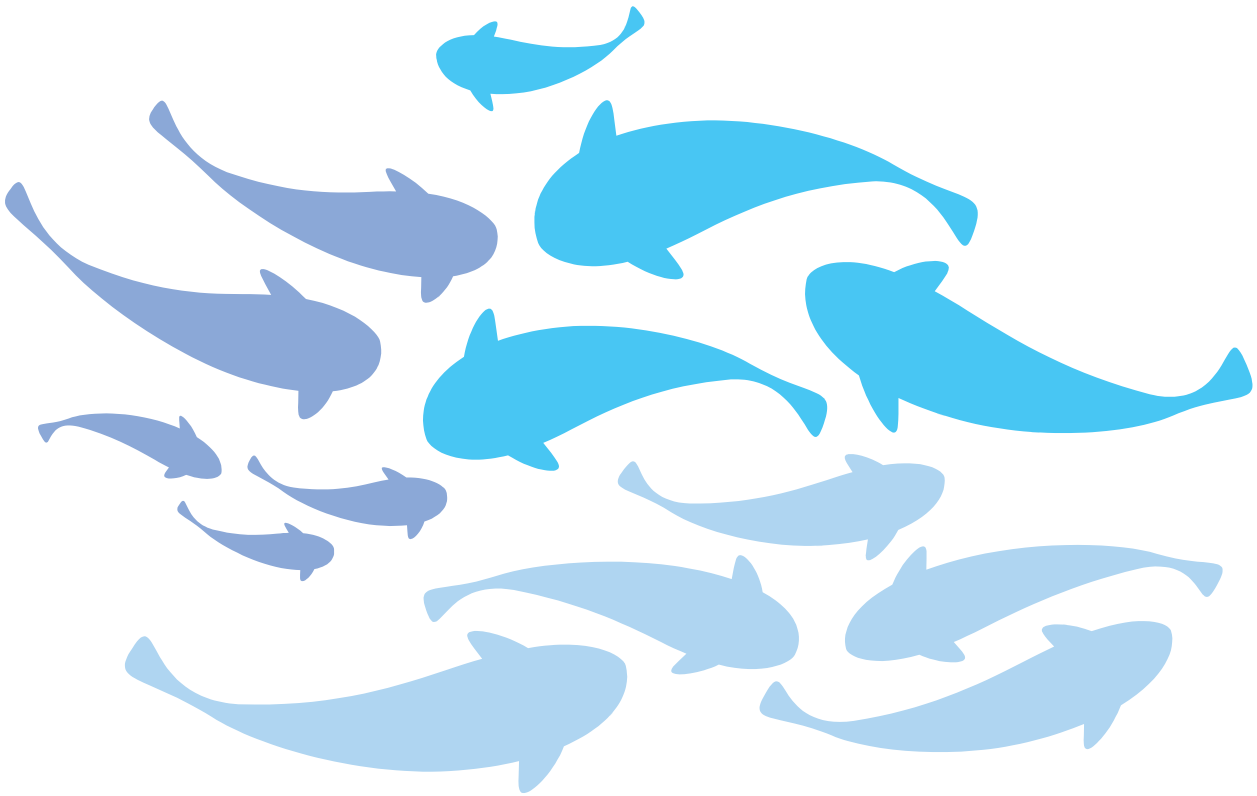
NOAA FISHERIES

Alaska Fisheries Science Center

Strategic Science Plan



Executive Summary

The Alaska Fisheries Science Center (AFSC) conducts the research to support NOAA Fisheries' stewardship mission on living marine resources and their habitats in the coastal oceans of Alaska and in the communities that rely on those resources. This region of nearly 1.5 million square miles includes waters in the Gulf of Alaska, Bering Sea, Aleutian Islands, Chukchi Sea, and Beaufort Sea. Together, these waters support some of the most important commercial fisheries in the world, are home to the largest marine mammal populations in the Nation, and support some of the most critically endangered marine mammal populations.

This Science Plan addresses the desired research activities, infrastructure, and support services for the AFSC over the next 3 - 5 years. The intent is to organize and communicate our research activities in a way that: (1) shows the full suite of research and support functions under three main themes and 12 foci so staff can see how their work contributes to the AFSC mission and 2) identifies the core research activities which would be conducted even under stringent budget scenarios. This effort is organized around the following three themes:

Theme 1: Monitor and assess fish, crab, and marine mammal populations, fisheries, marine ecosystems, and the associated communities that rely on these resources.

Theme 2: Understand and forecast effects of climate change on marine ecosystems.

Theme 3: Achieve organizational excellence in our administrative activities through innovation and the use of best practices.

The AFSC mission is guided by Department of Commerce, NOAA, and NOAA Fisheries' strategic plans and guidance[1]. Broad policy objectives reflected in the AFSC's mission include: "foster healthy and sustainable marine resources, habitats, and ecosystems," "listen and respond to stakeholder concerns," "ensure the productivity and sustainability of fisheries and fishing communities through science-based decision-making and compliance of regulations," "recover and conserve protected resources through the use of sound natural and social sciences," and "improve organizational excellence."

Implementing AFSC Science

Accompanying this Science Plan is an Implementation Process, outlining the procedures for obtaining organizational excellence through strategic resource allocation, informed decision-making, and transparent and effective communication to accomplish core activities and high priority research.

[1] Department of Commerce Strategic Plan (2014-2018), NOAA's Next Generation Strategic Plan (2010), NOAA's Annual Guidance Memorandum (2014-2020), NOAA Fisheries' Priorities and Annual Guidance for 2016, NOAA Fisheries Climate Science Strategy (2015), National Strategy for the Arctic Region (2013) and associated Implementation Plan (2014), and NOAA's Arctic Action Plan (2014).

Together, the Science Plan and Implementation Process documents provide guidance for decision making within the AFSC with the goal of increasing the transparency of these decisions. These documents help position the AFSC to meet our future challenges by clearly stating our core and desired research, providing focus, and enabling a concentration of AFSC resources to accomplish these goals.

New Challenges

Meeting the Demand for Climate Science

The AFSC mission between FY2017 and FY2022 will be largely guided by the NOAA Fisheries Climate Science Strategy which challenges NOAA Fisheries to increase the production, delivery, and use of climate data and information to fulfill our mandates. The Climate Science Strategy identifies seven objectives to efficiently and effectively meet these new information requirements to mitigate climate impacts on marine ecosystems and increase the resilience of economies and communities. These objectives are:

1. Identify appropriate, climate-informed reference points for managing LMRs.
2. Identify robust strategies for managing LMRs under changing climate conditions.
3. Design adaptive decision processes that can incorporate and respond to changing climate conditions.
4. Identify future states of marine, coastal, and freshwater ecosystems, LMRs, and LMR-dependent human communities in a changing climate.
5. Identify the mechanisms of climate impacts on ecosystems, LMRs, and LMR-dependent human communities.
6. Track trends in ecosystems, LMRs, and LMR-dependent human communities and provide early warning of change.
7. Build and maintain the science infrastructure needed to fulfill NOAA Fisheries mandates under changing climate conditions.

A goal of the Climate Science Strategy is to build a portfolio of integrated, "climate-ready" management actions, based on ecosystem-based fisheries management (EBFM) tools and approaches. EBFM provides tools for addressing climate-driven changes, reducing unintended outcomes of management actions, and balancing emergent tradeoffs under climate-change. Some EBFM tools have already been utilized for some time in Alaska to help manage fisheries under variable conditions; continued development and expansion of EBFM approaches will be needed for regional climate-ready fisheries management.

Further, the Strategy calls on each Region to work with partners to develop Regional Action Plans (RAPs) to identify strengths, weaknesses, priorities, and actions to implement the Strategy in each Region over the next 3-5 years. The AFSC is leading the nation in these efforts, and released our draft Regional Action Plan for the southeastern Bering Sea in February 2016. In the coming years, the AFSC will develop RAPs for Gulf of Alaska, the Aleutian Islands, and the Chukchi and Beaufort Seas.

Species in the Spotlight

In addition to these seven climate science objectives, NOAA Fisheries is also marking the 5th decade of the Endangered Species Act by strengthening the emphasis not to lose any species on our watch. Eight "species" listed under the Endangered Species Act were identified as among the highest risk for extinction in the near future, among them the Cook Inlet beluga whale population off Alaska. NOAA Fisheries has placed special priority (spotlight) on these species and has asked all of its regional science centers and regional offices to place a priority on funding new programs that will promote the recovery of these species.

