Development of operational objectives for the southeastern Bering Sea ecosystem

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Introduction

According to the United Nations Convention on Biological Diversity, an ecosystem approach [to management, EAM] is *a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way* (http://www.biodiv.org/default.shtml). In the northeastern Pacific Ocean, contemporary conservation and management issues include fisheries, mariculture and ocean ranching, invasive species (including rats and foxes on the Aleutian Islands), preservation of heritage sites, coastal development, coastal erosion from rising sea level, oil and gas exploration and development, oil spill prevention and response, and risks associated with toxic waste sites from defunct military facilities. Among these concerns, management plans have been most fully developed for commercial fisheries. Therefore, while we maintain the broader view of EAM, we focus on fisheries management for the purposes of this workshop.

Traditional fisheries management compares the status of an exploited fish stock to the well-being of users of that resource. Since the 1990s, fisheries managers have been advised to broaden their scope of awareness beyond single-species considerations owing to a greater appreciation of the following (FAO, 2003):

- General poor performance of single-species fishery management worldwide;
- Heightened awareness of interactions among fisheries and ecosystems;
- Better understanding of the functional value of ecosystems to humans;
- Recognition of the wide range of societal objectives associated with marine fishery resources and ecosystems.

As a result, fisheries management has been moving slowly toward multispecies and ecosystem approaches. That is, within the broader context of EAM, fisheries have been shifting toward an ecosystem-based fisheries management (EBFM), also called an ecosystem approach to fisheries (EAF). An EAF *strives to balance diverse societal objectives by taking into account the knowledge and uncertainties of biotic, abiotic, and human components of ecosystems and their interactions and applying an integrated approach to fisheries within ecologically meaningful boundaries* (Garcia *et al.*, 2003).

An appreciation of diverse societal objectives recognizes that benefits arising from fish harvests form just one of the "services" that humans derive from marine ecosystems. Instead, an EAM approach strives to balance the suite of ecosystem services according to objectives and priorities set by society. Ecosystem services may be categorized into the following types (MEA, 2005):

- *Provisioning*: food, water, fuel, fiber, biochemicals, and genetic resources;
- *Regulating*: climate, disease, water purification, and floods;
- *Cultural*: spiritual, recreational, ecotourism, aesthetic, and educational;
- *Supporting*: necessary for production of all other ecosystem services, *e.g.*, primary production, nutrient cycling, and ecological value.

Making EAF operational

To make EAF operational, there is a need to establish a policy, management, monitoring and assessment framework for a system with measurable operational objectives. An operational objective might consist of a verb (*e.g.*, reduce), a specific measurable indicator (*e.g.*, bycatch mortality), and a reference point (*e.g.*, 1% of standing biomass) (Jamieson *et al.*, 2001). Indicators are used to quantify the performance of management with respect to these objectives (Fig. 1).

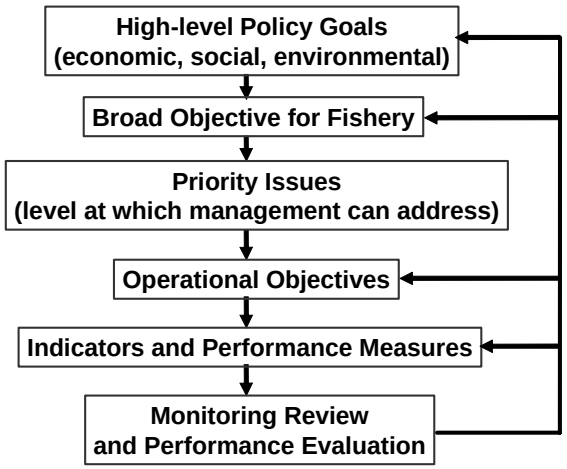

Fig. 1 Relationship between policy goals, broad fishery objectives, operational objectives, and indicators and performance measures for an ecosystem approach to fisheries (EAF). Adapted from FAO (2003).

