North Pacific Fishery Management Council
Five-Year Research Priorities, 2010-2014
Adopted October 2009

Based on recommendations from its scientific committees, the Council has identified priorities for research in the next one to five years as those activities that are the most important for the conservation and management of fisheries in the Gulf of Alaska, Aleutian Islands and the eastern Bering Sea. This listing of priorities is intended for two purposes: 1) to meet the requirements of the revised Magnuson-Stevens Act for the Councils to identify research that is needed in the next 5 years, and 2) to provide guidance on research priorities to the research community and to funding agencies.

Immediate Concerns

I. Fisheries

A. Fish and Fisheries Monitoring

1. Non-recovering stocks. A pressing issue is why stocks have declined and failed to recover as anticipated (e.g., Kodiak red king crab, Pribilof Island blue king crab, Adak red king crab). Research into all life history components is needed to identify population bottlenecks, an aspect that is critically needed to develop and implement rebuilding plans.
2. Continue efforts to design and implement an improved observer delivery program that allows accurate and precise estimation of the catch by season and sector, including expansion of the program to previously unobserved vessels. (Also see Strategic Priority II.A.1).
3. Improvements are needed in in-season catch accounting for crab in non-directed fisheries with high incidental catch rates.
4. Improve species identification in catches by both processors and observers for priority species within species complexes. Methods that quantify and correct for misidentifications are desired.

B. Stock Assessment

1. Develop a size-based stock assessment model of Tanner crab in order to provide appropriate scenarios for evaluating and selecting a rebuilding strategy.
2. Improve handling mortality rate estimates. Improved understanding on the post-release mortality rate of discarded crab from directed and non-directed crab pot fisheries and principal groundfish (trawl, pot and hook and line) fisheries is required. The magnitude of post-release mortality is an essential parameter used in the determination of total annual catch used to evaluate overfishing and in stock assessment and projection modeling. For example, assess discard mortality rates of Tanner crab by size, month, sex, and fishery type.

C. Fishery Management

1. Analyses are needed of the ability of pollock harvesters to adapt their behavior to avoid Chinook and other salmon bycatch under various economic and environmental conditions and incentive mechanisms.
2. An evaluation is needed of economic effects from the recently adopted crab rationalization program on Gulf of Alaska coastal communities, including Kodiak. This includes understanding the economic impacts (both direct and indirect impacts) and how the impacts are distributed

among communities and economic sectors; conducting qualitative research to assess changes in community participation and effort in fisheries; and estimating net economic benefits.

3. As Kodiak is likely to be at the center of controversy over the probable consequences of Gulf rationalization, research should be designed to use Kodiak in addition to other Gulf communities as a case study in prospective analyses of the potential effects of Gulf rationalization options on fishing behavior, participation, and economic impacts.

II. Fisheries Interactions

A. Protected species

1. There is a need for studies of localized fishery-protected species interactions. Whereas global fishery control rules may generally prevent overfishing on a broad regional basis, non-random patterns of fishing may cause high rates of removals in local areas important to apex predators such as Steller sea lions, ice seals, northern fur seals, spectacled eider, Steller's eider, and short-tailed albatross. More studies are needed to fully evaluate potential local effects of fishing on other components of the ecosystem (e.g., marine mammals, seabirds, and the impact on benthic habitat and fauna) by bottom contact gear.

2. Further research is needed on gear modifications and fishing practices for reducing bycatch, particularly of PSC species (e.g., salmon).

III. Habitats

A. Evaluate habitats of particular concern:

1. Assess whether Bering Sea canyons are habitats of particular concern by assessing the distribution and prevalence of coral and sponge habitat, and comparing marine communities within the canyon areas, including mid-level and apex predators (such as short-tailed albatrosses) to neighboring shelf/slope ecosystems.

2. Assess the extent, distribution, and abundance of important skate nursery areas in the EBS to evaluate the need for designation of new HAPCs.

