

NPFMC Research Priorities for 2018 - 2022

Research ID	Title	Description	Council Priority	Research Status
144	District-wide survey for demersal shelf rockfish in Southeast Alaska	Conduct a district-wide survey for demersal shelf rockfish in Southeast Alaska on a biennial or triennial basis.	Critical Ongoing Monitoring	Partially underway
145	Continuation of State and Federal annual and biennial surveys	Continuation of State and Federal annual and biennial surveys in the GOA, AI, and EBS, including 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 federal budgets in which funding may not be sufficient to conduct these surveys. Loss of funding for days at sea for NOAA ships jeopardizes these programs. Budgetary concerns have resulted in cuts to not only days at sea, which increases uncertainty, but also sampling the deepest strata, which threatens the value of trawl surveys as a synoptic ecological survey. 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. Although an ongoing need, these surveys are considered the highest priority research activity, contributing to assessment of commercial groundfish and crab fisheries off Alaska.	Critical Ongoing Monitoring	Underway
146	Improve surveys in untrawlable habitat, particularly for rockfish, Atka mackerel, and sculpins	For groundfish in general, and rockfish and Atka mackerel 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. A number of publications specific to untrawlable grounds and rockfish sampling have been published recently, but have not been incorporated directly into routine stock assessment routine survey designs.	Urgent	Underway
147	Life history research on data poor or non-recovering crab stocks	Why certain stocks have declined and failed to recover as anticipated is a pressing issue (e.g., Pribilof Island blue king crab, Adak red king crab). Research into all life history components, including predation by groundfish on juvenile crab in nearshore areas, is needed to identify population bottlenecks, an aspect that is critically needed to develop and implement rebuilding plans.	Important	Partially underway
148	Spatial distribution and movement of crabs relative to life history events and fishing	There is a need to characterize the spatial distribution and movement of crab stocks. For example, information is needed to understand the distribution of male/female snow crab at time of mating, a better understanding of spatial stock dynamics and population connectivity for Tanner Crab east and west of 166, and to understand the distribution and movement of golden king crab in the Aleutian Islands in areas historically fished and not fished. There is a need to characterize the spatial distribution of male snow crab at time of mating relative to reproductive output of females in the middle domain of the EBS shelf. Additionally there is a need to investigate spatial stock dynamics and population connectivity for Tanner Crab (2 stocks).	Urgent	Partially underway
149	Improve handling mortality rate estimates for crab	Continue to improve estimate of discarded crab handling mortality rate for crab species. Empirical data exist for snow and Tanner so new handling mortality data are needed for king crab by size, sex, and fishery type with consideration of temperature. This will require improving understanding of 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. The magnitude of post-release mortality is an essential parameter in the determination of the overfishing level used to evaluate overfishing in stock assessment and projection modeling. Current priorities are to assess handling mortality in long-line fisheries and for long term mortality studies.	Important	Partially underway

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150	Maintain the core biological and oceanographic data (e.g., biophysical moorings, stomach data, zooplankton, age 0 surveys, benthic production) necessary to support stock assessments and integrated ecosystem assessments	Maintain the core data and process studies needed to support integrated ecosystem assessments. Core data include inputs for single- or multi-species management strategy evaluations, food web, and coupled biophysical end-to-end ecosystem models (e.g. biophysical moorings, stomach data, zooplankton, age 0 surveys (i.e. BASIS surveys), benthic production). Develop and maintain indices of sea ice formation, sea ice retreat, and timing/extent of the spring bloom for the EBS. For this, maintenance of moorings, especially M-2, is essential. If recent changes in ice cover and temperatures in the Bering Sea persist, these may have profound effects on marine communities.	Critical Ongoing Monitoring	Underway
151	Develop a spatially-explicit model for BSAI pollock	Conduct studies to determine stock structure and potential spatial management for BSAI pollock (e.g., movement). Evaluate interactions of BSAI pollock with those in Russian waters. These studies should lead to a detailed spatial age-structured stock assessment model with at least 3 regions (Russia, NW EBS, SE EBS).	Important	Underway
153	Study vertical distribution of Pacific cod to better understand catchability	Research is needed on the vertical distribution of Pacific cod relative to the EBS bottom trawl and comparisons of gear between the EBS and GOA trawl gear. This is because there is controversy about fishery and survey catchability.	Important	Underway
154	Pacific cod stock assessment for the Aleutian Islands	Develop an age-structured Pacific cod stock assessment for the Aleutian Islands region. In 2014 the Aleutian Islands and eastern Bering Sea regions were split and have separate ABCs and OFLs. There is need to develop an assessment model for cod in the Aleutians.	Urgent	Underway
155	Evaluation of salmon PSC mitigation measures	Develop a research program that will facilitate evaluation of salmon (both Chinook and non-Chinook) PSC mitigation measures in the BSAI and GOA. This includes updated estimates of the amounts reasonably necessary for subsistence, timing of runs and openings relative to subsistence requirements, and access to cost data for the commercial pollock and salmon industries so that impacts on profits (not gross revenues) can be calculated.	Urgent	Underway
156	Improve knowledge for salmon PSC impact assessment	Improve the resolution of Chinook and chum salmon genetic stock identification methods (e.g., baseline development, marker development), improve precision of salmon run size estimates in western Alaska, and initiate investigations of biotic and abiotic factors influencing natural mortality rate during ocean migration in the GOA and BSAI. Baseline development is nearing completion, but more work on Cook Inlet chum is needed.	Urgent	Underway
157	Improve methods of monitoring fishery interactions	Develop improved catch monitoring methods of fishery interactions including direct and alternative options (e.g., electronic logbooks, video monitoring), particularly on smaller groundfish, halibut, and commercially guided recreational fishing vessels, including an assessment of feasibility for small vessels.	Urgent	Underway
158	Research ecosystem indicators and their thresholds for inclusion in ecosystem-level management strategy evaluation.	Initiate/continue research on the synthesis of ecosystem indicators, developing and evaluating thresholds for ecosystem indicators, and ecosystem-level management strategy evaluation.	Important	Partially underway
159	Evaluate interactions between fisheries and pinnipeds	Studies of the interactions between fisheries and protected species, such as Steller sea lions in the Central and Western Aleutian Islands (areas 541, 542, 543), and northern fur seals on the eastern Bering Sea shelf are needed. These studies should be conducted at appropriate spatial and temporal scales with an emphasis on seasonal prey fields, diet, and movement of fisheries and pinnipeds.	Urgent	Underway

