate of catchability. However, if a prior distribution for catchability is specified and the index is far from the correct values, then the prior distribution constrains the model from estimating the same trajectory.

A third simulation examines the potential effect of density-dependent movement from trawlable habitat to untrawlable habitat. For fish that have strong habitat preferences, at low stock sizes the expected ratio of densities in the preferred habitat to the non-preferred habitat is going to be the highest. At high stock sizes, the high density of fish in the preferred habitat will diminish its suitability to the point where the population will expand into the non-preferred habitat, and the expected ratio of density in preferred to non-preferred habitat will become smaller. Assuming either a positive or negative correlation between preferred habitat and trawlable grounds, then changes in the proportion of the population on preferable habitat would be expected to affect the survey biomass estimates.

We investigated this potential effect by simulating survey biomass estimates that include this effect with a range of magnitudes; it is assumed that at average stock size q is 1, but as the population density increases or decreases the fish move into or out of untrawlable grounds and q changes in a linear manner with density (Figure 3). We used 47 different linear relationships of q to overall population density (23 increasing, 23 decreasing, and 1 status quo). Assuming that the observed survey biomass estimates are a linear function of true biomass, we then multiply these curves into the observed survey biomass estimates for GOA POP (Figure 4) in order to produce time series of survey estimates that reflect a time-varying q. Note that at the medium biomass estimates, little variability occurs, but for the small and large values, more variability occurs. We then run these series of survey biomass estimates (with the same observed CV as the original survey biomass estimates) through the GOA POP model, while continuing to use the other biological data as is. We then look at resultant biomass trajectories compared to the status quo, and changes in likelihood of the fit to the other data sources.

This simulation revealed that recent biomass estimates from the stock assessment are somewhat sensitive to the effect of a time-varying q that is a function of overall stock density. When we compare the fit of the model to the data under different scenarios, the 2005 stock assessment fit to the data is in the middle of the simulation runs in terms of quality of fit (Figure 5). The set of biomass estimates that the resulted in the best model fit is indicated as the thick dashed red line in Figure 5; the model fit the catch, age and length composition data better with these survey biomass estimates. Given the assumptions above, this result suggests that the current data are consistent with a scenario in which survey q is linearly related to stock abundance. This situation may arise if the distribution of fish on trawlable and untrawlable grounds is density dependent, which could occur if untrawlable areas had relative high densities of fish during earlier low abundance years and the large increases in overall abundance indicated by the actual survey were partially caused by increased density on trawlable grounds.

Simulation Modeling of Survey Biomass Estimates
(Paul Spencer)

In contrast to the work above focusing on the ability of assessment models to estimate q, in this section we conduct simulations that model the trawl sampling and estimation procedures under a variety of situations. The CIE review of Dr. Patrick Cordue includes equations for the expected value of the ratio of the area-swept biomass estimate to actual biomass when stock densities differs between the trawlable and untrawlable grounds, and these equations form the basis of this simulation. In particular, two questions are of interest:

1) In what cases is the estimate of biomass a good index of the true biomass, and in what cases is the estimate not a good index of true biomass?

2) What information is needed to correct survey biomass estimates?

The simulation model was written in the R programming language, and consists of two separate functions to: 1) generate densities of a fish population, distributed across various strata and grids within strata; and 2) simulate a trawl sample from this population and estimate stock biomass. The details of these two processes are presented below; the notation is consistent with that used in the Cordue CIE review.

Generation of population numbers

Simulated populations are generated for 10 years, and in each year the population is distributed across 60 strata. Each stratum contains a number of grids which represent potential sampling units; the grid area is constant across strata and a variable number of grids between strata represent variable strata size. Within each grid, a proportion of trawlable area is obtained by sampling from uniform distribution bounded by 0 and 1.

The average density on the untrawlable grounds in strata i, grid j, and year y ($e_{i,j,y}$) is drawn from a lognormal distribution with mean e_i and coefficient of variation (CV) of σ_γ

$$e_{i,j,y} = e_i \exp^{\sigma_\gamma \gamma_j - \sigma_\gamma^2/2} z_y \tag{1}$$

where γ is a random normal variable with standard deviation σ_γ and z_y allows for temporal changes in e_i. Similarly, average density on the trawlable grounds in stratum i, grid j, and year y ($d_{i,j,y}$) is drawn from a lognormal distribution with CV of σ_ϵ and mean d_i, which is defined as $d_i = \alpha_{i,y}\, e_i$

$$d_{i,j,y} = \alpha_{i,y} e_i \exp^{\sigma_\varepsilon \varepsilon_j - \sigma_\varepsilon^2/2} z_y \tag{2}$$

where ϵ is a random normal variable with standard deviation σ_ϵ. The term $\alpha_{i,y}$ is the ratio of the expected value of density in trawlable ground to the expected value of density in untrawlable ground for a given stratum and year. For simplicity, e_i was kept constant across strata.

Temporal changes in $\alpha_{i,y}$ are modeled as

$$\alpha_{i,y} = \alpha_{i,1} + (y-1) * \Delta_\alpha \tag{3}$$

where Δ_α is the annual change in α. The scalar $\alpha_{i,y}$ was kept constant between strata, although the model can used to examine situations where $\alpha_{i,y}$ may be larger in high density strata. Positive values of Δ_α, with e_i constant, increases both the total biomass and the proportion of biomass in trawlable grounds; negative values if Δ_α have the opposite effect.

For a given year, the total biomass for a given stratum i is

$$B_i = a \sum_i t_{i,j} d_{i,j} + (1 - t_{i,j}) e_{i,j} \tag{4}$$

where a is the grid area and $t_{i,j}$ is the proportion of trawlable habitat in grid j. The total stock biomass, B, is the sum of biomass from all strata divided by an areal availability term (w)

$$B = \frac{\sum_i B_i}{w} \qquad (5)$$

Sampling from a population

Sampling from the simulated population requires the following steps: 1) designating each grid within a stratum as "trawlable" or "untrawlable"; 2) determining the number of samples to be taken from a stratum, and randomly selected trawlable grids for trawl locations (with one trawl per grid); 3) estimating average catch rate for all trawls within the stratum; and 4) estimating the stratum biomass by multiplying the average catch rate by the stratum area.

Each grid is designated as "trawlable" if the proportion of trawlable ground is greater than a critical proportion, chosen here to be 25%. Note that the designation of untrawlable does not imply that there is no trawlable habitat within the grid, but rather that the trawlable habitat does not occur in a contiguous area large enough for a standard survey trawl.

The number of samples taken from each stratum (n) is the product of a stratum sampling rate multiplied by the number of grids within the stratum. For simplicity, a constant sampling rate of 0.2 is assumed, although sampling rates that vary in proportion to the true biomass could easily be used. This would affect the variance of the biomass estimates (not considered here), and remains an important item for future work.

For a given sampled grid j, the catch rate for each tow is modeled as

$$c_j = uvd_j \exp^{\sigma_\eta \eta_j - \sigma_\eta^2/2} \qquad (6)$$

where v is the average vertical availability (the ratio of biomass in front of the net before horizontal herding to biomass caught by the net), u is average vulnerability (the average proportion of the biomass in the water column which is in front of the net after vertical herding), d_j is the average density of the trawlable ground in the sampled grid j, and η is an error term with mean zero and standard deviation σ_η. The stratum mean catch rate is the mean of the c_j over the n sampled trawlable grids:

$$\bar{c}_i = \frac{\sum_{j=1}^{n} c_{i,j}}{n} = \frac{\sum_{j=1}^{n} uvd_{i,j} \exp^{\sigma_\eta \eta_j - \sigma_\eta^2/2}}{n} \qquad (7)$$

and the survey biomass estimate for the stratum (Y_i) is

$$Y_i = m_i a \bar{c}_i \qquad (8)$$

where m_i is the number of grids for stratum i. The expected value of Y_i is

$$E(Y_i) = m_i auvE(d_i) = m_i auv\overline{d_i} \quad (9)$$

where $\bar{d}_i$ is the average taken over all trawlable grids.

It is desired to have the expected value of Y_i proportional to stock biomass, which is true if $\bar{d}_i$ is an unbiased estimate of stratum density. Because samples are only taken on the trawlable grounds, this is true only if the average densities on the trawlable and untrawlable grounds are equal. In the case where these densities are unequal, a corrected estimate of density can be made by multiplying the density terms in Eqs. 7 and 9 by the correction term

$$\bar{t}_i + \left(\frac{1-\bar{t}_i}{\alpha_i}\right) \quad (10)$$

where $\bar{t}_i$ is the average proportion of trawlable ground over all grids, and α_i is the ratio of expected densities between the trawlable grounds to the untrawlable grounds. These substitutions yield a corrected stratum survey biomass estimate $Y_{c,i}$ and the expected value of corrected survey biomass estimate $E(Y_{c,i})$. Summation over all strata produces overall survey estimates of Y, Y_c, $E(Y)$, and $E(Y_c)$.

In order to examine the general properties of this sampling problem, a number of simplifying assumptions are made and the results below focus on the expected values of the estimated survey biomass. First, it is assumed that there is no random variation in catch rates (σ_η =0), and that a constant sampling rate is applied to all strata. Second, the expected value of density in untrawlable habitat is constant for all strata, and a constant α is assumed across all strata within a given year (implying a constant expected value of density in trawlable habitat). The α for year 1 was set to 1.5, and the α for future years may differ depending on Δ_α For each of the five cases below, a time series of population densities by strata and grid were produced; the coefficients of variation σ_γ and σ_ϵ were set to 0.25 to produce variation in densities between grids. For each case, plots of q, defined here as the ratios of $E(Y)/B$ and $E(Y_c)/B$, are used to assess the extent to which the expected survey biomass estimates are proportional to true biomass.

Case 1) Expected density in trawlable grounds increases over time, expected densities in untrawlable grounds is constant (Δ_α = 1). This has the effect of increasing the proportion of the stock in trawlable grounds.

The plot of true survey biomass and ratios $E(Y)/B$ and $E(Y_c)/B$ are shown in Figure 6. The increased proportion of the stock in the trawlable ground means that portion of the stock sampled by the survey has systematically increased over time, thus leading to an increase in the expected $E(Y)/B$. In contrast, the corrected $E(Y_c)$ is nearly equal to B, producing a time series of $E(Y_c)/B$ that is nearly 1; it will be seen that the corrected $E(Y_c)$ provided unbiased estimates of B in all cases examined.

Case 2) Expected density in trawlable grounds decreases over time, expected densities in untrawlable grounds is constant (Δ_α=-0.1). Has the effect of decreasing the proportion of the stock in trawlable grounds.

This is the opposite of Case 1, and the decreased proportion of the stock in the trawlable ground means that portion of the stock sampled by the survey has systematically decreased over time, thus leading to a decrease in the expected $E(Y)/B$ (Figure 7).

Case 3) Expected densities in trawlable and untrawlable grounds remains unchanged over time (Δ_{α}=0.0).

In Case 3, the total biomass and the proportion in the trawlable grounds remain relatively constant over time. The ratios $E(Y)/B$ and $E(Y_c)/B$ are both constant over time, but because of the expansion of the observed trawl densities from the trawlable grounds to the untrawlable grounds, the uncorrected $E(Y)/B$ is different from 1 (Figure 8).

Case 4) Expected densities in all areas increases over time (Δ_{α}=0.0, z_y =(1,2,...,10)).

In Case 4, the stock biomass is increasing but the proportion in the trawlable grounds remains constant. Because the stock has not changed the relative difference in density between the trawlable and trawlable grounds over time, the ratios $E(Y)/B$ and $E(Y_c)/B$ remain constant, although, as before, the uncorrected $E(Y)/B$ is not 1 (Figure 9).

Case 5) Expected densities in all areas decreases over time (Δ_{α}=0.0, z_y =(1,0.9,...,0.1)).

Case 5 is identical to Case 4 expect that the trend in biomass is decreasing, and the results are identical (Figure 10).

Results and Conclusions

A critical feature of our assessments is that the survey biomass estimates track the true biomass in a consistent manner, and this simple analysis indicates that this would be expected to be true provided that temporal trends have not occurred in the proportion of the stock in trawlable grounds (or in other factors that influence catchability). Thus, age-structured assessments in which survey q is estimated and not fixed at one should provide reasonable results, provided that incorrect Bayesian prior distributions on q do not produce erroneous parameter estimates. Nonetheless, the survey biomass estimates are intended to provide unbiased estimates of stock size, and it is of interest to get correct estimates of survey biomass. This is especially true for stocks in Tiers 4-5, in which the survey estimates are taken as the true biomass, not an index.

This analysis was deliberately kept simple in order to examine the general properties of the problem of untrawlable grounds in our trawl surveys, and the intent is to use the model framework to conduct more realistic simulations. For example, in the analysis above the expected densities differ only between trawlable areas and untrawlable areas, and do not differ by strata. In patchily-distributed rockfish populations, one would expect some strata to have very high densities, and some specific grids to have very large densities. Additionally, the work above focused on expected values to illustrate general properties, but how variable would the results be when we use sample estimates of $\bar{t}$ and α instead of their expected values? Finally, consultation with trawl survey scientists may provide information of trawl-to trawl variability in specific parameters such as vulnerability and vertical availability, and whether these parameters may differ between strata and/or habitat types. The model is written in a generalized manner to allow evaluation of each of these questions.

The results above indicated that the information needed to correct the survey biomass estimates are the proportion of untrawlable grounds and the density of fish in untrawlable grounds. The following section describes a number of current and future projects involving AFSC-RACE scientists focused on describing the extent in untrawlable grounds in the Gulf of Alaska survey area.

Field Research on Untrawlable Grounds in the Gulf of Alaska
(Michael Martin, Chris Rooper, and Mark Zimmermann)

Accurate assessment of commercial groundfish stocks depend on timely and reliable fishery-independent biomass estimates from bottom trawl surveys. The recent analysis of the Gulf of Alaska (GOA) rockfish stock assessment by the Center for Independent Experts (CIE) demonstrated that the presence of untrawlable areas, for which groundfish species composition and biomass are unknown, in the bottom trawl survey regions may result in inaccurate estimates of fish biomass. In response to the CIE analysis Alaska Fisheries Science Center (AFSC) scientists from Auke Bay Laboratory (ABL), the Resource Ecology and Fisheries Management (REFM) and Resource Assessment and Conservation Engineering (RACE) Divisions have held a number of meetings to discuss the most appropriate methods to address the CIE review. These meetings have resulted in a center-wide initiative to estimate the effect of untrawlable areas on groundfish stock assessments and preliminary research to mitigate the effect of these untrawlable areas on bottom trawl survey biomass estimates.

With guidance from stock assessment biologists, a team of Groundfish Assessment Program biologists in RACE Division has initiated a number of projects to ascertain the proportion of untrawlable area in the Gulf of Alaska bottom trawl survey region. The RACE Division team has also begun work on identifying promising methods to determine the relative abundance of rockfish in trawlable and untrawlable habitats. Most of these projects are in their infancy and some will have extended time horizons. In the short-term, an initial estimate of the untrawlable area in the GOA has been calculated from data collected while assessing station trawlability during previous GOA bottom trawl surveys.

Current projects and collaborations initiated by the RACE team include:

- **Retrospective analysis of skipped stations by stratum.** Stations in the GOA survey are defined by a 5 km by 5 km grid and stations are allocated for sampling using a stratified random methodology. Inevitably this leads to a number of stations assigned each year where no trawlable ground can be found within the assigned grid cell. Information on untrawlable grid cells has been collected and compiled for surveys since 1990. The total area of untrawlable and trawlable stations was summed by stratum to provide preliminary estimates of the untrawlable and trawlable area in the GOA for each stratum. A histogram of this data is shown in Figure 11; there are 59 strata, and the mean and median of percent untrawlable are 40% and 31%, respectively. Two alternative methods used provided an upper and lower boundary of untrawlable area for each stratum. In early January the results were disseminated to stock assessment biologists for further analysis. Because the collection of these data was not originally intended to provide an estimate of the untrawlable proportion of the GOA survey area, some biases and errors in these initial estimates are to be expected.

- **Study to develop split-beam acoustic methods to estimate untrawlable areas.** Vessel time on the NOAA vessel *Oscar Dyson* has been assigned to develop and test the ability of a split-beam echosounder to distinguish trawlable and untrawlable areas. A cruise is tentatively scheduled for April 2007 and will take advantage of the existing multibeam and EK60 acoustic technology on the *Dyson*. Analysis of existing split-beam datasets has been initiated in advance of the field project and potential survey designs and project locations have been identified.

- **Analysis of existing single beam echosounder data.** Since 2000, single beam ES60 acoustic data has routinely been collected during RACE's GOA and Aleutian Island bottom trawl surveys. A number of small-scale projects are examining the feasibility of using these data to define trawlable and untrawlable areas. These efforts have focused on areas where ground truth information on the composition of the seafloor substrate exists. Data extraction methods and statistical analysis methods are currently being developed and results examined. Analyses of along-track slope and rugosity as well as waveform analyses are currently under development. When a workable method is achieved, analyses of the complete archived data set may be accomplished, providing coverage of significant portions of the GOA survey area.

- **Compilation and analysis of existing data sources.** A number of studies have examined seafloor characteristics in the GOA since the 1950s. These studies have produced diverse data projects ranging from individual sediment grabs at specific locations on the GOA shelf to multibeam and sidescan sonar maps covering large areas. The data is housed at various agencies including AFSC, ABL, the International Pacific Halibut Commission, USGS, and NOS. These data are being collected and compiled in a GIS framework by scientists at RACE and ABL. In the long-term the data can provide information to delineate untrawlable areas in the GOA.

- **Development of alternative assessment methods.** Assessment of fish density in untrawlable areas is a challenge faced on both the west coast of North America and Alaska. Collaboration with the Northwest and Southwest Fisheries Science Centers has been initiated in order to evaluate alternative methods to trawl surveys that will allow estimation of fish abundance in untrawlable areas. We hope to test the ability of an autonomous underwater vehicle (AUV) to estimate rockfish density during the previously mentioned *Oscar Dyson* cruise in April in collaboration with the NWFSC. Acoustic methods to estimate fish abundance in untrawlable areas are also being explored both within the RACE Division and in collaboration with the SWFSC.

Accounting for groundfish biomass in untrawlable substrates within survey areas is an important issue facing all fisheries management agencies in North America. Alaska Fisheries Science Center researchers are actively seeking out opportunities to collaborate on solving this problem with scientists from other agencies and regions. We are currently pursuing partnerships throughout the U.S. West Coast, Alaska and Canada to bring our combined resources and skills to address this common issue. Initial contacts, planning and collaboration are already underway. We foresee two long-term objectives; 1) develop methods to identify and map the untrawlable areas in the GOA and 2) develop a more precise and accurate estimate of groundfish biomass by combining estimates of groundfish abundance in untrawlable areas with the current bottom trawl survey biomass estimates.

Concluding Remarks on the Effect of Untrawlable Grounds

As mentioned above, if the factors that enter into the survey q (vulnerability, horizontal and vertical availability, and difference in relative density between trawlable and untrawlable grounds) do not show temporal trends, then q would be expected to remain constant and age-structured assessments that estimate q would be expected to provide reasonable results (assuming that reasonable prior distributions are used). In practice, survey q often is estimated within an assessment model, and the simulations above suggest that demographic data (fishery and survey age and length composition) may have strong influence on estimates of q even in cases when the "true" q is far from 1. The situation is more problematic for Tier 5 stocks in which q is assumed to be 1 and an age-structured model and demographic data do not exist. For these reasons, the effects of untrawlable grounds should be seriously considered for rockfish stocks.

The simulation modeling demonstrates that estimates of area and population density in untrawlable grounds, by strata and year, are needed to potentially correct the biomass estimates. Given the geographic scale of Alaskan trawl surveys, these are rather severe information requirements. For species that show apparent preferences for trawlable grounds, perhaps simple monitoring of spatial distribution by depth and strata may be enough to indicate whether major temporal trends in the proportion on trawlable ground have taken place. For species in which the preferred habitat is the untrawlable grounds, then it can be argued that trawl survey is not likely the most useful sampling gear in the first place, and more consideration could be given to other sampling gear. Note also the problem of untrawlable ground applies not just to rockfish, but to any species which shows differences in density between trawlable and untrawlable grounds. For example, the general effect on flatfish may be to overestimate the survey biomass if flatfish densities are higher on trawlable grounds.

We support continuation of studies that examine existing data to assess the proportion of trawlable grounds. Preliminary estimates of proportions of untrawlable grounds by GOA strata, based upon current trawl sampling design information, are discussed here, and we hope to obtain similar estimates for the AI survey area. In the longer-term, we encourage attempts by the RACE division to produce more accurate and specific estimates of proportion of untrawlable grounds using the various data sources mentioned above. This information could be used to recompute the biomass estimates on trawlable ground only and use that as an index for age-structured models. If more detailed information on density in untrawlable grounds were available, we could also recompute the total survey biomass estimate using the correction factor above. Some information exists on population density in untrawlable grounds (based on submersibles and other non-trawl gear), and, as a long-term goal, we encourage future studies of this type. Finally, we can evaluate the effect of these recomputed survey estimates in our age-structured and biomass-based stock assessments. Because of the daunting task of obtaining complete information from the Alaskan survey area, simulation modeling of survey biomass estimates, using the model above, could provide information on the expected effects of incomplete information.

Comparison of Various Methods for Estimation of Rockfish Natural Mortality (Kalei Shotwell, Chris Lunsford, and Dana Hanselman)

Natural mortality (*M*) is one of the most influential parameters in fishery stock assessments and is essential for estimating current biomass and fishing mortality rates. Natural mortality is also very difficult to estimate within stock assessment models because it is confounded with many other parameters in the model such as catchability and fishing mortality (Fu and Quinn 2000). Consequently, misspecification of natural mortality can have dramatic repercussions on harvest rate recommendations (Thompson 1994).

Several different methods are available for estimating natural mortality (Quinn and Deriso 1999); however, for long-lived species of rockfish (*Sebastes* spp.) in Alaska only a few are viable approaches. The majority of natural mortality estimates for rockfish in Alaska have been determined based on catch curve analyses, empirical life-history parameter relationships, or simplified maximum age methods (Archibald et al. 1981, McDermott 1984, Nelson and Quinn 1987, McDermott 1984, Malecha et al., *in preparation*). Other methods used for estimating natural mortality such as length frequency analysis and mark-recapture experiments are not applicable to rockfish due to their determinate growth at early ages and high tag mortality due to extreme barotrauma of the swim bladder. Estimates of natural mortality may also be generated explicitly using age-structured population models (Quinn and Deriso 1999). Several Alaska rockfish assessments currently use model generated estimates of natural mortality. However, not all rockfish models in use will converge on reliable estimates of natural mortality. Additionally, age-structured models do not exist for all species of rockfish in Alaska.

Estimates of natural mortality currently in use for Alaska rockfish stock assessments have been derived from a variety of different literature references (Table 12). In general, the values are fixed in the assessments using an estimate derived from available literature or are estimated internally in the model using the literature sources to specify a prior distribution. However, except for McDermott (1994), most studies have focused on the waters off the coast of British Columbia and within the Gulf of Alaska

(GOA). Only recently has limited information about natural mortality rates for rockfish existed for the Bering Sea and Aleutian Islands (BSAI).

Malecha et al. (*in preparation*) estimated natural mortality for seven *Sebastes* species and compared regional differences across Alaska. They contrasted the results of natural mortalities estimated using the techniques described in Alverson and Carney (1975) and Hoenig (1983). They concluded that the dependence on maximum age for both techniques influences the natural mortality estimates. Historical, regional, or temporal differences in natural mortality may simply be an artifact of low samples sizes or variations in fishing pressure (Malecha et al., *in preparation*). The relationship of maximum age versus natural mortality for Alaska rockfish (Figure 13) is consistent with the concepts presented by Hoenig (1983) where natural mortality was inversely correlated with longevity. However, regional differences do exist. Additionally, a plot of the top five maximum ages for several aged species demonstrates the difficulty of using maximum age as an estimator for natural mortality (Figure 2). There is a range in the natural mortality estimates of the oldest five fish. Many species of rockfish are very long-lived such as rougheye rockfish (*S. aleutianus*), and are, therefore, very difficult to age. This limits the number of samples that can be aged in any given year, and priority must be assigned to different species depending on the assessment year.

The CIE reviewers mention that the methods for estimating natural mortality using Hoenig (1983) were somewhat conservative and dependent on the number of aged samples. They suggested to investigate other regression-based methods for estimating natural mortality and to consider the sensitivity of the estimates based on comparisons between methodologies. The panel further emphasized the use of the "best" estimate of natural mortality, which is not necessarily the most conservative (CIE 2006).

Age samples continue to be collected from surveys and the fishery, and more age data exist since the time when many of these historical estimates of rockfish mortality were originally calculated. In an attempt to validate estimates of natural mortality currently used, the stock assessment authors plan to re-visit catch-curve analyses, empirical life-history techniques, and simplified maximum age methods, using the most recent age data. Where applicable, a summary of the results will appear in the 2007 SAFEs for GOA rockfish and the 2008 SAFEs for BSAI rockfish.

Methods and Data

Potential analyses that will be considered by assessment authors include catch curves, empirical life history relationships, and relationship to simplified maximum age:

<u>Catch Curve</u>

Catch curve analysis was used by Archibald et al. (1981) and Nelson and Quinn (1987) for generating total mortality estimates (Z) of several rockfish species from British Columbia and southeast Alaska coastal waters. This method was developed early in the 20th century using length as a proxy for age. The original idea was to follow a cohort through its life and to examine the rate of exponential decline after full selection. Once age reading methodologies were developed (e.g. Chilton and Beamish 1982), age was used instead of length which greatly simplified the assumptions. Specifically, the natural log of age frequency should have an ascending left limb up to a dome, which is where the fish is fully selected, and then begin descending in a straight line. The slope of this decline is an estimate of Z (total mortality, the sum of fishing mortality and natural mortality). For unfished or lightly exploited fish populations the estimate of Z can be used as an estimate of M. The important assumptions of the method are as follows from Ricker (1975):

1. Mortality is uniform for the ages used in the analysis
2. Fishing mortality is relatively constant over time
3. The sample is taken randomly from the age-groups involved
4. No time-trend in recruitment

For rockfish populations in Alaska, there is likely an increasing trend in recruitment, and a potential regime shift in recruitment at around 1977. To alleviate this potential violation of a key assumption, we use only age samples after 1990 to remove fish born prior to 1977 from our sample. We also pool all age data to create a "synthetic cohort" which should mediate variability in fishing mortality and recruitment (Ricker 1975). In addition, rockfish had extremely high fishing mortality in the 1960's but have been relatively stable since 1977. The age compositions have been run through an age-length key for each sampling year to make them approximately random. Estimated fishing mortality and natural mortality values are available from the stock assessment.

Empirical Life History

As very little information on natural mortality exists for some species such as rockfish, a common approach is to examine relationships of life-history parameters from a variety of studies and develop predictive equations for estimating natural mortality (Quinn and Deriso 1999). In general, species with high natural mortality will tend to have short lifespans, fast growth rates, and small asymptotic sizes. Several approaches for estimating natural mortality can be found for long-lived species such as rockfish that exploit the consistency in these life-history characteristics (Quinn and Deriso 1999).

Growth Curves

Alverson and Carney (1975) developed a procedure for estimating natural mortality that was based on von Bertalanffy growth curve parameters and the time when an unfished cohort reaches maximum biomass, or critical age. The von Bertalanffy isometric growth curve model is rearranged to solve for natural mortality (M) in the following equation:

$$\hat{M} = \frac{3K}{\exp(t^{*}K) - 1} \tag{11}$$

Here, t^* is the critical age and K is the growth parameter. If $M \sim K$, a first approximation for t^* could be made by multiplying the maximum observed age, t_m, by 0.25 (Quinn and Deriso 1999). However, Alverson and Carney (1975) determined that increased mortality in older animals and samples not representative of the population age structure made this relationship unlikely. They then developed an empirical estimation for t^* based on a regression of 63 author-reported maximum and critical ages and determined that $t^* \approx 0.38\, t_m$.

Longevity

Hoenig (1983) determined that natural mortality was inversely correlated with longevity across a wide variety of taxa (mollusks, fish, and cetaceans). He then developed the following regression equation for estimating natural mortality that was also related to maximum age (t_m).

$$\ln(\hat{M}) = 1.44 - 0.82 * \ln(t_m) \qquad (12)$$

The fit of this model is very good considering the widely disparate taxa ($r^2 = 0.82$) and is recommended over other simplified approaches to estimating natural mortality (Hewitt and Hoenig 2005).

Reproductive Effort

Gunderson and Dygert (1988) developed an empirical relationship between the relative reproductive effort using a gonadosomatic index (GSI) which is the ratio of gonad weight to somatic body weight. Using this relationship they independently estimated natural mortality of 20 fish stocks. McDermott (1994) collected samples of rougheye rockfish from the Pacific Northwest to the Bering Sea to estimate natural mortality using this GSI approach. Unfortunately, very limited GSI data is available for rockfish species in Alaska making this approach unavailable for most species.

Simplified Maximum Age

This technique for estimating natural mortality was developed independently in a variety of studies; however, for rockfish in Alaska the primary source was Hoenig (1983). He introduced this "rule-of-thumb" approach that is based on the exponential law of population decline for an unfished population and the proportion of animals surviving to a maximum age, t_m. In the following equation, P is an arbitrarily small constant that represents the proportion of animals surviving to t_m.

$$M = \frac{-\ln(P)}{t_m} \qquad (13)$$

In general it is suggested to use a value between 0.01 and 0.05 (Quinn and Deriso 1999). Hewitt and Hoenig (2005) suggests that this method is somewhat inferior to using the regression equation developed in Hoenig (1983) as there is no evidence for a particular proportion, P, being representative of the quantile of animals surviving to the maximum age.

Preliminary Results and Discussion using Gulf of Alaska (GOA) Rougheye Rockfish

Natural mortality for GOA rougheye rockfish is estimated within the stock assessment model as 0.035. The prior for this estimate is 0.03 which is based on McDermott (1994), who used the gonadosomatic index (GSI) following the methodology described by Gunderson and Dygert (1988) to estimate a range of natural mortalities for rougheye (0.03 – 0.04).

Applying the catch-curve analysis results in an age of full recruitment of 15, similar to the value estimated in the stock assessment model. The estimated total mortality is 0.0474 with a reasonably good fit to the data (Figure 14). Average estimated fishing mortality estimated from the stock assessment model is 0.028, which when subtracted from the estimate of Z, gives an estimated natural mortality from the catch-curve of 0.019 (Table 2).

Applying the empirical life history growth methodology developed by Alverson and Carney (1975) to GOA rougheye rockfish using t^* equal to 0.38 produces a natural mortality estimate of 0.004. The Hoenig (1983) method based on longevity and the "rule-of-thumb" approach (Hoenig, 1983) both produce natural mortality estimates of 0.035 (Table 2). Interestingly, the Hoenig (1983) estimates are nearly identical to the stock assessment model estimate whereas the catch curve and Alverson and Carney (1975) estimates are lower.

For 2007 GOA SAFE's and 2008 BSAI SAFE's authors will be encouraged to evaluate the appropriateness of the natural mortality estimates used in Alaska rockfish assessments. The above techniques provide the methodology and case example for several approaches that estimate natural mortality. These techniques can be easily applied to the best available data and will provide estimates which can be carefully evaluated.

Acknowledgements

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References

Alverson, D.L. and M.J. Carney. 1975. A graphic review of the growth and decay of population cohorts. J. Cons. Int. Explor. Mer, 36: 133-143.

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

Chilton, D.E., and R.J. Beamish. 1982. Age determination methods for fishes studied by the groundfish program at the Pacific Biological Station. Can. Spec. Pub. Fish. Aquat. Sci. 60 p.

CIE. 2006. Center for Independent Experts (CIE) summary report for the 2006 Alaska rockfish review. The Center for Independent Experts: University of Miami - Rosenstiel School of Marine and Atmospheric Science, 4600 Rickenbacker Causeway, Miami FL 33149. 91 pp.

Fu, C., and T.J. Quinn II. 2000. Estimability of natural mortality and other population parameters in a length–based model: *Pandalus borealis* in Kachemak Bay, Alaska. Can. J. Fish. Aquat. Sci. 57: 2420–2432.

Gunderson, D.R. 1980. Using *r-K* selection theory to predict natural mortality. Can. J. Fish. Aquat. Sci. 37: 2266-2271.

Hewitt, D.A. and J.M. Hoenig. 2005. Comparison of two approaches for estimating natural mortality based on longevity. U.S. Fish. Bull. 103: 433-437.

Hoenig, J.M. 1983. Empirical use of longevity data to estimate mortality rates. U.S. Fish. Bull. 82 (1): 898-903.

McDermott, S.F. 1994. Reproductive biology of rougheye and shortraker rockfish, *Sebastes aleutianus* and *Sebastes borealis*. Masters Thesis. Univ. Wash. Seattle. 76 p.

Malecha P. W., J. Heifetz, and D. H. Hanselman. 2007. Growth And Mortality Of Rockfishes (*Scorpaenidae*) From Alaska Waters. NOAA Tech Memo (in prep).

Nelson, B.D. and T.J. Quinn. 1987. Population parameters of rougheye rockfish (*Sebastes aleutianus*). In Proc. Int. Rockfish Symp. pp. 209-228. Univ. Alaska Sea Grant Report No. 87-2.

Quinn, T.J. II, and R.B. Deriso. 1999. Quantitative fish dynamics. Oxford University Press. New York.

Shepherd, S.A. and P.A. Breen. 1992. Mortality in abalone: its estimation, variability, and causes. Pages 276-304 In S.A. Shepherd, M.J. Tegner, and S.A. Guzman del Proo, eds., Abalone of the world: Biology, fisheries, and culture. Fishing News Books, Cambridge, UK.

Thompson, G.G. 1994. Confounding of gear selectivity and the natural mortality rate in cases where the former is a nonmonotone function of age. Can. J. Fish. Aquat. Sci. 51: 2654–2664.

Table 1: Estimates of natural mortality for Alaska rockfish (*Sebastes* spp.).

Species/Region	M	Est./Fixed	Methodology	Source
<u>Gulf of Alaska</u>				
Pacific Ocean Perch	0.06	Estimated	Prior based on catch curve analysis	Archibald et. al (1981)
Northern Rockfish	0.06	Estimated	Prior based growth curve parameter analysis	Alverson and Carney (1975)
Rougheye Rockfish	0.035	Estimated	Prior based on gonadosomatic index	McDermott (1994)
Shortraker Rockfish	0.03	Fixed	ad hoc catch curve of rougheye/shortraker ratio	Clausen (2005)
Sharpchin Rockfish	0.05	Fixed	Catch curve analysis	Archibald et. al (1981)
Redstripe Rockfish	0.1	Fixed	Catch curve analysis	Archibald et. al (1981)
Harlequin Rockfish	0.06	Fixed	ad hoc average of other slope species	Clausen (2005)
Silvergrey Rockfish	0.04	Fixed	ad hoc average of all silvergrey studies	Clausen (2005)
Redbanded Rockfish	0.06	Fixed	ad hoc average of other slope species	Clausen (2005)
Minor Species Slope Rockfish	0.06	Fixed	ad hoc average of other species	Clausen (2005)
Pelagic Shelf (Dusky, Dark, Widow, Yellowtail)	0.07	Fixed	Catch curve analysis	Chilton (In review)
Demersal Shelf (Yelloweye)	0.02	Fixed	Catch curve analysis	O'Connell et. al (2006)
<u>Bering Sea/Aleutian Islands</u>				
Pacific Ocean Perch	0.062	Estimated	Prior based on catch curve analysis	Archibald et. al (1981)
Northern Rockfish	0.045	Estimated	Prior based on GOA Northern	Alverson and Carney (1975)
Shortraker/Rougheye Rockfish	0.025	Fixed	GOA catch curve analysis	Heifetz and Clausen (1991)
Other Rockfish (Dusky)	0.09	Fixed	Based on GOA growth parameter analysis	Alverson and Carney (1975)

Table 2. Estimates of natural mortality for Gulf of Alaska rougheye rockfish.

Method	M
Current stock assessment model	0.035
Catch Curve Analysis	0.019
Empirical Life-History: Growth	0.004
Empirical Life-History: Longevity	0.035
Rule of Thumb: Maximum Age	0.035

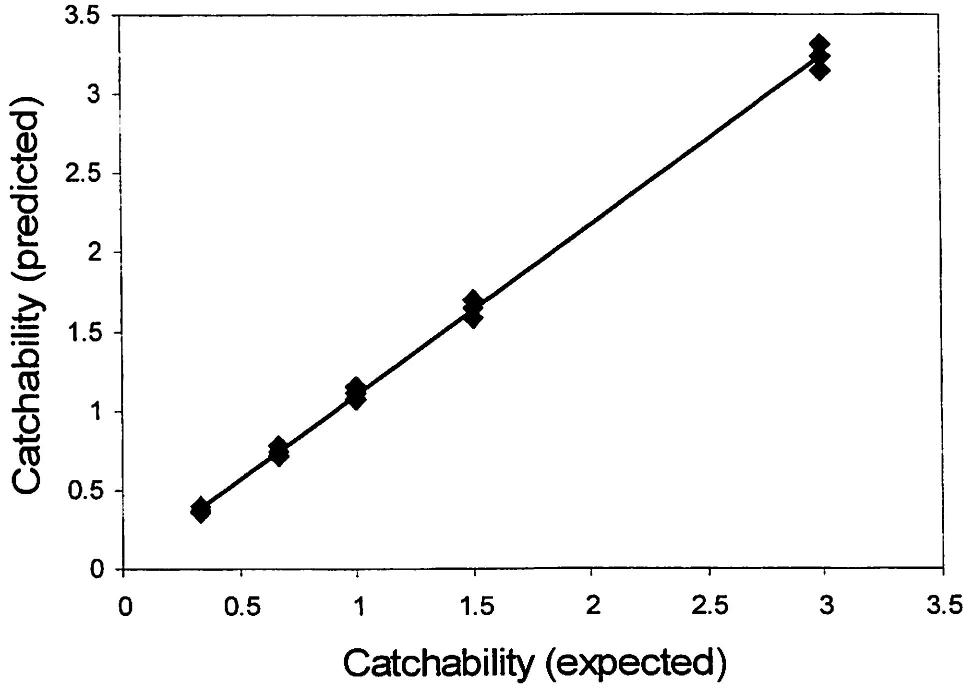

Figure 1. Predicted and expected catchability estimates when using biomass estimates from a known "POP-like" population scaled to different levels with different CVs.

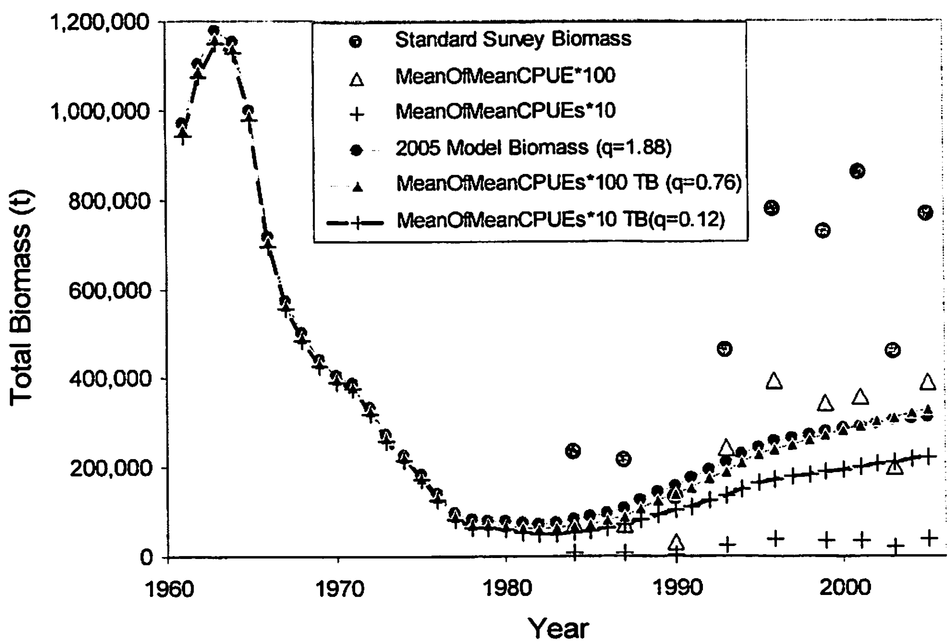

Figure 2. Experiment removing area from biomass calculations. Pink circles are the standard survey biomass estimates. Triangles are the grand means of strata CPUEs multiplied by 100. Blue plusses are the grand means of strata CPUEs multiplied by 10. Lines with the same symbols are the GOA POP model fits to the data, with their associated values of *q* in the legend.

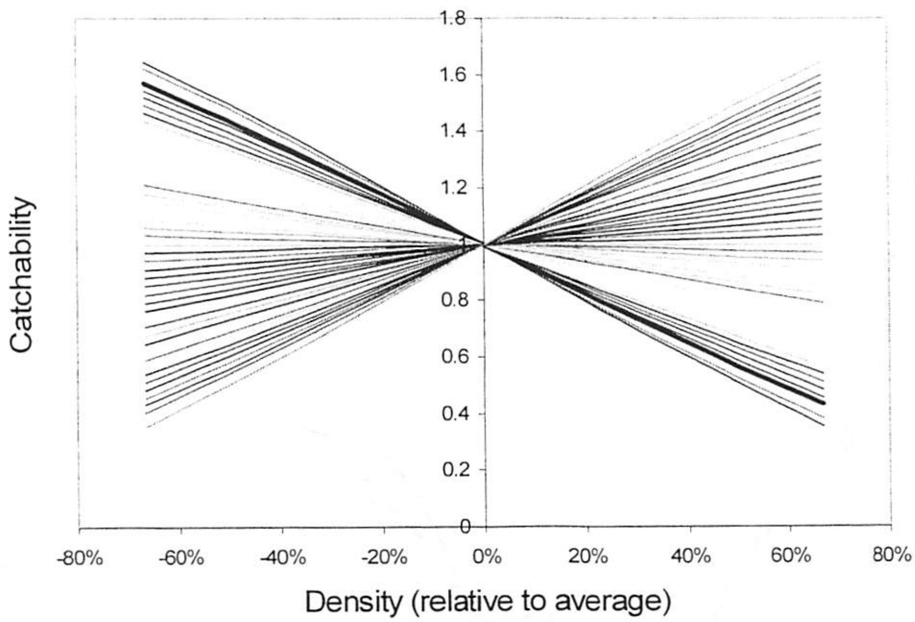

Figure 3. A range of potential density-dependent effects on catchability for simulation. These curves are multiplied against the observed survey biomass estimates. Thick black line is the best fitting relationship in the GOA POP model.

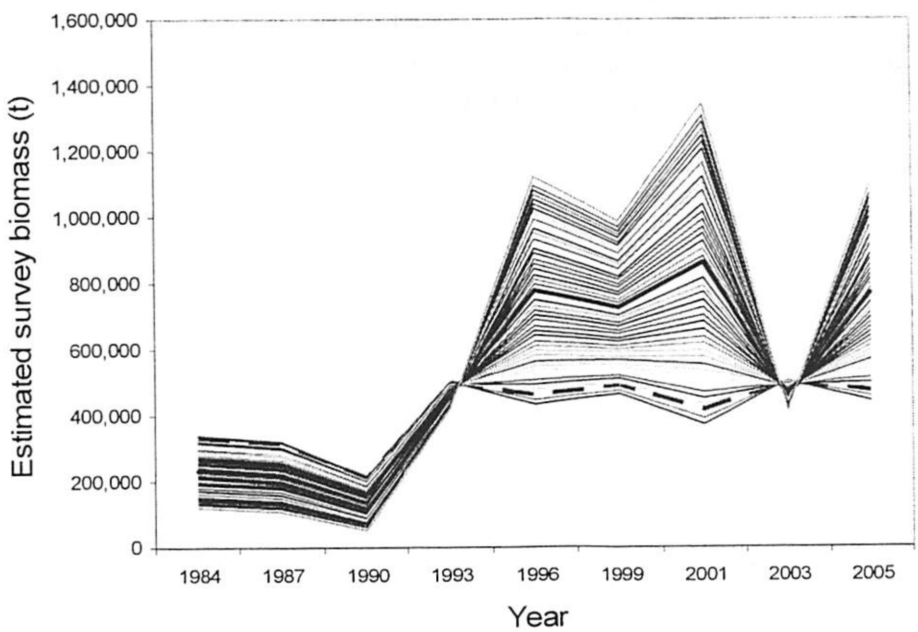

Figure 4. Set of simulated survey biomass estimates based on using the density-dependent relationships of catchability shown in Figure 1. Thick black line shows the standard survey estimates, and the dashed red line is the best fitting set of simulated survey estimates.

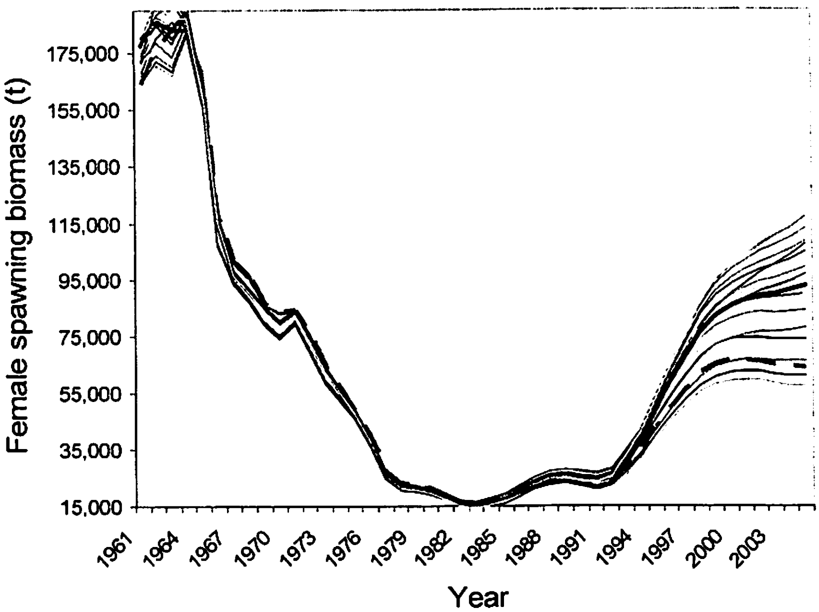

Figure 6. A selection of trajectories of female spawning biomass estimated by the GOA POP model for simulations using density-dependent catchabilities. Thick black line is the 2005 GOA POP stock assessment estimate of female spawning biomass. Thick red dashed line is the best fitting survey biomass data set.

