DRAFT CASE STUDY FOR BERING SEA ROCKFISHES
from NPFMC and NOAA Fisheries Service sources

Introduction This draft document has been prepared at the request of the Non-Target Species Committee to determine whether applying a proposed alternative for revising management of target and non-target groundfish to all managed North Pacific rockfish species provides sufficient information to identify potential management measures to enhance their protection. The committee recommended that staff apply the proposed alternative to Bering Sea rockfishes as a case study; however staff constraints limited the case study to only northern rockfish[1].

The committee will convene on May 31, 2005, at the Alyeska Prince Hotel, Girdwood, Alaska to review the draft and determine whether staff should expand the paper to include the remaining Bering Sea (BS), Gulf of Alaska (GOA), and Aleutian Island (AI) rockfishes or whether a different approach should be used to complete the rockfish discussion paper. The committee will reconvene in late summer/early fall 2005 to review the completed paper. The groundfish plan teams also will review and comment on the paper at their joint meeting in September 2005. The Council, Advisory Panel, and Scientific and Statistical Committee will review the paper at their October 2005 meetings. The Council may request additional information or initiate action at that meeting or in the future.

Regarding this draft, the preparer is seeking comments on how best to present the requested information on rockfishes. The draft contains the following sections:

1. Background – This section describes the timing and intent of the Council's request for a rockfish discussion paper to have a source document to aid it on future action items. Staff has struggled with identifying Council intent with which to structure the discussion. More direction would be welcome.

   This section also mentions three FMP amendments that have been initiated by the Council and introduces two options for revising management of all non-target groundfish species (Alternative 4a and 4b). It includes a general description of BS rockfish biology and the current TAC specifications process.

2. General description of rockfish biology and status quo management

3. Alternative 4b Case Study – This section describes the proposed alternative to revise management of non-target groundfish species and the selection of a case study to determine whether the non-target species management initiative addresses Council intent for the rockfish discussion paper.
   a) Part 1. Core v. Assemblage evaluation
      i. Step 1 Separate rockfish species into core species and assemblages
      ii. Step 2 Characterize species in stock assemblage group as: (a) sensitive or (b) non-sensitive
      iii. Step 3 Propose management measures - incomplete
   b) Part 2. Identify a *policy* to outline a *process* based on scientific *criteria* to determine when sufficient data are available to move species ~~between the core stock and stock assemblage categories~~ <u>from an assemblage to a core stock</u>

4. References

5. Appendix 1. Alternative 4(a)

6. Appendix 2. Fishery Management Unit

7. Appendix 3. Technical components for defining sensitivity

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[1] The preparer recognizes that the distribution of northern rockfish is limited in the BS and predominant in the AI.

1. Background During deliberation for final action on the Programmatic Supplemental Environmental Impact Statement (PSEIS) in April 2004, the Council revised its policy and objectives for managing groundfish in the Gulf of Alaska and Bering Sea/Aleutian Islands (see box).

BSAI Groundfish Fisheries Management Approach

The Council's policy is to apply judicious and responsible fisheries management practices, based on sound scientific research and analysis, proactively rather than reactively, to ensure the sustainability of fishery resources and associated ecosystems for the benefit of future, as well as current generations. The productivity of the North Pacific ecosystem is acknowledged to be among the highest in the world. For the past 25 years, the Council management approach has incorporated forward looking conservation measures that address differing levels of uncertainty. This management approach has in recent years been labeled the precautionary approach. Recognizing that potential changes in productivity may be caused by fluctuations in natural oceanographic conditions, fisheries, and other, non-fishing activities, the Council intends to continue to take appropriate measures to insure the continued sustainability of the managed species. It will carry out this objective by considering reasonable, adaptive management measures, as described in the Magnuson-Stevens Act and in conformance with the National Standards, the Endangered Species Act (ESA), the National Environmental Policy Act, and other applicable law. This management approach takes into account the National Academy of Science's recommendations on Sustainable Fisheries Policy.

As part of its policy, the Council intends to consider and adopt, as appropriate, measures that accelerate the Council's precautionary, adaptive management approach through community-based or rights-based management, ecosystem-based management principles that protect managed species from overfishing, and where appropriate and practicable, increase habitat protection and bycatch constraints. All management measures will be based on the best scientific information available. Given this intent, the fishery management goal is to provide sound conservation of the living marine resources; provide socially and economically viable fisheries for the well-being of fishing communities; minimize human-caused threats to protected species; maintain a healthy marine resource habitat; and incorporate ecosystem-based considerations into management decisions.

This management approach recognizes the need to balance many competing uses of marine resources and different social and economic goals for sustainable fishery management, including protection of the long-term health of the resource and the optimization of yield. This policy will use and improve upon the Council's existing open and transparent process of public involvement in decision-making.

The Council identified 45 objectives to meet the goals of this overall management approach. In June 2004, Council staff matched each of the 45 objectives with its related bookend range to assist the Council in assessing whether current groundfish management meets the policy and the status of each bookend action. The Council identified a work plan to address management policy actions in April 2004. It noted that many objectives directly or indirectly address rockfish management and requested that:

"Staff draft a discussion paper addressing rockfish management alternatives. The end product after this first step will provide guidance in conjunction with the Programmatic EIS to address appropriate elements in future FMP actions: 1. No action; 2. Harvest rates and management measures; 3. Habitat consideration."

In April 2005, the Council expanded the role of the Non-Target Species Committee such that it was charged with addressing all management aspects of both target and non-target rockfish species, and specifically with advising staff on the content of this discussion paper. The committee was in the process of developing a range of alternatives for revising management of all non-target groundfish (rockfishes, flatfishes, sharks, skates, sculpins, squid, and octopi) species. The range included three intermediate steps that would revise management of non-target species incrementally. These alternatives have been split off into separate amendments to the BSAI and GOA Groundfish FMPs[2]. The remaining alternative includes two options for revising management of all non-target groundfish species

Alternative 4a would revise the policy for managing all non-target groundfish species in one step, but would revise management of non-target rockfishes, flatfishes, and other species in three separate amendments to the BSAI and GOA Groundfish FMPs. The revised policy would distinguish management between target[3] and non-target[4] groundfish and replace the specification process with management measures that would better protect non-target (in this case, non-target rockfish) species because different objectives and measures may be appropriate for non-target species compared with target species.

The proposed management objective for target (rockfish) species is to optimize sustainable yield. The Council would continue to apply quota specifications, gear allocations, seasonal allocations, and in-season management as the best tools to achieve this objective (including rationalized rockfish fisheries in the GOA, if approved by the Secretary). The quota system would apply to single species only. Some improvements to stock assessment summaries might be suggested, such as identifying what tier species are in, why a species is in a particular tier (i.e., what data put them there) and what might be necessary to progress to the more data rich tiers. One suggested management improvement for target species is the collection of sufficient data to manage stocks at tier 3[5] at a minimum for each target species; however, the ad hoc working group[6] accepts the SSC recommendation to allow management at tier 4 on a case by case basis. Additional measures or stock identification at finer scales may be recommended for some target species.

The proposed management objective for non-target (rockfish) species has been discussed at great length. In general, the objective is to monitor catch and status of the stock, discourage targeting and minimize bycatch to the extent practical, which includes providing additional protection from the unintended negative fishery effects where appropriate[7]. The objective is NOT to optimize yield for non-target rockfishes. Setting quotas on species not intended to be harvested appears to be inappropriate; therefore, Alternative 4a would remove non-target species from the specification process. It would replace cumulative quotas for assemblages with more specific management measures that would better protect individual stocks (which could include, but is not limited to, maximum retainable allowances, increased stock identification, spatial or seasonal closures to some or all fishing gear, or marine reserves).