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Research ID	Title	Description	Council Priority	Research Status
160	Assess vital rates of Steller sea lions	Assess vital rates (i.e., reproduction and survival) of Steller sea lions in the western DPS (including Russia) at sufficient frequency to track population dynamics.	Urgent	Underway
161	Assess the health of Stellar sea lions	Assess possible indirect effects of fisheries removals via periodic health assessments, indices of body condition, survival of pups and juveniles, and natality of Steller sea lions in the western DPS.	Urgent	Underway
162	Quantify killer whale predation of Steller sea lions (M)	Quantify killer whale predation of Steller sea lions, particularly in the western and central Aleutian Islands.	Urgent	Underway
163	Conduct routine fish, crab, and oceanographic surveys in the northern Bering Sea and Arctic Ocean	Dynamic ecosystem and environmental changes in the northern Bering Sea and Arctic are occurring. Assessment of the current baseline conditions and trophic interactions is important. This effort should not supplant the regular surveys in the BSAI and GOA, which are of critical importance to science and management.	Urgent	Partially underway
164	Effects of trawling on female red king crab and subsequent recruitment	Research is needed on the effects of trawling on the distribution of breeding and ovigerous female red king crab and subsequent recruitment. Relevant studies include 1) assessing the efficacy of the current Red King Crab Savings Area Boundaries, and 2) assessing effects of potential habitat modifications on the distribution of females, particularly in nearshore areas of southwest Bristol Bay, and environmental effects (e.g., trawling overlap in warm vs. cold years), 3) quantification of unobserved mortality (e.g. pelagic trawl gear contacting bottom). Retrospective studies, the identification of larval release locations, and larval advection using Regional Ocean Modeling System would help address this need.	Important	Underway
165	Conduct routine surveys of subsistence in the northern Bering Sea and Arctic Ocean	Conduct routine surveys of subsistence use of marine resources in the northern Bering Sea and Arctic Ocean. These surveys will become increasingly important under ongoing warming ocean temperatures because range expansions of harvested fishery resources may occur. If range expansions or shifts occur, data will be needed to adjust standard survey time series for availability.	Urgent	Partially underway
166	Estimate scallop stock abundance	Estimate scallop stock abundance in unsurveyed areas using fishery independent methods including analysis of current camera sled data.	Urgent	Partially underway
167	Alternative approaches to acquire fishery-independent abundance data for for unsurveyed stocks of golden king crab	Explore alternative approaches to acquire fishery-independent abundance data on stock distribution and recruitment of unsurveyed crab stocks (e.g., Aleutian Islands golden king crab, cooperative research efforts with Industry).	Urgent	Partially underway
169	Studies on factors that affect catchability particularly for King and Tanner crab	For groundfish and crabs, studies are needed on factors that affect catchability, as they directly bear on estimates of the stock assessment. 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 Tanner crab and Red King Crab because of recent trends in stock status, and on fishery and for Aleutian Island golden king crab to improve the stock assessment model.	Important	Underway

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Research ID	Title	Description	Council Priority	Research Status
170	Quantitative reproductive index for the surveyed BSAI crab stocks	Advance research towards developing a quantitative reproductive index for BSAI crab stocks. 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 Bering Sea snow and Tanner crab and Bristol Bay red king crab.	Urgent	Underway
171	Acquire basic life history information (e.g., natural mortality, growth, size at maturity) for data-poor stocks	Basic life history information is needed for stock assessment and management of data-poor stocks, such as scallops, sharks, skates, sculpins, octopus, grenadiers, squid, and blue king crab (Bering Sea), golden king crabs (Aleutian Islands), and red king crab (Norton Sound). Specifically, information is needed on natural mortality, growth rates, size at maturity, and other basic indicators of stock production/productivity.	Urgent	Partially underway
172	Develop and validate aging methods for crabs.	Develop and validate aging methods for crabs to improve estimates of M for stock assessments.	Urgent	Underway
173	Expand studies to identify stock and management boundaries	To identify and refine stock boundaries and understand source/sink dynamics (e.g., scallop metapopulations). Conduct studies to evaluate all crab stock boundaries relative to management boundaries (e.g., Bristol Bay red king crab, Adak red king crab, Aleutian Island golden king crab, EBS Tanner crab, Pribilof blue king crab). Expanded studies are needed in the areas of genetics, mark-recapture, reproductive biology, larval distribution, and advection. Such boundaries are to be evaluated so that the risks and consequences of management actions are clear.	Urgent	Partially underway
174	Develop spatially explicit stock assessment models	Develop spatially explicit stock assessment models. High priority species for spatially explicit models include: walleye pollock, snow and Tanner crab, Pacific cod, sablefish, yellowfin sole, rock sole, arrowtooth flounder, Pacific ocean perch, black spotted rockfish, rougheye rockfish, and Atka mackerel.	Urgent	Partially underway
175	Develop age-structured models for scallop assessment	Age structured models for scallops are needed to increase understanding of population dynamics and harvestable surpluses.	Strategic	Partially underway
176	Refine methods to incorporate uncertainty into harvest strategies for groundfish	Refine P* and decision theoretic methods to incorporate uncertainty into harvest strategies for groundfish for ACL estimation. Continue existing management strategy evaluations at the stock level.	Urgent	Underway
177	Conduct prospective and retrospective analyses of changes in the spatial and temporal distribution of fishing effort in response to management change	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, multi-target crab fisheries) and environmental changes.	Strategic	Partially underway
178	Develop a framework for collection of economic information	Develop a framework for the 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.	Urgent	Partially underway

