

Row Labels	Res_Title
101	<p>Life history research on non-recovering crab stocks CPT Priority: medium SSC/Council Priority: High</p> <p>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.</p>
102	<p>Catch accounting of crab sex and size CPT Priority: medium SSC/Council Priority: Medium</p> <p>Improvements are needed for 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. [merge with 103]</p>
103	<p>Methods for reliable estimation of total removals CPT Priority: medium SSC/Council Priority: Medium</p> <p>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.</p>
105	<p>Spatial distribution of male snow crab CPT Priority: high SSC/Council Priority: High</p> <p>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. [merge with 149]</p>
107	<p>Improve handling mortality rate estimates for crab [note that nearly completed for chionoecetes; not yet for king crab]; develop methodology for king crab CPT Priority: high SSC/Council Priority: High</p> <p>Improve estimate of discarded crab handling mortality rate. 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. Empirical data exist for snow crab so new handling mortality data are needed for Tanner and king crab by size, sex, and fishery type with consideration of temperature. A methodology is needed for king crab</p>
110	<p>Maintain the core biological and oceanographic data (e.g., biophysical moorings, stomach data, zooplankton, age 0 surveys) necessary to support integrated ecosystem assessment CPT Priority: high SSC/Council Priority: High</p> <p>Maintain the core data 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).</p>

111 Biomass indices and alternate methodologies for lowest tier species

CPT Priority: **high**

SSC/Council Priority: Medium

Develop biomass indices for lowest tier species (Tier 5 for crab, Tier 6 for groundfish), such as sharks and octopus. Explore alternative methodologies for Tier 5 and 6 stocks such as length-based methods, catchability experiments (e.g., net selectivity), or biomass dynamics models. [\[consider link to 143\]](#)

113 Research on stock- recruit relationships

CPT Priority: **medium**

SSC/Council Priority: Medium

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.

116 Studies to identify crab stock boundaries

CPT Priority: **high**

SSC/Council Priority: High

Conduct studies to evaluate **all crab** stock boundaries **relative to management boundaries** (e.g., Bristol Bay red king crab, Adak red king crab, Pribilof blue king crab). Studies are needed in the areas of genetics, reproductive biology, larval distribution, and advection. Mark-recapture studies are needed as well. [\[link to 163\]](#)

125 Research ecosystem indicators and their thresholds for inclusion in ecosystem-level management strategy evaluation.

CPT Priority: **Medium**

SSC/Council Priority: High

Initiate/continue research on the synthesis of ecosystem indicators, developing and evaluating thresholds for ecosystem indicators, and ecosystem-level management strategy evaluation.

134 Assess whether Bering Sea canyons are habitats of particular concern

CPT Priority: **Low**

SSC/Council Priority: Medium

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.

135 Conduct routine fish, crab, and oceanographic surveys in the northern Bering Sea and Arctic Ocean

CPT Priority: **High**

SSC/Council Priority: High

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.

136 Effects of trawling on female red king crab and subsequent recruitment [\[underway\]](#)

CPT Priority: **High**

SSC/Council Priority: High

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 effects of potential habitat modifications on the distribution of females, particularly in nearshore areas of southwest Bristol Bay (partially underway), and environmental effects (e.g., trawling overlap in warm vs. cold years). Retrospective studies, the use of pop-up tags to identify larval release locations, and larval advection using Regional Ocean Modeling System would help address this need.

138 Continuation of State and Federal annual and biennial surveys

CPT Priority: High

SSC/Council Priority: Critical

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 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.

139 Conduct routine surveys of subsistence in the northern Bering Sea and Arctic Ocean

CPT Priority: Low

SSC/Council Priority: High

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.

140 Identification and integration of archived data

CPT Priority: Low

SSC/Council Priority: Low

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. Some archival acoustic data have been cataloged, and most trawl surveys have been included in databases. Some one-time research surveys remain neglected.

