



## WPRFMC FIVE-YEAR RESEARCH PRIORITIES UNDER THE MSRA 2014-2019

June 2016

The reauthorized Magnuson-Stevens Fishery Conservation and Management Act (MSRA), created new responsibilities and authorities for domestic regional fishery management councils and their advisory bodies. Following is the relevant MSRA text regarding the development and implementation of five-year regional research priorities by Councils.

### MSRA TEXT ON FIVE-YEAR RESEARCH PRIORITIES

Section 302 (h) Each Council shall develop, in conjunction with the scientific and statistical committee, multi-year research priorities for fisheries, fishery interactions, habitats, and other areas of research that are necessary for management purposes that shall –

- (A) establish priorities for 5-year periods;
- (B) be updated as necessary; and
- (C) be submitted to the Secretary and the regional science centers of the National Marine Fisheries Service for their consideration in developing research priorities and budgets for the region of the Council.

### HISTORY

At its 140<sup>th</sup> meeting (March, 2008) the Western Pacific Regional Fishery Management Council (WPRFMC) accepted recommendations from its Scientific and Statistical Committee (SSC) regarding a suite of research priorities and directed Council staff to expand upon them. The Council provided a final review before transmittal to the Pacific Islands Fisheries Science Center and the Secretary of Commerce for their consideration in establishing research priorities and budgets for the region. The final document was transmitted to NMFS on September 21, 2009.

The initial five-year research priorities expired on September 2013. Council staff reviewed and updated the status of each item and engaged its Protected Species Advisory Committee, Fishery Data Collection and Research Committee – Technical Subcommittee, and Social Science Planning Committee to assess whether new research items should be added. The SCC, during its 117<sup>th</sup> meeting (June 2014), endorsed the updated research priority document and the Council, at its 160<sup>th</sup> meeting (June 2014) accepted the SSC's endorsement. The Council transmitted the document to the Secretary and the Pacific Islands Fisheries Science Center on July 7<sup>th</sup>, 2014.

## STOCKS

The STOCKS section of the research priorities deals with the activities that contributes to the generation and improvement of stock assessments of crucial management unit species in the FEPs. Elements of stock assessments are described under this section. Improving the existing data collection to improve data that goes into stock assessments is one of the major priorities being addressed in this section

TABLE 1. RESEARCH NEEDS UNDER THE STOCK THEME IN ORDER OF PRIORITY

No	Rank	Research Needs
1	1	<b><i>Stock assessments and MSY estimates for major species/stocks in risk order ranking:</i></b> Risk order ranking refers to the risk (including both the likelihood and the consequences) of overfishing a species/stock. Stock assessments and MSY estimates are needed for federally managed stocks in order to comply with MSRA ACL requirements, and these assessments should be conducted based on a risk ranking of the stocks most likely to be subject to overfishing through to those fish stocks least likely to be subject to overfishing. Conducting simple surplus production models could be done on species with not benchmark assessments. For those species with existing assessments, improvements to the stock assessment methodologies should be the next goal.
2	1	<b><i>Life history and population parameters in risk order ranking:</i></b> Life history and population parameters, such as natural mortality rates, age and growth rates, and biomass, are needed to provide information on managed stocks in order to provide essential for estimating MSYs and ACLs. Establish a BioSampling Program in Hawaii to enhance collection of life history samples for reef fish
3	1	<b><i>Fishery data via improved fishery monitoring logbooks, observers and port sampling:</i></b> Many fisheries conducted in federal waters of the WP Region are incompletely monitored through creel surveys and in some cases trip tickets, or sales receipts. Expanded fishery monitoring systems will provide improved data and reduce both scientific and management uncertainty surrounding the establishment and implementation of ACLs and accountability measures.  Some ACLs are expected to require real-time monitoring which may be achieved via the daily electronic transmittal of logbook information. Implementation of mandatory reporting at all level with proper education and outreach and enforcement could also improve fishery monitoring. Implementation of electronic monitoring (e-logs, VMS reporting for large offshore fisheries and use of mobile technology for nearshore) may provide increased efficiency in fishery dependent data collection. Other improvements could include implementing additional data collection for critical fisheries not currently covered by the existing data collection programs.
4	1	<b><i>Tagging research to provide (semi) fishery independent information:</i></b> Tagging data is required to understand and define stock boundaries for managed stocks. It will also provide demographic information for estimating life-history parameters for MSY and ACL estimates for managed stocks. This priority can include tagging effort to