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179	Conduct pre- and post-implementation studies of the benefits and costs, and their distribution, associated with dedicated access privileges	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.	Urgent	Partially underway
180	Economic, social, and cultural valuation research on protected species	Economic, social, and cultural valuation research on protected species is needed (i.e., non-market consumptive use, passive use, non-consumptive use).	Important	Underway
182	Evaluate current and alternative Council PSC/bycatch reduction initiatives	Analyze the effects of recent Council actions on PSC and bycatch, including the interaction among PSC and bycatch reduction initiatives (e.g., halibut, salmon, crab). Attention should be given to different incentives that have the potential to cost-effectively reduce PSC.	Important	Partially underway
183	Research the role of habitat in population dynamics and ecosystem processes	Research is needed on the role of habitat in population dynamics and ecosystem processes. Specifically, studies are needed to evaluate how habitat-forming species (e.g., corals) influence life history parameters (e.g., mortality, growth, movement) of FMP species and their preferred prey. Such research will identify key habitats (including essential fish habitat and habitat areas of particular concern), improve the design and management of marine protected areas, and ultimately improve stock assessments and restoration efforts.	Important	Partially underway
184	Evaluate efficacy of habitat closure areas and habitat recovery	Establish a scientific research and monitoring program to understand the degree to which impacts on habitat, benthic infauna, etc., have been reduced within habitat closure areas, and to understand how benthic habitat recovery of key species is occurring (e.g., Red King Crab Savings Area efficacy and Pribilof Island Habitat Conservation Area). (This is an objective of EFH research approach for the Council FMPs).	Important	Partially underway
186	Collect and maintain zooplankton and meroplankton biomass and community composition time series	Collect and maintain zooplankton and meroplankton biomass and community composition time series in the eastern Bering Sea. Develop, collect and maintain time series of zooplankton biomass and community composition for the GOA, AI, Arctic.	Critical Ongoing Monitoring	Partially underway
187	Maintain indicator-based ecosystem assessment for EBS.	Maintain indicator-based ecosystem assessment for EBS.	Important	Underway
188	Develop indicator-based ecosystem assessments for AI (in progress), GOA, Arctic.	Develop indicator-based ecosystem assessments for AI (in progress), GOA, and the Arctic.	Important	Partially underway
189	Develop stock-specific ecosystem indicators and incorporate into stock assessments	Develop stock-specific ecosystem indicators and incorporate into stock assessments. (in progress)	Important	Partially underway
190	Collect and maintain time series of ocean pH	Collect and maintain time series of ocean pH in the major water masses off Alaska to improve understanding of ocean acidification and its effects on managed species, upper level predators and lower trophic levels	Critical Ongoing Monitoring	Partially underway
191	Assess whether changes in pH and temperature would affect managed species, upper level predators, and lower trophic levels.	Assess whether changes in pH and temperature would affect managed species, upper level predators, and lower trophic levels. Laboratory studies are needed to assess the synergistic effects of ocean acidification and changes in temperature on productivity of marine species.	Strategic	Partially underway

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192	Collect, analyze, and monitor diet information	Collect, analyze, and monitor diet information (species, biomass, energetics), 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.	Critical Ongoing Monitoring	Underway
193	Improve species identification	Improve species identification, by both processors and observers, for priority species within species complexes in catches, to meet requirements of total removals under ACLs. Methods that quantify and correct for misidentifications are desired.	Strategic	Completed
194	Identification and integration of archived data	Identification and recovery of archived data (e.g., historical agency groundfish and shellfish surveys, and fishery data) should be pursued. Investigate integrating these data into stock and ecosystem assessments. Some archival acoustic data have been cataloged, and most trawl surveys have been included in databases. Some one-time research surveys remain neglected.	Strategic	Partially underway
196	Evaluate hybridization of snow and Tanner crabs.	The presence of hybrids complicates the assessment and management of EBS snow and Tanner crab stocks. Genetics research is needed to better understand the abundance of hybrids relative to pure snow and Tanner crabs. Other needed research includes assessing temporal shifts in hybrid crab spatial distribution, the geospatial overlap with snow and Tanner crabs, the directionality of hybrid mating dynamics, and the extent of first generation crosses and backcrosses. To evaluate management implications, a two-species spatial population model should be developed that captures the essential features of the population dynamics, including hybridization. Alternative management approaches should be evaluated.	Strategic	Partially underway
197	Develop methodologies to monitor for new/emerging diseases and/or parasites among exploited species and higher trophic levels	Develop methodologies to monitor for new/emerging diseases and/or parasites among exploited species and higher trophic levels.	Urgent	Partially underway
198	Initiate and expand non-market valuation research of habitat, ecosystem services, and passive use considerations	Initiate and expand non-market valuation research of habitat, ecosystem services, and passive use considerations.	Strategic	No action
200	Monitor contaminant flux and loads in lower and higher trophic levels, and assess potential for impact on vital rates.	Monitor contaminant flux and loads in lower and higher trophic levels, and assess potential for impact on vital rates. Laboratory studies are needed to assess the effects of oil dispersants on the productivity of marine species.	Strategic	No action
202	Methods for reliable estimation of total removals	Develop methods for reliable estimation of total removals (e.g., surveys, poorly observed fisheries) to meet requirements of total removals under ACLs. Catch Accounting System now provides total removals annually. Improved reporting on some data such as subsistence catches and Pacific cod bait in crab fisheries is needed. Improvements are needed for in-season catch accounting by sex and size for crab in non-directed fisheries with high bycatch or PSC rates, particularly for blue king crab in the Pacific cod pot fishery in the Pribilof Islands.	Urgent	Partially underway
203	Improve discard mortality rate estimates for scallops	Field and laboratory studies are needed to estimate Alaskan scallop discard mortality by evaluating relationship between capture, release condition and deck time, and subsequent survival.	Urgent	Partially underway