B. Baseline Habitat Assessment

1. Dynamic ecosystem and environmental changes, on a pace not observed in recorded time, are occurring in the northern Bering Sea and Arctic. Given the potential for fishery expansion into the northern Bering Sea, as well as considerations associated with establishment of the new FMP for the Arctic, assessment of the current baseline conditions is imperative. This effort should not supplant the regular surveys in the BSAI and GOA, which are of critical importance.

Ongoing Needs

I. Fisheries

A. Fish and Fishery Monitoring

1. Continuation of State and Federal annual and biennial surveys in the GOA, AI and EBS, including BASIS surveys and crab pot surveys, is a critical aspect of fishery management off Alaska. It is important to give priority to these surveys in light of recent proposed federal budgets in which funding may not be sufficient to conduct these surveys. These surveys provide baseline distribution, abundance, and life history data that form the foundation for stock assessments and the development of ecosystem approaches to management. These surveys are considered the highest priority research activity contributing to assessment of commercial groundfish fisheries off Alaska.
2. Plan and implement routine surveys into the northern Bering Sea and conduct baseline surveys of the Arctic Ocean. These surveys will become increasingly important under ongoing warming ocean temperatures, because range expansions of harvested fishery resources are anticipated. If range expansions occur, data will be needed to adjust standard survey time series for availability.
3. Continue and expand cooperative research efforts to supplement existing surveys to provide seasonal or species-specific information for use in improved assessment and management. The SSC places a high priority on studies that provide data to assess seasonal diets and movements of fish and shellfish for use in studies of species interactions in spatially explicit stock assessments.
4. For groundfish in general, and rockfish in particular, continue and expand research on trawlable and untrawlable habitat, to improve resource assessment surveys. For example, improved surveys, such as hydro-acoustic surveys, are needed to better assess pelagic rockfish species, including GOA POP stocks.
5. Studies are needed to evaluate the effects of environment on survey catchability. For crabs, studies are needed on catchability as it directly bears on estimates of the stock size for setting of catch quotas. Research to refine the estimates of survey catchability, q, used to infer absolute, rather than relative abundance, would substantially improve the quality of management advice. Particular emphasis should be placed on snow and Tanner crab because of recent trends in stock status.
6. Continue research on the design and implementation of appropriate survey analysis techniques to aid the Council in assessing species that exhibit patchy distributions and, thus, may not be adequately represented (either over or under estimated) in the annual or biannual groundfish surveys.
7. There are needs to improve biological data collection (e.g., age, size, maturity, and sex) of some bycatch species (e.g., sharks, skates, octopus, squid, sculpins, and grenadiers) to better quantify potential effects of bycatch on these stocks.
8. Advance research towards developing a quantitative female reproductive index for the surveyed BSAI crab stocks. The current stock-status assessment process for surveyed BSAI crab stocks uses the estimated mature male biomass at the presumed time of mating as the best available proxy for fertilized egg production. Research on mating, fecundity, fertilization rates, and, for snow and Tanner crab, sperm reserves and biennial spawning is needed to develop annual indices of fertilized egg production that can be incorporated into the stock assessment process and to model the effects of sex ratios, stock distribution, and environmental change on stock productivity. Priority stocks for study are eastern Being Sea snow and Tanner crab and Bristol Bay red king crab.

9. Continue and expand existing efforts to collect maturity scans during fisheries that target spawning fish.
10. Identification and recovery of archived data (e.g., historical agency groundfish and shellfish surveys) should be pursued. Investigate integrating these data into stock and ecosystem assessments.

