Pacific Islands Region Fisheries Bycatch Review (2022–2024)

Yonat Swimmer & Emily Crigler

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Pacific Islands Fisheries Science Center
National Oceanic and Atmospheric Administration
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1845 Wasp Boulevard
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Executive Summary

The Pacific Islands Region (PIR) is widely regarded as a leader in addressing fisheries bycatch concerns and identifying solutions to achieve sustainable fisheries management. In 2022, the Pacific Islands Fisheries Science Center (PIFSC) initiated a comprehensive overview of the various aspects of NOAA-related fisheries bycatch within the PIR with an overarching goal of ensuring that the work is securely funded and meets the current and future management needs of the PIR. It was anticipated that the review would help identify gaps and areas for improvement, assist in planning for future needs within the PIR, and help ensure that current bycatch-related research and activities are appropriately designed, funded, coordinated, and successful in meeting the expressed needs of management.

The PIR review was led by Yonat Swimmer and Emily Crigler (PIFSC Fisheries Research and Monitoring Division) and was implemented in three phases; (i) online surveys and personal interviews with staff that work on bycatch-related issues in the region; (ii) an analysis of NOAA and NMFS guidance documents related to bycatch (including current PIR bycatch management needs); and (iii) a summit to unite all entities. The overall review of bycatch-related activities indicated that current bycatch work in the PIR is aimed at addressing a broad range of management needs—from more direct statutory requirements through the Magnuson–Stevens Fishery Conservation and Management Act, Endangered Species Act, and Marine Mammal Protection Act, to understanding and mitigating impacts of fisheries to protected species, and ultimately to advancing to Ecosystem-Based Fisheries Management. The review identified that funding for bycatch work in the PIR is often temporary, opportunistic, and unpredictable; the current system addressing bycatch needs in the PIR is often an ad hoc and reactive approach which may result in data gaps and unaddressed bycatch priorities.

The review culminated in August 2023, with a PIR Bycatch Summit which included experts from PIFSC, the Pacific Islands Regional Office (PIRO), and the Western Pacific Fishery Management Council (WPFMC). Participants in the summit presented ongoing bycatch work in the PIR and discussed ways to improve prioritization of work, promote collaboration, and leverage resources to increase efficiencies in future bycatch work in the PIR. Over 30 NOAA (i.e., PIFSC and PIRO) and WPFMC employees participated in the two-day summit.

Overall, the review identified that increased communication amongst NOAA, WPFMC, and industry partners would greatly enhance the efficiency of bycatch work in the region, both with regard to prioritization of bycatch work and efforts to secure funding for high priority research.

In sum, the various phases of this review highlighted the importance of bycatch work to the PIR and the broad range of activities that are ongoing. In addition to the successes, the review also highlighted a few deficiencies that PIFSC could address by creating any combination of the following: a dedicated Bycatch Research Program, a Bycatch Coordinator, and an annual Bycatch Summit. These considerations would improve communication and coordination of resources among all parties and help better align priorities and update personnel across the PIR on current bycatch needs.

Introduction

The PIR (Figure 1) has a long history of bycatch research and general success managing economically viable and sustainable fisheries while simultaneously minimizing bycatch of protected species, such as seabirds, sea turtles, elasmobranchs and marine mammals. Similar to other U.S. regions, bycatch research and activities in the PIR are mandated by federal regulations, including the Magnuson-Stevens Fisheries Conservation and Management Act (MSA), Endangered Species Act (ESA), and Marine Mammal Protection Act (MMPA). Because domestic fisheries are managed through MSA, ESA, and MMPA mandates, protected species interactions are a major driving force behind fisheries management actions, including fisheries closures, in the PIR.

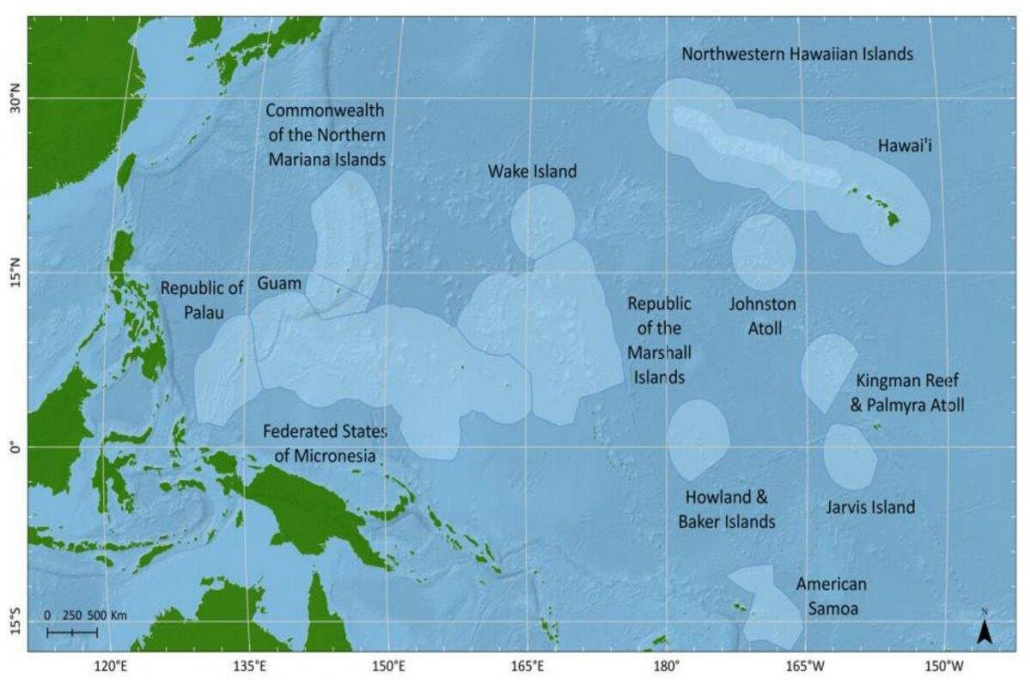


Figure 1: Map of U.S.-affiliated Pacific Islands Region (PIR)

In 1999, a lawsuit was brought against the National Marine Fisheries Service with charges that the longline industry's catch of threatened and endangered sea turtles posed a threat to the survival of Pacific sea turtle populations. The Hawai'i shallow-set longline fishery was closed for nearly three years in order to address the lawsuit and better manage sea turtle bycatch. PIFSC scientists conducted research that led to the implementation of regulations that reduced both the rate of incidental capture and the mortality of sea turtles in longline fisheries. Ultimately, the fisheries were reopened. An analysis of the sea turtle mitigation methods implemented in the PIR was conducted by PIFSC researchers using 20 plus years of observer data with clear findings of a

significant reduction in loggerhead and leatherback sea turtle interactions in Hawai‘i’s longline fisheries since the measures were implemented in 2004 (Swimmer et al., 2017).