Arctic Science

The Arctic has critical long-term strategic, ecological, cultural, and economic value. The AFSC has a unique role in the NOAA mission regarding the Arctic. Three key strategies are derived from the NOAA Arctic Action Plan: 1) Strengthen foundational science to understand and detect Arctic climate and ecosystem changes, 2) Improve stewardship and management of ocean and coastal resources in the Arctic, and 3) Advance resilient and healthy Arctic communities and economies.

National Priorities for Ocean Research

NOAA Fisheries describes its mission as being "responsible for the management, conservation and protection of living marine resources within the United States Exclusive Economic Zone. NOAA Fisheries also plays a supportive and advisory role in the management of living marine resources in coastal areas under state jurisdiction, provides scientific and policy leadership in the international arena and implements international conservation and management measures as appropriate. "

Many factors, both natural and anthropogenic, affect populations of fish, crab and marine mammals and marine ecosystems. Although natural factors cannot be controlled, and many human-caused factors are also outside the control of NOAA Fisheries, the scientific information collected and maintained by NOAA Fisheries informs and advises policymakers and managers. Understanding and predicting the health and productivity of marine ecosystems is critical to our stewardship mission. The AFSC Science Plan is aligned with this mission.

The National Ocean Policy Implementation Plan (National Ocean Council, 2013) identified several aspects of the AFSC mission as among the Nation's top priorities, including: ensuring sustainable marine fisheries; determining the impacts of interacting stressors on ecological systems, economies, and communities; and strengthening Arctic science and stewardship. While our research efforts will continue in the Gulf of Alaska, southern Bering Sea and Aleutian Islands, climate-induced loss of sea ice in Alaska requires that they also extend into the northern Bering, Chukchi, and Beaufort Seas.

Strategic Framework

This plan is structured around the aforementioned research and support themes. The full portfolio of the AFSC's activities are further characterized by particular foci which describe the accomplishments we expect to achieve within the theme.

AFSC Research and Support Themes and Associated Foci

1. Support fishery management through providing core research products used in annual management decisions.
    - 1.1. Maintain the current assessment tier of fish, crab, and marine mammal stocks (Core Activity)
    - 1.2. Support NOAA Fisheries and North Pacific Fishery Management Council analyses and international obligations (Core Activity)
    - 1.3. Create next generation fish, crab, and marine mammal stock assessments and biological and socioeconomic data collections, including priority for Cook Inlet beluga whales
    - 1.4. Conduct bycatch analyses and support conservation engineering advances
2. Understand and forecast effects of climate change on marine ecosystems
    - 2.1. Finalize and implement the Regional Action Plan for Climate Science Strategy in the Southeast Bering Sea
    - 2.2. Develop and implement Regional Action Plans for the Gulf of Alaska and the Aleutian Islands by 2017 and 2019, respectively
    - 2.3. Conduct integrated ecosystem assessments
    - 2.4. Implement NOAA Fisheries' components of NOAA's Arctic Action Plan
    - 2.5. Forecast direct and indirect effects of climate change on fish, crab, and marine mammal species, their habitats, and the associated communities which rely on these resources
3. Achieve organizational excellence in our administrative activities through innovation and the use of best practices.
    - 3.1. Develop annual resource allocation plans for AFSC based on criteria applied through the AFSC Science Planning and Implementation process. Coordinate result with the Alaska Regional Office (AKR), NOAA Fisheries Headquarters, and the North Pacific Fishery Management Council (NPFMC).
    - 3.2. Implement annual AFSC staffing plans for FY2017-2022 which aim to achieve a constant, targeted cost of federal labor. It is anticipated that such a goal may require a loss of federal positions through retirement and voluntary attrition.
    - 3.3. Incorporate Data Management Plans into each and every science project. Disseminate environmental data and metadata in a manner consistent with the NOAA Plan for Increasing Public Access to Research Results (PARR)

Research Themes

Research Theme 1 Support fishery management through providing core research products used in annual management decisions.

The primary responsibility of the AFSC is to provide scientific data and analysis and expert technical advice to the NOAA Fisheries' Alaska Regional Office (AKR), North Pacific Fishery Management Council (NPFMC), the State of Alaska, the International Pacific Halibut Commission, the Pacific Salmon Commission, Alaskan tribal governments, public stakeholders, and U.S. representatives participating in international fishery and marine mammal negotiations.

The work of monitoring and assessing fish, crab and marine mammal populations, fisheries, and marine ecosystems is mandated by legislation which includes the Magnuson-Stevens Fishery Conservation and Management Act (MSA), the Marine Mammal Protection Act (MMPA), the U.S Endangered Species Act (ESA), and the National Environmental Policy Act (NEPA). The first two research foci within this theme directly support these responsibilities and are our "Core Research Activities," representing work the AFSC would continue under the most restrictive budget scenarios. The final two foci in this theme address improvements to our core work that might be supported, depending on funding availability and priorities.

Research Foci for Research Theme 1

Focus 1.1: MAINTAIN THE CURRENT ASSESSMENT TIER OF FISH, CRAB AND MARINE MAMMAL STOCK ASSESSMENTS (CORE ACTIVITY)

Work under this focus would maintain the information and capabilities needed to support the assessments required for the current NPFMC tiers for fish and crab (Appendix 1), and maintain the information and capabilities required to support the current tier of Protected Resources Stock Assessment Improvement Plan (SAIP) tier of marine mammal stocks listed as strategic under the MMPA (Appendix 2). Maintaining these tiers requires preserving the current quality and quantity of data used in the assessments.

The stock assessments produced by the AFSC provide critical information to fishery and protected resource managers. Maintaining stock assessment activities requires adequate resources (including personnel) to collect fishery-independent and dependent data as well as to conduct stock assessments and to evaluate the likely biological and socioeconomic outcomes of management options.

Fish and crab stock assessments include recommendations for overfishing levels (OFL) and acceptable biological catch (ABC). These recommendations are used by the NPFMC when setting

total allowable catches (TAC) and are a key contributor to ensuring that Alaska's fisheries remain sustainable and are managed based on the best available scientific information.

Annual marine mammal stock assessments are critical to Alaska Regional Office's (AKR) protected resources managers as they provide the information necessary for annual evaluations of the level of fishery-related incidental serious injury and mortality of marine mammals relative to a marine mammal stock's Potential Biological Removal (PBR) level. In addition, measures to enable recovery of threatened and endangered populations of protected resources can impact fisheries.

The AFSC conducts a wide variety of research to support fish and crab stock assessments. Research activities such as conducting field surveys of population abundance, determining survey efficiency, age composition of stocks, age at maturity, fecundity, stock structure and spawning behavior, estimating fishing and natural mortality, and growth rate, and identification of geographical boundaries and essential habitat all contribute to the AFSC's ability to maintain the quality of our stock assessments.

In general, the types of assessment information currently available for marine mammal stocks are more limited than those for fish and crab stocks. Due to a lack of resources, marine mammal assessment scientists conduct abundance surveys and analyze the resulting data for less than half of the stocks for which the AFSC is responsible for developing population estimates, evaluating stock structure, and assessing trends in abundance. Evaluations of age-specific survival and reproductive rates, information on key habitat, and the causes of population trends are conducted for only a small handful of marine mammal stocks.

Maintaining adequate information and capabilities to support current tier designations requires ongoing monitoring and assessment activities. These include conducting surveys at a sufficient geographic scope and frequency, measuring age, and other life history parameters data needs for the assessments. The accompanying infrastructure, including staffing these activities, must also be sustained.

Focus 1.2: SUPPORT NOAA FISHERIES AND NPFMC ANALYSES AND INTERNATIONAL OBLIGATIONS (CORE ACTIVITY)

Providing biological and socioeconomic information responsive to NPFMC and AKR requests for scientific information in support of decisions and quota monitoring and analyses required by legal and regulatory processes is the AFSC's second core activity.

The AFSC also provides scientific support to a number of international conventions and organizations such as the Convention on the Conservation and Management of Pollock Resources in the Central Bering Sea, the International Whaling Commission, the North Pacific Anadromous Fish Commission, the Pacific Salmon Commission, the North Pacific Marine Science Organization, and the International Council for the Exploration of the Sea.

