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Pacific Islands Region Ecosystem-Based Fisheries Management Implementation Plan 2018–2022

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Pacific Islands Region
Ecosystem-based Fisheries Management
Implementation Plan
2018–2022

Pacific Islands Fisheries Science Center
Pacific Islands Regional Office

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List of Acronyms

ABC	Acceptable Biological Catch
ACL	Annual Catch Limit
BMPs	Best Management Practices
BOEM	Bureau of Ocean Energy Management
CNMI	Commonwealth of the Northern Mariana Islands
Council	Western Pacific Regional Fishery Management Council
CRCP	NOAA Coral Reef Conservation Program
DOD	Department of Defense
EBFM	Ecosystem-based Fisheries Management
EBM	Ecosystem Based Management
EEZ	U.S. Exclusive Economic Zone
EFH	Essential Fish Habitat
ENSO	El Niño - Southern Oscillation
EPA	United States Environmental Protection Agency
ESA	Endangered Species Act
ESD	Ecosystem Science Division
FEP	Fishery Ecosystem Plan
FMP	Fishery Management Plan
FRMD	Fisheries Research and Monitoring Division
HFA	Habitat Focus Area
HICEAS	Hawaiian Islands Cetacean Ecosystem Assessment Survey
IAC	Inter-American Convention for the Protection and Conservation of Sea Turtles
IATTC	Inter-American Tropical Tuna Commission
IEA	Integrated Ecosystem Assessment
IFD	International Fisheries Division
ISC	International Scientific Committee for Tuna and Tuna-Like Species in the North Pacific Ocean
LME	Large Marine Ecosystem
LEAP	Local Early Action Plan
MNM	Marine National Monument
MSE	Management Strategy Evaluation
MSY	Maximum Sustainable Yield
NEPA	National Environmental Policy Act
NGO	Non-government Organization
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NPFC	North Pacific Fisheries Commission
NPS	National Park Service
OP	Observer Program
OY	Optimum Yield
PDO	Pacific Decadal Oscillation
PIFSC	Pacific Islands Fisheries Science Center
PIMPAC	Pacific Islands Marine Protected Areas Community
PIRO	Pacific Islands Regional Office
PIRPB	Pacific Islands Regional Planning Body
PRD	Protected Resources Division
PRIA	Pacific Remote Island Areas
PSD	Protected Species Division
OFL	Overfishing Limit
RAMP	Reefs Assessment and Monitoring Program
REAC	Regional Ecosystem Advisory Committees
RFMO	Regional Fishery Management Organization
SAFE	Stock Assessment and Fishery Evaluation

SEEM	Social, Economic, Ecological, and Management Uncertainty
SFD	Sustainable Fisheries Division
SOD	Science Operations Division
SPC	Secretariat of the Pacific Community
SPRFMO	South Pacific Regional Fisheries Management Organization
SSC	Scientific and Statistical Committee
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WCPFC	Western and Central Pacific Fishery Commission

1. Purpose

NOAA Fisheries has long recognized the importance of ecosystem-based fisheries management (EBFM). The Ecosystem-based Fishery Management Policy and Road Map describe how NOAA Fisheries implements EBFM based on six guiding principles. NOAA Fisheries defines EBFM in the Policy as “a systematic approach to fisheries management in a geographically specified area that contributes to the resilience and sustainability of the ecosystem; recognizes the physical, biological, economic, and social interactions among the affected fishery-related components of the ecosystem, including humans; and seeks to optimize benefits among a diverse set of societal goals.” To implement EBFM, the Policy identifies and outlines six guiding principles:

1. Implement ecosystem-level planning
2. Advance our understanding of ecosystem processes
3. Prioritize vulnerabilities and risks of ecosystems
4. Explore and address trade-offs within an ecosystem
5. Incorporate ecosystem considerations into management advice
6. Maintain resilient ecosystems

The EBFM Roadmap also calls for the development of regional EBFM implementation plans to identify and coordinate priority EBFM activities across regional NOAA Fisheries science and management programs and with the cooperation of the associated the Regional Fishery Management Council. This document serves as the EBFM Implementation Plan for the Pacific Islands Region (2018–2022). The goal of this regional EBFM implementation plan is to identify concrete ways in which western Pacific regional fisheries science and management organizations can further EBFM in the near and longer term. This plan will define the long-term vision for EBFM in the region while identifying partners and establishing processes through which EBFM coordination will be facilitated.

Our conservation and management responsibilities spring from many mandates, the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), the Endangered Species Act (ESA), the Marine Mammal Protection Act (MMPA), the Coral Reef Conservation Act (CRCA), and the National Environmental Policy Act (NEPA), among others. The Magnuson-Stevens Act also includes 10 National Standards as principles to ensure sustainable and responsible fishery management.¹

Effective EBFM requires linking comprehensive scientific research with management objectives. With the wealth of information available from a wide variety of sources, resource managers must work with scientists to identify the data specific to their particular needs, clearly articulate the information they require from scientists, and describe the form in which that information would be most useful. Scientific products developed in consideration of management concerns can facilitate clearer answers to specific questions.

¹ <https://www.fisheries.noaa.gov/national/laws-and-policies/national-standard-guidelines>

2. Regional Context

NOAA Fisheries' Pacific Islands Fisheries Science Center (PIFSC) and Pacific Islands Regional Office (PIRO), as agents of the U.S. Government, and our primary partner the Western Pacific Fishery Regional Management Council (Council) conduct research and management in waters in and around the U.S. Pacific Islands. PIFSC, PIRO, and the Council offices and staff are located primarily in Honolulu, Hawai'i, with additional staff located in Guam, CNMI, and American Samoa. Our jurisdiction covers 2.3 million square miles of marine area, including the island archipelagos of Hawai'i, the Mariana Archipelago (Guam and the Commonwealth of the Northern Mariana Islands (CNMI)), and American Samoa, as well as the U.S. Pacific remote island areas of Johnston, Midway, Palmyra and Wake Atolls; Baker, Howland, and Jarvis Islands; and Kingman Reef; as well as millions of square miles of international waters within the region (see Figure 1). The total area of the U.S. Exclusive Economic Zone (EEZ) of the Pacific Islands region is roughly equal to all remaining U.S. EEZs combined.



Figure 1: Map of the U.S. Exclusive Economic Zones within the U.S. Pacific Islands Region

The Pacific Islands region is made up of dynamic and diverse nearshore and pelagic ecosystems that are unique in many ways, while providing ecosystem services valued by island communities and habitat for a wide variety of marine species. The ecosystems within the scope of the Pacific Islands region are subject to multiple stressors, and the degree of resilience and adaptability varies. Increased density in human populations, both across much of the Pacific Islands region and globally, have significantly intensified local and global threats to marine ecosystems. Many climate-associated changes are already occurring, including, rising ocean temperatures, and increasing atmospheric CO₂. These changes have resulted in coral bleaching and ocean acidification, which are triggering significant changes in the biological communities associated with coral reefs, including mortality or decreased growth of corals and potentially significant declines in biodiversity. Additionally, because many of the threats to coastal ecosystems are either land-based or the result of activities occurring shoreward of the U.S. EEZ, collaboration with the State of Hawai'i, the U.S. Territories of the Pacific, and other key partners is integral to successful advancement of EBFM across the Pacific Islands region.

Who We Are

PIFSC conducts science in support of the conservation and management of living marine resources across the region and in close consultation with PIRO. PIRO is tasked with the conservation and management of living marine resources and associated habitats in the U.S. Pacific Island Region and providing guidance and support for domestic and international fisheries. The Council has the

responsibility to provide fishery management recommendations to NOAA Fisheries. It prepares and submits the following to the Secretary of Commerce: fishery management/ecosystem plans and associated regulations, amendments to plans and regulations, and the specification of annual catch limits, among other requirements. Our research and management activities acknowledge that our trust resources and associated ecosystem components do not recognize or abide by our jurisdictional boundaries; hence, we can more effectively manage and conserve these trust resources by working and managing collaboratively with our jurisdictional partner agencies. We also collaborate on similar efforts in state and territorial waters as well as in international waters to support international fisheries treaties and protected species mandates.

3. Long-term Vision for and Benefits of EBFM in the Region

EBFM provides regional resource managers, scientists, and stakeholders with an integrated conceptual approach that ensures management of trusted species and communities are based on sound science advice that holistically accounts for ecosystem considerations. These may include habitat conservation, protected species interactions, environmental variability, ecological relationships, or socioeconomic and cultural considerations. The success of this approach will be measured by the increased number of areas and/or fisheries that are managed in ways that prevent overfishing (on an ecosystem basis), habitat degradation or adverse impacts to protected species.

In 2003 when the National Marine Fisheries Service created the Pacific Islands Region, the new PIRO and PIFSC, along with the Council, collaboratively developed and drafted a “Strategic Plan for the Conservation and Management of Marine Resources in the Pacific Islands Region” (March 2004). At the heart of the plan was the establishment of the vision for “[maintaining] healthy marine ecosystems that provide for stability in fishery resources, recovery of endangered and threatened marine species, and enhanced opportunities for commercial, recreational, and cultural activities in the marine environment” in the Pacific Islands region. The Council, working with PIFSC and PIRO, then advanced the plan by conducting three Ecosystem Workshops between 2005 and 2006; the key objective was generating policy options and information needed to effectively implement EBFM in the region². To this end, three themes were identified for promoting EBFM in the region. These included:

- ‘ecosystem science’ – including *biophysical* data acquisition and analysis, *models* development and application, and identification of *indicators*;
- ‘ecosystem social science’ – expanding economics, societal, and cultural data sources, *models* development and application, and identification of *indicators*;
- ‘ecosystem policy’ – in particular, embracing the *Aha Moku* system for the Pacific Islands region. This is the Hawaiian system of natural resource management based on the concept of *‘ahupua`a*, the traditional land and ocean tenure system of Hawai‘i. The *Aha Moku* system presents an adaptive and incremental strategy; a policy for indigenous resource user groups, and framework for community and agency interaction.

These activities set the stage for structural change toward place-based FEPs. Today and looking ahead, the long-term vision for EBFM remains, and with it the ultimate goal of implementing conservation and management measures based on ecosystem principles and scientific research. This implementation plan reiterates the region’s commitment to EBFM.