143 Alternative approaches to acquire fishery-independent abundance data for Aleutian Islands golden king crab

CPT Priority: **high**

SSC/Council Priority: High

Explore alternative approaches to the triennial ADF&G Aleutian Islands golden king crab pot survey to acquire fishery-independent abundance data on stock distribution and recruitment of Aleutian Islands golden king crab, including the potential for future cooperative research efforts with Industry. [\[link to above\]](#)

144 Assess seasonal diets and ~~movements~~ **species interactions for fish and shellfish**

CPT Priority: **high**

SSC/Council Priority: High

~~Assess~~ **Collect** seasonal or species-specific information for use in improved assessment and management (e.g., expand or continue cooperative research). The data would be useful in studies of species interactions in spatially explicit stock assessments **and understanding predation effects on crab stocks.**

147 Studies on factors that affect survey catchability particularly for King and Tanner crab and Aleutian Islands golden king crab

CPT Priority: high

SSC/Council Priority: High

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 and red king crab because of recent trends in stock status, and on fishery and fishing gear selectivity for Aleutian Island golden king crab to improve the stock assessment model.

148 Research on survey analysis techniques for species that exhibit patchy distributions

CPT Priority: Medium

SSC/Council Priority: Medium

Continue research on the design and implementation of appropriate survey analysis techniques, to aid the Council in assessing species (e.g., Pribilof Island king crab 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.

149 Quantitative reproductive index for the surveyed BSAI crab stocks

CPT Priority: high [on going some stocks]

SSC/Council Priority: High

Advance research towards developing a quantitative reproductive index for the surveyed 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. [\[link to above\]](#)

151 Acquire basic life history information (e.g., natural mortality, growth, size at maturity, molt probabilities) for data-poor stocks.

CPT Priority: high

SSC/Council Priority: High

Acquire basic life history information needed for stock assessment, PSC, and bycatch management of data-poor stocks, such as scallops, sharks, skates, sculpins, octopus, grenadiers, squid, and BSAI king and Tanner crab stocks. Specifically, information is needed on natural mortality, growth, size at maturity, molt probabilities and other basic indicators of stock production/productivity).

156 Improve estimates of natural mortality (M) for Pacific cod and crab stocks.

CPT Priority: remove from crab

SSC/Council Priority: Medium

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

157 Develop and validate aging methods for crabs.

CPT Priority: high, ongoing

SSC/Council Priority: High

Develop and validate aging methods for crabs to improve estimates of M for stock assessments.

159 Evaluate hybridization of snow and Tanner crabs.

CPT Priority: **low**

SSC/Council Priority: Low

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

160 Develop and evaluate global climate change models (GCM) or downscaled climate variability scenarios on recruitment, growth, spatial distribution

CPT Priority: **medium**

SSC/Council Priority: Medium

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.

161 Climate and oceanographic information covering a wider range of seasons is needed

CPT Priority: **medium**

SSC/Council Priority: Medium

There is also a need for climate and oceanographic information that covers a wider range of seasons than is presently available.

163 Expanded studies to identify stock and management boundaries

CPT Priority: **high** [[link to 116](#)]

SSC/Council Priority: High

To identify stock boundaries, 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 consequences of management and risks are clear. Verify stock structure and source/sink dynamics including physical oceanographic, genetic and life-history studies.

164 Develop spatially explicit stock assessment models

CPT Priority: **high**

SSC/Council Priority: High

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.

168 Conduct prospective and retrospective analyses of changes in the spatial and temporal distribution of fishing effort in response to management change

CPT Priority: **high**

SSC/Council Priority: High

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).

169 Develop a framework for collection of economic information

CPT Priority: **high, ongoing**

SSC/Council Priority: High

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.

170 Continue to evaluate the economic effects from crab rationalization programs on coastal communities.

CPT Priority: **low, consider removing (done)**

SSC/Council Priority: Medium

Continue to evaluate the economic effects from crab rationalization programs on coastal communities. This includes understanding economic impacts (both direct and indirect) and how the impacts are distributed among communities and economic sectors.

173 Evaluate the effectiveness of setting ABC and OFL levels for data-poor stocks

CPT Priority: High

SSC/Council Priority: Medium

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.~~

174 Examine interactions between coastal communities and commercial fisheries

CPT Priority: Medium

SSC/Council Priority: Medium

Examine interactions between coastal communities and commercial fisheries (e.g. subsistence-commercial linkages, adaptations to changes in resource use, economic opportunities for coastal communities).

176 Develop management strategy evaluations that incorporate changing climate and market economic conditions.

CPT Priority: Medium

SSC/Council Priority: Medium

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.

177 Develop an ongoing database of product inventories

CPT Priority: **medium**

SSC/Council Priority: Medium

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.