This scientific support takes many forms and includes: 1) the maintenance of the infrastructure for the North Pacific Observer Program; 2) the collection, maintenance and analysis of scientific information on ecological and socioeconomic effects of management strategies and alternatives; 3) the participation in international, national and regional working groups; 4) scientific analysis to support the MSA (including National Standards 1-8), NEPA, ESA and MMPA; and 5) scientific data collection activities such as surveys on fisheries-independent surveys for the abundance, biomass, and distribution of commercial species that form the basis of these analyses and advice.

The AFSC provides biological information necessary to evaluate the implications of management actions on fish, crab, and marine mammal stocks and marine ecosystems. It also conducts social and economic data collections, reporting, and research to support and inform management decisions. The Observer Program support involves training, briefing, debriefing and overseeing observers and maintaining quality of observer data. Analytical support may involve retrospective and prospective methods including techniques such as management strategy evaluations, socioeconomic surveys, and model-based evaluations.

Focus 1.3: CREATE NEXT GENERATION FISH, CRAB, AND MARINE MAMMAL STOCK ASSESSMENTS AND BIOLOGICAL AND SOCIOECONOMIC DATA COLLECTIONS, INCLUDING PRIORITY FOR COOK INLET BELUGA WHALES

Work related to this focus can increase knowledge (e.g., life history, habitat and abundance) of fish and crab species listed in fishery management plans and improve current fish and crab assessments for individual stocks by reducing the level of uncertainty in the assessment. It may also test and improve assumptions used in current annual stock assessments advancing the model's ability to reflect or simulate actual processes affecting those populations.

Activities within this focus may also include the collection of basic information (e.g., abundance, stock structure) for non-strategic marine mammal stocks and increase knowledge (e.g., life history, responses to stressors, and interpretation of trends in abundance) of strategic stocks and advance current Protected Resources SAIP tier. In addition, new social and economic data collections beyond those currently conducted on a regular, periodic basis may be initiated to alleviate gaps and improve the information and analyses available to support decision making associated with fishery and species management alternatives.

The AFSC conducts stock assessments that differ according to the specific needs of implementing regulations under the MSA, ESA and MMPA, and according to the differing characteristics of, and information available for, the populations of fish, crab and marine mammals. Under current budget levels, the AFSC intends on improving assessments and, if possible, expanding the number of populations surveyed through technological innovation and/or redirecting resources and examining the tradeoffs between survey frequency and the number of stocks surveyed. The AFSC will continue to seek additional resources for the improvement and expansion of stock assessments.

NOAA Fisheries has developed stock assessment improvement plans for fish, crab, and marine mammals. These improvement plans outline types of information needed in assessments at increasing levels of specificity or confidence, and provide a ranking system for stock assessments that includes maintaining existing levels of information, elevating stock assessments to national standards of excellence, and producing next generation assessments that explicitly incorporate ecosystem considerations such as multispecies interactions and environmental effects (see Theme 2), fisheries oceanography and recruitment processes, and spatial and seasonal analyses. We note that including climate and ecosystem forcing within single species population dynamics models is an important part of this focus and will demand development of new modeling approaches to improve stock and ecosystem assessments including incorporating ecosystem indicators, predator-prey interactions and habitat information into stock assessments and assessing the effects of fishing and the environment on the spatial distribution of managed species.

Next generation assessments for marine mammal populations would include the considerations identified above and would also take into account exposure to and effects of specific threats to a population, behavioral and physiological information, estimates of dispersal rates that include estimates of uncertainty, and assessments using stochastic models. In addition to basic information on abundance, distribution, and stock structure, next generation assessments will often require information about foraging habits, fine-scale distribution, habitat preferences, or changes in behavior in response to stressors. Improved fish, crab, and marine mammal stock assessments also require improved information on stock structure and boundaries.

The AFSC will maintain and as feasible, improve collection of the data required for fish and crab stock assessments and socio-economic assessments. This includes knowledge of whether or not data acquired for the assessments is influenced by trends in climate and the environment. Fish and crab stock assessments require three major categories of quantitative information: 1) trends in relative and/or absolute abundance of the population; 2) direct and incidental harvest; and 3) life history data (growth, maturity, and survival). Data collection will be expanded or improved through the use of new and developing technologies to better assess managed species and management activities. More quantitative information is necessary to improve social and economic assessments of management decisions affecting fishing communities and the commercial, recreational, and subsistence fishing sectors.

A high priority for the AFSC is to improve assessments of strategic marine mammal stocks to include trends in abundance, interpretation of these trends, and when needed by managers, information on foraging habitat, fine scale distribution, and behavioral responses of marine mammals to stressors. As funds allow, assessments of non-strategic marine mammals will be improved to meet the minimum requirements of the MMPA for abundance, human-related mortality and serious injury (estimated with acceptable precision), distribution and stock structure.

Focus 1.4: BYCATCH ANALYSIS AND CONSERVATION ENGINEERING

Bycatch is an increasingly critical issue affecting many of the federally managed fisheries in the North Pacific. The term "bycatch" can include unintended catch of species not being targeted in multi-species complexes, but may also include catch of species which are prohibited from being retained. In recent years the prohibited species catch (PSC) of chum and Chinook salmon and Pacific halibut have been at the forefront of many high-profile NPFMC management actions. The implications of the volume of PSC being caught in federally managed fisheries of Alaska resonate elsewhere, such as in the Endangered Species Act Section 7 consultation process for listed salmon species, in the State of Alaska managed salmon fisheries, and within the Pacific halibut fisheries managed by the International Pacific Halibut Commission to cite just three important examples.

The NPFMC has established strict PSC limits for Pacific halibut, Pacific salmon (Chinook and chum) and crab in particular target fisheries, gear types and seasons within Alaska to protect and conserve these species. When the PSC limits are exceeded (e.g., halibut in the Bering Sea), then the groundfish fishery is immediately closed resulting in lost harvest opportunity. Industry has implemented measures to minimize bycatch during the fishing season (e.g., in-season monitoring of salmon bycatch and voluntary avoidance of high bycatch areas), but these measures can increase the cost associated with fishing which negatively impacts the target fishery.

Directed science projects are needed by fishery managers and industry to: 1) better understand where and when bycatch of PSC will be a problem; 2) develop gear and fishing methods to minimize PSC bycatch in areas where there is a high degree of spatial overlap of PSC and target species; 3) develop Fishery Management Plan (FMP) amendments for reducing bycatch that are robust to variations in stock abundance of PSC species, and that provide appropriate incentives to avoid bycatch; 4) understand economic, social, and biological impacts of bycatch in the groundfish fisheries; and 5) determine the rivers of origin for various salmon species.

To expand on some examples:

- understanding the physical and biological mechanisms controlling temporal and spatial patterns of salmon bycatch can be achieved through systematic surveys targeting immature salmon in groundfish harvest areas;
- conservation engineering approaches can be used to design fishing gear that lowers the rate of bycatch;
- statistical and mathematical modeling approaches contribute to evaluating alternative approaches to bycatch reduction during the NPFMC's rule making process for FMP amendments; and
- economic and social impact analyses are important products to help understand the tradeoffs that exist between catching a particular species in a target fishery as opposed to as PSC.

The fishery observer program and its data management and analysis capabilities are fundamental to crafting scientific solutions to bycatch management problems. Sampling activities that support our understanding of species composition, age, weight-at-length, genetic stock composition, as well as recovery of coded wire and other tags, are essential to these areas of research. The AFSC could be utilizing observer data on salmon bycatch (e.g., size, age, genetics, coded wire tag information) to further develop adult equivalent models (AEQ) to evaluate the lagged impact to future salmon returns. Refinements to AEQ models could include alternative spatial stratification of these data so that possible stock composition variability can be targeted specifically to avoid salmon from stocks that are doing poorly.

Multi-species management strategy evaluations (MSEs) with technical interactions among species should also be developed to explore the potential implications of alternative, abundance-based harvest policies for setting bycatch limits of PSC. For example, a fixed cap is currently used for specifying bycatch limits for Pacific halibut, such that, regardless of abundance of Pacific halibut, its bycatch limit in the Bering Sea and Aleutian Islands trawl fishery does not depend on the status of the stock. A similar challenge exists with the control rule for managing salmon bycatch, because salmon PSC limits are also set independently of salmon abundance.