To build on successes, PIFSC, PIRO, and the Council should review accomplishments to date and establish new goals for near-, mid- and long-term implementation. EBFM maximizes ecosystem function and services. This involves tradeoffs, which will require the development of a new operational paradigm that shares this goal, shifting from reactionary to proactive management based on measured changes in the ecosystem. Fisheries management frequently revolves around short-term issues. A fully implemented EBFM framework allows managers to monitor changes in the fisheries as a function of the environment and ecosystems and proactively make timely management decisions that address emerging issues. This might include a transition toward ecosystem-based indicators and management thresholds that are based on synthesized information across disciplines, trophic levels, and taxa. This approach will require substantial research investment to support the development of key indicators, the application of appropriate ecosystem models and the comprehensive evaluations of various management strategies.

² E. Glazier (editor), 2011. “Ecosystem-based Fisheries Management in the Western Pacific.” Wiley-Blackwell.

Transitioning from our current science and regulatory structure to EBFM will require thoughtful, clearly defined steps. The genesis of those steps can be found as recommendations in several existing strategic plans:

Identify effective management strategies in the face of changing climate and ocean conditions and provide decision makers with the information they need for climate-ready decisions.

(Pacific Islands Regional Action Plan – Climate Science Strategy)

Engage with our science partners to advance domestic and international conservation and management of Pacific marine resources and the ecosystems that support them.

(PIRO Strategic plan 2016–2020)

Consider the implications of climate change in Council decision-making by identifying and prioritizing research that examines the effects of climate change on Council-managed fisheries and ensure climate change considerations are formally incorporated into the analysis of management alternatives.

(Fishery Ecosystem Plans (FEPs): adopted by the Council at its 151st meeting)

Improve understanding of the processes and dynamics of socio-ecological systems and the influences of climate, ecosystem, habitat, and species relationships on living marine resources to provide scientific advice to managers.

(PIFSC Science Plan 2018–2022)

The activities currently conducted in the Pacific Islands region, such as monitoring, data gathering, modeling, assessing, reporting, and regulating that inform management and conservation of NOAA trust resources, all operate in support of EBFM. The Council and PIRO strive to incorporate high-quality PIFSC science into actions by better formulating and evaluating management strategies and objectives, and relevant research questions, which will result in more relevant science and advice from PIFSC. Through full engagement in EBFM, the Regional partners will be better poised to meet our conservation and management goals and improve coordination, communication, and collaboration with our many research and stakeholder partners.

Environmental, ecological, and societal factors all need to be considered when trying to understand the ecosystems to be managed. Environmental factors include abiotic physical and climate drivers, such as climate variability (ocean acidification and sea level rise), terrestrial runoff or dissolved oxygen levels. Ecological factors encompass trophodynamics (predator-prey interactions, food webs, and availability), regional carrying capacity, and the physio-, chemo-habitats themselves. Societal factors include stressors, and adverse impacts (non-commercial and commercial fishing, gear interactions, habitat degradation/destruction, marine debris, and pollution); stewardship activities (habitat restoration efforts, conservation and stewardship of resources, or effective bycatch remediation); and societal outcomes related to marine management, such as economic stability, livelihoods, food security, and continuity of cultural heritage. An effective new management paradigm will acknowledge the importance of these three factors, including associated science and research, and incorporate them into a management framework. Proactively considering these three factors will help shift the thinking from single-species management to an ecosystem framework.

4. Regional EBFM Coordination: Current and Anticipated Outcomes and Benefits

The benefits of effective EBFM implementation will be enhanced by understanding and meeting the needs of our partners. Activities include collecting and analyzing data to provide it in a useful format to address current and future management issues and implementing effective and adaptive management strategies. Communication is central to achieving these goals. We must engage all partners to better identify strategies that are currently working or not working, what approaches might be more effective, and what science is needed to reduce the uncertainty surrounding implementation (see engagement strategy). The Pacific Islands region has organically implemented EBFM coordination in many arenas, and these examples, discussed in greater detail in the Appendix, can serve as models for future success in achieving the six guiding principles identified in the NOAA Fisheries' EBFM Policy.

Federal domestic fisheries management activity within the region derives from the legal authority under the Magnuson-Stevens Act. In 2010, the Council developed, and NOAA Fisheries implemented, five place-based fishery ecosystem plans (FEPs) to replace the former species-based fishery management plans (FMPs). Four of the FEPs are geographically based: the American Samoa Archipelago FEP, the Hawai'i Archipelago FEP, the Mariana Archipelago FEP, and the Pacific Remote Island Areas FEP. The fifth FEP governs pelagic fisheries operating in federal waters around the U.S. Pacific Islands and on the high seas. The FEPs establish the framework within which NOAA Fisheries and the Council can integrate and implement EBFM in each of the FEP areas of the region. Each of the FEPs contain ecosystem-based objectives, such as consideration for the long-term sustainable use of marine resources; human communities; impacts to bycatch species, protected species, and habitat; and adaptive management systems to respond to environmental changes.

Ecosystem-level advice requires ecosystem-level science created from robust data streams. PIFSC routinely conducts multiple types of resource and ecosystem monitoring surveys across the U.S. coral reef ecosystems. The Pacific **coral reef assessment and monitoring** surveys provide long-term data on a suite of topics; **life history surveys** collect biological samples (e.g., otoliths, gonads, and fins clips) from fishes across the Archipelagos; and **fishery-independent surveys** will develop unbiased and independent indices of abundance. PIFSC currently houses and manages an array of **data** sets that have been growing for decades, which need to be preserved and maintained for future use. Long-term data sets help us to understand the dynamic changes in the stocks, the fishery, and the environment on which the ecosystem models can interpret and create projections for different management scenarios.

The Pacific Islands region is subject to **climate** variability on multiple temporal and spatial scales. Many changes have already been observed and are projected to increase, directly and indirectly impacting our marine ecosystems and the people and communities that depend on them. EBFM conducted under the broad themes of basic science and research, monitoring, projecting future conditions, and adapting to persistent challenges will enhance the region's ability to provide effective and timely management.

Protected Species research is at the heart of monitoring, conservation, and development of solutions to minimize the bycatch or other forms of anthropogenic impact on marine mammals, sea turtles, seabirds, sharks, protected fish, and corals. In the western Pacific, conducting research to understand and mitigate the interactions between fisheries operations and protected species protects the viability of both. This research contributes to our understanding of ecosystem process impacts on protected species and fisheries, the effects of direct and cascading trophic interactions between organisms, and cumulative pressures that pose the most risk to vulnerable resources, including factors such as climate change.

PIFSC conducts a broad range of **socioeconomic research** across the Pacific Islands region to help us more effectively understand the role of people in EBFM, in terms of economic and societal goals and

the role of communities in management. This work is increasingly utilized in ecosystem models, providing a better understanding of the links between resource management and community well-being. Social and economic information are used to evaluate the impacts of the proposed fishery management action on human communities and local economies.

West Hawai'i Integrated Ecosystem Assessment (IEA) Project examines EBFM on a small scale. The project works to provide sound and relevant scientific information to address existing and future resource management concerns. This project has focused considerable effort on building local relationships to better understand management and community needs so the necessary science can be developed. A collaborative effort between the **West Hawai'i IEA and Hawai'i Habitat Focus Area (HFA)** is working to increase the sustainability and productivity of West Hawaiian fisheries by focusing on the habitat that fish need to spawn and grow, as well as protecting the coastal resources on which communities depend. These two programs have overlapping scientific and management interests and are actively accomplishing the tenets of EBFM by working together to integrate management priorities and goals into ongoing and future scientific activities.

In contrast to the small-scale IEA and HFA efforts that focus on local impacts, the **Pacific Marine National Monuments (MNM)** are large marine ecosystems situated in vast, remote, and largely uninhabited areas of the Pacific. The NOAA Fisheries Marine National Monuments Program co-manages four marine monuments—the **Papāhānaumokuākea MNM, the Mariana Trench MNM, the Pacific Remote Islands MNM, and the Rose Atoll MNM**. These are managed through a collaborative effort of various federal, state, territorial, and local agencies and emphasize integrated ecosystem-based management. Because of their relative isolation from population centers in the Pacific, these monuments present a unique opportunity to advance understanding of the global pressures of climate change, marine debris, ocean acidification, and sea level rise on habitat and fish stocks without confounding anthropogenic influences.

PIFSC, PIRO, and the Council are working on two **transformational research** projects that will serve as test cases for conducting science and developing science advice with an ecosystem objective or EBFM.

The first project is to develop a framework for understanding ecosystem and operational factors influencing protected species interaction patterns in the Hawai'i and American Samoa longline fisheries. Its primary objectives are to (i) conduct an analysis examining the environmental and ecological drivers affecting the distribution and aggregation of protected species and the socioeconomic factors driving fisher behavior which ultimately determine interaction patterns/rates, (ii) develop management strategies (e.g., time-area closures, dynamic isotherm bands or depths) and social marketing tools based on the modeled environmental drivers that would reduce interaction rates, (iii) predict fisher behavior response to proposed management strategies and provide probabilities of reaching Incidental Take limits within the fishery based on choice of management strategy, and (iv) analyze the trade-offs for the fishery in operational costs (e.g., gas, time at sea) or loss of target catch for following recommended strategies to reduce protected species interactions.

The second project is to develop and apply an Atlantis Ecosystem Model for the main Hawaiian Islands as a decision-support tool for EBFM. It will provide a tool for generating science advice to marine resource managers in highly heterogeneous environments and competing societal concerns. Each island and island group in the Pacific Islands region is unique with environmental and anthropogenic coastlines, with greater heterogeneity around the islands, but on relatively smaller spatial scales. The spatially explicit, holistic Atlantis ecosystem model will be able to inform EBFM regarding such impacts and offer management tradeoffs for consideration.

These projects represent our initial proactive foray into fully transforming the Region's operational science and management paradigm to build and support ecosystem-based management and conservation of fisheries and living marine resources. In the years going forward, we will continue to build on these initiatives until EBFM becomes ingrained in the processes of the Pacific Island region.

5. Partners

Activities that impact coastal resources often originate in local waters beyond federal jurisdiction. As a result, we cannot implement effective EBFM without our key partners in the State and territories. The PIFSC, PIRO, and the Council work with various partners that complement the ongoing science and management activities in the Pacific Islands region. Key partners include state and territorial governments, other NOAA line offices, other Federal partners, researchers, academic institutions, non-governmental organizations and local communities. In addition to the key partners described below, we partner with the **Pacific Islands fishing communities** that fish for subsistence, cultural purposes, revenue, and leisure; **academic institutions** that conduct research and educate the next generation of scientists and managers; and **non-governmental organizations** that work at the grassroots level to engage the public in the marine resource issues under NOAA Fisheries' purview on local, national, and global scales.