		determine spawning aggregation areas, determine effect of MPAs; movement pattern and growth rate, habitat movement, and gear interaction.
5	2	<b><i>Stock structure, especially for bottomfish populations:</i></b> Genetic and stable isotope data are required to understand and define stock boundaries and the degree of mixing by different stock population segments for managed stocks. These will be essential components for estimating MSYs and ACLs.
6	6	<b><i>Impacts of global climate change and ocean acidification on marine stocks:</i></b> Understanding large scale oceanographic changes in response to climate change will be essential for evaluating likely impacts to not only the stock dynamics but also impacts to the fleet dynamics when the stocks shifts distribution. These studies will also impact the estimation of MSY and ACLs for federally managed stocks in the WP Region.

## ECOSYSTEMS

The ECOSYSTEMS section addresses the science needed for ecosystem-based fishery management. Moving towards an integrated ecosystem-based management enables fishery management to be more proactive rather than being reactive to the current state of the stocks. This would also enable streamlining of management strategies at all levels using a management strategy evaluation approach.

TABLE 2. RESEARCH NEEDS UNDER THE ECOSYSTEM THEME IN ORDER OF PRIORITY

No	Rank	Research Needs
1	1	<b><i>Trophic interactions and food webs, including impacts of large predator removals. Expand and update ECOSIM and encourage the development of alternative models:</i></b> Develop and evaluate ecosystem or trophic models for use in ecosystem management; characterize the trophic dynamics of the ecosystem relevant to key fisheries species; and assess temporal dynamics of reef fish structure and examine recovery rates and yields following removal of large fish biomass. Look into the future climate change scenario and impacts on the coral reef community (CORSET). This could also include ecosystem models of that looks into high trophic level species removal that competes with endangered species (i.e. NWHI monk seals) to determine recovery rates.
2	2	<b><i>Impacts of forcings, humans, and natural biological cycles on nearshore habitat:</i></b> Improve understanding of the importance of large oceanographic forcings such as ENSO events, typhoons, seismic events, anthropogenic inputs (including pollution, tourism), and natural biological cycles or variability on nearshore reef resources and habitats over extended time scales.  The impacts of fishing, land-based sources of pollution and climate change have been identified by NOAA as the three priority threats to coral reef ecosystems of United States. Studies to determine place-based research and management needs to address these three priority threat areas should be conducted  Becoming an important component in the CNMI; getting a better handle on H2O quality issues; fish habitat and eutrophication; UOGML – need funding looking at species-habitat association and impacts of anthropogenic impacts
3	2 - reranked	<b><i>Estimating carrying capacity and productivity of near shore ecosystems:</i></b> Determining the carrying capacity of most management unit species in the Western Pacific region is yet to be completed. Carrying capacity is one of the basic parameters needed to produce stock assessments for these species.
4	3 - reranked	<b><i>Connectivity within and between island/archipelago ecosystems:</i></b> Investigate the connectivity of fish populations and other ecosystem factors between/within island or archipelago systems to assess whether changes in fisheries and/or fishery management actions in one area have an effect on fish populations/ecosystems in other areas. New way of studying recruitment; can contribute to the recruitment parameter of models; genetics and larval oceanography;

