

## **Chair's Summary of Program Review of Protected Species Science**

### **NOAA Pacific Islands Fisheries Science Center**

**Honolulu, Hawai'i**

**July 27-31, 2015**

#### **Review Panel Members**

- David Helweg, DOI Pacific Islands Climate Science Center, Chair
- Douglas DeMaster, NOAA Fisheries, Juneau AK
- James Estes, Department of Ecology and Evolutionary Biology, UC Santa Cruz
- Frank Paladino, Chair and Professor of Biology, Indiana University-Purdue University
- Robin Waples, NOAA Fisheries, Seattle WA

#### **Background and Overview of Meeting**

NOAA Fisheries works to conserve, protect and recover species under the U.S. Endangered Species Act (ESA) and the U.S. Marine Mammal Protection Act (MMPA). To ensure NOAA Fisheries achieves these mandates, it is appropriate to conduct periodic reviews of the scientific programs supporting protected species conservation and management.

The goal of this review was to evaluate current scientific programs of the NOAA Pacific Islands Fisheries Science Center (PIFSC) established to provide information relative to the conservation and management of marine mammals, endangered or threatened wildlife, and species of concern under NMFS jurisdiction. In addition, this review assessed the extent to which current science programs are focused on information needs identified by NOAA Pacific Island Regional Office (PIRO) managers.

Protected species-related science programs addressed in this review included the Hawaiian Monk Seal Research Program (HMSRP), the Cetacean Research Program (CRP), the Marine Turtle Research Program (MTRP), and the Bycatch Program conducted by the NOAA Fisheries Research and Monitoring Division (FRMD) of the International Fisheries Program, ranging from species associated with substantial amounts of data to species where data and information are limited. It is recognized that there are a variety of other protected species science programs within NOAA Fisheries (e.g., marine mammal health), but the focus of this exercise was for reviewers to provide observation and recommendations on the direction and quality of data collection and assessment programs.

Presenters and reviewers were asked to emphasize the following five points in their preparation and evaluation respectively:

1. Do current and planned protected species scientific activities fulfill mandates and requirements under the ESA and MMPA, and meet the needs of the regulatory partners, PIRO and OPR?
2. Are the collaborations that are in place effective? What other opportunities should be pursued?

3. Are the protected species scientific objectives adequate to meet the long-term and short-term goals?
4. Are the protected species studies being conducted properly (survey design, statistical rigor, standardization, integrity, peer review, transparency, confidentiality, etc.)?
5. Are advances in protected species science and methodological approaches being incorporated into PIFSC research? Is PIFSC active in advancing protected species science? Are these advances communicated and applied in NMFS broadly?

## **General Observations**

PIFSC staff did an outstanding job organizing and conducting this program review. Noteworthy were the efforts of Siri Hakala, Biologist, and Frank Parrish, Director of the Protected Species Division at PIFSC. The Center has a good mix of established scientists complemented by diverse and talented young professionals.

In the first presentation of each day, the PIRO provided lengthy listing of data, information, analysis, and assessment support they have been requesting of each Protected Species Program as it related to PIRO responsibilities under ESA, MMPA, other requirements, and other management needs. While requests were characterized according to the regulatory need (e.g., "ESA Section 7"), a system of prioritization of the requests was not readily apparent.

The quality of presentations by all teams (HMSRP, CRP, MTRP, and FRMD) was well-organized and highly professional. Protected Species teams clearly addressed each of the five core review points. Moreover, presentations by PIFSC staff indicate that their work gives strong consideration to information needs expressed by PIRO staff for management. The responsiveness to Panel questions by all teams (henceforth, "Q&A") was open and thoughtful.

The PIFSC Protected species program's focus on monk seals, cetaceans and marine turtles is strongly on populations in the present. While this is understandable given ESA and MMPA mandates, it is important to recognize that population dynamics are driven by ecosystem-level interactions and that populations in the present are inevitably products of the past.

Types of data presented included:

- NOAA supported visual and acoustic surveys from ships, aircraft, and unmanned platforms
- Land based field studies at remote and local coastal sites
- Diet data, including scats, stomach contents, and biochemical data
- Genetic data
- Tracking data from various forms of tags and telemetry
- Data from emerging technologies (e.g., autonomous vehicles)
- Habitat use and habitat quantity and quality data
- Bycatch related logbook and observer data
- Stranding and entanglement information
- Data related to the reduction of anthropogenic takes and mortality (e.g., bycatch)

- Socioeconomic data as appropriate

Public Commentary periods were offered each day. Input primarily was received from the Marine Mammal Commission, the Western Pacific Fisheries Management Council (henceforth, “Council”), NOAA Office of Science & Technology, and representatives of nearshore fishermen. Although not coordinated, a common theme from the Council and fishermen’s representatives was the desire to work more closely with PIFSC to better understand management metrics and the opportunity to co-develop potential solutions to by-catch and other shared concerns.

### **Panel Member’s Major Recurrent Observations and Recommendations**

The Review addressed three very distinct classes of Protected Species – Hawaiian monk seal (1 species), Cetaceans (25+ species), and Marine Turtles (5 species), each associated with distinct science and management histories and current emphases. Reviewers provided general observations and recommendations, as well as observations and recommendations specific to species classes.

- One major recurrent observation that cross-cut all programs was variability and limitation in data management programs, data structures, resourcing, and connectivity to other internal and external data programs, despite each program’s stated dedication to data stewardship.

Here, major recurrent observations and recommendations stated by Reviewers are summarized by Research Program.

#### *Hawaiian Monk Seal Research Program*

- Observations. Reviewers stated an overall positive assessment of the monk seal research program. The small staff have developed reasonably clear visions for both information and conservation needs. Attention is directed to ESA and MMPA-related mandates. Challenges of working in main Hawaiian locations with substantial human presence and cultural complexity should not be underestimated. In recent years, focus has been directed toward the consequences of past or planned conservation actions (principally translocations of young animals from places where survival is low to places where the likelihood of survival is believed to be higher). The program’s main data strengths are long time series accrued over the decades.
- Challenges. Reviewers stated that while the patterns of distribution, abundance, and vital rates are reasonably well described, causal drivers for observed population patterns are less well known and do not appear to receive systematic study. Moreover, Reviewers stated that the current program emphasis on action targeted at individual animals in the Northwest Hawaiian Islands appears to occur at the cost of reduced attention to a major contemporary characteristic of the Hawaiian monk seal population – increase in numbers observed in the main Hawaiian islands.
- Recommendations .
  - Reviewers commented that the direction of the HMSRP program appears to be founded on two assumptions, (1) that the species is and always has been limited to the Hawaiian archipelago, and (2) that monk seal numbers today are much lower than they were in the past. These assumptions, essentially about carrying capacity of the Hawaiian archipelago and greater Pacific basin, require more critical evaluation. An expanded view of ecosystem dynamics should include

bottom-up and top-down forcing, indirect interactions, and non-linear functional relationships, all of which are emerging as important processes from studies of other species and ecosystems. Reviewers urge the monk seal research team to reach out to potential collaborators to explore the feasibility of work to address these assumptions, and management implications subsequently addressed.

- Time series have been used to generate a “silver BB” post-hoc analysis of individuals that had been rehabilitated and released. This analysis is used to validate investment and effort. However, the program failed to capitalize on the same time series to conduct a Monte Carlo-type analysis of the same potential population effects of a random sample of individuals. This would provide a baseline against which the relative investment in actions centered around manipulation of individual animals could be compared.

### *Cetacean Research Program*

- Observations. Reviewers expressed understanding that this is a relatively new research program at the PIFSC, with the CRP historically concentrated on expertise at the Southwest Fisheries Science Center. The current expertise of the staff related to stock assessment methodology and passive acoustic methodology, as applied to the information mandates under the MMPA and ESA, is excellent. Program funding has jumped dramatically in association with the listing of False Killer Whales, and secondarily in association with proposed Department of Defense actions. The small staff are energetic, dedicated, and have tremendous potential to develop a true CRP at PIFSC. Reviewers expressed the impression that PIRO could do a better job of assuming responsibility for policy issues related to interactions of Center scientists with the PIFMC. The Center staff seems fully capable of dealing with scientific issues in interactions with the Council but should not have to defend policy.
- Challenges. Reviewers observed that the enormity of the Pacific Island Region, and the species diversity of the cetacean community in this Region, present challenges in terms of providing information needed to manage populations of cetaceans under the MMPA and ESA.
- Recommendations.
  - The program is using or developing state-of-the-art advanced passive acoustics technology to address information needs related to distribution and abundance. This is a very cost effective approach and should be encouraged.
  - PIFSC and PIRO should work together to address the Council’s concerns related estimation of Potential Biological Removal (PBR) level for pelagic false killer whales, including explication of uncertainty in computing estimates.