The following is a simple example of how such a framework might be developed for a groundfish fishery. A high-level policy goal is to maintain ecosystem structure and function. While noble and perhaps somewhat naive, this goal is too vague to allow if unequivocal determination has been attained. So a broad objective for a groundfish fishery, that is consistent with the policy goal, may be to maintain the community of predators within ecologically viable levels. Some might consider that this objective is still too broad to allow definitive measurement of management success. So operational objectives with increasing levels of specificity can be developed, such as maintaining the spawning biomass of the predators (*e.g.*, sharks, cod and halibut) at 35% or more of their unfished levels while banning the harvest of forage species (*e.g.*, capelin, eulachon, and sand lance) to maintain natural fluctuations in prey abundance. An objective becomes operational only if there are agreed-upon target and limit reference points associated with the objective, as well as a routinely monitored indicator that, when compared to the limit and target reference points, provides a performance measure showing how well management is achieving the objective (Fig. 2).

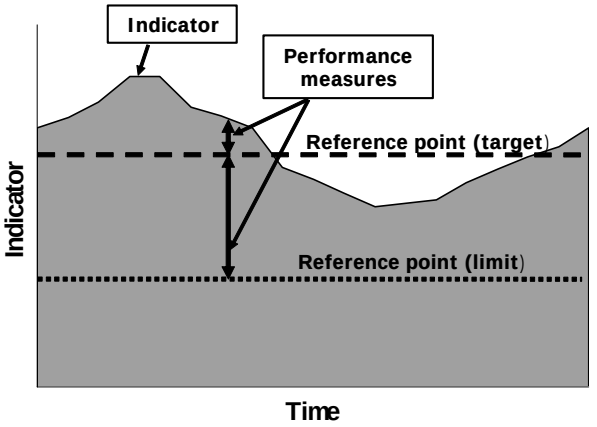

Fig. 2 Illustration of an indicator, reference points, and performance measures relative to an ecosystem operational objective. Modified after FAO (2003).

Ecosystem considerations in fisheries management in the eastern Bering Sea

The U.S. North Pacific Fishery Management Council (NPFMC) recommends regulations for federally managed fisheries in the U.S. Exclusive Economic Zone (EEZ, 3–200 nautical miles, nm) in the Gulf of Alaska, Aleutian Islands, and eastern Bering Sea; federal regulations are implemented and enforced by NOAA/Fisheries. For state-managed fisheries, regulations are set and fisheries are managed by the Alaska Board of Fisheries and Alaska Department of Fish and Game, respectively. The State of Alaska manages fisheries within state waters (0–3 nm), and management authority for some fisheries in the EEZ is delegated to the State of Alaska (*e.g.*, crabs, lingcod, and some rockfishes in the Gulf of Alaska), whereas still others (*e.g.*, crabs in the Bering Sea and Aleutian Islands, and scallops and salmon throughout Alaska) are managed under cooperative state–federal management plans.

Fisheries off the coast of Alaska tend to be conservatively managed, and exploited fish stocks have fared much better in this region than many other areas of the world (POC, 2003). NPFMC has a long track record of setting precautionary catch limits (Witherell *et al.*, 2000; Witherell, 2004). Conservative estimates of overfishing limits (OFLs) and acceptable biological catches (ABCs; where ABC < OFL) are recommended to NPFMC by their Scientific and Statistical Committee (Fig. 3). Moreover, total allowable catches (TACs) are always set at or below ABC levels and fishery removals are managed in-season so as not to exceed the TACs (Fig. 3). In addition, total catch for the Bering Sea/Aleutian Islands groundfish complex is constrained to 2 million mt, so that the sum of TACs for individual groundfish species is considerably less than the sum of ABCs. This limit provides a buffer against the uncertainties of single species harvest targets.