No	Rank	Research Needs
5	4	<i>Species interactions and ecosystem functions</i> : Determination of trophic interactions will be necessary for understanding the interrelationships between managed stocks and ecosystem components, for identifying stock complexes, and for estimating MSYs and ACLs.
6	4	<i>Status and factors of marine ecosystem resiliency</i> : Identify potential environmental and anthropogenic factors that may influence the long term resilience of coral reef ecosystems and assess the resistance and resilience of specific populations, locations, and habitats to episodic events (e.g., coral bleaching), emphasizing areas that may serve as sources of reproductive propagules.
7	5 (re-ranked by AP as #1)	<p><i>Functions and tradeoffs of MPAs</i>: Evaluate the effectiveness of MPAs, including no-take reserves and other marine zoning schemes, taking into account:</p> <ul style="list-style-type: none"> <li>- Abundance of ecologically and economically important species.</li> <li>- Spillover of fishery species into adjacent habitats.</li> <li>- Improvements in the condition of the sessile benthic community and abundance of mobile invertebrates.</li> <li>- Cascading effects on non-target species.</li> </ul> <p>Develop useful science-based indicators (biophysical and socioeconomic) of management effectiveness. Such indicators must be clearly articulated, measurable and related to conservation or management objectives.</p>
8	6	<i>Impacts of global climate change and ocean acidification on marine ecosystems</i> : Establish long-term monitoring programs in the U.S. Pacific islands to assess the impacts of global warming, ocean acidification and sea level rise on marine ecosystem resources and Pacific Island communities. This program should provide for timely analysis and public dissemination of the results and consider the socio-economic-cultural dimension of Pacific island fisheries as well as the physical, chemical and biological impacts on the marine environment.
9	7	<i>Condition factor (energy stores) of top predators</i> : Condition factor refers to a mathematical formula for determining the physiological state of a fish, including its reproductive capacity. It is calculated by dividing fish weight by length cubed ( $W/L^3$ ). The heavier a fish for a given length, the higher its condition factor (K). Research is needed to calculate condition factor of apex predators for stocks in each island area. This technique can be used to determine optimum habitat along the Marianas Island.
10	8	<i>Impacts of alien and invasive species</i> : Invasive and alien species impacts to marine ecosystems have been identified by State and Federal agencies and other non-governmental organizations as one of the major threats to Pacific Island ecosystems. The public and fishing community continue raise this issue as a major problem at public forums and meetings. Limited research on the impacts of introduced species such as taape, roi, gorilla ogo, and mudweed, has been completed to date.
11	9	<i>Develop and support decision tools for ecosystem management (e.g. CAMEO)</i> : Improve understanding of marine ecosystem processes to support ecosystem considerations in fisheries management by developing decision support tools that will better enable ecosystem approaches to ocean and coastal ecosystem management.
12	10	<i>Aqua/mariculture impacts</i> : Offshore aquaculture can impact ecosystems by acting as

No	Rank	Research Needs
		a fish aggregation device (FAD) and causing fish to congregate in areas where they might normally not occur. Other impacts such as pollution (via fish feed or waste), habitat degradation (site selection and placement), entanglement with protected species, effect of escapes on native species and habitat, and species selection (native vs non-native; use of wild species for brood stock) needs to be researched

## PROTECTED SPECIES

The PROTECTED SPECIES section deals with scientific research needed to reduce bycatch impacts on protected species and to ensure FEP compliance with statutory requirements such as the Endangered Species Act (ESA) and Marine Mammal Protection Act (MMPA). Improving the accuracy of protected species stock assessments as well as bycatch estimates are major priorities being addressed in this section, as are research contributing to the development of technological solutions to protected species bycatch.