Alternative 4a was tabled after advanced notice on proposed rulemaking to revise guidelines for implementing National Standard 1[8] (NS1) did not comport with proposed recommendations. *The Council may wish to reconsider the benefits of Alternative 4a if the rule is not published (Appendix 4).*

Alternative 4b Alternative 4(a) was revised to accommodate proposed revisions to NS1 guidelines that may not recommend that species be removed from status determinations (i.e., quota management). Alternative 4b reflects the proposed revised guidelines, which recommends that Councils:

(1) group stocks into "core[9]" stocks and stock "assemblages[10];"
(2) manage core stocks based on an individual Minimum Stock Size Threshold (MSST) and Maximum Fishing Mortality Threshold (MFMT); and
(3) manage assemblages based on MSSTs and MFMTs for either the assemblage or for one or more

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[2] (a) TAC formula for GOA "other species" assemblage is scheduled for final action in June 2005; (b) set OFL and ABC for GOA "other species" and/or (c) separate some or all of the GOA and BSAI "other species" assemblages into separate TAC categories are scheduled for final action in June 2006.
[3] species intentionally caught and sold
[4] species not intentionally caught and can not be sold
[5] Tier 3 indicates that reliable fishery parameter estimates of B, B_{40}, F_{35}, F_{40} are available for stock assessments
[6] comprised of Plan Team and SSC members, and AFSC REFM and AKRO staff
[7] committee should clarify "negative fishery effects."
[8] National Standard 1 states that conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry.
[9] key target species, historically-important target species, important by-catch species and highly vulnerable species
[10] groups of stocks related by geography, fisheries, etc.

indicator stocks.

A "representative species" from each assemblage would be most useful indicators for an assemblage if they were the most commonly encountered in the fishery. Continuing the practice of setting specifications for assemblages is the fundamental distinction between Alternatives 4a and 4b. Whether alternative 4a or 4b is the template for future FMP amendments, the management of fishery management units within the FMPs still needs to be clarified by NOAA General Counsel (Appendix 1)[11].

Alternative 4(b)[12]. Revise the BSAI and GOA groundfish FMPs to:

Part 1. Identify a *policy* to outline a *process* based on scientific *criteria* to determine core stock or assemblage management

- Step 1. Separate species that are currently in the target and non-target category into:
  - (a) Core stocks, if there is an intent by the commercial fishery to catch and market it or if sufficient information exists to set species-specific status determination criteria and the stock is considered sensitive or important (see draft NS 1 guidelines); (OFL, ABC, and TAC would be set for each species)
  - (b) Stock assemblages for all remaining single species and all species assemblages with no fishery intent to catch or market it but that are caught by the fishery; (***OFL, ABC, and TAC would be set for each assemblage)***
  - (c) Non-specified species for all remaining species or assemblages that are not caught in the fishery and remove them from the FMP

  ~~Option. Revise the forage fish category to include species from the current target and revised non-specified species categories, as appropriate~~
- Step 2. Characterize species in ~~stock assemblage group~~~~[13]~~ as:
  - (a) sensitive
  - (b) non-sensitive
- Step 3. Manage:
  - (a) Core stocks and stock assemblages under status quo management;
  - (b) Species within stock assemblages: protecting them from negative fishing effects of target fisheries:
    - (1) sensitive species: protection measures (maximum retainable allowances, closed areas, seasonal apportionments, etc.);
    - (2) non-sensitive species: monitor only (details to be decided)
  - (c) Non-specified species: monitor only

Part 2. Identify a *policy* to outline a *process* based on scientific *criteria* to determine when sufficient data are available to move species ~~between the core stock and stock assemblage categories~~ from an assemblage to a core stock[14] (*yet to be drafted subject of future ad hoc group meetings*)

2. General description of rockfish biology and status quo management

Bering Sea rockfishes comprise a very small percent of total groundfish biomass, allowable biological catch (ABC), and total allowable catch (TAC). Current core rockfish species would include Pacific Ocean perch, northern rockfish, shortraker rockfish, rougheye rockfish[15], and shortspine thornyheads. These species would continue to be managed under single species TACs. The first two species are managed under Tier 3. The remaining core rockfishes and the other rockfish assemblage are managed under Tier 5[16].

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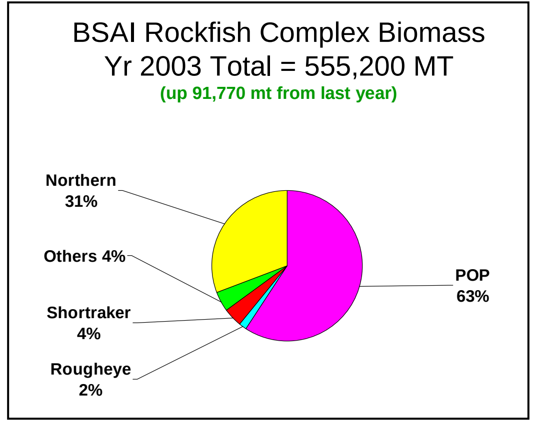
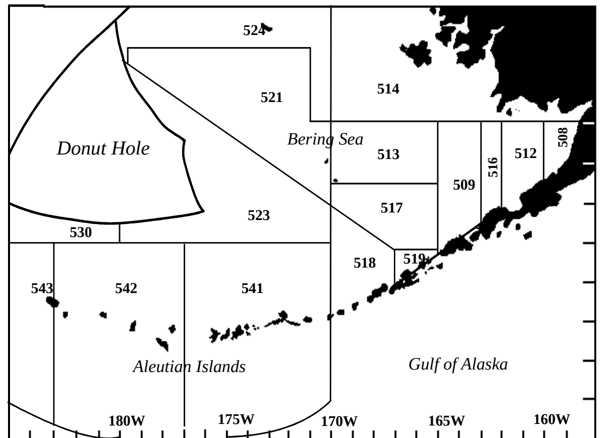
[11] the preparer needs to work on this topic
[12] includes proposed revision in Part 2 as suggested by staff
[13] may wish to identify sensitivity for core stocks also
[14] no longer moving species between "target" and "non-target" categories
[15] includes two species that are genetically distinguishable
[16] Tier 5 indicates a reliable B and M is availabelf or stock assessments



The Bering Sea/Aleutian Islands Groundfish Fishery Management Plan (FMP) controls the fishery through permits and limited entry, catch quotas (TACs), seasons, in-season adjustments, gear restrictions, closed waters, bycatch limits and rates, allocations, regulatory areas, record keeping and reporting requirements, and observer monitoring.

Management Unit The FMP encompasses the Exclusive Economic Zone (EEZ) in that portion of the North Pacific Ocean adjacent to the Aleutian Islands which is between 170° W. and the U.S.-Russian Convention Line of 1867, and of the Eastern Bering Sea. The plan area is divided into two regulatory areas: (1) the Bering Sea composed of 13 Statistical Areas and covering 844,039 km^2, and (2) the Aleutian Islands composed of 3 Statistical Areas and covering 1,000,106 km^2. The plan covers all domestic and foreign fisheries for all finfish and marine invertebrates except salmonids, shrimps, scallops, snails, king crab, Tanner crab, Dungeness crab, corals, surf clams, horsehair crab, lyre crab, Pacific halibut, and Pacific herring.



Statistical and regulatory areas for the Bering Sea and Aleutian Islands groundfish fisheries.

Determination of Total Allowable Catches The BSAI groundfish complex is a distinct management unit and has more than 15 commercially important species ("core") and many others of lesser or no commercial importance ("assemblage" and non-specified categories). This complex forms a large subsystem of the Bering Sea ecosystem with intricate interrelationships between predators and prey, between competitors, and between those species and their environment. Therefore, the productivity and Maximum Sustained Yield (MSY) of groundfish are conceived for the groundfish complex as a unit rather than for individual species or assemblages. The total MSY for the BSAI groundfish was estimated to be 1.7 to 2.4 million mt based on groundfish catches for 1968-1977. More recent estimates of MSY are not available.

Optimum Yield (OY) for the complex is set equal to 85% of MSY, or 2.0 million mt, plus such amounts of "non-specified species" as may be taken incidentally. OY is set lower than MSY to reduce the risk associated with relying on incomplete data and questionable assumptions in assessment models used to determine stock conditions. The OY has been permanently set at 2 million mt under the Consolidated Appropriations Act (PL 108-199). Congress also specified that the Council could apportion this directed fishery over and above the 2 million mt Optimum Yield (OY) cap in the BSAI groundfish fisheries for the purposes of apportioning pollock to the Aleut Corporation for the fishing years 2004 through 2008.