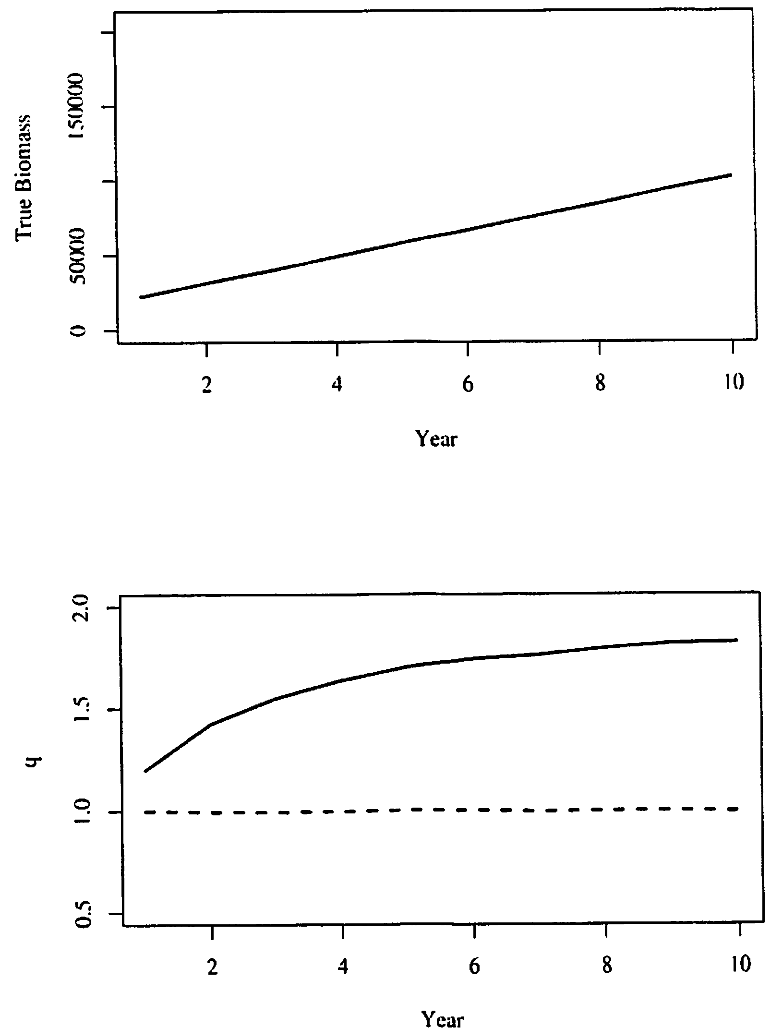

Figure 6. Simulated biomass (top panel) and expected estimates of q (lower panel) for uncorrected (solid line) and corrected (dashed line) survey biomass estimates where the proportion of biomass in trawlable grounds increases over time (Case 1).

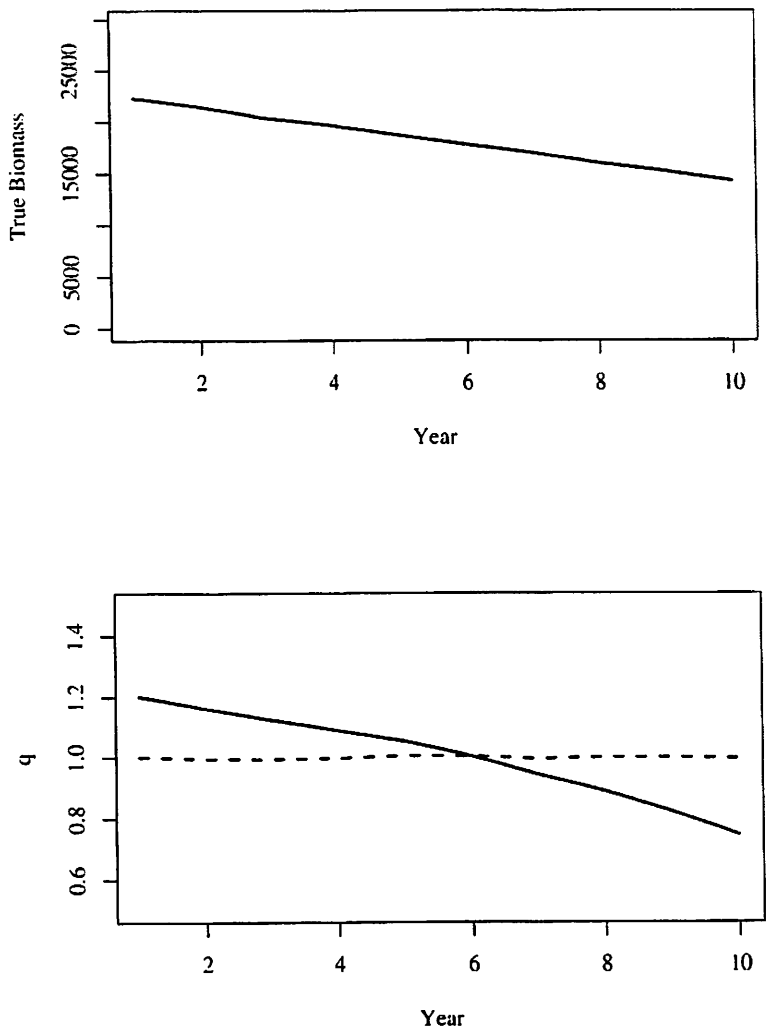

Figure 7. Simulated biomass (top panel) and expected estimates of q (lower panel) for uncorrected (solid line) and corrected (dashed line) survey biomass estimates where the proportion of biomass in trawlable grounds decreases over time (Case 2).

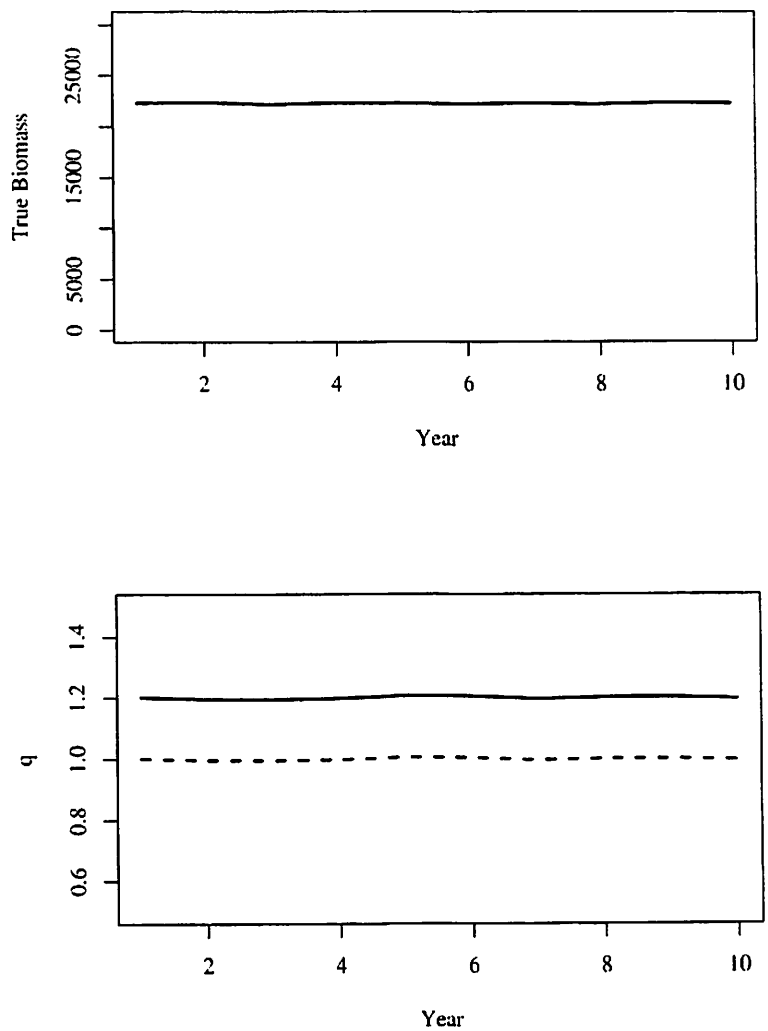

Figure 8. Simulated biomass (top panel) and expected estimates of q (lower panel) for uncorrected (solid line) and corrected (dashed line) survey biomass estimates where the expected biomass and proportion of biomass in trawlable grounds is constant over time (Case 3).

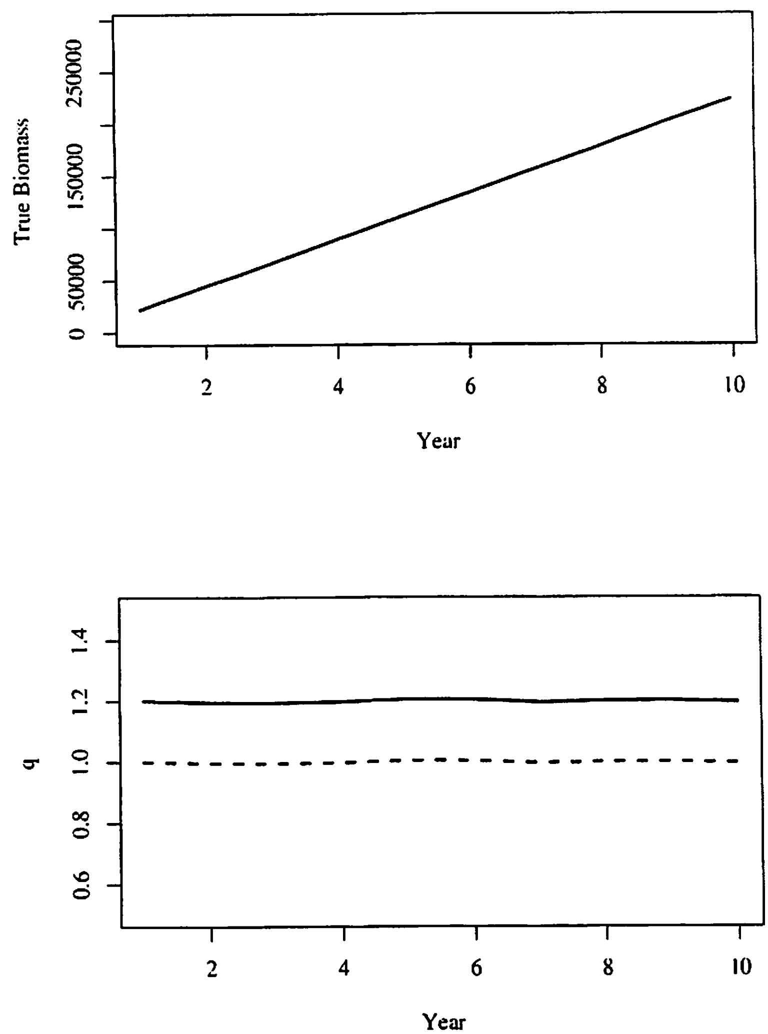

Figure 9. Simulated biomass (top panel) and expected estimates of q (lower panel) for uncorrected (solid line) and corrected (dashed line) survey biomass estimates where the expected biomass increases over time but the expected proportion of biomass in trawlable grounds is constant (Case 4).

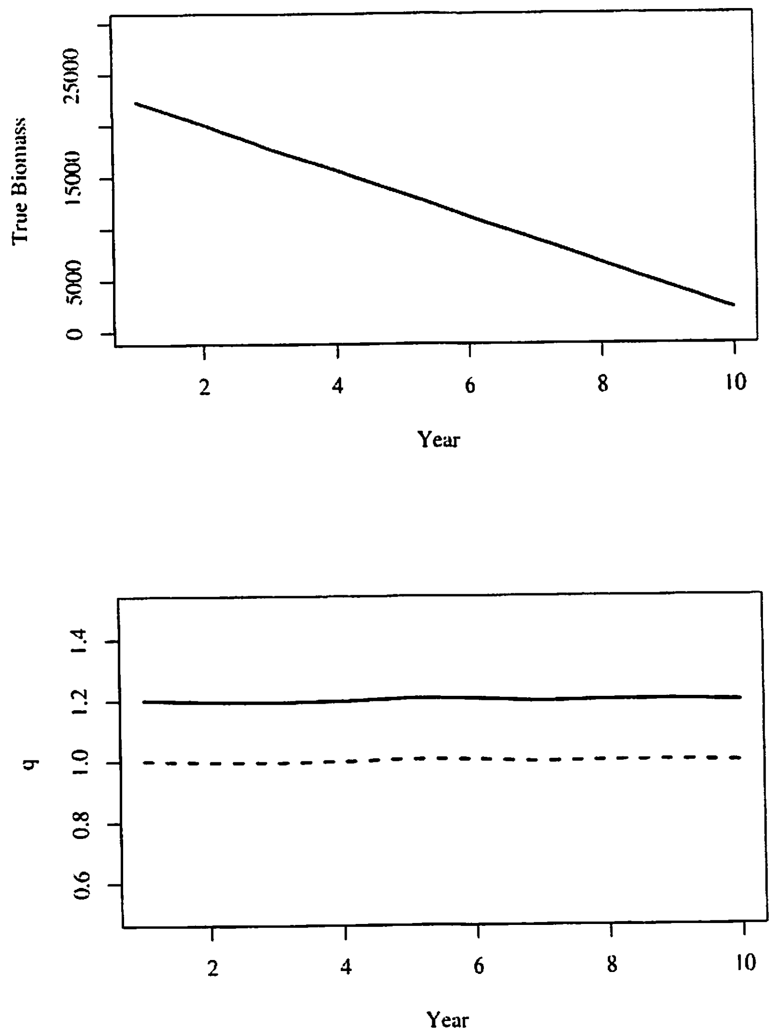

Figure 10. Simulated biomass (top panel) and expected estimates of q (lower panel) for uncorrected (solid line) and corrected (dashed line) survey biomass estimates where the expected biomass decreases over time but the expected proportion of biomass in trawlable grounds is constant (Case 5).

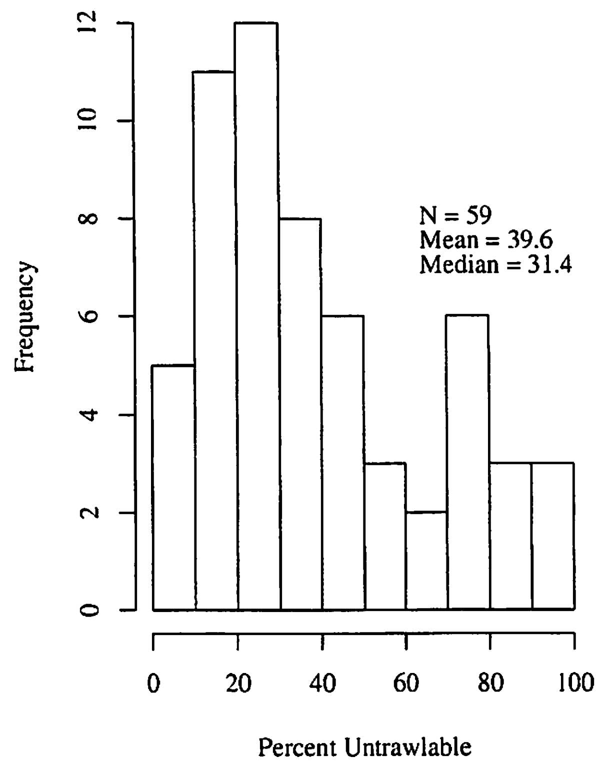

Figure 11. Frequency distribution of preliminary estimates of the proportion of untrawlable ground in the Gulf of Alaska survey area

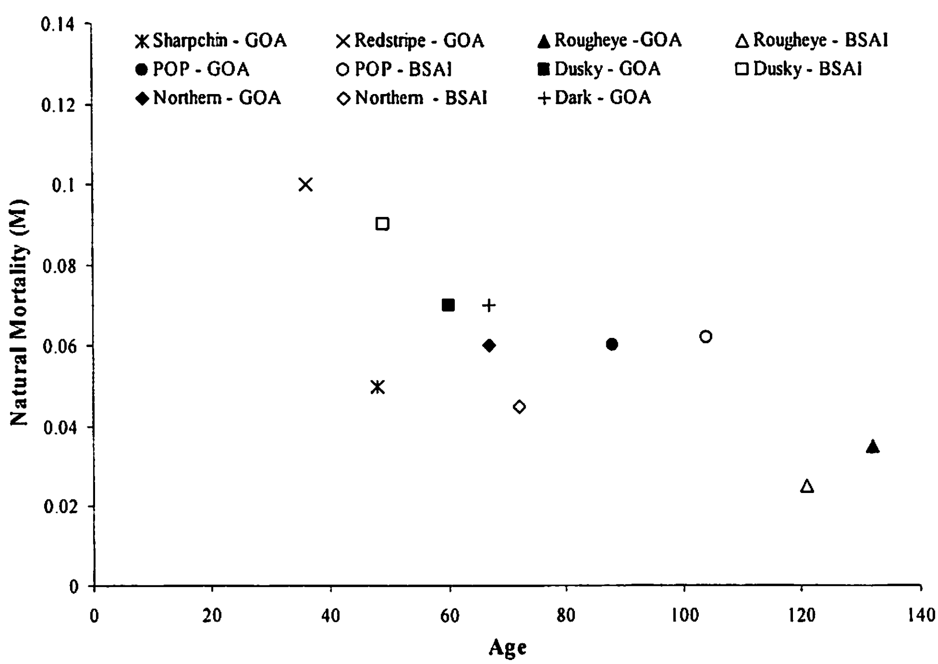

Figure 12. Estimates of natural mortality for Alaska rockfish.

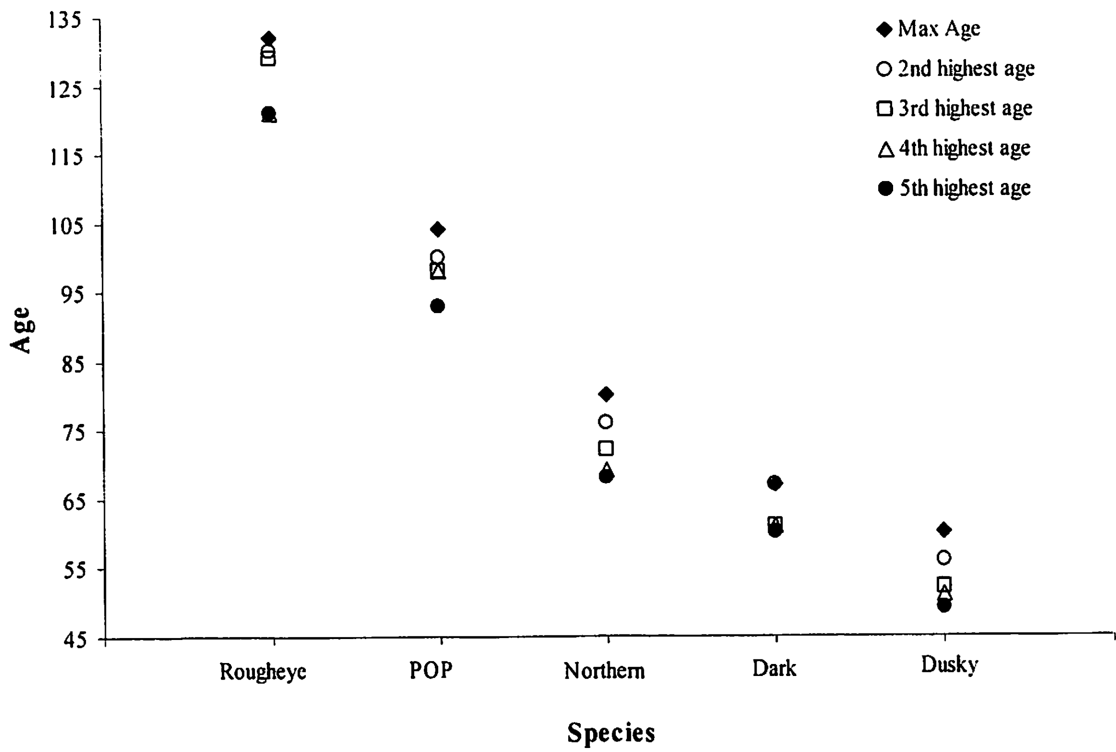

Figure 13. Top five maximum ages for several species of Alaska rockfish.

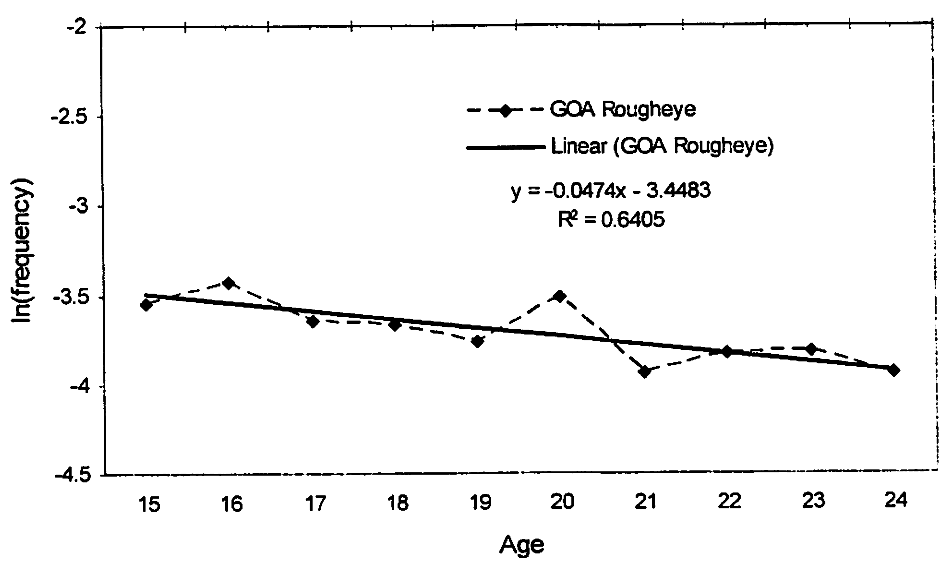

Figure 14. Catch curve analysis for Gulf of Alaska rougheye rockfish. Dashed line with markers is the observed pooled age distribution, while solid line is a linear regression.

White Paper: Discussion of an Industry Proposal to Revise Maximum Retainable Amount Percentages of Groundfish Relative to Retained Arrowtooth Flounder

By Andy Smoker & Jeff Hartman
Alaska Region, National Marine Fisheries Service
January 31, 2007

The Proposal

At its October 2006 meeting, the North Pacific Fisheries Management Council (Council) received a proposal from the Alaska Groundfish Data Bank to modify maximum retainable amounts (MRAs) for Gulf of Alaska (GOA) groundfish caught incidentally in the directed arrowtooth flounder fishery (Attachment 1). The proposal would relax existing regulatory provisions that limit the use of arrowtooth flounder as a basis species for calculating MRAs of GOA groundfish species. The Council requested that NMFS develop a discussion paper on the proposal to be considered at the February 2007 Council meeting.

Purpose and Need

In 1994 the Council chose to prohibit the use of arrowtooth flounder as a basis for calculating retainable amounts of groundfish species closed to directed fishing (59 FR 18229; July 27, 1994). In 1997 it set most of the groundfish MRAs at zero relative to retained amounts of arrowtooth flounder to prevent vessels from using arrowtooth flounder as a basis species for retention. In the GOA the MRAs for pollock and Pacific cod were established at 5 percent and for aggregated forage fish at 2 percent. Limited markets existed when this regulation was implemented as a final rule (62 FR 11109; March 11, 1997). At that time, there were concerns that fishing vessel operators would target arrowtooth flounder to increase the retainable amounts of valuable species closed to directed fishing and increase bycatch amounts of Pacific halibut. Increased halibut bycatch rates could result reaching halibut bycatch limits before the TACs established for other trawl target fisheries were harvested. Current MRAs for GOA groundfish are listed in Table 10 to 50 CFR 679 (Attachment 2).

The 1997 proposed rule (62 FR 724; January 6, 1997) to allow the use of GOA arrowtooth flounder as a basis species for pollock and Pacific cod when they are closed to directed fishing stated:

> "Current regulations prohibit the use of arrowtooth flounder as a basis species for the retention of other groundfish species closed to directed fishing. This prohibition was implemented by NMFS in 1994 to respond to industry and Council concern that directed fishing for arrowtooth flounder for the purpose of topping off with other, higher-valued species could result in unacceptably high halibut bycatch rates. Little or no market existed for arrowtooth flounder, which subsequently was discarded or rendered into meal, but the halibut bycatch amounts associated with the arrowtooth flounder were credited against the overall halibut bycatch limits available to other fisheries. Directed fishing for arrowtooth flounder could increase the rates at which halibut bycatch limits or allowances are reached, thus further limiting the ability of the groundfish fleet to harvest available TAC amounts before halibut bycatch restrictions close the fisheries. At the Council's December 1995 meeting, industry representatives requested that NMFS initiate several changes to existing MRB [MRAs were referred to as MRBs at the time of this rule] percentages. This request was in response to specific concerns about topping off activity and to testimony that a limited fishery for GOA arrowtooth flounder exists and that this species should be allowed as a basis species for the retention of pollock and Pacific cod. Industry representatives and NMFS in-

season managers also recommended that a reduction of the GOA sablefish MRB percentage be considered to respond to fishery management issues that became evident as a result of topping off activities in the 1996 trawl fisheries."

Since 1997, markets for arrowtooth flounder have been developed and this species now supports a viable target fishery. As a result, representatives for the GOA trawl industry now support changing the MRAs for GOA groundfish to expand the use of arrowtooth flounder as a basis species for the retention of groundfish closed to directed fishing. This change would provide the opportunity to the trawl fishing industry to retain more groundfish and reduce regulatory discards.

The Council approved two recently implemented amendments to the GOA Fishery Management Plan that influence current MRAs for incidentally caught species with respect to the directed arrowtooth flounder fishery. Amendment 63 removed skates from the "other species" TAC group and kept the MRA for skates the same as "other species" relative to all basis species. The MRA relative to the directed arrowtooth flounder fishery remained at 0 percent. Amendment 69 revised the method used to set the "other species" TAC and revised the MRA relative to arrowtooth flounder as a basis species from 0 percent to 20 percent. The suite of species that have MRAs of 0 percent relative to arrowtooth flounder (Table 1) increase the likelihood of regulatory discards. The changes to MRAs proposed by the Groundfish Data Bank are intended to increase the industry's opportunity to reduce discards.

The changes requested by the Groundfish Data Bank proposal and the species for which the MRAs would explicitly remain constant are listed in Table 1.

Table 1. Current and proposed GOA MRAs

Incidentally Caught Species	Current MRA %	Proposed MRA%
Pollock	5	5
Pacific cod	5	5
Deep-water flatfish	0	20
Rex sole	0	20
Flathead sole	0	20
Shallow-water flatfish	0	20
Sablefish	0	1
Aggregated rockfish	0	5 or less
Atka mackerel	0	20
Aggregated forage fish	2	2
Skates	0	20
Other species	20	20

The proposal reviews the current status of MRAs relative to arrowtooth flounder and why they are established at that rate.

<u>Brief History of Groundfish MRA's with Arrowtooth as a Basis Species</u>
Historically arrowtooth flounder has had limited value compared to with many other species of groundfish in the GOA. It is abundant and easily caught. Prior to 1994, the species was used as a very low valued basis species to target species closed to directed fishing. For example

arrowtooth flounder was retained on catcher vessels as a basis for retaining sablefish. Once the sablefish and arrowtooth flounder were delivered to a plant, the arrowtooth flounder was either sent to a meal plant or discarded. In 1994 all MRAs relative to arrowtooth were set at 0 percent. In 1997 the MRAs for Pacific cod and pollock were set at 5 percent and for forage fish at 2 percent. The 1994 and 1997 actions shared the intent of improving the use of halibut bycatch mortality relative to the other trawl groundfish targets and slowing the catch rate of sablefish. The 1997 rule also intended to increase utilization of pollock and Pacific cod in the directed arrowtooth flounder fishery.

Price data showing increasing value of arrowtooth flounder as a target

Average gross earnings per round metric ton of retained arrowtooth flounder received by both shoreside processors and catcher processor vessels increased from 2001 to 2005 are displayed in Table 2. These price approximations are based on a combination of weekly production reports, Alaska Commercial Operators Annual Reports (COARs), and blend and other catch accounting data, and tend to support anecdotal observations from the Groundfish Data Bank that prices for this species have increased in recent years. Given the increasing value of arrowtooth flounder, the proposed action could encourage some GOA vessel operators to target this species more frequently if MRAs were relaxed for species incidentally caught while arrowtooth flounder is open for directed fishing.

Table 2. Total product value of retained arrowtooth flounder catch in the groundfish fisheries off Alaska by processor type and year, 2001-2005.

Year	Catcher/processor ($ per round metric ton)	Shoreside processor ($ per round metric ton)
2001	259	98
2002	342	-
2003	344	-
2004	751	342
2005	717	556

Notes: For shoreside processors, these estimates include the product value of catch from both Federal and State of Alaska fisheries. For catcher/processors, they include only the product value from catch counted against Federal TACs. A dash indicates that data were not available or were withheld to preserve confidentiality. Data Source: weekly processor reports, commercial operator's annual report, Blend data 2000 to 2002, catch accounting system 2003 to 2005 for estimates of retained catch. National Marine Fisheries Service

Catch Data Indicating Target Status of Arrowtooth Flounder

The proportion of arrowtooth flounder that is retained has increased in recent years indicating that the species has become a legitimate target. Catch data in the following table indicate the retention status of arrowtooth flounder for two recent years, 2005 and 2006, and for the year when the change in MRA status was implemented, 1997. For the entire groundfish fleet, recent discards in the arrowtooth flounder target are less than 20 percent compared to over 30 percent in 1997. The absolute amount of arrowtooth flounder has increased as well.

Table 3. Gulf of Alaska discards of arrowtooth flounder in the arrowtooth flounder target by year

Year	Discarded (mt)	Retained (mt)	Total (mt)	% Discarded
1997	2,201	4,566	6,767	33
2005	2,063	8,665	10,728	19
2006	2,668	12,676	15,344	17

Other data indicate similar trends regarding the increase in catch of arrowtooth flounder as a directed fishery in recent years. Table 4 shows GOA arrowtooth flounder catch in the arrowtooth flounder target vs. all other targets. The 2004 Gulf wide catch was 15,335 mt of which 5,983 mt or 39 percent was taken in an arrowtooth flounder target. In 2005 the total catch increased to 19,790 mt of which 10,727 mt (54 percent) was taken in the arrowtooth flounder target. In 2006 the percentage of total catch in the arrowtooth target increased slightly from 2005. Table 4 also shows the absolute amount taken within the arrowtooth flounder target has increased substantially each year.

Table 4. Gulf of Alaska arrowtooth flounder (ARTH) catch

Year	ARTH target catch (mt)	Non-ARTH target (mt)	Total (mt)	% catch in ARTH target
2004	5,983	14,630	15,335	39
2005	10,727	9,063	19,790	54
2006	15,344	12,290	27,634	56

Gulf of Alaska 2006 Arrowtooth Flounder Fishery

Overview of the Fishery

The following discussion reviews the arrowtooth flounder fishery in a very broad manner. It looks only at 2006 catch data as an example for this fishery's profile. Catch are aggregated for the entire year. As a result, the arrowtooth flounder target category is associated with multiple retained species. The problem statement and the GOA MRA table show that many species that may be caught with arrowtooth flounder are required discards. Conversely, the fishery data compiled in this analysis indicate that arrowtooth flounder is caught with several other species that are open to directed fishing. Under the MRA regulations, species also open to directed fishing can be used as a basis for incidental catch retention. Discards directly associated with arrowtooth flounder MRA restrictions are not clearly evident because the targets examined in this analysis are calculated on an annual basis and do not use the same algorithm as the calculation of MRAs. In other words, it is difficult to assess how much discard of incidentally caught species calculated in the Catch Accounting System (CAS) occurs due to current arrowtooth flounder MRA restrictions. Multiple species are often open to directed fishing that are caught in conjunction with arrowtooth flounder and can provide a basis for retention.

In order to better understand the constraints, if any, the arrowtooth flounder MRA restrictions have on the ability of individual operators to decrease regulatory discards, the analysis would need to examine the species composition of individual deliveries and, where available, observer data.

The 2006 catch data and fishery status information show that many species are open to directed fishing concurrently with arrowtooth flounder. Arrowtooth flounder is grouped with deep-water flatfish and rex sole in the deep-water species complex[1]. When the deep-water complex is open to directed fishing, arrowtooth flounder, rex sole, and deep-water flatfish can be retained at rates unrestricted by the MRA tables. Likewise, when the shallow-water complex is open concurrently with the deep-water complex, flathead sole and shallow-water flatfish can be retained without proportional restrictions. Fisheries for these 'incidental' species are generally not closed due to TAC considerations, in contrast with skates which were closed to directed fishing in 2006 and remain closed in 2007.

General Structure of the Fishery

In the Gulf of Alaska 2006 groundfish fishery, arrowtooth flounder is caught predominately by trawl gear. Table 5 shows within the trawl catch about 56 percent are taken by catcher vessels and 44 percent by catcher/processors.

Table 5. 2006 Gulf of Alaska arrowtooth flounder catch by gear type and processing component

Gear Type	Catcher/ Processors (mt)	% of Total	Catcher Vessels (mt)	% of Total	Total Catch (mt)
Non-pelagic trawl	11,873	48	13,098	52	24,971
Pelagic trawl	0	0	2,176	100	2,176
Trawl total	11,873	44	15,274	56	27,147
Hook-and-line	204	43	272	57	477
Grand Total	12,077	44	15,546	56	27,624
NOTE: jig and pot gear had combined reported catches of less than 20 mt					

The limited amount of arrowtooth flounder taken by hook-and-line gear is incidental to the sablefish and Pacific cod fisheries. Within catcher vessels the hook-and-line fishery for sablefish takes the vast majority. Additional amounts are taken in the catcher/processor hook-and-line fishery for sablefish and their fishery for Pacific cod. Within the catcher/processor hook-and-line fisheries, about half of the arrowtooth flounder caught was retained. Within the catcher vessel fishery, it is all discarded.

Trawl-caught arrowtooth flounder is distributed among several targets and tends to group based on processing mode. Figure 1 shows that catcher/processors take arrowtooth flounder predominately in the arrowtooth flounder target, followed by rex sole, flathead sole, and small amounts in the rockfish target. Catcher vessels likewise take the majority of their arrowtooth

[1] The deep-water species fishery are all rockfish of the genera *Sebastes* and *Sebastolobus*, deep-water flatfish, rex sole, arrowtooth flounder, and sablefish.

flounder in the arrowtooth flounder target followed by pollock, shallow-water flatfish (the catch is predominately rock sole), rockfish, and Pacific cod.

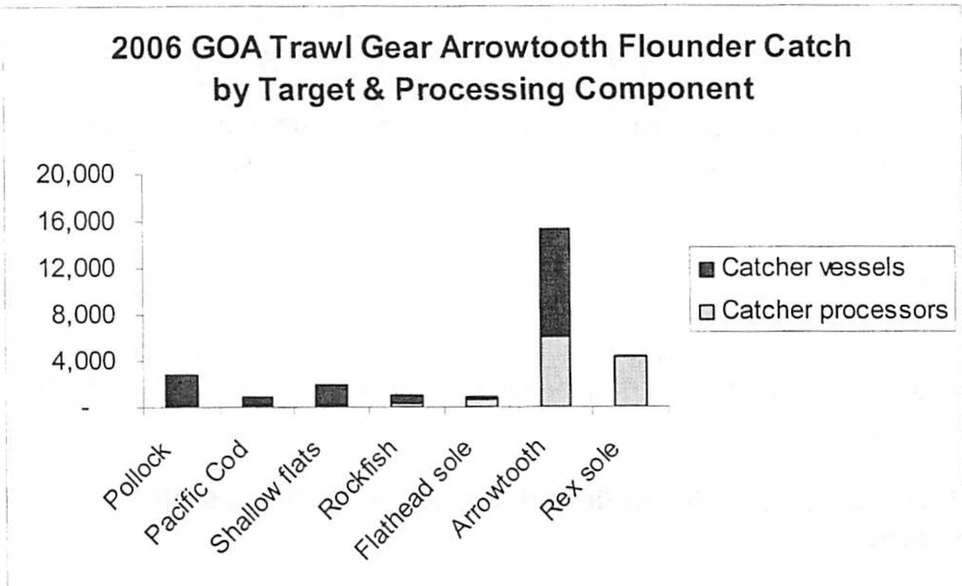

Figure 1.

Within the broad GOA trawl groundfish fishery, arrowtooth flounder is a mid-level component of the catch. Figure 2 illustrates that the 2006 trawl catch of arrowtooth flounder was taken predominately in April and generally in association with flatfish species.

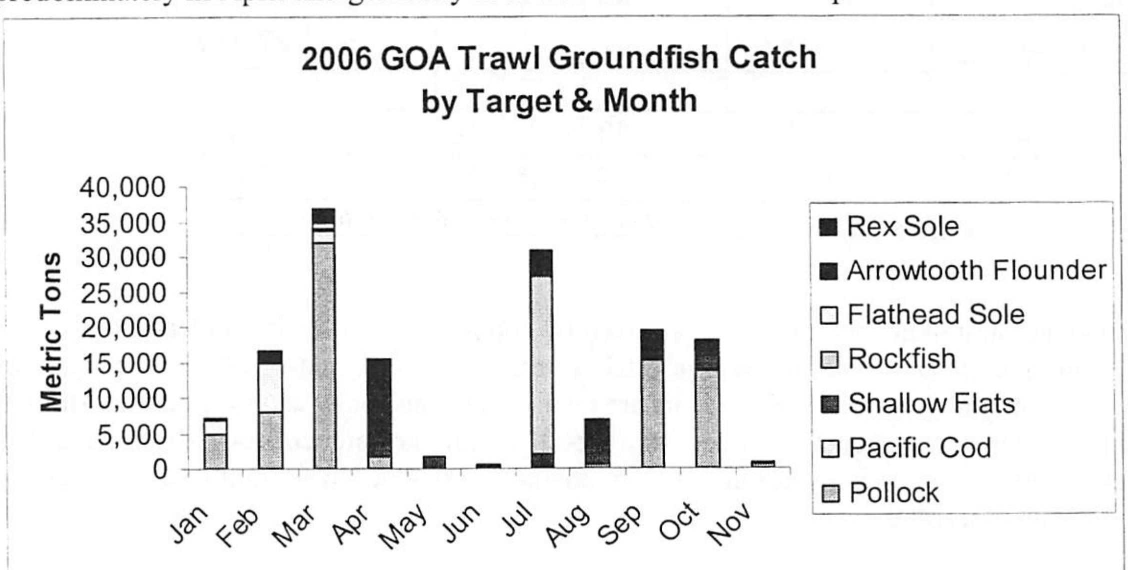

Figure 2.

Figure 3 shows arrowtooth flounder target is the dominate target when only flatfish are considered.

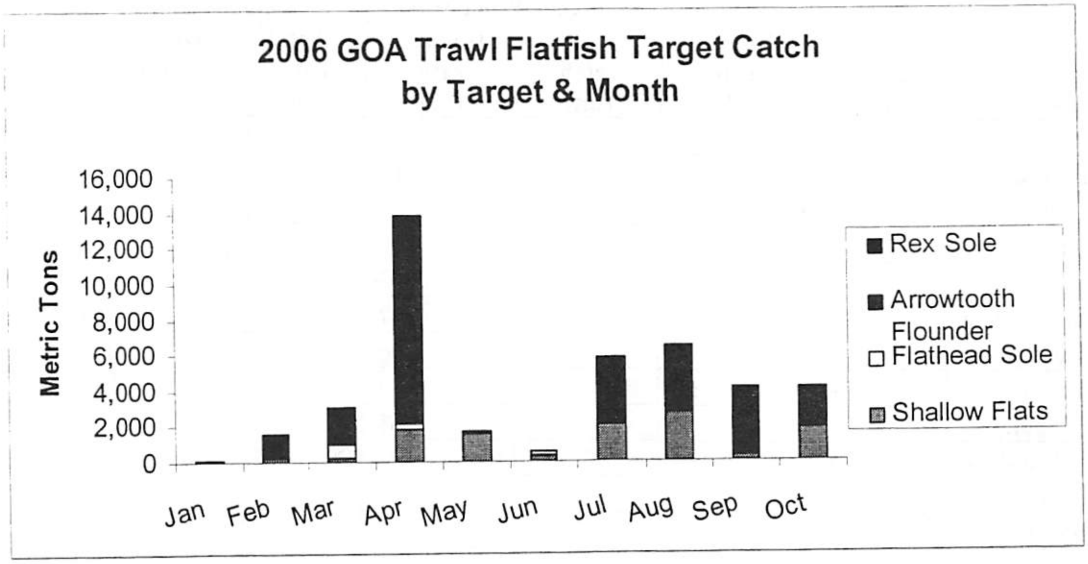

Figure 3.

Identification of Discards
The CAS is used to compile catch data to manage the groundfish fisheries and the associated prohibited species catch (PSC). The CAS calculates retained and discarded catch (including PSC) and assigns targets for that particular purpose. The CAS does not calculate basis and incidental species according to the regulatory rules associated with the MRA tables.

In the CAS, a target is determined by gear, Federal reporting area, and week. The CAS calculates single targets based on all retained catch and may include several species opened to directed fishing that are caught together. Targets are assigned to catcher processors on the basis of a week and to catcher vessels on the basis of a landing.

The MRA regulations identify basis and incidental species retention on different timeframes and species compositions than the CAS target calculations; therefore, this analysis does not show catch associated only with arrowtooth flounder as a basis species. Vessels may retain several species open to directed fishing. If several species are open to directed fishing and are landed together, the predominate retained species is generally assigned as the target. The display of annual retained and discarded species within the arrowtooth flounder target therefore does not reflect the MRA proportions, but rather, a dynamic of the trawl groundfish fishery.

Table 6 shows total catch and discard rates in the 2006 GOA trawl arrowtooth flounder target by processing component. It displays the annual general mix of species and the associated discard rates associated with the trawl arrowtooth flounder target.

Table 6. 2006 GOA trawl arrowtooth flounder target retention and discards by species and processing component

Species	Catcher Vessels		Catcher/Processors		Both Processing Components	
	Total catch (mt)	Discard rate (%)	Total catch (mt)	Discard rate (%)	Total catch (mt)	Discard rate (%)
Arrowtooth flounder	9,235	11	6,108	28	21,452	12
Flathead sole	937	3	324	10	1,584	4
Rex sole	385	2	718	5	1,821	2
Pacific cod	343	7	591	22	1,525	10
Pollock	664	9	91	27	847	10
Shallow-water flatfish	484	3	55	37	594	6
Pacific ocean perch	44	69	174	86	392	46
'Other' species	119	66	59	100	238	58
Sablefish	30	44	146	61	323	32
Big skate	157	21			157	21
Northern rockfish	12	56	129	79	270	40
Deep-water flatfish	43	6	95	81	233	34
Longnose skate	74	46	56	100	187	49
Pelagic shelf rockfish	26	72	103	6	233	11
'Other' skate	40	98	18	87	77	72
Thornyhead rockfish	5	21	16	10	36	7
Rougheye rockfish	17	49	-	-	17	49
Shortraker rockfish	8	8	3	4	14	5
'Other' rockfish	3	78	1	100	6	64
Atka mackerel	<1	79	2	39	4	21

The multiple species 'arrowtooth flounder target' consists of higher-valued species (all often open to directed fishing) that are retained at a high rate. Table 6 indicates a distinction between processing modes in the types of species retained within the broad arrowtooth flounder target. Figure 1 likewise indicates distinctions between catcher/processors and catcher vessels in targets where arrowtooth flounder is caught.

Table 7 shows the amount of retained catch by processing component by species in descending order. It indicates the preference of retained catch in the more generalized arrowtooth flounder/flatfish target.

Table 7. 2006 Gulf of Alaska trawl gear retained catch by processing component and species in the arrowtooth flounder target

Catcher/Processors		Catcher Vessels	
Species	Retained Catch (mt)	Species	Retained Catch (mt)
Arrowtooth flounder	4,417	Arrowtooth flounder	8,258
Rex sole	685	Flathead Sole	909
Pacific cod	459	Pollock	604
Flathead sole	291	Shallow-water flatfish (rock sole)	469
Pelagic shelf rockfish	97	Rex sole	375
Pollock	67	Pacific cod	319
Sablefish	57	Big Skate	123
Shallow-water flatfish (primarily rock sole)	35	Deep-water flatfish	41
Northern rockfish	27	Other skate	41
Pacific ocean perch	24	Longnose skate	40
Deep-water flatfish	18	Sablefish	17
Thornyhead rockfish	14	Pacific ocean perch	13
Shortraker	3	Rougheye	8
Unidentified Skate	2	Shortraker	8
Atka mackerel	1	Pelagic shelf rockfish	7
		Northern rockfish	5
		Thornyhead rockfish	4
		Unidentified Skate	1
		Other rockfish	1

The top three species retained by catcher/processors after arrowtooth flounder are rex sole, Pacific cod, and flathead sole. Trawl catcher/processors are predominately part of the offshore component which is very restricted in its ability to directed fish for Pacific cod. Pacific cod in this case could be retained relative to arrowtooth flounder, rex sole, and flathead sole. Some trawl catcher/processors are part of the inshore component. The inshore component has more opportunity to target Pacific cod. When the Pacific cod fishery is open, those vessels could retain it in conjunction with arrowtooth flounder without the MRA restriction.