B. Stock Assessment

1. Refine methods to incorporate uncertainty into harvest strategies for groundfish, crab, and scallops for ACL estimation.
2. Improve information (specifically, natural mortality, size at maturity, and other basic indicators of stock production/productivity) for "other species" and data-poor stocks of crab to allow application of Tier 5 or Tier 4 assessment criteria. Two possibilities that would require dedicated research for development are: (1) directly estimate fishing mortalities through large-scale tagging programs; and (2) habitat-based estimates of abundance based on local density estimates in combination with large-scale habitat maps. Little information is available, especially for sculpins, skates, octopuses, squids, grenadiers, and some sharks.
3. Collect data to improve natural mortality (M) estimates. Estimates of M (obtained independently from models) are needed for several stocks, including Pacific cod and BSAI crab stocks.
4. Studies are needed to validate and improve age determination methods for Pacific cod and spiny dogfish.
5. Quantify the effects of historical climate variability and climate change on recruitment and growth and develop standard environmental scenarios for present and future variability based on observed patterns. There is also a clear need for information that covers a wider range of seasons than is presently available.
6. There is a need for the development of advanced stock assessment modeling techniques. Specifically, there is a pressing need to develop techniques for linking uncertainty into stock assessments, including both scientific uncertainty (measurement error, process error or model misspecification) and implementation error (enforcement and catch monitoring).
7. There is a need for the development of projection models to evaluate the performance of different management strategies relative to the Council's goals for ecosystem approaches to management. Projection models are also needed to forecast seasonal and climate related shifts in the spatial distribution and abundance of commercial fish and shellfish (see Strategic Priority IV.A.1.a "Climate variability" below for more detail).
8. To identify stock boundaries, expanded studies are needed in the areas of genetics, reproductive biology, larval distribution, and advection. Expanded tagging efforts are needed to support the development of spatially explicit assessments. High priority species for spatially explicit models include: walleye pollock, Pacific cod, sablefish, yellowfin sole, rock sole, arrowtooth flounder, Pacific ocean perch, black spotted and rougheye rockfish, and Atka mackerel (see element 5 in Expanded Ecosystem Studies below). Specific issues include: a) an evaluation of the location of potential boundaries for an AI – EBS split that would be needed to assess the implications of the creation of a separate Aleutian Island management area, and b) stock delineation for estimation of adult equivalence to appropriately account for the impact of incidental catches of salmon in pollock fisheries on salmon populations.
9. Determine if discrete scallop beds along the GOA coast from Lituya Bay to Kodiak Island are reproductively isolated units or if upstream areas are a significant source of scallop recruitment via larval advection and subsequent settlement in downstream areas.

10. Continue whale depredation studies to improve the quality of longline survey estimates.

C. Fishery Management

1. Evaluate the effectiveness (e.g., potential for overharvest or unnecessarily limiting other fisheries) of setting ABC and OFL levels for data-poor stocks (Tier 5 and 6 for groundfish and Tiers 4 and 5 for crab) (e.g., squid, octopus, shark, sculpins, other flatfish, other rockfish, skates, grenadier, and crab). Research is needed to refine the basis for setting gamma for Tier 4 crab stocks.
2. Develop forecasting tools that incorporate ecosystem indicators into single or multispecies stock assessments to conduct management strategy evaluations under differing assumptions regarding climate and market demands. Standardization of "future scenarios" will help to promote comparability of model outputs.
3. Development of an ongoing database of product inventories (and trade volume and prices) for principal shellfish, groundfish, and salmon harvested by U.S. fisheries in the North Pacific and Eastern Bering Sea.
4. Analyze current determinants of exvessel, wholesale, international, and retail demands for principal seafood products from the GOA and BSAI;
5. Conduct pre- and post-implementation studies of the benefits and costs, and their distribution associated with changes in management regimes (e.g., changes in product markets, characteristics of quota share markets, changes in distribution of ownership, changes in crew compensation) as a consequence of the introduction of dedicated access privileges in the halibut/sablefish, pollock, and crab fisheries. "Benefits and costs" include both economic and social dimensions.
6. Conduct prospective analyses of the robustness and resilience of alternative management strategies under varying environmental and ecological conditions.
7. Conduct prospective and retrospective analyses of changes in the spatial and temporal distribution of fishing effort in response to management actions (e.g., time/area closures, marine reserves, bycatch restrictions, co-ops, IFQs).
8. Develop a framework for collection of economic information on commercial, recreational, and charter fishing, as well as fish processing, to meet the requirements of the MSFCMA sections 303(a)(5, 9, 13), 303(b)(6), and 303A.