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204	Tagging studies of Aleutian Islands Pacific cod and Atka mackerel	Tagging studies of Aleutian Islands Pacific cod, Atka mackerel, Alaska skate, and walleye pollock are needed to create models of short-term movement of fish relative to critical habitat (tagging for Atka mackerel and skates are partly underway).	Important	Partially underway
205	Age determination methods for Pacific cod, Pacific sleeper sharks, and spiny dogfish	Studies are needed to validate and improve age determination methods for Pacific cod, Pacific sleeper sharks, and spiny dogfish. Conventional tagging studies of young of the year and/or one-year old Pacific cod would be useful in this regard (partially underway for cod and dogfish).	Important	Partially underway
206	Biomass indices and alternate methodologies for lowest tier groundfish species	Develop biomass indices for lowest tier species (Tier 6 for groundfish), such as sharks and octopus. Explore alternative methodologies for Tier 6 stocks such as length-based methods, catchability experiments (e.g., net selectivity), or biomass dynamics models.	Important	Partially underway
207	Collect and analyze fishery effort and observer data for scallops	Collect and analyze fishery effort and observer data for scallops. Standardize CPUE data to correct for factors contributing to variable CPUE.	Critical Ongoing Monitoring	Underway
208	Research on stock- recruit relationships	New information and data are needed that would inform our understanding of the stock- recruit relationship for groundfish, Pacific halibut, and crab to project year-class strength.	Urgent	Underway
209	Continue to collect guided angler sector data for the halibut fishery	Continue to collect the guided angler sector data for the halibut fishery. Continue to explore factors that affect angler demand and trip supply. (note the IPHC collects unguided angler sector data)	Critical Ongoing Monitoring	Underway
210	Develop bioeconomic models	Develop bioeconomic models with explicit age- or size-structured population dynamics for BSAI and GOA groundfish fisheries to estimate maximum economic yield and other bioeconomic reference points under uncertainty.	Important	Partially underway
211	Benefits and costs of directed halibut catch and halibut PSC utilization	Research the benefits and costs of directed halibut catch and halibut PSC utilization in different fishing sectors. For halibut and other PSC and bycatch species, conduct research to better identify where regulations restrict the utilization of fish from its most beneficial use and evaluate how changes in existing regulations would affect different sectors and fisheries.	Urgent	Underway
212	Develop methods to estimate sea lion abundance	Develop new methods to estimate sea lion abundance, such as the use of unmanned aerial vehicles which could increase the probability of acquiring abundance estimates in remote areas.	Important	Underway
213	Assess the impact of the displacement of the groundfish fleet on Northern fur seals	Assess the impact of the displacement of the groundfish fleet due to Steller sea lion protection measures on the prey availability, foraging ecology diet, movements and vital rates for Northern fur seals.	Urgent	Partially underway
214	Evaluate the impact of seabird bycatch in fisheries on bird populations, and methods to reduce	Assess the extent and impact of seabird bycatch in fisheries on bird populations, and develop methods to reduce seabird bycatch, particularly protected species, such as short-tailed albatross.	Important	Underway
215	Determine potential impacts of fishing activities on marine mammals	Determine potential impacts of fishing activities on marine mammals (e.g., state managed gillnet fisheries), and in particular on North Pacific right whales and the Eastern North Pacific blue whales, particularly in identified critical (NPRW) or essential (NPBW) habitat.	Strategic	No action

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216	Assess whether Bering Sea canyons are habitats of particular concern	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 a comparison of mid-level and apex predators to neighboring shelf/slope ecosystems.	Important	Partially underway
217	Impact of fisheries on benthic habitat and trophic interactions	Conduct studies to assess the impact of bottom trawl fisheries on invertebrate abundance and species composition in benthic habitats. This is especially relevant to Bristol Bay red king crab, and also the foraging ecology of walrus (candidate species for listing under ESA), but also bearded seals, and gray whales.	Urgent	Underway
218	Survey capability for forage fish	Develop a long-term survey capability for forage fish (partially underway). The NPRB funded GOA and Bering Sea projects are currently describing the spatial and temporal variability in the structure of forage fish communities and the effect of this variability on predators. This work should be continued and methods for long-term monitoring should be developed.	Critical Ongoing Monitoring	Partially underway
219	Monitor skate egg case concentrations every 2 to 3 years using non-invasive research design, such as in situ observation	Skate egg case concentrations should be monitored every 2 to 3 years using non-invasive research design, such as in situ observation.	Important	No action
220	Research on survey analysis techniques for species that exhibit patchy distributions	Continue research on the design and implementation of appropriate survey analysis techniques, to aid the Council in assessing species (e.g., Pribilof Island king crabs and rockfish) that exhibit patchy distributions and, thus, may not be adequately represented (either over- or under-estimated) in the annual or biennial groundfish surveys.	Important	Underway
221	Collect maturity scans during fisheries that target spawning fish	Expand existing efforts to collect maturity scans during fisheries that target spawning fish (e.g., pollock). Time series of maturity at age should be collected to facilitate the assessment of the effects of density-dependence and environmental conditions on maturity. Maturity information for pollock and Pacific cod is collected by observers and should be analyzed. Maturity information for rockfish species near Kodiak has been collected recently, both during the fishery and dedicated scientific cruises, and should be analyzed. A dedicated survey to examine spawning sablefish has also been conducted. Efforts to collect maturity data, and then analyze for rockfish and other species should continue. In particular, retrospective studies to identify factors (e.g., fishing, climate, prey quality and quantity) influencing the maturity schedule should be conducted.	Strategic	Partially underway
222	Improve estimates of natural mortality (M) for Pacific cod.	Improve estimates of natural mortality (M) for several stocks, including Pacific cod.	Important	Partially underway
223	Develop and evaluate global climate change models (GCM) or downscaled climate variability scenarios to assess impacts to recruitment, growth, and spatial distributions.	Quantify the effects of historical climate variability and climate change on recruitment, growth, and spatial distribution. Develop standard environmental scenarios (e.g., from GCMs) for present and future variability based on observed patterns.	Strategic	Partially underway
224	Climate and oceanographic information covering a wider range of seasons	There is a need for climate and oceanographic information that covers a wider range of seasons than is presently available.	Strategic	Partially underway