State and Territorial Partners

We share responsibilities for managing marine resources with the state government agencies of Hawai'i and the territorial government agencies of American Samoa, Guam, and the Commonwealth of the Northern Mariana Islands (CNMI). These local partners manage marine resources within waters 0–3 nautical miles from their respective shorelines. The primary state and territorial agencies with management authority over marine resources are **Hawai'i's Department of Land and Natural Resources**, including the **Division of Aquatic Resources** and **Division of Conservation and Resources Enforcement**; **Guam Department of Agriculture's Division of Aquatic and Wildlife Resources**; **CNMI Department of Lands and Natural Resources, Division of Fish and Wildlife**; and the **American Samoa Department of Marine and Wildlife Resources**.

International Fisheries Management

U.S. pelagic longline fisheries operating in the region target highly migratory species (HMS) and fish both within the U.S. EEZ and in international waters. The United States, embodied by staff from PIFSC and PIRO, works within Regional Fisheries Management Organizations (RFMOs) to further the policies and priorities for managing domestic fisheries and conserving and managing living marine resources and ecosystems. The **Western and Central Pacific Fisheries Commission (WCPFC)** manages HMS, primarily tuna and tuna-like species and other species of fish taken by vessels fishing for tunas and tuna-like species in the western Pacific Ocean. The **Inter-American Tropical Tuna Commission (IATTC)** covers the same species as the WCPFC in the eastern Pacific Ocean. These organizations have a small area of overlap. The **South Pacific Regional Fisheries Management Organization (SPRFMO)** provides fisheries management on the high seas of the South Pacific for species other than HMS. The **North Pacific Fisheries Commission (NPFC)** focuses on fisheries resources harvested in the North Pacific Ocean. Each RFMO receives advice from its scientific committee. The **Secretariat of the Pacific Community (SPC)** serves as the scientific and data service provider to the WCPFC. In addition to the SPC, the **International Scientific Committee for Tuna and Tuna-Like Species in the North Pacific Ocean (ISC)** conducts stock assessments and research on stocks harvested in the North Pacific Ocean.

Aside from the HMS international activities, the **Inter-American Convention for the Protection and Conservation of Sea Turtles (IAC)** provides the legal framework for countries in the Americas and the Caribbean to take actions for the benefit of sea turtles.

Other Federal Partners

In addition to NOAA Fisheries, all other NOAA line offices are active in the Pacific Islands region including; **NOAA's Ocean and Atmospheric Research (OAR), the National Ocean Service (NOS), the National Environmental Satellite, Data, and Information Services (NESDIS), the National Weather Service (NWS) and NOAA's Office of Marine and Aviation Operations (OMAO).** OAR houses the Cooperative Research Institute affiliated with the University of Hawai'i, the **Joint Institute for Marine and Atmospheric Research (JIMAR)**. This grant-driven organization supports more than 50% of PIFSC staff and is a valuable partner in Pacific science. In addition to JIMAR, OAR also encapsulates the **University of Hawai'i Sea Grant College Program and the Pacific Marine and Environmental Laboratory**. The NOS focuses on collaborative management of ecosystems and coastal resources. The **Office of National Marine Sanctuaries** oversees two Pacific Sanctuaries: the National Marine Sanctuary of American Samoa and the Hawaiian Islands Humpback Whale National Marine Sanctuary. NESDIS coordinates climate science and supports the region with their Coastwatch/Oceanwatch Program that provides access to satellite oceanographic and atmospheric products. Through the OMAO, two primary support platforms, the NOAA Ships *Oscar Elton Sette* and *Hi'ialakai* serve the Pacific Islands region.

In addition, we work with many non-NOAA federal agencies to more effectively meet our mandates. The **Environmental Protection Agency (EPA); the U.S. Army Corps of Engineers;** agencies within the **Department of the Interior (DOI)**, such as the **United States Fish and Wildlife Service (USFWS)**, the **United States Geological Survey (USGS)**, the **National Park Service (NPS)**, and the **Bureau of Ocean Energy Management (BOEM)** have missions complementary to NOAA and are effective partners in examining the ecosystem for a variety of perspectives. With the military presence in the marine realm around the globe, the **Department of Defense (DOD)** is also a substantive partner in EBFM efforts.

The **National Ocean Policy, 2018**, provides a framework for federal agencies to coordinate activities regarding ocean-related matters and to facilitate collaboration with non-federal government agencies and ocean stakeholders. This coordination and collaboration across all levels of government will primarily focus on the public's access to marine data and information enabling regional ocean planners and ocean users to visualize and analyze ocean resources and human use information and make more informed ecosystem-based management decisions. For NOAA in the Pacific Islands region, the activities and partnerships formed will be facilitated and as needed, augmented by, the NOAA Regional Team.

6. Engagement Strategy

Engaged and well-informed communities are the cornerstone of implementing effective EBFM. This can only be achieved through directed and concerted effort, which includes the following strategies: 1) develop and implement a comprehensive strategic communications plan for EBFM, 2) increase community participation in resource management, 3) increase community participation in project-based EBFM, and 4) engage communities through outreach and education using a variety of media strategies.

1. Develop and implement a comprehensive strategic communications plan for EBFM

The first step in engaging the community is determining which partners within the community are involved in EBFM for key projects. This will help the community to identify their desired role within the project and for us to develop a plan targeting each segment. We will also pay attention to the needs of our constituents regarding how different parts of the community (especially in different areas of our region) need to be engaged in different ways (e.g., traditional vs. social media, large events vs. focus groups, etc.).

2. Increase community participation in resource management

PIFSC, PIRO, and the Council provide opportunities for community participation through various meetings and events. These multiple points of engagement can provide areas in which increased community participation can be measured. The strategy for engagement under this component is to utilize existing effort more effectively to increase and maintain community participation. Success for this component would be measured by an increased number of presentations and community members engaged.

The Council meets at least three times a year and includes a Fishers Forum as part of each meeting. The Council has multiple advisory groups where fishermen and the broader stakeholder community can directly engage and be involved in providing management advice. The Council will utilize its Regional Ecosystem Advisory Committees (REAC), which includes members from federal, state, and local agencies, non-government specialists, and private businesses, to share information, as well as better integrate and coordinate ocean and coastal ecosystem management.

PIRO and PIFSC offer unique opportunities for community participation. For example, they encourage the fishing community to discuss topical issues affecting the recreational and non-commercial fishing communities at opportunistic events, such as fishing tournaments, expositions, and trade shows. PIRO, PIFSC, and the Council also engage with the community through habitat restoration projects and seek to further increase and maintain community participation in these projects.

3. Increase community participation in project-based EBFM

The community needs to understand EBFM and how it might benefit them, in order to participate more effectively in the process. The development of projects presents opportunities for the community to engage in EBFM. In particular, habitat restoration projects offer a near shore, hands-on opportunity for community members and stakeholders to engage with marine resource scientists and managers to better understand how EBFM can help the region and the resources about which they care. Successful engagement strategies will be replicated in future EBFM projects.

4. Engage communities through outreach and education using a variety of media strategies

It is important to note that media strategies need to be tailored to the differences between island areas, as well as the differences between stakeholder groups being targeted for messaging. For instance, TV production in Hawai'i is effective for delivering information, but radio station ads are more effective in American Samoa. Similarly, while newspaper ads help target adults, younger generations get their news through social media. Strategies on providing outreach need to cover a wide spectrum of outlets and involve many different activities.

Interactive online data portals will help share our extensive data with academia and other stakeholders, ensuring that current scientific information is easily accessible to all. In time, our robust scientific data will be available in formats useful to both management and the broader community.

Targeting regional audiences with EBFM outreach materials will be a key component of the EBFM engagement strategy. The use of local images, place names and local success stories will enhance the visibility of our work throughout our region, as well as increase awareness, and build partnerships. We will identify key local community leaders to help develop community networks and action plans to promote grassroots community-based approaches to sustain resource management and restoration. Community engagement will need to be a two-way process: communities collaborating with managers and scientists on current projects and giving the community the opportunity to learn about the results of their work will build trust for the future. The sheer size of our region presents a challenge in maintaining internal and external engagement due to intraregional time zone differences of almost an entire day, in addition to travel costs. Staff throughout the region continue to work through these challenges with webinars and other technological tools, although relying on technology in the territories can be challenging where connectivity is less reliable.

7. Actions to Achieve EBFM Guiding Principles

Together, PIFSC, PIRO, and the Council have made strides in implementing many of the EBFM Guiding Principles in our day-to-day work. We will continue to work toward achieving the broader goals of EBFM by finding better ways to coordinate our efforts to incorporate ecosystem considerations in all our science and management activities. Each of the six EBFM Guiding Principles builds on the next, with the ultimate goal of maintaining productive and resilient ecosystems. The EBFM Guiding Principles and brief descriptions of some regional actions for achieving these guiding principles follow.

Guiding Principle 1: Implement ecosystem-level planning:

PIFSC, PIRO, and the Council will engage internal and external partners throughout the region as the agency shifts its focus to management from an ecosystem perspective through an engagement strategy described in Section 6. We expect key benefits, such as increased coordination between climate science and management functions, increased community participation in habitat restoration projects, and improved efficacy and efficiency of science, management, and stakeholder interface. All of these are goals within the multi-year strategic plans of the Council, PIFSC, and PIRO.

The development of FEPs is another overarching EBFM goal that meets the spirit of guiding principle #1. While our region has been managing our federal fisheries under place-based FEPs since 2010, we continually strive to improve this management framework by focusing on efforts to facilitate better communication, increase our ability to integrate disparate information and understand interactions within an ecosystem context, and help inform decision-makers about effective management strategies across jurisdictional boundaries. These activities include development, maintenance, and improvement to the Stock Assessment and Fishery Evaluation (SAFE) reports that incorporate ecological, societal, and environmental factors, and the execution of the FEPs, as well as our work in international fisheries management.

Guiding Principle 2: Advance our understanding of ecosystem processes:

As stated in the EBFM Road Map, “Ecosystem-level advice requires ecosystem-level science.” Numerous plans exist and are underway in the Pacific Islands region that guide the development of the tools and data streams needed to better understand Pacific ecosystems and ways in which human communities value and interact with these natural resources. The development and maintenance of robust data and data streams provide a foundation on which good management decisions are made. Our region also continues to sustain socioeconomic, ecological, environmental, and climate observing programs to monitor status and trends of core ecosystem components and drivers influencing living marine resources and human well-being and improve integration with other regional, national, and international programs.