### *Marine Turtle Research Program*

- Observations. Reviewers observed the MTRP is a long standing program with very professional and dedicated staff. Attention is directed to ESA -related mandates. This team has established a strong record of collaborations to further the long standing turtle research program monitoring and assessing 5 marine turtle species in the region. Reviewers commented on the use of modern and innovative technology and funding partners to accomplish required tasks for Regional assessment of critical habitat, the biology and ecosystem ecology of these turtles in these under investigated Islands of the region.
- Challenges.
  - There are very little discretionary funds for the turtle team to conduct the research required for Biological Opinions, critical habitat assessment and to study the impacts of global climate change and other ecological factors. Without

outside collaborations and contracts, the many recent accomplishments of this team over the past 3 years would be minimal, and could all but disappear without these external funds needed to accomplish this work.

- Fishery interactions are one of the significant threats to the recovery of populations. Information on estimated “takes” is mostly provided for by an on-going observer program separate from the MTRP. It was not possible to ascertain during the review as to whether this arrangement is optimal.
- Recommendations.
  - The MTRP needs to shift focus from being a service program to becoming a center of excellence for marine turtle research in the Pacific. The Turtle budget line has been successful in studying green turtles, but the program as presented is much more than Hawaiian green turtles. Re-branding is needed to show the new breadth with research across 5 species of marine turtles in the Pacific.
  - With regards to green turtle, while there is a long standing study, this team also has been the home for the very expensive but necessary stranding network. This is of diminishing scientific significance and much of these costs and activity should be absorbed and covered by the PIRO.

### *Bycatch Program*

- Observations. Efforts to quantify the degree to which commercial fisheries in the PIR are interacting with marine turtles, monk seals, and cetaceans is daunting, considering the number of fisheries, the logistics and cost of putting observers on commercial vessels, the region over which these fisheries are prosecuting, and the seasonality and spatial variability in the rate and nature of these interactions. Program staff currently make it a priority to establish long-term relationships with international partners relative to mitigating the impacts of bycatch of sea turtles associated with artisanal fisheries. Such efforts, while demanding considerable logistical effort and long-term planning, are important because they provide a basis for trust, as well as cost-effective partnering. These extensive collaborations were in sharp contrast to what appears to be a general lack of communication/coordination on analysis of bycatch data among Center scientists working in different groups.
- Challenges.
  - At present, it appears that most of the cost of training observers, placing observers on commercial vessels, debriefing observers, and data management is the responsibility of the NMFS/PIRO, and not the industry. Federal funding to support adequate coverage (i.e., coverage levels that are needed to provide reliable estimates of bycatch of protected species by fishery by year) for all commercial fisheries in the PIR is not available, although coverage rates for at least two commercial fisheries in the US EEZ around HI are adequate. Efforts to focus observer coverage on species of greatest concern in the US EEZ around HI seems reasonable, but is not entirely satisfactory.
  - With regard to turtle bycatch, while deterrents showed significant positive effects, bycatch was not eliminated. Reduced bycatch rates can't help but benefit affected turtle populations. However, the nature of these benefits are yet to be demonstrated.
- Recommendations.
  - Working with PIRO and PSD leadership, the MTRP should evaluate the scientific merits related to protected species management and fisheries management provided by existing fishery observer programs.

- Program staff currently are making considerable progress in mitigating bycatch rates by the integration of visual and auditory cues into fishing gear without adversely affecting catch rates of target species. Efforts are underway to optimize this approach through the use of multiple sensor modes. These efforts should be continued.
- It is very difficult to evaluate the impact of anthropogenic removals to a population without adequate information on population size. Additional effort is needed to use all available information to attempt to improve on abundance estimates on a population specific basis to better evaluate the impact on recovery of bycatch in fisheries managed by the PIRO.

## **Conclusions and Recommendations**

The Protected Species programs at PIFSC clearly are under-resourced, given lengthy list of data and analytical needs, and assessment support provided by the PIRO office. Some challenges in addressing these requests originate in the vast size of the regional service area, physically difficult field conditions, species with complex life histories, expansive movement patterns, and diverse or unknown habitat requirements, and highly international environment under which conservation and management must occur. The Panel appreciated the effort of PIFSC leadership to develop the document – Annual Planning Guidance Memo 2015 – as this lays out the priorities for the PIFSC for FY15.

Some general themes emerging across the Review suggest the following conclusions:

- Each research team is doing a great job communicating with their external partners. That said, there seems to be ample opportunity for cross-program and cross-divisional information exchange and potentially co-development of science objectives and work plans.
- For historical reasons, the partitioning of responsibilities between PIRO and PIFSC developed differently here than in other regions. In addition, the legacy programs for monk seals and green sea turtles, which have produced extremely valuable long-term datasets and a wealth of management-relevant information, are at a stage that is ripe for reassessment and, perhaps a course correction. Therefore, this is an opportune time to take a fresh look at big-picture issues and rethink priorities to ensure that the allocation of limited resources produces maximal benefits.
- Protected Species science teams will need additional financial and logistic support (e.g., ship support) to accomplish their mandates. The ship demands for research are greater for this region than for any other region in the U.S. by far. Critical information needs of managers will not be met without allocation of additional days at sea to this Program.
- Some species or population [segments] occur in the multiagency overlay Papahānaumokuākea Marine National Monument, working within which presents substantial administrative and logistical challenges.
- Program leadership should work with science teams to identify some portion of the annual work plan to develop analyses and advanced technologies that will allow them to understand population structure and movement not only in coastal waters but also across the full span of open ocean.

- Protected species leadership and science teams should work together to secure additional resources to address questions related to species ecology and habitat carrying capacity that could in the long run be very influential in addressing concerns related to recovery, conservation, and management.
- NOAA's Cooperative Institute for the Pacific Islands Region, the JIMAR (Joint Institute for Marine and Atmospheric Research) at the University of Hawai'i, appears to be central to successful implementation in all three programs (HMSRP, CRP, MTRP). Every effort should be made to see that it continues to be available into the foreseeable future.
- Focus on within-EEZ data collection and assessment ignores the biology of many pelagic species that may use these waters during only part of their life history. This may cause an artificial cap on the ability to understand observations of population dynamics and therefore limit the ability to provide science to inform conservation and management. A more holistic ecological perspective that integrates the species of study in both nearshore and pelagic systems (where appropriate), coupled with additional resources to implement this perspective, is needed. At a minimum, some generic evaluations should be conducted of how seriously wrong conclusions about population status might be when they are based on data for only a small (and likely unrepresentative) fraction of the population's range. A good near-term metric of progress on this might be to have substantial attention to this in the upcoming Ecosystems Program Review.

In summary, the Protected Species science programs are producing high volumes of data directly related to their mandates. Assessments and other management support products are targeted but often science teams are being asked to provide these products with sparse data. Science teams are talented and dedicated but are highly under-resourced. The leadership of PIFSC, PIRO, OPR and OST are encouraged to utilize this review to break themselves free from the history of their funding lines and project structures to work together to create a new vision of science and management of Protected Resources that capitalizes on the strengths of PIFSC and PIRO, properly aligns science and management functionality, and builds a plan for securing resources needed to address not only immediate mandated needs (e.g., re ESA and MMPA) but to provide the freeboard for each science program that will allow them to build the science base to address challenges imposed by the regional geographic context and anticipated protected species issues.