Since the early 2000s, PIFSC has been heavily involved in numerous research efforts to further reduce sea turtle bycatch in longline fisheries, including experimental trials on modified hooks (e.g., appendage, ringed, variable sizes; Sales et al., 2010; Swimmer et al., 2010, 2011; Domingo et al., 2012; Piovano et al., 2016) and bait types (Swimmer et al., 2005), often in collaboration with international colleagues. Over the past two decades, PIFSC has expanded this work to include bycatch reduction trials and research to better understand the factors that influence post-release mortality not only for sea turtles, but also for other important protected species and taxa including marine mammals and elasmobranchs (e.g., Musyl et al., 2011, Hutchinson et al., 2012, 2015), as well as in non-longline fisheries such as purse seine and gillnets (e.g., Wang et al., 2013; Swimmer et al., 2020). During this time, PIFSC has become a global leader in fisheries bycatch reduction research, and the region has been lauded for its management of fisheries that aims to minimize the impacts to protected species.

Despite the numerous efforts and management regulations in place, incidental captures of non-target and protected species continue to be a concern in all global fisheries, including in the PIR. Measures that involve time and area closures aimed to minimize interactions with protected species can result in significant economic impact, and thus are less desirable than other measures that aim to balance both conservation and industry needs. As such, the PIR remains heavily committed to fisheries bycatch reduction research with the goal to identify practical means to promote sustainable fisheries, ideally identifying practical solutions that can be used on a global scale.

In the past decade, there have been significant achievements in research and policy efforts by international fisheries management, and much of the science originated in the PIR. Notably, many conservation and management measures (CMM) within tuna Regional Fisheries Management Organizations (RFMOs, Figure 2) throughout the world's oceans have been inspired by research and advocacy stemming from NOAA’s efforts within the PIR. Of note are the relatively recent adoptions of protected species (e.g., sea turtles, elasmobranchs) bycatch reduction measures in the Western and Central Pacific Fisheries Commission (WCPFC), the International Commission for the Conservation of Atlantic Tunas (ICCAT), and the Inter-American Tropical Tuna Commission (IATTC). Ongoing work with WPFMC on seabird bycatch mitigation in longline gear will also play an active role in WCPFC conservation measure updates on seabirds. PIR NOAA personnel have developed safe handling guidelines to reduce mortality of protected species such as sharks, cetaceans, and sea turtles which have been incorporated into management or made available for tuna RFMOs.

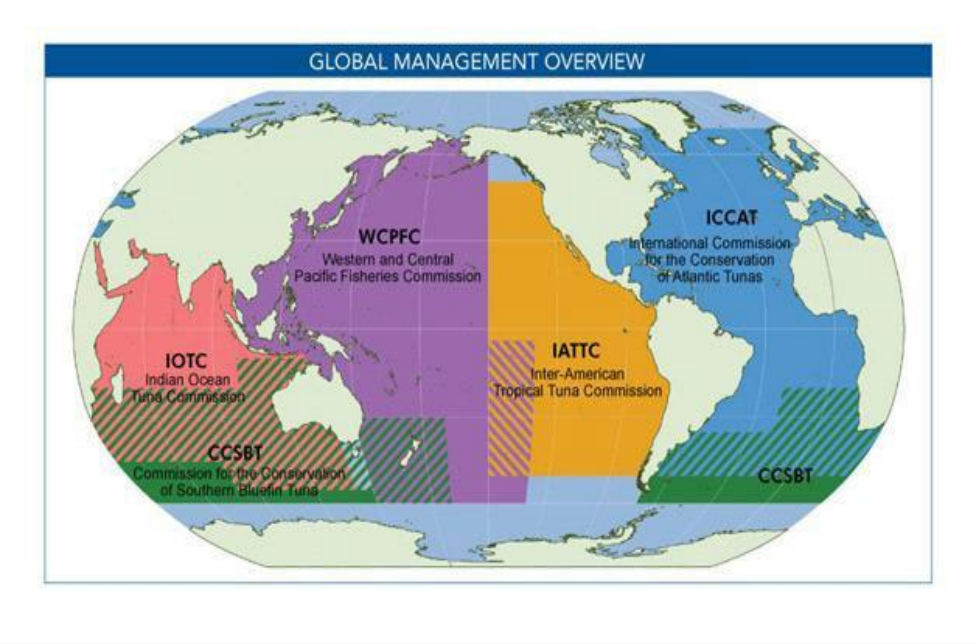


Figure 2. Global Regional Fisheries Management Organizations (RFMOs).

During spring 2022, PIFSC initiated a comprehensive overview of the various aspects of NOAA-related fisheries bycatch in the PIR with the following specific goals:

- Determine how PIFSC bycatch research aligns with the goals stated in the various NOAA, NMFS, and PIR guidance documents (including the WPFMC);
- Identify current sources and types of funding (e.g., permanent, temporary) for bycatch activities;
- Establish links between the resources and management needs, including identifying outstanding and priority issues for the future;
- Characterize time spent on bycatch-related activities by employees within PIFSC; and
- Provide a report of findings including suggestions on ways to improve efficiency and organization of bycatch research within the PIFSC and/or the PIR more generally.

NOAA Fisheries depends upon sound science for making informed decisions about managing fisheries resources. Minimizing bycatch in commercial fisheries is a clear agency priority and mandated by federal law. Specific to the PIR, one of the driving factors in fisheries management is protected species interactions. To that end, this review of PIFSC's and the PIR's fisheries bycatch activities is an attempt to document these activities and to assess them for efficiency, productivity, and their links to management needs both in the U.S. and internationally.

The review was expected to help identify gaps and areas for improvement, assist in planning for future needs within the PIR, and help ensure that current organization of

bycatch-related research and activities are appropriately designed, coordinated, and successful in meeting the expressed needs of management.

A variety of methods were used in this assessment, which we describe in three phases:

- Phase 1—Online surveys and personal interviews.
- Phase 2—Analyses of guidance documents and connections to management needs.
- Phase 3—Bycatch Summit.

This report aims to synthesize the information provided during the review and to make recommendations that will be helpful to PIFSC and the PIR as it strives to meet the region's diverse bycatch scientific and management needs.

Section 1: Phase I—Online Surveys and Personal Interviews

During Phase 1, the authors created an online survey aimed to better understand the scope of bycatch-related activities within PIR including: number of personnel involved, taxonomic groups, fisheries, and gear types. Individuals from the various PIFSC and PIRO divisions as well as the WPFMC were interviewed. Interviews consisted of ~45 minutes of descriptions of personnel roles, funding sources, activities, and potential adherence to guidance memos. Early in this process, it became clear that the definition of "bycatch" was inconsistent among participants, was as evidenced by the varying definitions across statutes MSA[1], the MMPA, and the ESA[2]. As such, for the purpose of this review, we used the NOAA Fisheries definition of bycatch—"discarded catch of marine species and unobserved mortality due to a direct encounter with fishing vessels and gear." (https://www.fisheries.noaa.gov/node/251).

Consistent with the definition of bycatch, the range of ongoing bycatch activities was quite broad across the PIR offices. A partial list of these activities is listed below, and a complete list and associated affiliations within NOAA PIR offices and divisions are in (Col A) "Combined activities" spreadsheet (PIR Bycatch Activities (COMBINED)).