The top three species retained by catcher vessels after arrowtooth flounder are flathead sole, pollock, and shallow-water flatfish (likely rock sole). Often during the year all three of these species are open concurrently to directed fishing.

Reviewing total and retained catch in the trawl arrowtooth flounder targets reveals that arrowtooth flounder is often a directed fishery and it can be taken in combination with other targets or species open to directed fishing. Depending on the actual incidental catch rates and status of the fisheries, some of the incidental catch of species closed to directed fishing associated with an arrowtooth flounder target may be retained against other species open to directed fishing and taken within the arrowtooth flounder target. Conversely, some species may be discarded because of the limited (or zero) MRAs that are calculated against arrowtooth flounder. To the extent that this occurs, more species may be retained as a result of the proposed changes to the MRAs.

Under the 2006 final groundfish harvest specifications, all skates were closed to directed fishing because most of the available quotas were necessary as incidental catch. Not enough skate TAC was available to conduct a directed fishery. Table 6 shows discard rates for skates ranging from 72 percent for 'other' skates, 49 percent for longnose skates, and 21 percent for big skates. Although a direct relationship between skate discards and the arrowtooth flounder fishery cannot be succinctly demonstrated in the CAS, it may be that some of the discards are associated with arrowtooth flounder MRA restrictions. An increase of the MRA as proposed from 0 percent to 20 percent will allow increased retention of a species currently discarded relative to arrowtooth flounder.

Halibut Bycatch Management and Species Status

Trawl groundfish fishing is highly influenced by halibut bycatch mortality management in the GOA. Groundfish fisheries are divided into two general categories; the deep-water complex and the shallow-water complex[2]. Each complex is allocated a portion of a 2,000 mt halibut mortality limit which is allocated across five seasons. The final season in October is not apportioned between the two complexes (Table 8).

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[2] At §679.21 (d)(3)(iii) these fisheries are defined as follows: (A) Shallow-water species fishery. Fishing with trawl gear during any weekly reporting period that results in a retained aggregate catch of pollock, Pacific cod, shallow-water flatfish, flathead sole, Atka mackerel, and "other species" that is greater than the retained aggregate amount of other GOA groundfish species or species group. (B) Deep-water species fishery. Fishing with trawl gear during any weekly reporting period that results in a retained catch of groundfish and is not a shallow-water species fishery as defined under paragraph (d)(3)(iii)(A) of this section.

Table 8. 2006 apportionment of Pacific halibut PSC trawl limits between the trawl deep-water species fishery and shallow-water species fishery

Season	Shallow-water (mt)	Deep-water (mt)	Total (mt)
January 20–April 1	450	100	550
April 1–July 1	100	300	400
July 1–September 1	200	400	600
September 1–October 1	150	Any remainder	150
Subtotal January 20–October 1	900	800	1,700
October 1–December 31			300
Total			2,000

Arrowtooth flounder is part of the deep-water complex as are deep-water flatfish, rex sole, sablefish, and rockfish. Sablefish are closed to directed fishing with trawl gear and rockfish are largely regulated under the Rockfish Pilot Program.

While arrowtooth flounder is open to directed fishing as a component of the deep-water complex, other deep-water complex components such as rex sole and deep-water flatfish (proposed to go from an MRA of 0 percent to 20 percent) are also open to fishing. When both fisheries are open simultaneously, retention of rex sole and deep-water flatfish are not restricted by MRAs relative to arrowtooth flounder. If rex sole or deep-water flatfish are closed due to TAC restrictions, the MRA restrictions relative to arrowtooth flounder would come into effect.

The proposal increases flathead sole and shallow-water flatfish from an MRA of 0 percent to 20 percent. Both species are part of the shallow-water complex. A review of the 2005 and 2006 fishery status indicates that most species components of the shallow-water complex are open to directed fishing for nearly the entire time the deep-water complex is open (Table 9). When the shallow-water complex is open concurrently with arrowtooth flounder (i.e., the deep-water complex) the MRAs for flatfish in the shallow-water complex are not an issue. For the time periods the shallow-water complex may be closed, the MRA tables do come into effect and discards can be required. In the event one or more of these species is closed to directed fishing, discards may likewise occur under the current regulations and could be reduced by the proposal.

Table 9. 2005 & 2006 GOA trawl halibut closures by species complex

2005 CLOSURES	Open	Closed	2006 CLOSURES	Open	Closed	Note
Shallow-water complex	20-Jan	19-Aug	Shallow-water complex	20-Jan	23-Feb	
	1-Sep	4-Sep		27-Feb	10-Jun	
	1-Oct	1-Oct		1-Jul	1-Sep	midnight
				6-Sep	6-Sep	12 hr
Deep-water complex	20-Jan	23-Mar		20-Sep	20-Sep	12 hr
	1-Apr	8-Apr		25-Sep	25-Sep	12 hr
	24-Apr	3-May		1-Oct	8-Oct	
	5-Jul	24-Jul				
	1-Sep	4-Sep	Deep-water complex	20-Jan	27-Apr	
	8-Sep	10-Sep		1-Jul	5-Sep	
	1-Oct	1-Oct	Combined	1-Oct	8-Oct	

Comparison of 1997 and 2006 Halibut Mortality by Trawl Groundfish Target

In the 1997 proposed rule expressed concern regarding the use of halibut mortality in the arrowtooth flounder target (62 FR 724; January 6, 1997):

> Directed fishing for arrowtooth flounder could increase the rates at which halibut bycatch limits or allowances are reached, thus further limiting the ability of the groundfish fleet to harvest available TAC amounts before halibut bycatch restrictions close the fisheries.

The use of halibut bycatch mortality in the arrowtooth flounder target has increased despite the MRA restrictions imposed in 1997. Table 10 and Figure 4 show the marked increase of halibut bycatch mortality in the arrowtooth flounder target.

Table 10. 1997 & 2006 Gulf of Alaska trawl halibut bycatch mortality by target species

Target Species	1997 halibut mortality (mt)	2006 halibut mortality (mt)
Deep-water flatfish	228	-
Rockfish	261	186
Arrowtooth flounder	78	616
Rex sole	299	116
Pacific cod	604	347
Shallow flatfish	451	632
Flathead sole	164	24
Other species	23	-
Pollock	5	82
Total	2,112	2,003

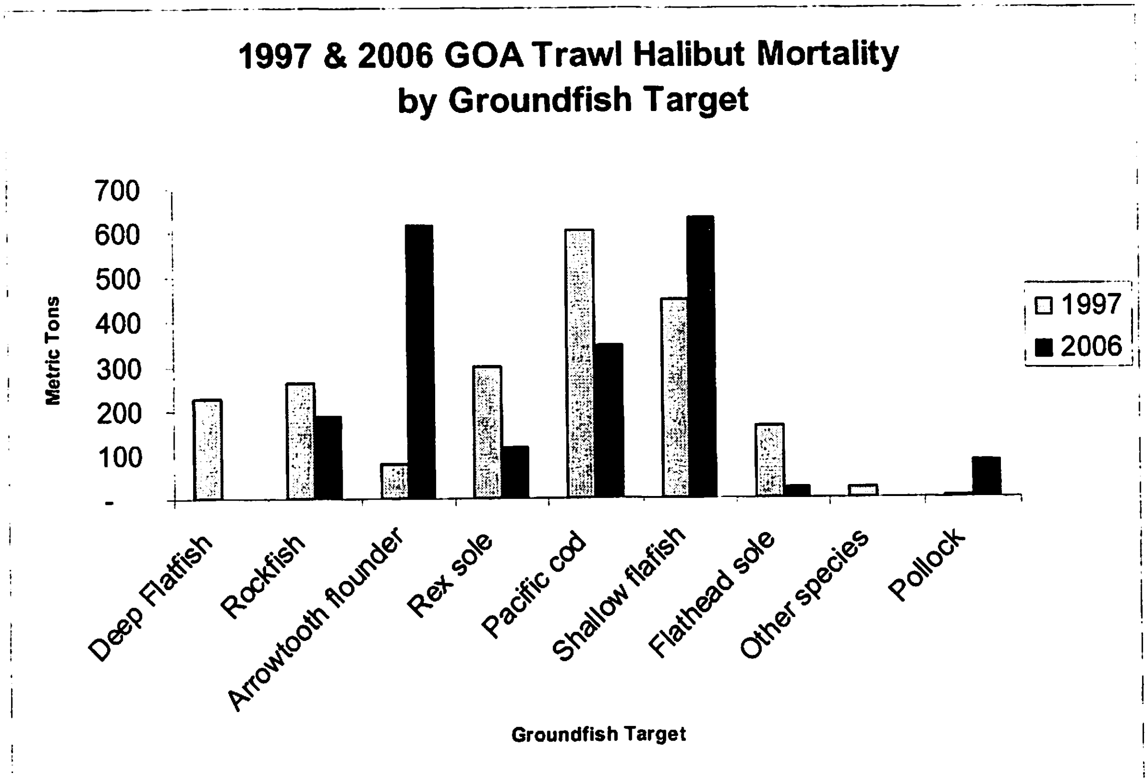


Figure 4.

A detailed examination of the differences between the target fisheries in these two years is beyond the scope of this analysis. Changes in markets, species availability, fishing practices, the composition of species within the targets, and the size of the ABC (for example Pacific cod) all may contribute to the distribution of fleet effort and the associated shift in halibut mortality assignments to different target fisheries.

<u>Conclusion and Effects of the Proposal</u>

The proposal could increase the amount of groundfish retained in the arrowtooth flounder target fishery.

The fishery analysis shows arrowtooth flounder can be taken in conjunction with species that are open to directed fishing. Incidental catch other than pollock and Pacific cod can be accounted for in 'mixed target yet primarily arrowtooth flounder' fisheries. To the extent that arrowtooth flounder is taken as a single target, increasing the MRAs for incidentally caught species would provide the opportunity to the fleet to increase retention of these species to the degree that economic or other incentives exist to do so.

This analysis has not explicitly demonstrated that current regulations are requiring discards. Table 6 shows that discards are occurring. An analysis that reviews catch and discard information at the delivery or haul level will be very complex and consume staff time. Apart from discards that may currently occur as a result of the MRAs associated with the arrowtooth flounder directed fishery, arrowtooth flounder has matured into a target. That arrowtooth flounder is now clearly a target justifies increasing the MRAs for incidental catch.

Since 1997, despite the current MRA regulations, the trawl fleet has taken an increasing amount of halibut in the arrowtooth flounder target (Figure 4). In other words, some components of the trawl fleet have deliberately chosen to utilize halibut mortality, a valuable commodity, in the arrowtooth flounder target. The arrowtooth flounder target dominates among the trawl gear flatfish targets (Figure 3). Arrowtooth flounder are more valuable (Table 2), are retained at an increasing rate (Table 3), and are taken in an increasing proportion in the arrowtooth flounder target rather than incidentally in other targets (Table 4). These conditions demonstrate that the status of arrowtooth flounder has changed since the implementation of the MRA regulations ten years ago. Adjusting the MRAs for arrowtooth flounder to increase the potential for retention can help meet the goal of reducing discards.

Potential Areas for Additional Analysis

As MRAs for a number of species that are incidentally caught in the arrowtooth flounder target are regulated for various management and resource access reasons, further analysis of this proposal might consider the following management and enforcement issues:

- What are historical catch and retention rates for these incidental species when arrowtooth flounder is open to directed fishing? Do historic data suggest that there is a residual amount of catch that could be retained if market or other incentives existed to do so?
- Would increasing MRAs for any of these species move catches closer to established ABCs? How do the incidental species ABCs compare with average catch and recent catches? Are total catches approaching the ABC so additional small increases in catch would be of concern?
- How many times has an incidental species been closed on TAC or reached the TAC in the groundfish harvest specifications, and is that a consideration in selecting a given species?
- Is the existing MRA set at 0 percent, between 0 percent and 10 percent or greater than 20 percent and why? Would an increase in exploitation or targeting of this species (if it occurred) conflict with the intent of the MRAs currently set?
- Is this species part of another species complex in the GOA for the purpose of management? Does an increasing MRA percent have implications for management?
- Are there any endangered or threatened species issues that may be related to increasing the MRA rate? MRAs currently apply in Steller sea lion protection areas for pollock, Atka mackerel, and Pacific cod. With any relaxation of a regulation in those areas/species it is generally useful to review to ensure they are consistent with a current Biological Opinion.
- While this proposal does not appear to alter any current or planned methods for MRA accounting or alter the definition of a fishing trip, are there enforcement implications (either positive or negative) for increasing the MRA rates at the amounts proposed?
- What impact might the proposal have on halibut bycatch? Are there other directed trawl fisheries that are limited by the expansion of the arrowtooth flounder fishery?

Attachment 1

FISHERY MANAGEMENT PLAN or REGULATORY AMENDMENT PROPOSAL
North Pacific Fishery Management Council

Date: 10/5/06

Name of Proposer: Alaska Groundfish Data Bank

Address: P.O. Box 788 Kodiak, Alaska 99615

Telephone: 907-486-3033

Fishery Management Plan: Gulf of Alaska

Brief Statement of Proposal: Revise the Maximum Retainable Allowances (MRA) for the Arrowtooth Flounder target fishery.

Objectives of Proposal (What is the problem?): When the MRAs were set in regulations, the Council chose to set incidental catch allowances at zero for a wide group of species to prevent vessels from using Arrowtooth as a basis species for retention since their was no market for Arrowtooth Flounder. Arrowtooth Flounder is now a viable target fishery and the MRAs for these other species need to be changed to remove the requirement for regulatory discards. The Council has had two recent amendments to the GOA FMP. The first amendment removed Skates from the Other Species TAC group, and the second amendment uses a different method to set the Other Species TAC. In the first case, the Council did not change the MRA for Skates for the Arrowtooth target fishery but instead left the MRA at 0%, in the second case for other species the Council revised the MRA from 0% to 20%. As the table below shows there are presently a suite of species that have a MRAs of 0% which creates a conservation concern since any incidental catch of these species must be discarded at sea.

Need and Justification for Council Action (Why can't the problem be resolved through other channels?): The MRAs are in regulations and therefore would have to be changed by a regulatory amendment.

Foreseeable Impacts of Proposal (Who wins, who loses?): Reduction of regulatory discards, increased utilization of fish that is caught by fishermen.

Are there Alternative Solutions? If so, what are they and why do you consider your proposal the best way of solving the problem? No

Supporting Data & Other Information. What data are available and where can they be found? Be specific and cite references.

Table 10 to Part 679 – Gulf of Alaska Retainable Percentages

Basis Species = Arrowtooth Flounder

Incidental catch species	MRA	P-MRA
Pollock	5%	5%
Pacific cod	5%	5%
Deepwater Flatfish	0%	20%
Rex Sole	0%	20%
Flathead Sole	0%	20%
Shallow Water Flatfish	0%	20%

Incidental catch species	MRA	P-MRA
Sablefish	0%	1%
Aggregated Rockfish	0%	5% or less
Atka Mackerel	0%	20%
Aggregated forage fish	2%	2%
Skates	0%	20%
Other Species	20%	20%

Attachment 2 : Table 10 to Part 679—Gulf of Alaska Retainable Percentages

BASIS SPECIES		INCIDENTAL CATCH SPECIES (for DSR caught on catcher vessels in the SEO, see § 679.20 (j)[6])														
Code	Species	Pollock	Pacific cod	DW flat[2]	Rex sole	Flathead sole	SW Flat [3]	Arrowtooth	Sablefish	Aggregated rockfish[8]	SR/RE ERA [1]	DSR SEO (C/Ps only) [6]	Atka mackerel	Aggregated forage fish[10]	Skates [11]	Other species [7]
110	Pacific cod	20	na[9]	20	20	20	20	35	1	5	[1]	10	20	2	20	20
121	Arrowtooth	5	5	0	0	0	0	na[9]	0	0	0	0	0	2	0	20
122	Flathead sole	20	20	20	20	na[9]	20	35	7	15	7	1	20	2	20	20
125	Rex sole	20	20	20	na[9]	20	20	35	7	15	7	1	20	2	20	20
136	Northern rockfish	20	20	20	20	20	20	35	7	15	7	1	20	2	20	20
141	Pacific ocean perch	20	20	20	20	20	20	35	7	15	7	1	20	2	20	20
143	Thornyhead	20	20	20	20	20	20	35	7	15	7	1	20	2	20	20
152/ 151	Shortraker/ rougheye [1]	20	20	20	20	20	20	35	7	15	na[9]	1	20	2	20	20
193	Atka mackerel	20	20	20	20	20	20	35	1	5	[1]	10	na[9]	2	20	20
270	Pollock	na[9]	20	20	20	20	20	35	1	5	[1]	10	20	2	20	20
710	Sablefish	20	20	20	20	20	20	35	na[9]	15	7	1	20	2	20	20
Flatfish, deep-water [2]		20	20	na[9]	20	20	20	35	7	15	7	1	20	2	20	20
Flatfish, shallow water [3]		20	20	20	20	20	na[9]	35	1	5	[1]	10	20	2	20	20
Rockfish, other [4]		20	20	20	20	20	20	35	7	15	7	1	20	2	20	20
Rockfish, pelagic [5]		20	20	20	20	20	20	35	7	15	7	1	20	2	20	20
Rockfish, DSR-SEO [6]		20	20	20	20	20	20	35	7	15	7	na[9]	20	2	20	20
Skates[11]		20	20	20	20	20	20	35	1	5	[1]	10	20	2	na[9]	20
Other species [7]		20	20	20	20	20	20	35	1	5	[1]	10	20	2	20	na[9]
Aggregated amount of non-groundfish species		20	20	20	20	20	20	35	1	5	[1]	10	20	2	20	20

Table 10 to Part 679--Gulf of Alaska Retainable Percentages

Notes to Table 10 to Part 679					
1	Shortraker/rougheye rockfish				
		SR/RE	shortraker/rougheye rockfish (171)		
			shortraker rockfish (152)		
			rougheye rockfish (151)		
		SR/RE ERA	shortraker/rougheye rockfish in the Eastern Regulatory Area.		
	Where numerical percentage is not indicated, the retainable percentage of SR/RE is included under Aggregated Rockfish				
2	Deep-water flatfish		Dover sole, Greenland turbot, and deep-sea sole		
3	Shallow-water flatfish		Flatfish not including deep-water flatfish, flathead sole, rex sole, or arrowtooth flounder		
4	Other rockfish		Western Regulatory Area	means slope rockfish and demersal shelf rockfish	
			Central Regulatory Area		
			West Yakutat District		
			Southeast Outside District	means slope rockfish	
			Slope rockfish		
			S. aurora (aurora)	*S. variegatus* (harlequin)	*S. brevispinis* (silvergrey)
			S. melanostomus (blackgill)	*S. wilsoni* (pygmy)	*S. diploproa* (splitnose)
			S. paucispinis (bocaccio)	*S. babcocki* (redbanded)	*S. saxicola* (stripetail)
			S. goodei (chilipepper)	*S. proriger* (redstripe)	*S. miniatus* (vermilion)
			S. crameri (darkblotch)	*S. zacentrus* (sharpchin)	*S. reedi* (yellowmouth)
			S. elongatus (greenstriped)	*S. jordani* (shortbelly)	
			In the Eastern GOA only, Slope rockfish also includes *S. polyspinous*. (Northern)		
5	Pelagic shelf rockfish		*S. ciliatus* (dusky)	*S. entomelas* (widow)	*S. flavidus* (yellowtail)
6	Demersal shelf rockfish (DSR)		*S. pinniger* (canary)	*S. maliger* (quillback)	*S. ruberrimus* (yelloweye)
			S. nebulosus (china)	*S. helvomaculatus* (rosethorn	
			S. caurinus (copper)	*S. nigrocinctus* (tiger)	
			DSR-SEO = Demersal shelf rockfish in the Southeast Outside District The operator of a catcher vessel that is required to have a Federal fisheries permit, or that harvests IFQ halibut with hook and line or jig gear, must retain and land all DSR that is caught while fishing for groundfish or IFQ halibut in the SEO. Limits on sale and requirements for disposal of DSR are set out at § 679.20 (j).		
7	Other species		sculpins	octopus	sharks | Squid
8	Aggregated rockfish		Means rockfish of the genera *Sebastes* and *Sebastolobus* defined at § 679.2 except in:		
			Southeast Outside District (SEO)	where DSR is a separate category for those species marked with a numerical percentage	
			Eastern Regulatory Area (ERA)	where SR/RE is a separate category for those species marked with a numerical percentage	

Notes to Table 10 to Part 679			
9	N/A	not applicable	
10	Aggregated forage fish (all species of the following families)		Species code
		Bristlemouths, lightfishes, and anglemouths (family *Gonostomatidae*)	209
		Capelin smelt (family *Osmeridae*)	516
		Deep-sea smelts (family *Bathylagidae*)	773
		Eulachon smelt (family *Osmeridae*)	511
		Gunnels (family *Pholidae*)	207
		Krill (order *Euphausiacea*)	800
		Laternfishes (family *Myctophidae*)	772
		Pacific herring (family *Clupeidae*)	235
		Pacific Sand fish (family *Trichodontidae*)	206
		Pacific Sand lance (family *Ammodytidae*)	774
		Pricklebacks, war-bonnets, eelblennys, cockscombs and Shannys (family *Stichaeidae*)	208
		Surf smelt (family *Osmeridae*)	515
11	Skates Species and Groups		
		Big Skates	702
		Longnose Skates	701
		Other Skates	700

INITIAL REVIEW DRAFT

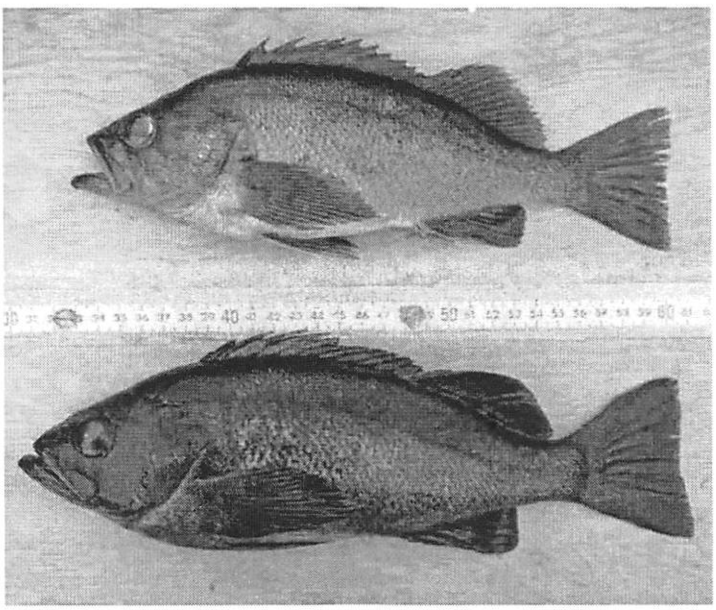
ENVIRONMENTAL ASSESSMENT / REGULATORY IMPACT REVIEW / INITIAL REGULATORY FLEXIBILITY ANALYSIS

for

Revised Management Authority of Pelagic Shelf Rockfish Complex in the GOA and the Other rockfish complex in the BSAI (Dark Rockfish)

Proposed amendments to the
Fishery Management Plans for Gulf of Alaska Groundfish and Bering Sea Aleutian Islands Groundfish

Prepared by staff of the
North Pacific Fishery Management Council



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January 19, 2007

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EXECUTIVE SUMMARY

This Environmental Assessment, Regulatory Impact Review and Initial Regulatory Flexibility Analysis describes the proposed amendment to the Gulf of Alaska Groundfish and Bering Sea Aleutian Islands Groundfish Fishery Management Plans (FMPs). This amendment proposes to remove dark rockfish (*Sebastes ciliatus*) from the GOA and BSAI groundfish FMPs. This species is currently contained in the pelagic shelf rockfish (PSR) assemblage in the GOA and in the other rockfish complex in the BSAI. It makes up a small proportion of the total biomass in each complex, is more often found in nearshore waters, and is caught in State fisheries. Removing this species from these FMPs would turn management for this species in both State and Federal waters over to the State of Alaska.

The following problem statement is proposed for this analysis:

Dark rockfish are a nearshore, shallow water species which are rarely caught in offshore, Federal waters. For management purposes they are contained within the pelagic shelf rockfish complex in the GOA, whose OFL and ABC are based primarily on the stock assessment for dusky rockfish which makes up the majority of the total exploitable biomass estimate for the PSR complex. In the BSAI dark rockfish are contained within the other rockfish complex whose biomass is largely comprised of dusky rockfish and thornyhead rockfish. As dark rockfish have now been identified as a separate species, are found in nearshore, shallow waters, and could potentially be locally overfished within the larger PSR complex TAC in the GOA, the Council should consider removing this species from the GOA groundfish FMP thereby transferring their management to the State of Alaska. For consistency in management the Council should also consider removing this species from the BSAI FMP.

Two actions are analyzed in this document with two alternatives for each action: Action 1 refers to the GOA groundfish FMP. Under this action there are two alternatives: alternative 1, to continue managing dark rockfish within the larger pelagic shelf rockfish complex; and alternative 2, to remove dark rockfish from the GOA FMP and turn over to the State of Alaska for management. Action 2 refers to the BSAI groundfish FMP. Under this action there are two alternatives: alternative 1, to continue managing dark rockfish within the other rockfish complex; and alternative 2, to remove dark rockfish from the BSAI FMP and turn over to the State of Alaska for management.

Environmental Assessment

There is limited impact in the Federal fishery of removing this species from either FMP. Dark rockfish comprise a small proportion of the total biomass in the PSR assemblage, which is dominated by the target species, dusky rockfish. Impacts to other PSR stocks as well as other groundfish stocks are minimal due to the relatively minor contribution to the overall exploitable biomass from the dark rockfish stock. Dark rockfish makes up a very minor component of the total biomass in the other rockfish complex in the BSAI. This is not a target fishery, and retained catch is dominated by shortspine thornyhead rockfish and dusky rockfish. These two species make up the majority of the biomass in the complex.

Management of dark rockfish by the State is anticipated to be an improvement over Federal management within the PSR complex due to the State's ability to manage this stock as a single stock and on smaller management areas to protect against the potential for localized depletion. There are no anticipated impacts to marine mammals, seabirds, threatened or endangered species, habitat or the ecosystem.

Regulatory Impact Review

Removal of dark rockfish from the pelagic shelf rockfish complex in the GOA could result in minor decreases in the pelagic shelf rockfish TAC, but since dark rockfish are such a small part of the stock of the complex any decline in the TAC is likely to be nominal. Removal of dark rockfish from the other rockfish complex in the BSAI will result in a minimal decrease in the TAC for this complex.

Initial Regulatory Flexibility Analysis

Transfer of management of dark rockfish to the State is likely to result in some changes in regulation of catch. The State could develop a directed fishery for dark rockfish, most likely for fixed gear vessels. Since fixed gear vessels tend to be small, it is possible that the development of such a directed fishery would have a positive impact on small entities, by increasing fishing opportunities. The IRFA in this document is preliminary until the Council selects a preferred alternative. At that point, the potential impact on affected small entities of the action will be developed further in the analysis.

TABLE OF CONTENTS

LIST OF FIGURES AND TABLES

1.0 PURPOSE AND NEED FOR ACTION

The groundfish fisheries in the Exclusive Economic Zone (EEZ) (3 to 200 miles offshore) in the Gulf of Alaska (GOA) and the Bering Sea Aleutian Islands (BSAI) are managed under the Fishery Management Plan (FMP) for the Gulf of Alaska Groundfish and the FMP for the Bering Sea Aleutian Islands Groundfish. These FMPs were developed by the North Pacific Fishery Management Council (Council) under the Magnuson Fishery Conservation and Management Act (Magnuson Act).

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

NEPA, E.O. 12866 and the RFA require a description of the purpose and need for the proposed action as well as a description of alternative actions which may address the problem. This information is included in Chapters 1 and 2 of this document. Chapter 3 contains information on the biological and environmental impacts of the alternatives as required by NEPA. Impacts on endangered species and marine mammals are addressed in Chapter 4. Chapter 5 contains a Regulatory Impact Review (RIR) which addresses the requirements of both E.O. 12866 and the RFA that economic impacts of the alternatives be considered. Chapter 6 discusses the potential impacts on small entities per the Regulatory Flexibility Act.

1.1 Purpose and Need

Dark rockfish are part of the pelagic shelf rockfish (PSR) assemblage in the Gulf of Alaska Groundfish Fishery Management Plan (FMP). Members of this assemblage include the following four species: dusky rockfish (*Sebastes variabilis*), dark rockfish (*S. ciliatus*), yellowtail rockfish (*S. flavidus*), and widow rockfish (*S. entomelas*). In the Bering Sea Aleutian Islands FMP dark rockfish are contained within the "other rockfish" complex which contains the following eight species: red banded rockfish (*Sebastes babcocki*), dark rockfish, dusky rockfish, redstripe rockfish (*S. proriger*), yelloweye rockfish (*S. ruberrimus*), harlequin rockfish (*S. variegatus*), sharpchin rockfish (*S. zacentrus*), shortspine thornyhead (*Sebatolobus alascanus*).

The forms of dusky rockfish commonly recognized as "light dusky rockfish" and "dark dusky rockfish" are now officially recognized as two species (Orr and Blackburn 2004). *S. ciliatus* applies to the dark shallow-water species with a common name dark rockfish, and *S. variabilis* applies to variably colored deeper-water species with a common name dusky rockfish.

Dark rockfish are found predominantly in nearshore, shallow waters. Assessment authors have suggested for years that dark rockfish be turned over the State of Alaska for management in the GOA as data in the stock assessment for PSR are predominantly from dusky rockfish (the offshore variety) not dark rockfish (the nearshore, shallow water variety). Most of the available information is from the offshore trawl surveys and offshore commercial fishery and dusky rockfish makes up the majority of the exploitable biomass and catch from the assemblage. A similar concern has been raised by the BSAI plan team for dark rockfish in the overall other rockfish assemblage.

1.1.1 Problem Statement

Given that dark rockfish are located predominantly in nearshore, shallow waters, if specifically targeted the potential exists for them to be locally overfished under the relatively high TAC for the entire pelagic shelf rockfish complex. Amendment 46 to the GOA groundfish FMP addressed a similar situation in the

PSR complex by removing black and blue rockfish, nearshore rockfish populations which were not thought to be well-assessed by the trawl survey, from the GOA groundfish FMP and turned management over to the State of Alaska (NPFMC 1998). A similar situation exists for dark rockfish, and management by the State of Alaska would better address localized harvest requirements for this nearshore species than is currently provided by Federal management under the larger PSR complex in the GOA and the other rockfish complex in the BSAI.

Since official recognition as a separate species, the GOA Plan Team has also endorsed removing dark rockfish from the FMP based on the following rationale: (1) separation at species level, (2) distribution of dark rockfish to nearshore habitats that are not specifically assessed by the GOA trawl survey, and (3) the risk of overfishing dark rockfish in local areas given the relatively high TAC for the pelagic shelf rockfish assemblage as a whole. In 2004, the SSC endorsed the rationale and agreed with the Plan Team's recommendation of removing dark rockfish from the FMP. The Council initiated this in 2005 but action was delayed until the 2005 GOA trawl survey data became available for analysis. An initial review draft of a GOA only amendment was presented to the Council in April 2006. At that time the Council chose to add an alternative to evaluate a similar action for the BSAI FMP due to suggestions made by the BSAI groundfish plan team and the SSC to that effect. The current analysis now evaluates removing dark rockfish from both the GOA FMP and the BSAI FMP.

The following problem statement is put forward to address the analysis for both BSAI and GOA FMPs:

Dark rockfish are a nearshore, shallow water species which are rarely caught in offshore, Federal waters. For management purposes they are contained within the pelagic shelf rockfish complex in the GOA, whose OFL and ABC are based primarily on the stock assessment for dusky rockfish which makes up the majority of the total exploitable biomass estimate for the PSR complex. In the BSAI dark rockfish are contained within the other rockfish complex whose biomass is largely comprised of dusky rockfish and thornyhead rockfish. As dark rockfish have now been identified as a separate species, are found in nearshore, shallow waters, and could potentially be locally overfished within the larger PSR complex TAC in the GOA, the Council should consider removing this species from the GOA groundfish FMP thereby transferring their management to the State of Alaska. For consistency in management the Council should also consider removing this species from the BSAI FMP.

1.2 Next Steps in the Process

This analysis is scheduled for initial review at the February Council meeting. Pending the review process by the Council, the analysis will be revised and released for public review following the February Council meeting. Final action on this amendment is scheduled for April 2007.

2.0 DESCRIPTION OF ALTERNATIVES

Two actions are analyzed in this document with two alternatives for each action: Action 1 refers to the GOA groundfish FMP. Under this action there are two alternatives: Alternative 1, to continue managing dark rockfish within the larger pelagic shelf rockfish complex; and alternative 2, to remove dark rockfish from the GOA FMP and turn over to the State of Alaska for management. Action 2 refers to the BSAI groundfish FMP. Under this action there are two alternatives: Alternative 1, to continue managing dark rockfish within the other rockfish complex; and Alternative 2, to remove dark rockfish from the BSAI FMP and turn over to the State of Alaska for management.

2.1 Action 1: GOA groundfish FMP

2.1.1 Alternative 1: Status quo

Under this alternative, dark rockfish would continue to be managed within the pelagic shelf rockfish assemblage. The Council and the National Marine Fisheries Service would retain management authority for dark rockfish within the PSR complex in the EEZ. Overfishing limits (OFLs), acceptable biological catch (ABC) limits and total allowable catch (TAC) limits are established for the complex as a whole and managed accordingly. In season, catch is managed through monitoring directed fishing, with the fishery closed when directed fishing is estimated to leave only the portion of the TAC necessary to support incidental catch in other directed fisheries. Once the directed fishery is closed, incidental catch is managed under the aggregate rockfish MRA, which limits catch of all rockfish of the genera *Sebastes* and *Sebastolobus* (which includes Pacific Ocean perch, northern rockfish, pelagic shelf rockfish, demersal shelf rockfish, and "other rockfish") to 15 percent of directed fishing harvests.

2.1.2 Alternative 2: Remove dark rockfish from the Gulf of Alaska FMP

Under this alternative, management authority for dark rockfish is redefined by withdrawing dark rockfish from the Federal GOA groundfish FMP. Under the Magnuson-Stevens Act, State management authority may be extended into Federal waters off Alaska in the absence of Federal management of the species in question. Under this alternative, the State of Alaska could assume management authority for dark rockfish. Management plans for this species would be prepared by ADF&G staff for the Gulf of Alaska state management regions and reviewed by the Board of Fisheries.

OFLs, ABCs and TACs would continue to be specified for the PSR complex, but this complex would no longer include dark rockfish. The State would take on the responsibility for assessment and management of the dark rockfish stock.

In managing dark rockfish, the State of Alaska would develop a fishery management plan for the species under which gear type, season and guideline harvest level (GHL) for the species would be specified. The State may impose on State-registered vessels fishing in Federal fisheries only additional State measures such as bycatch retention limits for dark rockfish, as are consistent with the applicable Federal fishing regulations for the fishery in which the vessel is operating. It is not the intention of the Council or NMFS to give the State authority to indirectly regulate other Federal fisheries through State implementation of gear restrictions, area closures or other bycatch control measures. Most likely, State management of dark rockfish would include regulation of any directed fishing for dark rockfish. Dark rockfish catch in Federal fisheries would be limited by the current MRA for aggregate rockfish or a separate bycatch limit as established by the State.

While specific management plans have not yet been formulated by the State, it is likely that measures used currently (e.g., in management of black rockfish) would be among those considered for dark rockfish management by the State (D. Carlile, pers. comm.).

These candidate measures would include, but not necessarily be limited to the following:

- Guideline harvest limits (GHLs, or quotas)
- Gear-, area- and directed-fishery-specific bycatch limits, wherein catch in excess of bycatch limits would be reported as bycatch overage on an ADF&G fish ticket, the excess bycatch would be required to be landed, with all proceeds from the sale of excess dark rockfish bycatch surrendered to the State.
- Full retention of all rockfish caught, with proceeds of the sale of any bycatch overage paid to the State of Alaska.
- Directed fisheries for dark rockfish in some areas of the State; in others perhaps bycatch only.
- No-take zones, wherein dark rockfish might not be allowed to be taken in a directed fishery and proceeds from any bycatch would be surrendered to the State.
- Gear restrictions (e.g. jig only) for directed fisheries.
- Trip limits.
- Reporting requirements such as submission of ADF&G fish tickets and/or logbooks.
- Vessel registrations for specific directed dark rockfish fishery areas.

2.2 Action 2: BSAI groundfish FMP

2.2.1 Alternative 1: Status Quo

Under this alternative, dark rockfish would continue to be managed within the other rockfish assemblage in the BSAI. The Council and the National Marine Fisheries Service would retain management authority for dark rockfish within the other rockfish complex in the EEZ. Overfishing limits (OFLs), acceptable biological catch (ABC) limits and total allowable catch (TAC) limits are established for the complex as a whole and managed accordingly. In season, catch is managed through monitoring directed fishing, with the fishery closed when directed fishing is estimated to leave only the portion of the TAC necessary to support incidental catch in other directed fisheries. Once the directed fishery is closed, incidental catch is managed under the aggregate rockfish MRA, which limits catch of all rockfish of the genera *Sebastes* and *Sebastolobus* (which includes Pacific ocean perch, northern rockfish, pelagic shelf rockfish, demersal shelf rockfish, and "other rockfish") to 15 percent of directed fishing harvests.

2.2.2 Alternative 2: Remove dark rockfish from the BSAI FMP

Under this alternative, management authority for dark rockfish is redefined by withdrawing dark rockfish from the Federal BSAI groundfish FMP. Under the Magnuson-Stevens Act, State management authority may be extended into Federal waters off Alaska in the absence of Federal management of the species in question. Under this alternative, the State of Alaska could assume management authority for dark rockfish. Management plans for this species would be prepared by ADF&G staff for the Aleutian Island and Bering Sea state management regions and reviewed by the Board of Fisheries.

OFLs, ABCs and TACs would continue to be specified for the other rockfish complex, but this complex would no longer include dark rockfish. The State would take on the responsibility for assessment and management of the dark rockfish stock.

In managing dark rockfish, the State of Alaska would develop a fishery management plan for the species under which gear type, season and guideline harvest level (GHL) for the species would be specified.

Candidate measures to be included in any State management plan would be similar to those listed for the GOA FMP (see section 2.1.2).

2.3 Alternatives Considered but not Carried Forward

One alternative which was considered but not carried forward for analysis involves transferring management authority of dark rockfish to the State of Alaska while retaining the species under the Federal FMP. Demersal shelf rockfish in Southeast Alaska is under a similarly delegated management program to the State of Alaska. This alternative was not carried forward for dark rockfish for many reasons. A similar alternative was considered and rejected for black and blue rockfish under amendment 46 to the GOA groundfish FMP. Reasons for rejecting this for that amendment are the following: 1) State personnel would be required to comply with additional management processes; 2) the State would need to meet both state and federal requirements which are often on different time-frames for management (e.g., public meetings and reports); and 3) the State did not believe it could meet the costly assessment requirements for managing a nearshore species under a federal management plan (NPFMC 1998). Instead conservative management of the species under a state management jurisdiction only would be less costly and more conservative.

These reasons are also valid for the delegating state management of dark rockfish. Furthermore the State has indicated that it is not interested in delegated management authority for this species and would only be willing to take on management of dark rockfish if it was removed from the Federal FMP. Given this indication, this alternative was not carried forward for analysis in this document.

3.0 AFFECTED ENVIRONMENT

3.1 General distribution and habitat requirements of dark rockfish

In the GOA FMP, dark rockfish are managed as part of the shelf rockfish (PSR) assemblage. Four species comprise this assemblage: dusky rockfish (*Sebastes variabilis*), dark rockfish (*S. ciliatus*), yellowtail rockfish (*S. flavidus*), and widow rockfish (*S. entomelas*). In the Bering Sea Aleutian Islands FMP dark rockfish are contained within the "other rockfish" complex which contains the following eight species: red banded rockfish (*Sebastes babcocki*), dark rockfish, dusky rockfish, redstripe rockfish (*S. proriger*), yelloweye rockfish (*S. ruberrimus*), harlequin rockfish (*S. variegatus*), sharpchin rockfish (*S. zacentrus*), shortspine thornyhead (*Sebatolobus alascanus*).

The forms of dusky rockfish commonly recognized as "light dusky rockfish" and "dark dusky rockfish" are now officially recognized as two species (Orr and Blackburn 2004). *S. ciliatus* applies to the dark shallow-water species with a common name dark rockfish, and *S. variabilis* applies to variably colored deeper-water species with a common name dusky rockfish. Dusky rockfish are often found in large aggregations over the outer continental shelf and upper slope to depths of 675m (Orr and Blackburn, 2004). Dark rockfish are found in more shallow habitats from nearshore rocky reefs to depths no greater than 160m (Orr and Blackburn 2004).

The range of dark rockfish extends from the western Aleutian Islands and eastern Bering Sea, through the Gulf of Alaska to southeast Alaska (Orr and Blackburn 2004). Throughout its range it is common in depths ranging from 5m to 160m (Orr and Blackburn 2004). Dark rockfish are commonly collected with black rockfish (*S. melanops*) by trawl and hook-and-line gear in shallow waters and are often mis-identified as black rockfish (Orr and Blackburn 2004). In deeper trawls in the Aleutian Islands and Gulf of Alaska dark rockfish are found in association with Pacific Ocean perch (*S. alutus*), northern rockfish (*S. polyspinus*) and dusky rockfish (Blackburn and Orr 2004). Dark rockfish are occasionally found in association with other rockfishes such as harlequin rockfish, sharpchin rockfish, and redstripe rockfish (Orr and Blackburn 2004).

Habitat use changes with ontogeny. The smallest fish sampled, 10-30 cm and less than 10 years old, were collected in 1-5 m of water using herring jigs and gillnets and were found very near shore in boulder fields, commonly in harbor breakwaters. With increasing age, dark rockfish move offshore to deeper water and were captured with jig gear in 6-50 m. Video observations by ADF&G have shown that adult dark rockfish are semi-demersal, occur in rocky areas, and sometimes utilize boulder interstitial areas. Preliminary results of reproductive studies conducted in the Kodiak area by ADF&G indicate copulation in dark rockfish occurs between January and February, with fertilization in April and parturition peaking between May and June. Age and size of maturity for dark rockfish are currently under investigation (D. Urban, ADF&G, pers. comm.).

Dark and black rockfish often occur in the same locations. Of 1,133 sampling locations by ADF&G in Gulf of Alaska and Eastern Aleutian Islands from 2001 to 2006, 26% captured both dark and black rockfish (Figure 3-1). Co-occurrence was seen across the central and western Gulf of Alaska as well as the eastern Aleutian Islands (Figure 3-2). Because the sampling was done with jig gear which is subject to fishing bias, these results may not document relative population densities, but do reflect at minimum presence of the two species.