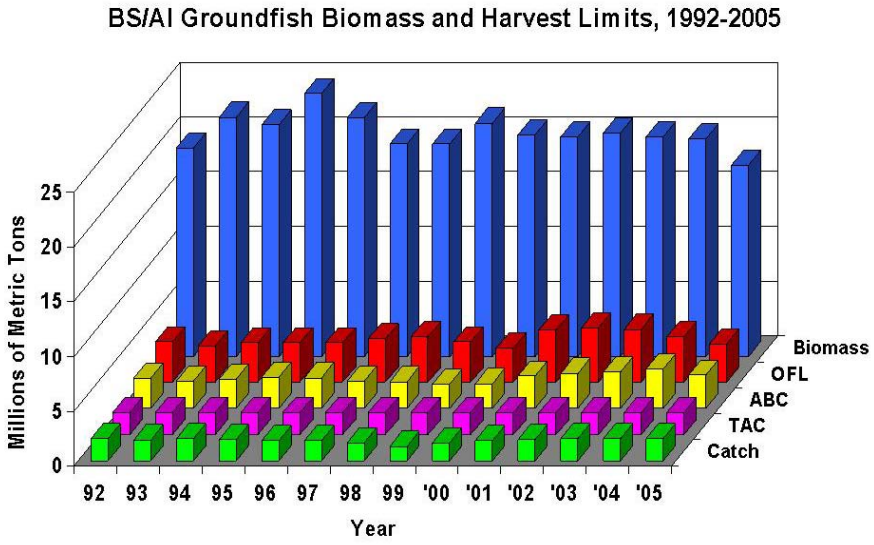

Fig. 3 Estimates of biomass, overfishing level (OFL), acceptable biological catch (ABC), and total allowable catch (TAC), and actual catch in millions of tons for groundfish in the Bering Sea/Aleutian Islands (BSAI) region from 1992–2005 (source: NPFMC).

Other conservative single-species aspects of federal fishery management in Alaska include capacity reduction programs for most fisheries, individual transferable quotas for crab, sablefish and halibut, and excellent data-collection programs, including fishery-independent surveys and an at-sea observer program. Likewise, the State of Alaska constrains groundfish and invertebrate catches by guideline harvest levels (similar to TACs) and does not allow commercial fisheries to be prosecuted if stocks fall below a precautionary threshold level of abundance.

NPFMC incorporates many ecosystem considerations into fishery management (Witherell *et al.*, 2000; Witherell, 2004). Examples include limits on bycatch and discards in the Bering Sea groundfish fisheries. Prohibited species catch (PSC) limits are established as a small fraction of crab and herring biomass and chinook and chum salmon abundance; when PSC limits are attained, specific areas close to fishing (Witherell and Pautzke, 1997). Other ecosystem approaches include large area closures to bottom trawling and dredging to protect corals and sponges, crabs, and other bottom habitats. Ninety-five percent of the Aleutian Islands management area (~277,100 nm^2) has been closed to bottom trawling since 2005 (Witherell, 2005). Some state waters have been closed to trawling by the State of Alaska since the late 1960s in efforts to protect crab habitats. Presently, nearly all state waters in the Gulf of Alaska and southeastern Bering Sea are closed to trawling, where only fixed gears (*e.g.*, pots, longlines, and jigs) are allowed for groundfish (Kruse *et al.*, 2000). Other ecosystem approaches

include numerous measures to protect Steller sea lions and reduce seabird bycatch, full retention standards for pollock and cod fisheries to reduce discards, and a prohibition on forage fish fisheries throughout the Gulf of Alaska, Aleutian Islands, and Bering Sea, with the exception of ongoing commercial fisheries for Pacific herring.

Need for further development of EAF for the Bering Sea

Despite the healthy status of many fished stocks, some fish and wildlife populations have undergone significant declines in recent decades. In 2004, no overfishing occurred in any of the 58 assessed marine fish and invertebrate stocks, but four of 32 assessed stocks were determined to be overfished (NMFS, 2005). The four stocks listed as overfished in 2004 were snow crabs (Bering Sea), blue king crabs (Pribilof Islands), blue king crabs (St. Matthew Island), and Tanner crabs (eastern Bering Sea). As many scientists attribute the cause of these low crab abundances to climate change, the term "depleted" may be more appropriate than "overfished." In the Gulf of Alaska, where the State of Alaska manages invertebrate stocks without a federal fishery management plan, most crab and shrimp stocks collapsed in the 1980s, and abundance continues at low levels despite fishery closures for more than 20 years (Kruse *et al.*, 2000). Significant declines in great whales, the western stock of Steller sea lions, fur seals, sea otters, and some seabirds, such as spectacled eider and Steller's eider, are of much concern. Whereas the role of humans is clear in some declines (*e.g.*, historical whaling, predation of seabird eggs by human-introduced rats and foxes on Aleutian Islands), others are less clear, but may involve a stronger role of climate (*e.g.*, recent decline of fur seals, lack of recovery of crabs and shrimps). A better understanding of the roles of humans and climate on these changes is necessary to strengthen EAF, refine management objectives, and to develop useful indicators, reference points, and performance measures.