TABLE 3. RESEARCH NEEDS UNDER THE PROTECTED SPECIES THEME IN ORDER OF PRIORITY

No	Rank	Research Needs
1	1	<p><b><i>Evaluate fishery interactions and post-hooking mortality rates:</i></b> NMFS' existing post-hooking mortality rates are based on outdated and incomplete information that needs to be updated so as to provide science-based assessments of conservation or management measures under consideration.</p> <p>Currently we only have a minimum estimate of fishing interactions and mostly only those associated with recreational <del>shore-based</del> fishing. We need to work on quantifying and describing all fisheries interactions and associated mortality and develop mitigation strategies where appropriate.</p>
2	1	<p><b><i>Estimate species-specific demographic parameters including annual survival and breeding probabilities for marine mammal species with known or possible interactions with fisheries (e.g., false killer whales, Pantropical spotted dolphins, pilot whales, rough-toothed dolphins):</i></b> Current abundance estimates of marine mammal stocks in the region do not use species-specific or Hawaii-specific demographic data. Research is needed to determine Hawaii-specific demographic rates, including annual survival and breeding probabilities, to inform abundance estimates and for use in stock assessments.</p>
3	3 – reranked	<p><b><i>Interaction reduction and mitigation methods:</i></b> Further experimental research into reducing interactions between protected species and fishery activities and gears.</p>
4	3	<p><b><i>Population and status assessments and evaluation of risk factors affecting stock recovery including changes to important reproductive habitat:</i></b> To date NMFS has emphasized fishery regulations to recover protected species however research has shown that in many cases terrestrial or non-fishing impacts to protected species are greater than fishery impacts. Understanding the relative sources of various impacts will allow the development of the most effective (and cost-effective) recovery plans and actions. Research to augment the knowledge regarding biogeographic distribution and abundance of ESA-listed coral species are also needed, with particular priority placed on areas potentially affected by the American Samoa and Mariana FEP fisheries.</p>
5	5	<p><b><i>Genetic structuring of key species to allow for scientifically robust designation of “discrete population segment” and “stocks”:</i></b> ESA allows for designation of “discrete population segment (DPS)”, and MMPA requires the management of populations by “stocks”. Genetic data are often used as key scientific evidence for the basis of DPS and stock designations. Robust scientific research on the genetic</p>

**Comment [A11]:** PSAC suggested deleting “shore-based” given that not all recreational fisheries are shore-based.

**Comment [A12]:** Insertion suggested by PSAC to highlight this risk factor, which is anticipated as a result of climate change.

No	Rank	Research Needs
		structuring of protected species interacting with fisheries is necessary to allow for effective management of such species.
6	6	<b><i>Impacts of global climate change, ocean acidification and sea level rises on protected species:</i></b> Research is needed on the potential impacts of global climate change, such as sea level rise; increase in average ocean temperatures; and ocean acidification, may have on the ocean environment such as changes in trophic structure and prey base, alteration in oceanographic patterns, changes in feeding and migratory pathways, among others and linking these to changes in fish resources
7	7	<b><i>Shark population, status and effects on Western Pacific fisheries:</i></b> Research into shark depredation and bycatch in Western Pacific fisheries with regards to decreasing shark bycatch and reducing shark depredation on target stocks.
8	8	<b><i>Potential for permitted takes of sea turtles:</i></b> Research is needed to determine whether limited takes of sea turtles for cultural or other purposes would significantly affect the recovery of sea turtle populations.
9	9	<b><i>Evaluation/improvement of turtle conservation projects:</i></b> A scientific evaluation of the effectiveness of terrestrial turtle conservation projects is needed to identify data gaps, successes or failures and priority projects to be continued or established. This would include developing and identifying science-based success criteria for the appropriate populations and would allow identification of the types of projects that provide the best conservation benefits in the most cost effective manner.
10	10 - reranked	<b><i>Examine conservation banking and offsets (credits):</i></b> As recognized by the USFWS, conservation banking and credits can encourage improved monitoring, conservation and management of listed species by allowing the public to offset some of the adverse impacts of their actions on these species. Failing to allow such offsets has been observed to result in the destruction of protected species or the denial of interactions with them. Research into this issue will determine whether positive impacts would be likely to result for listed species under the purview of NMFS.



## HUMAN COMMUNITIES

The Human Communities section addresses the socio-cultural and economic needs (the human dimensions) inherent in regional fisheries management. The MSA requires that the Council consider the importance of fishery resources to fishing communities, as well as to use social and economic data to support the specification of Optimum Yield. In addition, the MSA finds that the Pacific Insular Areas have unique social and historical characteristics. Finally, the WPRFMC's process to specify annual catch limits requires assessing relevant social and economic factors and their importance to the fishery.