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## 2015 Program Review of NOAA PIFSC Protected Species Science

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### Introduction

The Protected Species Division of NOAA's Pacific Islands Fisheries Research Center was reviewed during the week of 27-31 July, 2015 in Honolulu, Hawaii. Members of the review panel were asked to evaluate strengths and challenges of the monk seal, cetacean, marine turtle, and bycatch programs, and to provide recommendations for future direction. My report follows.

### Monk Seal

Monk seals are the most numerically impoverished of all pinnipeds, among which they are the only truly tropical species. Three species (Mediterranean, Caribbean, and Hawaiian monk seals) survived into modern times. The Caribbean monk seal is extinct and the remaining two extant species are thought to be highly vulnerable to extinction. The Hawaiian monk seal is ESA listed as Endangered, largely because of its small size and generally declining trends of abundance in the Northwest Hawaiian Islands. Historically, monk seals probably occurred throughout the Hawaiian archipelago but were likely extirpated from the Main (southeastern) Hawaiian Islands soon after contact by early humans. The southeastern Hawaiian Islands were recently recolonized and the overall population in this region is increasing. Broad goals of NOAA's monk seal program, as I understand them, are to 1) monitor distribution and abundance, 2) understand drivers of population change, 3) enhance population recovery, and 4) minimize risk of catastrophic decline from exposure to novel diseases.

### Programmatic Strengths

My overall assessment of the monk seal research program is highly positive. The small staff is dedicated, talented, creative, and hard working. These people have developed reasonably clear visions for both information and conservation needs. The in-house research program is strongly focused on population biology, which is served by current field activities and a long time series of data on monk seal distribution, abundance, population structure, and vital rates (age and sex specific fertility and mortality). Although Hawaiian monk seals occur in remote habitats that are difficult and expensive to access, the species' relatively sedentary nature and high visibility when hauled out on sandy beaches make them easier to study than many other marine mammal and large carnivore species. The program's main strengths are the long time series of data that have accrued over the decades and the highly creative and insightful analyses of these data that have been conducted in recent years, much of which has been directed toward the consequences of past or planned conservation actions (principally translocations of young animals from places where survival is low to places where the likelihood of survival is higher). Work being done on monk seal population biology is as good or better than that being done on any other marine mammal species.

The monk seal research program has also benefitted from various collaborations, including those with oceanographers, physiologists, veterinarians, and engineers.

### Challenges

The monk seal research and conservation program faces two fundamental challenges. One of these is logistic. Monk seals are difficult to access and thus field work on the species throughout most of its range depends on ship support. Although the quality of the demographic database is remarkably good, it could be improved with more time in the field. Continued ship support is essential to the program's future.

A second challenge is understanding causal processes. While the patterns of distribution, abundance, and vital rates are reasonably well described for Hawaiian monk seals, causal drivers are less well known. Ultimately, these drivers emerge from interactions with the ecosystem in which monk seals live. As it is for most large, wide-ranging animals, understanding the dynamics of these ecosystem linkages and interactions requires creative research approaches.

### Recommendations

The Hawaiian monk seal program appears to be founded on two implicit assumptions—that the species is and always has been limited to the Hawaiian archipelago, and that monk seal numbers today are much lower than they were in the past. These assumptions, while perhaps true, require more critical evaluation. The fact that early monk seals were able to disperse from a Tethyan (Mediterranean) center or origin, across the Atlantic Ocean to the Caribbean, and then through the Panamic Portal across the Pacific to the Hawaiian archipelago (the world's most remote and isolated oceanic islands) makes me suspect that the species once occurred more broadly across the tropical Pacific. This hypothesis might be tested by examining faunal remains (morphologically and genetically) from midden sites on the larger islands and archipelagos in other Pacific island groups. I would urge the monk seal research team to reach out to potential collaborators to explore the feasibility of such work, which could probably be done with relatively small investments of time and money. Potential ramifications for monk seal conservation and management are profound.

The second assumption--that monk seals were once more abundance across the Hawaiian archipelago than they are today--is also worth questioning. The fact that monk seals presently are in general decline across the northwest islands, an area protected from human impacts, makes me wonder if monk seals might not always have been rare in this region. This hypothesis could probably be tested with modern genetic approaches (coalescence modelling). Here again, the monk seal research team might reach out to potential collaborators to explore the feasibility of such work, which could probably be done with relatively small investments of time and money. Potential ramifications for monk seal conservation and management are profound.

The current view of monk seal ecology seems to emphasize i) competition with other large piscivores; ii) predation from large sharks; iii) disease; and iv) large-scale oceanographic events that somehow influence monk seals through bottom-up forcing. While these processes are all potentially important and worthy of attention, an expanded view of ecosystem dynamics should

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include top-down forcing, indirect interactions, and non-linear functional relationships, all of which are emerging as important processes from studies of other species and ecosystems.

Perhaps the greatest challenge to understanding ecosystem dynamics and their resulting links as demographic drivers in monk seal population dynamics is to put the hypotheses, whatever they might be, to rigorous tests. In my view this can only be done by perturbing the purported drivers, which of course would be both logistically difficult and probably illegal in the case of monk seals. The comparative method offers a reasonable alternative, especially in the case of monk seals which vary demographically in space and time. A careful search of this variation for environmental correlates will almost surely be fruitful.

A final suggestion for future program development and direction has to do with personnel needs. My understanding is that the next hire will be a wildlife veterinarian. A careful analysis is needed of both future risks to monk seals and personnel needs to best serve risk reduction and recovery. This may well confirm the need for a wildlife veterinarian. But I'm unconvinced that disease is the greatest threat to monk seals and that rehabilitation of sick or otherwise debilitated individuals for either captive breeding or return to the wild is the most promising path to recovery.

### Cetaceans

Cetaceans are taxonomically diverse, widely distributed, and for the most part poorly understood throughout the world oceans. There are 25 known species and at least 121 identified stocks in the tropical Pacific Ocean. These animals are exceedingly difficult to study. Most species are widely distributed and in many cases individuals have large home ranges. Visual detection is strongly dependent on sea state, which is often poor due to persistently windy tropical oceans. Because of their broad distribution, low population densities, and a common tendency to aggregate spatially, assessments of population abundance and trends is problematic. Cetaceans are subject to the influences of various anthropogenic stressors, including competition with fisheries, bycatch, and noise. Like most other large mammal species, cetaceans both influence and are influenced by their environments.

### Programmatic Strengths

The principle strength of NOAA's cetacean research program in the Pacific Islands is staff quality, all of whom are young, bright, well-trained, and dedicated. The program's main thrust is population assessment, which in turn involves gathering data on distribution and abundance. Research to date has made significant inroads into understanding spatial distribution and stock structure.

A hopeful and exciting dimension to the current program is use of state-of-the-art acoustical methods in cetacean population assessment. Visual survey data, while useful in obtaining information in individual identity, social grouping, and group size, offer little hope for documenting abundance and trends of most cetaceans. Acoustic signals from these highly vocal

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animals provide a hopeful alternative and the program is moving forward toward that general goal. There has been progress in the use of sound to better understand cetacean ecology in the Hawaiian and Marianas islands. Acoustic methods also offer the potential for improved understanding of other features of cetacean ecology at greatly reduced costs.

The program has benefitted from outside collaborations, especially those with Cascadia research. These collaborative efforts are leading to more rigorous assessments stock and social structure.

### Challenges

Few groups of organisms are more difficult and costly to study than cetaceans. This problem is exacerbated in the Pacific islands by modest program funding and the geographical vastness of the region. Ship time, which is essential for work on cetaceans, is expensive and of limited availability. Ship time is further constrained by transit times needed to traverse the typically great distances among island groups in the central and western tropical Pacific Ocean.

Data from visual surveys are of limited utility for estimating cetacean abundance and trends. New methods are needed to obtain this information. While the program staff have the talent and motivation to accomplish this challenging goal, increased funding and possibly increased staffing probably will be needed to achieve this goal.

Large amounts of data are being generated by the cetacean program, especially from acoustic and genetic measurements. Although the staff has done remarkably well at managing these data, they are not trained in data management and the effort diminishes time they can spend on other important endeavors. This problem will grow with inevitable further increases in the volume and complexity of data.