PIFSC, PIRO, and the Council will continue to support, develop, and maintain a wide range of data to provide a foundation for ecosystem-level science and management. These efforts include biological sampling and analyses which provide requisite life history information on priority insular and pelagic species, including ecosystem considerations of spatial, temporal, and environmental effects. Efforts also include developing and using advanced technology to improve protected species population assessments and increase efficiencies and expand assessments to previously unsurveyed areas of our region. The PIFSC Science Plan identifies a specific goal over the next 5 years to conduct and disseminate research on catch and bycatch species under a framework of moving toward ecosystem-based fisheries management. Our region also continues to develop and maintain core data and information streams, while improving standardization of data collection, storage, and reporting formats to ensure timeliness, quality, and accessibility of data products.

Guiding Principle 3: Prioritize vulnerabilities and risks to ecosystems and their components:

Along with our partners, we must identify and prioritize which ecosystems warrant extra attention relative to a wide variety of risks, such as climate change and pollution. Over the next 5 years, our region will take numerous actions to increase scientific understanding of our MNM ecosystems and develop and implement management plans for these large marine environments. These activities would increase the scientific understanding of the areas, benefit the global community, and provide clearly defined objectives and effective management measures based on sound science. We also expect to complete activities that would help us evaluate risks to managed species, habitats, and communities. In addition to activities that support the MNM management plans, the Regional Habitat Assessment Prioritization for Pacific Islands Stocks³ provides a final listing of regional priority activities. The Pacific Islands Vulnerability Assessments will analyze the vulnerability of managed fish and invertebrate stocks to climate change. Additional climate vulnerability assessments are in development for turtles, marine mammals, and coastal communities. This can help determine information gaps and improve ecosystem models to inform next generation stock and population assessments.

Guiding Principle 4: Explore and address trade-offs within an ecosystem:

Conducting ecosystem vulnerability and risk assessments allow scientists to explore the outcomes of management decisions. PIFSC is working to expand its capacity in the use of quantitative tools, such as management strategy evaluation and simulation modeling to address regional priorities. Staff are able to apply these tools to the suite of living marine resources, managed species, and habitats in the Pacific Islands region, including the human portion of the ecosystem.

Guiding Principle 5: Incorporate ecosystem considerations into management advice:

In the Pacific Islands region, we strive to incorporate ecosystem science into management actions. PIFSC is working to better understand the impacts of climate change to habitat, oceanographic processes, and marine life including, but not limited to, protected resources, fisheries, and coastal communities. Greater awareness of the ecosystem as a whole will also allow stakeholders to make informed decisions about how they utilize the marine environment, such as where and for which species to fish, reducing bycatch, minimizing habitat degradation, and locating habitat improvement projects. PIRO is developing the Pacific Corals Recovery Plan where the recommended recovery actions are at the coral reef ecosystem level, rather than at the listed species level, utilizing data and information from monitoring programs throughout the Pacific. For its part, PIRO will strive to better describe the ecosystem science needed to support effective management of the marine resources in the Pacific.

Guiding Principle 6: Maintain resilient ecosystems:

Ecosystems are resilient, but they need the opportunity to return to their healthy state. PIFSC, PIRO, and the Council, along with other interested stakeholders, will work to identify adaptive management practices which will foster healthy fisheries and ecosystems, including human communities. Understanding the processes and dynamics of socio-ecological systems and the influences that climate change, ecosystem structure and function, habitat quality, and species relationships have on these systems can bolster scientific advice for resource management. Collecting and integrating local traditional ecosystem knowledge and socio-economic indicators can further enhance science-based ecosystem management of marine resources.

³https://www.st.nmfs.noaa.gov/Assets/ecosystems/habitat/pdf/regionalHabitatAssessmentPrioritizationforPacificIslandsStocks_Final.pdf

8. Road Map Actions and Milestones

The national EBFM Road Map provides action items that could help achieve the guiding principles; these actions are identified as short-term, medium-term, long-term, or continuing. While some actions described in the Road Map will be implemented at the national level, they are not included here. Specific actions that our region intends to carry out over the 2018–2022 period are included in the following table and link the national road map actions to our regional milestones. Although these regional activities will result in sound science and management decisions, they have not been planned and implemented with full consideration of EBFM.

Road Map #	Road Map Action Items	Timing	Associated Milestone(s)
Guiding Principle 1: Implement ecosystem-level planning			
1a: Engagement Strategy—goal is engagement strategy for each region			
1a2	Develop National and Regional EBFM engagement strategies	Short and Mid	<p>EBFM team will host an EBFM Workshop to identify ecosystem-related information and monitoring needs, the science products available or in development that can address these needs, management needs, and the gaps.</p> <p>PIFSC, PIRO, and the Council work with the State, Territories, and key partners to both coordinate and conduct outreach by engaging our constituents and helping them to understand the role they play in the ecosystem. They will identify local leaders to help build stronger ties to local communities and stakeholders</p> <p>The Pacific Islands regional communications team will develop materials that include local information to disseminate to partners and others for further regional distribution.</p>
1a3	Develop best practices where there are overlapping jurisdictions	Continuing	The Council will continue to improve the Regional Ecosystem Advisory Committee (REAC). REAC will engage local agency partners in addressing ecosystem issues in the Pacific Islands region.
1a5	NOAA Fisheries supports any Ecosystem Plan Development Teams, Ecosystem Committees (or equivalent groups) that councils establish	Continuing	PIFSC and PIRO staff serve on Council plan teams, all of which operate in support of the FEPs. PIRO and PIFSC staff will participate in the Council’s REAC.

Road Map #	Road Map Action Items	Timing	Associated Milestone(s)
1b: FEPs—goal to assist in development for most of 12 Large Marine Ecosystems (LMEs)			
1b1	Establish FEP Coordinator/Analyst for each NOAA Fisheries Regional Office and in appropriate Headquarters Office	Continuing	<p>Each PIRO Sustainable Fisheries policy analyst, working with his/her Council-staff counterpart with oversight for each FEP (Pelagic, Hawai‘i, American Samoa, Marianas, and PRIA) acts as the FEP coordinators for his or her respective plans.</p> <p>PIFSC will work with the appropriate stakeholders to define meaningful Large Marine Ecosystems (LMEs) for the U.S. Pacific Islands Region. Beginning with the Mariana Archipelago, PIFSC will lead development of LMEs for each of the PIR areas where NOAA Fisheries has management jurisdiction and conducts research (also including the PRIA, American Samoa, and revisiting the “Insular Pacific-Hawaiian LME” which includes the Hawaiian Islands). PIFSC plans to work with partners and the public to conduct education and outreach activities about the LMEs and their significance.</p>
1b3	Assist councils, Commissions, RFMOs, and other bodies as requested, in their development of new, or revision of existing FEPs or other fisheries plans	Continuing	<p>PIRO staff work to ensure that conservation and management measures agreed to in international fora, specifically WCPFC and SPRFMO, are implemented domestically, as necessary, in U.S. regulations. In so doing, the NEPA analyses for the development of such regulations continues to incorporate relevant ecosystem indicators as identified by the scientific community. PIRO staff advises PIFSC or the scientific community on any additional ecosystem information needed. PIFSC leads the U.S. Science Delegation to the WCPFC and the ISC. PIFSC staff collect, analyze, and submit the fisheries statistics and annual reports to the WCPFC and conduct stock assessments in collaboration with WCPFC nations. PIFSC also collaborates with the Southwest Fisheries Science Center to provide fisheries data to report to the IATTC.</p> <p>PIFSC and PIRO assist Council in their work with existing FEPs to include ecosystem considerations in the analysis of amendments to the FEPs.</p>

Road Map #	Road Map Action Items	Timing	Associated Milestone(s)
Guiding Principle 2: Advance our understanding of ecosystem processes			
2a1	Advance resources to conduct EBFM	Continuing	<p>PIFSC, working with the National Advanced Sampling Technology working group, is exploring the utility of next generation camera designs, operationalizing the fishery independent survey, conducting AUV studies, and building an optical spectrometer as well as working to standardize the associated data streams.</p> <p>PIFSC, PIRO, and the Council continue to develop the capabilities for electronic reporting and monitoring in the federally managed fisheries, improving quantity, quality, and timeliness of catch and bycatch data for EBFM and its incorporation into fisheries regulation.</p> <p>The Council is exploring options to improve information products for the shallow-set fishery to minimize sea turtle interactions. This is an integration of information and model implementation using PIFSC Turtle Watch and the PIRO observer Program to avoid sea turtle interactions at areas with high interaction potential.</p>
2a3	Conduct biennial EBFM Science & Management Conference	Mid	The West Hawai‘i IEA Symposium is held every 3 years.
2a4	Develop and maintain core data and information streams	Short–Continuing	<p>PIFSC staff will make all non-confidential PIFSC data queryable and available to the public online, in the NOAA archives, and in recurring reports, such as Fisheries of the United States. Robust associated metadata will accompany the delivery of data.</p> <p>PIFSC will continue to collect a wide variety of core oceanographic data, ranging from those collected on oceanographic research cruises to multi-decadal monitoring, e.g., SST, chlorophyll, PAR, wind, SSH and currents, eddy kinetic energy, salinity, and the merged ocean color dataset, see <i>Pacific Islands Regional Action Plan—NOAA Fisheries Climate Science Strategy</i>.</p> <p>Based on a PIRO management need, PIFSC and PIRO will be developing an assessment of coral connectivity within the Pacific Monuments islands and associated Archipelagos.</p> <p>PIRO will conduct ocean acidification studies at Rose Atoll, locations within the Pacific Remote Islands, and continue ongoing research at Maug to better understand coral resilience and recovery with respect to climate change impacts.</p>