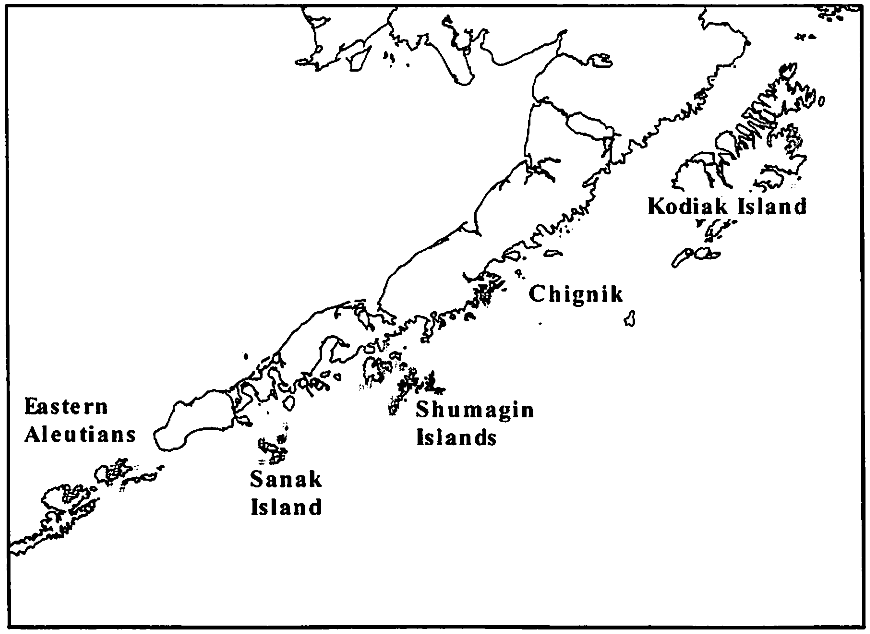


Figure 3-1 **Locations where dark rockfish were captured during ADF&G surveys, 2001-2006. Survey locations were not systematically distributed but targeted known fish concentrations.**

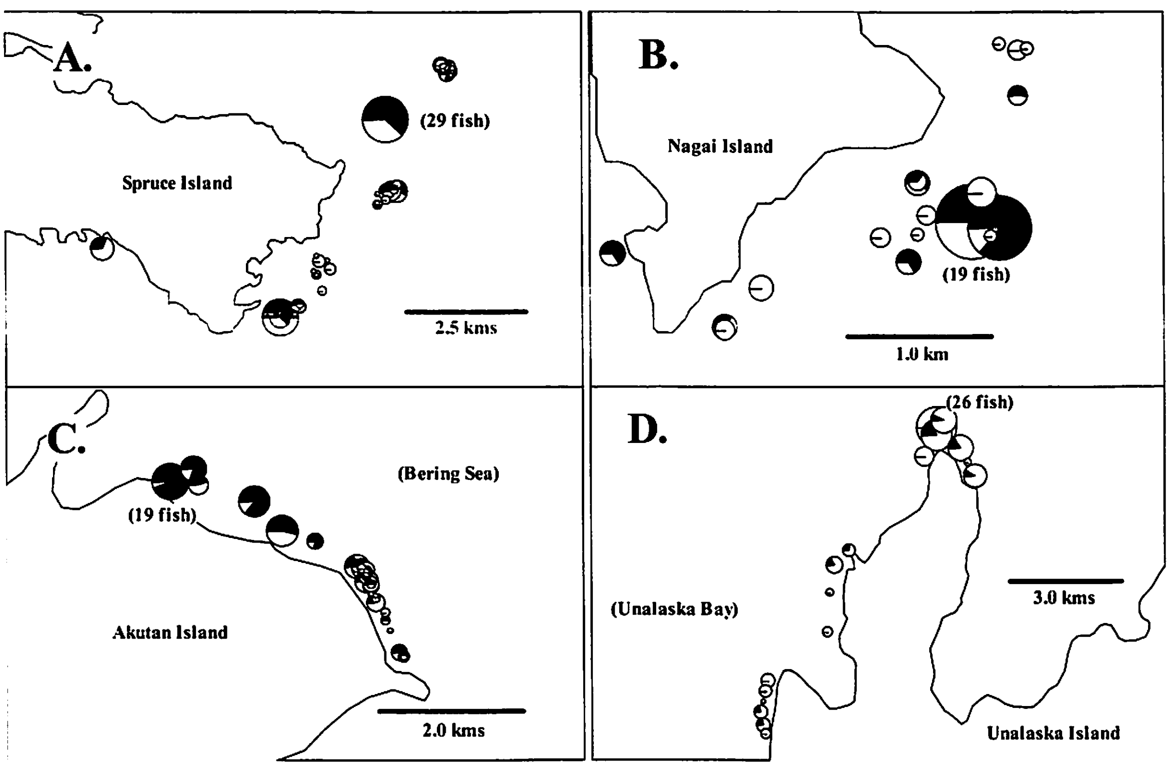


Figure 3-2 **Pie charts of black (black portion) and dark (gray portion) rockfish catches in: A. Spruce Island near the city of Kodiak, B. Mountain Point on Nagai Island in the Shumagin Island group, C. the north side of Akutan Island in the eastern Aleutian Islands and D. the NE side of Unalaska is near Unalaska Bay.**

The ecological separation of these two morphologically similar cogeners is not well understood although underwater video reveals the darks to be more solitary and demersal while the blacks typically are a schooling fish well up in the water column (Dan Urban, ADF&G, personal observations). A food habits study of 142 black and 84 dark rockfish was conducted by ADF&G in the Shumagin Islands. Stomachs were collected over a 10 day period in August 2005. It showed that these two species had a 29% diet overlap (Renkonen Index) with similar niche breadth (standardized Levin's measure, dark RF = 0.25, black RF 0.29). Black rockfish generally ate more fish (mostly sand lance and Pacific cod) while dark rockfish relied more on invertebrates, largely pteropods, decapod larvae, and jellyfish (Figure 3-3, ADF&G unpublished data).

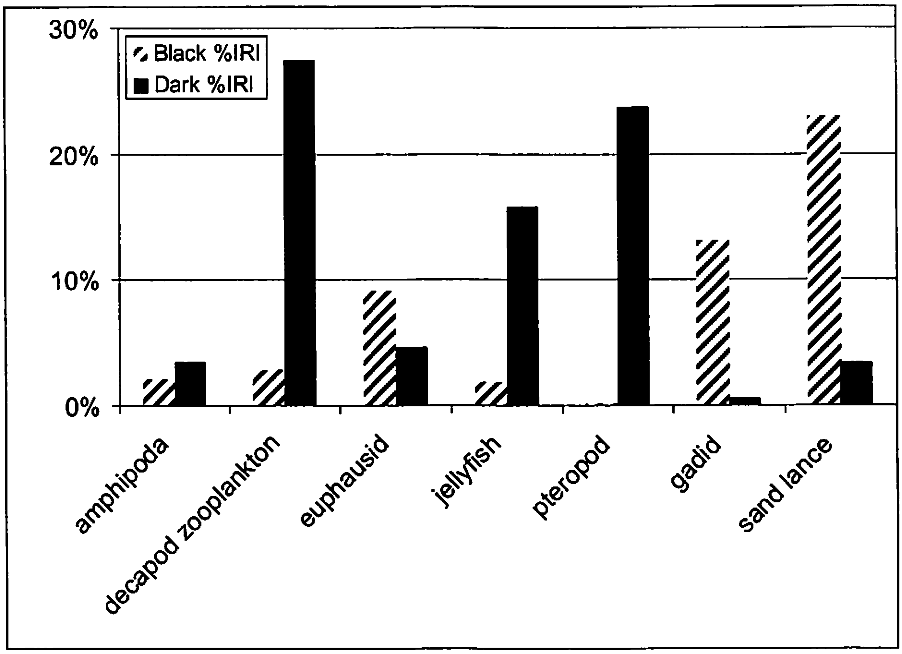


Figure 3-3 Percent Index of Relative Importance (a composite index based on frequency of occurrence, numbers consumed, and weight of prey items, Cortés 1997) for dark and black rockfish from the same area of the Shumagin Islands, August 2005.

3.1.1 Life history characteristics of *Sebastes* rockfish species

Life history characteristics for all *Sebastes* species include an egg stage completed within the female and a pelagic larval stage (Lunsford et al. 2005). Larval studies for dusky rockfish (the best studied of the species in the PSR assemblage) are hampered by a lack of genetic analyses thus post-larval dusky rockfish have not been identified but are assumed to be similar to other *Sebastes* species and hence to be pelagic. Information for dark rockfish is presumed to be similar to known information for dusky rockfish. The habitat of young juveniles is unknown but a demersal stage follows the pelagic stage as evidenced by the appearance of juveniles less than 25 cm fork length in bottom trawl surveys (Clausen et al. 2002). Older juveniles have been taken only infrequently in trawl surveys and then in inshore more shallow waters than the adults (Lunsford et al. 2005). Limited food information for this species indicates that euphausiids are an important prey item for adult dusky rockfish (Yang 1993).

The size of dusky rockfish taken in the fishery generally appears to have increased after 1992; in particular, the mode increased from 42 cm in 1991-92 to 44-47 cm in 1993-97. The mode then decreased to 42 cm in 1998, and rose back to 45 cm in 1999-2002 (Lunsford et al. 2005). Age data from the fishery indicates a range of ages from 4-76 years (Lunsford et al. 2005). Age and length data from the Federal fishery data are only available for dusky rockfish.

Mortality rates and maximum age for pelagic shelf rockfish species are presented in Table 1. The estimates range from 0.06–0.09 and were based on dusky rockfish samples (Lunsford et al. 2005). A value of 0.09 has typically been used in stock assessments for pelagic shelf rockfish species because these species were typically younger than other long-lived rockfish (Lunsford et al. 2005). A value of 0.07 was recently computed for dark rockfish based upon a study completed in the GOA (Chilton. *In Review*). This study indicated a higher maximum age than had been previously assumed for dark rockfish. This value of 0.07 was utilized to compute ABCs and OFLs for dark, widow and yellowtail rockfish in the recent stock assessment for pelagic shelf rockfish (Lunsford et al. 2005).

Table 1 Instantaneous rate of natural mortality and maximum age for pelagic shelf rockfish, based on the break-and-burn method of aging otoliths. Area indicates location of study: Gulf of Alaska (GOA) or British Columbia (BC).

Species	Mortality Rate	Maximum Age	Area	Reference
Dusky Rockfish	0.09	59	GOA	1
	0.09	51[b]	GOA	7
	0.08	59[c]	GOA	5
	0.06	76	GOA	6
Dark Rockfish	0.07	75	GOA	2
Yellowtail Rockfish	0.07	53	BC	3
Widow Rockfish	0.05a	59	BC	4

[a] Instantaneous rate of total mortality (Z).
[b] Maximum survey age.
[c] Maximum survey age.
References: (1) Clausen and Heifetz (1991); (2) Chilton, L. *In Review*. Growth and natural mortality of dark rockfish (*Sebastes ciliatus*) in the western Gulf of Alaska. 23rd. Lowell Wakefield Fisheries Symposium on Biology, Assessment, and Management of North Pacific Rockfishes; (3) Leaman and Nagtegaal (1987); (4) Chilton and Beamish (1982); (5) Malecha et al. (2004); (6) Calculated for this document using Hoenig (1983) $(-\ln(0.001)/t_m)$; (7) back calculated maximum age using Hoeing (1983) $(-\ln(0.001)/M)$.

Limited age and length data are available from ADF&G for dark rockfish from dockside sampling efforts from the 2002-2004 black rockfish commercial jig fishery from 1993-2006. and from black and dark rockfish surveys completed off Kodiak, Chignik, South Peninsula, and Eastern Aleutians from 2001 – 2006. Preliminary 2002 length data for dark rockfish ranged from 25–50 cm in the Kodiak region while ages ranged from 7-52 years (N. Sagalkin, unpublished data). Lengths of dark rockfish sampled range from 10 – 52 cm and 1 – 81 years old (ADF&G, unpublished data, Figure 3-4).

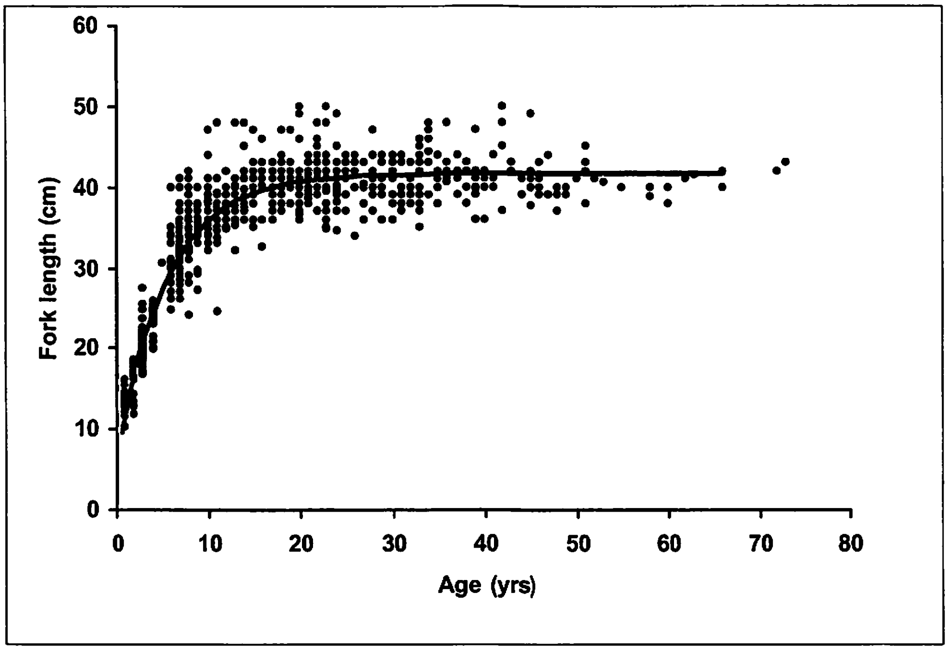


Figure 3-4 Age at length of male dark rockfish from Kodiak Island waters with a fitted von Bertalanffy growth curve (rho = 0.8363, k = 0.1787, L_∞ = 41.69

3.1.2 Biomass by species

3.1.2.1 GOA Pelagic Shelf rockfish complex

Dusky rockfish are the most abundant species in the pelagic shelf rockfish assemblage gulfwide. The remaining three species make up a small proportion of the assemblage. Biomass estimates from GOA trawl surveys are shown in Table 2. GOA trawl surveys were triennial until 1999 and biennial since that time. Starting in 1996 a distinction was made between "light" and "dark" dusky rockfish (and since 2005 they have been referred to by their now official names of dusky rockfish and dark rockfish). Data are presented through the most recent GOA trawl survey in 2005.

Biomass in all years is dominated by dusky rockfish. Biomass of dark, widow and yellowtail rockfish is patchy from one year to the next, with occasional single tows during the survey dominating the biomass estimate for that species. In 1999, dusky rockfish predominated, but a relatively large biomass of yellowtail rockfish was also seen in the Southeastern area. This yellowtail rockfish biomass can be mostly attributed to one relatively large catch in Dixon Entrance near the U.S./Canada boundary. In 2005, the dusky and dark rockfish biomass estimates were the highest ever recorded. The dark rockfish biomass was influenced by a large catch of 1,154 kg in the Shumagin area. The next largest catch of dark rockfish was 167 kg (Lunsford et al. 2005). With the exception of 2005 the relative contribution to the overall survey biomass from dark rockfish has been low (Table 3).

Table 2 Biomass estimates (mt) for species in the pelagic shelf rockfish assemblage in the Gulf of Alaska, based on results of bottom trawl surveys from 1984 through 2005 (Lunsford et al. 2005)

Species	Shumagin	Chirikof	Statistical Area Kodiak	Yakutat	Southeastern	Total
1984						
Dusky rockfish	3,843	7,462	4,329	15,126	307	31,068
Yellowtail rockfish	0	0	0	17	454	471
Total, all species	3,843	7,462	4,329	15,143	761	31,539
1987						
Dusky rockfish	12,011	4,036	46,005	18,346	1,097	81,494
Widow rockfish	0	0	0	51	96	147
Total, all species	12,011	4,036	46,005	18,397	1,193	81,641
1990						
Dusky rockfish	2,963	1,233	16,779	5,808	953	27,735
Widow rockfish	0	0	0	285	0	285
Total, all species	2,963	1,233	16,779	6,093	953	28,020
1993						
Dusky rockfish	11,450	12,880	23,780	7,481	1,626	57,217
Total, all species	11,450	12,880	23,780	7,481	1,626	57,217
1996						
Light dusky rockfish	3,553	19,217	36,037	14,193	1,480	74,480
Dark dusky rockfish	152	139	59	0	0	350
Widow rockfish	0	10	0	0	919	929
Yellowtail rockfish	0	0	20	0	65	85
Total, all species	3,704	19,366	36,116	14,193	2,464	75,843
1999						
Light dusky rockfish	2,538	9,157	33,729	2,097	2,108	49,628
Dark dusky rockfish	2,130	31	49	0	0	2,211
Widow rockfish	0	0	69	0	115	184
Yellowtail rockfish	0	0	0	162	12,509	12,671
Total, all species	4,668	9,188	33,847	2,259	14,732	64,694
2001						
Light dusky rockfish	5,352	2,062	23,590	7,924[a]	1,738[a]	40,667[a]
Dark dusky rockfish	362	15	36	0[a]	0[a]	413[a]
Widow rockfish	0	0	0	0[a]	345[a]	345[a]
Yellowtail rockfish	0	0	0	54[a]	4,192[a]	4,245[a]
Total, all species	5,714	2,077	23,626	7,978[a]	6,275[a]	45,670[a]
2003						
Light dusky rockfish	4,039	46,729	7,198	11,519	1,377	70,862
Dark dusky rockfish	235	49	16	0	0	300
Widow rockfish	0	0	0	0	32	32
Yellowtail rockfish	0	0	0	71	635	705
Total, all species	4,274	46,778	7,214	11,590	2,044	71,899
2005						
Dusky rockfish	69,295	38,216	60,097	2,488	389	170,484
Dark rockfish	21,454	389	2,348	0	0	24,191
Widow rockfish	0	0	51	0	77	128
Yellowtail rockfish	0	0	0	0	1,121	1,121
Total, all species	90,749	38,605	62,445	2,448	1,587	195,924

[a]Note: The Yakutat and Southeastern areas were not sampled in the 2001 survey. Estimates of biomass for these two areas in 2001 were obtained by averaging the corresponding area biomasses in the 1993, 1996, and 1999 surveys.

Table 3 Contribution of dark rockfish survey biomass to overall PSR survey biomass estimate

Year	% Survey Biomass
2001*	0.90
2003	0.42
2005	12.35

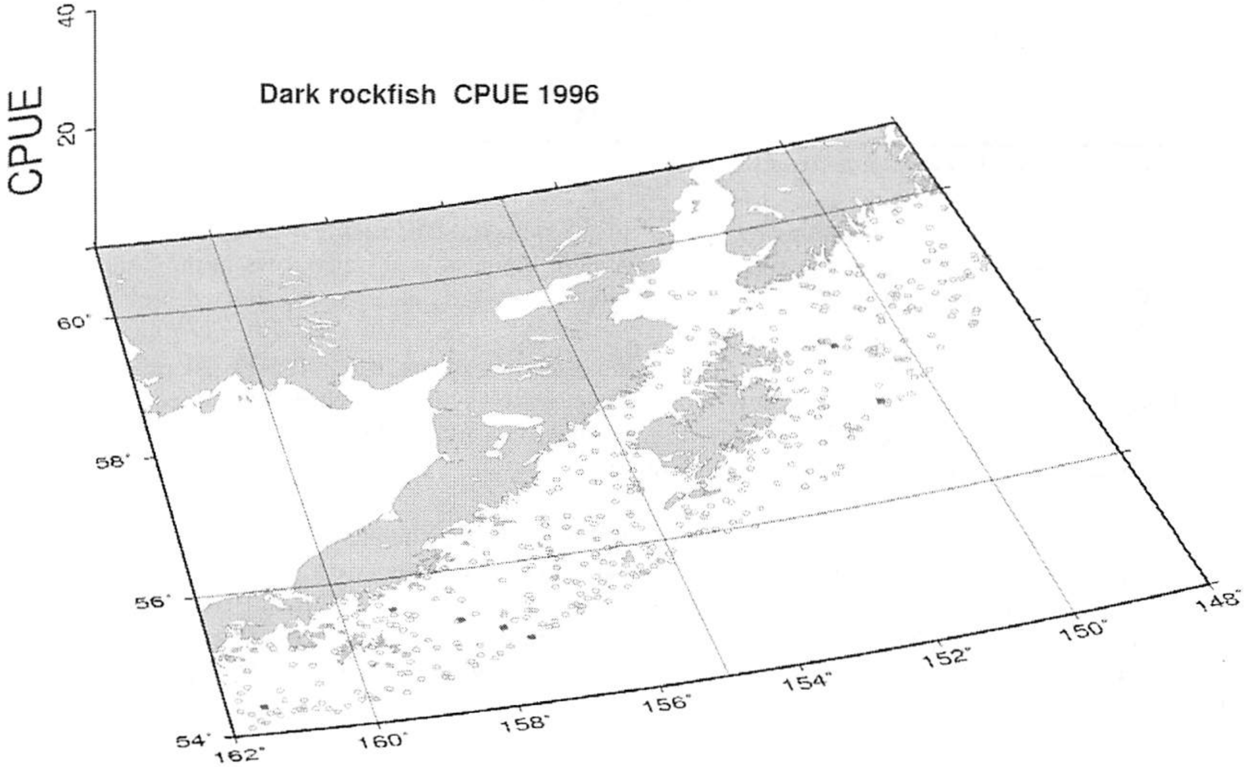
*Note the 2001 survey did not cover the eastern GOA

Trawl survey data shows locations by species in the pelagic shelf rockfish assemblage observed in the Gulf of Alaska since 1996. Dark rockfish shows high biomass in selected tows in the Shumagin area in 1999 (Figure 3-5a) and 2005 (Figure 3-5e). Trawl survey data also shows selected high tows east and southeast of Kodiak (Figure 3-5e).

Dusky rockfish trawl survey data shows consistent high tows albeit patchily distributed from one survey to the next (Figure 3-5a-e). The 2005 survey showed the highest biomass of dusky rockfish since the survey has been conducted (Lunsford et al. 2005).

Survey Biomass data for widow and yellowtail rockfish are shown for the 1984-2005 survey years (Figure 3-7a-i and Figure 3-8a-i). Widow rockfish data showed only one high biomass tow in 1996 in the southeast leading to a biomass estimate in that area of >900 mt. Yellowtail rockfish showed higher biomass tows in southeast in 1984, 1996, and 2005 (Figure 3-8a-i). The high survey biomass estimate for yellowtail rockfish in 1999 was attributed to one relatively large catch in the Dixon entrance area (Figure 3-8f).

3-5a.



3-5b.

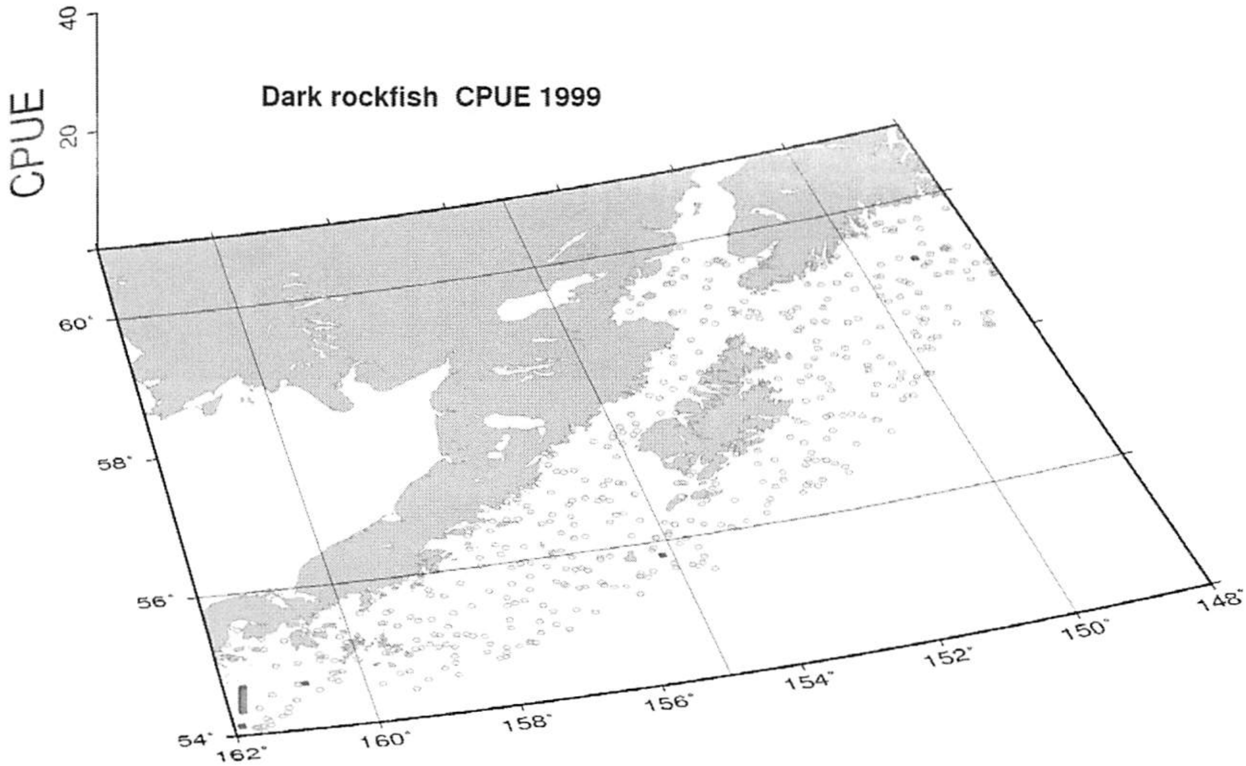
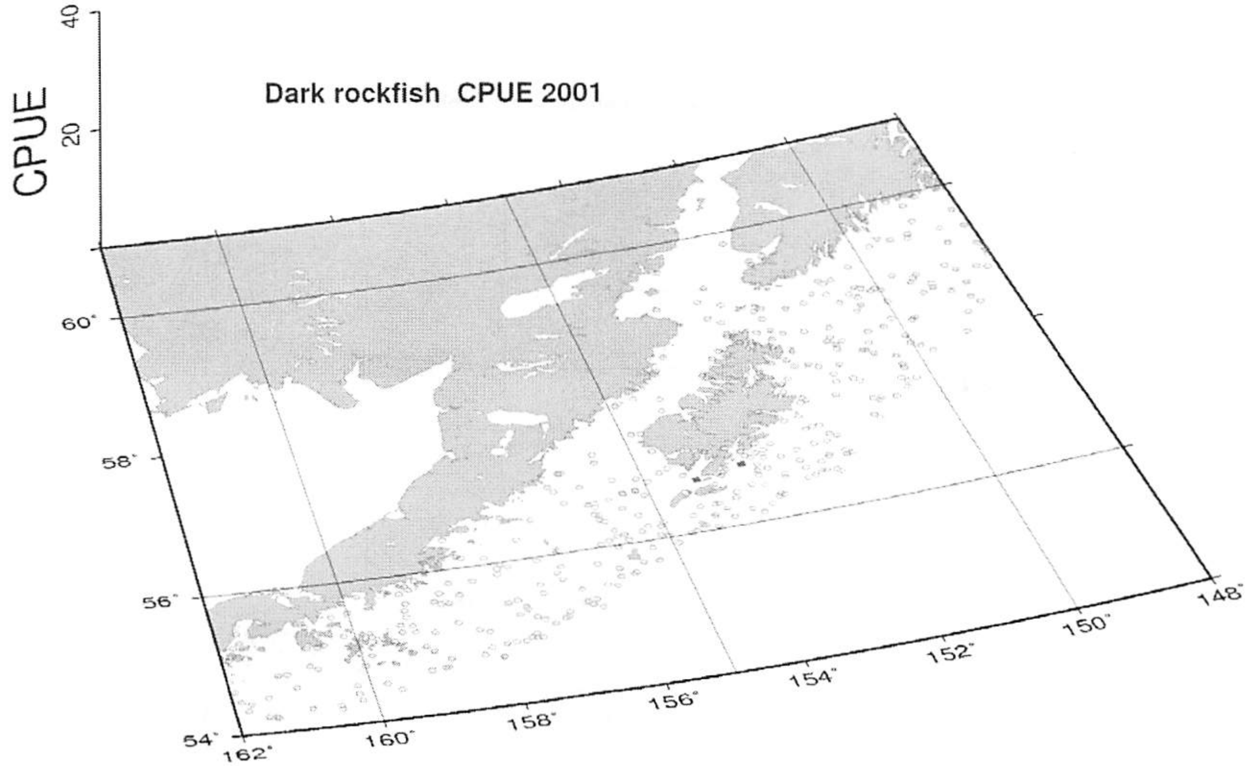


Figure 3-5 Dark rockfish CPUE from survey 1999-2005.

3-5c.



3-5d.

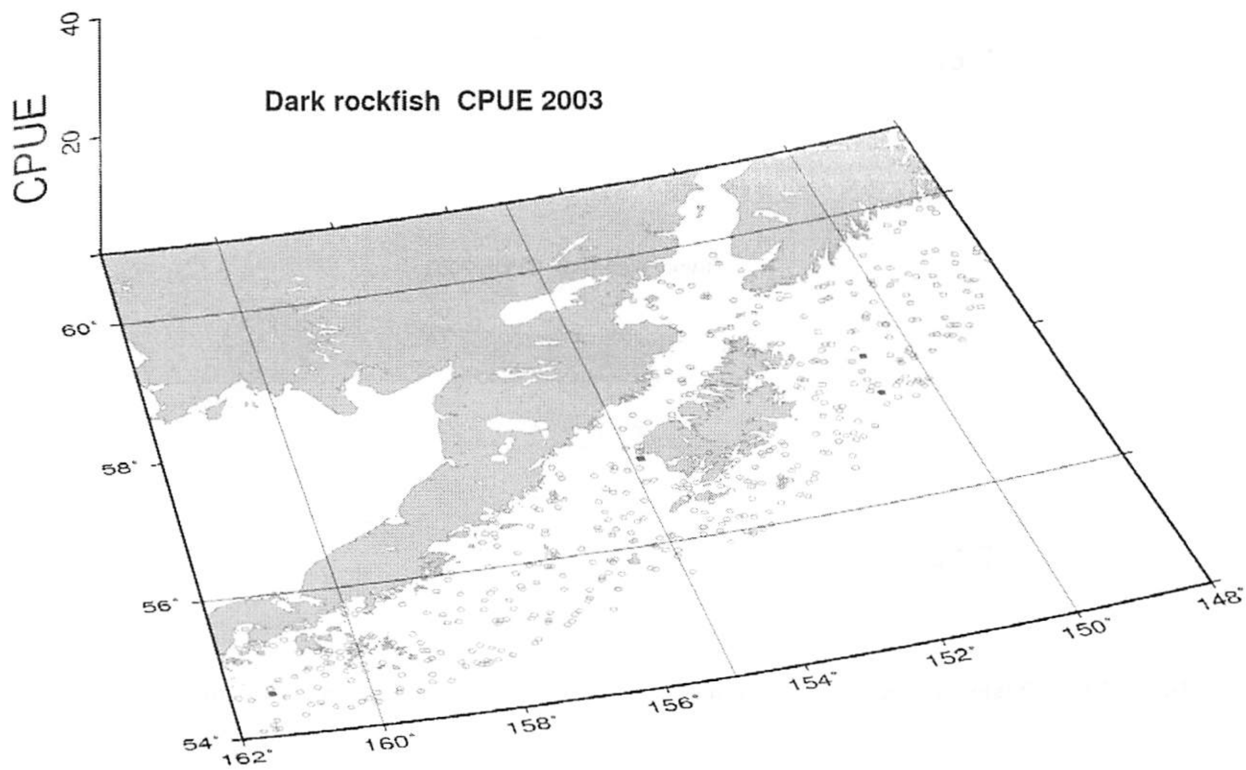
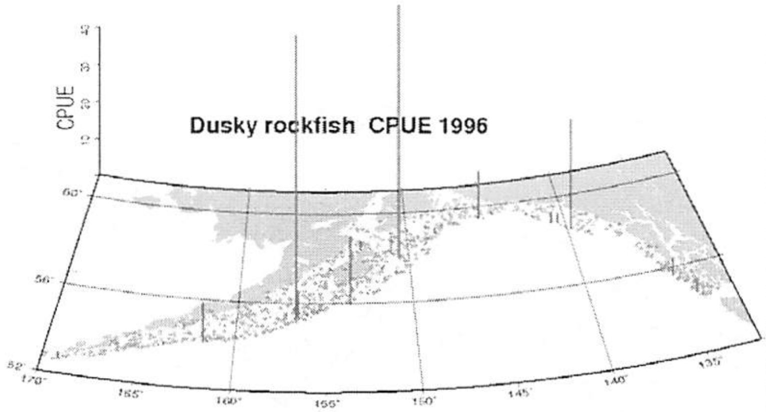
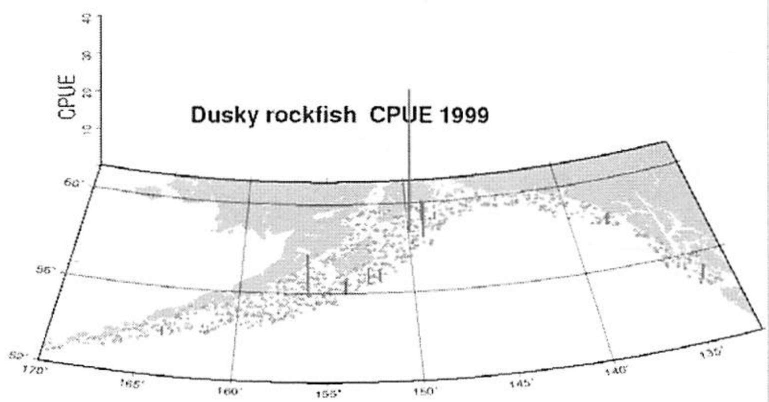


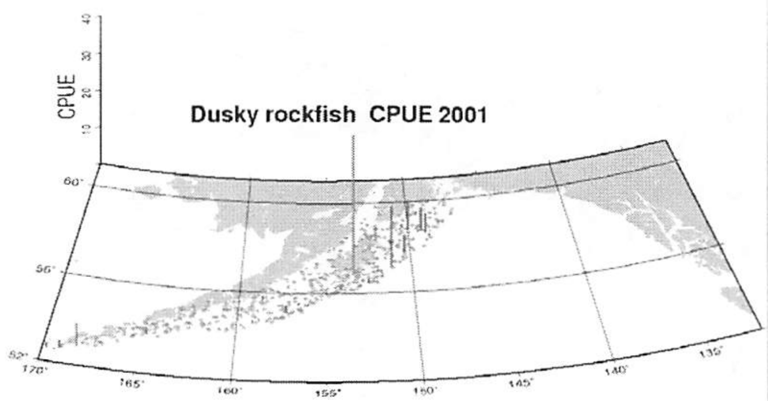
Figure 3-5 continued.



3-6a.

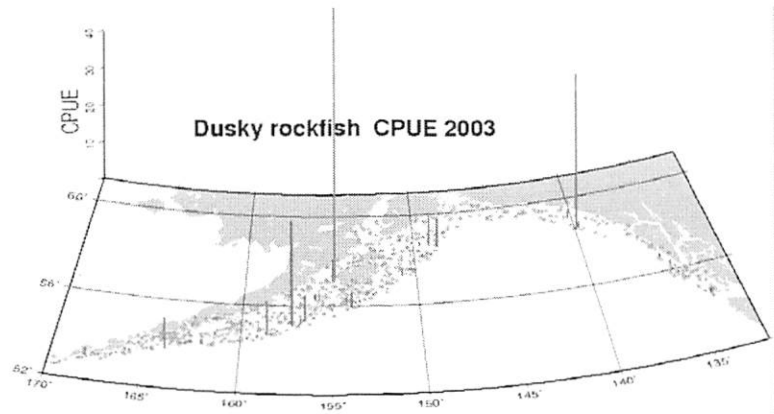


3-6b.

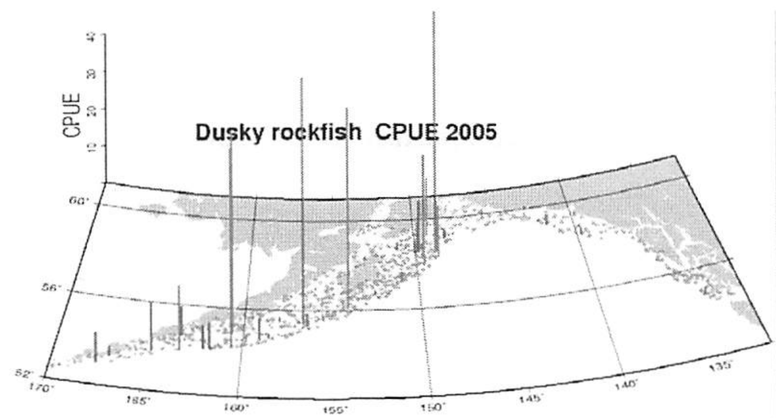


3-6c.

Figure 3-6 Dusky rockfish survey catch per unit effort (CPUE), survey years 1996-2003

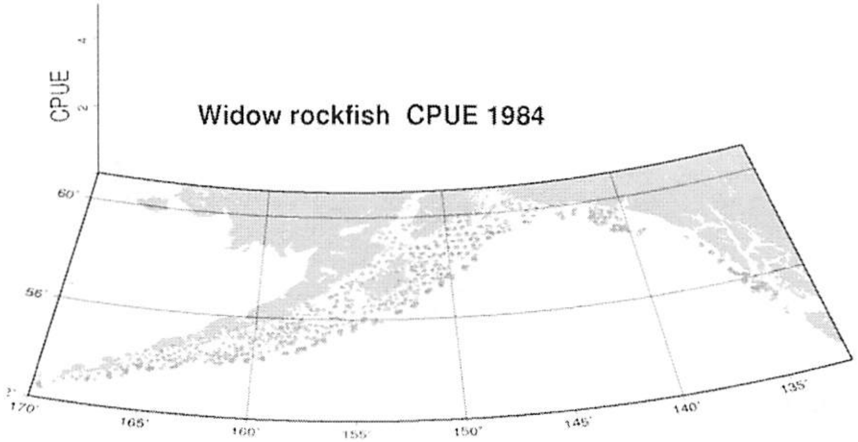


3-6d.

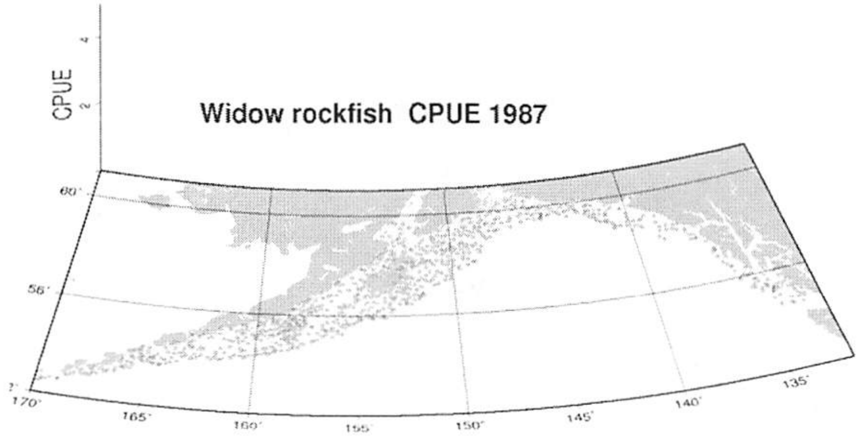


3-6e.

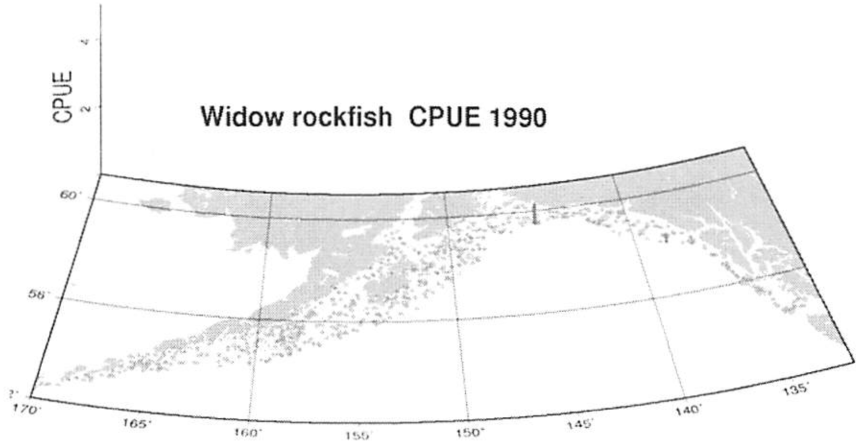
Figure 3-6 continued.



3-7a.

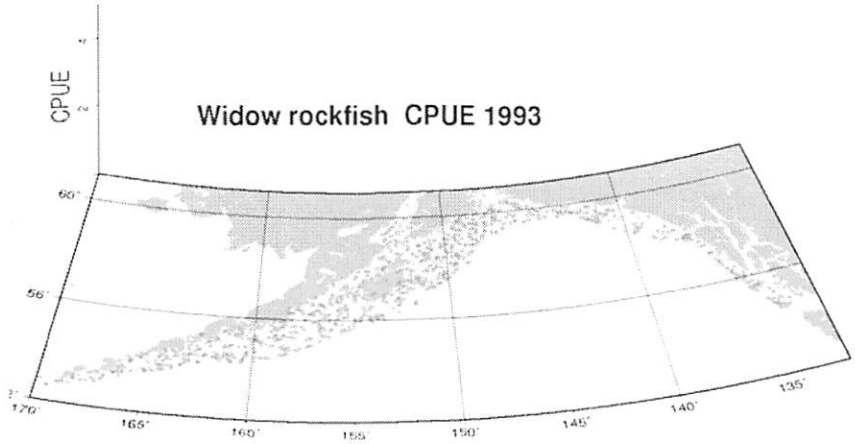


3-7b.

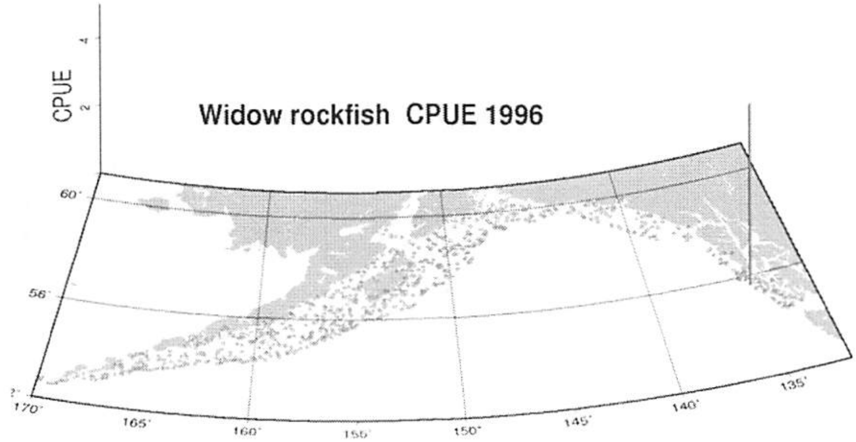


3-7c.

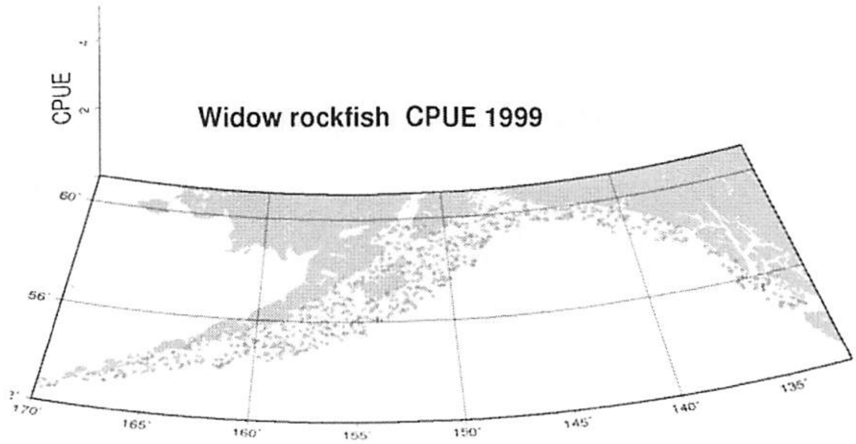
Figure 3-7 Widow rockfish survey catch per unit effort (CPUE), survey years 1984-2005



3-7d.

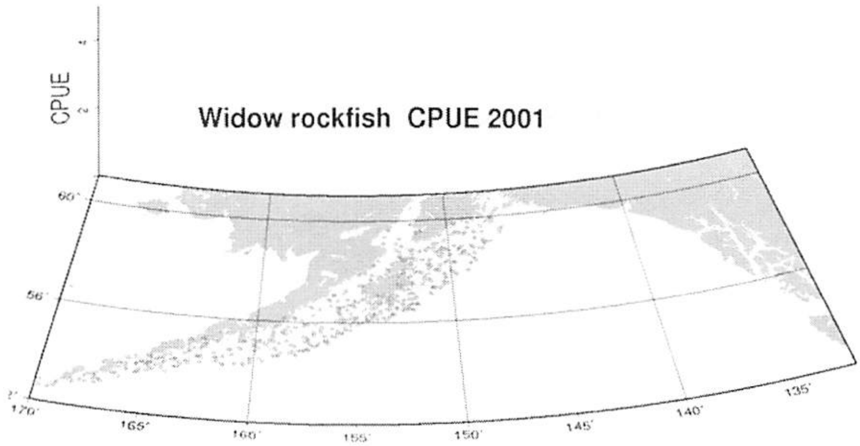


3-7e.

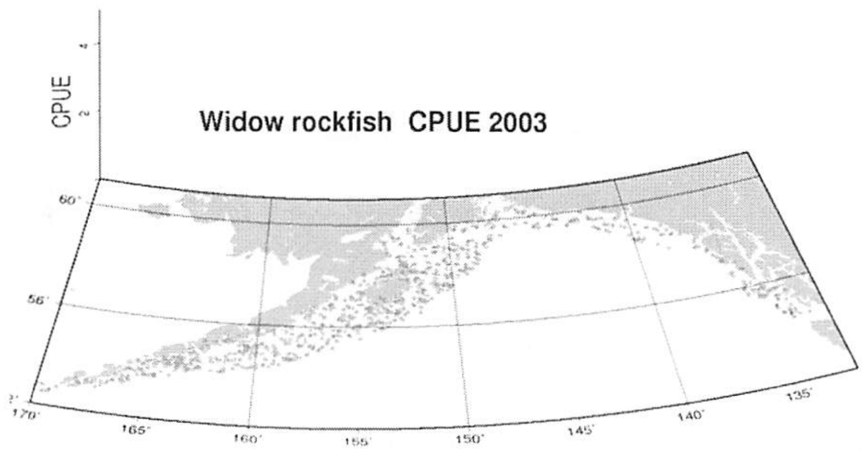


3-7f.

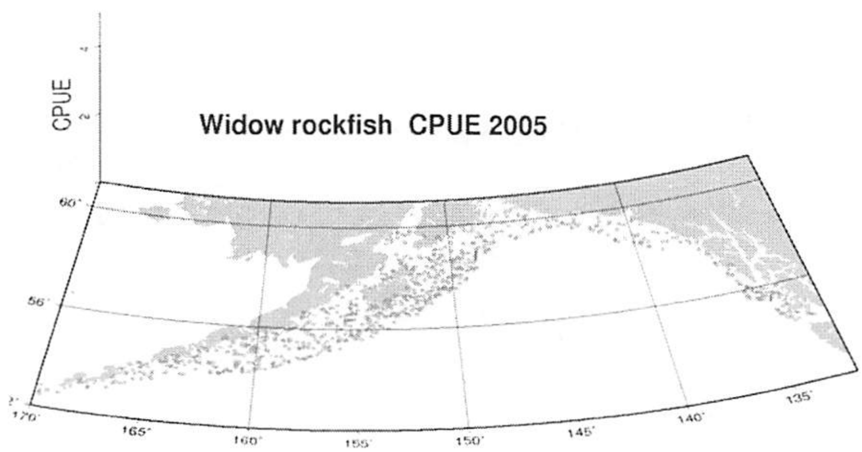
Figure 3-7 continued.