Conservation engineering offers the means to reduce prohibited species bycatch in a directed fishery and it has broad support from the NPFMC and industry. Modification of fishing gear based on fish behavior has the potential to either selectively reduce capture efficiency or allow escapement of non-target species. Testing, designing, and implementing different types of "excluders" is needed for both bottom trawl and midwater mobile gear in Alaska to reduce the bycatch of Pacific halibut and salmon. This applied research is best accomplished as a cooperative effort with the fishing industry, where NOAA Fisheries scientists and industry both bring their expertise, equipment, and platforms to the problem. Solutions require multiple steps such as evaluating flow within and around trawls in large flume tanks, soliciting ideas from fishers on potential gear modifications, using underwater video to document fish behavior inside the trawl, and conducting well-designed, in situ experiments to statistically test the efficiency of the trawls with and without excluders to determine effects on the bycatch and target species catch. Research that examines how local environmental conditions influence rates of bycatch in groundfish trawl and longline fisheries is also needed. Adapting fishing gear to the task of gathering data on temperature, depth, and conductivity at the time of fishing may lead to control rules that reduce bycatch. Models combining the environmental data with the biological data gathered by fishery observers could predict how environmental conditions influence bycatch rates, and thereby identify possible bycatch hotspots for groundfish fleets to avoid.

Research on bycatch of seabirds by commercial fisheries has long been an important activity for the AFSC. These efforts include: seabird bycatch data gathered by the observer program which allows bycatch estimates to be made by the AKR; research resulting in seabird bycatch reduction protocols in the longline fisheries through the use of streamer lines; pilot projects using electronic monitoring for compliance and seabird bycatch estimation; seabird necropsy and

food habits collections; and pilot projects on trawl paravane bycatch reduction and other efforts to reducing trawl seabird bycatch.

Research Theme 2 Understand and forecast effects of climate change on marine ecosystems

Large Marine Ecosystems (LME) are relatively large areas of ocean space of approximately 200,000 km^2 or greater, adjacent to the continents in coastal waters where primary productivity is generally higher than in open ocean areas. Unlike geographical ocean boundaries, LMEs are defined by ecological, rather than political or economic, criteria.

Climate change will impact all of the LMEs under the research responsibility of the AFSC. The AFSC has extensive research programs in the East Bering Sea, Gulf of Alaska, and Aleutian Islands LMEs and is carrying out research to improve our understanding of the manner in which these may respond to climate change. The AFSC needs to develop and conduct baseline assessments in the northern Bering-Chukchi Seas and Beaufort Sea LMEs.

To prepare for, and respond to, the current and future changes in climate and oceans, fisheries managers and scientists need tools to identify what fishery resources may be most vulnerable in a changing climate and why. Climate vulnerability assessment methodologies are being developed and applied to help fisheries managers and scientists identify ways to reduce risks and impacts to fisheries resources and the people that depend on them, as well as to identify gaps and help prioritize research. Managers can use the results to identify potential impacts and start discussions on possible management approaches to reduce impacts and increase resilience of fisheries, and fishing-dependent communities.

The AFSC's science to support stewardship needs to be aligned such that it is responsive to a changing planet, hence we are organizing our science activities outside of Theme 1 within the scope of the new NOAA Fisheries Climate Science Strategy and Ecosystem-Based Fishery Management (EBFM) Policy. Our goal is to provide management relevant scientific advice that is robust to climate change and is inclusive of ecosystem interactions. Hence AFSC research in areas such as habitat, fishery oceanography, and trophic relationships will be supported in Theme 2 to the extent they are informing to our stewardship mission and are connected to the Climate Science Strategy and EBFM research initiatives.

Research Foci for Research Theme 2

Focus 2.1: FINALIZE AND IMPLEMENT THE REGIONAL ACTION PLAN FOR CLIMATE SCIENCE STRATEGY IN THE SOUTHEAST BERING SEA

The draft Regional Action Plan for the Southeastern Bering Sea identifies specific research activities that are either underway or necessary to achieve the seven objectives identified in the more general NOAA Fisheries' Climate Science Strategy. In particular, this plan describes the need for single- and multi-species models with climate forcing to derive climate informed reference points. Implementation of the recently completed Fisheries Ecosystem Plan, as well as management strategy evaluations are important components of our goal to identify robust strategies for managing LMRs under changing climate conditions. Specific collaborative projects such as the Alaska Climate Project (ACLIM) will be conducted to provide a suite of models designed to provide scenarios of future fish production under a variety of climate and fishing scenarios. Future representative fishing pathways will be simulated through a multispecies technical interaction model that includes interacting constraints on future catch and dynamically projects future fish responses to climate variability and change and estimates future catch within existing or proposed constraints.

Effort must also be expended to help inform the NPFMC about climate-induced reference point changes. Changes in fishery-independent surveys and other direct observations are used to adapt fishing mortality to estimates of biomass for those stocks on which such information is available. As such, the repercussions of such changes, and the associated management recommendations that are likely to arise should be considered.

To identify future states of marine and coastal ecosystems, living marine resources, and communities dependent upon them, a range of concurrent activities should be undertaken. First, we must attempt to understand how the productivity and distribution of individual species are affected by environmental conditions influenced by climate and incorporate this understanding into single species models. Second is to explore how interactions among species are influenced by climate and the environment and incorporate that understanding into multi-species models. Third, we need to improve our abilities to construct ocean ecosystem models by downscaling global climate change data, including ocean acidification changes. Fourth is to develop, assess, and refine, environmental indices that currently reflect the influence of climate on single and multispecies complexes. Such indices of drivers of single species and multispecies production could be forecast from our ocean ecosystem models. In addition, vulnerability assessments of such species can be informative regarding their exposure and sensitivity to expected climate change in terms of a reduction in a productivity and or abundance. Fifth is to increase our understanding of current human dependence on the LMRs and their adaptability to better forecast the effects of climate change, both economically and socially, for a fuller and more holistic view of the ecosystem. Lastly, develop a series of periodic "report cards" to inform stakeholders on both the present and potential future states of the ecosystem and individual

species of commercial value or high interest. For such modeling efforts to be credible, mechanisms driving the climate impacts on LMRs, ecosystems and human communities should be investigated and characterized. Integrated ecosystem assessments, and associated trends, will need to be conducted and disseminated in order to provide early warning of observed changes.

Successful implementation of the Regional Action Plan in the Bering Sea depends heavily on understanding how and why fish and crab species respond to factors related to climate change. The process of identifying future states of marine and coastal ecosystems, living marine resources, and communities dependent upon them cannot be accomplished without surveys of the marine environment that permit the integration of biological and physical data. As explained in detail in the following section, fisheries oceanographic surveys provide the information necessary to understand the mechanisms of environmental control of production without which credible ocean ecosystem models cannot be constructed. Surveys that measure simultaneously ocean physics, nutrients, phytoplankton, zooplankton, and species composition of target organisms provide the data to understand the mechanisms through which climate drives the abundances of single species and multi-species complexes of interest to fishery management.

Focus 2.2: DEVELOP AND IMPLEMENT REGIONAL ACTION PLANS FOR THE GULF OF ALASKA AND THE ALEUTIAN ISLANDS

Regional Action Plans capable of achieving the seven objectives identified in the more general NOAA climate science strategy should be developed for the Gulf of Alaska and Aleutian Islands LMEs. The breadth and specific foci of these plans may generally be analogous to the plan developed for the Bering Sea, for both consistency and comparative purposes, but the species of interest, biophysical and anthropogenic characteristics, and thus necessary research, will differ by LMEs. In the interim, before the RAP is fully developed for the Gulf of Alaska (GOA), the AFSC will capitalize on focal species and new understanding of ecosystem processes provided by the recently completed Integrated Ecosystem Research Program. In the Aleutian Islands our efforts will be guided by the body of research accomplished by the AFSC and other researchers (e.g., National Science Foundation studies, assessment surveys, coral and sponge biology, Pacific cod and Atka mackerel tagging, and Steller sea lion research). The RAP for the Aleutian Islands may become the foundation for a future Integrated Ecosystem Research Program and could serve as the foundational document for studying climate change in this region. At this point, the development of a GOA RAP is considered a higher priority than the Aleutian Islands RAP. Therefore, efforts will be made to finish the GOA RAP by the end of 2017 and the Aleutian Islands RAP by the middle of 2019.

Focus 2.3: CONDUCT INTEGRATED ECOSYSTEM ASSESSMENTS

Research fitting into this focus develops integrated analyses that monitor and evaluate multiple ecosystem components (e.g., fish, seabirds, marine mammals, their habitats, oceanography, and human dimensions) of LMEs.