Road Map #	Road Map Action Items	Timing	Associated Milestone(s)
2b2	Establish routine, regular, and dynamic reporting of ecosystem status reports for each large marine ecosystem	Mid	The Council is developing the Data Integration Chapter of the Annual SAFE Report that summarizes ecosystem effects on fisheries dynamics. The summaries will be on a dynamic interactive online platform that describes both the environment and the fisheries.
Guiding Principle 3: Prioritize vulnerabilities and risks of ecosystems and their components			
3a: Eco-level risk assessment—goal is to evaluate majority of main risks, including Climate Change, for most of our 12 LMEs			
3a1	Conduct Systematic Risk Assessments for relevant NOAA regional ecosystems	Short, Mid, Long, and Continuing	<p>PIFSC is working to conduct systematic assessments of climate impacts in three important ways in 2019. PIFSC will complete two reports: 1) <i>Pacific Island Climate Fish Vulnerability Assessment</i>, and 2) <i>Climate Change Vulnerability Analysis Report for Coral Reef Ecosystems</i> and continue implementation of the <i>Pacific Islands Regional Action Plan—NOAA Fisheries Climate Science Strategy</i>.</p> <p>Scientists will prepare an Environmental Sensitivity Index for the Mariana Trench MNM Islands Unit and will conduct a vulnerability assessment to understand potential climate change scenarios in the Mariana Trench MNM. These and many other efforts will be articulated in the final Marianas Trench MNM Science Plan anticipated to be published in 2019.</p> <p>Science staff will conduct research in support of the Papahānaumokuākea MNM Management Plan. Scientists will continue monitoring shallow and deepwater habitats and characterize the different types and spatial distributions to protect ecological integrity and inform management efforts. Scientists will measure connectivity and genetic diversity of key species, analyze historical impacts of reef growth at Midway Atoll to facilitate restoration of natural reef building, survey distributions and populations of known invasive species at regular intervals, and support research on invasive species detection and the effect of invasive species on native ecosystems. Scientists will continue to collect, analyze, and input research, monitoring, and bathymetric data into appropriate databases to inform management.</p> <p>PIRO staff in partnership with local agencies will evaluate existing state of restoration efforts on Guam and prioritize the next steps forward to guide large-scale reef restoration efforts.</p>

Road Map #	Road Map Action Items	Timing	Associated Milestone(s)
3a2	Explore protocols for conducting regional habitat risk assessments for those areas known to serve important ecological functions for multiple species groups or those that will be especially vulnerable or important in the face of climate change	Mid	<p>Scientists will evaluate effects of contamination in terrestrial and nearshore areas from shoreline dumps at French Frigate Shoals and at Kure, Midway, and Pearl and Hermes atolls and prioritize cleanup action based on risk assessments to support the Papahānaumokuākea MNM Management Plan.</p> <p>Mariana Trench MNM Management team is developing protocols to prevent marine debris from U.S. fishing fleets that fish in the CNMI and Guam EEZs and partner with them for removal incentives.</p> <p>PIRO staff are working to locate areas within the Marianas Trench MNM that demonstrate potential for climate change resilience</p>
3a3	Ensure more integrated, systematic, risk assessments, which could be used to coordinate regional NEPA analyses	Long	Complete final PIFSC environmental assessment/incidental take authorization for fisheries and ecosystem research
3b: Managed species, habitats & communities risk assessment—goal is to evaluate risk to managed species			
3b1	Ensure that factors which impact 800+ U.S. managed species are being considered	Short, Continuing	PIFSC Pacific Islands Vulnerability Assessment project is implementing a tool for rapidly assessing the vulnerability of 83 marine taxa to the impacts of climate change. This project: 1) provides a relative climate vulnerability ranking across species; 2) identifies key attributes/factors that drive this vulnerability; and 3) identifies key data gaps in understanding and mitigating climate change impacts to living marine resources.
3b2	Conduct Habitat Assessment Prioritization for all NOAA Fisheries regions	Mid	<p>PIRO and PIFSC will complete the Mariana Trench MNM Management and Science Plans and support the development of the Pacific Remote Islands Marine National Monument (PRIMNM) draft management plan. These plans direct scientists to collect available spatial data; characterize the distribution of various habitats and geological features, and describe physical, chemical, biological resources and processes, communities, and environments to support management of the MNM.</p> <p>PIRO, under NOAA’s Habitat Blueprint, will implement Priority Watershed Projects in the Manell-Gues Watershed in Guam, and associated reef restoration efforts. These efforts are targeted to improve habitat for hundreds of fish and coral species and the largest aggregation of ESA-listed sea turtles documented in Guam’s waters, while improving important local fishing grounds and building community resilience to climate change impacts.</p> <p>PIFSC scientists continue working with Territorial and other partners to conduct population studies for marine mammals and threatened and endangered species, to continue to assess coral reef communities and other benthic habitats in the Monuments, to</p>

Road Map #	Road Map Action Items	Timing	Associated Milestone(s)
			<p>acquire baseline data about fishery populations, and to monitor impacts of authorized Monument activities via the use of remote surveillance technologies.</p> <p><i>The Regional Habitat Assessment Prioritization for Pacific Islands Stocks</i>, which developed a habitat assessment prioritization process to be carried out for regional fish stocks (completed January 2018).</p>
3b3	Conduct Fishing Community vulnerability assessments for all NOAA Fisheries regions	Short	PIFSC scientists are developing climate vulnerability assessments for turtles and marine mammals. PIFSC scientists are also conducting vulnerability studies of coastal communities, in the context of both commercial and non-commercial fisheries, as well as climate change.
Guiding Principle 4: Explore and address trade-offs within an ecosystem			
4a: Modeling Trade-Offs-goal is to have sufficient analytical capacity to evaluate a full range of tradeoffs			
4a1	Assess and bolster ecosystem and Living Marine Resources (LMR) modeling needs in each Fisheries Science Center (FSC)	Short–Mid	<p>The federal MSE position for the Pacific will be filled in 2019. In addition to the full-time position, PIFSC created an intensive MSE training available to all assessment scientists in January 2018, to increase MSE capacity at the Center.</p> <p>PIFSC capacity will be complemented by the development and application of new modeling tools for assessing data-poor species, an open access user-friendly data-moderate model, and for a new meta-population analysis model.</p>
4a2	Development of an EBFM analytical toolbox that includes ecosystem modeling tools and best practices, data-poor qualitative and semi-quantitative tools, and related decision tools	Mid	Council is working with PIFSC and PIRO to develop a modeling framework for improving understanding of ecosystem factors influencing protected species interactions in the Hawai'i longline fisheries.
4a4	Establish suitable review venues and deliberative bodies for ecosystem models and associated information in each FSC region	Mid	The Western Pacific Stock Assessment Review Framework provides a review process for any ecosystem models developed by PIFSC and its partners used for fisheries management purposes. For ecosystem work outside the scope of fisheries management, PIFSC uses the skills of the Center for Independent Experts to provide robust peer review.
4b: MSEs - goal is to have MSEs that cover most of our 12 LMEs and Fisheries			
4b1	Develop functional system-level MSEs	Mid	Using the main Hawaiian Islands Atlantis model, simulations can give an understanding of how living marine resources (e.g., habitat, fisheries and protected species) will shift in response to ecosystem changes. Scientists and managers could apply

Road Map #	Road Map Action Items	Timing	Associated Milestone(s)
			identified management strategies and use the model to evaluate ecosystem impacts.
Guiding Principle 5: Incorporate ecosystem considerations into management advice			
5a: Eco-Level Reference Points—goal is to establish and use Ecosystem Level Reference Points			
5b: Ecosystem considerations for LMRs—goal is to appropriately include ecosystem factors in crafting advice for managed species			
5b1	Develop and track fishery stock status indices that denote when ecosystem considerations are used	Mid	<p>PIFSC staff are working toward understanding how the pelagic fleets, particularly the Hawai‘i longline fleet, change fishing practices in response to a shifting climate and how that changing climate impacts the ecology of the commercially exploited fish.</p> <p>Council and PIFSC continue to develop ecosystem indicators for the annual SAFE reports, which are revised and refined annually.</p>
5b2	Support consistent and effective implementation of the NS1 guidelines, which includes guidance on incorporating ecosystem information into stock management	Mid–Continuing	<p>PIFSC staff continues to conduct all assessments of living marine resources in the U.S. exclusive economic zone in the central and western Pacific, including protected (marine mammals, sharks, and turtles) and commercially exploited (finfish and crustaceans) species. PIFSC plans to incorporate ecosystem level information into each of these assessments, as robust parameters are available, to test the measurable impact. This will allow scientists and managers to understand more clearly the sensitivity of stocks to those considerations.</p> <p>Council staff convenes working groups to conduct the P* Analysis and SEEM Analysis (Social, Economic, Ecological, and Management Uncertainty) for assessed stocks in the FEPs. Included in these analyses are characterizations of uncertainties from ecological and stock dynamics brought about by changing climate and ecosystems. The Council is working to improve this process using a more structured and quantitative approach.</p>
5b3	Identify best practices for incorporating ecosystem considerations into management decisions	Short–Mid	<p>PIFSC produces the Annual Update Report for West Hawai‘i IEA Ecosystem Status and Trends Report.</p> <p>PIRO will assess the effectiveness of local reef-to-ridge watershed conservation and implementation of Best Management Practices (BMPs).</p> <p>PIRO will provide training of local resource staff to assist in the biological surveys and help build local capacity in managing the reefs for the key watersheds.</p> <p>Council, PIFSC, and PIRO complete annual SAFE Reports for American Samoa, Marianas, and Hawai‘i, and Pelagic species that includes the Ecosystem Consideration Chapter and the Data Integration Chapter.</p>

Road Map #	Road Map Action Items	Timing	Associated Milestone(s)
5c: Integrated Advice for other Management Considerations—goal is to systematically evaluate advice provided across multiple species within an ecosystem			
5c1	Explore protocols for considering ecosystem-level information in EFH reviews, identifying ecosystem-level habitat areas of particular concern, and setting habitat conservation objectives and/or indicators	Short	<p>The Council, PIFSC, and PIRO will collaborate on improvements for the 5-year Essential Fish Habitat reviews. Included in this effort is the development of a species-occurrence predictor model for level 1 and 2 EFH definitions.</p> <p>PIFSC scientists continue research on protected species within their ecosystem. Research in the near term will examine the use of coastal habitat by oceanic white tip shark, recently listed as threatened under ESA, model the critical habitat of false killer whales, and the nesting behaviors of marine turtles nesting in remote island areas.</p> <p>PIFSC will report on reef condition indicators, examine hierarchical drivers of reef fish assemblages, analyze and report on reef fish survey data, and conduct a vulnerability assessment of reef fishes.</p> <p>PIFSC staff will execute the coral reef and life history surveys, each year rotating the destination among the three territories and the State of Hawai‘i.</p>
5c2	Finalize and implement National Bycatch Reduction Strategy	Short	PIRO and PIFSC staff provide the annual statistical updates to the national bycatch report, as well as the data summaries and trend analyses for various fisheries and taxa based on the latest years of data. Tiering off the National Bycatch Reduction Strategy, PIFSC, PIRO, and the Council will collaborate to develop a Regional Implementation Plan.
5c3	Evaluate ecosystem effects of offshore aquaculture	Long	<p>PIRO, in coordination with the Council, is developing a draft Programmatic Environmental Impact Statement (PEIS) to analyze the potential environmental impacts of implementing a Pacific Islands Region aquaculture management program. As the PIRO aquaculture program moves forward with developing the PEIS and the framework for managing the aquaculture program, key ecosystem considerations will be incorporated into the analyses of environmental effects as well as in the implementation of the program. The PEIS will be used to develop the management framework for the Council to consider as part of the aquaculture amendment.</p> <p>PIRO and Council will work with aquaculture industry and research partners to identify, develop and implement ways to minimize the ecosystem impacts by aquaculture.</p>