3-7g.

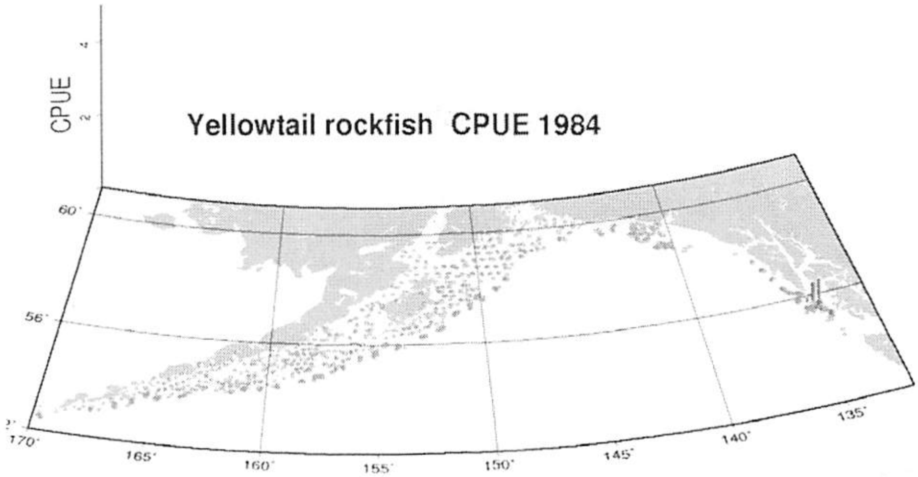


3-7h.

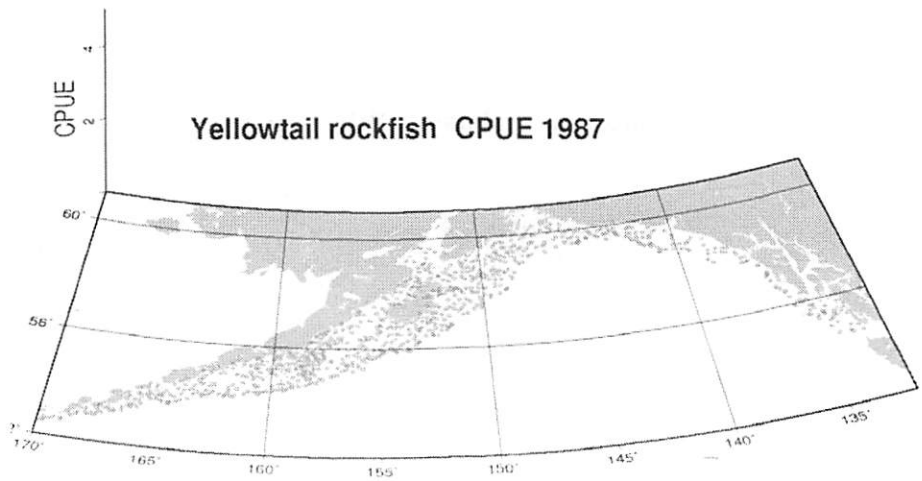


3-7i.

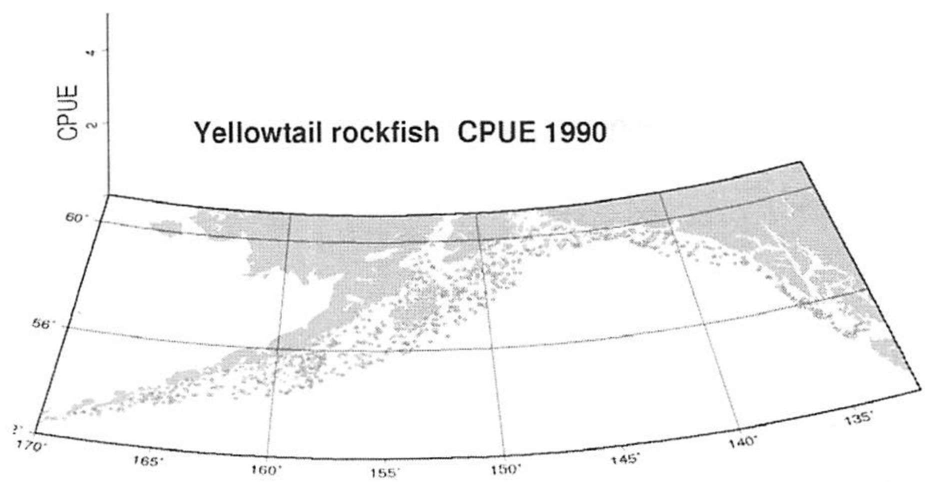
Figure 3-7 continued.



3-8a.

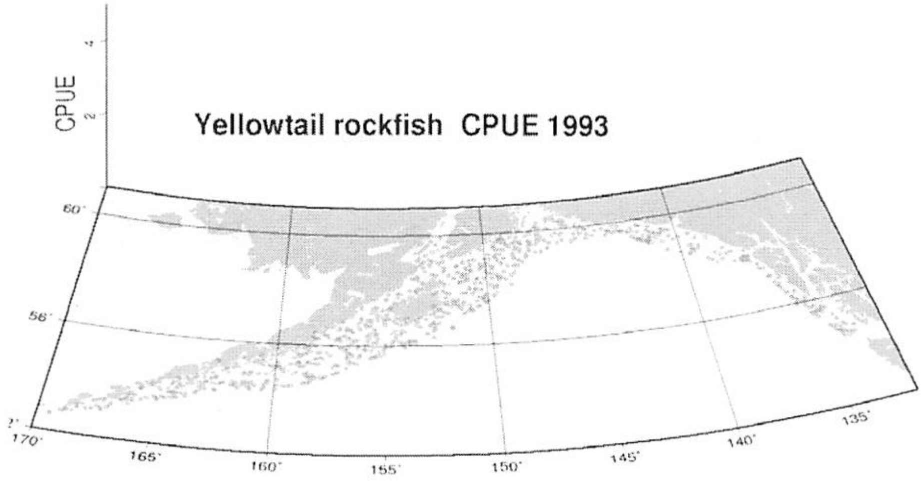


3-8b.

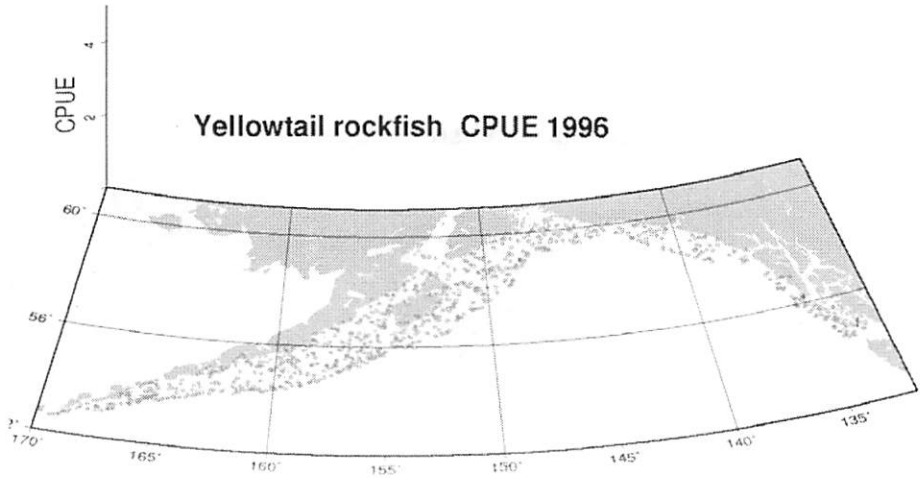


3-8c.

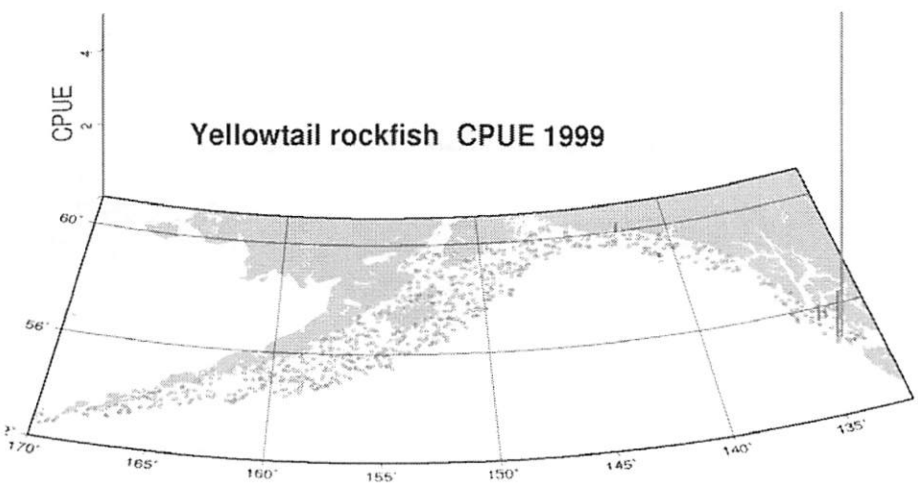
Figure 3-8 **Yellowtail rockfish survey catch per unit effort (CPUE) trawl surveys 1984-2005**



3-8d.

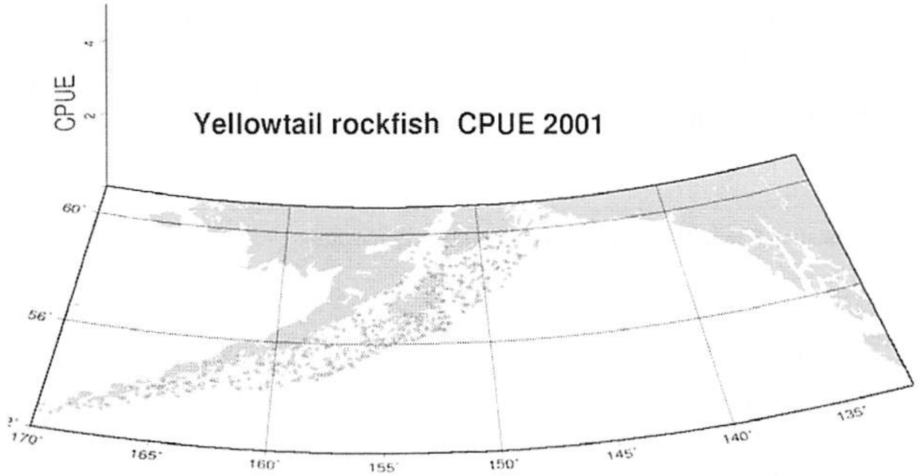


3-8e.

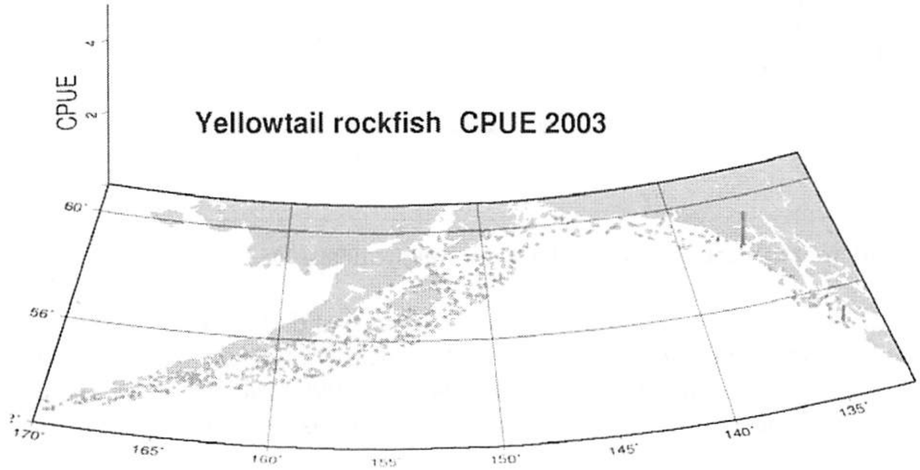


3-8f.

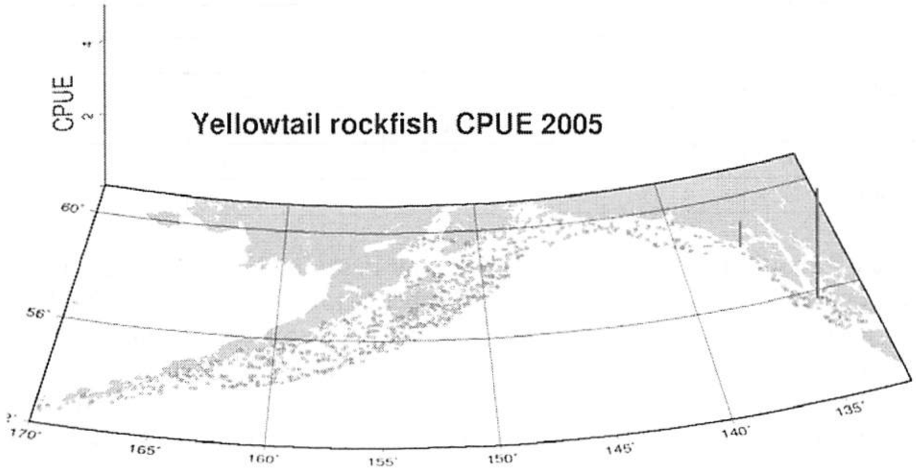
Figure 3-8 continued.



3-8g.



3-8h.



3-8i.

Figure 3-8 continued.

Further analysis of trawl survey data for the GOA is included in order to investigate the relative prevalence of dark rockfish amongst rockfish species sampled as well as their habitat preference. Figure 3-9 shows the weight of dark rockfish found in survey hauls by bins. Large hauls of dark rockfish are extremely uncommon, with more than half of the hauls which catch dark rockfish containing less than 5 kg.

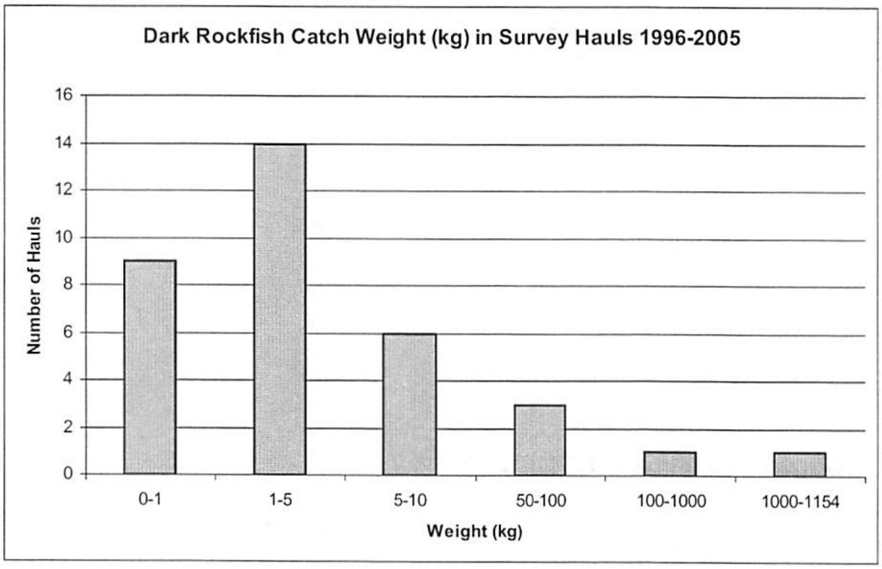


Figure 3-9 Dark rockfish catch in survey hauls by weight 1996-2005

Table 4 shows the relative weight (minimum and maximum) of dark rockfish in surveyed tows as well as the average bottom depth of the tow. Other than the single tow in 2005 with a maximum weight of 1154 kg, the maximum weight over the time period was 94 kg in 1999 (Table 4). Average bottom depth is relatively shallow and the number of hauls in which dark rockfish were identified is quite low (Table 4).

Table 4 Dark rockfish in surveyed tows 1996-2005

Year:	1996	1999	2001	2003	2005
Survey Data					
Minimum weight	0.35	1.30	1.01	0.52	0.21
Maximum weight	8.80	93.80	13.90	11.04	1153.98
Average weight	3.16	20.64	5.37	4.13	115.87
Average bottom depth	111.44	109.20	65.75	93.83	94.77
Number of hauls	9	5	4	6	13

In contrast, Table 5 shows similar survey information for dusky rockfish. Maximum weights are much higher, average bottom depth is much deeper and number of tows in which dusky rockfish are identified is much higher (Table 5). Data for black rockfish were also compiled for comparison with the depth strata for dusky and dark rockfish. Black rockfish are found in shallow waters and infrequently encountered in the bottom trawl survey due to their habitat preference (Table 6). Minimum weight, maximum weight, encounter rate in the survey and depth are all more similar to dark rockfish than to dusky.

Table 5 Dusky rockfish in surveyed tows 1996-2005

Year:	1996	1999	2001	2003	2005
Survey Data					
Minimum weight	0.15	0.14	0.09	0.09	0.32
Maximum weight	2403.55	874.00	926.31	2605.66	2239.44
Average weight	63.85	28.02	35.22	50.67	86.35
Average bottom depth	157.06	157.16	130.29	150.44	153.01
Number of hauls	109	89	70	115	140

Table 6 Black rockfish in surveyed tows 1996-2005

Year:	1996	1999	2001	2003	2005
Survey Data					
Minimum weight	0.50	1.27	0.66	1.73	0.99
Maximum weight	107.00	4.80	1.41	32.48	363.15
Average weight	36.05	2.32	1.08	14.00	89.59
Average bottom depth	54.00	46.50	55.33	97.25	82.89
Number of hauls	3	8	3	4	9

3.1.2.2 BSAI other rockfish complex

Biomass of species in the other rockfish complex is generally dominated by shortspine thornyhead rockfish and dusky rockfish. Dark rockfish are encountered infrequently in the Aleutian Island survey. Biomass total within each year as well as summary information across years for all other rockfish species are presented in tables 7-10. When encountered in the BSAI region, dark rockfish were nearly always in the AI survey. In the Bering Sea dark rockfish were rarely encountered (Table 10). Figure 3-10 shows locations by haul of dark rockfish in the Aleutian Islands region, while Table 11 shows the breakdown of biomass in the survey for dark rockfish by Aleutian Island region and depth strata. The majority of dark rockfish when encountered were found in the Western Aleutian region in the depth strata from 0-100m (Table 11, Figure 3-10). Coefficients of variation on these biomass estimates are very high given the patchy nature of surveying these species (Table 11). Dark rockfish make up a small percentage of the overall survey biomass in the Aleutian Islands in any year, ranging from 0.8 to 4.5 % since 1997 (Table 12)

Table 7 Biomass from the Aleutian Islands surveys

Aleutian Islands	1980	1983	1986	1991	1994	1997	2000	2002	2004	2006
dark dusky rockfish						524	99	315	320	982
harlequin rockfish	0	6	18	22	20	68	25	24	4,663	48
light dusky rockfish						712	1,306	612	2,089	6,687
redbanded rockfish	0	5	0	1	0	2	0	1	5	5
sharpchin rockfish	1	0	0	3	2	0	0	0	3	0
shortspine thornyhead	695	3,627	6,860	6,341	7,311	10,441	11,700	15,255	18,280	18,844
dusky rockfish	35	1,135	2,925	525	291					
Grand Total	730	4,774	9,803	6,891	7,624	11,747	13,130	16,208	25,359	26,567

Table 8 **Biomass from the SE EBS surveys**

	YEAR									
SE EBS	1980	1983	1986	1991	1994	1997	2000	2002	2004	2006
dark dusky rockfish						0	0	5	8	2
harlequin rockfish	0	0	18	0	2	0	0	2	4,167	7
light dusky rockfish						138	55	97	1,359	731
redbanded rockfish	0	0	0	1	0	0	0	0	0	0
sharpchin rockfish	0	0	0	3	1	0	0	0	3	0
shortspine thornyhead	23	566	423	187	1,071	1,545	1,051	1,012	945	968
dusky rockfish	13	236	2,812	58	99					
Grand Total	36	802	3,253	248	1,172	1,683	1,107	1,117	6,481	1,708

Table 9 **Biomass totals (by year) AI**

Aleutian Islands				
	1997-2006		1980-2006	
dark dusky rockfish	2,240	2%		
harlequin rockfish	4,828	5%	4,894	4%
light dusky rockfish	11,406	12%		
redbanded rockfish	13	0%	19	0%
sharpchin rockfish	3	0%	8	0%
shortspine thornyhead	74,521	80%	99,354	81%
dusky rockfish	0	0%	18,557	15%
Grand Total	93,011		122,831	

Table 10 **Biomass totals (by year) EBS**

EBS (SE portion)				
	1997-2006		1980-2006	
dark dusky rockfish	16	0%		
harlequin rockfish	4,176	35%	4,196	24%
light dusky rockfish	2,380	20%		
redbanded rockfish	0	0%	1	0%
sharpchin rockfish	3	0%	6	0%
shortspine thornyhead	5,522	46%	7,791	44%
dusky rockfish	0	0%	5,613	32%
Grand Total	12,096		17,608	

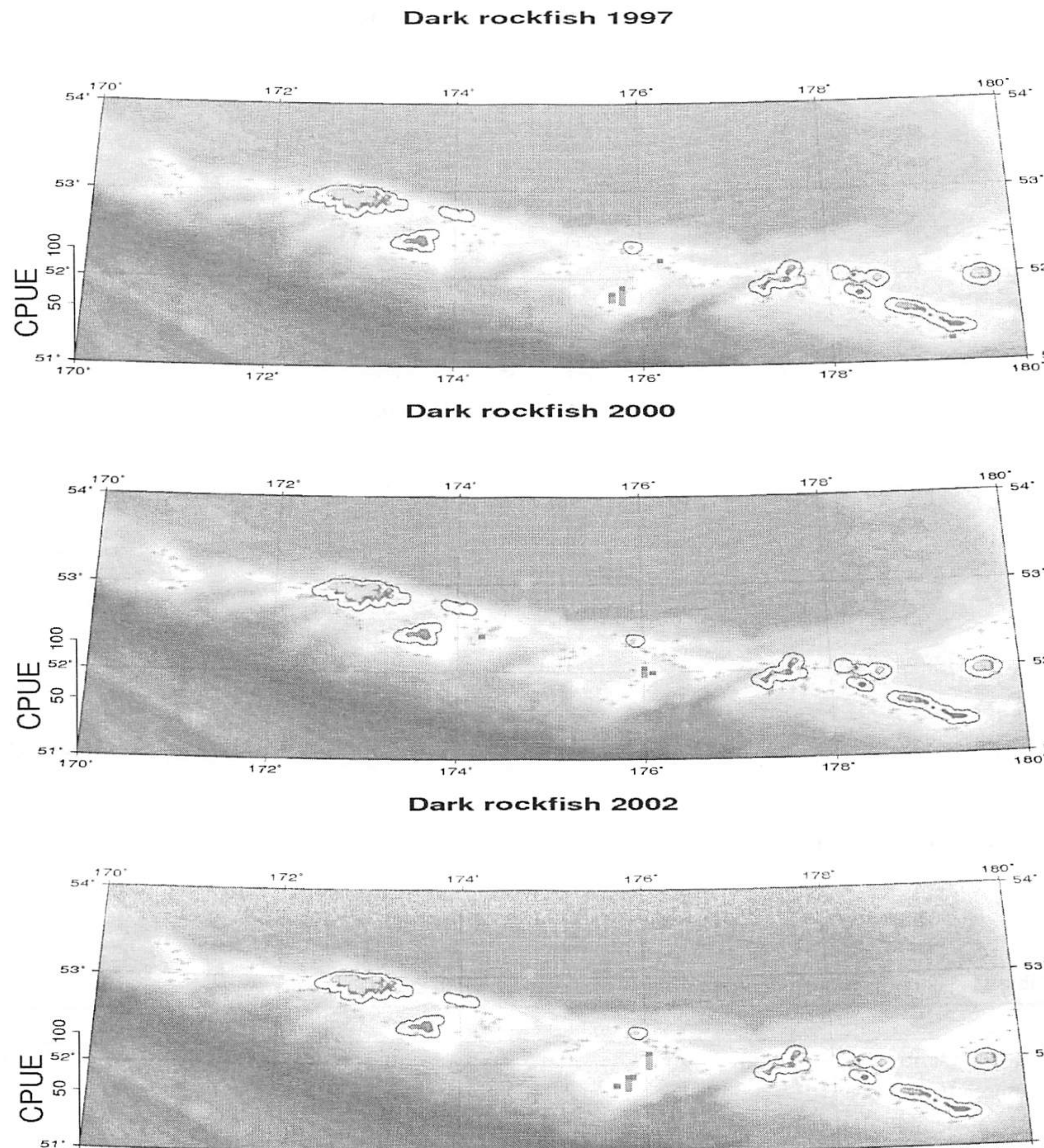
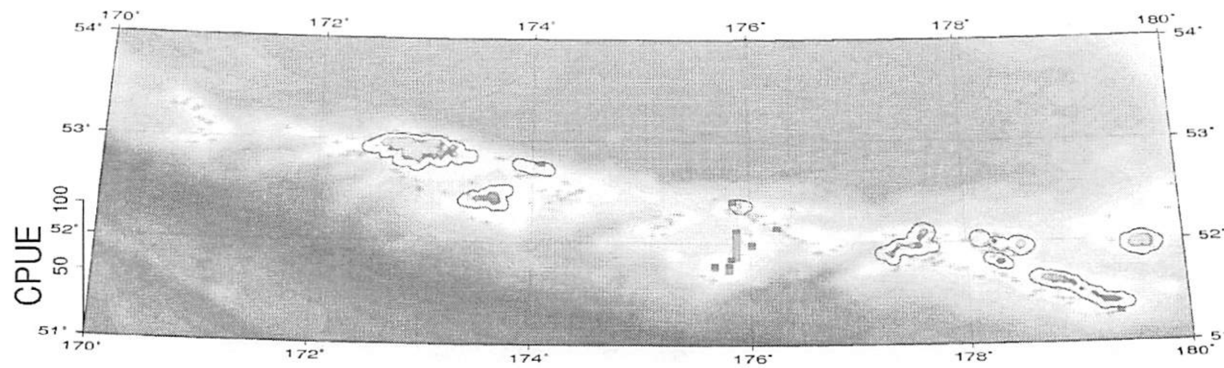


Figure 3-10 dark rockfish CPUE from the AI survey 1997-2006

Dark rockfish 2004



Dark rockfish 2006

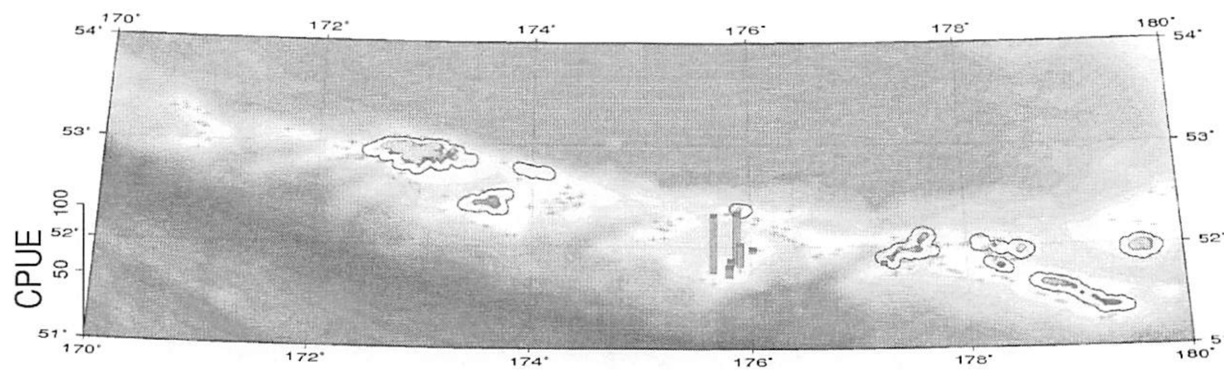


Figure 3-10 continued.

Table 11 **dark rockfish biomass from survey data by depth strata and region**

	1997	2000	2002	2004	2006
Southern Bering Sea, 1 - 100m	0	0	5.4	8	1.3
Southern Bering Sea, 101 - 200m	0	0	0	0	0.8
Eastern Aleutian, 1 - 100m	32.4	0	0	0	0
Eastern Aleutian, 101 - 200m	0	0	0	0	8.4
Central Aleutian, 1 - 100m	0	0	0	0	72.9
Central Aleutian, 101 - 200m	9.9	0	0	2.3	0
Western Aleutian, 1 - 100m	481.6	98.6	310	308	898.4
Western Aleutian, 101 - 200m	0	0	0	1.9	0
Total	523.9	98.6	315.4	320.2	981.8
CV for total	61%	96%	57%	58%	47%

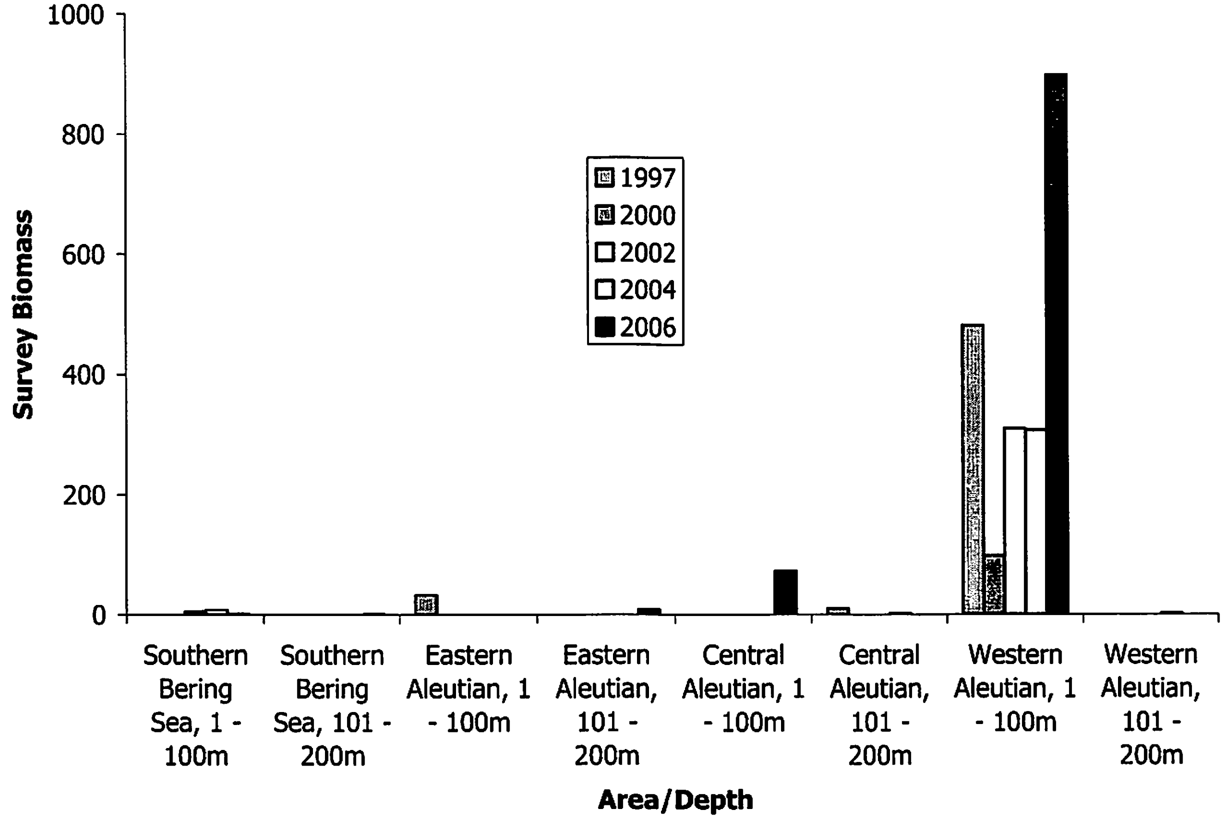


Figure 3-11 Biomass of dark rockfish in survey data by depth strata and region

Table 12 Relative contribution of dark rockfish survey biomass to the total survey biomass in the AI 1997-2006

Year	Survey biomass of darks	Total survey iomass of other rockfish complex	Percent contribution of dark rockfish to survey total
1997	524	11753	4.5
2000	99	13130	0.8
2002	315	16207	2.0
2004	320	25360	1.3
2006	982	26566	3.7

Table 13 shows the relative weight (minimum and maximum) of dark rockfish in surveyed tows as well as the average bottom depth of the tow. Similar data for dusky rockfish are presented in Table 14. Maximum weight of dark rockfish is lower than for dusky rockfish in two of the four years. Average bottom depth of haul is relatively shallow and number of hauls is relatively low in which dark rockfish were identified (Table 13).

Table 13 Dark rockfish data from surveyed tows in the AI

Year	1997	2000	2002	2004
Survey Data				
Minimum weight	0.18	0.15	1.32	0.79
Maximum weight	33.00	16.35	27.86	49.95
Average weight	6.66	5.67	11.63	7.81

Year	1997	2000	2002	2004
Average bottom depth	111.71	139.00	80.60	90.40
Number of hauls	7	3	5	10

Table 14 Dusky rockfish data from surveyed tows in the AI

Year	1997	2000	2002	2004
Survey Data				
Minimum weight	0.22	0.07	0.29	0.46
Maximum weight	15.45	121.50	27.50	161.58
Average weight	3.68	7.90	4.41	13.40
Average bottom depth	150.70	166.66	154.48	163.21
Number of hauls	20	41	29	33

Tentative biomass estimates are available from State surveys for black rockfish species but are not available for dark rockfish at this time in State waters. Hydroacoustic survey experience in State waters indicates that as dark rockfish tend toward the bottom they are likely found in the hydroacoustic dead zone
and can't be easily detected via this method (Dan Urban, pers. comm.). These species may be difficult species to survey other than with submersibles or ROV transects (Dan Urban, pers. comm.).

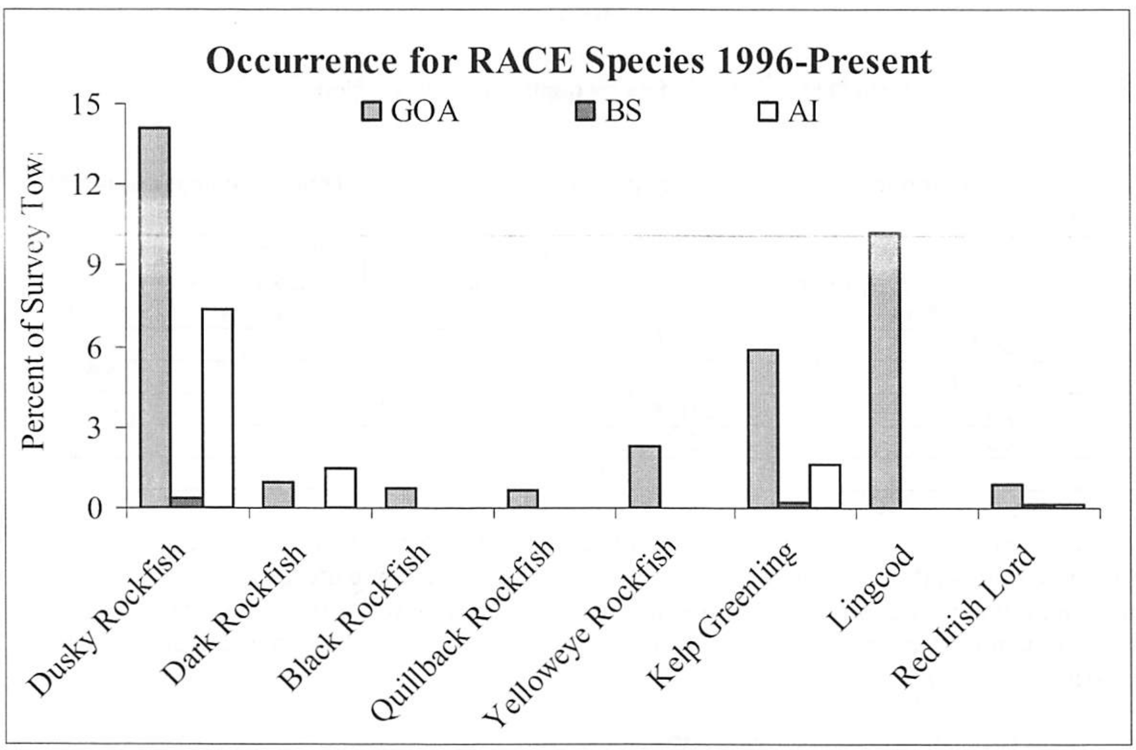


Figure 3-12 Occurrence of dark and dusky rockfish in surveys as a percentage of tow biomass in the BS, AI and GOA in conjunction with other nearshore species.

Figure 3-12 shows the occurrence of dark and dusky rockfish in surveys in the BS, AI and GOA in conjunction with other State managed species in these areas. Dark rockfish are caught in approximately

1% of all survey tows in these areas, which is considerably less than many State managed species (Figure 3-11).

3.1.3 Stock Assessment

3.1.3.1 GOA pelagic shelf rockfish assessment

A single ABC is estimated for the pelagic shelf complex as a whole. An age-structured model is used to estimate the ABC and OFL for the dusky rockfish stock. This stock is currently in Tier 3. Under Amendment 56, Tier 3, the maximum permissible fishing mortality for ABC is $F_{40\%}$ and fishing mortality for OFL is $F_{35\%}$. These fishing rates are applied to the model estimated biomass to generate the ABC and OFL for the stock. The ABC is then apportioned over the three GOA management areas. For widow, yellowtail and dark rockfish, the average of exploitable biomass from the three most recent trawl surveys is used to determine the ABC (Tier 5). In Tier 5, F_{ABC} is defined to be <=0.75 x M. For M of 0.07 for the three species, F_{ABC} is then 0.75 x M, which equals 0.0525. Multiplying this value of F by the current exploitable biomass for dark, widow, and yellowtail rockfish (10,493 mt) yields an ABC of 551 mt for 2007. The ABC is then apportioned over the GOA management areas. Table 15 provides the 2007 OFL and ABC calculated by species based on the 2006 stock assessment. There was no 2006 GOA trawl survey thus estimates for Tier 5 species (e.g. all but dusky rockfish) are based upon the 2005 stock assessment results. Changes to the ABC and OFL for the PSR complex in 2007 from the previous year's assessment are due to updated catch information included in the projection model for dusky rockfish.

Table 15 2007 OFL and ABC, calculated by species.

Species	OFL	ABC
Dusky	5,723	4,991
Dark	735 (combines all three species)	436
Widow		9
Yellowtail		106
Total PSR	6,458	5,542

The 2007 complex OFL is 6,458mt and the ABC is 5,542mt. This is apportioned over the three GOA areas as the following for 2007 WGOA=1,466mt, CGOA = 3,325mt, WYAK =307mt and EYAK/SEO = 444 mt.

3.1.3.2 BSAI other rockfish assessment

A single OFL is estimated for the other rockfish complex. ABCs are specified by individual area for the EBS and the AI. The complex is assessed at the Tier 5 level. In previous assessments Reuter and Spencer (2003; 2004) have recommended that shortspine thornyhead be split out of the other rockfish complex given that this species biomass makes up over 90% of the other rockfish biomass. The authors have also noted that the species is demographically different from other species in the complex with biomass estimates that have lower uncertainty than those of the remaining members of the complex (Reuter and Spencer, 2006). The Plan Team and SSC have continued to recommend that shortspine thornyhead remain in the complex. The Plan Team and SSC agree with the authors approach however in calculating OFL and ABC using different natural mortality rates for shortspine thornyhead (M=0.03) and for the remaining other rockfish biomass (M=0.09).

The BSAI OFL represents the sum of the individually calculated shortspine thornyhead (SST) OFL with the OFL from the remaining species in the complex (calculated as a group). The ABC is calculated separately by area (for EBS and AI). Each area-specific ABC represents the sum of the individually calculated ABC for shortspine thornyhead together with the group ABC for the remaining species in the complex. The respective BSAI biomass estimates are calculated by adding the average biomass (1997-2006 surveys) of the AI (SST = 14,905 mt; Other rockfish = 3,698 mt) with the average EBS slope survey (2002-2004) (SST = 17, 906 mt, Other rockfish 19 mt) estimate and the EBS shelf survey (Other rockfish 142 mt). BSAI OFL equals ((SST BSAI biomass (32,811) x 0.03 = 984)+ (Other rockfish BSAI biomass (3,859 mt) x 0.09 = 347)) = 1,331. For calculation of the respective ABCs each of the biomass estimates were multiplied by 0.75of M (SST 0.75 x 0.03 = 0.0225 and Other rockfish 0.75 x 0.09 = 0.0675). The resulting OFLs and ABCs for 2007 are shown below:

Other rockfish complex Tier 5 for 2007 (from Reuter and Spencer, 2006):

Region	M	Exploitable biomass (mt)	F_{ABC}	ABC (mt)	F_{OFL}	OFL (mt)
BSAI SST	**0.03**	**32,811**			**0.03**	984
BSAI Orock	**0.09**	**3,859**			**0.09**	347
BSAI Total						**1,331**
EBS SST	0.03	17,906	0.0225	403		
EBS Orock	0.09	161	0.0675	11		
EBS Total				**414**		
AI SST	0.03	14,905	0.0225	335		
AI Orock	0.09	3,698	0.0675	250		
AI Total				**585**		

3.2 Pelagic Shelf Rockfish Fishery (GOA)

Pelagic shelf rockfish (GOA) have been caught almost exclusively with bottom trawls although some contribution from observed longline vessels has occurred. OFLs are specified gulfwide while ABCs and TACs are apportioned by area in the GOA. Overfishing levels in recent years are lower than in the period from 1998-2003 while ABCs have remained fairly constant (Table 16). Generally, in the PSR fishery in the GOA, the TAC has been established as equal to the ABC (Table 17).

Table 16 Overfishing levels (OFL), acceptable biological catch (ABC) and total allowable catch (TAC) levels for the GOA pelagic shelf rockfish complex 1998-2006

Year	OFL	ABC (total all areas)	TAC (total all areas)
1998*	9,420	4,880	4,880
1999	9,420	4,880	4,880
2000	9,040	5,980	5,980
2001	8,220	5,980	5,490
2002	8,220	5,490	5,490
2003	8,220	5,490	5,490
2004	5,570	4,470	4,470
2005	5,680	4,553	4,553
2006	6,662	5,436	5,436

*includes black and blue rockfish which were removed from the GOA FMP in 1998

The majority of the catch occurs in the Central GOA management area (Table 17).

Table 17 Commercial catch[a] (mt) of fish in the pelagic shelf rockfish assemblage in the Gulf of Alaska, with Gulfwide values of acceptable biological catch (ABC) and total allowable catch (TAC), 1988-2005. Updated through October 18, 2005. (Lunsford et al. 2005)

		Regulatory Area[b]					Gulfwide		
Year	**Category**	Western	Central	Eastern	West Yakutat[c]	Southeast Outside[d]	Total	ABC	TAC
1988	Foreign	0	0	0	-	-	0		
	U.S.	400	517	168	-	-	1,085		
	JV	Tr	1	0	-	-	1		
	Total	400	518	168	-	-	1,086	3,300	3,300
1989	U.S.	113	888	737	-	-	1,738	6,600	3,300
1990	U.S.	165	955	527	-	-	1,647	8,200	8,200
1991	U.S.	215	1,191	936	-	-	2,342	4,800	4,800
1992	U.S.	105	2,622	887	-	-	3,605	6,886	6,886
1993	U.S.	238	2,061	894	-	-	3,193	6,740	6,740
1994	U.S.	290	1,702	997	-	-	2,989	6,890	6,890
1995	U.S.	108	2,247	536	471	64	2,891	5,190	5,190
1996	U.S.	182	1,849	265	190	75	2,296	5,190	5,190
1997	U.S.	96	1,959	574	536	38	2,629	5,140	5,140
1998	U.S.	60	2,477	576	553	22	3,113	4,880	4,880
1999	U.S.	130	3,835	694	672	22	4,659	4,880	4,880
2000	U.S.	190	3,074	467	445	22	3,731	5,980	5,980
2001	U.S.	121	2,436	451	439	12	3,008	5,980	5,980
2002	U.S.	185	2,680	457	448	9	3,322	5,490	5,490
2003	U.S.	164	2,194	617	607	10	2,975	5,490	5,490
2004	U.S.	281	2,182	211	199	12	2,885	4,470	4,470
2005	U.S.	118	1,843	218	215	3	2,397	4,553	4,553

[a]Catches for 1988-97 include black rockfish and blue rockfish, which were members of the assemblage during those years.
[b]Catches for West Yakutat and Southeast Outside areas are not available for years before 1996. Eastern area is comprised of the West Yakutat and Southeast Outside areas combined.
[c]West Yakutat area is comprised of statistical areas 640 and 649.
[d]Southeast Outside area is comprised of statistical areas 650 and 659.

Catches have been below TACs. Annual catches have generally increased from 1988 to 1992 and have fluctuated since that time. The pattern can largely be explained by management actions affecting rockfish during this time period. Prior to 1991 TACs for more desirable rockfish species such as Pacific ocean perch were relatively large thus the incentive to target lower valued rockfish (such as dusky rockfish in the PSR complex) was low. As TACs for slope rockfish became more restrictive in the 1990's the incentive to target other rockfish increased, resulting in higher catches for PSR species and a high in 1992 of 3605mt gulfwide. In-season management measures have largely prevented further increases in the dusky rockfish fishery. In some years (e.g., 1997-1998 and 2000-2005) the PSR trawl fishery in the Central GOA was closed prior to reaching the TAC. The fishery was closed either to ensure that catch did not exceed TAC or to prevent excessive bycatch of species such as Pacific Ocean perch and Pacific halibut (Lunsford et al. 2005).