II. Fisheries Interactions

A. Catch Estimation Issues

1. Improve estimation of catch of and other fishery interactions with marine mammals (e.g., state-managed gillnet fisheries), seabirds, non-target groundfish (e.g., sharks, skates) and crab, and protected species. Improved methods should include direct and alternative monitoring options (e.g., electronic logbooks, video monitoring), particularly on smaller groundfish, halibut, and commercially guided recreational fishing vessels.

B. Protected Species Interactions

1. Population dynamics, life history, and assessment of protected species, particularly Steller sea lions and northern fur seals, are a high priority. In particular, investigation of factors contributing to changes in natality of Steller sea lions is an important area of research.
2. Economic, social, and cultural valuation research on protected species (i.e., non-market consumptive use, passive use, non-consumptive use).

III. Habitat

A. Habitat Mapping

1. Improved habitat maps (especially benthic habitats) are required to identify essential fish habitat and distributions of various substrates and habitat types, including habitat-forming biota, infauna, and epifauna.
2. Begin to develop a GIS relational database for habitat, including development of a historical time series of the spatial intensity of interactions between commercial fisheries and habitat, which will be needed to evaluate impacts of changes in EFH on the growth, reproduction, and distribution of fish and shellfish.
3. Assess the extent of the distribution of Primnoa corals in the GOA.

B. Function of Habitat

1. Evaluate relationships between, and functional importance of, habitat-forming living substrates to commercially important species, including juveniles.
2. Develop a time series of the impact of fishing on GOA, AI, and EBS habitats that could be used to assess: a) the impact of changes in management on the rate of habitat disturbance, and b) the impact of habitat disturbance on the growth, distribution, and reproductive success of managed species.
3. Evaluate effects of fishing closures on benthic habitats and fish production. There are many closures that have been in effect for various periods of time for which evaluations have not been conducted. A recent example includes slope HAPCs designated in the western Gulf of Alaska.

IV. Other areas of Research Necessary for Management

A. Expanded Ecosystem Studies

1. Environmental influences on ecosystem processes

a) Climate variability: Changes in ocean temperature may affect managed species, upper level predators, and lower trophic levels.

(1) Sea ice: If recent changes in ice cover and temperatures in the Bering Sea persist, they may have profound effects on marine communities. Development and maintenance of indices of the timing and extent of the spring bloom is a high priority. For this, maintenance of moorings, especially M-2, is essential.

(2) Zooplankton production: Apparent declines in zooplankton wet weight over the shelf, measured by the Oshoro Maru, could imply the loss of critical copepod and euphausiid prey of important commercial species, such as pollock, as well as the ESA listed North Pacific right whale.

(3) NMFS and BSIERP scientists should evaluate EBS survey data collected in 2008 during the summer trawl survey, acoustic surveys, and the BASIS cruises to assess whether these surveys will provide reliable estimates of zooplankton species composition and abundance for the Eastern Bering Sea. Evaluate the potential of collaborative research with Japanese and Russian investigators to assess species composition and abundance in samples archived abroad.

(4) Fish composition: NMFS and BSIERP scientists should complete proposed analysis of existing data sets (bottom trawl surveys, acoustic trawl surveys, and BASIS surveys) to quantify changes in relative species composition of commercial and non-commercial species, identify and map assemblages, and monitor changes in the distribution of individual species and assemblages. Additional monitoring may be necessary in the Aleutian Islands and other areas of the Gulf of Alaska.

(5) Assess the movement of fish, to understand the spatial importance of predator-prey interactions in response to environmental variability.

b) Ocean acidification: changes in pH may affect managed species, upper level predators, and lower trophic levels.

2. Trophic interactions.

a) Diet information, from seasons in addition to summer, is needed to assess spatial and temporal changes in predator-prey interactions, including marine mammals and seabirds. The diet information should be collected on the appropriate spatial scales for key predators and prey to determine how food webs may be changing in response to shifts in the range of crab and groundfish.

b) Ecosystem structure studies: Studies are needed on the implications of food web interactions of global warming, ocean acidification, and selective fishing. For instance, studies are needed to evaluate selective removal of some components of the ecosystem (e.g., Pacific cod, pollock, and crab) relative to others (e.g., arrowtooth flounder).