Goals and objectives for the Bering Sea

In 2004, the National Marine Fisheries Service (NMFS) completed an Alaska Groundfish Fisheries Programmatic Supplemental Environmental Impact Statement (PSEIS), a comprehensive assessment of the overarching conservation and management policies and objectives of the Alaska groundfish fishery management plans (NMFS, 2004). This PSEIS assessment was conducted through the environmental review process established by the National Environmental Policy Act. Original, revised, and final versions of PSEIS were developed and reviewed during a series of public hearings, as well as during meetings of NPFMC from 2001 to 2004. As a consequence, NPFMC recommended amendments to the fishery management plans for the Bering Sea/Aleutian Islands and Gulf of Alaska groundfish fisheries. The revised plans include a high-level policy statement, a broad goal and objectives for the fishery, a set of priority issues, and a more specific set of objectives within each priority issue (NPFMC, 2005; see Appendix 1 excerpted from the revised fishery management plan for the Bering Sea/Aleutian Islands).

NPFMC's high-level policy statement for both the Bering Sea/Aleutian Islands groundfish fishery management plan and Gulf of Alaska fishery management plan 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.

NPFMC developed a set of broad objectives for the fishery, which are to:

1. provide sound conservation of the living marine resources;
2. provide socially and economically viable fisheries for the well-being of fishing communities;
3. minimize human-caused threats to protected species;
4. maintain a healthy marine resource habitat; and
5. incorporate ecosystem-based considerations into management decisions.

The Council identified nine priority issues:

1. prevent overfishing;
2. promote sustainable fisheries and communities;

3. preserve the food web;
4. manage incidental catch and reduce bycatch and waste;
5. avoid impacts to seabirds and marine mammals;
6. reduce and avoid impacts to habitat;
7. promote equitable and efficient use of fishery resources;
8. increase Alaska Native consultation;
9. improve data quality, monitoring and enforcement.

Within these nine issues, 45 specific objectives (*i.e.*, "tasks") were adopted and grouped into those already included in the groundfish management program, those related to actions currently under Council consideration, those related to actions currently on hold or not initiated, and those that apply to all management actions (see Appendix 2 for details). NPFMC has developed a work plan to address these priority issues and objectives (Appendix 3). Progress on the work plan is reviewed during each Council meeting.

Following the approach recommended during a workshop on objectives and indicators in Canada (Jamieson *et al.*, 2001), for purposes of our workshop, we will not consider issues that primarily concern *economic and social dimensions of human use* (*i.e.*, issues 2, 7, 8, and 9). Instead, we focus on the remaining five issues that address *conservation of species and habitats* (*i.e.*, issues 1, 3, 4, 5, and 6).

Priority conservation issues with examples of operational objectives and indicators

The following are the five broad priority conservation issues identified by NPFMC. For each conservation issue, an example of an hypothetical operational objective and an associated indicator is provided.

Prevent overfishing

- *Operational objective:* maintain harvest rates below those defined to be overfishing, F_{OFL}, for each exploited fish and invertebrate stock. Whereas the exact definition and value of F_{OFL} varies by stock based on the level of available data and stock-specific life history parameters, for most groundfish stocks managed by NPFMC, F_{OFL} is based on $F_{35\%}$, a rate that will, on average, reduce spawning stock biomass to 35% of the unfished level.
- *Indicator:* estimated annual fishing mortality based on the sum of landings, discards, and bycatch mortality divided by fishery-independent estimates of stock biomass.

Preserve the food web

- *Operational objective:* do not "fish down the food web" by maintaining trophic-level balance in the eastern Bering Sea relative to the mean trophic-level range (3.32 to 3.77, mean 3.61) observed during the base period, 1954–1984.
- *Indicator:* estimated annual mean trophic level of the catch of all groundfish and crabs from the eastern Bering Sea.

Manage incidental catch and reduce bycatch and waste

- *Operational objective:* reduce discarded bycatch by 40% from levels estimated from 1994–1997.
- *Indicator:* estimated discards as a percentage of total groundfish catch.

Avoid impacts to seabirds and marine mammals

- *Operational objective:* reduce total seabird bycatch on longline vessels by 30% from levels from 1994–1997.
- *Indicator:* Estimated seabird bycatch based on counts on vessels with observers extrapolated to the total longline fleet based on the proportion of observed to estimated total fishing effort.