Road Map #	Road Map Action Items	Timing	Associated Milestone(s)
5c5	Review long-term protected species recovery and rebuilding plans to ensure they account for the potential effects of near-term and long-term climate change, particularly relating to alterations to food web structure	Long	<p>The Hawaiian Islands Cetacean Ecosystem Assessment Survey (HICEAS) sought to understand the Pacific cetacean species and their associated ecosystem dependency. Though the cruise was in 2017, the research to explore data is ongoing, ranging from acoustics to species density, and will contribute to long-term protected species conservation.</p> <p>PIFSC staff will continue to work toward understanding the ecology of the critically endangered Hawaiian monk seal. PIFSC staff will examine the causes and consequences of disease, impacts of birth order and toxins, examine links between oceanic productivity and juvenile seal survival, evaluate the efficacy of translocations between subpopulations, and evaluate and strive to improve outcomes of rehabilitation and release efforts. This science will assist PIRO with the development of recovery plans based on ecosystem science.</p> <p>PIFSC staff are exploring marine turtles' use of their nearshore habitats and how they are impacted by climate change.</p> <p>PIRO is developing the Pacific Corals Recovery Plan, which uses an ecosystem-based approach to recovery planning, meaning that the focus of the recommended recovery activities will be at the coral reef ecosystem level instead of the listed species level. The intent is to provide benefits to both listed and unlisted coral species (and other reef species) that are part of the same coral reef ecosystem. The Recovery Plan will incorporate data and information from coral monitoring programs around the Pacific, including PIFSC (for U.S. waters), the Micronesia Coral Reef Monitoring Program, and the Great Barrier Reef Monitoring Program. Since the trophic effects of fishing are among the five major threats to listed corals, the Recovery Plan will include actions to address that threat, which could benefit reef fish.</p> <p>PIRO staff will sponsor the Saipan Coral Nursery Pilot Project. This effort is a partnership between NOAA, CNMI's Dept. of Land & Natural Resources/Division of Fish & Wildlife (DLNR/DFW) and Bureau of Environmental & Coastal Quality/Coastal Resources Management (BECQ/CRM), and other partners. Colonies will be collected by taking fragments from those lagoon staghorn stands that have shown the greatest level of resilience to recent bleaching; including species that have shown resistance and those that have shown a strong level of recovery during thermal stress events.</p>

Road Map #	Road Map Action Items	Timing	Associated Milestone(s)
Guiding Principle 6: Maintain Resilient Ecosystems			
6a: Evaluate Resilience—goal to develop and achieve ecosystem performance measures			
6a1	Evaluate and Track Ecosystem-level reference point to assess changes in ecosystem-level resilience	On-going	<p>PIRO staff working on the Saipan Reef Resilience Study will provide a before and after imagery for 35 reefs around Saipan following 6 years of stress related to bleaching and storm impacts.</p> <p>PIRO sponsors the Saipan Coral Nursery Pilot Project. This effort is a partnership between NOAA, CNMI’s Dept. of Land & Natural Resources/Division of Fish & Wildlife (DLNR/DFW) and Bureau of Environmental & Coastal Quality/Coastal Resources Management (BECQ/CRM), and other partners. Colonies will be collected by taking fragments from those lagoon staghorn stands that have shown the greatest level of resilience to recent bleaching; including species that have shown resistance and those that have shown a strong level of recovery during thermal stress events.</p>
6b: Community Well-Being—goal to maintain well-being of coastal communities			
6b1	Explore community health and well-being socioeconomic metrics	Mid	<p>PIRO is studying social adaptive capacity related to climate impacts among fishing communities at five sites in Micronesia (Guam and the Federated States of Micronesia). The project examines vulnerability based on dependency on fisheries and other livelihoods, conditions of essential resources, and their adaptive capacity to changes in those categories. Additionally, through our partnership with PIMPAC, the team is applying a tool called LEAP (Local Early Action Plan) which is a community-based climate vulnerability, adaptation, and resource management planning tool for use in coastal and island communities.</p> <p>PIFSC socioeconomic group is developing a conceptual model for understanding the role of cultural values in the context of an ecosystem (as applied within the West Hawai’i IEA).</p> <p>PIRO will implement the Guam Community Coral Reef Monitoring Program to provide support for coral reef conservation efforts on Guam. This program facilitates consistent, meaningful exchanges of information between the community and resource managers; collaborations with local partners to facilitate community participation in pilot coral reef restoration projects; and builds capacity for socioeconomic monitoring.</p>

Road Map #	Road Map Action Items	Timing	Associated Milestone(s)
6b3	Track community health, well-being, and vulnerability socio-economic metrics	Mid–continual	<p>PIRO staff will integrate climate resiliency and adaptation into community marine spatial planning in American Samoa. This project focuses on working with two coastal communities targeted with a climate-change education campaign and with a Fisheries MPA program to integrate climate vulnerability information.</p> <p>Technical memo “Applying National Community Social Vulnerability Indicators to Fishing Communities in the Pacific Island Region” describes the construction of social indicators of fishing community vulnerability and resilience specific to the PIR (completed January 2018).</p> <p>PIFSC social scientists are collecting a wide range of secondary data (e.g. poverty, education, employment), dating back to 2005. These are used to develop time series of social indicators for social vulnerability, gentrification pressure, fishing engagement and reliance, and natural hazards risk, which would help track community condition over time.</p>

Appendix 1.

Regional EBFM Coordination Details

Below are more details of the examples from Section 4 that highlight regional EBFM coordination and have been successful.

Domestic Fisheries Management

Using its authority under the Magnuson-Stevens Act, the Council developed, and NOAA Fisheries implemented, five species-based FMPs. In 2009, the Council reorganized the management provisions of these five FMPs into five place-based fishery ecosystem plans (FEP). Four of the FEPs are geographically based: the American Samoa Archipelago FEP, the Hawai'i Archipelago FEP, the Mariana Archipelago FEP, and the Pacific Remote Island Areas FEP. The fifth FEP governs pelagic fisheries operating in federal waters surrounding the U.S. Pacific Islands and on the high seas. The FEPs consolidate management provisions to address marine resources and user groups as integrated components within the archipelago-based units of management. This transition from species-based FMPs to place-based FEPs is an important first step in establishing the framework in which NOAA Fisheries and the Council can begin the integration and implementation of EBFM in each of the FEP areas of the PIR.

Comprehensive ecosystem approach to fisheries management must be initiated through an incremental, collaborative, and adaptive management process. To further the goal of EBFM, NOAA Fisheries and the Council have incorporated ecosystem-based management objectives into each FEP and established procedures by which the best scientific information available from stock assessments, SAFE Reports, and other sources, can be considered in developing conservation and management measures, including the specification of annual catch limits (ACL) and accountability measures.

Each FEP requires the Council's Scientific and Statistical Committee (SSC) to set an acceptable biological catch (ABC) for each fishery. The ABC is the maximum catch at which the probability or risk of overfishing (P^*) is less than 50 percent and accounts for scientific uncertainty in the estimates of the overfishing limit (OFL) and other scientific uncertainties. These may include, but are not limited to, uncertainty in data and models, stock status, stock productivity and susceptibility, recruitment variability, trends in population variables, and other factors determined relevant by the SSC. Each FEP includes a qualitative process by which the P^* value may be reduced below 50 percent.

Each FEP also requires the Council to set an ACL for each fishery that cannot exceed the ABC. This process includes methods by which the ACL may be reduced from the ABC based on social, economic, and ecological considerations or management uncertainty (SEEM). An ACL set below the ABC further reduces the probability that actual catch will exceed the OFL and result in overfishing and can also account for other ecosystem level considerations.

Another fisheries management action currently under consideration that would fall under EBFM is reclassification of some stocks in the FEPs as ecosystem component species. Ecosystem component species are stocks generally not targeted in federal fisheries under the jurisdiction of the Council but are included in the FEPs to achieve ecosystem-based fishery management objectives. This action would enable us to ensure resources are focused on those stocks that need conservation and management in federal waters, while retaining ecosystem component species in the FEP for monitoring, allowing implementation of additional measures that are needed for these species.

EBFM works only if the fisheries science conducted is used by resource managers. One of the primary challenges to EBFM in the PIR is that many of the threats to coastal ecosystems are either land-based or

the result of activities occurring shoreward of the U.S. EEZ. Therefore, collaboration with the state and territories of the PIR will be integral to successfully advance EBFM.

Resource and Ecosystem Monitoring Surveys

In the Pacific Islands region, the U.S. coral reef ecosystems of the Hawaiian Archipelago, the Mariana Archipelago, and the American Samoa Archipelago, along with the associated PRIA are routinely surveyed during integrated and interdisciplinary Pacific coral reef assessment and monitoring research cruises. These ecosystem surveys provide long-term status and trend data on the abundance, diversity, size, and distribution of reef fishes, corals, and benthic communities and habitats, as well as the dynamic ocean environments that these resources occupy. Since its inception in 2000, Pacific coral reef assessment and monitoring program (RAMP) has established baseline ecosystem assessments and initiated long-term monitoring of spatial patterns and temporal trends that integrate biological observations of trust resources with changing water quality, environmental, and oceanographic conditions. In particular, these ecosystem surveys include observations to document the influences of ocean warming and acidification on coral reef ecosystems. The consistent use of comparable methods across diverse habitats, environmental conditions, and stressors from human activities reveal spatial and temporal patterns and support an unprecedented ability to understand ecosystem processes that enable development of ecosystem models that can be used to support management strategy evaluation. Each outlined effort contributes to scientifically robust PIFSC products used in management.