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225	Development of projection models to evaluate (a) the robustness and resilience of different management strategies under varying environmental and ecological conditions and (b) to forecast seasonal and abundance of commercial fish and shellfish.	There is a need for the development of projection models to evaluate the robustness and resilience of different management strategies under varying environmental and ecological conditions. Projection models are also needed to forecast seasonal and climate related shifts in the spatial distribution and abundance of commercial fish and shellfish.	Strategic	Partially underway
226	Monitor the economic effects from fishery policy changes on coastal communities.	Monitor the socio-economic effects from fishery policy changes on coastal communities. This includes understanding socio-economic impacts (both direct and indirect) and how the impacts are distributed among communities and economic sectors.	Critical Ongoing Monitoring	Partially underway
227	Improve estimation of fishery interactions with non-target groundfish, and prohibited species.	Improve estimation of fishery interactions (including catch) and non-target groundfish (e.g., sharks, skates), and prohibited species.	Urgent	Underway
228	Monitor subsistence harvest (patterns, norms, quantities) in communities affected by Council actions.	Monitor the subsistence harvest patterns, norms and quantities in communities that depend upon resources that may be affected by Council action.	Critical Ongoing Monitoring	Partially underway
230	Examine social and economic interactions between coastal communities and commercial and recreational fisheries	Examine social and economic interactions between coastal communities and commercial and recreational fisheries (e.g. subsistence-commercial linkages, adaptations to changes in resource use, economic opportunities for coastal communities).	Important	Underway
231	Retrospective analysis of the impact of Chinook salmon PSC avoidance measures on the BSAI pollock fishery	Conduct retrospective analyses to assess the impact of Chinook salmon PSC avoidance 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.	Important	Partially underway
232	Develop management strategy evaluations that incorporate changing climate and market economic conditions.	Develop management strategy evaluations under differing assumptions regarding climate and economic conditions. Promote the standardization of future scenarios from different models to promote comparability of model outputs.	Urgent	Underway
233	Develop an ongoing database of product inventories	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.	Strategic	No action
234	Analyze current determinants of demand for principal seafood products	Analyze current determinants of ex vessel, wholesale, international, and retail demand for principal seafood products from the GOA and BSAI.	Strategic	Partially underway
235	Investigate gear modifications and changes in fishing practices to reduce bycatch and PSC	Gear modifications and changes in fishing practices to reduce bycatch and PSC are needed.	Urgent	Partially underway
236	Conduct studies of sperm whale and killer whale depredation of catch in long-line fisheries and surveys	Studies of sperm and killer whale depredation of catch in long-line fisheries and surveys are needed to improve the quality of long-line abundance estimates.	Important	Underway
237	Improved habitat maps	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 in the GOA, BS, and Aleutian Islands.	Important	Underway

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238	Develop a GIS relational database for habitat, to include a historical time series of the spatial intensity of interactions between commercial fisheries and habitat.	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. Such time series are needed to evaluate the impacts of changes in fishing effort and type on EFH.	Strategic	Underway
239	Assess the extent of the distribution of corals	Assess the extent of the spatial distribution of corals and conduct routine monitoring of these areas.	Urgent	Partially underway
240	Develop a multivariate index of the climate forcing of the Bering Sea shelf	Develop a multivariate index of the climate forcing of the Bering Sea shelf . Three biologically significant avenues for climate index predictions include advection, setup for primary production, and partitioning of habitat with oceanographic fronts and temperature preferences.	Important	Partially underway
241	Develop bottom and water column temperature database and indices	Develop bottom and water column temperature database and indices for use in EBS, GOA, and AI stock assessments.	Important	Partially underway
242	Collect and maintain primary production time series	Collect and maintain primary production time series in the EBS, AI, GOA, and Arctic; particularly in relationship to key climate and oceanographic variables.	Strategic	Partially underway
244	Collect and maintain time-series data on the community composition, production and biomass of benthic invertebrate and vertebrate fauna	Collect and maintain time-series data on the community composition, production and biomass of benthic invertebrate and vertebrate fauna.	Strategic	Partially underway
245	Assess the impact of increases in recovering whale populations on lower trophic level energy pathways	Assess the impact of increases in recovering whale populations (e.g., gray, humpback and fin) on lower trophic level energy pathways.	Important	No action
246	Cooperative research efforts to supplement existing at-sea surveys that provide seasonal, species-specific information on upper trophic levels	Continue and expand cooperative research efforts to supplement existing at-sea surveys that provide seasonal, species-specific information on upper trophic levels (seabirds and marine mammals). Updated surveys to monitor distribution and abundance of seabirds and marine mammals are needed to assess impacts of fisheries on apex predators, improve the usefulness of apex predators as ecosystem indicators, and to improve ecosystem management.	Important	Partially underway
247	Assess the relative importance of non-commercially exploited species to human communities	Assess the relative importance of non-commercially exploited species (invertebrates, fish, marine mammals, and seabirds) to human communities, particularly in Arctic.	Important	Partially underway
248	Measure and monitor large scale fish composition	Measure and monitor large scale 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, monitor changes in the distribution of assemblages, and understand the spatial importance of predator-prey interactions in response to environmental variability. Additional monitoring may be necessary in the Aleutian Islands, northern Bering Sea, and areas of the Gulf of Alaska.	Strategic	Underway
249	Monitor the movement of Steller sea lions and northern fur seals	Monitor the movement of Steller sea lions and northern fur seals in response to environmental variability to understand the spatial changes of predator-prey interactions.	Critical Ongoing Monitoring	Partially underway