Management responsibilities focus on areas with the US EEZ but the distribution of most cetacean species and the movements of many individuals transcend EEZ borders. Therefore, research and management actions limited to waters within the EEZ will almost surely be inadequate to properly understand cetacean biology and to mitigate potential threats to these species and stocks.

Bycatch of false killer whales in the longline fishery was the principle factor motivating NOAA to increase cetacean research efforts in the Pacific Islands. Properly documenting the impacts of bycatch is one particular challenge. The time and attention required of the research staff to deal with technical and political aspects of the issue is another.

### Recommendations

The cetacean research program's goals focus on population assessment. Given the current budget, staff, and practical constraints of working on cetaceans, I believe the program should stay that course. Progress is being made and there is potential for further learning. However, the staff should be encouraged to think more broadly about what might be both feasible and useful in future efforts to understand cetacean ecology. Two areas stand out as being especially important. One is a broader view of the interplay between cetaceans and their ocean environment. Important

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processes are surely occurring along two paths—from the ocean environment to cetaceans, and from cetaceans to the environment.

A second area of potentially productive endeavor is the narrower focus on individuality. Population biologists tend to homogenize individuals into species, stocks, and sometimes sex and age classes. But the importance of individuality is becoming apparent virtually everywhere people have been able to look for it. As information accumulates on the behavior and natural history of known individuals, more attention to the understanding of individuality will probably become possible.

Assessment of bycatch and its population-level influences on false killer whales (and possibly other species of cetaceans) will need to be resolved with as much objectivity and analytical rigor as possible. Two areas of further research might improve this effort. One of these is documenting the fate of individuals that are hooked in the longline fishery and released alive. If these individuals were tagged or instrumented prior to release, their eventual fate might be determined with greater confidence and objectivity. Second, the impacts of bycatch on populations are poorly known and may never be assessable through population monitoring. I would suggest exploring the utility of a PCod-type modeling approach, which has been developed independently by the cetacean research community to better understand impacts of anthropogenic sound on cetaceans. The PCod model structure seems amenable to substituting bycatch for sound effects.

### Marine Turtles

Sea turtles occur throughout the world's tropical oceans, typically nesting on sandy beaches and foraging at sea. Five species—Green, Olive Ridley, Hawksbill, Loggerhead, and Leatherback turtles—occur in the central/western tropical Pacific Ocean. All species are ESA listed as Threatened or Endangered across this region. Sea turtles are long-lived with extended periods of sexual immaturity. The abundance and distribution of most species have been reduced by various human activities, including exploitation of eggs on beaches, exploitation of post-hatching life stages on shore and at sea, and incidental take in fisheries. NOAA's sea turtle research program in the Pacific Islands is focused primarily on documenting the distribution, abundance, and trends of sea turtle populations within the US EEZ, understanding causes of mortality, and designing strategies to mitigate losses and recover populations.

### Programmatic Strengths

The Pacific Islands sea turtle research program benefits from thoughtful leadership as well as key collaborations with personnel from NOAA's Southwest Fisheries Science Center. Because of the relative ease with which turtle populations can be monitored through nesting beach surveys and the long time series of available data from earlier studies, indices of abundance and population trends are relatively well known. Satellite tagging of nesting females on beaches and animals captured at sea is providing an important growing database on patterns of movement at sea. The program is doing a good job with the analysis, interpretation, and publication of these data.

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Finally, the research program has served NOAA's management division in numerous important ways. Overall, the sea turtle research program has made important contributions to both applied and basic science, and is well positioned to continue to do so (contingent mostly on future financial and field logistic support).

### Challenges

Although the distribution, abundance, and trends of various marine turtle species and stocks are reasonably well known over recent decades, knowledge of distribution and abundance in the deeper past is generally lacking. While the objectives of conservation and management are seldom to return species and ecosystems to their pre-human states, such longer-term perspectives are nonetheless important in understanding the present status of species and establishing recovery goals.

Understanding marine turtle biology is complicated by their complex life histories and characteristically long-range movements. Different life stages (e.g., eggs, hatchling, juvenile, subadult, and adult) are usually subject to different risks and environmental stressors and the extensive movements of these animals at sea means that management actions with US EEZ waters may not be adequate to sustain or recover populations. The long life spans of sea turtles, and especially their prolonged periods of pre-reproduction, mean that time scales of recovery following what may be effective management actions will unavoidably be quite long. Similarly, sustained or increasing numbers of nesting females are not necessarily indicative of longer term sustainability or growth of populations.

A seldom-asked question for studies of widely ranging species is whether information gathered at a particular study site or sites is representative of the species throughout their range? Field research efforts on sea turtles are limited to a few locations, thus raising the question of whether or not data obtained from these sites are representative of populations across the tropical Pacific. I see no obvious reason to believe they are not, but then I also think it will be difficult to answer the question.

Stranding programs for sea turtles and other marine vertebrates are usually conducted with the intent of obtaining information on age, sex, and cause of death. A difficulty in all cases is the unknown degree to which the death assemblage on shore is representative of mortality at sea.

The sea turtle program's future does not appear to be as dependent on ship time as are the monk seal and cetacean research programs. However, financial support for the program is still a concern. At current funding and staffing levels, virtually all NOAA base monies go to salaries. Field research thus depends on reimbursable funds. While the staff may continue to succeed in obtaining reimbursable support, such funds may also dictate the nature of future research, which in turn could compromise the program's ability to provide basic and fundamentally important information on the distribution, abundance, trends, and general ecology of sea turtles.

### Recommendations

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While the sea turtle program appears to be doing a reasonable job with the management of their data, I would urge you to consider whether this will continue to be the case with the inevitable growth in diversity and volume of information. I would also urge the program to carefully consider the advantages and disadvantages of electronic field data recording, thereby eliminating the possibility of transcriptional errors as well as the time required for data entry.

A significant threat to leatherback turtles in particular is bycatch in the shallow-set longline fishery. Data on the absolute numbers of bycaught turtles declined sharply with closure of this fishery in 2000, and has since remained relatively low (even after the fishery was reopened in 2004), thus suggesting that detrimental impacts of bycatch on leatherback populations has been greatly reduced. I am not convinced that this is the case, and would urge that the data be reanalyzed to scale bycatch loss to per capita, based on the best estimates of leatherback adult abundance over this time period.

Pinnipeds and cetaceans are characterized by typical Type I survivorship schedules whereas sea turtles are characterized by Type III survivorship schedules. Because of this, age-specific reproductive values of sea turtles change profoundly from life stage to life stage, in turn strongly influencing the potential influence of anthropogenic influences and any efforts to mitigate these influences by management on different turtle life stages. Although this general issues has been addressed for marine turtle management elsewhere, management in the tropical Pacific would benefit from the inclusion of elasticity analyses.

Prior research has shown or suggested significant ecological influences of sea turtles on their prey resources (e.g., green turtles on seagrass and leatherback turtles on jellyfish). These direct interactions almost surely have broader indirect effects on other species and ecological processes. While I am not suggesting an expansion of the sea turtle research program into this conceptual arena (because of the costs any such effort would necessarily mean for to the current research objectives), I urge staff to remain cognizant of this dimension to sea turtle ecology and to look for ways in which they might address the issue in the future.

### Bycatch

Bycatch appears to be the principle cause of population declines, risks of extinction, and recovery failure for most cetacean and marine turtle species and populations of concern in the tropical Pacific Ocean. The efforts and results we learned about pertained exclusively to turtle bycatch. While findings from several experimental approaches to the reduction of bycatch in pound nets and longline fisheries were encouraging, I would urge further work in three areas.

1. Accommodation. Are the significant reductions in turtle bycatch from light sticks maintained over the longer term of exposure, or do animals accommodate to this novel stimulus and thus become increasingly likely to be bycaught in longline fisheries through time?
2. Demographic impacts. While the tested deterrents to turtle bycatch showed significant positive effects, bycatch was not eliminated. Reduced bycatch rates can't help but benefit

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affected turtle populations. However, the nature of these benefits are unclear. They might simply delay time to extinction; they might allow a depleted or declining population to stabilize at some higher abundance that would otherwise have been the case; or they might reduce mortality rates sufficiently to affect population growth and recovery. Further analyses of these various possibilities would be extremely useful for conservation and management.