Under the MSA, NOAA is charged with implementing Ecosystem Approach to Management (EAM) for the nation's ocean and coastal resources. Realizing EAM will require developing an understanding of the manner in which atmospheric and oceanic processes interact with habitat to control the dynamics of fish, crab, and marine mammal populations, and the manner in which management systems influence the impact of human activities on ecosystem productivity and organization. For our purposes, for fish and crab, the EAM approach also can be termed EBFM (ecosystem-based fisheries management, defined earlier). It will also require an understanding of the ways in which humans value these resources. Forecasting these impacts will require understanding the factors controlling production at various trophic levels, predator-prey interactions, climate pressures, and the interaction of these factors with market forces, human behavior and incentives. Monitoring these impacts will require improvement of current ecosystem indicators and development of additional indicators of fishing and climate impacts and incorporation of these indicators into fish, crab and marine mammal stock assessments. More fully realizing EAM will require judicious expansion of our current data gathering operations to meet the requirements of ecosystem-level data gathering and synthesis known as Integrated Ecosystem Assessment (IEA) for each of the Large Marine Ecosystems (LMEs).

An IEA is the synthesis and analysis of all available information on relevant physical, chemical, ecological and human processes in relation to specified ecosystem management objectives. IEAs provide an efficient means of summarizing the status of ecosystem components, screening and prioritizing potential risks, and evaluating alternative management strategies against a backdrop of environmental (e.g., temporal and spatial) and socioeconomic variability. They also provide a means of evaluating tradeoffs in management objectives among potentially competing ocean-use sectors in support of marine spatial planning. Our five Alaska LMEs (the Gulf of Alaska, East Bering Sea, Aleutian Islands, Northern Bering-Chukchi Seas, and Beaufort Sea), all lack fully developed IEAs. The Ecosystems Considerations chapter of the Groundfish Stock Assessment and Fishery Evaluation reports provides a foundation for developing IEAs for the eastern Bering Sea and Gulf of Alaska, but no such bases exist for the Chukchi and Beaufort Seas.

A major IEA component will be developed for the Bering Sea during the next few years. The development of a Fisheries Ecosystem Plan (FEP) for the Bering Sea Management Area was approved by the NPFMC in December 2015. The FEP is expected to include a climate module that would: 1) synthesize current climate change project outcomes; 2) prioritize species for management strategy evaluation (MSE); and 3) run MSEs on specific species and scenarios identified by the NPFMC. This will take place on a 5-7 year cycle and will be summarized in an eastern Bering Sea Climate Change and Fisheries Assessment Report. The Bering Sea FEP will enhance the current IEA for this region.

Both the EAM and IEAs require development and improvement of ecosystem indicators of fishing and climate impacts necessary for advancing EAM stock assessments for fish, crab, and marine mammal populations. Development, assessment and forecasting of ecosystem indicators will provide a powerful means for determining management efficacy and a basis for adaptively improving management practices.

Focus 2.4: IMPLEMENT NOAA FISHERIES' COMPONENTS OF NOAA'S ARCTIC ACTION PLAN

NOAA's Arctic Action Plan provides a national strategy for the region providing a blue print for the nation's effort in three broad areas: advancing U.S. interests; pursuing responsible stewardship of resources; and strengthening international cooperation. The NOAA Fisheries mission most closely aligns with the second line of effort. Within that line of effort are three strategic goals:

- Strengthen foundational science to understand and detect Arctic climate and ecosystem changes;
- Improve stewardship and management of ocean and coastal resources in the Arctic; and
- Advance resilient and healthy Arctic communities and economies.

The marine areas of the Arctic include the Aleutian Islands, Bering Sea, Chukchi and Beaufort Seas. Over much of this area, seasonal sea ice is the major environmental factor defining the ecosystem. Loss of sea ice, a potential restructuring of the ecosystem, and increased human activity all have the potential to dramatically alter these ecosystems, particularly in the northernmost areas. These changes will impact marine living resources and the communities that rely upon them.

NOAA Fisheries is the primary steward of living marine resources in the arctic. That stewardship responsibility cannot be effectively executed without a strong foundational science component. We lack precise data on existing populations and the key processes that control productivity of arctic ecosystems. The challenge for AFSC is to quickly establish baseline estimates of the biomass and distribution of key living marine resource populations as well as the processes that presently control them. Regular monitoring of those populations and the environment will be required to determine if in fact changing climate is affecting the ecosystem. Single-species, multi-species, and ecosystem models for the region must also be developed and continually updated with new understanding to help NOAA Fisheries forecast change and provide advice to communities on what mitigation measures may be successful. This is necessary to help advance resilient and healthy Arctic communities and economies

The need to do fish stock biomass assessment in the U.S. arctic is defined by the NPFMC's Fishery Management Plan for the Fish Resources of the Arctic. In adopting the precautionary approach to fisheries management in the area of the U.S. arctic above the Bering Strait, the NPFMC clearly articulated the requirement to understand the fishery resources within the area before permitting any taking of resources.

The responsibility to join with other Arctic nations in the assessment of Arctic fish stock biomass was assigned to NOAA during the Arctic Summit in Anchorage 2015. The United States and Norway are leading an international negotiation to control commercial fishing in international waters of the central Arctic Ocean. AFSC has the lead in the scientific process supporting the negotiations. The parties to the negotiations, the Kingdom of Norway, the Russian Federation, the United States of America, Canada, and the Kingdom of Denmark, the People's Republic of China, the Republic of Korea, Japan, Iceland and the European Union, have called for a meeting of scientific experts on Arctic fish stocks in the central Arctic Ocean to develop scientific information on Arctic fish stocks in advance of further negotiations on matters related to the 2015 Oslo Accord on commercial fishing. The scientific process is expected to continue indefinitely in support of any international agreements reached at the ministerial level.

Focus 2.5: FORECAST DIRECT AND INDIRECT EFFECTS OF CLIMATE CHANGE ON FISH, CRAB, AND MARINE MAMMAL SPECIES AND THE ASSOCIATED COMMUNITIES WHICH RELY ON THESE RESOURCES

While the effect of annual climate variation has been observed to impact fisheries in Alaska, the overall impact of climate change on Alaska fisheries is unclear. For example, the ecological effects of reduced sea ice has previously impacted a major fishery in the southeastern Bering Sea for walleye pollock, but this fishery recovered in subsequent years when sea ice again was more widespread. These climate impacts, while temporary, allow us to understand some of the future impacts of climate change. For the eastern Bering Sea pollock example, data from integrated ecosystem surveys conducted by AFSC (e.g., BASIS), provided a mechanistic understanding of the impact of continued back-to-back years of reduced/increased sea ice in spring on the food web for young of the year gadids (e.g., walleye pollock) via the interchange of lipids (i.e., fats), fish fitness during critical periods of life, and survival to older age classes. [2]

The long-term climate science approach of the AFSC and NOAA's Pacific Marine Environmental Laboratory is composed of three parts: ecosystem monitoring, process studies, and modeling, retrospective analyses, and management strategy evaluations. The three parts – monitoring, process studies, and analyses – are the three legs of the stool on which our understanding of climate effects is seated. Ecosystem monitoring consists of standard oceanographic surveys which sample ocean physics, phytoplankton, zooplankton and egg, larvae, and juvenile stages of fish. Process studies are shorter term studies directed toward understanding ecological relationships (e.g., primary production rates, predator-prey relationships). Both the ecosystem monitoring and the process studies typically are supported by laboratory studies (e.g., growth response to temperature) and laboratory analyses (e.g., lipid content of sampled zooplankton and fish). Modeling and retrospective studies provide a framework for jointly understanding the results of the ecosystem monitoring and process studies. Modeling can be complex (ecosystem models that are computationally intensive) or simple (bioenergetics models).

[2] Coyle et al., 2011; Hunt et al., 2011; Heintz et al., 2013; and Sigler et al., 2016.

Research Theme 3 Achieve organizational excellence in our administrative activities through innovation and the use of implementing best practices

The third part of the AFSC mission is the pursuit of organizational excellence through fostering an inclusive, engaged, productive workforce and implementing best practices and innovation in science leadership, planning, infrastructure, communications, and administration. We recognize that the AFSC's outstanding reputation stems from the exceptional competency and dedication of our many staff working throughout the organization. They are the innovators that produce creative and high impact science that translates into mission excellence. Hence, we strive to match that with excellence in leadership with the goal of fostering the efficient and effective achievement of our mission through streamlined business practices, integrated information sharing, an engaged and productive workforce and a positive, welcoming, and inclusive culture.