Reduce and avoid impacts to habitat

- *Operational objective:* Reduce bottom habitat disturbance by 25% from the base period 1990–1999.
- *Indicator:* annual bottom trawl effort (days fished).

Food for thought: Input from two pre-workshops on objectives for Alaska

In preparing for the Indicators workshop in Seattle, two preliminary events were held, one on January 25, 2006, in Anchorage and the other on February 8, 2006, in Seattle. The former was held as an afternoon session at the conclusion of the annual *Marine Science in Alaska* Symposium and the latter was held as an evening session during the meeting of NPFMC. The first workshop was attended by approximately 75 participants, whereas the latter was attended by 20 participants.

A report on these two workshops was prepared by Gordon Kruse and has been posted on the PICES website at http://www.pices.int/projects/Bering_Indicators/project_documents.aspx for this workshop. However, a few of the more intriguing comments and questions are:

- We know the Bering Sea is a dynamic system and we also know that some reference points (*e.g.*, crab biological reference points) are not always robust, so how do we manage for performance measures in a dynamic system? The idea to "maintain" might not be the appropriate term.
- Objectives that include the phrase "to maintain" and those dealing with "ecosystem structure" are vague. There is a need to consider ecosystem states that may change over time (multiple states of the system) and there is a need to allow ecosystem indicators to fluctuate over time. There has been considerable work on the benthic intertidal zone that indicates the existence of multiple steady states.
- Consider species that are indicators of various kinds of ecosystem change: secular, cyclical, and decadal.
- Consider the possibility that indicators themselves may change. For instance, if sea ice ultimately disappears from the Bering Sea, it would no longer be a useful indicator for the Bering Sea, but could remain useful for the Arctic Ocean.
- Often we can only see ecosystem shifts in hindsight (*i.e.*, note that we are still arguing over the last El Niño), so it may be naive to say when we see an ecosystem change we will respond accordingly.
- There is a focus on the use of single, sentinel species as indicators of ecosystem-level changes. It may be useful to broaden our consideration by looking at aggregate indicators, such as the biomass of a class of consumers.
- We are entrenched in methods that try to maintain the mean but eliminate the variance. What if the most important feature for sustaining variability is maintaining the variance and not the mean?
- It is important to consider the need to examine aspects of variability over time. Consider focusing on things for which we understand the variance structure well.
- Consider diversity *versus* richness as an indicator. Also, consider the spatial distribution of biodiversity.
- Are there desirable upper limits on species, such as particular marine mammal abundances? For example, how high does arrowtooth flounder need to reach to trigger a halt to the pollock fishery or to hold the fishery harmless for their crab and halibut bycatch to foster removal of arrowtooth flounder from the system?
- Consider statistical *versus* functional methods to render indicators. For the latter, consider exploring groupings of species in the system by functional groups, such as winter spawners *versus* summer spawners, or predators of copepods *versus* predators of other plankton, *etc*.
- Consider using species with which we do not interact directly – *e.g.*, walrus in the Bering Sea that feed on clams – as indicators. Then, use these species to compare to those species that are affected by fisheries to try to sort out our effects.
- There are other views regarding the role of the human population in the system, such as Chuck Fowler's (NMFS/National Marine Mammal

Laboratory) approach that argues that harvests are an order of magnitude too high relative to other similar trophic-level consumers.
- Some indicators are common across systems. Consider looking at degraded systems to see what indicators may have shown a change in those systems and adopt those.
- Consider focusing on indicators that motivate management decisions. Sea ice indicators are nice, but what management decision hinges on this indicator?

Opportunity: Development of a Fishery Ecosystem Plan for the Aleutian Islands

Since 2005, NPFMC has been considering a Fishery Ecosystem Plan (FEP) for the Aleutian Islands management area as a more explicit EAF. NPFMC has committed to developing FEP, and has created a scientific Ecosystem Team to assist with its formulation.

Interest in establishing the first North Pacific FEP in the Aleutian Islands stems from several considerations. The area has attracted more interest in recent years concerning fisheries for walleye pollock, Pacific cod and Atka mackerel. To date, the Aleutian Islands has been lumped together with the Bering Sea under one fishery management plan for groundfish, however, some evidence suggests that stock structure for some commercial species may require separate management units.