Total Allowable Catch (TAC) for each target species and for the "other species" category will be determined by the Alaska Regional Administrator of NOAA Fisheries Service based on the Council's recommendations. The sum of these TACs, or the TAC for the groundfish complex excluding non-specified species shall be under the OY and is subject to the management measures prescribed in this FMP.

The Council recommends TACs for each target species and the "other species" category based on the best available data concerning the stocks and the fisheries. The Council's recommendations concerning TACs for the upcoming fishing year are based on the following:

1. Biological conditions of stocks as noted in an annual Stock Assessment & Fishery Evaluation (SAFE) report prepared each year by the Plan Team with the assistance of NOAA Fisheries and other agencies. The

SAFE report contains historical catch trends, biomass and ABC estimates, assessments of harvest impacts, and alternative harvesting strategies.

2. Socioeconomic considerations including promotion of efficiency, optimum marketable size of fish, impacts on prohibited species and dependent domestic fisheries, desire to enhance depleted stocks, seasonal access to the groundfish fishery by U.S. vessels, commercial importance to local communities, subsistence needs, and the need to promote utilization of certain species.

The Council sets preliminary TACs in October, takes public comment in October and November, and finalizes the TACs in December for the upcoming fishing year. Twenty-five percent of the preliminary groundfish specifications adopted in September go forward until superseded by publication of the final specifications in the Federal Register. This permits the groundfish fisheries to start on January 1, and for in-season management actions to take place, even if the publication of the final specifications is delayed past January 1.

Allocation of Total Allowable Catches At the beginning of the fishing year (the calendar year), after TAC is determined for each species or group, an unspecified reserve is set aside to correct operational problems in the fisheries, to adjust species TACs according to stock conditions, and for further apportionments. The reserve equals the sum of 15% of each target species and "other species" category TAC. The reserve is not designated by species and will be apportioned to the fishery during the year by the Regional Director in the amounts and by species that he determines necessary. Since 1990, the Council has recommended that all TAC be allocated to the domestic fishery. No joint venture fisheries or foreign allocations have been approved, so the groundfish fishery has been wholly U.S.-processed since 1990.

Seasonal Allocations Harvest allocations and management are based on the calendar year. The fishing year is defined as the period beginning midnight Alaska local time on January 1 and ending at midnight Alaska local time on December 31 of that year. Fishing seasons for specific species or gear types may be set by regulatory amendment and may differ from the fishing year. All trawl fisheries are delayed until January 20. Trawl fisheries also open and close based on seasonal allocation of halibut and crab bycatch limits.

Community Development Quotas The Council has adopted CDQ allocations for all groundfish species (except squid) as part of Amendment 39, which allocates 7.5 percent of all groundfish TACs to 65 western Alaska community development groups.

Total Allowable Catch Closures The Regional Administrator may close an area in whole or part to directed fishing for a species whose remaining TAC is needed as bycatch in other directed fisheries. If directed fishing is prohibited, the species may be retained in amounts less than what would constitute directed fishing. If a TAC is fully reached, the Regional Administrator will publish a notice declaring that species as prohibited and it must be discarded. If continued fishing on other species may constitute a threat of overfishing on a species whose TAC is exhausted, the Regional Administrator has the authority to stop the other directed fisheries or require gear adjustments. In taking such action, the Regional Administrator must consider:

1. Risk of biological harm to the species whose TAC has been reached.
2. Risk of socioeconomic harm to authorized users of the species for which TAC has been reached.
3. Impacts of a continued closure on the socioeconomic well-being of other domestic fisheries.

Inseason Adjustments The Secretary of Commerce, acting through the Regional Administrator, is authorized to make three types of inseason adjustments:

1. Modify seasons in part or all of a management area.
2. Modify allowable gear in all or part of a management area.
3. Adjust TAC and PSC limits.

It must be determined first, however, that the adjustment is necessary to prevent overfishing of any species, finfish or shellfish; or prevent further harvest of a target groundfish species or bycatch of a prohibited species because the TAC or PSC has been found, scientifically, to be mis-specified. In choosing whether to modify seasons or gears, the Regional Administrator must use the least restrictive action of the following which will still serve the purpose:

1. A gear modification which would protect a species needing conservation but still allow other fisheries to continue.
2. A time/area restriction which would allow other fisheries to continue in non-critical areas and times.
3. A complete closure of an area to all groundfish fishing.

3. Alternative 4b Bering Sea Rockfish Case Study The Non-Target Species Committee recommended that Bering Sea rockfishes be selected for a case study to evaluate whether using Alternative 4b as a template for the rockfish discussion paper adequately addresses the Council's original concerns in June 2004. If approved by the committee at its May 31, 2005 meeting, the case study will be expanded to include the remaining BS, GOA, and AI rockfishes. The proposed approach for managing groundfish species is still in draft form. While originally intended to change the management practices for non-target species, it may evolve into a procedure for complying with proposed revised guidelines to prevent overfishing (which is a laudable but *different* goal). Alternative 4b may continue to evolve as the analysis develops.

Part 1 of Alternative 4b would define a policy for setting criteria to determine: (1) core stock or assemblage management for groundfish (here applied to BS rockfishes); and (2) when sufficient data are available to move species from an assemblage to a core stock. The criteria for Step 1 may be defined in revised guidelines for implementing National Standard 1 (see footnote 7). If not, then the Council would define a *process* to address the separation of species into "core" and assemblage categories under Step 1. AFSC staff is undertaking the separation of species into sensitive and non-sensitive categories for Council review under Step 2. Step 3 would identify appropriate management measures for each core species or assemblage. Part 2 would identify how species move from an assemblage to a core species. These steps are presented graphically in Figure 1.

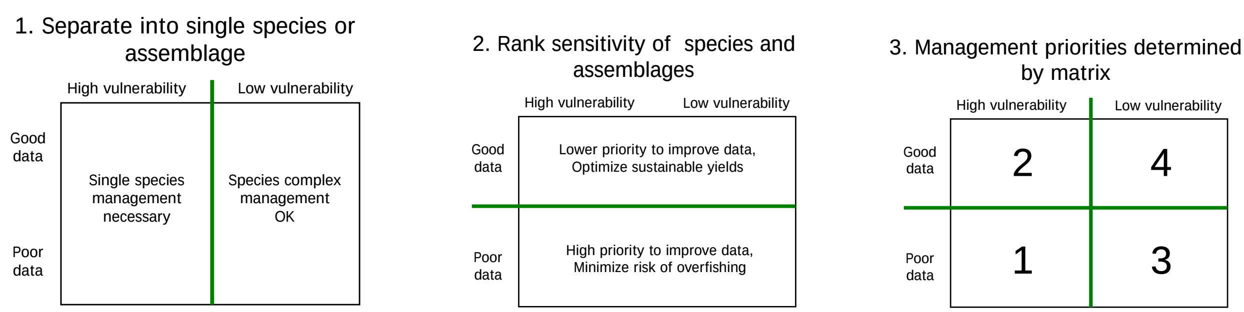


Figure 1. Alternative 4b conceptual approach

a) Part 1. Alternative 4b Core vs. Assemblage Evaluation

Potential criteria for evaluating whether stocks are subject to a target fishery include:

1) Are already target species with fully developed fisheries (e.g., pollock, Pacific cod);
2) Have market value and are currently marketed;
3) Are species fishermen say they want to catch (because they have market value);
4) Would be the targets of fisheries if we allowed them (currently on bycatch only status)?;
5) Are caught and retained over threshold levels (set by NMFS)?