The Life History Program surveys collect biological samples (e.g., otoliths, gonads, and fins clips) from coral reef fishes, deep-slope snappers and groupers, and pelagic fishes in the Hawai‘i, Mariana, and Samoa Archipelagos. These samples allow estimation of detailed life history and population dynamic information, such as length-at-age, growth, maturity, and mortality. Not only are these used as direct inputs into quantitative stock assessments, but also increase our understanding of how these parameters vary among species, along fishing pressure gradients, and temporally and spatially provide insights into fishery production, ecological theory, and environmental variability.

Most stock assessments require reliable time-series of catches, fishing effort, and life history demographics to estimate stock abundance trends and evaluate sustainability benchmarks. These assessments rely on fishery-dependent data, such as fishermen and vendor reporting. PIFSC is moving toward operationalizing fishery-independent surveys, which are specifically designed to develop unbiased and independent indices of abundance. They advance our ability to capture fishery-independent estimates of stocks, and augment and improve the robustness of assessments, the science upon which fishery management decisions are based. Once fully operational, this technology could be used in the U.S. Pacific Territories to gather fisheries independent data on data poor stocks.

Data Management

Ecosystem-level advice requires ecosystem-level science created from robust data streams. PIFSC currently houses and manages an array of data sets that have been growing for decades. It is imperative that PIFSC and PIRO preserve long-term time series and data sets, particularly for observational data. These are fundamental to addressing future unforeseeable science and management questions. Existing information streams, even those currently perceived to have less utility, may ultimately allow scientists to answer much needed management questions in a more informed manner. Long-term data support our understanding of ecosystems and our ability to conduct EBFM will arise from these data.

PIRO and PIFSC continue to manage the regulatory, legal, and planning information necessary to fulfill our mandated authorities for the conservation and management of fisheries, listed species, and marine habitats in the Pacific. This information includes the following: data collected on the monitoring and assessments of marine resources in the region, permitting and monitoring of the domestic commercial fishing industry, spatial data generated for habitat and species protection, spatial data regarding fishery footprints, and analyses of impacts of proposed management actions and other information related to management and planning for U.S. and international fisheries and habitat conservation.

We are working on improving data accessibility for the public, beyond what is required under the U.S. government's 2013 initiative to expand access to the results of federally funded research. One endeavor is the development of a pilot web-based data portal for PIFSC data streams. This data portal will include user-interactive data analytics tools that generate data visualizations and numerical summaries based on non-confidential data summaries from on-going historic and episodic data collection projects. Current data streams in the pilot version include: (a) fishery performance indicators, (b) economic monitoring programs, (c) socioeconomic data supporting regional SAFE reports, (d) trends in State of Hawai'i commercial fishing and community engagement at various geographic scales, (e) National Report submissions to Regional Fishery Management Organizations (RFMO), including spatio-temporal maps of catch and effort, and (f) links to fishing community snapshot tools and community social vulnerability indicators. This project establishes a viable open source framework to allow greater access and provide value-added visualizations to core regional data streams for fishery managers, members of the fishing community, and the general public. Once this web portal is finalized and made publicly available, resource managers will be given the opportunity to provide feedback on data or output needed to enhance effectiveness of this tool for management purposes.

Socioeconomic Research

The PIFSC conducts a broad range of socioeconomic research across the Pacific Islands region in support of NOAA goals of sustainable fisheries and habitat and protected resource conservation. These efforts help us more effectively understand the role of people in EBFM, both in terms of economic and societal goals, and the role of communities in management. For example, we have developed Community Social Vulnerability Indicators for the fishing communities in American Samoa, Hawai'i, Guam, and CNMI. We are also building a time series of data points to enable the development of recent historical trends in key indicators of social well-being. These indicators are beginning to be used in socio-ecological assessments as well, which examine coral reef resilience and social vulnerability.

Additionally, PIFSC social scientists are developing a suite of tools to address socio-economic concerns within the region. Some efforts include: a conceptual model for understanding the role of cultural values in the context of an ecosystem applied within the West Hawai'i IEA; a study to better understand social adaptive capacities of fishing communities to changing climate; research on the importance of fishing to culture in American Samoa; and work with PIRO, PIFSC, and other local and international conservation organizations to conduct and evaluate socioeconomic monitoring. The goal of the study is to better understand the links between resource management and community well-being. Approaches such as interdisciplinary collaboration, bio-cultural indicators, and stakeholder engagement in identifying research topics are receiving more emphasis as an improved holistic integrated method for monitoring with respect to EBFM.

Climate

The Pacific Islands region is subject to climate variability and change on multiple temporal and spatial scales. Temperature, wind, currents, sea level, coral reef bleaching, and ocean acidification are all impacted by natural climate variability modes such as El Niño—Southern Oscillation (ENSO) and the Pacific Decadal Oscillation (PDO). The persistent increase in greenhouse gases, which drives climate change and ocean acidification, can have greater negative effects, resulting in physical, chemical, and biological impacts to the marine ecosystems and trust resources of the Pacific Islands region. Many of these changes have already been observed and are projected to increase, directly and indirectly impacting our marine ecosystems and the people and communities that depend upon them. NOAA Fisheries Climate Science Strategy—Pacific Islands Regional Action Plan⁴ specifies several key actions that PIFSC, PIRO, and the Council can take over the next five years to enhance our ability to both assess and understand our changing climate:

⁴ <https://doi.org/10.7289/v5/tm-pifsc-59>

- Maintain and enhance ongoing monitoring programs for insular and pelagic ecosystems, sea turtles, cetaceans, and monk seals, and analyze these data to detect climate impacts.
- Update surveys of fishing community economics, vulnerability, adaptive capacity, and resilience.
- Develop and incorporate climate indicators and information into Fisheries Ecosystem Status Reports under the Fisheries Ecosystem Plans.
- Incorporate climate information into billfish, tuna, and bottomfish stock assessments and coral reef fish annual catch limits.
- Incorporate climate change information into designations of protected species critical habitat, recovery planning, and National Environmental Policy Act (NEPA) and ESA analyses.

The first annual Pacific Islands Climate Science Workshop was held in 2017⁵ and identified climate-related information needs, the science products available or in development that can address these needs, and the existing gaps among PIFSC, PIRO, and the Council. The common thread at the workshop was adaptive capacity, including questions on how the climate is going to change, and the extents to which the ecosystems and communities have resilience and adaptive capacity to climate impacts. Looking beyond protected and managed species, social adaptive capacity was a significant concern. The information needed to address these, and other questions fell into four broad themes:

- Basic science and research: a better understanding of population segments and stocks, as well as species' life history rates and parameters, diet studies, process studies, and an improved understanding of intermediate trophic levels. This basic information is needed for a number of both protected and commercially valuable species before we can begin to understand how they might be impacted by climate change and their potential adaptive capacity.
- Monitoring: the need for consistent, high-quality, long-term monitoring that establishes baseline conditions and identifies trends. Partnering and data sharing are essential for maintaining time series across the Pacific Islands region.
- Projecting future conditions: the need for robust projections of future conditions reaches into nearly every question raised at the workshop. These projections are needed for a host of variables (productivity, temperature, acidity, sea level, etc.) to determine habitat shifts, risk to critical infrastructure, and stock movement. These projections enable regional managers to be proactive instead of reactive.
- Persistent challenges: though there are many persistent challenges, effective communication among stakeholders, managers, and scientists is a recurring theme. Managing living marine resources in a changing environment will inevitably involve tradeoffs.

Some additional climate related considerations that were not specifically highlighted in the workshop report but are, nevertheless, important to examine include:

- A better understanding of social vulnerability, dependency of fisheries resources, sensitivity of the social systems to climate impacts, and social adaptive capacities for long-term human development.
- Deciding how to balance trade-offs depends, in part, on understanding how stakeholders value different resources. Communication has the potential to increase trust among scientists, managers, and stakeholders.

Monitoring and research must be done strategically to help guide management decisions. In the Pacific Islands region, information on changing conditions or habitat loss and its impacts on NOAA trust resources and communities who are dependent on them for various ecosystem services, is vital. Coordination between PIFSC and PIRO on how and where the emphasis of effort will be placed will be important.

⁵Summary Report from the First Annual Collaborative Climate Science Workshop
<https://repository.library.noaa.gov/view/noaa/17123>

Protected Species

Protected species research and management is a critical component of EBFM. The science programs within PIFSC continue to advance the understanding of ecosystem processes on protected species and fisheries, as well as the effects of direct and trophic interactions between protected species and fisheries. Understanding these processes will require a multidisciplinary approach to study and analyze data on diet, predator-prey interactions and other tropho-dynamics, ecosystem productivity, habitat attributes and use, influence of oceanography and climate change, and threats to protected species. PIFSC has already begun the process of implementing EBFM by taking a number of actions, including the following: the assessment of our protected species stocks through the Protected Species Stock Assessment Improvement Plan (PR-SAIP); the monitoring, conservation, and development of solutions to minimize the bycatch or other forms of anthropogenic impact of marine mammals, sea turtles, seabirds, protected fish, corals, and sponges; and the study of individual and cumulative pressures that pose the most risk to vulnerable resources, including factors such as climate change.

West Hawai'i IEA and Habitat Focus Area

The West Hawai'i Integrated Ecosystem Assessment (IEA) Project's overarching goal is to provide sound and relevant scientific information that addresses existing and future resource management concerns in West Hawai'i. The area contains a diverse group of marine species in a highly productive marine ecosystem that supports myriad ecosystem services important to the local community, including eco-tourism, aquaculture, non-commercial, recreational fishing, and commercial aquarium fish collection. Since its inception, the West Hawai'i IEA has focused considerable efforts on building relationships with state, federal, and non-governmental organizations and engaging local community organizations to better understand management and community needs. Much of our current understanding is synthesized in the West Hawai'i Integrated Ecosystem Assessment Status and Trends report. The report examines a suite of 29 indicators: social (e.g., population, tourism), biological (e.g., coral reef, benthic community), climate (e.g., sea level rise, Pacific Decadal Oscillation), and ocean (e.g., wave forcing, rainfall) to explore ecosystem effects of changes in the environment, policy options, and management strategies. An IEA considers interactions among ecosystem components and recognizes that human activities should be guided using collaborative, interdisciplinary, and adaptive methods. In doing so, the IEA framework recognizes that an understanding of the whole, not simply the individual components, is necessary to conserve marine ecosystems and the services they deliver.