Also, in recent years, NPFMC has recognized the Aleutian Islands as a region containing unique ecological values that the Council wishes to preserve. The Aleutian Islands have been a focus for Steller sea lion protection measures and conservation of benthic habitats to protect coldwater corals and sponges.

The Aleutian Islands ecosystem was the focus of a special issue of the journal *Fisheries Oceanography* (Schumacher *et al.*, 2005). Many papers in this issue indicated that the Aleutian Islands themselves may involve more than one region. For example, the Aleutian passes east of Samalga Pass are more shelf-like in nature, whereas those to the west are more oceanic. Significant differences in ecology are associated with these features.

The Aleutian Islands marine ecosystem remains an area of severely limited knowledge due, in part, to its remoteness. Schumacher and Kruse (2005) identified the need for increased funding for ecosystem research as well as the need to broaden management objectives to encompass a wider set of ecosystem services in an integrated ecosystem management plan. Quite possibly, timing may now be ripe for such progress.

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Appendix 1 Excerpt from Chapter 2 of the BSAI [GOA] Groundfish FMPs, "*Management Approach for the BSAI [GOA] Groundfish Fisheries*"

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 labelled 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.

Appendix 2 Management objectives from the groundfish FMPs.

Goal	**Objectives relating to actions already established as part of groundfish management program** (does not preclude further actions under these objectives)	**Objectives relating to actions currently under Council consideration**	**Objectives relating to actions that are on hold from Council consideration, or have not yet been initiated**	**Objectives relating to considerations that are applied to all management actions**
Prevent Overfishing	2. Use existing OY caps. 3. Specify OY as a range.	*4. Periodic reviews of F_{40} and adopt improvements. *5. Improve management through species categories.		1. Adopt conservative harvest levels
Promote Sustainable Fisheries and Communities				6. Promote conservation while providing for OY 7. Promote management measures that avoid social and economic disruption 8. Promote fair and equitable allocation 9. Promote safety
Preserve Food Web	12. Limit harvest on forage species.	*10. Develop indices of ecosystem health. *11. Improve ABC calculations to account for uncertainty and ecosystem.		13. Incorporate ecosystem considerations in fishery management
Manage Incidental Catch and Reduce Bycatch and Waste	14. Continue and improve current incidental catch and bycatch program. 18. Continue to manage incidental catch and bycatch through seasons and areas. 19. Account for bycatch mortality in TAC accounting. *20. Control prohibited species bycatch through PSC limits.	*15. Develop incentive programs for bycatch reduction. *17. Develop management measures that encourage techniques to reduce bycatch.	16. Encourage research for non-target species population estimates.	21. Reduce waste to biologically and socially acceptable levels
Avoid Impacts to Seabirds and Marine Mammals	22. Continue to protect ESA-listed and other seabirds. *23. Maintain or adjust SSL protection measures.	24. Encourage review of marine mammal and fishery interactions.		

Appendix 2 Continued

Goal	Objectives relating to actions already established as part of groundfish management program (does not preclude further actions under these objectives)	Objectives relating to actions currently under Council consideration	Objectives relating to actions that are on hold from Council consideration, or have not yet been initiated	Objectives relating to considerations that are applied to all management actions
Avoid Impacts to Seabirds and Marine Mammals	25. Continue to protect ESA-listed and other marine mammals.			
Reduce and Avoid Impacts to Habitat	27. Identify EFH and HAPC, and mitigate fishery impacts as necessary. *29. Encourage research on baseline habitat mapping.		*26. Review and evaluate efficacy of habitat protection measures for managed species. 28. Develop MPA policy. *30. Develop goals and criteria for MPAs; implement as appropriate.	
Promote Equitable and Efficient Use of Fishery Resources		*32. Maintain LLP and initiate rights-based management programs.	33. Periodically evaluate effectiveness of rights-based management programs.	31. Provide economic and community stability through fair allocation 34. Consider efficiency when adopting management measures
Increase Alaska Native Consultation			36. Consider ways to enhance local and traditional knowledge collection. 37. Increase Alaska Native participation in fishery management.	35. Incorporate local and traditional knowledge into fishery management
Improve Data Quality, Monitoring, and Enforcement		*38. Increase utility of observer data. *39. Develop equitable funding mechanisms for the NPGOP.	*40. Increase economic data reporting requirements. *41. Improve technology for monitoring and enforcement. 42. Encourage development of an ecosystem monitoring program.	43. Cooperate with NPRB to identify needed research 44. Promote enforceability 45. Coordinate management and enforcement programs with Federal, State, international, and local partners

* indicates that objective is reflected on Council's work plan.