Organizational excellence is directly connected to AFSC leadership quality, effectiveness, and even tone. Our goal is to be servant leaders, as demonstrated through our listening, empowerment and the development of people, humility, authenticity, interpersonal acceptance, and stewardship, and by providing strategic direction in our role of serving resource managers and the public in our region. As such, we offer the following set of interconnected operating principles as informative to our behavior and decision-making. They are intended to be a navigation aid, providing guidance on how we should go about doing our work, translating mission strategy into execution.

1. Leadership has to be values-based, where core values are modeled and mentored from the top down in an accountable performance environment. Core values inform how we meet our mission. They reflect a principles-based approach, where everyday business decisions are guided by values such as honesty, compassion, customer service, collaboration, empathy, safety, and a commitment to stewardship and scientific excellence.
2. Leadership needs sufficient capacity to lead, with a leadership team commensurate with meeting internal and external challenges in a timely manner.
3. Leadership should be flexible, with operational guidelines that allow maximum latitude given the specific roles and responsibilities of the leadership team.
4. Leadership must rely upon an inclusive organizational approach, building teams that function well together is essential, as they are flexible and efficient at dealing with difficult decisions regarding priorities, resource allocations, staff tasking, and planning.
5. Leadership must have a commitment to the collective missions of NOAA and NOAA Fisheries to establish effective communication, where staff morale is bolstered by a culture committed to honest and open communication, which provides diverse venues for such engagement including Division All Hands meetings, Program All Hands meetings, individual employee/supervisor meetings, and the AFSC Workforce Collaboration Team.

We cannot overemphasize our role in supporting an engaged workforce, ensuring that all segments of our workforce feel professionally valued and empowered. Diversity is critically important to the NOAA mission and involves a broad range of human uniqueness: personality; work style; perception and attitudes; values and lifestyle; work ethic; worldview; communication style; and much more. Valuing diversity means appreciating and encouraging people to be who they really are, helping them to develop their full potential, and utilizing their special talents, skills, ideas, and creativity.

The priority of this engagement is realized through a commitment by AFSC management to employees. For example, supervisors are asked to meet with employees yearly to discuss and identify training opportunities. Supervisors receive leadership, performance and feedback training to help them coach and mentor their employees. Employee engagement is a standing agenda item for all AFSC leadership meetings.

AFSC mission execution is accomplished through an integrated decentralization strategy, with separation of authority for the Directorate, Divisions, and Programs defined in organization charts. The Science Director serves the role of primary leader of the AFSC with final authority and responsibility for its products and translating mission, goals, and objectives - particularly those of the NOAA Fisheries Alaska Regional Office and the NPFMC - into action by the AFSC. The Deputy Science Director oversees the operations and activities of the AFSC to support its long-term and annual goals and objectives, supporting the Director by overseeing the execution of the AFSC's science mission and ensuring that daily operations run smoothly and any risks or issues are addressed. The Operations, Management, and Information (OMI) Director oversees the day-to-day administrative and business operations of the AFSC, ensuring that the business services required within the AFSC are addressed, including overseeing administrative services, budget formulation and execution, grants management, workforce management, communications, and facilities operations. The Planning Officer is similar to a "Chief of Staff" responsible for program management and development of strategic initiatives, including participating as a member of the Senior Executive Team and overseeing the annual Science Planning and Implementation Processes.

All six Divisions, of which five are science focused, and one administrative, work together to accomplish the set of prioritized activities provided each year through our science planning process. Division Directors serve three primary roles: (1) leader of their respective divisions; (2) strategic advisors to the Science Directorate; and (3) leaders advancing the AFSC mission as a whole, supporting collaboration across the organization. The primary focus areas for the Division Directors are: helping to identify capacity and capability needs that must be addressed in order to achieve the AFSC's mission and objectives; providing leadership; and managing their respective divisions. As such, Division Directors each manage infrastructure, budget and staff in accordance with the annual Implementation Plan. They are also responsible for following organizational protocol and for ensuring that the administrative outputs of their division meet quality and accuracy requirements.

Integration is fostered through collaborative decision making. The AFSC Board of Directors (BOD), comprised of senior leadership across the AFSC, provides collective, consensus, and

transparent decision making. The BOD ensures that the mission of the AFSC stays on course, and increases accountability by taking ownership of all major staffing, by reviewing all hiring, science prioritization, and resource allocation decisions. Because the BOD also represents both the scientific and support staff of the organization, it provides an important venue for coordination and communication across the components of the AFSC. The BOD meets approximately two times a month and for extended periods (2-3 day retreats) three times a year.

Integration is also achieved through diverse cross-Divisional ad-hoc and formal working groups such as those addressing at-sea safety, safety policy, budget execution, IT policy, and IT operations. The OMI leads the review of budget targets with increasing frequency towards the close of the fiscal year, both at the Divisional and AFSC levels. Organizational changes including the impacts of such changes on decision making are evaluated within Divisions and across the AFSC through multiple ongoing workforce planning processes. One such process, for example, maps out Divisional workforce and organizational structures three years into the future to align decision making with anticipated changes in the AFSC's mission and priorities.

Administration

Organizational excellence includes addressing risk management through all parts of our mission enterprise by ensuring adequate internal controls are in place. As a NOAA Fisheries financial management center, the AFSC initiates transactions that materially affect agency resources, NOAA financial statements and must be responsive to congressional intent. OMI leadership works with Division personnel to ensure that:

1. AFSC financial data is presented fairly and accurately in all material respects;
2. The AFSC financial position is in conformity and compliance with applicable laws and regulations;
3. Congressional intent for budgetary Program, Projects, and Activities (PPAs) are adhered to (commonly referred to as "PPA integrity"); and
4. Internal control policies are developed and followed to sustain the AFSC mission, guard against repeated violations of statutory or regulatory requirements, and protect against waste, loss, unauthorized use, or mismanagement of AFSC's assets.

The OMI Division works closely with AFSC leadership to oversee and coordinate the full suite of workforce management functions including performance management, strategic workforce planning, recruitment and staffing, employee and labor relations, EEO, pay and benefits, and training. The AFSC strives to provide a work environment that applies regulations and polices in a fair and consistent manner. This is accomplished by providing information on the AFSC Intranet, conducting training, fostering a positive relationship with bargaining unit representatives, supporting the AFSC Workforce Collaboration Team and actively engaging with managers and staff on workforce management issues and questions.

Finally, it's important to recognize the importance of a safe work environment and to always ensure that safety remains a top priority in our efforts. The AFSC Safety and Environmental Compliance Officer (SECO) leads this effort through coordination with the Directorate and Division leadership. It has been said that if we complete our mission, and someone gets hurt in

the process, it was really a failure. Our job is to get things done, even jobs that are very difficult, but at the end of the day, everyone should be able to go home healthy and in one piece. In order to achieve this goal, the AFSC ensures safety and environmental compliance are a regular part of our business through the AFSC Safety Council, various safety committees and including safety as a recurring topic at BOD meetings.

Although no specific foci are identified the Administrative support mission, the AFSC will strive to develop and execute an administrative support plan for FY2017-2022 which increases organizational effectiveness and efficiency across the AFSC.

Science Communications

AFSC recognizes that attracting, retaining and advancing a highly skilled, competent, and diverse workforce is achieved by cultivating an innovative and open work environment where people feel valued and recognized for their contributions. To facilitate this, AFSC leadership promote the open-exchange of information through diverse internal communications channels in its mission execution, including: policy and procedures guidance on the AFSC Intranet, newsletters, weekly activity reports, management directives, memoranda, emails, and a variety of scheduled and unscheduled meetings. Meeting schedules include quarterly Division all hands, monthly Program all hands, monthly Divisional management team, semi-annual Directorate meetings with Divisions, biweekly AFSC Board of Director meetings. Employees have access to management through differing venues such as suggestion boxes, an open door policy, Intranet feedback, Program/Divisional leadership, and monthly brown bag lunch meetings with the AFSC Deputy Director.

The AFSC also recognizes the importance of demonstrating the relevancy and benefits of our research to key audiences outside the agency including members of the fishing community, state and scientific partners, the Alaska Regional Office, the NPFMC, Alaska Native communities, environmental nongovernment organizations, and the general public. We will continue to inform, educate and involve the public and other stakeholders in our activities, and work to build an open, transparent and participatory organization.