3. Attraction. Is it possible that some species or individuals of either turtles or other non-target species are attracted to the novel stimuli and thus bycaught at increased rates?

These are not criticisms but rather a series of suggestions for what would seem to be useful follow-ups of the highly encouraging preliminary findings of the bycatch research program.

### General Conclusions and Recommendations

The western tropical Pacific Ocean is vast, remote, and for the most part accessible only by ship. With NOAA's aging fleet, the prohibitive expenses of building new vessels, and rapidly growing charter costs, I believe the program's greatest challenge will be access to areas over which species and processes of interest occur. Visioning and planning for ways of dealing with this challenge should be a high priority.

The program's greatest strength is its human resources. Each project is led and staffed by well-trained, talented, and dedicated scientists. These individuals all have done outstanding jobs of designing and conducting research on the distribution, abundance, and status of species and stocks within at least portions of their range in the tropical central and western Pacific Ocean, assessing threats to these various species and stocks, and in some cases helping to mitigate those threats.

The program's vision and emphasis for all species and areas is largely on the present and recent past. While mandates of the ESA and MMPA warrant such approaches, much of value might be obtained by looking to the deeper past. The distribution and abundance of marine turtles have clearly declined, but the extents of those declines over the centuries and millennia are unclear. If recent analyses and conclusions from studies of green turtles in the Caribbean are applicable to the tropical Pacific, marine turtles may have numbered in the millions or even tens of millions of individuals before the region's earliest human occupation. Such knowledge, which should be attainable from the same general methods used by Loren McClenachan and colleagues (*Frontiers in Ecology and the Environment*, 2006), would be useful in figuring the potential for marine turtle recovery and for better understanding their ecological roles in tropical Pacific marine ecosystems. Similar sorts of questions might be asked of monk seals. Have Hawaiian monk seals always occurred exclusively in the Hawaiian archipelago or did the species once range more widely across the tropical Pacific? Were monk seals in the Hawaiian archipelago once much more common than they are today, or has the species always occurred at relatively low densities? Both questions are potentially answerable through paleontological and genetic analyses. Answers would be immensely useful to future conservation and management decisions.

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While the current programmatic focus on population biology is easily justified based on ESA and MMPA mandates, understanding population patterns and trends requires an understanding of the ways these focal species are linked to their environment. Such linkages typically are envisioned to occur through bottom-up forcing processes that begin with the physical environment.

Although understanding bottom up linkages important, it is not sufficient, a claim supported by studies of numerous other large vertebrates known to interact with their environment in more complex ways (e.g., see Terborgh and Estes, *Trophic Cascades: Predators, Prey and the Changing Dynamics of Nature*, Island Press, 2010). If work on monk seals, cetaceans, and marine turtles ever expands to include a food web or ecosystem perspective, which eventually it surely must, I hope you will assume a broader view of process than simple bottom up forcing.

It would be most convenient if all animals were sedentary. But they of course are not, and the more they move, the more difficult they are to understand and to manage. Unfortunately, scales of pattern and process in the ocean realm are often vast. Cetaceans and turtles, in particular, move great distances from breeding to foraging grounds, or simply in response to changes in their environment. These species must be studied and managed at comparable scales.

## 2015 Program Review of NOAA PIFSC Protected Species Science

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#### General and cross-cutting issues

PIFSC staff did an outstanding job organizing this program review. Siri was calm, efficient, and unflappable. The presentations were well coordinated and professional. Organization of the sessions was logical and facilitated meaningful dialogue. The staff was knowledgeable, poised, and responsive to questions. It was encouraging to see that the Center has a good mix of established, veteran scientists supplemented by a diverse cadre of bright Young Turks.

Several common themes emerged from the review:

- The geographic area for which the Center is charged with providing scientific information is enormous and presents numerous logistic challenges to anyone trying to conduct field research. Furthermore, many species are pelagic and wide-ranging, which presents additional challenges for identification and assessment of the status of biologically meaningful conservation units.
- Center staff have been very resourceful in finding ways to compensate for the fact that they have insufficient funds to meet all of their mandates, let alone conduct independent research that is more discretionary. However, the Center soon might have to make hard decisions about triage. For example, is it better to focus resources in a few key areas to ensure that data produced and resulting scientific advice is as robust as possible? Or is it better to spread efforts more broadly to ensure that at least some management-relevant information is available for a wide range of species? In either case, it might mean that accepting new assignments will require termination of some activities that are currently considered high priority. It would be prudent for the Center to plan in advance for that eventuality. The Center has some legacy programs (monk seals; green sea turtles) that have produced enormously valuable, long-term datasets. However, it is not likely that all of these efforts can be continued indefinitely at the same scale. The Center should conduct a cost-benefit analysis to quantify the amount of management-relevant information that could be generated under various future scenarios that involve scaling back of effort. Results of such analyses would provide essential information for any decisions regarding triage.
- The Center is wholly or partially responsible for producing scientific information to inform management of dozens of protected species, and perhaps > 100 total populations or stocks. But the allocation of funds is severely skewed to a couple of species/populations. There are two major reasons for this: 1) historical precedent, and 2) Congressional mandates. It appears that the latter constraint will be eased at least somewhat in the near future (perhaps as early as FY16) as the number of line item/earmarks specified in the NMFS budget is sharply reduced. If so, this will provide an unprecedented opportunity for the Center to take a step back and consider what would

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be an optimal way to allocate available funds to address key elements in the strategic plans identified by the Center and NMFS. The Center and RO could then work together to take steps to try to steer implementation of effort toward that desired outcome. As noted above, cost-benefit and ‘bang-for-the-buck’ analyses should play an important role in this exercise.

- PIRO staff outlined the types of scientific information they need for informed management, and Center staff are clearly very responsive to these needs. However, achieving an appropriate balance between being responsive to management needs and conducting cutting-edge research that maintains and advances the credibility of the science products produced by the Center is a complex exercise that requires careful consideration and periodic adjustment. At one extreme, Center scientists primarily conduct ivory-tower research that has little practical application; at the other extreme, Center scientists’ careers stagnate as their time and energy are consumed by producing technical information to meet PIRO needs but have little time to publish peer-reviewed papers. The former scenario does not address agency mandates; the latter scenario is not sustainable because a) Center scientists would be unable to stay at the top of their fields and would gradually lose credibility as top scientists, and b) the Center would no longer be able to attract top young scientists to fill dead-end positions dedicated to science support. Fortunately, there is no shortage of very challenging scientific problems that have direct management relevance. Top leaders in the Center and PIRO should work to develop a win-win framework whereby Center scientists can continue to produce cutting-edge research while providing sufficient science support to PIRO. This is a complex topic that is difficult to assess from a brief review such as this, but my impression is that the balance might be skewed too far in terms of producing science support for PIRO. Recent changes in leadership within both the Center and PIRO suggest that this would be an opportune time to seriously engage in discussion of these issues.
- In some cases the Center has taken a rather narrow view of what it considers its “core” responsibilities with respect to protected species science. Although collecting data and conducting analyses required to evaluate “take” under the ESA and PBR under the MMPA is an important role, the narrow focus by the Center on these issues comes at the expense of attention to a much wider range of issues that directly relate to long-term viability of protected species. More details on this theme are provided in the separate sections below.
- Climate change and ecosystem-level analyses are two important topics that were discussed very little. These are difficult topics to consider when funds are limited, and I realize that next year’s reviews will focus on ecosystem issues. However, these topics affect all species, and assessments of risk/viability are not complete without considering their effects. It is not enough to assign certain staff to deal with ‘climate change’ and ‘ecosystems’ and forget about these topics in other activities; it is important to integrate

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these factors into all aspects of the work the Center does. We didn't hear much about how that is being done or might be done in the future.

- Center staff have been energetic and creative in securing external funding to supplement resources provided by NMFS. However, the expanded capacity for accomplishing specific objectives comes at the cost of flexibility and efficiency. The collaborations might be fragile and might fall apart with turnover of key personnel or changing priorities of collaborators. Often it will be difficult or impossible to implement ideal experimental designs with such collaborations.
- It seems that the PR division would benefit from better coordination among the different programs, and with the FRMD division. Perhaps some resources could be pooled to address common problems of data management.
- The JIMAR program appears to be a gem, so every effort should be made to see that it continues to be available into the foreseeable future.