Northern rockfish are clearly not a target fishery in the BS. Harvest data from 2000-2002 indicates that approximately 90% of the BSAI northern rockfish are harvested as bycatch in the Atka mackerel fishery, with a large amount of the catch occurring in September in the western Aleutians (area 543). The discard rates of northern rockfish in the BSAI area has been over 90% since the mid-1990s. While a target fishery did exist in the AI during the mid-1990s, vessels currently targeting Atka mackerel are configured to process the latter species exclusively. Additionally, BSAI northern rockfish appear to be generally smaller than those in the GOA, perhaps contributing to its lack of market value in the BSAI. It is possible that it might develop into a target fishery in the future.

i. Step 1. Separate rockfish species that are currently in the target and non-target category into:

Core stocks	**Stock assemblages**	**Non-specified species**[17]
Pacific ocean perch	Other rockfish (8 species)	None
northern rockfish	shortspine thornyhead	
shortraker rockfish	dark rockfish	
rougheye rockfish	sharpchin rockfish	
	harlequin rockfish	
	redbanded rockfish	
	broadfin thornyhead rockfish	
	dusky rockfish	
	redstripe rockfish	

ii. Step 2. Characterize species in stock assemblage group as: (a) sensitive or (b) non-sensitive

A critical, but difficult, step is to define species listed in the stock assemblage as sensitive[18] or non-sensitive.[19] Management of sensitive stocks could entail specific management measures that are yet to be identified. Management of non-sensitive stocks could be limited to stock assessment and monitoring, or monitoring only. AFSC staff is currently drafting criteria for separating Bering Sea rockfishes into sensitive and non-sensitive categories (Figure 2).

	Vulnerability	
Data Quality (tier-specific)	**high**	**low**
good survey coverage	single species	complex if needed for management or
		single species
poor survey coverage	single species	complex or single species
	start high quality data collection	collect additional data if possible
	interim quality, precautionary	
	no directed fishery	
	alternative management strategies	
	under alternative management schemes,	
	low MRB, area/time closures, creative thinking.	

Figure 2. Conceptual matrix for determining sensitivity of groundfish species.

Sensitivity may be defined as the potential for experiencing negative population effects from fishing. The process for defining sensitivity is a decision matrix based on data quality and vulnerability. The criteria being used to develop the lists is detailed in Appendix 2. Right now the sorting is incomplete, but generally looks like Figure 3.

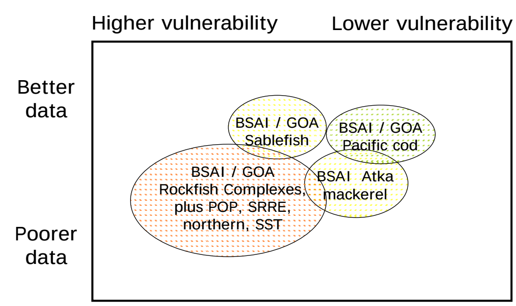


Figure 3. Venn diagram depicting sensitivity

[17] for all remaining species or assemblages that are neither targe

[18] defined by quality[a] and vulnerability[b].

a/ the appropriateness of the survey coverage in space (relative to the species range and to its habitat), time (of year), gear; and 2) the precision of the survey estimate (i.e., the CV).

b/ life history, habitat, economic value, co-occurrence with target fishery, easily misidentified, risk of disproportionate harvest to biomass, current management measures, exploitation rate, biomass

[19] It should be considered whether sensitivity of core rockfish stocks also should be considered.

Four possible criteria for defining species as sensitive include:

(1) rapidly declining abundance trend,
(2) sensitive life history traits,
(3) restricted range and or specific habitat, and
(4) crucial role in ecosystem (predator prey or other dependent association).

Rapid decline in abundance trend could be determined by specifying a certain percentage decline per year. The population size and trend of northern rockfish can be inferred from AI trawl surveys, which have considerable sampling error for rockfish species. Northern rockfish do not have a rapidly declining abundance trend, and their area-swept survey biomass estimates have ranged 87,000 t to 215,000 t from 1991 to the present. Note that the actual size of a population, in addition to the trend, is also an important indicator of stock sensitivity. A population could appear to have a stable population size at a relatively low level, but the population size may be so low that a random event may drive the population to a "point of no return" where loss of genetic diversity and other harmful effects may become significant. The estimated population size for AI northern rockfish, mentioned above, do not appear to be close to a minimum viable population size, given our current knowledge of northern rockfish genetics.

Sensitive life history traits were identified as those contributing to the overall potential for a population to increase (the "r" parameter in the logistic growth equation or its equivalent). A spectrum of life history patterns were identified which ranged from "high resilience" to "very low resilience" categories. In general, "high resilience" species with high potential rates of population increase have one or more of the following traits: fast growth rates, low age at maturity, high fecundity, and are relatively short lived. At the other end of the spectrum, "very low resilience" species with low potential rates of population increase may have slow growth rates, late age at maturity, low fecundity, and/or very long lives. Two intermediate categories were identified, such that species could be classified generally as having high resilience, average resilience, moderate to low resilience, and very low resilience. Species could be classified as having sensitive life history traits if they were classified as moderate to low resilience or very low resilience species.

Northern rockfish would appear to have sensitive life history traits. The estimated age at 50% maturity (based on GOA data) is approximately 13 years; they are fairly long-lived (maximum age reported in the BSAI of 72 yrs). Fecundity of northern rockfish is not known, and rockfish exhibit a wide range of estimated fecundity at maturity from 1,700 eggs or embryos to 417,000 (Haldorson and Love 1991). Despite ovoviviparous reproduction, fecundity in rockfishes, as a group, are not dramatically lower than oviparous fish such as cods (*Gadidae*) and snappers (*Lutjanidae*) (Haldorson and Love 1991). However, if fecundity increases with age, as has been suggested for widow rockfish (Ralston and Pearson 1997), the sensitivity to overfishing is increased.

Rockfish recruitment for many stocks is often characterized by rare events of rather strong recruitment and many years of weak recruitment. A Bayesian meta-analysis of rockfish stock-recruitment relationships has indicated that Alaska Pacific ocean perch are more resilient than rockfish off the continental west coast of the U.S. (Dorn 2002), although this study did not specifically include northern rockfish. Natural mortality rates for northern rockfish are not well known, and current estimates are derived from theoretical relationships with longevity and von Bertalanffy's growth rate. Northern rockfish would likely be classified as moderate to low resilience.

It is difficult to establish criteria for the amount of *restricted range and habitat specificity* that would cause concern. However, because so little about the specific habitat associations of most core species is known, then observed restricted range or occurrence in specific locations over time might indicate a habitat association for assemblage species and may be evidence enough for additional management measures (e.g., spatial) to protect the species from fishing effects.

Crucial role in the ecosystem also remains undefined at this time. The main questions that can be answered with current data are who eats the species, and who is eaten by the species? Simply gathering adequate data to address this issue would be useful and may identify which assemblage species were candidates for special management under this criterion. One example would be the already existing forage fish category in which multiple families were placed off limits as target species because of their collective importance as prey for marine mammals, birds, and target groundfish. It may be possible to assign other assemblage species to this existing category as it becomes clear that they are essential forage species (e.g., squid, octopus, and eelpouts).

Northern rockfish are distributed throughout the Aleutian Islands, and little is known of specific habitat associations. Based on the AI trawl surveys, the bulk of the population occurs in the western Aleutians, with much smaller numbers occurring along the eastern Bering Sea slope. Like other rockfish, northern rockfish are thought to be patchily distributed, and survey data indicates they occupy a depth zone between 100m and 250m. The available survey indicates that these species are caught over rough bottoms, although little detailed information is known on specific habitat associations.

The recent survey estimates of AI northern rockfish biomass (205,000 t in 2000 and 176,000 t in 2002) indicate that this species is one of the most abundant in the Aleutian Islands, and on this basis alone would appear to be crucial part of the Aleutian Islands ecosystem.

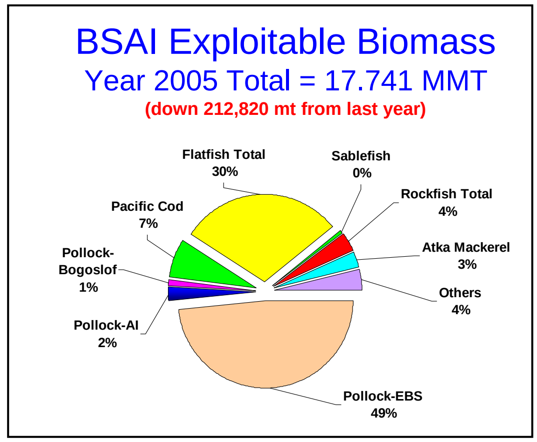
Note that the criterion of a “crucial role” differs in nature from the others. The other criteria relate to whether a stock is demonstrating adverse effects from fishing and/or environmental stressors (decline in population size), or the degree to which the population is resistant to overfishing (habitat range) and its resilience once overfishing has occurred (life-history traits). A stock could be an important part of the ecosystem without having particularly sensitive life-history characteristics; BSAI walleye pollock and flatfish come to mind. The point here seems to be that the “crucial role” criterion perhaps relates not so much to stock sensitivity as much as providing reasons why management may wish to lean to more conservative measures.