TABLE 4. RESEARCH NEEDS UNDER THE HUMAN COMMUNITIES THEME IN ORDER OF PRIORITY

No	Rank	Research Needs
1	1	<i>Develop an annotated bibliography of the fisheries-related economic and human dimension data sources and publications regarding Hawaii, CNMI, Guam, and American Samoa, in order to understand what has been written and what data are available in private and public institutions throughout the region.</i> Social policy analysis, as well as knowing what data gaps exist, require a complete understanding of the available human dimensions information for regional fisheries.
2	1	<i>Develop a comprehensive, representative contact database of non-commercial fishermen and use it to, among other things, conduct surveys to estimate non-commercial participation, catch, and effort in all islands areas.</i> Absent recreational/noncommercial fishing licenses, we have no frame of people and contact information for information distribution/collection, especially in Hawaii, and thus we continue to lack basic information on participation, etc.
3	1	<i>Pilot an a priori process and structure for combining social and biophysical information to create integrated characterizations of Council-managed fisheries.</i> Managing fisheries ecosystems requires an integrated understanding of the social and biophysical elements of those ecosystems, and how they relate and are impacted by one another.
4	2	<i>Examine and measure attributes of non-commercial fishing, such as a social theory-based approach to categorizing non-commercial fishermen and surveys of those people in the Hawaii Division of Boating and Ocean Recreation database who indicated recreational fishing as a principal use.</i> Previous studies that have examined categorization have mostly done so descriptively. Using a theoretical approach will provide a basis for predicting fishermen's behavior and for managing not-for-profit fishing as distinct from commercial fishing.
5	2	<i>Update characterizations of all Council-managed pelagic fisheries, to include the charter fisheries of Hawaii and Guam.</i> Information about the various pelagic fleets and their associated fisheries has not been updated in some time, despite the fact that much of the Council's ongoing management attention is focused on them.
6	2	<i>Identify the fisheries and parameters that should be part of a human dimensions monitoring program for Council-jurisdiction fisheries, including identifying attributes that serve as relevant indicators of change in the social component of the fisheries ecosystem for all FEP.</i> The Council currently lacks coordinated, timely, and

No	Rank	Research Needs
		regularly-updated information to track management drivers and effects.
7	2	<b><i>Identify and investigate socioeconomic impacts to fisheries and fishing communities from protected species interactions and ESA/MMPA requirements generally (e.g., loss or damage to gear/bait (adds operational costs for the vessels)).</i></b> In the face of increasing petitions for listing marine species that may interact with local fisheries, more data is needed to inform Council decision-making and positions on such issues and to understand their potential effect on fishermen and fishing communities.
8	2	<b><i>Understand the modern sustenance, subsistence and cultural importance and value of fish in each island area, especially coral reef species, as well as modes of post-harvest distribution. Questions might include the motivations that underpin sharing (altruism, cultural drivers, external pressure, etc.) and social/psychological benefits that come from sharing. As part of this research, document the long term cultural needs and desires of indigenous populations regarding fishery resources.</i></b> This project is conceptually related to others on this list that seek to learn more about our fishing communities. Contemporary information is needed to frame ongoing management activities in a cultural context, as required by the MSA for the Pacific Islands Insular Areas.
9	2	<b><i>Survey the staff of jurisdictional marine resource departments for skill and expertise needs in fisheries so the Council can more efficiently assist with local institutional capacity building.</i></b>
10	2	<b><i>Understand culture and economic based resource use conflicts between established and more recent residents of fishing communities, and suggest approaches to ameliorate them (e.g., Guam and Compact of Free Association immigrants).</i></b> The Council process, including education/communication activities and products, will benefit from increased knowledge about fisheries social conflicts.
11	2	<b><i>Research fishery dynamics (participants; boats; distribution of fish; evolution of gear and techniques; demographics; revenues; fixed and variable costs of operation; etc.) of small vessel pelagic troll and handline fisheries in American Samoa, Hawaii, Guam and CNM, with emphasis on: those who go to "the Mountain" and the weather buoys, and the P-FADer..</i></b> The pelagic troll and handline fisheries of the region are highly important to local economies and subsistence. They comprise a mix of motivation and fish distribution but have yet to be systematically researched. The Cross Seamount fishery is a unique fishery that periodically attracts Council attention because of concerns with potential overharvest of juvenile bigeye tuna and an emerging shortline fishery for bigeye and monchong. More research is needed to understand the current dynamics of the fishery.
12	2	<b><i>Assess the human dimensions of U.S. Pacific marine managed areas, especially procedural justice, transferred economic, social, and ecological effects, and safety.</i></b> This region contains the most amount of federally restricted ocean (for conservation and other purposes). Many fishermen insist they have not been adequately involved in MPA decision-making processes and are therefore are resentful, less likely to believe proponents' claim, or to obey regulations.
13	3	<b><i>Understand how changes in the management of the MHI bottomfish fishery (ACLs, changes in non-commercial participation from the adoption of non-commercial federal permits/reporting/bag limits, the federal vessel registry, etc.) have affected</i></b>