NOAA Fisheries is working with our partners to increase the sustainability and productivity of fisheries by focusing on the habitat that fish need to spawn and grow, as well as protecting the coastal resources on which communities depend. The West Hawai'i Habitat Focus Area (HFA) was selected in 2013 because of its unique coastal ecosystems, known threats to these ecosystems, multiple ongoing conservation efforts, and the strong foundation of partnerships and community involvement. The unique ecosystems include an extensive fringing coral reef supporting federally managed fish and protected species. Threats include nutrient discharge to coral reefs from cesspools and fertilizers, sediment runoff from large areas of bare land, overharvesting, and climate change. To help manage these threats, the West Hawai'i HFA developed the following objectives: improve coral health through the reduction of the delivery of land-based pollutants, such as sediments and nutrients; reduce vulnerability of communities and natural resources to the localized effects of climate change; ensure that communities are informed and contribute to the sustainable use and restoration of natural resources; and provide better management tools and easily accessible information to promote informed decisions.

The West Hawai'i HFA and IEA have overlapping scientific and management interests and are working together to integrate management priorities and goals into ongoing and future scientific activities. Three key examples highlight the collaborative efforts between the West Hawai'i HFA and West Hawai'i IEA to support Ecosystem Based Management (EBM) in the region:

Assessing Coral Reef Resilience and Vulnerability to Climate Change: Understanding the ecosystem's vulnerability to climate change combines reef resilience and projections of future climate disturbances,

such as coral bleaching. As such, it allows resource managers to make informed and targeted management decisions that take into account both present-day and future impacts to ecosystem health.

- (1) *Assessing the impact of local stressors and evaluating management strategies for Puakō's coral reef ecosystem:* The HFA and IEA are collaborating to better understand local stressors and ultimately provide a suite of management options and associated trade-offs to the state and local community. By demonstrating the likelihood of outcomes from a range of potential management options, these collaborative efforts provide an important decision-support tool that can inform the natural resource management decision process at Puakō.
- (2) *Assessing water quality and coral reef health near two resorts in the West Hawai'i HFA:* The HFA, IEA, and their partners at the Nature Conservancy and University of Hawai'i at Hilo are currently synthesizing data and results to determine how each watershed and marine ecosystem functions while working to ultimately provide management recommendations to private and public resource managers.

The West Hawai'i HFA and IEA programs are committed to working together to support ecosystem-based management. Upcoming strategic planning efforts for the respective programs will identify opportunities for collaboration to leverage resources, build synergy, and maximize the impact of programmatic efforts in the region.

Pacific Marine National Monuments

In contrast to the small-scale IEA and Habitat Blueprint efforts that focus on local impacts, the Pacific MNMs are large marine ecosystems designated under the Antiquities Act of 1906⁶ to preserve “objects of historic or scientific interest.” These monuments are situated in vast, remote, and largely uninhabited areas of the Pacific. The four marine monuments—the Papāhānaumokuākea MNM, the Marianas Trench MNM, the Pacific Remote Islands MNM, and the Rose Atoll MNM—combine to encompass over 3 million square kilometers, which are managed through a collaborative effort of various federal, state, territorial, and local agencies. The MNMs emphasize integrated ecosystem-based management by ensuring traditional access by indigenous persons for culturally significant subsistence, cultural and religious uses within the monuments. They also provide opportunities to learn about coral reef ecosystems or related marine resources. Commercial fishing is prohibited in the monuments.

An emphasis on ecosystem exploration and research in the MNMs serves to expand our understanding of the physical, chemical, and biological ocean processes, social connections to the environments, the abundance and distribution of marine resources, and the geologic features within these sites. Monuments designation presents a need and opportunity to advance our understanding of the global pressures of climate change, marine debris, ocean acidification, and sea level rise without the confounding influences of local stressors, such as overfishing and land-based sources of pollution.

The Monuments are, in general, less impacted by immediate anthropogenic stressors, such as run-off and non-marine debris, due to their isolation and protection. Thus, these areas serve an important role as refugia for many commercially important fisheries species, for several endangered and threatened species, and for the associated habitats. But, this isolation can only provide a certain level of protection from threats correlated with climate change and marine debris. A major on-going issue that will continue to impact effective management and research of the Monuments is the distances of these remote areas from population centers, which complicates monitoring and enforcement of the fishing and access prohibitions and makes effective research extremely costly and labor intensive. Additionally, the vulnerability of these relatively pristine habitats and largely endemic marine life to global climate

⁶ The Antiquities Act of 1906, (Pub.Law 59–209), is an act signed into law by Theodore Roosevelt and gives the President of the United States the authority to, by presidential proclamation, create national monuments from federal lands to protect significant natural, cultural or scientific features.

change, invasive species introduction, and marine debris accumulation threatens the sensitive balance of the various ecosystems, which the Monuments were designated to protect.

Coastal and Marine Spatial Planning

NOAA Fisheries recognizes that EBFM, as part of the larger strategic goal of EBM, can assist the agency in better meeting its mandates to sustainably manage the nation's living marine resources. The National Ocean Policy, 2018, directs federal agencies to coordinate activities regarding ocean-related matters and facilitate collaboration with non-federal government agencies and ocean stakeholders focused on the public's access to marine data and information. Using an ecosystem-based spatial planning process for analyzing current and anticipated ocean uses and identifying areas most suitable for various activities involves increased coordination and collaboration across all levels of government and can lead to a more efficient, streamlined, and certain decision-making process.

In the Pacific Islands region, the work of the now-disbanded Pacific Islands Regional Planning Body (PIRPB) led to the delivery of a marine spatial plan for American Samoa that will provide guidance for agencies, individuals and other entities proposing an activity or action in the waters of American Samoa. It encourages compatible uses, reduces use conflicts, and balances sustainable ocean use with marine conservation, as well as identifies research needs. It is a comprehensive reference of existing spatial data regarding ocean use and provides insight into stakeholder perspectives regarding preferred ocean uses and potential use/user conflicts. It is not a regulatory plan to manage the marine and coastal ecosystems of American Samoa; rather, it is a consensus-based blueprint for harnessing and integrating the regulatory, enforcement, and other capacities of the various local and federal agencies charged with guiding marine development, conservation, preservation, utilization, and maritime shipping in the Territory.

The PIRPB also advanced the development of a data portal and mapping interface; tools that will allow all users, including government, project proposers, and stakeholders to utilize the same data and to review project efficacy through the same lens. It will also allow better integration of future human uses of our ocean environment with the goals of EBFM through overlapping important ecosystem layers with current and proposed use layers.

Appendix 2.

Links to Ongoing Projects Supporting EBFM

A. Climate

NOAA Fisheries Climate Science Strategy:
<https://doi.org/10.7289/V5/AR-PIFSC-H-18-01>

Pacific Islands Regional Action Plan: NOAA Fisheries Climate Science Strategy:
<https://doi.org/10.7289/v5/tm-pifsc-59>

Pacific Islands Regional Action Plan for Climate Science:
<https://www.fisheries.noaa.gov/content/pacific-islands-regional-action-plan>

B. Fisheries

Fishery Ecosystem Plans (American Samoa FEP, Hawai'i FEP, Marianas FEP, Pacific Remote Islands Area FEP, Pelagic FEP):
<http://www.wpcouncil.org/fishery-plans-policies-reports/current-fishery-ecosystem-plans-sorted-by-island-areas/>

National Saltwater Recreational Fisheries Policy–Pacific Islands Region Implementation Plan:
<https://repository.library.noaa.gov/view/noaa/17055>

Stock Assessment and Fishery Evaluation (SAFE) Reports:
<http://www.wpcouncil.org/fishery-plans-policies-reports/fishery-reports-2/>

C. Habitat

The Coral Reef Conservation Program:
<https://coralreef.noaa.gov/welcome.html>

Coral Reef Resilience to Climate Change in Guam in 2016:
https://www.coris.noaa.gov/activities/guam_coral_resilience/

Manell-Geus HFA:
<https://www.habitatblueprint.noaa.gov/habitat-focus-areas/manell-geus-guam/>

The NOAA Sentinel Site Program:
<https://oceanservice.noaa.gov/sentinel/sites/hawaii.html>

Pacific Island Managed and Protected Area Community tools and other guidebooks:
<http://www.pimpac.org/activities.php?pg2=2&pg3=8>

Papahānaumokuākea MNM Plan:
<https://www.papahanaumokuakea.gov/management/mp.html>

West Hawai'i HFA Implementation Plan:

<https://www.habitatblueprint.noaa.gov/wp-content/uploads/2016/10/West-Hawaii-HFA-Implementation-Plan.pdf>

West Hawai'i IEA Status and Trends Report (2016):

<https://repository.library.noaa.gov/view/noaa/12106>

West Hawai'i IEA Status and Trends Report (2019):

<https://repository.library.noaa.gov/view/noaa/19771>

West Hawai'i IEA Three Year workplan (FY2016-FY2018):

<https://www.integratedecosystemassessment.noaa.gov/Assets/iea/gulf/documents/regional-work-plans/NOAA-IEA-Work-Plan-West-Hawaii.pdf>

West Hawai'i IEA program overview:

<https://www.integratedecosystemassessment.noaa.gov/regions/hawaii>

West Hawai'i HFA program overview:

<https://www.habitatblueprint.noaa.gov/habitat-focus-areas/west-hawaii/>

D. Protected Resources

False Killer Whale Take Reduction Plan overview:

<https://www.fisheries.noaa.gov/pacific-islands/marine-mammal-protection/pacific-islands-region-false-killer-whale-take-reduction-team>

Protected Species: Coral Listing and Recovery Plan:

<https://www.fisheries.noaa.gov/action/listing-20-reef-building-coral-species-under-esa>

Recovery Plan for Hawaiian Monk Seals:

<https://www.fisheries.noaa.gov/resource/document/recovery-plan-hawaiian-monk-seal>

Recovery Plan for U.S. Pacific Populations of the Green Sea Turtle:

<https://www.fisheries.noaa.gov/resource/document/recovery-plan-us-pacific-populations-green-turtle-chelonia-mydas>

E. Ocean Planning

Pacific Islands Regional Planning Body:

<https://pacificislandsrpb.org/>