Legend:

ABC	acceptable biological catches	LLP	license limitation program	OY	optimal yield
EFH	essential fish habitat	MPA	marine protected area	PSC	prohibited species catch
ESA	Endangered Species Act	NPGOP	North Pacific Groundfish Observer Program	SSL	Steller sea lion
HAPC	habitat of particular concern	NPRB	North Pacific Research Board	TAC	total allowable catch

Appendix 3 NPFMC work plan (May 2006) for implementing groundfish management policy.

General Priority (in no particular order of importance)	Specific priority actions	Related to management objective:	Status *(updated 5-4-06)*	2006			2007				
				Jun	Oct	Dec	Feb	Apr	Jun	Oct	Dec
Protection of Habitat	a. complete EFH action as scheduled	**27**	**Amendment approved by Council**								
	b. recommend to NOAA Fisheries increased mapping of benthic environment	**29**	part of Council's research priorities, approved in April 06								
	c. develop and adopt definitions of MPAs, marine reserves, etc.	**30**	discussion paper presented in Feb 05								
	d. review all existing closures to see if these areas qualify for MPAs under established criteria	**30**	discussion paper presented in Feb 05								
	e. evaluate effectiveness of existing closures	**26**	discussion paper presented in Feb 05								
Bycatch Reduction	a. complete rationalization of GOA fisheries	**17 (32)**	rockfish demonstration program approved; analysis ongoing for broader rationalization								
	b. complete rationalization of BSAI non-pollock fisheries	**17 (32)**	partially addressed through IRIU Amd 80 (final action Jun 06); also Pacific cod sector allocations (approved)								
	c. explore incentive-based bycatch reduction programs	**15**	partially to be addressed through GOA rationalization and BSAI salmon vessel bycatch accountability analyses								
	d. explore mortality rate-based approach to setting PSC limits	**20**									
	e. consider new management strategies to reduce incidental rockfish bycatch and discards	**17**	revised ranking system for species of concern								
Protection of Steller Sea Lions	a. continue to participate in development of mitigation measures to protect SSL including development of an EIS and participation in the ESA jeopardy consultation process	**23**	consider revisions to SSL management measures in 2006-07								
	b. recommend to NOAA Fisheries and participate in reconsideration of SSL critical habitat	**23**	NMFS requested to re-initiate FMP-level Section 7 consultation on DoC species								
Prevent Overfishing	a. continue to participate in the development of "lumping and splitting" criteria	**5**	GOA 'other species' amd approved; 'other species' breakout analysis initiated								
	b. consider new harvest strategies for rockfish	**4**	MSE of rockfish harvest strategy								
	c. set TAC at or < ABC	**1**	**Amendment approved by Council**								
Ecosystem Management	a. revisit calculation of OY caps	**11, 4**	research paper presented to SSC in Feb 05								
	b. recommend to NOAA Fisheries and participate in the development and implementation of ecosystem indicators as part of stock assessment process	**10**	development ongoing; ecosystem SAFE to be presented each year; PICES workshop to develop indicators for the BS (Jun 06)								
Improve Data Quality and Management	a. expand or modify observer coverage and sampling methods based on scientific data and compliance needs	**38, 39**	analysis reviews alternatives; final action scheduled for Jun 06								
	b. develop programs for economic data collection that aggregate data	**40**	partially addressed through GOA rationalization								
	c. modify VMS to incorporate new technology and system providers	**41**	global VMS analysis initial review in Jun 06								

Legend:

ABC	acceptable biological catches
BS	Bering Sea
BSAI	Bering Sea/Aleutian Islands
EFH	essential fish habitat
ESA	Endangered Species Act
FMP	Fisheries Management Plan
GOA	Gulf of Alaska
IRIU	improved retention/improved utilization
MPA	marine protected area
MSE	Management Strategy Evaluation
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OY	optimal yield
PICES	North Pacific Marine Science Organization
PSC	prohibited species catch
SAFE	Stock Assessment and Fishery Evaluation
SSC	Scientific and Statistical Committee
SSL	Steller sea lion
TAC	total allowable catches
VMS	Virtual Monitoring System