<u>Summary</u> Northern rockfish would be characterized as a “core” non-target, sensitive stock. Management consists largely of monitoring and maximum retainable allowances of bycatch rates. The potentially patchy distribution of northern rockfish may argue for time/areas closures, although it is difficult to say where these areas should be located. One obvious choice is to close areas where fishing tends to take northern rockfish as bycatch. For example, northern rockfish bycatch in the Aleutian Islands is taken largely in a number of discrete locations where the Atka mackerel fishery operates, such as Seguam Pass, Petral Bank, Amchitka Island, and Buldir Island-Tahoma Bank area. If it were determined that current harvest policies were not adequately conserving northern rockfish, time/area closures for these areas may be considered. Additionally, any time/area closures aimed at Aleutian Islands northern rockfish would have to be coordinated with desired management measures for Atka mackerel fisheries. More permanent time/area closures would ideally be based on early life history information that protected spawning stocks and the critical early life history stages.

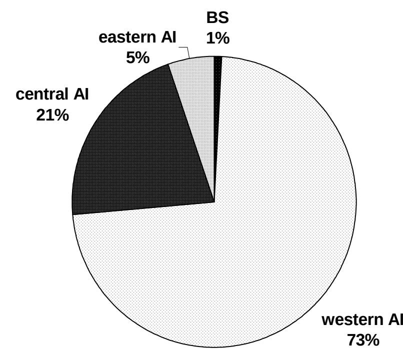
Note that monitoring would ideally involve species abundance, catch estimation, age and length composition, and quantitative population assessment. The current data support at least a preliminary age-structured assessment of BSAI northern rockfish, and the process of producing this assessment has increased our knowledge of BSAI northern rockfish. Given the importance of rockfish in the AI ecosystem and the increased public attention on rockfish, it would be difficult to justify a monitoring approach that is less detailed than the current data allow. New management measures may be proposed after Council consideration of its identification as a sensitive stock.

RESULT:	**Sensitive**		**Non-sensitive**	
(Target/Non-target)	**Core**	**Assemblage**	**Core**	**Assemblage**
	Pacific ocean perch (T)			dusky
	northern (NT)			shortspine
	shortraker (NT)			harlequin
	rougheye (NT)			dark
				sharpchin
				redbanded
				thornyhead

Summary of current data on northern rockfish population biology Northern rockfish (*Sebastes polyspinus*) inhabit the outer continental shelf and upper slope regions of the North Pacific Ocean and Bering Sea. A variety of types of research can be used to infer stock structure of northern rockfish, including larval distribution patterns and other life-history information, and genetic studies. Species identification based on morphological characteristics is difficult because of overlapping characteristics among species, as few rockfish species in the North Pacific have published descriptions of the complete larval developmental series.

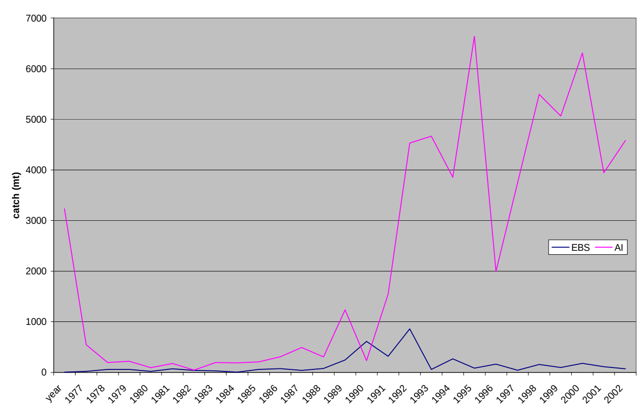


An initial genetic analysis revealed no evidence of population structure in Alaskan northern rockfish from either mtDNA or microsatellite analysis (Gharrett 2003), based upon small samples of 20 fish from each of three locations (Kodiak Island, Unimak Pass, and Stalemate Bank). Although the sample sizes were small and had little power, the authors concluded that the analysis was sufficient to conclude that existing structure is not pronounced. However, this study looked at only a portion of the mtDNA genome and a handful of microsatellite loci, and had small sample sizes. Also, the failure to identify population structure does not necessarily imply that northern rockfish consist of a single population unit. If subtle differences occur, much larger sample sizes would be required in order to identify stock structure.



Rockfish biomass by subarea (avg 1991-2004)

The biomass of northern rockfish is concentrated largely in the western Aleutian Islands, with an average of 73% of the estimated biomass from the 1991-2004 NMFS AI trawl surveys occurring in this region (Table 12.5). The coefficients of variation (CV) of these biomass estimates by region are generally high, but especially so in the southern Bering Sea portion of the surveyed area (165 W to 170 W), where the CV was less than 0.60 only in the 2000 survey. An average of survey results between 1991 and 2004 indicate that the predominant biomass of northern rockfish is in the western Aleutian Islands, with less than 1 percent in the Bering Sea.



A northern rockfish target fishery does not currently exist in the BSAI management area. As previously discussed, most northern rockfish catch in the BSAI management area occurs in the Atka mackerel fishery. Harvesting of northern rockfish is not likely to diminish the amount of northern rockfish available as prey due to the low fishery selectivity for fish less than 20 cm. Although the recent fishing mortality rates have been relatively light, averaging 0.03 over the last five years, it is not know what the effect of harvesting is on the size structure of the population or the maturity at age.

Northern rockfish catch prior to 1990 was small relative to more recent years (Figure). Approximately 90% of BSAI northern rockfish during 2000-2003 were harvested in the Atka mackerel fishery, with a large amount of the catch occurring in September in the central and western Aleutians (areas 542 and 543). This reflects both the spatial regulation of the Atka mackerel fishery and the increased biomass of northern rockfish in the western Aleutian Islands. Northern rockfish are patchily distributed and are harvested in relatively few areas within the broad management subareas of the Aleutian Islands, with important fishing grounds being Petral Bank, Sturdevant Rock, south of Amchitka I., and Seguam Pass (Dave Clausen, NMFS-AFSC, personal communication).

Information on discards is generally not available for northern rockfish in years where the management categories consist of multi-species complexes. For instance, discards in the “sharpchin/northern” complex, which was in place for 2001-2003, has been interpreted as all northern rockfish because the catches of sharpchin rockfish are generally rare in both the fishery and survey. Recent discard rates in the Bering Sea generally have been above 80 percent (Table 12.3). Recent discard rates in the Aleutian Islands exceeded 97% in 2001 and 2002.

Table 12.3. Estimated retained, discarded, and percent discarded northern rockfish catch in the eastern Bering Sea (EBS).

	Catch (t)			
Year	Retained	Discard	Total	Percentage
2001	16	164	180	91.1%
2002	9	105	113	92.4%
2003	14	57	72	79.9%

Biomass trends The estimated survey biomass shows a slightly increasing trend, starting in 1977 and increasing gradually to 1998. The total biomass and spawner biomass showed similar patterns as the survey biomass (Figure 12.4).

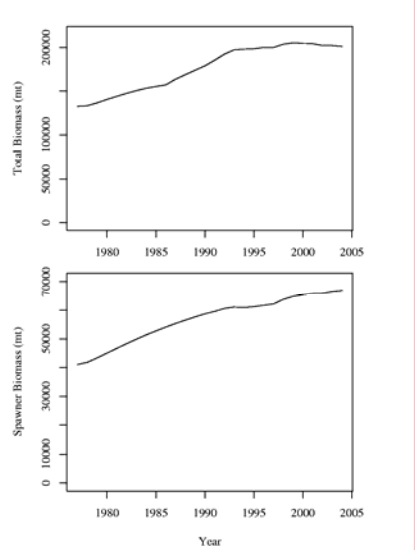


Figure 12.4. Total and spawner biomass for BSAI northern rockfish

Age/size compositions The estimated age at 50% selection for the survey and fishery selectivity curves were 7.07 and 7.64 years, respectively. A higher age at 50% selectivity would be reported if a restraint in the assessment model was not in place.