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Research ID	Title	Description	Council Priority	Research Status
250	Conduct ecosystem structure studies	Studies are needed to evaluate the effects of global warming, ocean acidification, and selective fishing on food webs. 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).	Important	Partially underway
251	Modeling studies of ecosystem productivity	Modeling studies of ecosystem productivity in different regions (EBS, GOA, and AI). For example, studies could evaluate the appropriateness of the 2 million t OY cap.	Important	Underway
361	Effects of Ocean Acidification on Scallops	Laboratory studies are needed to understand the mineralization of scallop shells through their life cycle and under current spatial variability and future scenarios of ocean acidification.	Strategic	No action
362	Monitoring potential water quality impacts	Seasonal water quality monitoring in known scallop areas are needed to determine whether conditions are detrimental to scallop growth and survival.	Important	No action
363	Area-specific variability in scallop population processes	Investigate area-specific variability in vital population processes including growth, recruitment, natural mortality and movement including mark-recapture tagging studies. Bed-specific growth could be analyzed from archived shells.	Important	Partially underway
364	Updated sperm whale stock assessment	Updated sperm whale abundance estimates are needed. Sperm whale depredation interactions with longline fisheries have increased, but little is known about sperm whale populations. Updated population estimates and defined PBR's are needed to effectively respond if a take occurs in the longline fishery.	Urgent	No action
365	Retrospective analysis of the impact of Chinook PSC avoidance measures on communities of western Alaska	Conduct retrospective analysis using qualitative and quantitative methods on salmon dependent communities of western Alaska that may be affected by Chinook salmon PSC avoidance measures in the BSAI. Analysis should evaluate long-term changes in local Chinook abundance and uses, and provide detailed ethnographic work exploring the meaning of salmon to these communities in the context of industrialized offshore fisheries.	Urgent	No action
366	Continue to investigate time variation and the shape of fishery and survey selectivity models	There is considerable controversy about (1) whether selectivity should be dome-shaped or asymptotic, and (2) whether selectivity should be time-varying by default. Using a dome-shaped curve can create a large increase in biomass which may not be real. Treating selectivity as time-varying increases the number of model parameters greatly, which may lead to confounding among parameters. Better scientific guidance through research studies is needed to address these two problems.	Urgent	Partially underway
367	Continue to improve stock assessment methodology with respect to uncertainty	Recent studies have made advances in determining effective sample size, effective number of parameters, Bayesian parameterizations, and how to weight datasets in assessments with multiple datasets. Introduce methodology to identify additional sources of uncertainty. GMACS (Generalized Modeling for Alaskan Crab Stocks) is a statistical size-structured population modeling framework. It is designed to be flexible, scalable, and useful for both data-limited and data-rich situations. GMACS is intended to be the primary modeling platform used to conduct assessments of all crab stocks in the Bering Sea. GMACS was first used to provide management advice for Saint Matthews blue king crab in 2016, and work is ongoing for a Bristol Bay red king crab application. Additional functionality is needed for GMACS to be applied to snow and Tanner crab.	Urgent	Underway

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Research ID	Title	Description	Council Priority	Research Status
368	Develop a simulation model of Steller sea lion fishery interactions	Management strategy evaluation tools based on coupled bio-physical models with fishing and top trophic level foragers (e.g., Steller sea lions) should be developed to evaluate the performance of different harvest strategies, to inform future management decisions, and to prioritize field studies.	Urgent	No action
381	Effects of changes to the observer program	Evaluate the effects of changes to data collection protocols that occur because of observer restructuring, potential funding limitations and the introduction of electronic monitoring. Ensure that data collected provides a valid representation of the catch and can be compared easily to the previous data collection methods and time series remain intact.	Urgent	No action
382	Investigate in situ methods of tagging species that experience barotrauma	Species with swim bladders experience barotrauma, so that tagging studies result in high mortality and little information. Icelandic and Norwegian scientists have developed in situ methods for tagging, so that these fish never change depth. This could provide precise estimates of movement rates from tagging studies needed for spatial stock assessments. Such a recommendation for walleye pollock is found in a 2011 Report of a Workshop on Spatial Structure and Dynamics of Walleye pollock (AFSC Processed Report 2011-04).	Important	No action
383	Determine quantitative indicators of spatial structure, particular for walleye pollock and Pacific cod	The next generation of stock assessment models will be spatial age- and length-structured assessment models, in line with the goal of ecosystem-based fishery management. Current distributions of spatial location have been empirically summarized, but methods should be explored to convert these to movement patterns for biological and/or management regions.	Important	Underway
385	Study Pacific halibut PSC, bycatch, and discard behavior in fisheries	Continue to explore management actions that reduce the incentives for PSC-, bycatch- and discard-related mortality of Pacific halibut. Evaluation of observer coverage, accuracy, and representativeness of PSC and bycatch estimates should be included.	Urgent	Underway
386	Investigate long term effects of fishing on Pacific halibut	Collect genetic samples for future comparison.	Strategic	Underway
387	Determine effects of migration on the Pacific halibut population and management	Extend existing analyses of tagging studies to include age-specific components. Continue to evaluate the role of migration in contributing to population dynamics and trends associated with area-specific catch, PSC levels, and downstream effects.	Important	Underway
388	Study temporal and spatial patterns in size-at-age of Pacific halibut	Reanalyze historical records of Pacific halibut size-at-age. Requires identifying samples from consistent spatial areas as well as re-ageing of older samples that utilized differing methods for age determination. Relate observed patterns to somatic growth via otolith increment analysis and development of bioenergetics model relating long-term environmental and ecological drivers to halibut size-at-age. Continue to explore the potential role of fishing in observed size-at-age trends via direct or evolutionary pathways and the interaction with size-selective fishing, include these analyses in harvest policy analyses.	Urgent	Underway
389	Investigate ecosystem effects and inter-species interactions of halibut	Investigate potential ecosystem effects and inter-species interactions on Pacific halibut recruitment and size-at-age. Includes integration of existing IPHC and NOAA trawl survey observations of size-at-age, diet, and population distribution and trends for multiple species in the GOA and BS.	Important	Underway