### **Monk seals**

This is an iconic species and the Center has led a decades-long effort to monitor key demographic traits to inform conservation and management. The long-term datasets that provide estimates of vital rates at several different sites are extremely valuable.

- I was a bit surprised at the apparent lack of interest in understanding historical (hundreds/thousands of years) patterns of distribution and abundance. Although there is no requirement under the ESA to restore a listed species to historical levels, understanding the conditions under which the species evolved and was viable in the past provides important context for assessing current viability. Allocating even a modest amount of effort to this topic could pay relatively large dividends.
- Although the molecular genetic data (which presumably reflect neutral genetic variation) did not detect any evidence of population genetic differentiation, the different sites have different age-specific patterns of fecundity and reproductive value. These differences could be entirely environmentally driven, but it would be prudent to at least consider the possibility that they have a heritable component, in which case local adaptation might be important. If so, this could have important ramifications for translocation efforts.
- Similarly, it would be prudent to consider the possibility that the steady population decline (and consistently high juvenile mortality) at FFS reflects a population that has exceeded its carrying capacity, at least under current environmental conditions. This idea should be considered in the context of the historical evaluations mentioned above.
- Scientists in this program have long engaged in emergency-room type interventions with this species in an attempt to stem the long-term decline. Although comparison with true controls is not possible, it seems that these actions have had some positive effect on the population. At the same time, program scientists have collected valuable demographic information. However, these efforts are so focused on a single population of a single species that it is difficult to see the extent to which work done here has influenced

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protected species science within NMFS and more broadly within the scientific community (Question 5 in the Terms of Reference).

- For a small population that has been steadily declining for several decades, it is understandable that efforts have focused on short-term interventions to reduce mortalities. However, it is also important to evaluate these actions in the broader context of long-term recovery goals—in particular, to make sure that short-term actions do not preclude future options. Based on information we were given, it seems that the current recovery goals are generally not considered to be very realistic or meaningful. If that is the case, perhaps the Center should initiate an effort to develop more meaningful viability targets.
- The different vital rates at different sites suggest that seals at these different sites are demographically independent populations/subpopulations. Some thought should be given to how to integrate these data into an overall risk assessment. More broadly, program staff should attempt an overall assessment of the status of this species that incorporates information from both NWHI and main island population components. Methods exist for combining disparate types of data into overall risk assessments; for an example, see Drake et al. (2010)<sup>1</sup>

### Cetaceans

This is a young program that likely would not exist except for the recent listing of false killer whales. The young staff are bright and energetic but have the daunting task of attempting to assess the status of dozens of stocks/species over a large portion of the most remote spots in the Pacific Ocean. Here are a few suggestions:

- For practical reasons, surveys focus on EEZ areas around a few islands or island groups. However, many (perhaps most) of the target species are broadly distributed across the north and/or south Pacific, where they might be more or less panmictic. Although global status assessments of these species are probably not feasible without major new investments of resources, with existing resources it should be possible to do some useful evaluations. These evaluations could address the following general question: If a broadly distributed species is managed differently in different geographic areas based on information from local samples, what types of problems could result? This general scenario could be modeled, perhaps using management strategy evaluations. Empirical data for some of the target species or reasonable proxies could be used to help parameterize this exercise.

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<sup>1</sup> Drake, J., E.A. Berntson, J.M. Cope, R.G. Gustafson, E.E. Holmes, P.S. Levin, N. Tolimieri, R.S. Waples, S. Sogard, G.D. Williams. 2010. Status review of five rockfish species in Puget Sound, Washington: Bocaccio (*Sebastes paucispinis*), canary rockfish (*S. pinniger*), yelloweye rockfish (*S. ruberrimus*), greenstriped rockfish (*S. elongatus*), and redstripe rockfish (*S. proriger*). U.S. Dept. of Commerce, NOAA Tech. Memo., NMFS-NWFSC-108 (available at: [http://www.nwfsc.noaa.gov/assets/25/1130\\_03072011\\_122127\\_RockfishSRTM108WebFinal.pdf](http://www.nwfsc.noaa.gov/assets/25/1130_03072011_122127_RockfishSRTM108WebFinal.pdf))

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- A somewhat similar problem is that almost all of the effort to monitor cetaceans around the main Hawaiian islands occurs on the leeward sides, but telemetry data show most occurrence is on windward sides of the islands. It is much easier to say that effort should be shifted to the windward areas than to actually accomplish this, given the difficulties presented by rough seas and high winds. However, it should be possible, in some cases at least, to do an evaluation of just how misleading relying only on the leeward data might be in assessing the distribution and abundance of cetaceans. One or a few targeted, comparative studies might provide information that would allow generalizations regarding unstudied systems.
- It seems inevitable that program staff will have to rely more heavily on technological advances, such as passive acoustics and ship-based drones. It will be challenging to find optimal ways to integrate these new types of data into overall assessments that also include more traditional types of data.
- Data on group size and social affiliations are interesting but at present not well integrated into overall assessments. How best to do this deserves some thought.
- It is difficult to evaluate this issue as an outsider, but it is my impression that PIRO could do a better job of assuming responsibility for policy issues related to interactions of Center scientists with the PIFMC. The Center staff seem fully capable of dealing with scientific issues in interactions with the Council but should not have to defend policy.
- If proposed changes to the way PRPs are organized become reality, the Center might have the opportunity to re-allocate resources that previously were narrowly earmarked. Before that happens, it would be prudent for program staff to develop a strategic plan for how any additional resources should best be used.

### **Marine turtles**

The long-term program for green turtles has generated huge amounts of valuable data. With many recent changes, now is an opportune time to take a step back and map out a strategy for the future. Factors that should be part of the re-evaluation include:

- It is important to carefully review all aspects of experimental design to ensure that limited resources are allocated for maximal effectiveness. For example, is it necessary to take biological samples from 100% of stranded animals? By taking subsamples from the existing long-term datasets, staff could estimate how much management-relevant information would be lost if sampling coverage were reduced by 10%/50%/90%.
- The green turtle program developed before there was a regional office presence, so the Center assumes some responsibilities that more logically would be carried out by PIRO. Whether and if so how to transfer those responsibilities to PIRO should be a topic of discussion.
- Increasing trends in the population are very encouraging and a major conservation success story. However, in spite of the promising trends, the status review team concluded that the Hawaiian DPS still is at significant risk of extinction. The major risk factors are 1) the number of reproductive females is still relatively small and smaller than

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in most other DPSs; and 2) nesting is concentrated at a single site to a much higher degree in this DPS (over 90% at FFS) than in any other DPS (no other DPS has as much as 50% at a single site). Project leaders should consider how research conducted in the future can help inform evaluations of the degree to which these risk factors have been alleviated.

- Tagging data provide valuable information about movements of individuals in space and time, but so far they are largely descriptive. Can program staff find ways to integrate this information more fully into assessments of population status? Also, it will be important to find ways to assess non-lethal effects of tags, which likely are hard to detect but could be substantial in long-lived animals like marine turtles.
- This program has substantial data management needs and needs specialized expertise to meet them. Perhaps the solution is to combine forces with the other programs and pool resources to obtain the expertise they need.

### **Bycatch**

This short section of the agenda described bycatch work conducted by staff from another division. The presentation of research on bycatch-reduction techniques was nicely done and emphasized the importance of carefully cultivating collaborators in many different countries to address this global issue. The bycatch workshop was an impressive example of these outreach efforts. These extensive collaborations were in sharp contrast to what appears to be a general lack of communication/coordination on analysis of bycatch data among Center scientists working in different groups. It is obviously important to evaluate these data in terms of PBR; however, focusing exclusively on this aspect of the data fails to utilize other important insights that can be gained about population status. For example, estimating the fraction of the population that is taken by bycatch is at least as important as quantifying the total number. This could be particularly important for leatherback turtles. The sharp decline of bycaught leatherbacks following closing of the shallow-set long-line fishery around 2001 is encouraging, but this really needs to be interpreted in terms of the trend in the Pacific population, which by some accounts has declined sharply over the last decade or so.