Under the current management the Gulf of Alaska rockfish fisheries open on January 1[st] for non-trawl gear participants. The opening for trawl gear is near July 1[st], but varies year-to-year. The trawl opening is generally timed to coincide with the availability of the quarterly halibut PSC allocation. The fishery is also timed to accommodate the sablefish longline survey that occurs later in the summer. The rockfish fisheries, which also take some sablefish, must be completed early enough to allow the redistribution of sablefish stocks to avoid possible survey bias. The opening is also scheduled to accommodate in-season management so that managers have adequate catch and effort information to make Federal Register closure announcements, if needed, avoiding the 4th of July holiday weekend. The opening typically coincides with the openings of the Aleutian Islands Pacific ocean perch and Bering Sea flathead sole fisheries to distribute effort among the fisheries.

Both the trawl and non-trawl fisheries are prosecuted from a single TAC, with the harvest from the trawl fishery limited to the remaining available TAC after the non-trawl fleet has prosecuted the fishery from its January 1st opening. Since the non-trawl fleet has shown little interest in the fisheries historically, most of the TAC has been harvested by the trawl fleet.

Most participants target Pacific ocean perch first, until the TAC of that species is fully harvested. Pacific ocean perch are a larger biomass and typically are easier to target than the other two species. The season for Pacific ocean perch usually lasts between one and two weeks. Once the Pacific ocean perch fishery is closed, vessels will usually move on to the northern rockfish or pelagic shelf rockfish directed fisheries. The directed fisheries for northern rockfish and pelagic shelf rockfish typically last less than one month, closing before the end of July. Managers have exercised some caution in managing the fishery, occasionally closing the fisheries to ensure that the TAC is not exceeded. When sufficient TAC has remained available, managers have reopened the fisheries later to allow participants to complete the harvest.

Typically, harvests of the rockfish TACs have resulted in closure of the fisheries, although at times halibut PSC in the deep-water complex has closed the fisheries. In 2000, halibut PSC closed the pelagic shelf rockfish fishery. In 2001, halibut PSC closed both the northern rockfish and pelagic shelf rockfish fisheries in July. The fisheries were reopened on October 1st, when the fourth quarter halibut allocation became available. The fisheries closed again near the end of October, after harvest of the deep-water halibut PSC allocation.

From 1991-2005, dark rockfish have not made up more than 2.6 percent of the assemblage catch for pelagic shelf rockfish (Table 5). In most of these years dark rockfish made up only trace amounts of the catch with more than 99% of the catch made up of dusky rockfish. In 1999, dark rockfish made up 2.6% with dusky rockfish making up 97.4% of the catch. In 2004, widow rockfish made up a larger relative percentage of the total catch than in previous years with dusky rockfish making up 95.5% and dark rockfish 0.4%. In both of these years the high observed catch for dark rockfish (2.6% in 1999) and widow rockfish (4.5% in 2004) respectively were due to abnormally large individual tows recorded by observers (C. Lunsford, pers. comm.). In most years large tows of dark rockfish are not recorded by observers, indicating large catches of dark rockfish are uncommon in the trawl fishery. In 2005, the catch composition was 98.8% dusky rockfish and 1.1% dark rockfish (Table 18).

Table 18 Percentage of assemblage catch (from observer data)

Year	Dusky	Dark	Yellowtail	Widow
1991	93.5	0.2	5.1	1.2
1992	98.9	0.3	trace	0.8
1993	98.1	trace	0.5	1.4
1994	98.3	1.2	0.1	0.4
1995	99.2	trace	trace	0.8
1996	99.7	trace	trace	0.3
1997	99.9	trace	trace	0.1
1998	99.9	trace	trace	trace
1999	97.4	2.6	trace	trace
2000	99.2	0.6	0.1	0.2
2001	99.7	0.3	trace	trace
2002	99.4	0.5	trace	0.1
2003	98.8	0.8	trace	0.3
2004	95.1	0.4	trace	4.5
2005	98.8	1.1	0.2	trace

Source: C. Lunsford, NMFS

Catches for dusky rockfish are concentrated on several relatively shallow, offshore banks on the outer continental shelf particularly the "W" grounds west of Yakutat, Portlock Bank (northeast of Kodiak Island) and around Albatross Bank south of Kodiak Island (Lunsford et al. 2005). Highest CPUE in the commercial fishery is generally at depths of 100-149 m (Reuter 1999).

From 1988-1995 nearly all of the catch of dusky rockfish was taken by large factory trawlers that processed the fish at sea. Since 1999 a larger proportion of the catch has been taken by smaller shore-based trawlers in the Central GOA and the catch has been delivered to Kodiak-based processing plants. These shore-based trawlers have accounted for the following percentages of trawl catch in the CGOA from 1996-2004 (Table 19).

Table 19 Percent shore-based trawl catch in Central GOA area 1996-2004 (Lunsford et al 2005)

Year	Percent shore-based trawl catch in Central GOA area
1996	27.1
1997	18.1
1998	25.0
1999	45.2
2000	74.4
2001	58.0
2002	49.7
2003	n/a
2004	64.6

Overall catch by gear type from 1998-2005 is shown in Table 9. Some fish are not identified to species and end up in an aggregate PSR catch category. Here dusky rockfish contains both dark and dusky rockfish. Trawl catch accounts for the majority of all catch in the pelagic shelf rockfish fishery. Dark rockfish are caught by jig gear and the jig catch listed in Table 20 could be primarily dark rockfish. The highest jig catch in recent years was 53 mt in 2004. Trawl catch of dusky rockfish dominates all catch by year and gear type in this assemblage. Separate species codes are being developed to identify dusky rockfish and dark rockfish in future catch accounting given the differentiation to species level. In order to identify dark rockfish as a separate species in the Federal catch accounting system the federal reporting requirements need revision and fairly complex data processing revisions are also required (A. Smoker, pers. comm.). New reporting requirements will be necessary whether or not the Council chooses to move dark rockfish for State management.

Table 20 Retained catch (mt) of PSR species by gear type 1998-2005 (screened for confidentiality). Source: NMFS Catch Accounting

Species and year	Trawl	Fixed gear*	Jig Gear
1998			
Dusky rockfish	1,288	84	4
PSR**	1,510	0	0
Widow rockfish	18	0	0
Yellowtail rockfish	0	0	2
1999			
Dusky rockfish	2,364	19	3
PSR**	2,136	0	0
Widow rockfish	0	0	0
Yellowtail rockfish	0	1	3
2000			
Dusky rockfish	2,395	15	5
PSR**	1,092	0	0
Widow rockfish	0	0	0
Yellowtail rockfish	0	1	2
2001			
Dusky rockfish	1,932	9	9
PSR**	892	0	0
Widow rockfish	0	0	0
Yellowtail rockfish	24	0	1
2002			
Dusky rockfish	1,807	3	15
PSR**	1,195	0	0
Widow rockfish	0	0	0
Yellowtail rockfish	0	0	1
2003			
Dusky rockfish	2,946	9	8
Widow rockfish***	n/a	n/a	n/a
Yellowtail rockfish	0	0	3
2004			
Dusky rockfish	2,410	8	53
Widow rockfish	n/a	n/a	n/a
Yellowtail rockfish	0	1	1
2005			
Dusky rockfish	2,023	18	17
Widow rockfish	n/a	n/a	n/a
Yellowtail rockfish	0	n/a	1

*fixed gear includes hook and line and pot gear. Jig gear is not included as it is broken out separately.
**PSR aggregate were not identified to species
***total only available in 2003 (7mt)

Dark rockfish are also caught in the state jig fishery. Dark rockfish have often been misidentified as black rockfish and caught in the black rockfish commercial fishery (Orr and Blackburn 2004). Dark rockfish have not been separately identified in the black rockfish fishery, although recent dockside sampling efforts by ADF&G have identified dark rockfish and other pelagic shelf rockfish species during the state jig fishery (see section 3.3 for additional information).

Major bycatch species for hauls targeting pelagic shelf rockfish include primarily northern rockfish and fish in the "other slope" rockfish category, followed by Pacific ocean perch (Ackley and Heifetz 2001). The "other slope" rockfish category includes 15 rockfish species with the primarily caught species in the category being sharpchin, redstripe, harlequin, silvergrey, yellowmouth and redbanded rockfish. Dusky rockfish was the primary bycatch species for hauls targeting northern rockfish (Ackley and Heifetz 2001). Bycatch of pelagic shelf rockfish species in the non-rockfish fisheries is presumed to be small (Lunsford et al 2005).

Discard rates of pelagic shelf rockfish have been lower than the rates for other slope rockfish species and in recent years (200-2004) have ranged from 2.4% to 4.7% (Lunsford et al 2005). Dark rockfish are included in the MRA for aggregate rockfish in the GOA. MRAs for aggregate rockfish range from 5-15% by fishery except for arrowtooth flounder which remains at 0 (Appendix 1). The Council is considering management measures to adjust the arrowtooth flounder MRA in the GOA.

3.3 BSAI other rockfish fishery

Dark rockfish are managed as part of the "other rockfish" complex in the Aleutian Islands/Eastern Bering Sea. Dusky rockfish and shortspine thornyheads are the two most abundant species in this complex. The distributions of other species in this complex including dark rockfish are not well documented (Reuter and Spencer, 2006). There is no targeted fishery for "other rockfish" in the AI or EBS. In the Aleutians, "other rockfish" are primarily caught by the atka mackerel trawl fishery (dusky rockfish) and to a lesser extent the sablefish longline fishery (shortspine thornyheads). In the Bering Sea "other rockfish are taken in small amounts by several fisheries, primarily the pacific cod trawl and longline fishery. From 1990-2001 dark rockfish comprised <1% of the "other rockfish" catch in the EBS and 3% in the AI catch (Table 20). For catch accounting purposes dark rockfish are grouped with redbanded, redstripe, yelloweye, and shapchin rockfish. In 2006 the catch of these four species was 61 mt in the AI and 6 mt in the BS (Table 21).

OFLs for the other rockfish complex are set for the entire BSAI area, while ABCs and TACs are set by area for the EBS and AI (Table 20). The TAC in the EBS has been set below ABC in recent years while the AI TAC is set equal to ABC. TACs are set to meet incidental catch needs.

Table 21 OFL, ABC and catch for the other rockfish complex in the BSAI 2004-2007

Year	Area	OFL	ABC	TAC	Catch
2004	BSAI	1,280			
	EBS		960	960	317
	AI		634	634	337
2005	BSAI	1,870			
	EBS		810	460	178
	AI		590	590	286
2006*	BSAI	1,870			
	EBS		810	460	153
	AI		590	590	417
2007	BSAI	1,330			
	EBS		414	n/a	n/a
	AI		585	n/a	n/a

*catch through 11/04/06

Historical catches of other rockfish are shown in table 21 below. Peak catch in the EBS occurred in 1978 with a catch of 941 mt while peak catch in the AI was in 1982 with a harvest of 2,114 (Reuter and Spencer, 2006).

Table 22 Summary of catches (mt) of other rockfish in the eastern Bering Sea and Aleutian Islands regions. (from Reuter and Spencer, 2006) data from NMFS/AK regional website.

	Eastern Bering Sea						Aleutian Islands					
	Domestic						Domestic					
Year	For.	JV	DAP	Total	ABC	OFL	For.	JV	DAP	Total	ABC	OFL
1977*	112	--	--	112			700	--	--	700		
1978*	941	--	--	941			212	--	--	212		
1979*	759	--	--	759			1,039	--	--	1,039		
1980	456	3	--	459			420	--	--	420		
1981	331	--	25	356			328	--	--	328		
1982	262	11	3	276			2,114	--	--	2,114		
1983	212	8	--	220			1,041	4	--	1,045		
1984	121	8	47	176			42	14	--	56		
1985	33	3	56	92			2	14	83	99		
1986	4	12	86	102			Tr	15	154	169		
1987	3	4	467	474			0	6	141	147		
1988	0	8	333	341			0	68	210	278		
1989	0	4	188	192			0	0	481	481		
1990	0	0	418	418			0	0	858	858		
1991	0	0	422	422			0	0	343	343		
1992	0	0	600	600			0	0	664	664		
1993	0	0	192	192			0	0	496	496		
1994	0	0	133	133			0	0	292	292		
1995	0	0	288	288			0	0	219	219		
1996	0	0	170	170			0	0	282	282		
1997	0	0	163	163			0	0	305	305		
1998	0	0	188	188			0	0	364	364		
1999	0	0	135	135			0	0	631	631		
2000	0	0	232	232	369	492	0	0	563	563	685	913
2001	0	0	295	295	361	482	0	0	592	592	676	901
2002	0	0	398	398	361	482	0	0	518	518	676	901
2003†	0	0	293	293	960	1,280	0	0	366	366	634	846
2004†	0	0	289	289	960	1,280	0	0	314	314	634	846
2005†	0	0	157	157	809	1,865	0	0	275	275	590	1,865
2006§	0	0	139	139	809	1,865			389	389	590	1,865

These biomass estimates were revised (2001) to show the catch of those species currently in the other rockfish category.
† Catch estimates updated 2006
§ Estimated removals through October 16th, 2006.

Historically the majority of the catch in the fishery (both EBS and AI) has been of dusky rockfish and shortspine thornyhead (Table 22) which make up the majority of the biomass in the complex as well.

Table 23 The common and scientific names of rockfish in the "other rockfish" reporting category identified, 1990- 2001, by AFSC research surveys (at least one observation) and U.S. fishery observers (greater than 1% of hauls) in the eastern Bering Sea and Aleutian Islands. *Source: Reuter and Spencer, 2006*

		EBS		AI	
Common name	Scientific name	Survey	Fishery	Survey	Fishery
Red banded rockfish	*Sebastes babcocki*	~	~	*1%*	*<1%*
Dark rockfish	*Sebastes ciliatus*	~	*1%*	*4%*	*3%*
Dusky rockfish	*Sebastes variabilis*	*18%*	*39%*	*22%*	*45%*
Redstripe rockfish	*Sebastes proriger*	~	*1%*	~	*1%*
Yelloweye rockfish	*Sebastes ruberrimus*	~	*1%*	*<1%*	*1%*
Harlequin rockfish	*Sebastes variegatus*	~	*1%*	*9%*	*5%*
Sharpchin rockfish	*Sebastes zacentrus*	~	*<1%*	*<1%*	*<1%*
Shortspine thornyhead	*Sebastolobus alascanus*	*62%*	*43%*	*61%*	*34%*

Recent catches in both the AI and EBS show a similar trend (Table 22). There is no target fishery for the other rockfish complex. Target fisheries which catch these two species are primarily the Atka mackerel trawl fishery and Pacific cod longline fishery (for dusky rockfish catch) and the longline fisheries (sablefish, turbot, halibut) as well as rockfish trawl fishery (for shortspine thornyhead catch) (Reuter and Spencer, 2006). No specific information is currently available on the catch by fishery of the dark rockfish component of the catch in the AI or EBS.

Table 24 Total fishery catch (mt) of top species in other rockfish group in the Aleutian Islands and eastern Bering Sea from 2003-2006. *Source: Reuter and Spencer, 2006. data from Catch Accounting System, NMFS AK Regional Office.*

Aleutian Islands

2006*	541	542	543	Total
Dusky	101	48	9	**158**
Shortspine	35	96	15	**146**
Rockfish unid.	7	54	>1	**61**
Harlequin	4	9	10	**23**
Total	**147**	**207**	**34**	**388**

2005	541	542	543	Total
Dusky	66	53	14	**133**
Shortspine	40	46	27	**113**
Rockfish unid.	1	4	9	**14**
Harlequin	1	8	5	**14**
Total	**108**	**111**	**55**	**274**

2004	541	542	543	Total
Dusky	33	81	18	**132**
Shortspine	42	36	18	**96**
Harlequin	1	17	18	**36**
Rockfish unid.	>1	26	21	**47**

Total	76	160	75	311

2003	541	542	543	Total
Dusky	62	73	17	152
Shortspine	67	69	41	177
Harlequin	1	22	11	34
Rockfish unid.	1	1	1	3
Total	**130**	**165**	**70**	**366**

*Total catch as of October 16, 2006

Eastern Bering Sea

2006*	EBS
Shortspine thornyhead	92
Dusky	40
Rockfish unid.	6
Total	**139**

2005	EBS
Shortspine thornyhead	119
Dusky	36
Rockfish unid.	1.5
Total	**157**

2004	EBS
Shortspine thornyhead	242
Dusky	32
Rockfish unid.	15
Total	**289**

2003	EBS
Shortspine thornyhead	256
Dusky	23
Rockfish unid.	13
Total	**293**

*Total catch as of October 16, 2006

Dark rockfish are included in the MRA for aggregate rockfish in the BSAI. MRAs for aggregate rockfish range from 5-15% by fishery except for arrowtooth flounder which remains at 0 (Appendix 1).

3.4 Other Groundfish Stocks

Groundfish stocks caught in conjunction with fisheries for pelagic shelf rockfish in the GOA include Pacific ocean perch, northern rockfish and species in the "other slope" rockfish complex. In the BSAI there are no targeted fisheries for other rockfish, but these fish are commonly caught in the Atka mackerel fishery (AI) and Pacific cod longline and trawl fisheries in the BSAI. Descriptions of these species and fisheries are contained in the annual Stock Assessment and Fishery Evaluation reports for the Gulf of Alaska (NPFMC 2005).

Dark rockfish are often caught in conjunction with black rockfish. Dark rockfish and black rockfish often co-occur in nearshore kelp beds of the Gulf of Alaska, and are superficially similar in appearance, especially in body color, which can lead to misidentification. Black rockfish are a nearshore, shallow water species that are commercially targeted using jig gear. Black and blue rockfish were both removed from the Federal FMP in 1998 under amendment 46 and turned over to the State of Alaska for management due to concerns of overfishing these species under the relatively high TAC for the pelagic shelf species complex (NPFMC 1998).

Black rockfish is now solely managed by the State of Alaska following removal from the GOA groundfish FMP of black and blue rockfish under amendment 46 to the FMP (NPFMC 1998).
Commercial fisheries targeting black rockfish use jig gear.

3.4.1 GOA black rockfish fishery

In the GOA, the commercial fishery for black rockfish opens in all Westward districts on January 1st and remains open until December 31, or until GHLs are attained (Mattes and Failer-Rounds 2005). Harvests are monitored through fish ticket records, processor reports and dockside sampling of commercial catches. Some black rockfish is also landed as bycatch in other fisheries (Ruccio et al. 2004). Trip limits in the Kodiak District for black rockfish are 5,000 pounds per five day harvest and landing. Vessel operators must register specifically for the black rockfish fishery in this district. No trip limits are imposed in the Chignik or South Alaska Districts of the Westward Region.

Canneries processing black rockfish in Kodiak in 2003 noted that increased sorting efforts for dusky and dark rockfish led to estimates that many deliveries that were close to 5,000 pounds total for all rockfish species often contained ¼ to ½ "dusky" rockfish (combined light and dark dusky rockfish species) once sorted (Ruccio et al. 2004). Total harvest in 2003 as reported on fish tickets for Kodiak, Chignik and South Alaska Peninsula areas for black rockfish was 141,265 pounds and for combined dusky rockfish species 17,967 pounds. The majority of the dusky rockfish harvest (17,910 of the total 17,967 pounds) was taken in the Kodiak District.

Information from ADF&G has indicated that as much as 25% of the fish reported as black rockfish caught in the Kenai Peninsula jig fishery may have actually been dark rockfish (Lunsford et al 2005).

Catch and effort data for the Kodiak District from 1990-2004 are shown in Table 25.

Table 25 Catch and effort, excluding discards, for the Kodiak Area black rockfish fishery 1998-2004 (from Sagalkin and Spalinger 2005)

Year	Vessels	Number of Landings	Directed GHL	Total Harvest (lbs)	Price per pound
1998	76	355	190,000	195,623	0.32
1999	84	316	185,000	131,986	0.40
2000	92	282	185,000	255,044	0.41
2001	55	194	185,000	220,825	0.40
2002	41	143	185,000	204,547	0.43
2003	49	106	185,000	85,362	0.36
2004	52	140	185,000	123,231	0.36

A total of 76 vessels harvested 231,555 pounds (105 mt) of black rockfish from the combined Kodiak, Chignik and Eastern District of the South Alaska Peninsula Area in the 2004 fishery (Sagalkin and Spalinger 2005). Of those participating, 31 vessels harvested black rockfish in the directed commercial fishery with jig gear while the remainder landed it as bycatch in other fisheries (Sagalkin and Spalinger 2005). The majority of the harvest was from the Kodiak District.

Dockside sampling efforts have increased in recent years and samplers have collected a range of data in addition to fish ticket records, fishing locations and effort. Recently data has been collected during the black rockfish jig fishery on fish length, sex, reproductive maturity, and otoliths for aging (Sagalkin and Spalinger 2005). Species composition data from dockside sampling indicates that the percentage of black rockfish identified as darks is higher in recent years (Figure 3-13 and Figure 3-14).

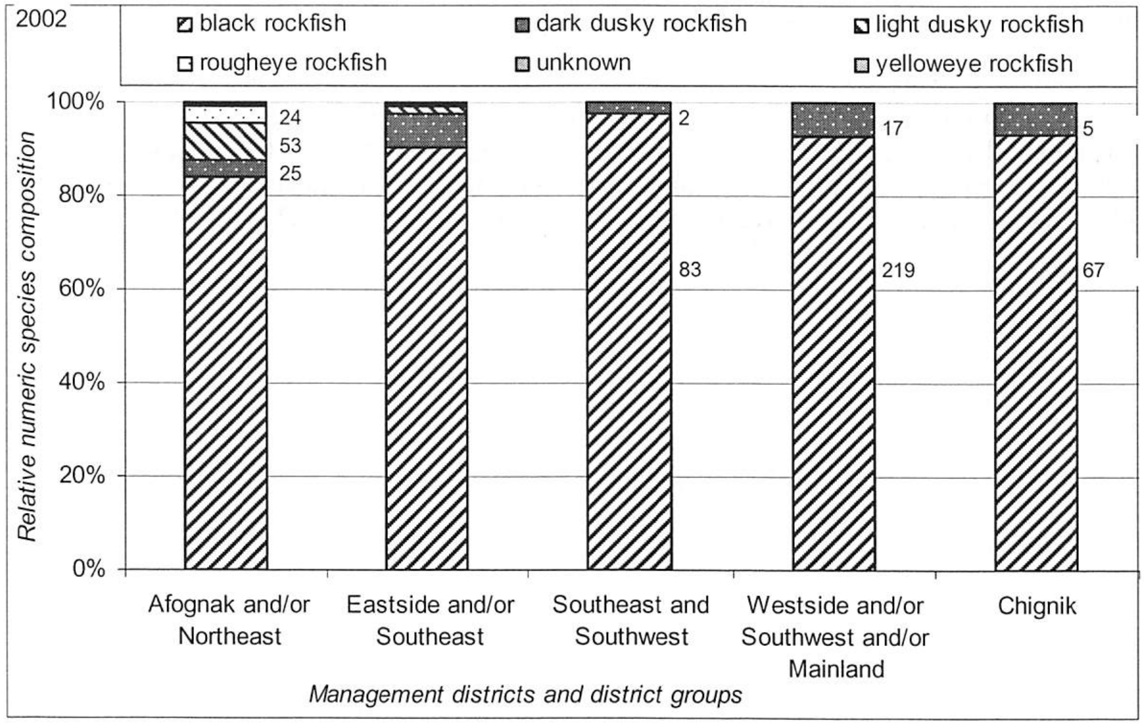


Figure 3-13 Percent species composition landed in the 2002 Black rockfish jig fishery (Source ADF&G)

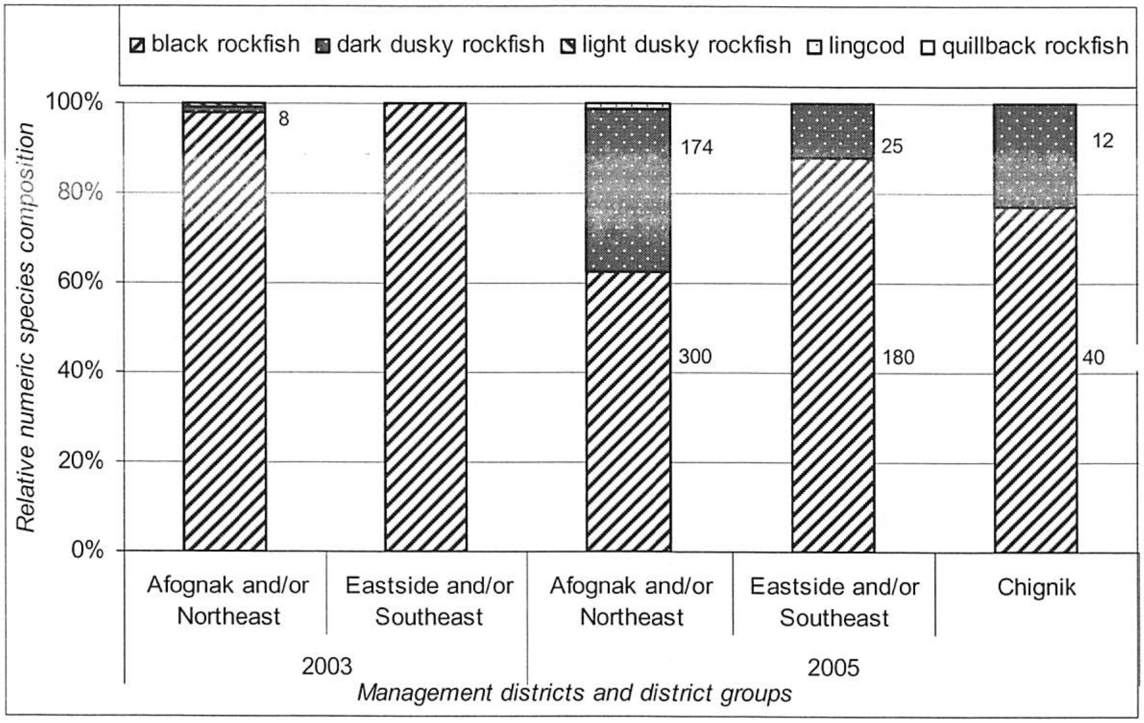


Figure 3-14 Percent species composition landed in the Black rockfish jig fishery 2003, 2005 (Source ADF&G)

Figures 5 and 6 show the percent species composition from the directed black rockfish jig fishery from dockside sampling in the Westward Region. In all areas and years the catch is predominantly black rockfish, however in 2005 a substantial proportion of the catch was dark rockfish (Figure 3-14). Generally processors offer less money for dark rockfish than for black rockfish, thus there is limited incentive for the fishermen to separate the two species (N. Sagalkin pers. comm.).

Preliminary data from the Cook Inlet management region also shows the proportion of dark rockfish in the landed black rockfish catch (Table 26). The relative proportion of dark rockfish in the catch has ranged from 0.9 to 5.6%. The lower rates of 0.9 in 2001, as compared to the following three years, may be due to the higher relative percentage of unidentified dusky rockfish in that year that were likely dark rockfish (Table 26).

Table 26 Species composition of pelagic shelf rockfish sampled in the Cook Inlet Area jig fishery and surveys 2001-2004.

Species	2001	2002	2003	2004	Ave (01-04)
Black rockfish	94.4	94.7	93.5	96.4	94.5
Unspec. Dusky rockfish	4.3	0.5	0.2	0.0	1.9
Dark rockfish	0.9	4.2	5.6	3.3	3.0
Dusky rockfish	0.4	0.7	0.8	0.3	0.5

Source: W. Dunn, ADF&G preliminary data

Dockside sampling data in the 2004 fishery for the Cook Inlet Area indicated that from a total of 672 rockfish sampled in the ports of Homer and Seward, species composition were 79% black rockfish, 7% dusky rockfish, 1% quillback rockfish and 13% yelloweye rockfish (Trowbridge and Bechtol 2004). Dusky rockfish were not separated into dusky and dark by species. Of the samples collected 87% came from the directed jig fishery.

A research survey in 2004 in the Shumagins area using a chartered jig vessel caught approximately 900 black rockfish and 434 dark rockfish, which could show an indication of the species composition in that region (D. Urban pers. comm.). The Shumagins are also the region of the high biomass estimates from tows in the trawl surveys in 1999 and 2005 (Figure 3-5).

Thus while data are still limited there are indications that a relatively high proportion of dark rockfish are caught in the commercial fisheries for black rockfish. Dusky rockfish are not caught in high amounts in the black rockfish fishery (Figure 3-13, Figure 6 and Table 12).

3.4.2 BSAI black rockfish fishery

State waters of the Aleutian Islands District and the Western District of the South Alaska Peninsula Registration Area are managed jointly for black rockfish. This area consists of all waters south of a line extending west from Cape Sarichef (54 ° 36' N. lat) and west of a line extending south of Scotch Cap Light (164 ° 44' W. long.). For management purposes this is referred to as the Aleutian Islands black rockfish fishery. In the AI, the commercial fishery for black rockfish opens in all on January 1st and remains open until December 31, or until GHLs are attained (Mattes and Failer-Rounds 2005). Harvests are monitored through fish ticket records, processor reports and dockside sampling of commercial catches.

The GHL for black rockfish was 100,000 pounds from 1994-1998 and 90,000 pounds from 1999-2006. Harvest has been far below the GHL in recent years.

Landings and vessel participation are listed in Table 26. Most years landing information cannot be shown due to confidentiality restrictions.

Table 27 Black rockfish landings (in pounds) in the State Aleutian Islands fishery 1997-2006

Aleutian Islands Black Rockfish

Year	Round Pounds	Unique Vessel Count	No. of Landings
1997	102,588	5	20
1998	confidential	confidential	confidential
1999	21,522	11	44
2000	confidential	confidential	confidential
2001	confidential	confidential	confidential
2002	confidential	confidential	confidential
2003	confidential	confidential	confidential
2004	2,801	15	34
2005	6,090	9	21
2006	confidential	confidential	confidential
	confidential	confidential	confidential

Dockside sampling data are not available for the black rockfish fishery in the Aleutian Islands thus the possible percentage of landings of dark rockfish in the black rockfish fishery are unknown.

3.5 Threatened and Endangered Species

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.

Table 28 Species listed as endangered and threatened under the ESA that may be present in the Federal waters off Alaska include:

Common Name	Scientific name	ESA status
Northern Right Whale	*Balaena glacialis*	Endangered
Bowhead Whale [1]	*Balaena mysticetus*	Endangered
Sei Whale	*Balaenoptera borealis*	Endangered
Blue Whale	*Balaenoptera musculus*	Endangered
Fin Whale	*Balaenoptera physalus*	Endangered
Humpback Whale	*Megaptera novaeangliae*	Endangered
Sperm Whale	*Physeter macrocephalus*	Endangered
Snake River Sockeye Salmon	*Onchorynchus nerka*	Endangered
Short-tailed Albatross	*Phoebaotria albatrus*	Endangered
Steller Sea Lion	*Eumetopias jubatus*	Endangered and Threatened [2]
Snake River Fall Chinook Salmon	*Onchorynchus tshawytscha*	Threatened
Snake River Spring/ Summer Chinook Salmon	*Onchorynchus tshawytscha*	Threatened
Puget Sound Chinook Salmon	*Onchorynchus tshawytscha*	Threatened
Lower Columbia River Chinook Salmon	*Onchorynchus tshawytscha*	Threatened
Upper Willamette River Chinook Salmon	*Onchorynchus tshawytscha*	Threatened
Upper Columbia River Spring Chinook Salmon	*Onchorynchus tshawytscha*	Endangered
Upper Columbia River Steelhead	*Onchorynchus mykiss*	Endangered
Snake River Basin Steelhead	*Onchorynchus mykiss*	Threatened
Lower Columbia River Steelhead	*Onchorynchus mykiss*	Threatened
Upper Willamette River Steelhead	*Onchorynchus mykiss*	Threatened
Middle Columbia River Steelhead	*Onchorynchus mykiss*	Threatened

Spectacled Eider	*Somateria fishcheri*	Threatened
Steller Eider	*Polysticta stelleri*	Threatened

[1] The bowhead whale is present in the Bering Sea area only.
[2] Steller sea lion are listed as endangered west of Cape Suckling and threatened east of Cape Suckling.

Of the species listed under the ESA and present in the action area, some may be negatively affected by commercial groundfish fishing. Section 7 consultations with respect to the actions of the Federal groundfish fisheries have been done for all the species listed above, either individually or in groups. Additional information on endangered and threatened species appears in the Alaska Groundfish Fisheries Programmatic Supplemental Environmental Impact Statement (NMFS 2004).

3.6 Marine Mammals

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

Direct and indirect interactions between marine mammals and groundfish harvest occur due to overlap in the size and species of groundfish harvested in the fisheries that are also important marine mammal prey and due to temporal and spatial overlap in marine mammal foraging and commercial fishing activities. A detailed analysis of the effects of commercial fisheries on marine mammals appears in the Alaska Groundfish Fisheries Programmatic Supplemental Environmental Impact Statement (NMFS 2004).

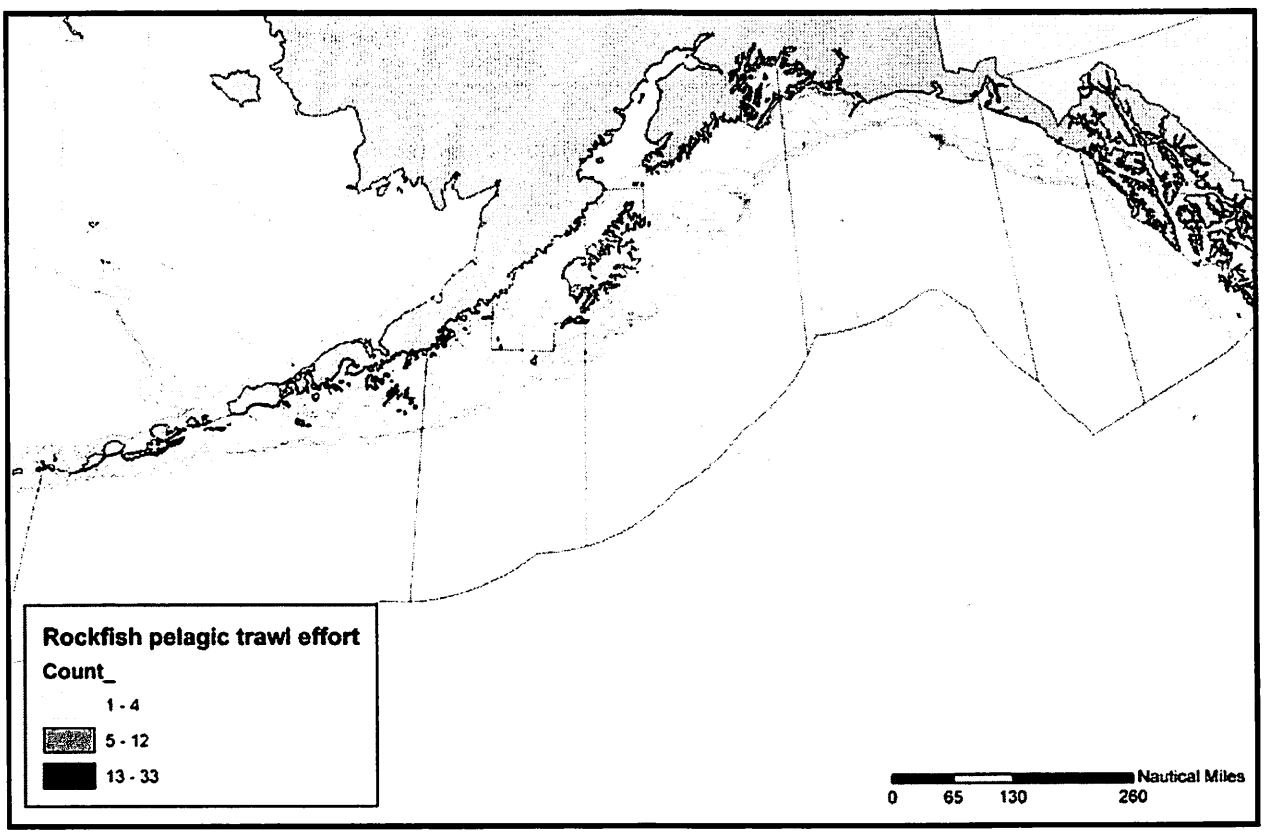
3.7 Seabirds

Many seabirds occur in Alaskan waters indicating a potential for interaction with commercial 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. A detailed analysis of the effects of commercial fisheries on seabirds appears in the Alaska Groundfish Fisheries Programmatic Supplemental Environmental Impact Statement (NMFS 2004).

3.8 Habitat and Essential Fish Habitat

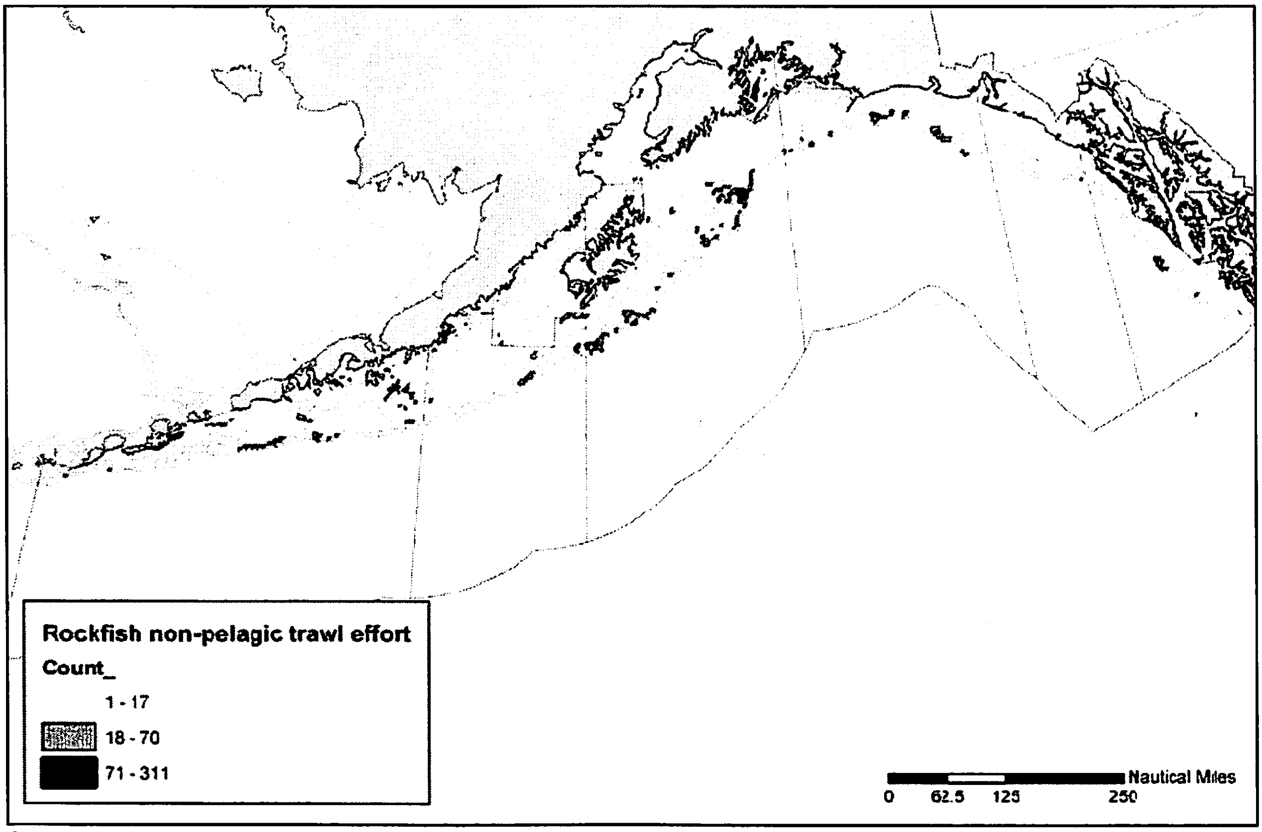
Section 303(a)(7) of the Magnuson-Stevens Act requires all FMPs to describe and identify Essential Fish Habitat (EFH), defined as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." In addition, FMPs must minimize to the extent practicable adverse effects of fishing on EFH and identify other actions to conserve and enhance EFH. To this end, the Environmental Impact Statement for Essential Fish Habitat Identification and Conservation in Alaska (NMFS, 2004) provides a detailed analysis of the interactions between fisheries and EFH. Most of the controversy surrounding EFH concerns the effects of fishing activities on sea floor habitats. The analysis concludes that there are long term effects of fishing on benthic habitat features off Alaska and acknowledges that considerable scientific uncertainty remains regarding the consequences of those effects on the sustained productivity of managed species. Based on the best available scientific information, the EIS concludes that the effects on EFH are minimal because the analysis finds no indication that continued fishing activities at the current rate and intensity would alter the capacity of EFH to support health populations of managed species over the long term. The analysis concludes that no Council-managed fishing activities have more than a minimal adverse effect on EFH, which is the regulatory standard requiring action to minimize adverse effects under the MSA. Notwithstanding these findings, the Council elected to adopt a variety of new measures to conserve EFH, which are scheduled to be implemented by August 13, 2006.

Figure 3-15 shows the concentration of observed rockfish pelagic trawl hauls from 1990 to 2002. The figure suggests that slope rockfish pelagic trawl fisheries occur at relatively low effort levels (fewer than 33 observed hauls/25 square kilometers from 1990 to 2002) in all locations in the Gulf of Alaska. The areas of greatest concentration are on the slope south of the Kenai Peninsula, with fewer areas of concentration south of Kodiak Island. Figure 3-16 shows the concentration of observed rockfish non-pelagic (bottom) trawl hauls from 1990 to 2002. The figure suggests that bottom trawl fishery for slope rockfish has taken place at relatively low effort levels all along slope areas. As with the pelagic trawl effort, concentrations of bottom trawl effort (more than 71 observed hauls/25 square kilometers from 1990 to 2002) in the Central Gulf have occurred south of Kodiak Island and south of the Kenai Peninsula. The Pacific Ocean perch fishery occurs over sand, gravel, and mud at depths of 90 to 200 fathoms. The northern rockfish and pelagic shelf rockfish fisheries occur over rock, gravel, and hard sand at depths of 40 to 80 fathoms. The analysis of the EIS provides detailed descriptions of EFH and the effects of fishing on EFH (NMFS, 2004).



Source: EFH EIS (NMFS 2004).

Figure 3-15 Observed slope rockfish pelagic trawl effort (hauls/25 square kilometers), 1990 to 2002.



Source: EFH EIS (NMFS 2004).

Figure 3-16 Observed slope rockfish non-pelagic (bottom) trawl effort (hauls/25 square kilometers), 1990 to 2002.

3.9 Ecosystem Considerations

Ecosystem considerations from the pelagic shelf rockfish fishery are summarized annually in the Gulf of Alaska Stock Assessment and Fishery Evaluation (SAFE) report (NPFMC 2005). Ecosystem considerations from the other rockfish fishery are summarized annually in the Bering Sea Aleutian Islands SAFE report (NPFMC 2006). These considerations are summarized according to the ecosystem effects on the pelagic shelf rockfish stock as well as the potential fishery effects on the ecosystem. Generally, determination of ecosystem considerations is limited by lack of biological and habitat information for rockfish.

The following tables summarize the available information on indicators of ecosystem effects for these two fisheries (Table 13 GOA PSR fishery , Table 14 BSAI other rockfish fishery).

Table 29 Analysis of ecosystem considerations for pelagic shelf rockfish and the dusky rockfish fishery.

Ecosystem effects on GOA pelagic shelf rockfish

Indicator	Observation	Interpretation	Evaluation
Prey availability or abundance trends			
Phytoplankton and Zooplankton	Important for larval and post-larval survival but no information known	May help determine year class strength, no time series	Possible concern if some information available
Predator population trends			
Marine mammals	Not commonly eaten by marine mammals	No effect	No concern
Birds	Stable, some increasing some decreasing	Affects young-of-year mortality	Probably no concern
Fish (Halibut, arrowtooth, lingcod)	Arrowtooth have increased, others stable	More predation on juvenile rockfish	Possible concern
Changes in habitat quality			
Temperature regime	Higher recruitment after 1977 regime shift	Contributed to rapid stock recovery	No concern
Winter-spring environmental conditions	Affects pre-recruit survival	Different phytoplankton bloom timing	Causes natural variability, rockfish have varying larval release to compensate
Production	Relaxed downwelling in summer brings in nutrients to Gulf shelf	Some years are highly variable like El Nino 1998	Probably no concern, contributes to high variability of rockfish recruitment

GOA pelagic rockfish fishery effects on ecosystem

Indicator	Observation	Interpretation	Evaluation

Fishery contribution to bycatch			
Prohibited species	Stable, heavily monitored	Minor contribution to mortality	No concern
Forage (including herring, Atka mackerel, cod, and pollock)	Stable, heavily monitored (P. cod most common)	Bycatch levels small relative to forage biomass	No concern
HAPC biota	Medium bycatch levels of sponge and corals	Bycatch levels small relative to total HAPC biota, but can be large in specific areas	Probably no concern
Marine mammals and birds	Very minor take of marine mammals, trawlers overall cause some bird mortality	Rockfish fishery is short compared to other fisheries	No concern
Sensitive non-target species	Likely minor impact on non-target rockfish	Data limited, likely to be harvested in proportion to their abundance	Probably no concern
Fishery concentration in space and time	Duration is short and in patchy areas	Not a major prey species for marine mammals	No concern, fishery is being extended for several months starting 2006
Fishery effects on amount of large size target fish	Depends on highly variable year-class strength	Natural fluctuation	Probably no concern
Fishery contribution to discards and offal production	Decreasing	Improving, but data limited	Possible concern with non-target rockfish
Fishery effects on age-at-maturity and fecundity	Black rockfish show older fish have more viable larvae	Inshore rockfish results may not apply to longer-lived slope rockfish	Definite concern, studies being initiated in 2005

Table 14 Analysis of ecosystem considerations for other rockfish

Indicator	Observation	Interpretation	Evaluation
Ecosystem effects on *Other Rockfish*			
Prey availability or abundance trends			
Zooplankton	Stomach contents, ichthyoplankton surveys, changes mean wt-at-age	Data non-existent	Unknown
Predator population trends			
Marine mammals	Fur seals declining, Steller sea lions increasing slightly	No affect	Probably no concern
Birds	Stable, some increasing some decreasing	No affect	Probably no concern
Fish (Pollock, Pacific cod, halibut)	Stable to increasing	Affects not known	Probably no concern
b. Changes in habitat quality			
Temperature regime	None	Affects not known	Unknown
Winter-spring environmental conditions	None	Probably a number of factors	Unknown
Production	Fairly stable nutrient flow from upwelled BS Basin	Inter-annual variability low	No concern

4.0 ENVIRONMENTAL IMPACTS

4.1 Action 1 GOA FMP

4.1.1 Alternative 1: Status quo

4.1.2 Impacts on Pelagic Shelf Rockfish Stocks

Under alternative 1, Status Quo, there would be no change to the management of the pelagic shelf rockfish assemblage. Complex-level ABCs, OFLs and TACs would continue to be specified. As the TAC for the complex as a whole is largely based upon the biomass of dusky rockfish, the dark rockfish stock would continue to be at risk for potential overfishing under this relatively high complex-level TAC. One change that is anticipated under the status quo alternative is that catch accounting would begin to identify dark rockfish in the catch records due to the segregation of dark and light dusky by species. Catch information for dark rockfish will improve. However no management measures to restrict the harvest of dark rockfish will be taken.