No	Rank	Research Needs
		<i>participants and other beneficiaries.</i> This fishery is an important commercial and noncommercial fishery.
14	3	<i>Develop surveys of fishing community perceptions of fish population and fisheries ecosystems trends in all island areas to understand if they align with manager and scientist evaluations in order to understand if/where education and outreach might be needed.</i> Policy-makers wish to manage according to scientific information. However, if such data are not believed by fishermen and other ocean uses, then policy-making can be very contentious and inefficient.
15	3	<i>Develop or investigate an existing method, such as supply chain analysis, for determining the groups of people who are most directly “in a fishery” and who share a common dependency on commercial, recreational, or subsistence fishing or on directly related fisheries-dependent services and industries.</i> The Council has never had a well-documented portrait of the most important groups comprising some of our fisheries. Having this information provided for better policy analysis and more targeted communication to potentially-affected groups.
16	4	<p><i>Conduct detailed fishery analysis, socio-economic, and socio-cultural studies of yellowfin tuna (YFT) and bigeye in the Hawaii based fisheries:</i> Given the economic and cultural importance of YFT in Hawaii it is important to conduct a thorough evaluation on the status and determine not only the population dynamics of the species but the dynamics of the fishery and the market as well. Based on several tagging studies, the YFT in the Hawaiian waters are primarily spawned and recruited locally. The ones that successfully recruited in the population tend to remain in Hawaiian waters throughout their lifespan with low level of exchange rate with other regions in the Pacific. Given that these tunas are primarily Hawaii-based, regional management considerations should be given to these species. The following studies would be useful in order to support management of YFT: move to human communities</p> <ol style="list-style-type: none"> <li>1) Examine long term trends in yellowfin CPUE by size class for coastal troll and handline gear.</li> <li>2) Investigate and estimate the landings and economic value of small yellowfin tuna in poorly documented fisheries and markets.</li> <li>3) Determine the contribution of yellowfin tuna to commercial landings at small size classes, i.e. &lt; 3 lbs, 3 – &lt;10 lbs, 10 - &lt;15 lbs, etc.</li> <li>4) Examine socio-cultural impacts of raising the commercial size limit on yellowfin tuna or the imposition of recreational size and bag limits.</li> <li>5) Conduct a Yield per Recruit analysis of yellowfin harvested by Hawaii-based fisheries.</li> </ol>
17	4	<i>Understand key management implications of climate change on fisheries and fishing communities in all three island areas and identify attributes of island communities that may help them be resilient in the face of changes.</i> As more information is becoming available on the potential biophysical implications of climate change on the Region’s fisheries, research is needed to understand how fishermen and fishing communities may have to adapt to changed fisheries.
18	5	<i>As part of other research efforts, investigate the scope and nature of any cultural exchange that may be resulting from fishing in the marine national monuments to</i>

No	Rank	Research Needs
		<i>understand occurrence, perceptions and attitudes.</i> Regulations that authorize cultural exchange fishing in the marine national monuments are unique and new in our region. Since the regulations specified there be no log books or permit requirements for cultural exchange in the monuments, research is needed to documents its scope and importance.
19	5	<i>Provide a social scientific basis, based on island cultural attributes and economic reality, as to why boat-based data is the most appropriate level for use in our region.</i> In many parts of the country, noncommercial data is collected at the fishermen level. However, many argue that in the Pacific Islands, it would be culturally and methodologically more appropriate to collect data for federal waters at the boat-based level.