- Stock assessments (e.g., shark populations)
- Electronic monitoring and protected species identification and injury assessments
- Protected species bycatch estimation
- Bycatch mitigation research and post-release mortality studies
- Pacific marine turtle threats assessments, satellite tag development, and genetics
- Marine mammals (threats assessment for false killer whales, mitigate serious injury)
- Ecosystem-Based Fisheries Management (EBFM)
- Pacific Islands regional observer program (PIROP) data management and reporting
- PIROP efforts to track sea turtles using satellite tags and collect biological samples at sea
- Bycatch reviews and updates of conservation and management measures within RFMOs
- Environmental data analyses associated with target and bycatch rates including temporal and spatial associations

[1] MSA defines "bycatch" as fish which are harvested in a fishery, but which are not sold or kept for personal use and includes economic discards and regulatory discards. The term does not include fish released alive under a recreational catch and release fishery management program.

[2] For species protected under the MMPA and ESA, bycatch is a type of "take." In general, take includes capturing, collecting, harming, harassing, hunting, killing, pursuing, shooting, trapping, or wounding any species protected by the MMPA or the ESA, or attempting to engage in any such conduct.

- SAFE reports and other public reports–submission of data sets on fish catch and protected species interactions
- Socio-economic landscape, stakeholder relationships associated with bycatch regulations
- Implementation of regulations to conserve protected species (e.g., sharks and seabirds)
- Administration of sea turtle-specific funds for Pacific-wide conservation
- Development of domestic regulations to implement international management
- Direct and indirect involvement in seabird bycatch mitigation research

Participants in Phase 1 indicated that they spend substantial time on bycatch-related work, as exemplified in Figure 3. The survey also highlighted the sense of ownership and pride that scientists and managers have with their bycatch-related work, and that most of that work involves protected species interactions such as black footed albatrosses and false killer whales that are associated with Hawai‘i’s longline fisheries (both shallow-set and deep-set).

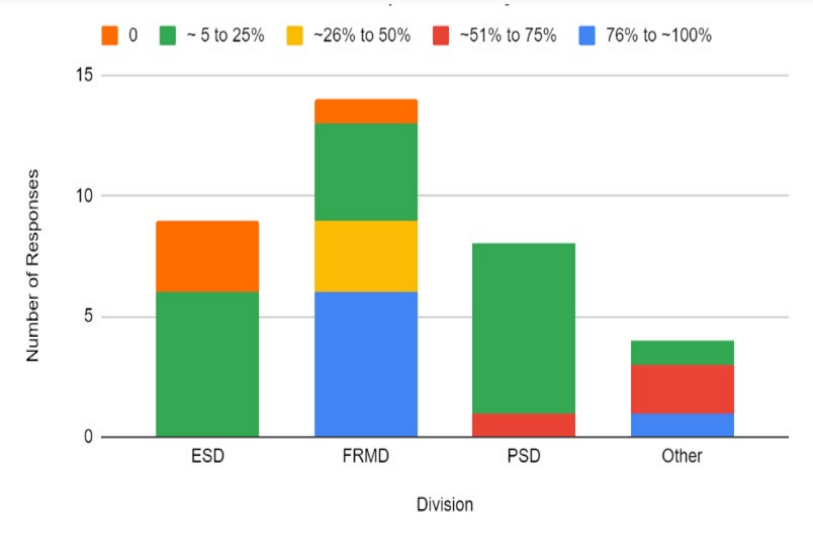


Figure 3. Time spent on bycatch (as a percentage of time worked) within each PIFSC division per online survey results.

Personnel reported concerns regarding funding and an ability to initiate or sustain long-term research due to financial uncertainty. Respondents identified that most bycatch-related funding is temporary, opportunistic, unpredictable, and thus does not lend itself to long-term planning and extended research. This is likely due to priorities resulting from legal or stakeholder-initiated actions.

Results from interviews identified that bycatch activities are most often supported by various funding opportunities from NOAA Fisheries Offices, including Protected Species, Sustainable Fisheries, and International Affairs, Trade, and Commerce. Additionally, it was noted that work is temporary and project-specific, and funds are

received either directly or indirectly through funding sources such as those listed below. The time frames for most project-specific activities are 12–18 months, after which funding either expires or there may be potential for extensions (though not necessarily additional funding).

Funding sources used for bycatch work in the PIR per survey questions in Phase 1.

- Fisheries Information System (FIS)
- Cooperative Research Program (CRP)
- HQ Discretionary funds from various divisions
- Bycatch Reduction & Engineering Program (BREP)
- Climate Program Office (CPO)
- Coral Reef Conservation Program (CRCP)
- Office of Science & Technology (OST)
- Economics & Human Dimensions Science Program
- EASA (NOAA Stock Assessment Funds)
- Office of International Affairs (OIA)
- Office of Protected Resources (OPR)
- National Observer Program (NOP)
- Protected Species Toolbox Initiative
- Office of Sustainable Fisheries (OSF), Magnuson-Stevens Act Implementation

Overall, Phase 1 identified a significant amount of personnel time spent on bycatch activities across NOAA PIR, with a very broad range of activities spanning numerous taxa and fisheries (gear types), and with **funding sources primarily project-specific, temporary, and unpredictable**.

Section 2: Phase II—Analysis of Alignment Between PIR Research, Guidance Documents and Management Needs

The second phase of the review assessed whether bycatch work in the region is well aligned with the following seven guidance documents from NOAA Fisheries, PIFSC, PIRO, and WPFMC:

1. NOAA Fisheries Strategic Plan—2022–2025
2. NOAA Fisheries National Bycatch Reduction Strategy—2020–2024
3. Pacific Islands Region Geographic Strategic plan—2020–2023
4. PIFSC Science Plan—2019–2023
5. Western Pacific Fishery Management Council 5-year Research Priorities—2020–2024
6. PIFSC Annual Guidance Memos—2022–2023
7. Annual Council Priorities for the PIFSC Annual Guidance Memo—2023–2024

Further information on the goals and objectives of each these guidance documents is included below:

1. *NOAA Fisheries Strategic Plan for 2022–2025*. The goals of the NOAA Fisheries Strategic Plan focus on key statutes and the priorities of the current Administration. There are three main goals included in the NOAA Fisheries Strategic Plan: (1) adaptively manage fisheries for sustainability and economic competitiveness; (2) safeguard protected species and propel their recovery; and (3) diversify our workforce, promote equity and environmental justice, and improve our mission performance through organizational excellence. This Strategic Plan is meant to serve as the primary guidance for planning, budgeting, and execution in NOAA Fisheries.

2. *National Bycatch Reduction Strategy*. The NOAA Fisheries National Bycatch Reduction Strategy sets national-level objectives and actions for all of NOAA Fisheries' bycatch reduction programs across all regions. It includes five main objectives: (1) monitor and estimate the rates of bycatch and bycatch mortality in fisheries to understand the level of impact and the nature of the interactions; (2) conduct research to improve our bycatch estimates, understand the impacts of bycatch on species and community dynamics, and develop solutions to reduce bycatch and bycatch mortality; (3) conserve and manage fisheries and protected species by implementing measures to reduce bycatch and its adverse impacts; (4) enforce fishery management measures, including those aimed at reducing bycatch and bycatch mortality, to ensure applicable laws; and (5) develop a common understanding of bycatch to share information on our efforts to address bycatch and identify areas where we can improve.