Recruitment There is little information to discern strong recruitments in the early years of the model, although relatively strong year classes are observed in 1984, 1988,-1989, and 1993-1994.

<u>Habitat considerations</u> Little information exists on the habitat use of northern rockfish. Carlson and Staty (1981) and Kreiger (1993) used submersibles to observe that other species of rockfish appear to use rugged, shallower habitats during their juvenile stage and move deeper with age. Although these studies did not specifically observe northern rockfish, it is reasonable to suspect a similar ontogenetic shift in habitat. Length frequencies of the Aleutian Islands survey data indicate that small northern rockfish (< 25 cm) are generally found at depths less than 100 m. The mean depth of northern rockfish from recent AI trawl surveys has ranged between 100 and 150 m. There has been little information identifying how rockfish habitat quality has changed over time.

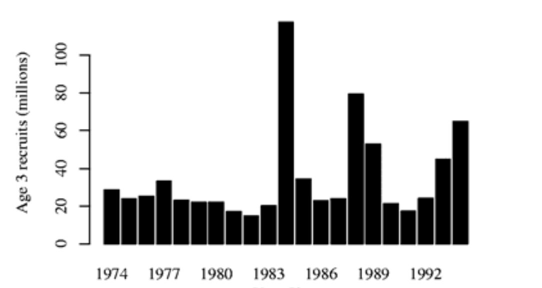


Figure 12.12. Estimated recruitment (age 3) of BSAI northern rockfish

Specification process Rockfish management categories in the domestic fishery since 1991 have included multiple species. Beginning in 1991, the POP complex was subdivided into separate groups to protect against overfishing of higher valued component species. From 1991 to 2000, northern rockfish harvest in the EBS was included in the "other red rockfish" category, whereas harvest in the Aleutian Islands was reported in a "northern/sharpchin" category. In 2001, northern rockfish in the EBS were managed in a "northern/sharpchin" category, matching the species complex in the AI, and the management was combined across the BSAI area. In 2002, sharpchin rockfish were dropped from the complex because of their sparse catches, leaving single-species management category of northern rockfish combined for the BSAI. Northern rockfish may only be landed as bycatch at or below specified levels (maximum retainable allowances (MRA)) in other directed fisheries (Table 1).

Northern rockfish is managed under a single species TAC, combined for the BSAI that uses one model for BSAI northern rockfish that produces a single ABC and OFL level for the BSAI stock. The BS portion of the combined stock contributes a very small percentage (about 4 percent). It is managed under Tier 3.

Small quotas Partitioning TACs for some rockfish species into Bering Sea versus Aleutian Island region TACs would result in TACs that would be too low to manage efficiently. As described by NMFS staff (see Appendix A), breaking out BSAI rockfish species often has complex implications. When the species constitutes a small portion of an assemblage, the stock assessment often yields a very low OFL, ABC, and subsequent TAC for that species. BSAI rockfish species are not a target species in volume, but they may (or may not) be of high value as an incidental catch. The tendency of fishermen to maximize the catch of a low volume but highly valued species may exacerbate problems associated with OFLs. Current fishing practices may not be selective enough to prevent their capture. The OFL for a new species category may be limiting enough that the TACs for some higher volume target groups cannot be fully harvested. IFQ halibut and sablefish fisheries are particularly vulnerable to incidentally caught species that have relatively low OFLs. For example, if the catch of an incidental species approaches the OFL, a widespread closure of the IFQ fishery could occur prior to the participants taking their individual quotas.

In addition to breaking out a single species from a group, many of the same issues apply when species are subdivided by TAC, ABC or OFL within subareas or regulatory areas. For example, if a rockfish species is subdivided by area into separate ABCs and OFLs, one of the subareas may have an ABC and OFL combination that could be highly restrictive to large target fisheries that incidentally take that species.

The issues associated with managing new small quotas within the larger groundfish fisheries are magnified in the CDQ program. The struggle to manage small quotas for some species within the CDQ program has been long identified as a particular problem. When new BSAI species are identified for management, CDQ groups may receive allocations of as little as one or two metric tons. The expectation that CDQ groups should be able to harvest their target species, while not exceeding very small allocations of non target species, may be difficult to realize.

The 'squid box' in the CDQ pollock trawl fishery and the 'skate box' in the Pacific cod hook-and-line fishery in the BSAI are well documented examples. The Council recommended different approaches for relaxing the restrictions that accounting for those (bycatch) species imposed on the attainment of the remaining (target) CDQ allocations. Squid were removed from the CDQ allocations of groundfish under a BSAI FMP amendment. Individual CDQ group allocations of 'other species' were pooled into a commonly held CDQ reserve to prevent skate bycatch by a single CDQ group would not exhaust its 'other species' allocation before its Pacific cod allocation could be harvested.

High discard rates Jane insert graphic

More than 90 percent of northern rockfish discards occur in the Atka mackerel trawl fishery. Discards exceeded 4,000 mt in 2003. This fishery has the highest amount and rate of rockfish discards in the North Pacific.

Management actions taken to improve northern rockfish management and management initiatives under development

Since 2001, northern rockfish were specified as a separate TAC category as described above. Spatial separation into separate area categories for the BS and AI has not been possible because poor survey coverage in the BS and AI trawl surveys and management impracticalities of small quotas (as described above). However, the movement from assemblage to single species management (not only for northerns, but all BSAI red rockfish) is a significant improvement in their management, as well as the development of an age-structured northern rockfish model and movement into Tier 3. When the text is expanded to include other rockfish species, I will discuss the change in the MRA for shortraker and rougheye.

Criticisms of northern rockfish management

Paul Spencer will provide

Responses to criticism of northern rockfish management

Paul Spencer will provide

Local depletion studies for northern rockfish

Priority ranking for depletion studies
1. Pacific Ocean Perch
2. Northern
3. Rougheye
4. Shortraker
5. Dusky
6 Remaining rockfish

Localized depletion is defined as the reduction in population size over a relatively small spatial area due to intensive fishing. Localized depletion is a potential conservation issue for rockfish because several species have been observed to be patchily distributed and stock structure could occur at relatively small spatial scales. This could affect local spawning populations greater than the overall population. For example, three genetically distinct stocks of POP have been observed off the coast of British Columbia (Wither et al. 2001). Other rockfish species, such as rougheye and shortraker rockfish, have adult phases that appear strongly associated with rugged benthic habitats and appear relatively sedentary as adults. Genetic studies indicate that their genetic stock structure may occur at broad spatial scales that are consistent with management areas, although the management units may have a smaller spatial scale than the genetic population structure. Apart from genetic information known only for some species, much is unknown about the spatial structuring of rockfish populations.

Most rockfish species, including northern rockfish, may be susceptible to localized depletions. Localized depletion is dependent upon fishing intensity of sufficient strength to reduce the population size. The best information available to prioritize studies is based on species that are targeted by a fishery followed by those caught as bycatch in other fisheries, partly based on better data in target fisheries. Typically, analyses of localized depletion use the catch-per-unit-effort (CPUE) from directed fishing as an index of abundance, but in the absence of directed fishing one would not necessarily expect the changes in CPUE to directly reflect changes in abundance. Spencer and Reuter (2005) concluded that the available data do not indicate significant declines in CPUE that would suggest localized depletion. In other words, the observed data provides a fairly good description of the true fishery characteristics, which were limited in the number of tows for any given spot. While it is true that it will be more difficult to observe a statistically significant result with limited data, the fact that they did not observe localized was not the result of insufficient data. .