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### 2015 Program Review of NOAA PIFSC Protected Species Science

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**Background:** I want to preface my review with a comment that not having worked for NOAA or NMFS nor having served on a panel prior to this my observations and comments are primarily from a scientific viewpoint and my unfamiliarity of the internal management and mandates of NOAA and NMFS is limited. While this may provide a much different perspective I am also aware of limitations to the actions of these research teams as governed by their responsibilities and charge from NOAA – NMFS as outlined by the mandates of the ESA and MMPA that may have been a major driving force on their research strategy and plans.

#### **General Observations and Recommendation with Key (Specific) Findings and Recommendations (as reviewer has comments on)**

Hawaiian Monk Seal Research: Not working with marine mammals I was impressed with the long term data set and commitment to the conservation and understanding of this critically endangered species. My observation from the presentations and background information provided by this team was that in the 1950's NW Hawaiian Island surveys and associated archipelagos estimated Monk seal abundance to be at approximately 3,000 individuals with no Monk seal populations associated with the main inhabited Hawaiian Islands. Today an extensive 30 year dataset documents that about 800 individuals remain in the NW Islands and there is a newly established population of about 200 individuals that has moved into the main islands. The last 30 years of data collection have relied heavily on the establishment of Island field camps manned by trained volunteers and professionals who have conducted extensive demographic documentation of the population and individual lineages. The weather has interrupted the collection of data for a few years but for the most part these gaps have not drastically impacted the dataset and overall analysis. There is a good team of scientists for data input and analysis using the most modern and appropriate modeling and statistical programs to analyze demographic trends and manipulate the data. The team has a good publication record and dissemination of data to the public and scientific community.

One limitation I notice is the reliance on older ASCII data file formats for the older database that has not been converted for easy insertion using R or other more easily importable analysis formats. The teams is quite dedicated to the "Conservation of all monk seal individuals" and has put an emphasis on the interdiction and translocation of individuals for conservation and protection of all possible contributing animals to the future of this species. While there was an extensive literature background included in the reviewers packet the presentations focused primarily on population assessment, interdictions, and threats to general health, very little of the oceanography, critical habitat delineation, general biology or genetics was included in these presentations nor were there publications or extensive reviews in our information packets on these topics which left me wanting a more in depth analysis of why the 30 year recovery effort in the NW Islands has not been successful in increasing numbers or juvenile survival.

For example the work of Jeff Polovina et. al. on the impact of oceanographic features on the nutrient availability and habitats in the NW HI, the possible impact of "Monument status" of the NW territories, and behavioral/diving dataset from Frank Parrish et. al, which in my opinion provides

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important clues as to the underlying monk seal decline despite this 30 year effort, was left out of these presentations and background data. Thus the ecology, ecosystem, and general biology level considerations were not really presented and there was no speculation on the carrying capacity of these habitats and possible impact of ecological and energetic factors on the continued decline of seals in the NW HI. Furthermore the establishment of a more “successful/healthy” subpopulation of monk seals in the main Hawaiian Isles was not really emphasized nor stressed in the models or analyses presented.

It was stressed that funding for continued camp establishment in the NW Islands was critical and availability of white boat days was essential for this continued program. This is critical to the long term demography study which is invaluable and provides climatic and decadal trends which are rare in population studies. However the reliance on a loose network of observers and volunteers for the main Hawaiian Isles was not clearly defined nor was the consistency and reliability of the dataset obtained by these “volunteer observers” demonstrated. I would recommend an intensive “citizen science” outreach and training program coordinated by the monk seal team to establish a minimum standard for the dataset obtained by these “volunteers”. A standard data collection routine and datasheet should be created with maybe photo ID and or some other library of demographic information and a normalization of this new, important and emerging database with the survey data obtained from the field camps of the past 30 years.

### o **Science activities fulfilling mandates and management needs**

**Observations :** This team has focused on the mandates of the ESA and MMPA and has a 30+ year database of demography data which is quite detailed and provides important insights to this endangered species. The length of the study also provides remarkable opportunities to look at long term impacts of climate change and habitat alteration whether due to natural or anthropogenic causes.

### • **Strengths:**

A long history of directed funding with earmarked funds and positions for the program established over many years. A very committed team of dedicated scientist with a very high level of expertise and experience. This research group has a substantial staff and core body of leaders. The program has an extensive, long term, and very complete demographic dataset of this endangered species over the range is found within USA EEZ. There is substantial support from the upper management infrastructure such as Frank Parrish and Ann Garrettt and a good partnerships with JIMAR and other outside entities and agencies. There is a strong commitment to the Conservation of each individual and a strong focus on the mandates of the MMPA and ESA. Their publication record and quality are good. To shore up their commitment to health and maintenance of each member of the population the team outlined a plan to hire a permanent Veterinarian on staff to provide this care and support. They also referred to a silver bullet analysis which demonstrated the importance of each “rescued” or “interdicted” individual but in my opinion the statistical analysis for this was flawed. There should be a reanalysis using a Monte Carlo statistical selection of cohort “Non-interdicted” individuals, following each of these randomly selected individuals to compare their contribution to the overall population and not a comparison with population averages to demonstrate the “differential importance” interdicted individuals vs others on contribution to future generations. For small declining populations all individual are important contributors.

The collaboration with JIMAR provides an important resource of trained personnel and volunteers that have been critical for the field camps and other research. The availability of white boat

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days seems adequate for their needs but does put a strain on the demography program if weather and climatic uncertainties become disruptive. The TMMC collaboration which provides animal hospital and care for injured animals works well with their stated goals of bolstering individual survival.

- **Challenges:**

I would have liked more detail provided into the habitat and ecosystem level of investigation and charges of the MMPA and ESA on these issues. There was no discussion nor background information provided on oceanographic impacts or climate change impacts on the future and survival of this endangered species. The overall vision was in my opinion narrowly focused on maintaining the long term demography program and short term conservation mandates of the MMPA and there was no long term vision of how this research program will deal with ecosystem, oceanographic and climate change impacts on this endemic species.

There should be by now some estimates on the carrying capacity or rough calculation for the NW HI and the Main HI so that recovery plans could be adjusted and managed accordingly. With a rapidly emerging Main HI population there was no real emphasis on how this team intends to obtain the critical and matching demographic dataset to be comparable to the long term camp data from NW HI. This team will need to find a way to incorporate trained main-island teams that will be able to provide the same dataset obtained from the declining NW HI populations. While I realize permitting issues are an issue with marine mammals there are plenty of qualified people who could be incorporated into the proper monitoring of this important expanding population, possibly through a JIMAR collaboration. A greater focus on the differences between the ecosystems and carrying capacity between the NW Islands and the expanding main islands is critical to the long term conservation of this endemic seal.

A better understanding of the historic range and paleoecology of the species should also be pursued. There is speculation that the seals were eradicated by the influx of humans but no real understanding of the distribution prior to present day has been investigated. I suggest a collaboration through JIMAR for a paleoecology paleodemographic analysis of the Hawaiian Monk seal would be an interesting and helpful part of the overall understanding of the distribution trends for this endemic species.

- **Recommendations to address issue:**

Possible shifting of some team personnel to main islands for the long term inclusion of quality and comparable data on the expanding population there into long term demography dataset.

A greater focus on ecosystem analysis of habitat and oceanographic factors impacting these animals. The incorporation of studies and modeling of the possible impact of climate change on the NW Islands and main islands. Possible use of trained local personnel on the main HI that would provide regular, comparable, and standardized data input from this new and expanding population.

A calculation of the carrying capacity of the NW HI and a greater ecosystem like approach on the reasons and factors for continued decline in the NW HI despite 30 + years of conservation and protection. Analysis and publication of the differences in diving and foraging behavior

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of monk seals on different NW islands and also comparison to main island individuals. A use of more modern field ecophysiological techniques to investigate the energetic and nutritional status of the different habitats in the NW islands and Main HI.