3. *Pacific Islands Region Geographic Strategic Plan 2020–2023*. The Pacific Islands Region Geographic Strategic Plan is a joint effort between PIFSC and PIRO and is intended to align with the strategic goals of the Department of Commerce (DOC) and

NOAA. The plan provides a framework for decisions related to resource planning and allocation over a 5-year period. It includes three high level strategic goals including: (1) amplify the economic value of commercial and recreational fisheries while ensuring their sustainability; (2) conserve and recover protected species while supporting responsible fishing and resource development; and (3) improve organizational excellence and regulatory efficiency. Each of these strategic goals includes a set of key implementation strategies and indicators or metrics of success.

4. *Pacific Islands Fisheries Science Center 5-year Science Plan 2019–2023*. The Pacific Islands Fisheries Science Center 5-year Science Plan describes the framework within which PIFSC will annually prioritize its research and monitoring activities. The plan includes four broad themes—promoting sustainable fisheries, conserving protected species, research to support ecosystem-based fisheries management (EBFM), and organization excellence. Each theme also includes specific areas of focus and specific targets.

5. *Western Pacific Fishery Management Council 5-year Research Priorities 2020–2024*. The MSA requires that WPFMC develop multi-year research priorities for fisheries, fisheries interactions, habitats, and other areas of research that are necessary for management purposes. These multi-year research priorities are submitted to PIFSC for consideration in developing research priorities and budgets for the region. The 2020 to 2024 MSRA Research Priorities were developed based on the management needs identified in WPFMC's 5-Year Program Plan for 2020–2024. The research priorities are aligned with the four of the five programs of the WPFMC: (1) Pelagic Fisheries; (2) Island Fisheries; (3) Protected Species; and (4) Communities. Underneath each program are thematic research areas related to stocks and ecosystems.

6. *Pacific Islands Fisheries Science Center Annual Guidance Memo ("AGM") for FY22 and FY23.* The purpose of the PIFSC AGM is to describe specific programmatic undertakings for the coming year and to strike a balance among execution of statutory mandates, current stakeholder priorities, and budget realities. It highlights specific priority initiatives for each year which are strategically developed activities that align with PIFSC long-term goals and objectives. Each AGM incorporates PIFSC priorities for the year including multi-year commitments launched in prior years and multidisciplinary team-based projects.

7. *Western Pacific Fishery Management Council Annual Priorities for the PIFSC AGM for FY23 and FY24.* Each year WPFMC sends a letter to PIFSC to highlight certain research priorities and request that they be included in the development of the PIFSC AGM. Research priorities for the WPFMC in FY23 and FY24 included the activities falling under the four following themes: (1) Island Fisheries; (2) Pelagic Fisheries; (3) Protected Species; and (4) Human Communities.

The second phase of the review also included follow up conversations with staff from PIFSC, PIRO, and WPFMC on the management needs being addressed by each of the

current bycatch activities, which are captured in Col G of PIR Bycatch Activities (COMBINED). In addition, the second phase of the review identified links to management needs for each activity (as communicated from staff), sources of funding, and priorities and objectives outlined in each of the seven guidance documents.

A comprehensive review of bycatch-related activities indicated that current bycatch work in the PIR addresses a broad range of management needs—from more direct statutory requirements through MSA, ESA, and MMPA (e.g., record interactions, assess impacts to populations, and track and implement closures) to understanding and mitigating impacts of fisheries to protected species, and understanding bycatch interactions as they relate to EBFM.

The list of ongoing bycatch work in the region was measured against the seven guidance documents listed above to determine whether the work was well aligned with the objectives outlined in the documents and to assess current funding sources and management needs. The NOAA Fisheries National Bycatch Reduction Strategy, as an example, includes the following five objectives:

***Objective 1**: Monitor and estimate bycatch rates*

***Objective 2:** Conduct research to improve bycatch estimates and develop solutions to reduce bycatch and bycatch mortality*

***Objective 3:** Target and implement measures to reduce bycatch and adverse impacts*

***Objective 4:** Enforce fishery management measures*

***Objective 5**: Share information on efforts to address bycatch and improve industry's understanding of bycatch reduction methods*

When comparing the PIR bycatch work against the objectives[3] included in the NOAA Fisheries National Bycatch Reduction Strategy, it was clear that the largest proportion (~50%) of this work being undertaken in the region, with dedicated staff and dedicated resources, is geared towards monitoring and estimating bycatch. This includes annual bycatch reporting and population assessments. A smaller proportion of the bycatch work is dedicated to implementing targeted conservation measures (~30%) and research and development of mitigation strategies (~20%). **There is a clear gap in the areas of improving stakeholder awareness of bycatch mitigation strategies, promoting greater awareness of bycatch and discard mortality issues within fishing communities, and fostering relationships with domestic and international**

[3] Bycatch activities were not compared against Objective 4: Enforce fishery management measures, as this is outside of the scope of work in PIFSC and PIRO.

partners and stakeholders to better understand and address bycatch concerns. It is estimated that only ~3% of PIR bycatch-related work falls into this category. Figure 5 shows the breakdown of bycatch activities when compared to the objectives in the NOAA Fisheries National Bycatch Reduction Strategy.

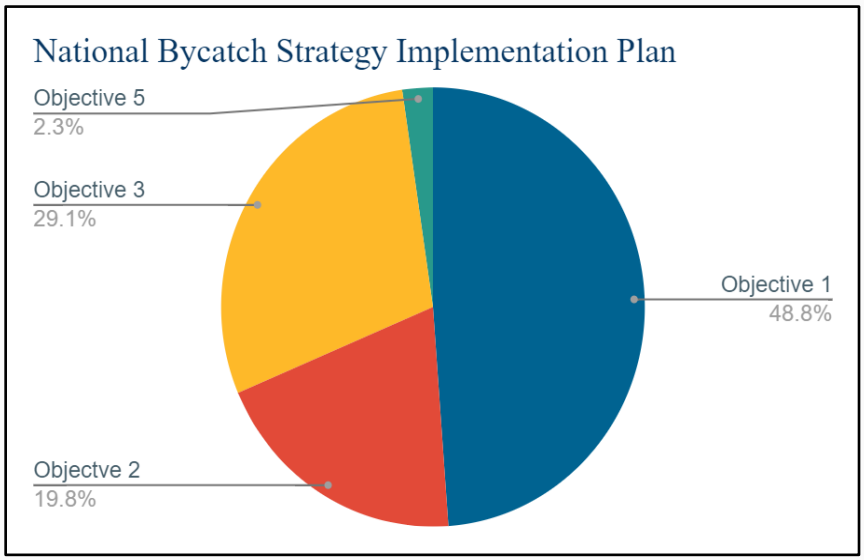


Figure 4. PIR bycatch work as it relates to the NOAA Fisheries National Bycatch Reduction Strategy Implementation Plan.