178 Analyze current determinants of demand for principal seafood products

CPT Priority: Low

SSC/Council Priority: Medium

Analyze current determinants of ex vessel, wholesale, international, and retail demand for principal seafood products from the GOA and BSAI.

179 Conduct pre- and post-implementation studies of the benefits and costs, and their distribution, associated with dedicated access privileges

CPT Priority: High, **ongoing**

SSC/Council Priority: High

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.

191 Improved habitat maps

CPT Priority: **medium, ongoing**

SSC/Council Priority: Medium

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.

192 Develop a GIS relational database for habitat, to include a historical time series of the spatial intensity of interactions between commercial fisheries and habitat.

CPT Priority: **medium, ongoing**

SSC/Council Priority: Medium

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.

194 Research the role of habitat in ~~fish population dynamics, fish production (growth, reproduction), and ecosystem processes~~

CPT Priority: High , **ongoing**

SSC/Council Priority: High

Research is needed on the role of habitat in ~~fish population dynamics, fish production, 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.

195 Evaluate efficacy of habitat closure areas and habitat recovery

CPT Priority: High

SSC/Council Priority: High

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. (This is an objective of EFH research approach for the Council FMPs).

196 Develop a multivariate index of the climate forcing of the Bering Sea shelf

CPT Priority: Medium

SSC/Council Priority: Medium

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.

197 Develop bottom and water column temperature database and indices

CPT Priority: Medium [**consider link to 110, others**]

SSC/Council Priority: Medium

Develop bottom and water column temperature database and indices for use in EBS, GOA, and AI stock assessments.

- 198 Maintain moorings and develop/maintain a sea ice formation, sea ice retreat, and spring bloom indices for the EBS**
CPT Priority: Medium
SSC/Council Priority: High
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.
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- 199 Collect and maintain primary production time series**
CPT Priority: **medium**
SSC/Council Priority: Medium
Collect and maintain primary production time series in the EBS, AI, GOA, and Arctic; particularly in relationship to key climate and oceanographic variables.
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- 200 Collect and maintain zooplankton and meroplankton biomass and community composition time series**
CPT Priority: **high**
SSC/Council Priority: High
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.
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- 201 Collect and maintain data on forage fish community composition and abundance**
CPT Priority: **remove from crab**
SSC/Council Priority: Medium
Collect and maintain data on forage fish community composition and abundance in the Bering Sea, GOA, AI, Arctic.
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- 214 Measure and monitor fish composition**
CPT Priority: **High** **[why is this here?]**
SSC/Council Priority: Medium
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, 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.
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- 215 Assess the movement of fish to understand the spatial importance of predator-prey interactions in response to environmental variability**
CPT Priority: **High** **[link to 144]**
SSC/Council Priority: Medium
Assess the movement of fish in response to environmental variability to understand the spatial changes of predator-prey interactions.
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- 216 Collect and maintain time series of ocean pH**
CPT Priority: **high** **[link to aboves]**
SSC/Council Priority: High
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
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217 Assess whether changes in pH would affect managed species, upper level predators, and lower trophic levels.

CPT Priority: **high, ongoing**[[link to 218, combine](#)]

SSC/Council Priority: High

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

218 Assess the synergistic effects of ocean acidification, [\[move this part to 219 oil, dispersants\]](#), and changes in temperature on productivity of marine species.

CPT Priority: **High, ongoing** [[link to 217](#)]

SSC/Council Priority: Low

Laboratory studies are needed to assess the synergistic effects of ocean acidification, oil, dispersants, and changes in temperature on productivity of marine species.

219 Monitor contaminant flux and loads in lower and higher trophic levels, and assess potential for impact on vital rates. [\[combine oil dispersants from 218\]](#)

CPT Priority: **Low**

SSC/Council Priority: Low

Monitor contaminant flux and loads in lower and higher trophic levels, and assess potential for impact on vital rates.

220 Collect, analyze, and monitor diet information

CPT Priority: [[link to above](#)]

SSC/Council Priority: High

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.

221 Conduct ecosystem structure studies

CPT Priority: **medium**

SSC/Council Priority: Medium

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)

NEW

CPT Priority: **high**

Investigate spatial stock dynamics and population connectivity for Tanner crab (2 stocks)

CPT priority: **low**

Check on disease and parasites [add crab for review]