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Research ID	Title	Description	Council Priority	Research Status
390	Assess the population status of harbor seals in the Aleutian Islands and determine factors affecting their population trajectories	Assess the population status of harbor seals in the Aleutian Islands and determine factors affecting their population trajectories	Strategic	No action
431	Develop tools for analyzing coastal community vulnerability to fisheries management changes	Develop tools for assessing and predicting coastal community vulnerability to fisheries management changes. Assess changes in community vulnerability over time by FMP and individual catch share fishery.	Important	Underway
451	Arrowtooth flounder stock structure and movement	Arrowtooth flounder studies to support information related to stock structure and movement for Alaskan flatfish species	Important	Partially underway
452	Dusky Rockfish and Shortspine Thornyhead genetics research for improved population structure	Genetic research to better study dusky rockfish and shortspine thornyhead population structure.	Important	No action
453	Cod density in untrawlable areas in the AI	Evaluation of survey data (including IPHC long line, AFSC long line and NMFS trawl) in comparison with fishery data to better understand the proportion of cod biomass in untrawlable areas of the NMFS trawl survey.	Important	Underway
454	Sculpin natural mortality, seasonal food habits	Research to determine natural mortality for sculpin species in the GOA. Data gaps exist in sculpin species life history characteristics, spatial distribution, and abundance. GOA-specific mortality estimates would be beneficial, rather than using the M derived from BSAI sculpin species. Additionally, the collection of seasonal food habits data would help clarify the role of both large and small sculpin species within the GOA ecosystem	Important	No action
455	Shark aging, size at maturity, natural mortality	For sharks - data needed on size at maturity, natural mortality, better aging methodology. May be possible to collect age data from large " sleeper sharks that are caught in IPHC surveys. Access to those animals could enhance size and maturity data."	Important	Partially underway
472	Evaluate causes of variable meat size, undersize meats in scallops	Exploratory tows in the Bering Sea (District Q) and some areas open to harvest around Yakutat (District D) have shown scallops with disproportionately small meats relative to shell height. The cause of this condition as well as potential for recovery is unknown to industry. Additionally, samples from Bering Sea scallops with weak meats were collected and sent to the ADF&G Anchorage Pathology Lab for analysis of any evidence of diseases and/or parasites. The results showed that the scallops were infected with an apicomplexan-like parasite. To further evaluate the geographic extent and infection rates of this parasite, a sampling effort was initiated in July 2015 to collect samples from select locations across the state, from Yakutat to the Bering Sea.	Important	Partially underway
491	Assess dependence and impacts of halibut management actions on communities	Quantitatively and qualitatively examine the suite of engagements, dependencies, and vulnerabilities of halibut dependent communities and impacts of halibut management actions.	Urgent	No action
492	Investigate factors underlying fishery responses to halibut PSC caps	There is need to understand the underlying factors through which industry can adjust its behavior and its corresponding halibut encounter rates, in response to potential changes in halibut PSC caps. Investigations under this category could be conducted in combination with evaluations of alternative management actions for halibut PSC under Research Priority 385.	Urgent	No action

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Research ID	Title	Description	Council Priority	Research Status
493	Examine the relative importance of historical closed areas in the vicinity of the Pribilof Islands as juvenile halibut nursery habitat relative to other regions coast-wide.	Evaluate the biological effects of establishing spatial protections of juvenile halibut from fishing gear on BSAI halibut stock health.	Urgent	No action
494	Investigate skate egg concentration areas as EFH and HAPC	Skate conservation and skate egg concentration areas remain a priority for EFH and HAPC management and within Council and NMFS research plans.	Important	Partially underway
511	Computerized image analysis of current camera sled data	Assessment of existing database of camsled images is needed to provide scallop counts and sizes, contributing to abundance estimates. Additionally, sediment and habitat type and presence of other organisms can be assessed.	Important	Underway
513	Evaluate extent and importance of parasites in scallop populations	Samples from Bering Sea scallops with weak meats were collected and sent to the ADF&G Anchorage Pathology Lab for analysis of any evidence of diseases and/or parasites. The results showed that the scallops were infected with an apicomplexan-like parasite. To further evaluate the geographic extent and infection rates of this parasite, a sampling effort was initiated in July 2015 to collect samples from select locations across the state, from Yakutat to the Bering Sea.	Important	Partially underway
531	Collect growth data for Bering Sea crab stocks	Collect stock specific growth data for Bering Sea crab stocks that are currently managed using inadequate sample size data.	Urgent	Partially underway
532	Natural mortality estimation for crab stocks	Investigate natural mortality for crab stocks, to include responses to environmental variability and predation. Compare to existing natural mortality parameters used in stock assessment modeling.	Important	No action
533	Explore optimal sampling strategies and geospatial approaches for time series of survey data	The Stock Assessment Improvement Plan seeks to ensure that NMFS conducts its surveys in the most effective and efficient manner possible. Statistical analysis of the optimal number of survey stations needed to accurately assess the status and trends of groundfish and crab stocks is required to achieve this goal. An extension of this activity would be to explore alternative abundance estimation methods. For example exploring Thorson's geostatistical model as an alternative to the designed-based estimates for abundance indices used in stock assessments is a potentially useful analysis. Extensions would include an assessment of whether there are certain life history characteristics or levels of aggregation when geospatial models are used.	Urgent	Underway
534	Develop technical interaction model for BSAI MSE	A multi-species management strategy evaluation (MSE) with technical interactions among species is being developed to explore the potential implications of alternative harvest policies as was done for the Programmatic Supplemental Environmental Impact Statement (PSEIS). The approach of using an MSE with technical interactions is useful and unique in that the whole cycle of a fishery system is modeled: true status of several fish stocks in the fishery (Pacific cod, pollock, yellowfin sole, and Pacific halibut) are simulated; data are generated based on the true status of each stock, stock assessments are performed using the generated data; catch limits and bycatch limits are calculated, and the management system and fleet dynamics are mimicked to simulate the decision-making process that occurs when allocating catch limits among stocks within the constraint of the 2 million ton cap.	Urgent	Underway