When compared across all seven guidance documents, the majority of bycatch activities in the PIR aligned well with the priorities and objectives identified. However, we also identified a number of examples where certain work falls outside of the scope of the guidance documents or where the direct management need is not as clear or immediate. There is also work that is prioritized across all documents but has no specific long-term funding source. These examples are listed below:

1. Both PIFSC and PIRO continue to dedicate resources to the study of lancetfish, *Alepisaurus* spp., which are commonly bycaught in Hawai‘i’s longline fisheries. Lancetfish stomach contents can provide information on prey availability and thus habitat characteristics across many decades, providing a long-term time series data set that could play a role in understanding broader ecosystem and climate implications in the region. Despite not serving a direct role in management needs, this work is bycatch-related yet with a focus on trophic ecology and climate change dynamics. It therefore falls outside bycatch-specific guidance.
2. Despite prioritizing electronic monitoring (EM) development across all seven guidance documents, this work is supported with a limited amount of direct base or discretionary funds from the PIR. Most PIFSC research on EM to date has been funded primarily through temporary funds, which have been acquired through internal proposals written annually. This ad hoc approach raises

concerns as to whether or not the required technology, data management, and analysis systems could be developed and implemented in a timely fashion given the importance of bycatch regionally. This is a particular priority for the detection of protected species interactions both domestically and internationally.

3. Certain bycatch work has also been highlighted by WPFMC and PIRO as a priority management need yet has limited dedicated research within the PIFSC. An example of this data gap relates to seabird bycatch mitigation in Hawai‘i’s longline fisheries. In the WPFMC annual priorities for the PIFSC AGM for both FY23 and FY24, there was a request for PIFSC to prioritize and dedicate resources to the continued development of bycatch mitigation measures in the Hawai‘i shallow-set fishery. To date, WPFMC has taken the lead on assessing the effectiveness of current seabird bycatch mitigation strategies and working with the fishing industry to design potentially more effective strategies. This work has been supported by staff from PIRO and PIFSC; however, no direct research has been undertaken by PIFSC to address the requests from the Council, and there has been no mention of seabird bycatch mitigation as a priority in the annual PIFSC AGMs.

In general, there was alignment between bycatch-related activities and management goals, with the few exceptions listed above. However, it was noted that the process for translating the broader NOAA and NMFS bycatch objectives into the bycatch priorities included in the PIFSC Science Plan and the PIFSC AGM was unclear.

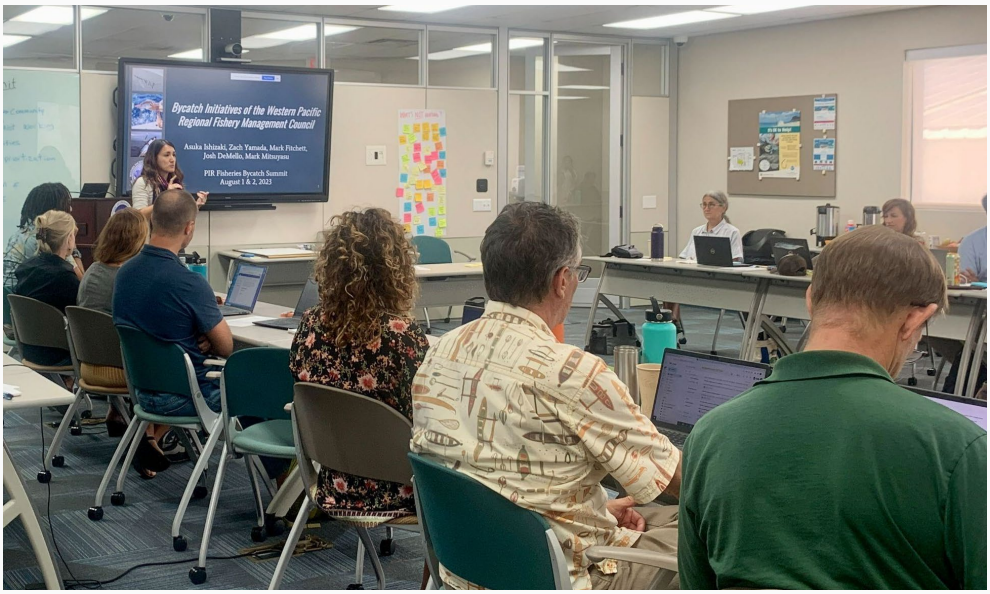
Through conversations with staff, it became apparent that there is no clearly defined process for the prioritization of bycatch work in the region. Overall, the current system addressing regional bycatch needs seems to be an ad hoc, somewhat reactive approach, which may result in data gaps for areas of priority research. While most staff could easily connect bycatch activities to general management needs (e.g., to better understand bycatch interactions or habitat and ecosystems), it was not always clear whether or how the outcomes of these activities result in management advice or the implementation of conservation action. Funding for bycatch-related activities in the region is also often temporary, opportunistic, and unpredictable, which makes long-term planning of bycatch work difficult.

Review participants also emphasized that the PIR is highly dependent on data collected by the Pacific Islands Regional Observer Program (PIROP) to conduct bycatch research. This came up multiple times throughout the second phase of the review, particularly due to concerns surrounding the continued funding of human observers in the PIR and the potential loss of valuable bycatch data. “Template for New Sections” can be used for Methods, Results, Discussion, etc. This is meant to be a versatile template to fit the needs of your report.

Section 3: Phase III—Bycatch Summit

The Bycatch Summit was held at Pier 38 in Honolulu, August 1–2, 2023 and included participation by more than 30 subject matter experts from PIFSC, PIRO, and WPFMC. The summit included presentations on recent bycatch research, discussions on successes and challenges, and facilitated group activities to identify bycatch priorities, strategies to more effectively manage the work, promote collaboration and leverage resources to increase efficiencies in future bycatch work. The full agenda is included as Appendix 1.

Presentations on Day 1 were provided by PIFSC Fisheries Research and Monitoring (FRMD), Protected Species (PSD) and Ecosystem Sciences Divisions (ESD), as well as PIRO Sustainable Fisheries (SFD), Protected Resources (PRD), and International Fisheries Divisions (IFD), and WPFMC. Presentations included overviews of bycatch work as well as information on how that work is prioritized and funded (e.g., statutory requirements), any metrics used to assess success or completion, how research findings are communicated, plus their potential and/or realized management purpose.



Asuka Ishizaki, Protected Species Coordinator for the Western Pacific Fishery Management Council, provides a presentation to Bycatch Summit participants on recent WPFMC bycatch work in the region.

Day 2 of the summit included group exercises to explore current and future PIR bycatch priorities, to strategize on a process to prioritize bycatch needs, and to better leverage resources to fund bycatch work in the PIR. Using four main themes based on objectives from the National Bycatch Strategy—monitoring and estimation; research and development; implementation of management measures; and communication and

collaboration—participants were asked to provide examples of either current or future priority bycatch work in the region. Participants used an affinity diagram process to organize ideas under each theme into clusters of priorities and then ranked which of those priorities they felt were the most important areas to address in the PIR[4]. A full list of the priorities and rankings are included in Appendix 2. Similar priorities which emerged across themes were ranked together.