4.1.3 Impacts on Other Groundfish Stocks

Under alternative 1, Status Quo, there would be no change to management of the pelagic shelf rockfish assemblage, thus there is no anticipated change in the impact of this fishery on other groundfish stocks. Bycatch in the PSR fishery includes northern rockfish and species in the "other slope" rockfish complex (see Section 3.2 for more information). The pelagic shelf rockfish fishery will continue to concentrate on dusky rockfish and relative bycatch of species is unlikely to change.

The impact on the State-managed black rockfish fishery is unlikely to change under current management of the pelagic shelf rockfish complex. Dark rockfish will likely continue to be caught in conjunction with the black rockfish fishery. Under the current management system there is limited incentive to report dark rockfish landings as separate from black rockfish landings. With the separation of dark and dusky rockfish by species, State reporting codes will change (as with Federal) and improved information on dark rockfish information is likely.

4.1.4 Impacts on Threatened or Endangered Species

This alternative is not expected to have negative impacts on endangered or threatened species beyond those identified in previous consultations under section 7 of the Endangered Species Act. No spatial or temporal dispersion of pelagic shelf rockfish catch is anticipated.

4.1.5 Impacts on Marine Mammals

Direct and indirect interactions between marine mammals and harvests from the pelagic shelf rockfish fisheries are not expected to differ under this alternative. Total catch is expected to be the same and the distribution of catch is not expected to differ in a way that will affect interactions.

4.1.6 Impacts on Seabirds

Direct and indirect interactions between seabirds and harvests from the pelagic shelf rockfish fisheries are not expected to differ under this alternative. Total catch is expected to be the same and the distribution of catch is not expected to differ in a way that will affect interactions.

4.1.7 Impacts on Habitat and EFH

The Status Quo alternative is not expected to have any additional impacts on habitat or EFH. Effort levels for rockfish fisheries in general (of which pelagic shelf rockfish fishery is a small portion) are considered low and occur in areas of less sensitive habitat (rock, gravel, mud, and sand). The current fishing has minimal effects on benthic habitat and essential fish habitat (EFH EIS). These effects are likely to continue, if current management is maintained.

4.1.8 Impacts on the Ecosystem

Effects of fishing on the Gulf of Alaska marine ecosystem are analyzed in detail in the Alaska Groundfish Fisheries Programmatic SEIS. Additional impacts on the ecosystem from the pelagic shelf rockfish fishery are summarized annually in the SAFE report. The status quo alternative is not anticipated to have any negative impact on the Gulf of Alaska ecosystem.

4.1.9 Socioeconomic Impacts

Socioeconomic impacts of maintaining the current pelagic shelf rockfish assemblage are anticipated to be minimal. Dark rockfish make up a small percentage of overall catch in the complex. Retaining them in the pelagic shelf rockfish complex has limited economic impact. Additional information on participation in the PSR fishery, ex-vessel values in the PSR fishery and economic impacts can be found in the Regulatory Impact Review in Chapter 5 of this document.

4.2 Alternative 2

4.2.1 Impacts on Pelagic Shelf Rockfish Stocks

Alternative 2, transferring dark rockfish to State management by removing it from the Federal FMP, is anticipated to result in better management of the dark rockfish stock. Currently dark rockfish are managed under a relatively high complex-level TAC which is set primarily for dusky rockfish. If dark rockfish are removed from the pelagic shelf rockfish assemblage, the State will manage them as a single stock in State and Federal waters. The majority of the dark rockfish stock are presumed to be located in near-shore, shallow waters. The biennial trawl survey conducted by NMFS does not adequately assess this habitat and thus does not adequately assess the biomass of dark rockfish stocks.

Dark rockfish are caught infrequently in the Federal PSR fishery but more frequently in the State jig fishery. Under State management, dark rockfish would be assessed and managed as a single stock and the potential would exist to manage on smaller regions than the Federal management of the complex. There would be a decrease in the overall annual ABCs (and TACs) for the pelagic shelf rockfish complex as a result of no longer including the fractional amount of biomass contributed by the dark rockfish stock.

In recent years (with the exception of 2005) this decrease in the overall ABC (and TAC) has been less than 2% (Table 30). As discussed in Sections 3.1 and 3.2, the ABC and TAC for the complex is primarily based on the much larger biomass of dusky rockfish thus the contribution from dark rockfish is very low in most years. Widow and yellowtail rockfish would continue to be managed within the pelagic shelf rockfish complex and the relative contribution to the ABC from these stocks will continue to be incorporated into the PSR ABC.

Table 30 ABC for the pelagic shelf rockfish complex 2002-2006 and the relative contribution from the dark rockfish stock to the overall complex ABC.

Year	PSR ABC	Dark rockfish ABC (mt)	% contribution to ABC
2002	5,490	90	1.64
2003	5,490	90	1.64
2004	4,470	88	1.99
2005	4,553	88	1.93
2006	5,436	436	8.02

As discussed in section 3.1, the trawl survey biomass estimate for dark rockfish in 2005 was much higher than previous years (12% of the 2005 biomass estimate was made up of dark rockfish). Again, this was due to one abnormally large tow in the survey. The ABC is based upon a three survey average due to fluctuations in biomass from one survey to the next (Lunsford et al. 2005). Thus, even with the three survey average taken into consideration, the percent contribution to the ABC in 2006 from dark rockfish is 8%.

In all fisheries (including Federal fisheries), State managers would set an MRA (or separate bycatch limit) to limit incidental catch. Although uncertain, these MRAs would likely allow minor amounts of dark rockfish to continue to be retained in the pelagic shelf rockfish fishery. Since historic catches are approximately 1 percent or less of pelagic shelf rockfish catch, it is unlikely that the MRA would compel substantial discarding or reduce catch. The MRA, however, would prevent targeting of dark rockfish, which could occur under current rules. In other directed fisheries, discards of dark rockfish required by the MRA are likely to be minor, as catch of the species is relatively small relative to target catch.

Under this alternative the State would assume all management responsibilities for dark rockfish. This would entail assessment of the stock, management and all recordkeeping and recording requirements. Both federal and State recordkeeping requirements would be adjusted to account for dark rockfish as a species separate from dusky rockfish. Catch information for dark rockfish will be improved by these changes in catch accounting. New reporting requirements will be necessary whether or not the Council chooses to move dark rockfish for State management. The State of Alaska reporting requirements and catch processing coding changes will also be necessary. Creation of a State Fishery Management Plan for dark rockfish will also presumably be necessary as well as the reporting requirements (logbook requirements and other dockside sampling as per black rockfish) that are necessary for directed State fisheries.

A potential exists for exploiting the State management of this stock in Federal waters under this alternative. Hypothetically, a vessel could refuse to comply with State regulations for the State dark rockfish fishery (e.g., a permit and compliance with directed fishing according to State law) and then proceed to fish the species in Federal waters. A similar situation occurred in the scallop fishery in 1995, when a Federal Scallop FMP did not exist (for more information see the 2006 Scallop SAFE report, NPFMC 2006). The fishery was eventually closed in State and Federal waters by emergency order and re-opened when a Federal FMP officially delegating authority to the State was approved. However, given the limited interest in the dark rockfish fishery, coupled with the predominance of the biomass of the nearshore species in State waters, it appears highly unlikely that such a situation would develop. Nevertheless, if a situation as described were to develop, emergency State and Federal measures would be immediately taken to protect the dark rockfish stock and ameliorate the situation.

4.2.2 Impacts on other groundfish stocks

Transferal to State management under alternative 2 is expected to have no impact on other Federally managed groundfish stocks. As discussed in Chapter 3 dark rockfish make up a very small percentage of the overall biomass and catch in the pelagic shelf rockfish complex. Dusky rockfish make up the majority of all catch (and the biomass of the complex). Impacts to the bycatch of species such as northern rockfish are expected to be the same under alternative 2 as under the current status quo alternative.

State management of dark rockfish under this alternative would enhance reporting of dark rockfish in both the directed dark rockfish fishery as well as the black rockfish fishery. This would enhance data collection on dark rockfish and black rockfish stocks and improve catch accounting for both species.

4.2.3 Impacts on threatened or endangered species

This alternative is not expected to have negative impacts on endangered or threatened species beyond those identified in previous consultations under section 7 of the Endangered Species Act. No spatial or temporal dispersion of pelagic shelf rockfish catch is anticipated.

4.2.4 Impacts marine mammals

Direct and indirect interactions between marine mammals and harvests from the pelagic shelf rockfish fisheries are not expected to differ under this alternative. Total catch is expected to be the same or slightly decreased and the distribution of catch is not expected to differ in a way that will affect interactions.

4.2.5 Impacts on seabirds

Direct and indirect interactions between seabirds and harvests from the pelagic shelf rockfish fisheries are not expected to differ under this alternative. Total catch is expected to be the same or slightly decreased and the distribution of catch is not expected to differ in a way that will affect interactions.

4.2.6 Impacts on habitat and EFH

This alternative is not expected to have any additional impacts on habitat or EFH. Effort levels for rockfish fisheries in general (of which pelagic shelf rockfish fishery is a small portion) are considered low and occur in areas of less sensitive habitat (rock, gravel, mud, and sand). The current fishing has minimal effects on benthic habitat and essential fish habitat (EFH EIS). These effects are likely to continue, if current management is maintained.

4.2.7 Impacts on the ecosystem

Effects of fishing on the Gulf of Alaska marine ecosystem are analyzed in detail in the Alaska Groundfish Fisheries Programmatic SEIS. Additional impacts on the ecosystem from the pelagic shelf rockfish fishery are summarized annually in the SAFE report. This alternative is not anticipated to have any negative impact on the Gulf of Alaska ecosystem.

4.2.8 Socio-economic impacts

Removing dark rockfish from the Federal FMP and developing State management would convey additional protection for the species from overfishing and would allow for more conservative and potentially area (and species) specific management. Removal of dark rockfish from the pelagic shelf rockfish complex could result in decreases in the pelagic shelf rockfish TAC. As discussed in section 4.2.1, the contribution to the TAC from the dark rockfish portion of the PSR assemblage is variable from one survey year to the next. It has ranged from 2-8% of the total complex ABC from 2000-2006.

Additional information on participation in the PSR fishery, ex-vessel values in the PSR fishery and economic impacts can be found in the Regulatory Impact Review in Chapter 5 of this document.

4.3 Action 2 BSAI FMP

4.3.1 Alternative 1: Status quo

4.3.2 Impacts on Other Rockfish Stocks

Under alternative 1, Status Quo, there would be no change to the management of the other rockfish assemblage. Complex-level ABCs, OFLs and TACs would continue to be specified. The TAC for the complex as a whole is largely based upon the biomass of shortspine thornyhead and dusky rockfish, with limited contribution from the dark rockfish stock. One change that is anticipated under the status quo alternative is that catch accounting would begin to identify dark rockfish in the catch records due to the segregation of dark and light dusky by species. Catch information for dark rockfish will improve. However no management measures to restrict the harvest of dark rockfish will be taken.

4.3.3 Impacts on Other Groundfish Stocks

Under alternative 1, Status Quo, there would be no change to management of the other rockfish assemblage, thus there is no anticipated change in the impact of this fishery on other groundfish stocks.

The impact on the State-managed black rockfish fishery is unlikely to change under current management of the other rockfish complex. Dark rockfish will likely continue to be caught in conjunction with the black rockfish fishery. With the separation of dark and dusky rockfish by species, State reporting codes will change (as with Federal) and improved information on dark rockfish information is likely.

4.3.4 Impacts on Threatened or Endangered Species

This alternative is not expected to have negative impacts on endangered or threatened species beyond those identified in previous consultations under section 7 of the Endangered Species Act. No spatial or temporal dispersion of pelagic shelf rockfish catch is anticipated.

4.3.5 Impacts on Marine Mammals

Direct and indirect interactions between marine mammals and harvests from the incidental catch of other rockfish in directed fisheries are not expected to differ under this alternative. Total catch is expected to be the same and the distribution of catch is not expected to differ in a way that will affect interactions.

4.3.6 Impacts on Seabirds

Direct and indirect interactions between seabirds and harvests from the incidental catch of other rockfish in directed fisheries are not expected to differ under this alternative. Total catch is expected to be the same and the distribution of catch is not expected to differ in a way that will affect interactions.

4.3.7 Impacts on Habitat and EFH

The Status Quo alternative is not expected to have any additional impacts on habitat or EFH. The current fishing has minimal effects on benthic habitat and essential fish habitat (EFH EIS). These effects are likely to continue, if current management is maintained.

4.3.8 Impacts on the Ecosystem

Effects of fishing on the Bering Sea Aleutian Islands marine ecosystem are analyzed in detail in the Alaska Groundfish Fisheries Programmatic SEIS. The status quo alternative is not anticipated to have any negative impact on the Bering Sea and Aleutian Islands ecosystem.

4.3.9 Socioeconomic Impacts

Socioeconomic impacts of maintaining the current other rockfish assemblage are anticipated to be minimal. Dark rockfish make up a small percentage of overall catch in the complex and are only incidentally caught in other directed fisheries. Retaining them in the other rockfish complex has limited economic impact. Additional information on participation in the rockfish fisheries, ex-vessel values in the rockfish fisheries in the BSAI and economic impacts can be found in the Regulatory Impact Review in Chapter 5 of this document.

4.4 Alternative 2

4.4.1 Impacts on Other Rockfish Stocks

Alternative 2, transferring dark rockfish to State management by removing it from the Federal FMP, is anticipated to result in better management of the dark rockfish stock by managing it in conjunction with black rockfish. Black rockfish are a target fishery in the State in the Aleutian Islands region. If dark rockfish are removed from the other rockfish assemblage, the State will manage them as a single stock in State and Federal waters. The majority of the dark rockfish stock are presumed to be located in near-shore, shallow waters. The trawl surveys conducted by NMFS does not adequately assess this habitat and thus does not adequately assess the biomass of dark rockfish stocks.

Dark rockfish are caught infrequently as incidental catch in other target fisheries in the BSAI. Under State management, dark rockfish would be assessed and managed as a single stock and the potential would exist to manage on smaller regions than the Federal management of the complex. There would be a minimal decrease in the overall annual ABCs (and TACs) for the other rockfish complex as a result of no longer including the fractional amount of biomass contributed by the dark rockfish stock.

In all fisheries (including Federal fisheries), State managers would set an MRA (or separate bycatch limit) to limit incidental catch. Although uncertain, these MRAs would likely allow minor amounts of dark rockfish to continue to be retained BSAI fisheries. Since historic catches are approximately 1 percent or less of other rockfish catch in the EBS and 3% or less in the AI, it is unlikely that the MRA would compel substantial discarding or reduce catch. The MRA, however, would prevent targeting of dark rockfish, which could occur under current rules. In other directed fisheries, discards of dark rockfish required by the MRA are likely to be minor, as catch of the species is relatively small relative to target catch.

Under this alternative the State would assume all management responsibilities for dark rockfish. This would entail assessment of the stock, management and all recordkeeping and recording requirements. Both federal and State recordkeeping requirements would be adjusted to account for dark rockfish as a species separate from dusky rockfish. Catch information for dark rockfish will be improved by these changes in catch accounting. New reporting requirements will be necessary whether or not the Council chooses to move dark rockfish for State management. The State of Alaska reporting requirements and catch processing coding changes will also be necessary. Creation of a State Fishery Management Plan for dark rockfish will also presumably be necessary as well as the reporting requirements (logbook requirements and other dockside sampling as per black rockfish) that are necessary for directed State fisheries.

A potential exists for exploiting the State management of this stock in Federal waters under this alternative. Hypothetically, a vessel could refuse to comply with State regulations for the State dark rockfish fishery (e.g., a permit and compliance with directed fishing according to State law) and then proceed to fish the species in Federal waters. A similar situation occurred in the scallop fishery in 1995, when a Federal Scallop FMP did not exist (for more information see the 2006 Scallop SAFE report, NPFMC 2006). The fishery was eventually closed in State and Federal waters by emergency order and re-opened when a Federal FMP officially delegating authority to the State was approved. However, given the limited interest in the dark rockfish fishery, coupled with the predominance of the biomass of the nearshore species in State waters, it appears highly unlikely that such a situation would develop. Nevertheless, if a situation as described were to develop, emergency State and Federal measures would be immediately taken to protect the dark rockfish stock and ameliorate the situation.

4.4.2 Impacts on other groundfish stocks

Transferal to State management under alternative 2 is expected to have no impact on other Federally managed groundfish stocks. As discussed in Chapter 3 dark rockfish make up a very small percentage of the overall biomass and catch in the other rockfish complex. Shortspine thornyhead and dusky rockfish make up the majority of all catch (and the biomass of the complex).

State management of dark rockfish under this alternative would enhance reporting of dark rockfish in both the directed dark rockfish fishery as well as the black rockfish fishery. This would enhance data collection on dark rockfish and black rockfish stocks and improve catch accounting for both species.

4.4.3 Impacts on threatened or endangered species

This alternative is not expected to have negative impacts on endangered or threatened species beyond those identified in previous consultations under section 7 of the Endangered Species Act. No spatial or temporal dispersion of catch is anticipated.

4.4.4 Impacts marine mammals

Direct and indirect interactions between marine mammals and harvests from fisheries are not expected to differ under this alternative. Total catch is expected to be the same or slightly decreased and the distribution of catch is not expected to differ in a way that will affect interactions.

4.4.5 Impacts on seabirds

Direct and indirect interactions between seabirds and harvests from fisheries are not expected to differ under this alternative. Total catch is expected to be the same or slightly decreased and the distribution of catch is not expected to differ in a way that will affect interactions.

4.4.6 Impacts on habitat and EFH

This alternative is not expected to have any additional impacts on habitat or EFH. Effort levels for rockfish fisheries in general are considered low and occur in areas of less sensitive habitat (rock, gravel, mud, and sand). The current fishing has minimal effects on benthic habitat and essential fish habitat (EFH EIS). These effects are likely to continue, if current management is maintained.

4.4.7 Impacts on the ecosystem

Effects of fishing on the Bering Sea Aleutian Islands marine ecosystem are analyzed in detail in the Alaska Groundfish Fisheries Programmatic SEIS. Additional impacts on the ecosystem from the pelagic shelf rockfish fishery are summarized annually in the SAFE report. This alternative is not anticipated to have any negative impact on the Bering Sea Aleutian Islands ecosystem.

4.4.8 Socio-economic impacts

Removing dark rockfish from the Federal FMP and developing State management would convey additional protection for the species from overfishing and would allow for more conservative and potentially area (and species) specific management. Removal of dark rockfish from the other rockfish complex could result in minimal decreases in the other rockfish ABC and TAC.

Additional information on participation in the rockfish fisheries, ex-vessel values in the rockfish fisheries and economic impacts can be found in the Regulatory Impact Review in Chapter 5 of this document.

4.4.9 Cumulative Impacts

This section describes the cumulative effects of the various alternatives. Cumulative effects of an alternative are the impacts on the environment resulting from the incremental effect of the alternative when added to other past, present or reasonably foreseeable future actions.

Direct and indirect effects of this action have been discussed in previous sections of this analysis. Additional actions considered here are ones which are reasonably foreseeable and may in conjunction with the proposed action have an additional impact.

One action of this nature is the Central GOA pilot rockfish program, a five-year management program approved by the Council under Amendment 68 to the GOA groundfish FMP. This program will allocate rockfish species in the Central GOA management area in order to convey short-term economic stability to the region while comprehensive GOA groundfish rationalization initiatives are undertaken by the Council and NMFS. The pelagic shelf rockfish assemblage is among the species to be allocated under this program. A direct allocation of PSR will be specified. If dark rockfish are removed from that assemblage, it will likely have either a separate MRA or be included under the aggregate rockfish MRA. In either case the incremental effect of implementing this program with dark rockfish excluded from the PSR allocation is expected to be minimal. The cumulative greatest effect will be realized by harvesters in the non-trawl sector who will benefit from a separate federal allocation of rockfish under the program (which will include primarily PSR and northern rockfish), while still having access to dark rockfish under State management. Since trawl vessels have little catch of dark rockfish, the cumulative effect of pilot program and the action to separate dark rockfish from the PSR assemblage will be minimal. The pilot program is anticipated to be implemented in 2008.

As with implementation of the pilot rockfish program, any incremental effect of implementing long-term comprehensive rationalization of the GOA groundfish fishery with dark rockfish removed from the PSR assemblage is likewise expected to be minimal. The specific effects of that possible action on any sector are not predictable, given the current hiatus in the development of that program.

5.0 REGULATORY IMPACT REVIEW

5.1 Introduction

This Regulatory Impact Review (RIR) examines the costs and benefits of a proposed amendment to remove dark rockfish from the Gulf of Alaska groundfish FMP.

5.2 What is a Regulatory Impact Review?

The preparation of an RIR is required under Presidential Executive Order (E.O.) 12866 (58 *FR* 51735: October 4, 1993). The requirements for all regulatory actions specified in E.O. 12866 are summarized in the following Statement from the E.O.:

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

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

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

5.3 Statutory Authority

Under the Magnuson-Stevens Act, the United States has exclusive fishery management authority over all marine fishery resources found within the exclusive economic zone (EEZ). The management of these marine resources is vested in the Secretary of Commerce (Secretary) and in the Regional Fishery Management Councils. The groundfish fisheries in the EEZ off Alaska are managed under the Fishery Management Plan (FMP) for Groundfish of the GOA.

5.4 Purpose and Need for Action

Dark rockfish are part of the pelagic shelf rockfish (PSR) assemblage in the Gulf of Alaska Groundfish Fishery Management Plan (FMP). Members of this assemblage include the following four species: dusky rockfish (*Sebastes variabilis*), dark rockfish (*S. ciliatus*), yellowtail rockfish (*S. flavidus*), and widow rockfish (*S. entomelas*). In the Bering Sea Aleutian Islands FMP dark rockfish are contained within the "other rockfish" complex which contains the following eight species: red banded rockfish (*Sebastes babcocki*), dark rockfish, dusky rockfish, redstripe rockfish (*S. proriger*), yelloweye rockfish (*S.*

ruberrimus), harlequin rockfish (*S. variegates*), sharpchin rockfish (*S. zacentrus*), shortspine thornyhead (*Sebatolobus alascanus*).

The forms of dusky rockfish commonly recognized as "light dusky rockfish" and "dark dusky rockfish" are now officially recognized as two species (Orr and Blackburn 2004). *S. ciliatus* applies to the dark shallow-water species with a common name dark rockfish, and *S. variabilis* applies to variably colored deeper-water species with a common name dusky rockfish.

Dark rockfish are found predominantly in nearshore, shallow waters. Assessment authors have suggested for years that dark rockfish be turned over the State of Alaska for management in the GOA as data in the stock assessment for PSR are predominantly from dusky rockfish (the offshore variety) not dark rockfish (the nearshore, shallow water variety). Most of the available information is from the offshore trawl surveys and offshore commercial fishery and dusky rockfish makes up the majority of the exploitable biomass and catch from the assemblage. A similar concern has been raised by the BSAI plan team for dark rockfish in the overall other rockfish assemblage.

5.5 Alternatives Considered

Two actions are analyzed in this document with two alternatives for each action: Action 1 refers to the GOA groundfish FMP. Under this action there are two alternatives: alternative 1, to continue managing dark rockfish within the larger pelagic shelf rockfish complex; and alternative 2, to remove dark rockfish from the GOA FMP and turn over to the State of Alaska for management. Action 2 refers to the BSAI groundfish FMP. Under this action there are two alternatives: alternative 1, to continue managing dark rockfish within the other rockfish complex; and alternative 2, to remove dark rockfish from the BSAI FMP and turn over to the State of Alaska for management.

5.6 Action 1: GOA groundfish FMP

5.6.1 Alternative 1: Status quo

Under this alternative, dark rockfish would continue to be managed within the pelagic shelf rockfish assemblage. The Council and the National Marine Fisheries Service would retain management authority for dark rockfish within the PSR complex in the EEZ. Overfishing limits (OFLs), acceptable biological catch (ABC) limits and total allowable catch (TAC) limits are established for the complex as a whole and managed accordingly. In season, catch is managed through monitoring directed fishing, with the fishery closed when directed fishing is estimated to leave only the portion of the TAC necessary to support incidental catch in other directed fisheries. Once the directed fishery is closed, incidental catch is managed under the aggregate rockfish MRA, which limits catch of all rockfish of the genera *Sebastes* and *Sebastolobus* (which includes Pacific ocean perch, northern rockfish, pelagic shelf rockfish, demersal shelf rockfish, and "other rockfish") to 15 percent of directed fishing harvests.

5.6.2 Alternative 2: Remove dark rockfish from the Gulf of Alaska FMP

Under this alternative, management authority for dark rockfish is redefined by withdrawing dark rockfish from the Federal GOA groundfish FMP. Under the Magnuson-Stevens Act, State management authority may be extended into Federal waters off Alaska in the absence of Federal management of the species in question. Under this alternative, the State of Alaska could assume management authority for dark rockfish. Management plans for this species would be prepared by ADF&G staff for the Gulf of Alaska state management regions and reviewed by the Board of Fisheries.

OFLs, ABCs and TACs would continue to be specified for the PSR complex, but this complex would no longer include dark rockfish. The State would take on the responsibility for assessment and management of the dark rockfish stock.

In managing dark rockfish, the State of Alaska would develop a fishery management plan for the species under which gear type, season and guideline harvest level (GHL) for the species would be specified. The State may impose on State-registered vessels fishing in Federal fisheries only such additional State measures such as bycatch retention limits for dark rockfish, as are consistent with the applicable Federal fishing regulations for the fishery in which the vessel is operating. It is not the intention of the Council or NMFS to give the State authority to indirectly regulate other Federal fisheries through State implementation of gear restrictions, area closures or other bycatch control measures. Most likely, State management of dark rockfish would include regulation of any directed fishing for dark rockfish. Dark rockfish catch in Federal fisheries would be limited by the current MRA for aggregate rockfish or a separate bycatch limit as established by the State.

While specific management plans have not yet been formulated by the State, it is likely that measures used currently (e.g., in management of black rockfish) would be among those considered for dark rockfish management by the State (D. Carlile, pers. comm.).

These candidate measures would include, but not necessarily be limited to the following:

- Guideline harvest limits (GHLs, or quotas)
- Gear-, area- and directed-fishery-specific bycatch limits, wherein catch in excess of bycatch limits would be reported as bycatch overage on an ADF&G fish ticket, the excess bycatch would be required to be landed, with all proceeds from the sale of excess dark rockfish bycatch surrendered to the State.
- Full retention of all rockfish caught, with proceeds of the sale of any bycatch overage paid to the State of Alaska.
- Directed fisheries for dark rockfish in some areas of the State; in others perhaps bycatch only.
- No-take zones, wherein dark rockfish might not be allowed to be taken in a directed fishery and proceeds from any bycatch would be surrendered to the State.
- Gear restrictions (e.g. jig only) for directed fisheries.
- Trip limits.
- Reporting requirements such as submission of ADF&G fish tickets and/or logbooks.
- Vessel registrations for specific directed dark rockfish fishery areas.

5.7 Action 2: BSAI groundfish FMP

5.7.1 Alternative 1: Status Quo

Under this alternative, dark rockfish would continue to be managed within the other rockfish assemblage in the BSAI. The Council and the National Marine Fisheries Service would retain management authority for dark rockfish within the other rockfish complex in the EEZ. Overfishing limits (OFLs), acceptable biological catch (ABC) limits and total allowable catch (TAC) limits are established for the complex as a whole and managed accordingly. In season, catch is managed through monitoring directed fishing, with the fishery closed when directed fishing is estimated to leave only the portion of the TAC necessary to support incidental catch in other directed fisheries. Once the directed fishery is closed, incidental catch is managed under the aggregate rockfish MRA, which limits catch of all rockfish of the genera *Sebastes* and *Sebastolobus* (which includes Pacific ocean perch, northern rockfish, pelagic shelf rockfish, demersal shelf rockfish, and "other rockfish") to 15 percent of directed fishing harvests.

5.7.2 Alternative 2: Remove dark rockfish from the BSAI FMP

Under this alternative, management authority for dark rockfish is redefined by withdrawing dark rockfish from the Federal GOA groundfish FMP. Under the Magnuson-Stevens Act, State management authority may be extended into Federal waters off Alaska in the absence of Federal management of the species in question. Under this alternative, the State of Alaska could assume management authority for dark rockfish. Management plans for this species would be prepared by ADF&G staff for the Gulf of Alaska state management regions and reviewed by the Board of Fisheries.

OFLs, ABCs and TACs would continue to be specified for the other rockfish complex, but this complex would no longer include dark rockfish. The State would take on the responsibility for assessment and management of the dark rockfish stock.

In managing dark rockfish, the State of Alaska would develop a fishery management plan for the species under which gear type, season and guideline harvest level (GHL) for the species would be specified. Candidate measures to be included in any State management plan would be similar to those listed for the GOA FMP (see section 2.1.2).

5.8 Background

The 2005 Economic SAFE report gives summary information on the ex-vessel value of the rockfish fishery as a whole (Hiatt et al. 2005). Information from this document for the GOA aggregate rockfish fishery is summarized below in Table 31 and Table 32. Note this includes all rockfish catches, of which pelagic shelf rockfish is only a small fraction. Dark rockfish, in turn, are a small portion of the pelagic shelf rockfish catch indicates that catcher vessels catch a significantly higher proportion of the catch in this fishery than catcher processors.

Table 31 Ex-vessel value of rockfish catch in the GOA by vessel category and year ($ millions) from Hiatt et al. 2006

Gear	Year	Catcher vessel	Catcher processor	Total
Trawl	2000	2.7	2.7	5.4
	2001	1.4	2.0	3.5
	2002	2.4	3.0	5.4
	2003	3.2	2.8	6.0
	2004	3.0	3.5	6.5
	2005	3.8	5.3	9.2
Hook and Line	2000	2.2	.2	2.4
	2001	1.9	.2	2.1
	2002	2.0	.2	2.1
	2003	1.6	.2	1.8
	2004	1.7	.2	2.0
	2005	1.5	.2	1.7

Table 32 Ex-vessel value of rockfish catch in the BSAI by vessel category and year ($ millions)

Gear	Year	Catcher vessel	Catcher processor	Total
Trawl	2000	.0	2.7	2.7
	2001	.0	2.4	2.4
	2002	.1	2.9	2.9
	2003	.0	3.6	3.6
	2004	.1	3.6	3.7
	2005	.2	4.9	5.1
Hook and Line	2000	.1	.3	.4
	2001	.2	.2	.4

	2002	.2	.2	.3
	2003	.1	.2	.3
	2004	.1	.2	.3
	2005	.1	.2	.3

Source: Hiatt et al. 2006

Data for the dusky rockfish landings by all gear types from 2003-2005 (includes both dusky rockfish and dark rockfish) indicates that catcher vessels catch a significant higher proportion of the catch in this fishery than catcher processors (Table 33). Unfortunately, the same level of data for the BSAI is not available at this time. In order to provide some indication of the fishery, aggregated rockfish data was included (Table 33 and Table 34). The data indicates that trawl gear and catcher processors are the primary participants in the BSAI rockfish fishery. Other rockfish are not a target fishery and are instead caught incidentally in other directed fisheries, notable in the longline fisheries for Pacific cod(where dusky rockfish is retained), Atka mackerel trawl fishery (retaining dusky rockfish), longline fisheries for sablefish, turbot and halibut (retaining thornyheads) and the rockfish trawl fishery (retaining thornyhead rockfish).

Table 33 Number of vessels and retained catch of pelagic shelf rockfish by vessel category in the GOA

Year	Vessel category	Number of Vessels	Retain Catch (mt)
2003	Catcher processor	17	926
	Catcher Vessel	148	1,466
2004	Catcher processor	19	985
	Catcher Vessel	134	1,381
2005	Catcher processor	18	777
	Catcher Vessel	89	1,104

Source: NPFMC, 2005

Table 34 Number of vessels by gear that caught rock fish by vessel category in the BSAI

Year	Vessel category	Trawl	Hook and Line
2003	Catcher processor	11	2
	Catcher Vessel	1	4
2004	Catcher processor	10	2
	Catcher Vessel	1	1
2005	Catcher processor	6	3
	Catcher Vessel	0	1

Source: Hiatt et al. 2006

Table 35 Total catch of rockfish by gear by vessel category in the BSAI (1,000 metric tons, round weight)

Year	Vessel category	Trawl	Hook and Line
2003	Catcher processor	20	0
	Catcher Vessel	0	0
2004	Catcher processor	17	0
	Catcher Vessel	0	0
2005	Catcher processor	14	0
	Catcher Vessel	1	0

Source: Hiatt et al. 2006

Data are not available at this time for ex-vessel value in price per pound specifically for the dusky rockfish fishery. However, data analyzed for the Central GOA pilot rockfish project (Amendment 68 to the GOA groundfish FMP) show ex-vessel price per pound for catcher vessels in the Central GOA pelagic shelf rockfish fishery (Table 36). The table shows that trawl ex-vessel prices ranged from 5 cents per pound to 7 cents per pound, while non-trawl ex-vessel prices ranged from 17 cents per pound to 26 cents per pound.

Table 36 Number of catcher vessels, landings, ex-vessel revenues and average ex vessel prices in the Central GOA pelagic shelf rockfish fishery (1998-2002)

Year	Gear	Number of vessels	Landings (mt)	Ex-vessel gross revenues ($)	Average ex-vessel price ($/lb)
1998	Non-Trawl	2	*	*	*
	Trawl	29	615.8	81,450	0.60
1999	Non-Trawl	2	*	*	*
	Trawl	32	1,293.2	199,577	0.070
2000	Non-Trawl	2	*	*	*
	Trawl	31	2,240.9	301,359	0.061
2001	Non-Trawl	6	4.0	2,374	0.272
	Trawl	33	1,232.6	138,534	0.051
2002	Non-Trawl	8	2.1	1,224	0.261
	Trawl	33	1,265.6	147,873	0.053

Source: NPFMC, 2005

A further look at participation by year, gear and management area gives some indication of the relative participation for each gear type in the overall pelagic shelf rockfish fishery (Table 37).

Table 37 Number of vessels operating by NMFS management area and gear types for pelagic rockfish (primarily dusky, dark, yellowtail, and widow rockfish)

		Area							
Year/Sum of # of vessels	**Gear**	**610**	**620**	**630**	**640**	**649**	**650**	**659**	**GOA Total**
1998	Jig		2	11	2	1	11	1	28
	Fixed	15	18	70	20	12	33	30	198
	Trawl	26	37	53	16				132
1998 Total		*41*	*57*	*134*	*38*	*13*	*44*	*31*	*358*
1999	Jig			10		2	13	1	26
	Fixed	27	27	60	19	16	33	38	220
	Trawl	22	39	52	20				133
1999 Total		*49*	*66*	*122*	*39*	*18*	*46*	*39*	*379*
2000	Jig		6	12		2	13	5	38
	Fixed	25	30	79	24	13	39	39	249
	Trawl	27	26	39	9	2			103
2000 Total		*52*	*62*	*130*	*33*	*17*	*52*	*44*	*390*
2001	Jig		4	13			12	5	34
	Fixed	29	21	55	11	6	36	26	184
	Trawl	27	27	38	11				103
2001 Total		*56*	*52*	*106*	*22*	*6*	*48*	*31*	*321*
2002	Jig	2	6	18	3		11	9	49
	Fixed	22	14	37	7		28	21	129
	Trawl	20	19	33	4				76
2002 Total		*44*	*39*	*88*	*14*		*39*	*30*	*254*
2003	Jig			10	0		57	3	70
	Fixed	0	0	3			35	8	46
	Trawl	9	3	37	0				49
2003 Total		*9*	*3*	*50*	*0*		*92*	*11*	*165*
2004	Jig		0	22			43	4	69
	Fixed			3	0		25	5	33
	Trawl	10	5	36	0				51
2004 Total		*10*	*5*	*61*	*0*		*68*	*9*	*153*
2005	Jig	0	0	16			27	0	43
	Fixed			0			10	7	17
	Trawl	8	6	33	0				47
2005 Total		*8*	*6*	*49*	*0*		*37*	*7*	*107*

Source: NMFS Catch Accounting (preliminary data)

The State fishery for black rockfish catches a higher proportion of dark rockfish than the Federal fishery for pelagic shelf rockfish (see section 3.4 for additional information on the black rockfish fishery and relative species composition of dark rockfish). The majority of the black rockfish harvest occurs in the Kodiak District. Catch and effort data for this fishery indicate that price per pound for landed black rockfish has varied from 32 cents per pound to 40 cents per pound since 1998 (Table 38).

Table 38 Catch and effort, excluding discards, for the Kodiak Area black rockfish fishery 1998-2004

Year	Vessels	Number of Landings	Directed GHL	Total Harvest (lbs)	Price per pound
1998	76	355	190,000	195,623	0.32
1999	84	316	185,000	131,986	0.40
2000	92	282	185,000	255,044	0.41
2001	55	194	185,000	220,825	0.40
2002	41	143	185,000	204,547	0.43
2003	49	106	185,000	85,362	0.36
2004	52	140	185,000	123,231	0.36

Source: Sagalkin and Spalinger 2005

No price information is available for dark rockfish, but anecdotal reports indicate that price per pound is lower than for black rockfish. Currently, fishermen have limited incentive to report catches of dark rockfish separately from black rockfish, given the lower price potential for dark rockfish.

5.9 Analysis of the Alternatives

Under the current management, dark rockfish is managed by federal managers as a part of the pelagic shelf rockfish complex. Continued management as part of the complex is likely to maintain current impacts. As described in Section 3.3, the majority of the pelagic shelf rockfish catch is dusky rockfish. Percent contribution by dark rockfish to total catch ranges from 0.4 to 1.1 percent of the total catch between 2000 and 2005, inclusive (Table 4). Catch of dark rockfish is likely to remain a relatively small portion of the pelagic shelf rockfish catch, with little affect on fishermen.

Removing dark rockfish from the Federal FMP and developing State management would convey additional protection for the species from overfishing and would allow for more conservative and potentially area (and species) specific management. Removal of dark rockfish from the pelagic shelf rockfish complex in the GOA and the other rockfish complex in the BSAI will likely result in decreases in the associated TACs. As discussed in section 4.2.1, the contribution to the TAC from the dark rockfish portion of the PSR assemblage is variable from one survey year to the next. From 2000-2005, the dark rockfish stock contributed less than 2% of the total ABC (and TAC). However, due to a large survey biomass estimate in 2005, the resulting relative contribution of dark rockfish to the PSR ABC (and TAC) rose to 8% in 2006.

Landing trends indicate a decline in trawl catch over the period considered 1998-1005 (Table 18). Removal of dark rockfish from the PSR complex in the GOA is unlikely to result in catch exceeding the revised MRA. Removal of dark rockfish from the other rockfish complex in the BSAI is also unlikely to result in catch exceeding a revised MRA for this species.

In all fisheries (including Federal fisheries), State managers would likely set an MRA (or separate bycatch limit) to limit incidental catch. Although uncertain, these MRAs would likely allow minor amounts of dark rockfish to continue to be retained in the pelagic shelf rockfish fishery. Since historic catches are approximately 1 percent or less of pelagic shelf rockfish catch, it is unlikely that the MRA would compel substantial discarding or reduce catch. The MRA, however, would prevent targeting of dark rockfish, which could occur under current rules. In other directed fisheries, discards of dark rockfish required by the MRA are likely to be negligible, as catch of the species is relatively small relative to target catch.

Depending on management choices of the State, it is possible that a directed fishery for dark rockfish could develop in State waters. Most likely such a fishery would be prosecuted with fixed gear, which could increase the value of catch, as rockfish harvested with fixed gear have typically brought higher ex vessel prices than trawl caught rockfish. Whether such a fishery would grow to the current level of trawl catch is uncertain. Since the current directed fishery for pelagic shelf rockfish opens on January 1st and closes with the closing of the trawl fishery, which starts in the first week of July, opportunity exists for targeting dark rockfish with fixed gear under current management. In any case, due to the relatively low abundance of dark rockfish, such a fishery is likely to be relatively small. Anecdotal reports from fishermen indicate that dark rockfish can be targeted, either together with black rockfish or separately. In either case, the development of a directed fixed gear fishery for the dark rockfish could increase revenues generated from harvest of the species, but depends heavily on the growth of the fishery.

6.0 INITIAL REGULATORY FLEXIBILITY ANALYSIS

6.1 Introduction

This Initial Regulatory Flexibility Analysis (IRFA) evaluates the impacts, on small entities, of a proposed amendment to remove dark rockfish from the Gulf of Alaska groundfish FMP.

This IRFA addresses the statutory requirements of the Regulatory Flexibility Act (RFA) of 1980, as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA) of 1996 (5 U.S.C. 601-612).

6.2 The Purpose of an IRFA

The Regulatory Flexibility Act (RFA), first enacted in 1980, was designed to place the burden on the government to review all regulations to ensure that, while accomplishing their intended purposes, they do not unduly inhibit the ability of small entities to compete. The RFA recognizes that the size of a business, unit of government, or nonprofit organization frequently has a bearing on its ability to comply with a Federal regulation. Major goals of the RFA are: (1) to increase agency awareness and understanding of the impact of their regulations on small business, (2) to require that agencies communicate and explain their findings to the public, and (3) to encourage agencies to use flexibility and to provide regulatory relief to small entities. The RFA emphasizes predicting impacts on small entities as a group distinct from other entities and on the consideration of alternatives that may minimize the impacts while still achieving the stated objective of the action.

On March 29, 1996, President Clinton signed the Small Business Regulatory Enforcement Fairness Act. Among other things, the new law amended the RFA to allow judicial review of an agency's compliance with the RFA. The 1996 amendments also updated the requirements for a final regulatory flexibility analysis, including a description of the steps an agency must take to minimize the significant economic impact on small entities. Finally, the 1996 amendments expanded the authority of the Chief Counsel for Advocacy of the Small Business Administration (SBA) to file *amicus* briefs in court proceedings involving an agency's violation of the RFA.

In determining the scope, or 'universe', of the entities to be considered in an IRFA, NMFS generally includes only those entities that can reasonably be expected to be directly regulated by the proposed action. If the effects of the rule fall primarily on a distinct segment, or portion thereof, of the industry (e.g., user group, gear type, geographic area), that segment would be considered the universe for the purpose of this analysis. NMFS interprets the intent of the RFA to address negative economic impacts, not beneficial impacts, and thus such a focus exists in analyses that are designed to address RFA compliance.

Data on cost structure, affiliation, and operational procedures and strategies in the fishing sectors subject to the proposed regulatory action are insufficient, at present, to permit preparation of a "factual basis" upon which to certify that the preferred alternative does not have the potential to result in "significant adverse impacts on a substantial number of small entities" (as those terms are defined under RFA).

Because, based on all available information, it is not possible to 'certify' this outcome, should the proposed action be adopted, a formal IRFA has been prepared and is included in this package for initial review.

6.3 What is required in an IRFA?

Under 5 U.S.C., Section 603(b) of the RFA, each IRFA is required to contain:

- A description of the reasons why action by the agency is being considered;
- A succinct statement of the objectives of, and the legal basis for, the proposed rule;
- A description of and, where feasible, an estimate of the number of small entities to which the proposed rule will apply (including a profile of the industry divided into industry segments, if appropriate);
- A description of the projected reporting, record keeping and other compliance requirements of the proposed rule, including an estimate of the classes of small entities that will be subject to the requirement and the type of professional skills necessary for preparation of the report or record;
- An identification, to the extent practicable, of all relevant Federal rules that may duplicate, overlap or conflict with the proposed rule;
- A description of any significant alternatives to the proposed rule that accomplish the stated objectives of the proposed action, consistent with applicable statutes, and that would minimize any significant economic impact of the proposed rule on small entities. Consistent with the stated objectives of applicable statutes, the analysis shall discuss significant alternatives, such as:

    1. The establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities;
    2. The clarification, consolidation, or simplification of compliance and reporting requirements under the rule for such small entities;
    3. The use of performance rather than design standards;
    4. An exemption from coverage of the rule, or any part thereof, for such small entities.

