North Pacific Fishery Management Council
Five-Year Research Priorities, 2011-2015
Adopted October 2010

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 certain stocks have declined and failed to recover as anticipated (e.g., 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. Improvements are needed for in-season catch accounting by sex and size for crab in non-directed fisheries with high bycatch rates.
3. Develop methods for reliable estimation of total removals (e.g., surveys, poorly observed fisheries) to meet requirements of total removals under ACLs. Improve species identification, by both processors and observers, for priority species within species complexes in catches. Methods that quantify and correct for misidentifications are desired.

B. Stock Assessment

1. Improve handling mortality rate estimates for crab. 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 in the determination of total annual catch used to evaluate overfishing in stock assessment and projection modeling. For example, assess discard mortality rates of Tanner crab by size, month, sex, and fishery type.
2. Refine methods to incorporate uncertainty into harvest strategies for groundfish for ACL estimation.
3. Develop biomass indices for Tier 6 species, such as sharks.
4. Conduct a tagging study of red king crab in the region north of Bristol Bay to assess the movement between this region and the Bristol Bay registration area.
5. Winter surveys of groundfish in all three areas (EBS, GOA and AI) to create seasonal models of fish biomass distribution relative to critical habitat.
6. Tagging studies of Pacific cod and Atka mackerel to create models of short-term movement of fish relative to critical habitat (tagging methods for pollock are in development).
7. Tagging studies of Atka mackerel to estimate local abundance inside and outside critical habitat.

C. Fishery Management

1. Develop a strategy to manage salmon bycatch in the BSAI and GOA.
2. Improve estimation of fishery interactions (including catch) with marine mammals (e.g., state-managed gillnet fisheries), seabirds, non-target crab and groundfish (e.g., sharks, skates), and protected species. Further development of 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.
3. Salmon genetics and stock identification work to better understand stock of origin of chinook bycatch in GOA trawl fisheries.

II. Fisheries Interactions

A. Protected species

1. Focal studies of SSL foraging behavior, SSL diet, fish abundance, fish movement, oceanography, ocean productivity and fisheries impacts in contrasting areas of SSL population trend in the Aleutian Islands and in areas where SSL forage. These studies would be conducted in summer and winter. Fish abundance estimates would be from trawling, acoustics, tagging, pots and/or camera surveys depending on the species and habitat. AFSC standard trawl surveys are not appropriate for assessing fish biomass distribution at local scales important to SSL.
2. A short-tailed albatross monitoring program is needed to quickly record and communicate STAL encounters with commercial fishing operations.
3. More studies are needed to fully evaluate the possible linkages between fishery induced disturbances or local prey depletion for northern fur seal in the Pribilof Islands region.
4. Further research is needed on gear modifications and fishing practices for reducing bycatch, particularly of PSC species (e.g., salmon).
5. Conduct studies of whale depredation of catch in long-line fisheries and surveys to improve the quality of long-line abundance estimates.
6. Foraging ecology studies of SSL in the western and central Aleutians. Specifically, this research would include at-sea tracking of adult females and juveniles, and collecting SSL scat and spew. Supplemental research could include stable isotope analyses, fatty acid analysis, contaminant studies, monitoring of condition and health indices, and additional photogrammetric work.
7. Studies to assess vital rates (i.e., reproduction and survival) of SSL in the western and central Aleutians. Specifically, this would require longitudinal studies (e.g., branding of pups) to determine rates of age- or size-class specific survival, as well as studies to help evaluate the reproductive performance of adult females and natality, including comparative surveys throughout the western Distinct Population Segments.
8. Studies investigating advancements in methods to estimate sea lion abundance, such as the use of unmanned aerial vehicles, that would increase the probability of acquiring abundance estimates in remote areas.
9. Studies to improve understanding of killer whale predation of SSLs, particularly in the western and central Aleutian Islands.
10. Increased frequency of pup and non-pup surveys.

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 and above the canyon areas, including mid-level and apex predators (such as short-tailed albatrosses) to neighboring shelf/slope ecosystems.

B. Baseline Habitat Assessment

1. Dynamic ecosystem and environmental changes in the northern Bering Sea and Arctic are occurring on a pace not observed in recorded time. In response to the new FMP for the Arctic, assessment of the current baseline conditions is imperative. This effort, while of great scientific importance, should not supplant the regular surveys in the BSAI and GOA, which are of critical importance to science and management.

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. Continue to 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 that are found in untrawlable habitat or are semi-pelagic species such as northern and dusky rockfish.
5. Studies are needed to evaluate effects of the 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 biennial groundfish surveys.

7. There is a need 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. Acquire basic life history information (specifically, natural mortality, size at maturity, and other basic indicators of stock production/productivity) for sharks, skates, sculpins, octopus, and squid and data-poor stocks of crab, to allow application of Tier 5 or Tier 4 assessment criteria. There are two possibilities that would require dedicated research: (1) directly estimate fishing mortalities through large-scale tagging programs; and (2) develop 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.