The highest bycatch priorities identified by participants in the summit (in order of priority) were:

1. Industry engagement including collaboration with fishers on bycatch mitigation research, communication of research findings to fishers and other stakeholders, and increased training opportunities for fishers on mitigation strategies;
2. Ensuring continued funding for PIRO and EM, maintaining observer coverage, expanding EM, and determining how to balance observer and EM coverage moving forward;
3. International efforts including support for international collaborations to understand protected species populations and reduce bycatch in international fleets, monitor and estimate threats in international areas, increased engagement in RFMOs, and better understand bycatch from foreign fleets;
4. Post-release mortality research for protected species;
5. Gear modification research including fighting lines, FAD designs, tori lines, etc.;
6. EBFM and predictive modeling;

Participants used an affinity diagram to brainstorm, categorize and rank bycatch priorities.

[4] Participants ranked priorities using a "dot-voting" technique. Each participant was given three stickers (dots) and asked to vote for three priorities.

Summit participants identified ways to better leverage resources to conduct bycatch research in the region. Strategies identified include:

- Greater collaboration across PIFSC, PIRO, WPFMC, and industry to develop proposals for the various funding opportunities that are available each year (Bycatch Reduction and Engineering Program [BREP], MSA, Office of Protected Resources [OPR], etc.) at both the national and international levels;
- Partner with industry to conduct bycatch research to enhance collaboration and reduce costs, and also support industry in applying for outside funding to conduct bycatch work;
- Seek to build and leverage relationships with universities (for example, the new UH Fisheries Program) to partner with students to conduct bycatch research; and
- “Message up” (to NOAA leadership, Congress, etc.) about the importance of bycatch work in the region but change the narrative to emphasize the positive global impact of the work.

Participants also identified strategies to prioritize bycatch work in the region including:

- Improved communication and collaboration among PIFSC, PIRO, and WPFMC on annual research priorities (through both directors and staff) to identify top priorities for the region. These could be based on management needs such as ESA mandates, pending lawsuits, RPMs from BiOps, information needed to improve future ESA consultations, communications with fishers and stakeholders, cross-taxa impacts, etc.;
- Create/rebuild a dedicated bycatch program at PIFSC;
- Create project-based bycatch teams and/or identify a bycatch group to meet regularly (annually or quarterly basis);
- Engage in strategic thinking regarding management needs and long-term projects that are necessary to implement management changes. This would involve PIFSC, PIRO, WPFMC, and industry in the PIR.

Through both the bycatch presentations and the group exercises, a number of participants emphasized the importance of the PIROP and highlighted that the PIR bycatch research is highly dependent upon PIROP observer data. The summit highlighted the importance of collaboration among PIFSC, WPFMC, PIRO, industry partners, and international partners to determine bycatch priorities and undertake bycatch work in the region. There are a number of ongoing activities where PIFSC, WPFMC, and PIRO staff have shown excellence in coordinating efforts and leveraging resources towards bycatch activities within the PIR, as well as internationally. However, participants also expressed the need to enhance efforts to collaborate, both regionally and internationally, on research efforts, data collection, and funding sources.

Participants expressed concerns regarding data gaps in bycatch information in purse seine fisheries, specifically the need to better understand the impacts of FADs on protected species plus a need to reduce bycatch (e.g., silky sharks) in purse seine

fisheries. These are areas where there has been relatively little work done at PIFSC, historically. Lack of a clear process for prioritization was communicated, most notably at PIFSC. In particular, there was some confusion regarding how or if the PIFSC AGM guides PIFSC or PIR bycatch work.

Again, a consistent theme in these discussions was the largely unpredictable funding nature of bycatch work. The lack of permanent, long-term and predictable funds has impacted the amount of dedicated bycatch research that is undertaken, including federal funds (or lack thereof) to support federal (FTEs) and other staff that focus on bycatch research in the region. Discussions also raised awareness of the need to both minimize and leverage funds to better address current needs.

Section 4: Discussion

While bycatch reduction, particularly of protected species, is conveyed as a NOAA Fisheries priority across all levels, the opportunities for predictable and long-term funding in the region are rare. It became evident through the review that the lack of permanent or long-term funding impacts the quantity and type of bycatch work that is undertaken in the PIR. Much of the current bycatch focus is geared towards monitoring and estimating bycatch rates, while far less is dedicated to directed research to understand the impacts of bycatch and develop reduction solutions. Additionally, the number of PIFSC staff focused on bycatch mitigation research has been reduced in recent years because of the lack of predictable and long-term funding and prioritizing of other important issues. With fewer dedicated resources, bycatch work in the PIR has become somewhat piecemeal, with minimal opportunities for long-term research, resulting in significant gaps in work that is, based on multiple policy and planning documents, a high priority for the region and NOAA at large. Notable gaps include research on species' post-release mortality and bycatch mitigation research, particularly for protected species such as seabirds and elasmobranchs, which may be significant given that bycatch interactions play such a large role in fisheries management in the PIR.

The review identified that PIFSC, PIRO, and WPFMC could better align on addressing management needs for bycatch work and resulting management outputs. This includes collaborative identification of management needs, prioritizing information needs, acquiring funds, completing relevant research, and ultimately using the science to inform fisheries management in the PIR. While this is the ultimate shared goal, there are relatively few examples where this has been achieved. The most notable example is the PIFSC research conducted on longline leader material (wire vs. monofilament) in relation to post-release survival of sharks. Results from the PIFSC research has led to the implementation of conservation and management measures both domestically (via WPFMC process) and internationally (e.g., RFMO conservation measures at the WCPFC). In addition, this original PIFSC research is currently serving as a basis for modifying regulations in fishing gear in all the world's tuna RFMOs, including IATTC, IOTC, and ICCAT.

The summit also identified the need to improve communication and increase collaboration across PIFSC, PIRO, WPFMC, and industry. Greater engagement among stakeholders is important for a multitude of reasons including identifying bycatch priorities for the region as well as coordinating efforts and leveraging resources towards effective management options. Engaging more with fishers will lead to improvements on design ideas, raise awareness of emerging issues, and improve the roll-out of new mitigation technologies (e.g., distribution of new technologies, language translation) and

likelihood of implementation. Working with industry can help bolster relationships, which enhance opportunities to conduct experimental fishing operations and identify emerging bycatch solutions. The need for improved communication extends to other major stakeholders in the Pacific, particularly at the international level, as these interactions will help catalyze greater collaboration on bycatch research and activities and could result in additional funding opportunities or help to leverage existing resources.

Several new and emerging research needs were also identified. A partial list of foreseeable priorities for the region include mitigation of shark depredation, development of bycatch deterrents to reduce bycatch of protected species, modeling efforts to better understand ecological impacts due to protected species bycatch, re-initiation of a biological opinion due to increases in sea turtle interactions in longline fisheries, and understanding/reducing the impact of FADs on protected species, to name a few. The identification of these regional needs was a result of this review and speaks to the need for additional opportunities to highlight and prioritize bycatch needs in the region.