Catch records for rockfish species only caught intermittently in the fisheries do not allow for a depletion study on small temporal and spatial scales. When the temporal scale becomes too large, the certainty of any evidence of localized depletion decreases. For example, the catch of northern rockfish in the Aleutian Islands is obtained predominately in the Atka mackerel fishery, and CPUE declines could either reflect declines of northern rockfish biomass or the increased use of areas where northern rockfish bycatch is minimized. One could potentially use a survey to detect localized depletion of bycatch species, but the sampling intensity of the trawl surveys is not sufficient to detect population declines within small areas. There are localized areas where high catches of some other rockfish species have occurred, such as rougheye rockfish in the Seguam area, but the lack of a target fishery and the relatively few hauls where rougheye are the most dominant rockfish in the catch impedes a quantitative approach to estimation of depletion.

Data needs for improved science and management of northern rockfish Rockfish, especially those that occupy the edge of the continental slope are often patchy and difficult to sample. The spatial distribution of some species is highly aggregated, which makes them particularly vulnerable to overfishing. An accurate survey biomass estimate for rockfish is needed to properly assess the status of the stock. However, the AFSC groundfish trawl surveys have not adequately sampled some species of slope rockfish, due to their highly aggregated distribution. This poor sampling is a result of both the small area inhabited by slope rockfish when compared to more uniformly distributed flatfish, and because much of its primary bottom habitat is inaccessible to standard survey gear (Lunsford 1999). Large fluctuations in survey biomass estimates occur as a result with extremely wide confidence intervals. The species that are most aggregated are redstripe, harlequin, sharpchin, and northern rockfish.

Slope survey results have not been used in the BS due to high measurement error, relatively small population sizes compared to the AI biomass estimates, and lack of recent surveys. The slope survey has a minimum depth of 200 m, which excludes some habitat for northern rockfish. As in the BSAI POP assessment, the slope survey results are not used for assessing northern rockfish biomass and the 1991-2004 Aleutian Islands trawl surveys are used as an index of the BSAI population. As it turns out, northern rockfish along the EBS slope are not very well sampled by either survey because their depth distribution straddles the boundary between the BS shelf and slope surveys.

Adaptive cluster sampling (ACS, Thompson 1990) is one technique that has been examined to improve the precision of biomass estimates for Pacific ocean perch (POP). The general idea of this approach is that when high density stations are encountered in a random survey, the neighborhood of that station is intensely sampled. If the species is highly aggregated, adaptive cluster sampling should result in a qualitatively better understanding of rockfish clusters as well as a more precise biomass estimate. Field studies of ACS for POP showed some improvement in precision, but perhaps not enough to justify the additional sampling effort (Hanselman et al. 2003). The design might work better on more rare or aggregated species such as harlequin rockfish, but the species is unlikely commercially important enough to warrant additional sampling effort.

Other recent work has examined the utility of collecting ship-board hydroacoustic data in conjunction with fishing and surveys (Hanselman and Quinn 2004). Several applications of the hydroacoustic data showed that hydroacoustics may be a useful tool to improve precision of survey estimates either through double sampling or using hydroacoustic results to stratify the sampling areas.

Future work for sampling rockfish should concentrate on obtaining more samples within their habitat range, perhaps with a vessel equipped with a more rugged net to assess areas that previously only hydroacoustics have sampled. This would allow a more random and representative sample of rockfish habitat and their distribution than the current gear allows. Additional traditional sampling in the strata with the largest variances would be a simple but effective aid in increasing survey precision.

Overall, rockfish surveys in the short term would benefit from an increase in traditional survey effort in their specific depth and habitat range. Long term goals of rockfish survey design might include a rockfish-specific survey, hydroacoustic biomass estimation, and utilization of an *in situ* tagging device to learn more about migration, natural mortality and other life history parameters.

iii. Step 3. Possible management measures Under Alternative 4b, all assemblage species would continue to be managed with a quota. Prohibited species status would be declared at the start of the fishing year for those species whose quota is insufficient to support directed fishing. This means that those species may only be landed as bycatch at or below specified levels (maximum retainable allowances (MRA)) in other directed fisheries (Table 2). All species would be subject to <u>at least</u> an MRA to discourage targeting.

The Council could recommend additional management measures to enhance the protection of some rockfish stocks. These would be examined on a case by case basis. Additional management measures could be designed to apply to the criterion of highest concern. For example, assemblage species with an extremely restricted range may receive additional protection from fishing effects by closing part or all of the range to fishing (with certain gear types, during certain seasons, as appropriate). Alternatively, a more evenly distributed species with sensitive life history traits and a severely declining abundance trend might be managed with a bycatch cap to limit take to a known amount each year.

These additional management measures would be above and beyond the MRA and monitoring already in place for all non-targets. There will always be reasons that necessitate management changes, such as uncertainty and new information, but the appropriate level of protection for assemblage species should be provided in a way that is more flexible, effective, efficient, and responsive to their sensitivity. For example, protection could be provided by time/area closures, gear restrictions/modifications, size limits, or bycatch allowances.

For some species, monitoring only would occur. Monitoring would include both fishery dependent and fishery independent elements. NMFS staff would monitor survey biomass and or abundance trends, fishery catch-per-unit-effort trends, and fishery retention rates at the lowest practical taxonomic level (although bycatch MRAs might be set at higher, complex levels). Representative species from an assemblage would be monitored for changes in length composition or age composition if ageing methods exist. Improvements to species identification, which are already in progress in the observer program, would be required for this program to succeed.

The sensitivity of a stock to fishing pressure may have nothing to do with whether or not it is targeted by a fishery. Management measures beyond traditional TAC-setting rules could also be applied to sensitive core stocks. Staff has suggested a revision to Alternative 4b language to provide for additional management measures to enhance protection of sensitive core stocks.

Part 2. Identify a *policy* to outline a *process* based on scientific *criteria* to determine when sufficient data are available to move species ~~between the core stock and stock assemblage categories~~ <u>from an assemblage to a core stock</u>

Incomplete – committee should discuss proposed staff edits to language.

Table 1 (Part 679–BSAI Retainable Percentages)

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 non-groundfish species		20	20	20	20	35	20	20	20	20	1	1	2	5	20	2	20

NOTES to Table 2	
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.

4. References

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5. APPENDIX 1. Alternative 4a

(This alternative originally was developed by the ad hoc working group at the direction of the Council to revise management of non-target species to address the perception by scientists that the current TAC specification process may not adequately protect non-target species that are managed within groups within the "other species" category.)

Step 1. Separate groundfish species into:
- (a) target species category, if there is an intent by the commercial fishery to catch and market it
- (b) non-target species category, if there is no intent to catch/market it would contain either single species or complexes;

Step 2. Sort:
- (a) single species into target category if targeted/marketed and there is adequate information for assessment and management
- (b) all remaining single species and all species complexes;

Step 3. Characterize non-target species as:
- (a) sensitive
- (b) non-sensitive;

Step 4. Manage:
- (a) target species category by specifying optimum yield and overfishing definitions relative to MSY (status quo);
- (b) non-target species category by protecting them from negative fishing effects of the target groundfish fisheries by either or both:
  1. management measures (maximum retainable allowances, closed areas, seasonal apportionments, etc.)
  2. monitoring only;

Step 5. Establish a mechanism to transition species between categories;

Step 6. Create separate fishery management units in the groundfish FMPs for target and non-target species categories.

<u>What we lose by not adopting Alternative 4a.</u> All current rockfish and flatfish complexes would be eliminated in the following manner. An intended target species (or multiple species if appropriate) from each complex would be split out to the individual species level. The remainder of the complex will go into the non-target category and be managed under MRAs or other management measures. It appears that some complexes, like GOA Other Slope Rockfish, are entirely non-target species. This resulted from a long history of splitting out target species. These complexes would be moved to the non-target species category. If the remaining non-target species are caught together in real life then the MRA may be set at the complex level; if they are not then non-target catch complexes should be reorganized based on which species are actually caught together as bycatch of target fisheries to determine what MRA(s) should be by target fishery.

The working group may determine that some species currently managed with a single species TAC are not in fact the intended target of any fishery. BSAI Alaska plaice is one example. The working group would not recommend that a TAC be set for these species, and annual stock assessments would not be necessary. AFSC staff may continue to prepare full age structured stock assessment for non-target species, but highest priority would be given to improving stock assessments for intended target species (e.g., shortraker and rougheye rockfishes), for those non-target species proposed for target fishing, or for those non-target species whose ecosystem role is deemed important to assess annually (e.g., Arrowtooth flounder).