2. Improve estimates of natural mortality (M) for several stocks, including Pacific cod and BSAI crab stocks.

3. Studies are needed to validate and improve age determination methods for Pacific cod, Pacific sleeper sharks, and spiny dogfish.

4. Evaluate the assessment and management implications of hybridization of snow and Tanner crabs.

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 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.

7. 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 rockfish, rougheye rockfish, snow crab, and Atka mackerel.
8. Studies of sources and sinks for scallop larvae are needed to improve our understanding of the rate of larval exchange between scallop beds.

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. Conduct retrospective analyses to assess the impact of Chinook salmon bycatch measures on the BSAI pollock fishery. Analyses should include an evaluation of the magnitude and distribution of economic effects of salmon avoidance measures for the Bering Sea pollock fishery. In this case, it is important to understand how pollock harvesters have adapted their behavior to avoid bycatch of Chinook and "other" salmon, under various economic and environmental conditions and incentive mechanisms.
3. 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.
4. Development of an ongoing database of product inventories (and trade volume and prices) for principal shellfish, groundfish, Pacific halibut, and salmon harvested by U.S. fisheries in the North Pacific and eastern Bering Sea.
5. Analyze current determinants of ex vessel, wholesale, international, and retail demand for principal seafood products from the GOA and BSAI.
6. 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, AFA pollock, and crab fisheries. "Benefits and costs" include both economic and social dimensions.
7. Conduct prospective analyses of the robustness and resilience of alternative management strategies under varying environmental and ecological conditions.
8. 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, PSC and other bycatch restrictions, co-ops, IFQs).
9. 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.
10. Continue to evaluate the economic effects from recently adopted crab rationalization programs on the Gulf of Alaska coastal communities, including Kodiak. This includes understanding economic impacts (both direct and indirect) and how the impacts are distributed among communities and economic sectors.

II. Fisheries Interactions

A. Protected Species Interactions

1. Economic, social, and cultural valuation research on protected species (i.e., non-market consumptive use, passive use, non-consumptive use).
2. There is a need for studies of localized fishery-protected species interactions. Studies of interactions between Steller sea lions and fisheries are needed in the Central GOA, with an emphasis on seasonal prey fields, diet, and movement of sea lions and their prey. These studies should be conducted at appropriate spatial and temporal scales.
3. Foraging ecology studies of SSL in the Commander Islands. Research techniques would be similar to item #1.
4. Foraging ecology studies of SSL in the Gulf of Alaska. In addition to at-sea tracking of older animals, outside of the Kodiak area the primary information needed from this sub-region is updated information on diet composition of SSL throughout the sub-region.
5. Maintain assessment of SSL vital rates in the Russian Far East and Commander Islands. Research techniques would be similar to item #4 and include expansion to autumn and winter periods.
6. Aerial photogrammetric survey studies of rookeries and haul-outs in Russia. This survey methodology would provide abundance estimates for sea lions in Russia directly comparable to estimates for Alaska.

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. Ecosystem indicator development and maintenance.

1. Climatic indicators.

2. Lower trophic level community production data

   a) Collect primary production time series.

   b) Collect and maintain zooplankton production and biomass time series in the EBS. Develop, collect and maintain time series of zooplankton production and biomass for the AI, GOA and Arctic.

   c) Collect and maintain zooplankton community composition time series in the Bering Sea. Develop, collect and maintain time series of zooplankton community composition for the GOA, AI, Arctic.

   d) Collect and maintain benthic community composition, production and biomass time series in all regions.

3. Develop methods for incorporating ecosystem indicators into stock assessments and ecosystem assessments.

4. Ecosystem indicator synthesis research (thresholds, management objectives).

B. Research on Environmental Influences on Ecosystem Processes

1. Climate variability: monitor and understand how changes in ocean conditions influence managed species.

   a) Maintain moorings. 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.

   b) Monitor seasonal sea ice extent and thickness: If recent changes in ice cover and temperatures in the Bering Sea persist, these may have profound effects on marine communities.

   c) Measure and monitor fish composition: Evaluate 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.

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

2. Conduct Research on Ocean Acidification

   a) Collect and maintain time series of ocean pH in the major water masses off Alaska.

b) Assess whether changes in pH would affect managed species, upper level predators, and lower trophic levels.

C. Basic research on trophic interactions

1. Collect, analyze, and monitor diet information, from seasons in addition to summer, 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.

2. 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 differential exploitation of some components of the ecosystem (e.g., Pacific cod, pollock, and crab) relative to others (e.g., arrowtooth flounder).

D. Ecosystem Modeling

1. Food habits collections and ecosystem modeling to quantify interactions between SSL groundfish prey and the food web effects of changes in fishing mortality.

2. Modeling and field studies of ecosystem productivity in different regions (EBS, GOA and AI).