Through the effective use of our Communications Program assets in public affairs, education and outreach, publications, and graphic services and by utilizing traditional and evolving media we are able to make marine science and its benefits more accessible to a broader audience -- making it understandable and inspiring. One of the chief external challenges we face is attracting and building a cadre of science, technology, engineering, and math (STEM) leaders in preparation for the NOAA workforce of tomorrow. To this end, the AFSC engages the public by serving as knowledgeable and excited ambassadors of the science that is important to the NOAA mission. The AFSC is also invested in proven educational program/activities that target diverse communities to inspire critical thinking, and problem-solving skills and that create a pipeline for students to stay engaged in marine science from kindergarten through college with the ultimate goal of promoting a stronger federal workforce for the future.

The AFSC will develop a Communication Plan for FY2017-2022 that will continue to heighten the impact of our science, and increase public awareness of our contributions to the NOAA mission by employing new approaches and mediums for communicating information both internally and externally.

Foci for Organizational Theme 3

Focus 3.1: DEVELOP ANNUAL RESOURCE ALLOCATION PLANS THROUGH THE SCIENCE PLANNING PROCESS

One of the primary ways our values inform our mission is through the science planning process, where we see ourselves in a supportive customer service role, providing needed science in support of resource management decisions in Alaska and elsewhere in the North Pacific Ocean. This planning process has seven components:

1. A Science Plan (this document) that provides general guidance over a span of 3-5 years.
2. Deconstruction of AFSC science into discrete annual Activity Plans (typically about 130-150 in number) with research activities, products, and resource needs identified.
3. An Annual Guidance Memorandum (AGM) that identifies specific research priorities each year.
4. Criteria for evaluating and scoring Activity Plans.
5. Board of Directors engagement in scoring Activity Plans yielding a final ranked set of Plans responsive to the AGM, for use in all AFSC resource allocation decisions. This set of plans is called the Implementation Plan.
6. Divisional meetings to communicate to staff the result of this process for their Activity Plans.
7. Alignment of employee performance plans with Activity Plan outputs so that the sum of these outputs equal the sum of performance plan work products.

A common thread through this entire process in the requirement for NOAA Fisheries Alaska Regional Office input, ensuring that each year's set of research activities are aligned toward priority Regional Office needs and through them, NPFMC management needs. Such emphasis is embedded in the Science Plan through the identification of the concept of core research functions, through the set of priorities established annually by the AGM, and then by translating these priorities to Activity Plans through the application of the evaluation criteria.

Focus 3.2: IMPLEMENT AN AFSC STAFFING PLAN FOR FY16-20 THAT RESULTS IN A CONSTANT, TARGETED COST OF PERMANENT LABOR

Again we recognize that AFSC's outstanding contribution to the NMFS stewardship mission in Alaska stems from the exceptional competency and dedication of our many staff working throughout the organization. The importance of our scientific staff, many of which are international leaders in their field, are widely recognized by our stakeholders. It's just as important to recognize that AFSC research activities require dedicated and knowledgeable technical and support staff to design, prepare, stage, and maintain critical equipment and instruments and facilities. The AFSC must continue to dedicate staff and budgetary resources for operations and administrative functions. Continued information technology support is critical to ensure computer systems are secure and functional and to develop and maintain necessary databases and applications for research and administrative functions. Laboratory, field, and office safety is a priority and an essential part of successful performance of AFSC research. Staff with expertise and resources to maintain our facilities and ensure workplace safety and environmental compliance are critical support functions that must be supported.

The AFSC has a staffing strategy of managing labor to cost targets that are responsive to our budget targets. This means that for periods of time in which budgets are level, our labor target will be also level. Annual labor costs are affected by a number of factors, some of which, like CAPS, promotions, and January COLA increases, escalate costs. Other factors such as the tendency of new hires (e.g., replacing retirements or resignations) to start at a lower CAPS salary interval, decrease costs. Our experience has been that cost escalations exceed cost decreases, hence in the past few years, under of period with level budgets, the size of the AFSC workforce has decreased by nearly 70 positions to sustain labor costs at a constant level.

We accomplish that by selectively backfilling vacant positions using our resource allocation process described above to identify the highest priority critical capabilities that are needed to meet resource management needs in Alaska. We can also accomplish that by reducing the scope of our research mission, a most difficult task since everything we currently do addresses important management needs and, as such, has impact to that mission. Nonetheless, with a shrinking labor force, we must have robust processes and engagements (both internal and external) that lead to decisions about the scale and scope of our research mission which ultimately inform our future staffing plans.

Focus 3.3: INCORPORATE DATA MANAGEMENT PLANS INTO SCIENCE PROJECTS AND ACHIEVE CONSISTENCY WITH THE PUBLIC ACCESS TO RESEARCH RESULTS POLICY

Because AFSC is first and foremost a scientific research institution, its focus has historically been firmly on scientific research, information, and publications. However, as our science mission is increasingly more data intensive and technology dependent, our success in delivering science projects needed to support the agency's stewardship mission will be increasingly dependent upon how well we can effectively use technology to advance research, provide public access to research results, and reduce costs. To meet this need we will expand our focus to reflect the

importance of technology, support and encourage increased software development and automation across the AFSC, evaluate and improve our IT service model and delivery across the Center and implement new data-lifecycle management processes, standards, and tools.

In working to meet the needs identified above, the importance of clear, understandable communication of IT processes, security measures, helpdesk tickets, and problems cannot be overstated. Automation opportunities are prevalent throughout the AFSC and we will develop business process management tools that can be used to improve common workflows, especially for technical support and administrative tasks. AFSC IT staff will also identify tools and supported mechanisms for collaborations, encouraging communities of practice, forming like-minded groups, and creating venues where non-technical staff are able to get advice or direction from skilled technologists. We will also work towards more cross-AFSC integration, especially on standards for software development processes, code management, and technologies.

The core mission of a Fisheries Science Center is to generate the scientific information and analysis necessary for the conservation, management, and utilization of the respective region's living marine resources. In support of this mission, and as an essential part of the research lifecycle, from Annual Guidance Memo, Activity Plans, and conducting research activities, to publishing, preserving, and increasing the visibility and impact of research outcomes, we expend substantial resources on collecting, processing, analyzing, producing, storing, using, sharing, and distributing data. In addition to the data analysis and publications, one of the key products of the fisheries scientific research lifecycle are datasets that share with publications key outputs of the AFSC that form the foundation for future scientific and technical knowledge.

There is an emerging need to address the current gap that arises from a poor connection between Data Lifecycle Management activities and day-to-day research lifecycle activities. This need is driven in part by the 2013 federal open data policy, Public Access to Research Results (PARR), which requires agencies to collect or create information in ways that support downstream information processing and dissemination activities. It is also being driven by the increasing dependence upon new data technologies and large, terabyte-sized data sets. As such, data management within the AFSC is complex and must be managed in a way that ensures data and data products are high quality, accessible, and released in a manner consistent with the NOAA Plan for Increasing Public Access to Research Results. The AFSC must have the capacity to archive, compile and interrelate, model, and analyze numerous independent data types totaling millions of records. The AFSC must also maintain and expand the documentation of metadata and address other data management requirements.

Our response to these drivers will be to address Data Lifecycle Management, which begins with good practices with all aspects of the data lifecycle such as generating and collecting the data, managing the data, analyzing the data, and making data available for public access. When done properly, the data lifecycle should not be considered independently from the research lifecycle. Measured and relatively simple shifts in Data Lifecycle Management approaches and practices, aided by technology, will be instituted over the next few years. Although done initially to meet PARR requirements, the real value of these shifts will be an improvement to the research

lifecycle and the work life of our scientists and managers as they focus on continuing to produce leading research. Such activities include reevaluation of our approach to technology solutions and ushering changes to incorporate data lifecycle management in our operations. We will incorporate data planning into our science planning process, investing in tools and capabilities for ease of data collection, documentation, sharing, processing, analysis, and preservation, providing researchers credit through data citations, improving our ability to make research results easily available for public interaction and collaboration. For that reason, we see these two drivers: NOAA's PARR implementation plan and an ever increasing dependency on data technology and large date sets, as beneficial, providing another pathway to operational excellence in the AFSC science mission.

Appendices

1. Table of fish and shellfish species and species groups managed by NOAA Fisheries within the U.S. Exclusive Economic Zone off Alaska.
2. Table of marine mammal stocks managed by NOAA Fisheries AFSC within the U.S. Exclusive Economic Zone.

Appendix 1: Table of fish and shellfish species and species groups managed by NOAA Fisheries within the U.S. Exclusive Economic Zone off Alaska.