All groups in the non-target category would be monitored at the most detailed practicable taxonomic level in surveys and at some pre-agreed grouping level in fisheries. This would depend on initial priorities set for monitoring certain groups based on either future yield potential, sensitivity to harvest, or other ecological reason. Monitoring may include age-structured population modeling for non-target stocks of interest, and would not necessarily represent a diminished amount of scientific information about the stock. In contrast to the current non-specified category, reporting of catch at some level would be required. All species would be subject to at least an MRA to discourage targeting, but the proposed system would allow for some use of incidental catch and some limited market exploration. The idea is to have new fisheries develop with constraints until sufficient data is collected to determine an appropriate harvest limit. The group understands that some non-target species are more sensitive to unintended negative fishing effects than others. Thus, it attempted to define criteria for sensitivity and additional management measures to protect more sensitive species. These additional management measures would be above and beyond the MRA and monitoring already in place for all non-targets. There will always be reasons that necessitate management changes, such as uncertainty and new information, but the appropriate level of protection for non-target species should be provided in a way that is more flexible, effective, efficient, and responsive to their sensitivity. For example, protection could be provided by time/area closures, gear restrictions/modifications, size limits, or bycatch allowances. The sensitivity of a stock to fishing pressure may have nothing to do with whether or not it is targeted by a fishery. Management measures beyond our traditional TAC-setting rules could also be applied to sensitive target stocks.

6. APPENDIX 2. Fishery Management Unit

The Council has a responsibility to develop an FMP for each fishery under its authority that requires conservation and management. The management structure of an FMP, addressing both required and discretionary provisions under MSA, depends on how the fishery management unit (FMU) is described. A Council may develop management objectives for a fishery or portion of a fishery identified in the FMP, with advice from its scientific and public advisors. Target and other species are in the FMU (and are managed under an OFL). Prohibited and non-specified species have been determined not to be in the FMU (and are not managed under an OFL). Forage fish was identified as a model for proposals for non-target species management. It was not a category at the time of that legal determination, so a legal decision on that category has not been made. The forage fish category may not be considered part of the FMU because an OY is not specified for it.

It may be possible to define multiple FMUs within one FMP, for example one for optimizing yield and one for conserving non-targets, but this is still unclear. Identifying that species are not part of the target of a fishery does not mean they are not covered by an FMP. The MSA authorizes that MSY and OY requirements can be applied for a "fishery," however, it is currently applied at the individual stock level within a fishery. The Magnuson-Stevens Act also requires objective and measurable criteria for defining when a fishery is overfished, including an analysis of how the criteria were determined and the relationship of the criteria to the reproductive potential of stocks of fish in that fishery

7. APPENDIX 3. Technical components for defining sensitivity

Defining "data quality"

Survey data: Cover entire range of species (temporally and spatially)?
Survey cv within desired range (suggestion: 0.3 or less?) (see Table 1)
Biological collections (age, length, maturity, fecundity)

Fishery data: Adequate species identification in fishery catch?
Adequate observer coverage of fishery catching species?
Biological collections (age, length, maturity, fecundity)

Life history data: Estimates of vital parameters exist? Based on what?
M, maximum age, age and size at maturity, fecundity
Estimated from the population(s) in the FMP area? Recently?

Survey CVs as estimated for the 2001 Draft PSEIS

Flatfish and demersal groundfish top the list

Rockfish, Other species lower

Pelagics, Stocks in small areas lower

Species/Species group	Species Type	Area	Survey CV	Survey type
Rock sole	Flatfish	EBS	8%	BT
Pacific cod	Roundfish	EBS	9%	BT
Sablefish	Roundfish	GOA	10%	LL
Yellowfin sole	Flatfish	EBS	10%	BT
Arrowtooth flounder	Flatfish	GOA	9%	BT
Deepwater flatfish	Flatfish	GOA	9%	BT
Flathead sole	Flatfish	EBS	11%	BT
Alaska Plaice	Flatfish	EBS	12%	BT
Rex sole	Flatfish	GOA	9%	BT
Arrowtooth flounder	Flatfish	EBS	12%	BT
Flathead sole	Flatfish	GOA	12%	BT
Walleye pollock	Roundfish	GOA	19%	BT/EIT
Other rockfish	Rockfish	EBS	15%	BT
Shortspine thornyhead	Rockfish	GOA	13%	BT
Skates	Other species	GOA	13%	BT
Smelts	Other species	GOA	14%	BT
Shortraker/Rougheye	Rockfish	GOA	15%	BT
Shallow flatfish	Flatfish	GOA	15%	BT
Sculpins	Other species	GOA	15%	BT
Pacific cod	Roundfish	GOA	15%	BT
Walleye pollock	Roundfish	EBS	23%	BT/EIT
Squid	Other species	GOA	17%	BT
Other rockfish	Rockfish	AI	18%	BT
Walleye pollock	Roundfish	AI	19%	BT
Pacific Ocean perch	Rockfish	AI	21%	BT
Other flatfish	Flatfish	EBS	26%	BT
Other slope rockfish	Rockfish	GOA	21%	BT
Greenland turbot	Flatfish	EBS	31%	BT
Sharks	Other species	GOA	26%	BT
Other red rockfish	Rockfish	EBS	33%	BT
Sharpchin/Northern	Rockfish	AI	28%	BT
Pacific Ocean perch	Rockfish	EBS	35%	BT
Pacific Ocean perch	Rockfish	GOA	30%	BT
Shortraker/Rougheye	Rockfish	AI	32%	BT
Southeast Pollock	Roundfish	GOA	33%	BT
Atka mackerel	Roundfish	AI	38%	BT
Pelagic rockfish	Rockfish	GOA	39%	BT
Northern rockfish	Rockfish	GOA	41%	BT
Octopus	Other species	GOA	48%	BT

Defining "vulnerability:" Long lived, slow growing / maturing, low fecundity species
Specific habitat association and / or restricted range
Present or potential future economic value
Consistently associated / caught with abundant target species
Can rank vulnerability of species relative to one another

Quantitative methods for ranking vulnerability introduced by Jennings et al 1998, 1999; used by Frisk et al 2001 for elasmobranchs to guide management

More recently, staff has begun to think in terms of sensitivity (rather than vulnerability), which incorporates an even wider range of life history and fishery interactions for each species. AFSC staff has undertaken an assessment of sensitive v. non-sensitive species for all non-target species. We will review a draft report of sensitive and non-sensitive Bering Sea rockfishes in a separate document that will be reviewed by the committee at the May 31 meeting, and which will be incorporated into the final discussion paper for review in October 2005.

Defining Sensitivity: Is it vulnerable to fishing? – catch estimates
What is the ratio of catch to population abundance? – biomass estimates
Is this ratio a problem? – life history characteristics

Other BSAI Rockfish example

Name	Max age	Alverson Carney	CV B	Ratio C/B
Redbanded Edge of Dist. Low C & B	106	.03	.48	.47
Dusky	59	.06	.48	.08
Harlequin	47	.08	.48	.08
Sharpchin C & B	58	.06	.43	5.12
Yelloweye	118	.03	UNK	UNK

Assumptions: Alverson / Carney M = f (MaxAge)
Average catch is a reasonable estimate of expected bycatch of non-target in target fisheries.
Average catch/Average biomass is a rough approximation of Average fishing mortality
Ratio of Average Catch to Average Biomass is a rough approximation of fishing mortality rate in a stock that exhibits highly variable survey biomass.
$cv \approx 0.5$
$C / \bar{B} \leq M$
Dusky not vulnerable?
What to do with yelloweye and redbanded where catch and biomass very small? Sharpchin is a nearshore species and redbanded is at edge of range.

Conclusions: Alverson / Carney provides first approximation of M.
When species is reasonably assessed, definition of vulnerable can be a function of choices of representative life history.
When catches and biomass low difficult to determine vulnerability (e.g. sharpchin or redbanded rockfish).
Not sensitive because current resources needed to adequately assess this group would detract from others?
Definition of vulnerable can be a function of choices of representative life history.
If catch unknown – sensitivity unknown
Assemblage analysis?
Assume summer associations similar to other seasons.