It is also clear that PIFSC and the broader PIR would benefit from a process which more effectively prioritizes bycatch investments and activities. Identifying specific bycatch priorities would benefit annual guidance documents, the dedication of resources and funding, including from external sources (e.g., BREP), and would assist the PIROP in prioritizing observer data collection if and when resources become limited. Any prioritization process should include metrics for success or completion and be tied directly to management needs, with an opportunity to assess management outcomes. Prioritizing would also enable more thorough planning for long-term projects, thereby increasing the probability for continuity of funding, proper execution of research, and communication of findings, all leading to more productive outcomes.

Section 5: Future Considerations

Some of the main findings of this review include the need to more clearly define bycatch priorities, enhance collaboration, and improve communication on bycatch activities, as well as identify funding opportunities that address new and emerging bycatch needs in the region. There is a range of strategies that helps address these needs. At one end of the spectrum would be the creation of a dedicated bycatch program, with dedicated bycatch research staff; however, this would necessitate more permanent funding in the region. At a minimum, PIFSC could create one or two bycatch coordinator positions that would work closely with PIRO, WPFMC, and industry partners to facilitate bycatch work within the PIR. It is also not clear if PIFSC aims to engage in directed bycatch research, whereby NOAA employees are the principal investigators, or if the preference is for PIFSC staff to serve as technical consultants or coordinators and outsource that work. In the case of the latter, a PIFSC bycatch coordinator(s) could be sufficient to serve in this capacity. Either way, there are advantages of such an approach, including increased focused communication, enhanced anticipation of research needs, prioritization of work, leveraging of resources, measuring progress, and communication of findings. Dedicated staff or a PIFSC bycatch coordinator could also focus efforts on tracking the various funding opportunities that are available each year and collaborate with PIRO, WPFMC, and industry to develop proposals that fund bycatch research in the region, manage bycatch-related contracts, increase engagements in order to enhance research collaborations, and ensure that relevant findings are communicated appropriately and consistently. This could help alleviate the sense that research is occurring in a reactive manner and instead create a proactive approach to addressing PIR bycatch needs.

A PIFSC bycatch program or bycatch coordinator could also instigate more relationships with university partners and fishing communities, regarding emerging bycatch issues and research capabilities with the PIR. Ideally there would be more opportunities to engage locally with partners at University of Hawai‘i and Hawai‘i Pacific University where expertise and shared resources could yield highly useful information that would serve the PIR.

In addition to a bycatch program or bycatch coordinator, the PIR would benefit from hosting an annual or bi-annual Bycatch Summit to bring together experts across PIFSC, PIRO, WPFMC, and other stakeholders to discuss ongoing and emerging bycatch research needs and possible routes to work towards effective solutions. The summit could include discussions on findings from recently concluded bycatch research, updates regarding ongoing bycatch work in the region, new and emerging issues, and top regional priorities. It could also be used as an avenue to develop a formal prioritization process for bycatch work in the region which could then feed into regional

guidance documents, including the AGM and science plan, to ensure that bycatch priorities in the PIR are accurately reflected and addressed. Clearly defined bycatch priorities would allow PIFSC and PIRO to more efficiently allocate resources towards the highest priority bycatch work in the region. The Bycatch Summit could be coordinated and facilitated by the bycatch program or the bycatch coordinator.

A bycatch program or a bycatch coordinator could also initiate quarterly virtual meetings that incorporate informal dialogues or presentations related to bycatch issues in the PIR. The advantages include a platform for more frequent communication to discuss new and emerging issues, a greater sense of community, and even introductions of new “players” in the field of PIR bycatch.

In summary, the various phases of this review highlighted the importance of bycatch work to the PIR and the broad range of ongoing activities. In addition to the successes, the review also highlighted a few deficiencies that PIFSC and PIRO should consider addressing. In general, regional leadership should determine whether they will continue to prioritize bycatch research activities in the region, and if so, determine a process to prioritize that work. Strategies for better coordination and collaboration in the region should be developed, possibly led by existing staff. It is also strongly recommended that PIR leadership seek more sustained funding for key bycatch activities in the region.

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Appendix 1: PIR Bycatch Summit Agenda

Pacific Islands Region Fisheries Bycatch Summit
August 1 & 2, 2023, Pier 38 Honolulu

Agenda

Day 1

9:00 AM	Welcoming Remarks	Charles Littnan, T Todd Jones
9:20 AM	Overview of PIR Bycatch Review & Objectives of Bycatch Summit	Yonat Swimmer, Emily Crigler
9:45 AM	Presentations: PIFSC Protected Species Division + Q & A	Jessie Bohlander, Alex Gaos, Michelle Barbieri, Erin Oleson
10:30 AM	Coffee Break	
11:00 AM	Presentations: PIFSC Fisheries Research and Monitoring Division + Q & A	Keith Bigelow
11:45 PM	Lunch Break	
1:00PM	Presentations: PIFSC Ecosystem Sciences Division + Q & A	Frank Parrish, Ryan R., Johanna Wren, Minling Pan
1:45 PM	Activity Break: Reflection	
2:00 PM	Presentations: Western Pacific Fishery Management Council + Q & A	Asuka Ishizaki
2:45 PM	Coffee Break	
3:00 PM	Presentations: Pacific Islands Regional Office (General) + Q & A	Chelsey Young, Irene Kelly, Lynn Rassel, Valerie Post
3:45 PM	Wrap up Day 1	Yonat Swimmer, Emily Crigler

Day 2

9:00 AM	Recap of Day 1	Yonat Swimmer, Emily Crigler
9:15 AM	Presentations: Pacific Islands Regional Observer Program + Q & A	Lesley Hawn, Rich Kupfer
10:00 AM	Group Exercise: Bycatch Priorities in the PIR	All Participants
10:45 AM	Coffee Break	
11:00 AM	Group Exercise Prioritizing Bycatch Work in the PIR	All Participants

12:00 PM Lunch Break

1:00 PM Discussion: Leveraging Resources and Strategies to Prioritize Bycatch Work in the PIR All Participants

4:00 PM Wrap up Day 2 Yonat Swimmer, Emily Crigler

Appendix 2: Affinity Diagram Results–PIR Bycatch Priorities

Participants at the Bycatch Summit ranked priorities using a “dot-voting” technique. Each participant was given three stickers (dots) and asked to vote for three priorities. The number of tallied votes for each priority is included in parentheses below.