North Pacific Fishery Management Council Tiers are defined in the introduction of the annual Bering Sea and Aleutian Islands (BSAI) and Gulf of Alaska Groundfish and BSAI Crab Stock Assessment and Fishery Evaluation (SAFE) reports. In general, assessments in lower-numbered tiers (e.g., Tier 1) include more information such as the age structure of the population, while assessments in high-numbered tiers (e.g., Tier 6) have minimal information. It is the goal of NOAA Fisheries to continually improve stock assessments by increasing the number of stocks with lower-numbered tiers.

Stock	NPFMC Tier
Eastern Bering Sea Pollock	Tier 1
Aleutian Is. Pollock	Tier 3
Bogoslof Is. Pollock	Tier 5
GOA Pollock	Tier 3 (Southeast Outside is Tier 5)
Eastern Bering Sea Pacific cod	Tier 3
Aleutian Islands Pacific cod	Tier 5
GOA Pacific cod	Tier 3
BSAI Sablefish	Tier 3
GOA Sablefish	Tier 3
BSAI Yellowfin Sole	Tier 1

Stock	NPFMC Tier
GOA Shallow-water Flatfish[3]	Tier 5 (Rock soles in Tier 3)
BSAI Greenland turbot	Tier 3
GOA Deep-water Flatfish[4]	Tier 6 (Dover sole in Tier 3)
BSAI Arrowtooth flounder	Tier 3
BSAI Kamchatka flounder	Tier 3
GOA Rex Sole	Tier 5
BSAI Northern Rock Sole	Tier 1
GOA Arrowtooth Flounder	Tier 3
BSAI Flathead Sole	Tier 3
GOA Flathead Sole	Tier 3
BSAI Alaska Plaice	Tier 3
GOA Pacific Ocean Perch	Tier 3
BSAI Other Flatfish[5]	Tier 5
GOA Northern Rockfish	Tier 3
BSAI Pacific Ocean Perch	Tier 3
GOA Shortraker Rockfish	Tier 5
GOA Other Slope Rockfish[6]	Tier 5 (Sharpchin in Tier 4)
BSAI Northern Rockfish	Tier 3
GOA Rougheye and Blackspotted	Tier 3
BSAI Other Rockfish	Tier 5

[3] The GOA shallow water flatfish complex includes northern rock sole, southern rock sole, yellowfin sole, butter sole, starry flounder, English sole, sand sole and Alaska plaice. Northern and southern rock sole are in Tier 3 while the other species in the complex are in Tier 5.

[4] The GOA deepwater flatfish complex includes Dover sole, Greenland turbot and deepsea sole. Turbot and deepsea sole are in Tier 6 while Dover sole is in Tier 3.

[5] The BSAI other flatfish group includes those flatfish besides rock sole, yellowfin sole, arrowtooth flounder, Greenland turbot, flathead sole and Alaska plaice. Although over a dozen species of flatfish are found in the BSAI area, the other flatfish biomass consists primarily of starry flounder, rex sole, longhead dab, Dover sole and butter sole.

[6] The GOA shortraker and "other slope rockfish" complex includes sharpchin, redstripe, harlequin, silvergrey, and redbanded rockfish.

Stock	NPFMC Tier
GOA Northern Rockfish	Tier 3
GOA Dusky Rockfish	Tier 3
BSAI Shortraker rockfish	Tier 5
GOA Demersal Shelf Rockfish	Tier 4 for yelloweye, Tier 6 for remainder
BSAI Blackspotted and Rougheye rockfish	Tier 3
GOA Thornyheads	Tier 5
BSAI Atka Mackerel	Tier 3
GOA Atka Mackerel	Tier 6
BSAI Squid	Tier 6
GOA Skates	Tier 5
GOA Sharks	Tier 6
BSAI Skates	Tier 5 (Tier 3 for Alaska skate)
BSAI Sharks	Tier 6
BSAI Sculpin	Tier 5
BSAI Octopus	Tier 6
GOA Squid	Tier 6
GOA Octopus	Tier 6
GOA Sculpins	Tier 5
BSAI/GOA Grenadiers	Ecosystem component[7]
GOA Forage Fish	
Eastern Bering Sea Snow Crab	Crab Tier 3
Bristol Bay Red King Crab	Crab Tier 3
St. Matthew Island Blue King Crab	Crab Tier 4
Eastern Bering Sea Tanner Crab	Crab Tier 3

[7] Grenadiers are managed as an ecosystem component of the GOA or BSAI, for the purposes of these groundfish FMPs.

Stock	NPFMC Tier
Pribilof Islands Red King Crab	Crab Tier 4
Pribilof Islands Blue King Crab	Crab Tier 4
Norton Sound Red King Crab	Crab Tier 4
Aleutian Islands Golden King Crab	Crab Tier 5
Pribilof Islands Golden King Crab	Crab Tier 5
Adak Red King Crab	Crab Tier 5

Appendix 2: Table of marine mammal stocks managed by NOAA Fisheries AFSC within the U.S. Exclusive Economic Zone. Assessments with low values have no or very poor stock assessments; stocks in tiers 2 and 3 have at least minimally acceptable assessment information. Criteria for assessing the tiers of marine mammal stock assessment were initially developed in NMFS 2004[8] and have been adjusted slightly by NOAA Fisheries Office of Science and Technology.

Stock	Assessment Tier
Baird's beaked whale - Alaska Stock	0
Cuvier's beaked whale - Alaska Stock	0
Minke whale - Alaska Stock	0
Narwhal - Unidentified Stock	0
Sperm whale - North Pacific Stock	0
Stejneger's beaked whale - Alaska Stock	0
Bearded seal - Alaska Stock	1
Beluga whale - Beaufort Sea Stock	1
Beluga whale - Bristol Bay Stock	1
Beluga whale - Eastern Bering Sea Stock	1
Beluga whale - Eastern Chukchi Sea Stock	1
Dall's porpoise - Alaska Stock	1
Fin whale - Northeast Pacific Stock	1
Harbor porpoise - Bering Sea Stock	1
Harbor porpoise - Gulf of Alaska Stock	1
Harbor porpoise - Northern Oregon/Washington Coast Stock	1
Harbor porpoise - Southeast Alaska Stock	1
Harbor porpoise - Washington Inland Waters Stock	1
Harbor seal - Aleutian Islands Stock	1
Harbor seal - Bristol Bay Stock	1
Harbor seal - Clarence Strait Stock	1

[8] NMFS. 2004. A requirements plan for improving the understanding of the status of U.S. protected marine species. NOAA Technical Memorandum NMFS-F/SPO-63, 112p

Stock	Assessment Tier
Harbor seal - Dixon/Cape Decision Stock	1
Harbor seal - Hood Canal Stock	1
Harbor seal - Oregon/Washington Coast Stock	1
Harbor seal - Southern Puget Sound Stock	1
Harbor seal - Washington Northern Inland Waters Stock	1
Killer whale - AT1 Transient/Prince William Sound Stock	1
Killer whale - Eastern North Pacific Alaska Resident Stock	1
Killer whale - Eastern North Pacific Gulf of Alaska, Aleutian Islands, Bering Sea Transient Stock	1
Killer whale - Eastern North Pacific Northern Resident Stock	1
Killer whale - West Coast Transient Stock	1
North Pacific right whale - Eastern North Pacific Stock	1
Pacific white-sided dolphin - North Pacific Stock	1
Ribbon seal - Alaska Stock	1
Ringed seal - Arctic Subspecies/Alaska Stock	1
Spotted seal - Alaska Stock	1
Harbor seal - Cook Inlet/Shelikof Strait Stock	2
Harbor seal - Glacier Bay/Icy Strait Stock	2
Harbor seal - Lynn Canal/Stephens Passage Stock	2
Harbor seal - North Kodiak Stock	2
Harbor seal - Pribilof Islands Stock	2
Harbor seal - Prince William Sound Stock	2
Harbor seal - Sitka/Chatham Strait Stock	2
Harbor seal - South Kodiak Stock	2
Humpback whale - Central North Pacific Stock	2
Humpback whale - Western North Pacific Stock	2
Northern fur seal - California Stock	2
Beluga whale - Cook Inlet Stock	3

Stock	Assessment Tier
Bowhead whale - Western Arctic Stock	3
Northern fur seal - Eastern Pacific Stock	3
Steller sea lion - Eastern U.S. Stock	3
Steller sea lion - Western U.S. Stock	3