6.4 What is a small entity?

The RFA recognizes and defines three kinds of small entities: (1) small businesses, (2) small non-profit organizations, and (3) small government jurisdictions.

Small business. Section 601(3) of the RFA defines a 'small business' as having the same meaning as 'small business concern', which is defined under Section 3 of the Small Business Act. 'Small business' or 'small business concern' includes any firm that is independently owned and operated and not dominant in its field of operation. The SBA has further defined a "small business concern" as one "organized for profit, with a place of business located in the United States, and which operates primarily within the United States or which makes a significant contribution to the U.S. economy through payment of taxes or use of American products, materials or labor... A small business concern may be in the legal form of an individual proprietorship, partnership, limited liability company, corporation, joint venture, association, trust or cooperative, except that where the firm is a joint venture there can be no more than 49 percent participation by foreign business entities in the joint venture."

The SBA has established size criteria for all major industry sectors in the United States, including fish harvesting and fish processing businesses. A business involved in fish harvesting is a small business if it is independently owned and operated and not dominant in its field of operation (including its affiliates) and if it has combined annual receipts not in excess of $3.5 million for all its affiliated operations worldwide. A seafood processor is a small business if it is independently owned and operated, not dominant in its field of operation, and employs 500 or fewer persons on a full-time, part-time, temporary, or other basis, at all its affiliated operations worldwide. A business involved in both the harvesting and processing of seafood products is a small business if it meets the $3.5 million criterion for fish harvesting operations. Finally, a wholesale business servicing the fishing industry is a small business if it employs 100 or fewer persons on a full-time, part-time, temporary, or other basis, at all its affiliated operations worldwide.

The SBA has established "principles of affiliation" to determine whether a business concern is "independently owned and operated." In general, business concerns are affiliates of each other when one concern controls or has the power to control the other, or a third party controls or has the power to control both. The SBA considers factors such as ownership, management, previous relationships with or ties to another concern, and contractual relationships, in determining whether affiliation exists. Individuals or firms that have identical or substantially identical business or economic interests, such as family members, persons with common investments, or firms that are economically dependent through contractual or other relationships, are treated as one party with such interests aggregated when measuring the size of the concern in question. The SBA counts the receipts or employees of the concern whose size is at issue and those of all its domestic and foreign affiliates, regardless of whether the affiliates are organized for profit, in determining the concern's size. However, business concerns owned and controlled by Indian Tribes, Alaska Regional or Village Corporations organized pursuant to the Alaska Native Claims Settlement Act (43 U.S.C. 1601), Native Hawaiian Organizations, or Community Development Corporations authorized by 42 U.S.C. 9805 are not considered affiliates of such entities, or with other concerns owned by these entities solely because of their common ownership.

Affiliation may be based on stock ownership when, (1) a person is an affiliate of a concern if the person owns or controls, or has the power to control 50 percent or more of its voting stock, or a block of stock which affords control because it is large compared to other outstanding blocks of stock, or (2) if two or more persons each owns, controls or has the power to control less than 50 percent of the voting stock of a concern, with minority holdings that are equal or approximately equal in size, but the aggregate of these minority holdings is large as compared with any other stock holding, each such person is presumed to be an affiliate of the concern.

Affiliation may be based on common management or joint venture arrangements. Affiliation arises where one or more officers. directors, or general partners, controls the board of directors and/or the management of another concern. Parties to a joint venture also may be affiliates. A contractor and subcontractor are treated as joint venturers if the ostensible subcontractor will perform primary and vital requirements of a contract or if the prime contractor is unusually reliant upon the ostensible subcontractor. All requirements of the contract are considered in reviewing such relationship, including contract management, technical responsibilities, and the percentage of subcontracted work.

Small organizations. The RFA defines "small organizations" as any not-for-profit enterprise that is independently owned and operated and is not dominant in its field.

Small governmental jurisdictions. The RFA defines small governmental jurisdictions as governments of cities, counties, towns, townships, villages, school districts, or special districts with populations of fewer than 50,000.

6.5 Reason for considering the action

As discussed in the EA and RIR sections of this analysis, the Council is considering this action in order to provide better protection for the small inshore stock of dark rockfish. This stock is currently contained in the pelagic shelf rockfish assemblage which is dominated by the biomass of the offshore dusky rockfish. Detailed descriptions of each alternative analyzed in this EA/RIR/IRFA can be found in Section 2.0.

6.6 Objectives of, and legal basis for, the proposed action

Under the Magnuson-Stevens Act, the United States has exclusive fishery management authority over all marine fishery resources found within the exclusive economic zone (EEZ). The management of these marine resources is vested in the Secretary of Commerce (Secretary) and in the Regional Fishery Management Councils. The groundfish fisheries in the EEZ off Alaska are managed under the Fishery Management Plan (FMP) for Groundfish of the GOA.

Statutory authority for measures designed to prevent overfishing is specifically addressed in Sec. 600.350 of the Magnuson-Stevens Act. That section establishes National Standard 1—Prevent Overfishing.

The objective of the proposed action is to prevent overfishing of the dark rockfish stock.

6.7 Number and description of small entities regulated by the proposed action

6.8 Impacts on Regulated Small Entities

Transfer of management of dark rockfish to the State is likely to result in some changes in regulation of catch. The State could develop a directed fishery for dark rockfish, most likely for fixed gear vessels. Since fixed gear vessels tend to be small, it is possible that the development of such a directed fishery would have a positive impact on small entities, by increasing fishing opportunities. The increase over current opportunities is likely to be relatively minor, as fixed gear vessels currently have little catch despite an extended season.[1]

Small entities that own trawl vessels are unlikely to realize any noticeable adverse effects from this action. Although trawl vessels would no longer be permitted to directed fish for dark rockfish (as a part of the pelagic shelf rockfish complex) in federal waters, since dark rockfish make up a very small part of the pelagic shelf rockfish catch, it is unlikely that any vessels would be required to discard dark rockfish catch in that fishery because of the MRA. A decline in the pelagic shelf rockfish TAC could occur, but that decline is likely to be small since the dark rockfish stock is a very small part of the combined stock of pelagic shelf rockfish. Since some of the decline in TAC is likely to be offset by incidental catch under the MRA, it is unlikely that catches will be noticeably affected.

6.9 Recordkeeping and Reporting Requirements

No additional recordkeeping will be required by the change in management proposed by this action.

6.10 Federal rules that may duplicate, overlap, or conflict with proposed action

This analysis did not reveal any federal rules that duplicate, overlap or conflict with the proposed action.

7.0 CONSISTENCY WITH APPLICABLE LAW AND POLICY

7.1 Magnuson-Stevens Act

7.1.1 National Standards

[1] Current regulations allow fixed gear vessels to begin fishing for pelagic shelf rockfish (including dark rockfish) in January, with the fixed gear fishery typically closing in mid-July with the harvest of the TAC by trawl vessels, which begin fishing in early July.

The Council's over-arching mandate to guide it in the prevention of overfishing is National Standard 1. This national standard states that:

Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery.

This action is specifically being considered in order to limit the current potential for overfishing of the dark rockfish stock. Under the current pelagic shelf rockfish assemblage, the dark rockfish stock is vulnerable to overfishing given the relatively high complex-level TAC that could be taken on any member of the assemblage. Dark rockfish as discussed in the analysis makes up a small fraction of the biomass in the assemblage and is generally found in shallow, in-shore waters. Transferal of management to the State of Alaska is anticipated to be better responsive to protection of this stock.

7.1.2 Section 303(a)(9) – Fisheries Impact Statement

Section 303(a)(9) of the Magnuson-Stevens Act requires that any plan or amendment include a fishery impact statement which shall assess and describe the likely effects, if any, of the conservation and management measures on a) participants in the fisheries and fishing communities affected by the plan or amendment; and b) participants in the fisheries conducted in adjacent areas under the authority of another Council, after consultation with such Council and representatives of those participants taking into account potential impacts on the participants in the fisheries, as well as participants in adjacent fisheries.

The alternative actions considered in this analysis are described in Chapter 2 of this document. The impacts of these actions on participants in the fisheries and fishing communities are evaluated in the Regulatory Impact Review, Chapter 5.

7.2 Marine Mammal Protection Act

The alternatives analyzed in this action are not likely to result in any significant impacts to marine mammals.

7.3 Coastal Zone Management Act

This action is consistent with the Coastal Zone Management Act.

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9.0 REFERENCES

Ackley, D. R., and J. Heifetz. 2001. Fishing practices under maximum retainable bycatch rates in Alaska=s groundfish fisheries. Alaska Fish. Res. Bull. 8(1): 22-44.

Chilton, L. *In Review.* Growth and natural mortality of dark rockfish (*Sebastes ciliatus*) in the western Gulf of Alaska. 23rd Lowell Wakefield Fisheries Symposium on Biology, Assessment and Management of North Pacific Rockfishes.

Clausen, D. M., and J. Heifetz. 1991. Pelagic shelf rockfish. In Stock assessment and fishery evaluation report for the 1992 Gulf of Alaska groundfish fishery, p. 7-1 - 7-12. North Pacific Fishery Management Council, 605 W. 4th. Avenue, Suite 306, Anchorage, AK 99501-2252.

Clausen, D. M., and J. Heifetz. 1996. Pelagic shelf rockfish. In Stock assessment and fishery evaluation report for the groundfish resources of the Gulf of Alaska, p. 271-288. North Pacific Fishery Management Council, 605 W. 4th. Avenue, Suite 306, Anchorage, AK 99501-2252.

Clausen, D. M., C. R. Lunsford, and J. T. Fujioka. 2002. Pelagic shelf rockfish. In Stock assessment and fishery evaluation report for the groundfish resources of the Gulf of Alaska, p. 383-418. North Pacific Fishery Management Council, 605 W. 4th. Avenue, Suite 306, Anchorage, AK 99501-2252.

Cortés, E. 1997. A critical review of methods of studying fish feeding based on analysis of stomach contents: application to elasmobranch fishes. Can. J. Fish. Aquat. Sci. 54:726-738.

Hoenig. J. 1983. Empirical use of longevity data to estimate mortality rates. Fish. Bull. 82:898-903.

Leaman, B.M. and D.A. Nagtegaal. 1987. Age validation and revised natural mortality rate for yellowtail rockfish. Trans. Am. Fish. Soc. 116:171-175.

Lunsford, C.R., S.K. Shotwell, D.H. Hanselman, D.M. Clausen, and D.L. Courtney. 2005. Gulf of Alaska Pelagic Shelf Rockfish. *In*, Stock Assessment and Fishery Evaluation Report for the groundfish fisheries of the Gulf of Alaska. P 727 – 780. Compiled by the GOA Groundfish Plan Team. North Pacific Fishery Management Council, 605 West 4th Ave., Anchorage, AK, 99501.

Malecha, P.W., and J. Heifetz. 2004. Growth and mortality of rockfish (Scorpaenidae) from Alaska waters. In Review, 39 p. Available from the Auke Bay Laboratory, NMFS, NOAA, 11305 Glacier Hwy, Juneau, AK 99801.

National Marine Fisheries Service. 2004. Alaska groundfish fisheries final programmatic supplemental environmental impact statement. Available from Alaska Region, National Marine Fisheries Service, Box 21668, Juneau, AK 99802.

National Marine Fisheries Service. 2005. Final Environmental Impact Statement for Essential Fish Habitat Identification and Conservation in Alaska. Available from Alaska Region, National Marine Fisheries Service, Box 21668, Juneau, AK 99802.

North Pacific Fishery Management Council. 1998. EA/RIR/IRFA for Amendment 46 to the Fishery Management Plan for the Groundfish Fishery of the Gulf of Alaska for Revise Management Authority of Pelagic Shelf Rockfish. North Pacific Fishery Management Council, 604 West 4th Ave., Anchorage, AK, 99501.

North Pacific Fishery Management Council. 2005. EA/RIR/IRFA for Amendment 68 to the Fishery Management Plan for the Groundfish Fishery of the Gulf of Alaska for Central Gulf of Alaska Rockfish Demonstration Program. North Pacific Fishery Management Council, 604 West 4th Ave., Anchorage, AK, 99501

Orr, J. W., and J. E. Blackburn. 2004. The dusky rockfishes (Teleostei: Scorpaeniformes) of the North Pacific Ocean: resurrection of *Sebastes variabilis* (Pallas, 1814) and a redescription of *Sebastes ciliatus* (Tilesius, 1813). Fish. Bull., U.S. 102:328-348. Online. (.pdf, 569KB).

Reuter, R. F. 1999. Describing dusky rockfish (*Sebastes ciliatus*) habitat in the Gulf of Alaska using historical data. M.S. Thesis, California State University, Hayward CA. 83 p.

Seeb, L. W. 1986. Biochemical systematics and evolution of the Scorpaenid genus *Sebastes*. Ph.D. Thesis, Univ. Washington, Seattle, WA. 177 p.

Yang, M-S. 1993. Food habits of the commercially important groundfishes in the Gulf of Alaska in 1990. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-22. 150 p.

APPENDIX 1. MRA TABLES

Table 10 to Part 679--Gulf of Alaska Retainable Percentages

BASIS SPECIES		INCIDENTAL CATCH SPECIES (for DSR caught on catcher vessels in the SEO, see § 679.20 (j)[6])														
Code	Species	Pollock	Pacific cod	DW flat[(2)]	Rex sole	Flathead sole	SW Flat [(3)]	Arrowtooth	Sablefish	Aggregated rockfish[(8)]	SR/RE ERA [(1)]	DSR SEO (C/Ps only) [(6)]	Atka mackerel	Aggregated forage fish[(10)]	Skates [(11)]	Other species [(7)]
110	Pacific cod	20	na[9]	20	20	20	20	35	1	5	[(1)]	10	20	2	20	20
121	Arrowtooth	5	5	0	0	0	0	na[9]	0	0	0	0	0	2	0	20
122	Flathead sole	20	20	20	20	na[9]	20	35	7	15	7	1	20	2	20	20
125	Rex sole	20	20	20	na[9]	20	20	35	7	15	7	1	20	2	20	20
136	Northern rockfish	20	20	20	20	20	20	35	7	15	7	1	20	2	20	20
141	Pacific ocean perch	20	20	20	20	20	20	35	7	15	7	1	20	2	20	20
143	Thornyhead	20	20	20	20	20	20	35	7	15	7	1	20	2	20	20
152/ 151	Shortraker/ rougheye [(1)]	20	20	20	20	20	20	35	7	15	na[9]	1	20	2	20	20
193	Atka mackerel	20	20	20	20	20	20	35	1	5	[(1)]	10	na[9]	2	20	20
270	Pollock	na[9]	20	20	20	20	20	35	1	5	[(1)]	10	20	2	20	20
710	Sablefish	20	20	20	20	20	20	35	na[9]	15	7	1	20	2	20	20
Flatfish, deep water [(2)]		20	20	na[9]	20	20	20	35	7	15	7	1	20	2	20	20
Flatfish, shallow water [(3)]		20	20	20	20	20	na[9]	35	1	5	[(1)]	10	20	2	20	20
Rockfish, other [(4)]		20	20	20	20	20	20	35	7	15	7	1	20	2	20	20
Rockfish, pelagic [(5)]		20	20	20	20	20	20	35	7	15	7	1	20	2	20	20
Rockfish, DSR-SEO [(6)]		20	20	20	20	20	20	35	7	15	7	na[9]	20	2	20	20
Skates[(11)]		20	20	20	20	20	20	35	1	5	[(1)]	10	20	2	na[9]	20
Other species [(7)]		20	20	20	20	20	20	35	1	5	[(1)]	10	20	2	20	na[9]
Aggregated amount of non-groundfish species		20	20	20	20	20	20	35	1	5	[(1)]	10	20	2	20	20

Notes to Table 10 to Part 679				
1	Shortraker/rougheye rockfish			
	SR/RE	shortraker/rougheye rockfish (171)		
		shortraker rockfish (152)		
		rougheye rockfish (151)		
	SR/RE ERA	shortraker/rougheye rockfish in the Eastern Regulatory Area.		
	Where numerical percentage is not indicated, the retainable percentage of SR/RE is included under Aggregated Rockfish			
2	Deep-water flatfish	Dover sole, Greenland turbot, and deep-sea sole		
3	Shallow water flatfish	Flatfish not including deep water flatfish, flathead sole, rex sole, or arrowtooth flounder		
4	Other rockfish	Western Regulatory Area	means slope rockfish and demersal shelf rockfish	
		Central Regulatory Area		
		West Yakutat District		
		Southeast Outside District	means slope rockfish	
		Slope rockfish		
		S. aurora (aurora)	*S. variegatus* (harlequin)	*S. brevispinis* (silvergrey)
		S. melanostomus (blackgill)	*S. wilsoni* (pygmy)	*S. diploproa* (splitnose)
		S. paucispinis (bocaccio)	*S. babcocki* (redbanded)	*S. saxicola* (stripetail)
		S. goodei (chilipepper)	*S. proriger* (redstripe)	*S. miniatus* (vermilion)
		S. crameri (darkblotch)	*S. zacentrus* (sharpchin)	*S. reedi* (yellowmouth)
		S. elongatus (greenstriped)	*S. jordani* (shortbelly)	
		In the Eastern GOA only, Slope rockfish also includes *S. polyspinous*. (Northern)		
5	Pelagic shelf rockfish	*S. ciliatus* (dusky)	*S. entomelas* (widow)	*S. flavidus* (yellowtail)
6	Demersal shelf rockfish (DSR)	*S. pinniger* (canary)	*S. maliger* (quillback)	*S. ruberrimus* (yelloweye)
		S. nebulosus (china)	*S. helvomaculatus* (rosethorn	
		S. caurinus (copper)	*S. nigrocinctus* (tiger)	
		DSR-SEO = Demersal shelf rockfish in the Southeast Outside District The operator of a catcher vessel that is required to have a Federal fisheries permit, or that harvests IFQ halibut with hook and line or jig gear, must retain and land all DSR that is caught while fishing for groundfish or IFQ halibut in the SEO. Limits on sale and requirements for disposal of DSR are set out at § 679.20 (j).		
7	Other species	sculpins	octopus	sharks / Squid
8	Aggregated rockfish	Means rockfish of the genera *Sebastes* and *Sebastolobus* defined at § 679.2 except in:		
		Southeast Outside District (SEO)	where DSR is a separate category for those species marked with a numerical percentage	
		Eastern Regulatory Area (ERA)	where SR/RE is a separate category for those species marked with a numerical percentage	

Notes to Table 10 to Part 679			
9	N/A	not applicable	
10	Aggregated forage fish (all species of the following families)		
		Bristlemouths, lightfishes, and anglemouths (family *Gonostomatidae*)	209
		Capelin smelt (family *Osmeridae*)	516
		Deep-sea smelts (family *Bathylagidae*)	773
		Eulachon smelt (family *Osmeridae*)	511
		Gunnels (family *Pholidae*)	207
		Krill (order *Euphausiacea*)	800
		Laternfishes (family *Myctophidae*)	772
		Pacific herring (family *Clupeidae*)	235
		Pacific Sand fish (family *Trichodontidae*)	206
		Pacific Sand lance (family *Ammodytidae*)	774
		Pricklebacks, war-bonnets, eelblennys, cockscombs and Shannys (family *Stichaeidae*)	208
		Surf smelt (family *Osmeridae*)	515
11	Skates Species and Groups		
		Big Skates	702
		Longnose Skates	701
		Other Skates	700

Table 11 to Part 679–BSAI Retainable Percentages *(Updated 10/18/02)*

BASIS SPECIES		INCIDENTAL CATCH SPECIES[5]															
		Pollock	Pacific cod	Atka mackerel	Alaska plaice	Arrow-tooth	Yellow fin sole	Other flatfish[2]	Rock sole	Flathead sole	Green-land turbot	Sable-fish[1]	Short-raker/ rougheye	Aggregated rockfish[6]	Squid	Aggregated forage fish[7]	Other species[4]
110	Pacific cod	20	na[5]	20	20	35	20	20	20	20	1	1	2	5	20	2	20
121	Arrow-tooth	0	0	0	0	na[5]	0	0	0	0	0	0	0	0	0	2	0
122	Flathead sole	20	20	20	35	35	35	35	35	na5	35	15	7	15	20	2	20
123	Rock sole	20	20	20	35	35	35	35	na[5]	35	1	1	2	15	20	2	20
127	Yellowfin sole	20	20	20	35	35	na[5]	35	35	35	1	1	2	5	20	2	20
133	Alaska Plaice	20	20	20	na[5]	35	35	35	35	35	1	1	2	5	20	2	20
134	Greenland turbot	20	20	20	20	35	20	20	20	20	na[5]	15	7	15	20	2	20
136	Northern	20	20	20	20	35	20	20	20	20	35	15	7	15	20	2	20
141	Pacific Ocean perch	20	20	20	20	35	20	20	20	20	35	15	7	15	20	2	20
152/ 151	Shortraker/ Rougheye	20	20	20	20	35	20	20	20	20	35	15	na[5]	5	20	2	20
193	Atka mackerel	20	20	na[5]	20	35	20	20	20	20	1	1	2	5	20	2	20
270	Pollock	na[5]	20	20	20	35	20	20	20	20	1	1	2	5	20	2	20
710	Sablefish1	20	20	20	20	35	20	20	20	20	35	na[5]	7	15	20	2	20
875	Squid	20	20	20	20	35	20	20	20	20	1	1	2	5	na[5]	2	20
Other flatfish[2]		20	20	20	35	35	35	na[5]	35	35	1	1	2	5	20	2	20
Other rockfish[3]		20	20	20	20	35	20	20	20	20	35	15	7	15	20	2	20
Other species[4]		20	20	20	20	35	20	20	20	20	1	1	2	5	20	2	na[5]
Aggregated amount non-groundfish species		20	20	20	20	35	20	20	20	20	1	1	2	5	20	2	20

NOTES to Table 11	
1	Sablefish: for fixed gear restrictions, see 50 CFR 679.7(f)(3)(ii) and 679.7(f)(11).
2	Other flatfish includes all flatfish species, except for Pacific halibut (a prohibited species), flathead sole, Greenland turbot, rock sole, yellowfin sole, Alaska plaice, and arrowtooth flounder.
3	Other rockfish includes all *Sebastes* and *Sebastolobus* species except for Pacific ocean perch; and northern, shortraker, and rougheye rockfish. The CDQ reserves for shortraker, rougheye, and northern rockfish will continue to be managed as the “other red rockfish” complex for the BS.
4	**Other species** includes sculpins, sharks, skates and octopus. Forage fish, as defined at Table 2 to this part are not included in the “other species” category.
5	na = not applicable
6	**Aggregated rockfish** includes all of the genera *Sebastes* and *Sebastolobus*, except shortraker and rougheye rockfish.
7	**Forage fish** are defined at Table 2 to this part.

Andy Smoker D16

Alaska Region

National Marine Fisheries Service

White Paper:
Discussion of an Industry Proposal to Revise Maximum Retainable Amount Percentages of Groundfish Relative to Retained Arrowtooth Flounder

Table 1. Current and proposed GOA MRAs

Incidentally Caught Species	Current MRA %	Proposed MRA %
Pollock	5	5
Pacific cod	5	5
Deep-water flatfish	0	20
Rex sole	0	20
Flathead sole	0	20
Shallow-water flatfish	0	20
Sablefish	0	1
Aggregated rockfish	0	5 or less
Atka mackerel	0	20
Aggregated forage fish	2	2
Skates	0	20
Other species	20	20

Table 2. Total product value of retained arrowtooth flounder catch in the groundfish fisheries off Alaska by processor type and year, 2001-2005

Year	Catcher/processor ($ per round metric ton)	Shoreside processor ($ per round metric ton)
2001	259	98
2002	342	-
2003	344	-
2004	751	342
2005	717	556

Table 3. Gulf of Alaska discards of arrowtooth flounder in the arrowtooth flounder target by year

Year	Discarded (mt)	Retained (mt)	Total (mt)	% Discarded
1997	2,201	4,566	6,767	33
2005	2,063	8,665	10,728	19
2006	2,668	12,676	15,344	17

Table 4. Gulf of Alaska arrowtooth flounder (ARTH) catch

Year	ARTH target catch (mt)	Non-ARTH target (mt)	Total (mt)	% catch in ARTH target
2004	5,983	14,630	15,335	39
2005	10,727	9,063	19,790	54
2006	15,344	12,290	27,634	56

Table 5. 2006 Gulf of Alaska arrowtooth flounder catch by gear type and processing component

Gear Type	Catcher / Processor (mt)	% of Total	Catcher Vessels (mt)	% of Total	Total Catch (mt)
Non-pelagic trawl	11,873	48	13,098	52	24,971
Pelagic trawl	0	0	2,176	100	2,176
Trawl total	11,873	44	15,274	56	27,147
Hook-and-line	204	43	272	57	477
Grand Total	12,077	44	15,546	56	27,624
NOTE: jig and pot gear had combined reported catches of less than 20 mt					

Figure 1. 2006 GOA Trawl Gear Arrowtooth Flounder Catch by Target & Processing Component

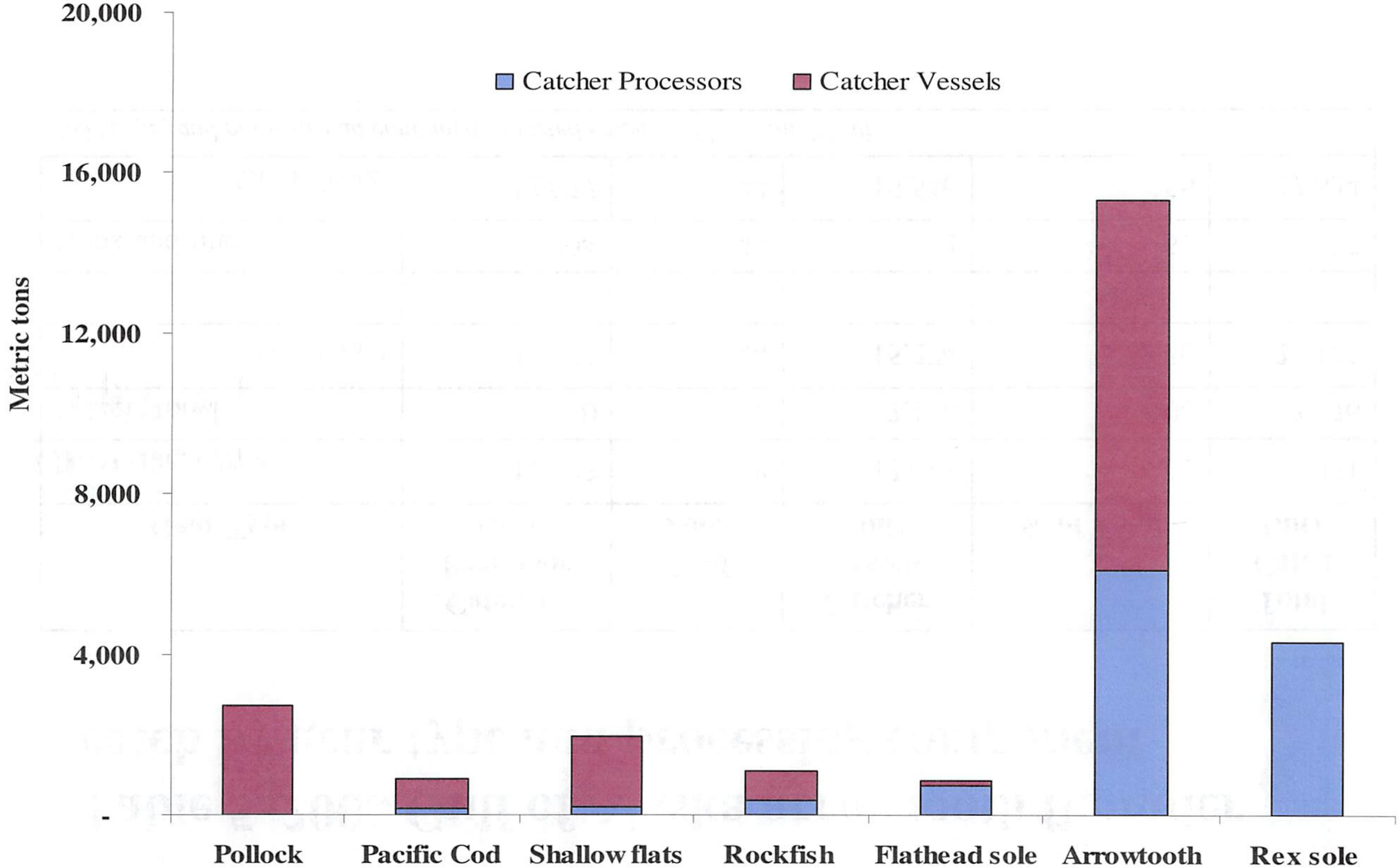


Figure 2. 2006 GOA Trawl Groundfish Catch by Target & Month

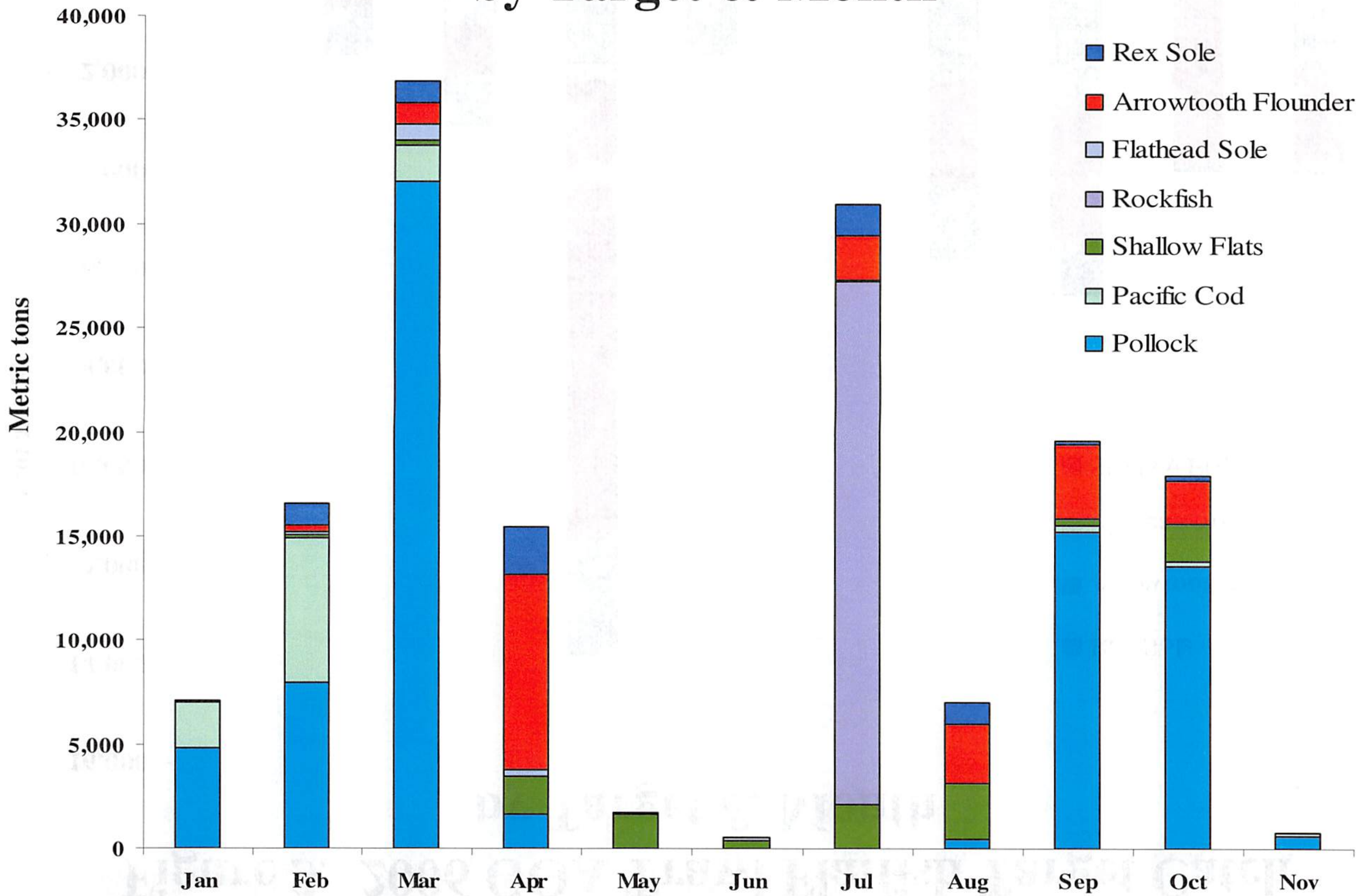
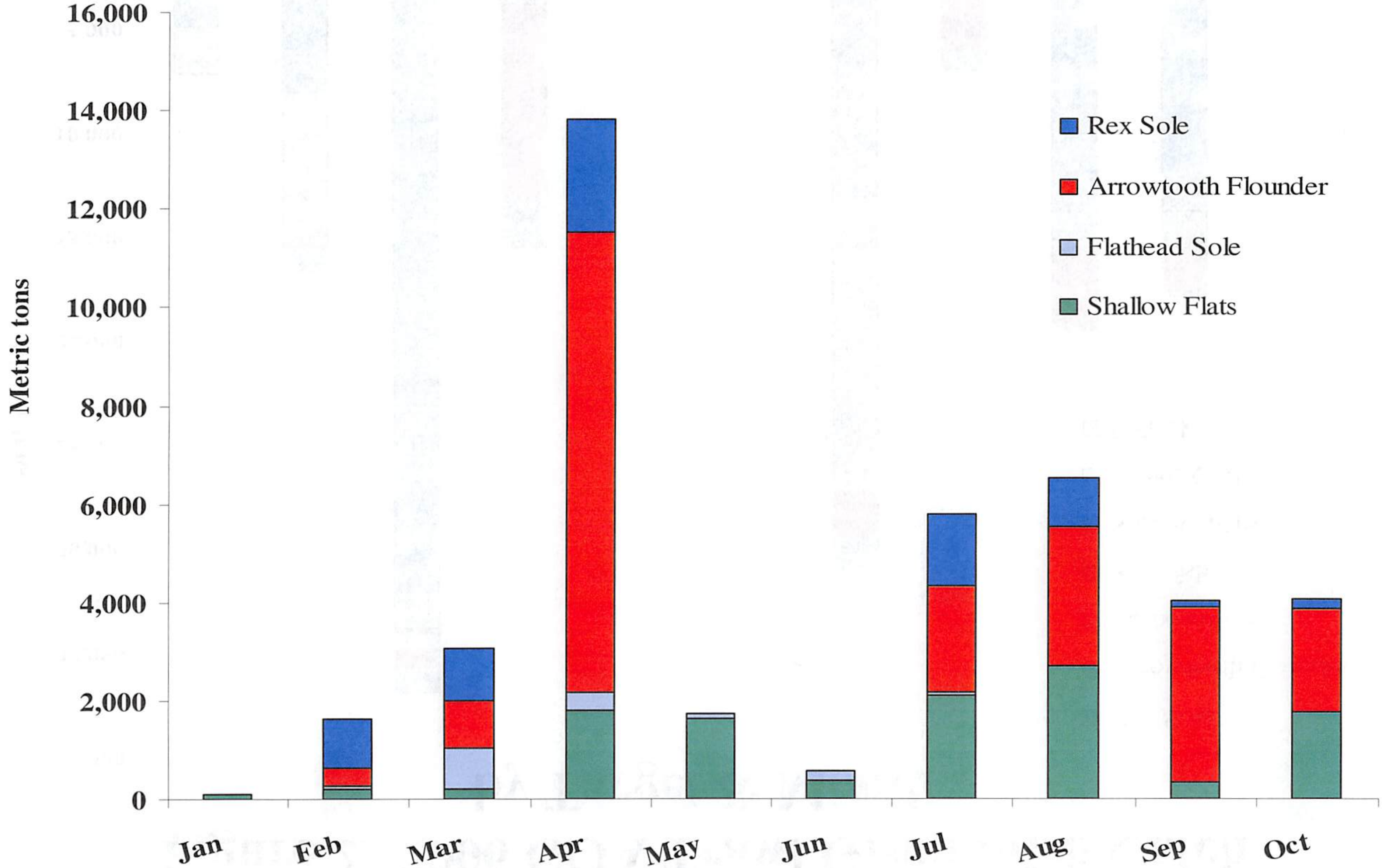


Figure 3. 2006 GOA Trawl Flatfish Target Catch by Target & Month



Replaced

Table 6. 2006 GOA trawl arrowtooth flounder target Retention and discards by species and processing component

Species	Catcher Vessels		Catcher/Processors		Both Processing Components	
	Total catch (mt)	Discard rate (%)	Total catch (mt)	Discard rate (%)	Total catch (mt)	Discard rate (%)
Arrowtooth flounder	9,235	11	6,108	28	21,452	12
Flathead sole	937	3	324	10	1,584	4
Rex sole	385	2	718	5	1,821	2
Pacific cod	343	7	591	22	1,525	10
Pollock	664	9	91	27	847	10
Shallow-water flatfish	484	3	55	37	594	6
Pacific ocean perch	44	69	174	86	392	46
'Other' species	119	66	59	100	238	58
Sablefish	30	44	146	61	323	32
Big skate	157	21			157	21
Northern rockfish	12	56	129	79	270	40
Deep-water flatfish	43	6	95	81	233	34
Longnose skate	74	46	56	100	187	49
Pelagic shelf rockfish	26	72	103	6	233	11
'Other' skate	40	98	18	87	77	72
Thornyhead rockfish	5	21	16	10	36	7
Rougheye rockfish	17	49	-	-	17	49
Shortraker rockfish	8	8	3	4	14	5
'Other' rockfish	3	78	1	100	6	64
Atka mackerel	<1	79	2	39	4	21

Table 7. 2006 Gulf of Alaska trawl gear retained catch by processing component and species in the Arrowtooth flounder target

Catcher/Processors		Catcher Vessels	
Species	**Retained Catch (mt)**	**Species**	**Retained Catch (mt)**
Arrowtooth flounder	4,417	Arrowtooth flounder	8,258
Rex sole	685	Flathead Sole	909
Pacific cod	459	Pollock	604
Flathead sole	291	Shallow-water flatfish (rock sole)	469
Pelagic shelf rockfish	97	Rex sole	375
Pollock	67	Pacific cod	319
Sablefish	57	Big Skate	123
Shallow-water flatfish (primarily rock sole)	35	Deep-water flatfish	41
Northern rockfish	27	Other skate	41
Pacific ocean perch	24	Longnose skate	40
Deep-water flatfish	18	Sablefish	17
Thornyhead rockfish	14	Pacific ocean perch	13
Shortraker	3	Rougheye	8
Unidentified Skate	2	Shortraker	8
Atka mackerel	1	Pelagic shelf rockfish	7
		Northern rockfish	5
		Thornyhead rockfish	4
		Unidentified Skate	1
		Other rockfish	1

Table 8. 2006 apportionment of Pacific halibut PSC trawl limits between the trawl deep-water species fishery and shallow-water species fishery

Season	Shallow-water (mt)	Deep-water (mt)	Total (mt)
January 20–April 1	450	100	550
April 1–July 1	100	300	400
July 1–September 1	200	400	600
September 1–October 1	150	Any remainder	150
Subtotal January 20–October 1	900	800	1,700
October 1–December 31			300
Total			2,000

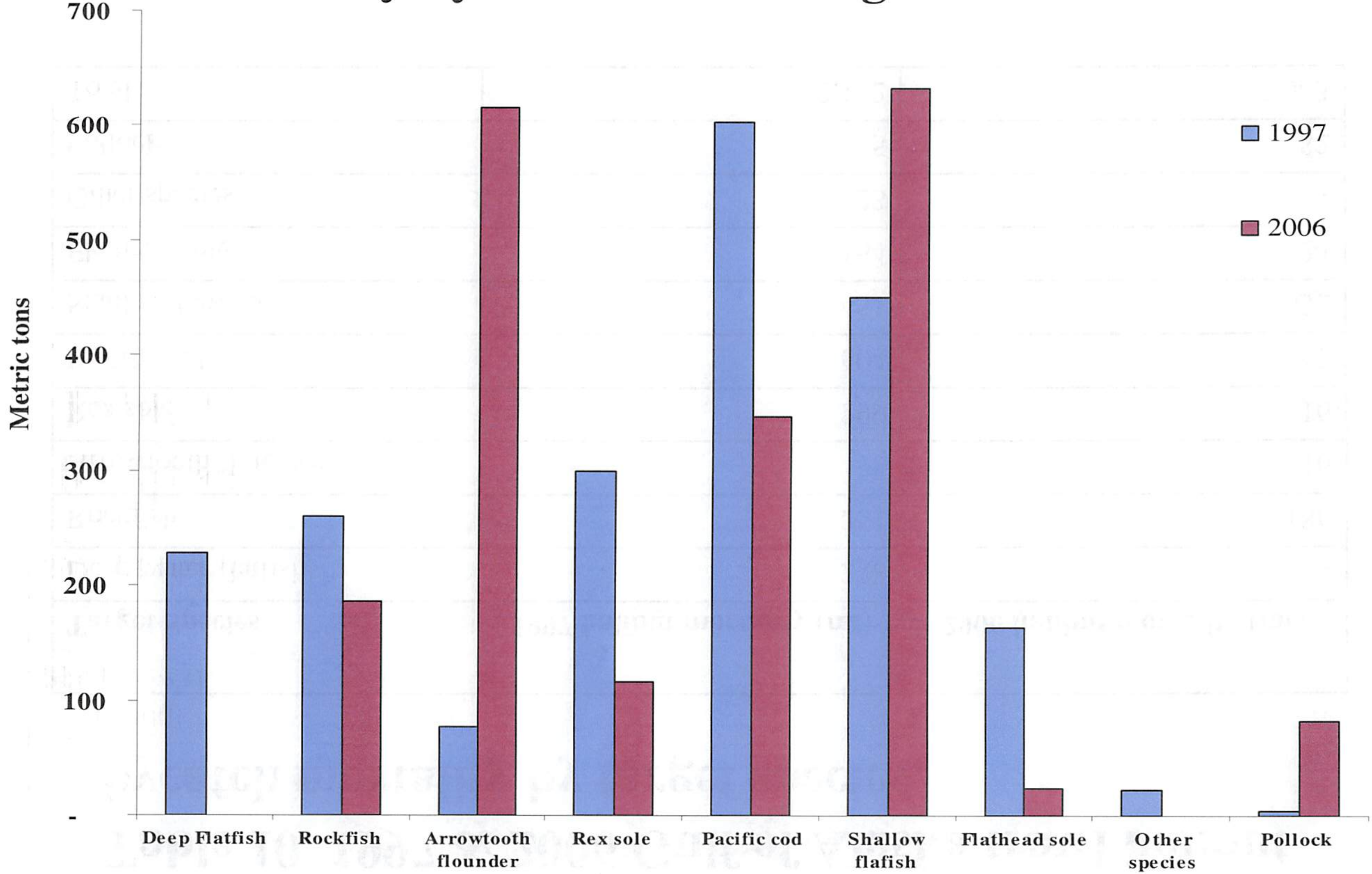
Table 9. 2005 & 2006 GOA trawl halibut closures by species complex

2005 CLOSURES					2006 CLOSURES				
		Open	**Closed**				**Open**	**Closed**	**Note**
Shallow-water complex		20-Jan	19-Aug		**Shallow-water complex**		20-Jan	23-Feb	
		1-Sep	4-Sep				27-Feb	10-Jun	
		1-Oct	1-Oct				1-Jul	1-Sep	midnight
							6-Sep	6-Sep	12 hr
Deep-water complex		20-Jan	23-Mar				20-Sep	20-Sep	12 hr
		1-Apr	8-Apr				25-Sep	25-Sep	12 hr
		24-Apr	3-May				1-Oct	8-Oct	
		5-Jul	24-Jul						
		1-Sep	4-Sep		**Deep-water complex**		20-Jan	27-Apr	
		8-Sep	10-Sep				1-Jul	5-Sep	
		1-Oct	1-Oct		**Combined**		1-Oct	8-Oct	

Table 10. 1997 & 2006 Gulf of Alaska trawl halibut bycatch mortality by target species

Target Species	1997 halibut mortality (mt)	2006 halibut mortality (mt)
Deep-water flatfish	228	-
Rockfish	261	186
Arrowtooth flounder	78	616
Rex sole	299	116
Pacific cod	604	347
Shallow flatfish	451	632
Flathead sole	164	24
Other species	23	-
Pollock	5	82
Total	2,112	2,003

Figure 4. 1997 & 2006 GOA Trawl Halibut Mortality by Groundfish Target



CORRECTED

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Table 6. 2006 GOA trawl arrowtooth flounder target Retention and discards by species and processing component

Species	Catcher Vessels		Catcher/Processors		Both Processing Components	
	Total catch (mt)	Discard rate (%)	Total catch (mt)	Discard rate (%)	Total catch (mt)	Discard rate (%)
Arrowtooth flounder	9,235	11	6,108	28	15,343	17
Flathead sole	937	3	324	10	1,260	5
Rex sole	385	2	718	5	1,103	4
Pacific cod	343	7	591	22	934	17
Pollock	664	9	91	27	756	11
Shallow-water flatfish	484	3	55	37	539	7
Pacific ocean perch	44	69	174	86	218	83
'Other' species	119	66	59	100	179	77
Sablefish	30	44	146	61	176	58
Big skate	157	21			157	21
Northern rockfish	12	56	129	79	141	77
Deep-water flatfish	43	6	95	81	138	58
Longnose skate	74	46	56	100	131	69
Pelagic shelf rockfish	26	72	103	6	130	20
'Other' skate	40	98	18	87	58	95
Thornyhead rockfish	5	21	16	10	21	13
Rougheye rockfish	17	49	-	-	17	49
Shortraker rockfish	8	8	3	4	11	7
'Other' rockfish	3	78	1	100	4	85
Atka mackerel	<1	79	2	39	2	40