Category 1: Monitor and Estimate

- **Monitoring funding (20):**
  - Pursue sufficient and dependable funding for observer program; observer data are crucial to our work, so finding a way to keep them funded consistently is a big priority for us; maintain statistically significant observer program; robust observer program and EM program to document catch composition of bycatch
- **Determine observer/ EM coverage rates (16):**
  - Maintain observer coverage and supplement w/EM to support examining effectiveness of FKW TRP measures including handling recommendations; ensure sampling capabilities exist at the "right" level for observer program; expand EM work to assess collectable data which could help determine post-release condition for sharks and mobula; quantify % coverage needed for each species for accurate interaction estimations; develop a plan for determining how to blend EM and observer coverage—it has a trickle-down effect.
- **Evaluate management measures (10):**
  - Evaluate fishery performance under SS LL turtle trip limit measure; performance review of sea turtle interaction limits; estimate and compare the costs of reducing bycatch using different approaches
- **International assessments (9):**
  - Monitor and reduce threats to ETP populations that interact w/U.S. fisheries; collaborate internally to identify bycatch hotspots (geartype/location); increase funds/research to better understand sea turtle nesting data trends that impact fisheries; monitor and estimate threats in international areas; reliable foreign fleet bycatch assessments
- **Time series (2):**
  - Maintain long-term data sets

Category 2:

Research and Develop Solutions

- **Predictive modeling (EBFM) (12):**
    - Continue to develop EBFM; seek multi-species solutions using modeled products that provide robust advice to fishers based on oceanography; develop operational tool that offers a prediction of expected target: bycatch ratio in time and space (e.g., EcoCast); EBFM to assist w/greater selectivity spatially/temporally; climate change and OCS; discern if observed changes in bycatch are environmentally driven-
- **Human dimensions (8):**
    - Study/understand the human dimensions of bycatch measures & regulatory actions; build relationships with fishers in order to better understand fishing location decisions (among other things)-
- **Operationalize data collection (5):**
    - Collect environmental-/fisheries-independent data to feed into models (spatial distributions, dynamic management, etc.); fishery-independent longline surveys to better understand species distribution and effects of effort displacement; use of bycatch data streams to address life history gaps not achievable through other methods (e.g., BET); operationalize data collection on subsurface ocean conditions through fleet collaborations-
- **Protected species research (10):**
    - Leatherback length estimation; continue AI work to detect protected species interactions/reduce EM costs; understanding spatial ecology of protected species; population structure of FKW and other bycaught cetaceans in the WCPO; understanding population structure of mobulas in the Pacific; continue genetic sampling of mobula; research into loggerhead sea turtle bycatch increase in the SS LL fishery; improve understanding of how population trends and climate may affect protected species interaction rates in LL fishery; mitigation strategies to reduce interactions with or reduce mortality of seabirds, sea turtles, and sharks
- **International efforts (13):**
    - Build capacity for international projects; build PIR international team, different mitigation in WCPO, EPO, and more broadly internationally; reduce bycatch in purse seine fisheries; reduce bycatch in international and IUU fleets; identify data needs/gaps to carry out analyses to support evaluation of research to demonstrate potential impacts of mitigation across the Pacific; research on impact of foreign fleets on bycatch-
- **Gear modification research (17):**
    - Continue SS LL tori line research; develop innovative tagging mechanism for FKW post-hooking mortality research; biodegradable FAD materials; gear modification to prevent capture (ex: LED lights); develop non-entangling biodegradable FAD designs; research on tools or gears that can reduce bycatch; encourage research on innovative ways to reduce FKW depredation; EFPs to test proof of concept; continue research on fighting line device; strategies for

reducing trailing gear when releasing FKW and others; examine effectiveness of industry fighting line device to reduce FKW serious injury and improve outcomes for sharks-

- **Handling (0):**
  - Review/improve safe handling & release guidelines; develop improved handling guidelines for sharks and rays; develop an ecocast-like tool for SS and DS longline that factors in profitable catch & bycatch of protected species-
- **Post-release mortality (19):**
  - Continue and expand post-interaction mortality and movement studies; research ways to promote safe release and survival; improve post-release survival of bycatch from purse seine fisheries; research post-release mortality for species of concern; improve understanding of post-release survival and encounter rates of incidentals; expand post-release mortality tagging study for mobulas to look at long-term effects; shark and seabird bycatch mortality and mitigation research; understand post-hooking mortality/impacts for leatherbacks-
- **Nearshore sharks (2):**
  - Develop tools that reduce shark interactions w/ FADs/nearshore fishers that may kill OCS and other sharks; shark depredation and mitigation research for small-boat fisheries (esp. bottomfish)-

Category 3: Implementation of Management Measures

- **International concerns (6):**
  - Increase RFMO observer coverage and data; build in application of international projects in BiOps; reduce silky shark and bigeye tuna bycatch in international fisheries; international adoption of biodegradable and non-entangling FADs
- **Industry development (9):**
  - Inclusion of fishers/industry in all phases to understand what is doable and for broad adoption; work with industry to roll out fighting line device and monitor use; involve fishers/industry in developing solutions to minimize bycatch
- **Industry implementation (6):**
  - Crew training program for protected species handling in HI and AS longline fisheries; continue crew training; provide tools (line cutters) to increase post-release survival
- **Additional measurements (5):**
  - Explore the potential use of non-regulatory measures to minimize bycatch; raise profile of conservation offsets; increase enforcement checks for compliance; consider measures recommended in TRPs and ESA recovery plans for implementation
- **Funding (3):**
  - Determine ways of funding to avoid reduction in observer coverage; increase funding for bycatch work; increase consistent funding for international projects
- **Management strategies (2):**
  - Connect scientific products to management needs; ensure science is dictating bycatch limits (e.g., sea turtles)

- **Explore non-market species alternative usage (3):**
  - Create markets for currently non-value species; keep lancetfish for a reduction fishery (and snake mackerel and oilfish)

Category 4: Communication and Collaboration

- **International engagement (6):**
  - Improve/create international relationships for bycatch research and reduction; understand bycatch of international and IUU fleets; international collaboration to improve populations of protected species that overlap with U.S. fisheries; continue/expand support for international collaborations to understand protected species populations and bycatch beyond U.S. data; effective communication with congress on value of international programs; leverage U.S. economy to urge international bycatch research and compliance
- **PIFSC/PIRO council (develop prioritization) (2):**
  - Develop a dedicated cross-region team (PIFSC and PIRO) for strategies on bycatch issues: continue engagement across PIRO, PIFSC, Council, etc. to work through issues of prioritization (need to communicate more regularly; share research results among PIFSC, PIRO, council, & fishers more often—have a bycatch summit; increased engagement between partners to better connect future scientific products w/ management needs; PIRO could develop strategic prioritization for protected species research needed to reduce bycatch threats
- **Industry outreach involvement (21):**
  - Focus fisher training and provide incentives to reduce trailing gear on all protected species, sharks, etc.; collaborate with fishers to develop mitigation strategies; allow fishers to help define problems and develop solutions; increase capt/crew participation in sample collection; involve industry early, good communication leads to management techniques with higher compliance; communicate with nearshore fishers to reduce shark interactions in bottomfish and tuna troll; industry involvement—what are their ideas re: avoiding bycatch; protected species and bycatch avoidance programs in longline fisheries; get feedback on whether modeled bycatch reduction measures create issues for fishers; present eco-cast-like tools to fishers and modify based on feedback; outreach to fishers on DS LL tori line rulemaking process; regularly communicate findings back to communities in a way that they understand
- **Partnerships with other groups (find ways to learn about post-interactions) (3):**
  - Post-incidental interaction follow-up—check documents, share resources, crew/capt/owner review; identify avenues for data sharing w/ partners w/o having to pay them (confidential data); resource library for user-focused research and info.