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Research ID	Title	Description	Council Priority	Research Status
535	Development and evaluation of data poor and data moderate methods	Several methods are currently in use around the country for setting harvest specifications for data-poor and data-moderate stocks (corresponding, respectively, to Tiers 6 and 4-5 of the BSAI and GOA groundfish harvest control rules), several others are currently under development, and still others could be developed in the future. There is a need to continue development of such methods and to conduct comparative performance tests of the methods.	Strategic	Underway
536	Evaluate incorporation of climate change impacts into stock assessments	Climate change impacts are becoming an increasingly important consideration for long term planning and should be included in projections of exploitable fish stocks and associated ecosystem components. Incorporation of climate-based parameters into fish stock assessments will allow for exploration of harvest scenarios in the context of evolving climate conditions. Research is needed to explore how these parameters can be integrated into fishery stock assessments.	Strategic	Underway
537	Identification of best practices for long term storage of ageing structures.	Archived ageing structures such as otoliths can deteriorate over time unless they are stored in appropriate media. Loss of archived structures reduces the potential for obtaining information through techniques such as micro-chemical analysis. Best practices for long term storage are currently not well established.	Strategic	Partially underway
551	Estimate scallop survey catchability	Catchability of scallops in the fishery independent survey is needed to generate abundance estimates of scallops. Currently the survey provides only CPUE data.	Urgent	No action
552	Expand statewide scallop survey	The State of Alaska fishery independent dredge survey has been conducted in a limited number of known beds. Expansion of the survey beyond the edges of known beds into previously un-surveyed areas will improve knowledge of bed size and true scallop distribution..	Critical Ongoing Monitoring	Underway
553	Population structure of scallops	Currently scallop beds are monitored independently. Knowledge of source/sink dynamics and meta-populations processes will improve the ability to manage weathervane scallops at the stock level.	Important	No action
554	Molt and mate timing for Norton Sound red king crab	Within the assessment, there are conflicting observations about molt timing in April/May versus August/September. Moreover these observations suggest the potential for biennial mating. These issues could have important consequences on the assessment model.	Important	Partially underway
555	Herring genetics on overwintering and spawning grounds	A comparison of genetic composition of herring on the overwintering grounds and on the spawning grounds is needed to evaluate population structure.	Important	Partially underway
556	Re-evaluate the location and temporal structure of Herring Savings Areas	Re-evaluate whether the current locations of the Herring Savings Areas are likely to be effective at protecting herring populations (i.e. overlap with current distribution of herring during the specified dates) and whether seasonally-fixed or moving closures would be the most effective. Re-evaluation is particularly necessary due to recent changes in herring distributions. The research would ensure that groundfish fisheries are not pushed into areas with higher salmon PSC and squid bycatch without meeting the goal of protecting herring.	Urgent	No action

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Research ID	Title	Description	Council Priority	Research Status
571	Age validation for scallop shells	The combination of O18 (oxygen isotope) analysis and a benthic temperature model can be used to validate that the bands in cross sections of scallop shells are annuli and can be used to determine scallop age. This method is less time consuming than other methods that require recapture of scallops.	Important	No action
592	Maturity estimates for Bering Sea and Aleutian Island crab stocks	Application of Tier 3 control rules for crab requires reliable estimates of maturity to determine mature biomass. Maturity estimates of BSAI crab stocks are, in many cases, based on old studies using outdated methods. New studies to estimate both male and female maturity curves are needed for several stocks, with Aleutian Islands golden king crab considered a priority.	Urgent	No action
611	Collection of socio-economic information	Collect socio-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.	Critical Ongoing Monitoring	Partially underway
612	Maintain observer program	Maintain the observer data collection activity and ensure that fishery dependent data collected provides a valid representation of the catch and can be compared easily to the previous data collection methods and time series remain intact.	Critical Ongoing Monitoring	Underway
613	Maintain and update coupled biophysical projections for the North Pacific	Coupled model projection systems are needed to support the NPFMC's strategic initiatives related to the Bering Sea Regional Action Plan, the Bering Sea Fisheries Ecosystem Plan and the Alaska Climate Integrated Modeling activity. Research is needed on methods to dynamically downscale physics and biogeochemical information derived from global models and earth systems models to regional ocean models (ROMs) as well as methods for coupling nutrient-phytoplankton-zooplankton (NPZ) into ROMs. Likewise continued research on methods for coupling biological models (including the response of fishers) to projected environmental change will be an ongoing strategic activity. Projected environmental conditions from the ROMs/NPZ model is the foundation for management strategy evaluations needed to provide climate informed harvest strategies for the future. Support for continued update and refinement of the ROM/NPZ coupled models will be an ongoing strategic research need for the NPFMC.	Strategic	Partially underway
614	Expansion of catch in areas database to include BSAI and GOA crab and scallop fishing.	The NOAA Catch in Areas database incorporates VMS and Observer data and is used to characterize the distribution of fishing activity by target. This information is required for assessment of fishing effects on EFH and calculating fisheries bottom contact and spatial overlap. The database does not currently include crab or scallop fishing activity. Both VMS and observer data are available for these fisheries and work is needed to add it to the CIA database.	Important	No action
615	Evaluate the interactions between fisheries and killer whales and sperm whales	Attempt to quantify killer whale and sperm whale depredation on halibut, sablefish, and turbot in the CV and CP longline and trawl fleets. Study the effects on DMRs, the observer program, stock estimates, wastage, and unobserved mortality. Evaluate methods of avoidance, deterrence, and cost.	Urgent	Underway