There should be a greater collaboration with other international Monk seal teams and investigators. These collaborations and genetic comparisons may help with long term health and survival issues that are of concern to the team such as a vaccination program and other general health issues. In addition the possibility of establishment of a captive breeding program, especially in collaboration with the new facilities associated with the TMMC should be explored as a possible conservation tool.

Convert the database to more modern and importable data formats. While this is an arduous and laborious task it will lead to better and quicker analysis and manipulation of the dataset and allow for easier collaborations with interested outside parties.

- o **Collaborations, their effectiveness, and other opportunities**

- o **Observations:**

This is a strong loyal and committed team that has continued a long term, detailed demographic study of the only endemic endangered marine pinniped in the USA EEZ. The team is dedicated to the conservation and understanding of this interesting and difficult to study marine mammal. They do focus on the mandates of the MMPA and ESA and have focused on the protection and conservation of each individual. Collaborations with JIMAR and TMMC especially on the issues of the development of a captive breeding program and establishment of main HI teams to properly assess the growing expanded population of seals there will be critical for the future of this program.

**Strengths:**

Good and long term collaborations have already been established and should be continued and fostered.

- **Challenges:**

Some outside the box thinking especially in regard to the establishment of Main Hawaiian Island research data collection and incorporation into the quality long term demographic dataset.

Consideration of a captive breeding program for this endangered species with partners to accomplish these goals.

- o **Recommendations to address issue:**

A long term strategic planning session should be on the agenda for not just compliance with MMPA and ESA mandates but also a better long term plan for the conservation of this critical member of the marine biodiversity of the Hawaiian Islands and surrounding ecosystems. Possibly a

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workshop that will also help to better define an ecosystem approach and investigative strategy for this highly qualified and dedicated team.

### **o Support from upper management Science Center & PIRO Advances in science support and communication across NMFS**

#### **Observations:**

Ann Garret is new to the job and was not fully up to speed in my opinion on the issues before the monk seal team and the region.

Frank Parrish and Michael Seki were fully engaged and were very supportive and aware of the importance of this team and work. They too were somewhat new to their positions but were on top of budgets, personnel and needs of this working group. I was most impressed with the engagement of Frank Parrish on all aspects of the review and the respect he has from this Monk seal team in particular.

- **Strengths:** all are committed and familiar with the issues but the newness of this region in comparison to other Regions in the continental US they are scrambling for and identity and equal status. It is apparent the SW Regional office has retained some of the budget and expertise which is needed for the fulfillment of all MMPA and ESA requirements of this Region.
- **Challenges:** As stated above fully engaging the Regional upper management on all issues and funding needs of this somewhat newer region.

## **Cetacean Research**

### **o Science activities fulfilling mandates and management needs**

**Observations:** This research and conservation team is new and just starting because of emerging needs of this region on the evaluation and conservation of 25 different species and over 121 stocks. I was Very impressed with the Team leader Dr. Erin Oleson and her command of what she is charged with and her innovative approaches to do so much in such a short time with less than minimal staff and budget. Overall this team was established in 2005 and being the new kid on the block has the least staff and lowest budget yet the greatest diversity of animals to assess, manage and research. I was amazed that this team has very quickly responded to the False Killer Whale crisis and quickly established partnerships with NGO's, ONR, and JIMAR to quickly establish a well designed research program to assess and understand the role of Cetaceans in the Central and West Pacific. Through the use of at sea surveys using white boat days along with the above mentioned partners and the development of new and alternative assessment tools this team has started the difficult task of population assessments and critical habitat analysis. The innovative use of acoustics both passive and active were an important step in their ability to provide information necessary for eventual biological opinions stock assessment reports and critical habitat analyses. Their partnership with Cascadia Research Collective and JIMAR has been critical for their work on false killer whales which have become an emerging species of interest due to interactions with fisheries. The deployment of 36 tracking tags on these whales has provided a very quick insight into their behavior, occurrence and critical habitat use. This was all in response to the

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demands upon the region passed down through the regional director to investigate the interaction of these whales with fisheries.

- **Strengths:** Excellent, professional and creative team led by Drs. Erin Oleson and Amanda Bradford. I am very impressed with their rapid and innovative response to Regional needs and requests. Their rapid establishment of collaborations with excellent professionals, NGO's, funding with rfp's, grants and collaborations as well as the use of innovative new techniques to establish a respectable working team.

- **Challenges:** This team is the most underfunded group in the region with an enormous mandate and responsibility and absolutely inadequate personnel. I am amazed with the products already produced and it will be a challenge to keep these folks from not collapsing from overwork.

**Recommendations** to address issue: Funding and personnel. This team needs more funding and quality people to accomplish the requests from the regional office.

This cetacean team was a shining beacon of professionalism, dedication, creativity and scientific knowledge. My praise for them and what they have accomplished in such a short time is limitless. I would highly recommend the region and the Science center management find a way to clone these folks and properly fund their activity. Their plans to use sea gliders and wave gliders for cetacean assessment along with passive and active acoustics is very cutting edge and will be very cost efficient in the long run if effective.

- **Strengths:** Frank Parrish and Michael Seki were very engaged and aware of the needs and excellence of this team. I am not sure of where they will find the funds or personnel to properly provide this team with the tools needed to do the tasks and requests that will be placed on them.

- **Challenges:** Ann Garrett needs to be quickly brought up to speed on the pressing needs of this team and research group.

### Marine Turtle Research

#### o **Science activities fulfilling mandates and management needs**

**Observations:** A long standing program with very professional and dedicated staff. I was amazed that the new team leader Dr. T. Todd Jones who has only been the leader for about 2 weeks was so in command of the budgets, needs, science and inner workings of this team. Overall Dr. Jones has inherited a long standing program of marine turtle demography and a fully functioning stranding network from the 40 plus years of work by Dr. George Balazs. He has however expanded the research component as has all research teams to include the western islands and territories. This team has established a strong record of collaborations with JIMAR, ONR, territory, state and island governments to further the long standing turtle research program monitoring and assessing 5 marine turtle species in the region. There is the potential for friction with the replacement of the long standing team leader George Balazs, with a young new team leader but I was impressed with the commitment of George to see the transition successful and his continued commitment to the success of the marine turtle program

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he created from nothing over 40 years ago. The actions of George Balazs were highly commendable and fostered confidence that this transition was working and that the team was settling into a new dynamic with George a vital part of the future.

- **Strengths:** Dr. Jones is an energetic and very charismatic scientist who has quickly established a number of new projects and scientific research indicatives. The in water telemetry collaboration with ONR has allowed the assessment of critical habitat for green and hawksbill turtles in Guam and other western islands while also delivering requested data for the Navy. This is the creative use of modern and innovative technology and funding partners to accomplish required tasks for Regional assessment of critical habitat, the biology and ecosystem ecology of these turtles in these under investigated Islands of the region. There is an excellent record of scientific publications and NOAA-NMFS products for the proper assessment and understanding of these marine turtle species and their habitats.
- **Challenges:** While there is a long standing study of the green turtle for proper demography and population assessment the team needs to start obtaining important hatching success data from all nesting sites and the creation of a better understanding of life history stages and survivorship. This team has been the home for the very expensive but necessary stranding network. This is in my opinion of diminishing scientific significance and much of these costs and activity should be absorbed and covered by the regional office. There is a critical need by all teams for better Data management. A position for this purpose exclusively should be created and maybe shared by all the teams. A true IT specialist is needed. There are very little discretionary funds for the turtle team to conduct the required research necessary for Biological opinions, critical habitat assessment and to study the impacts of global climate change. Without outside collaborations and contracts the many recent accomplishments of this team over the past 3 years would be minimal. Their use of cutting edge telemetry and physiological techniques has been a shining light but could all disappear without these external funds needed to accomplish this work.

### : Recommendations to address issue

- This team is dealing with dwindling budgets, staff turn- over, and perhaps an identity crisis with the shift and new leadership. There was 2 historical programs which were combined into one and the hiring of a new program leader it is time to re-brand the program and move forward!

The Hawaiian Green Sea Turtle budget line has been successful in studying green turtles who are now displaying a population growth of 5% a year, but the program, as outlined by T. Todd Jones and Frank Parrish is much more than Hawaiian green turtles. The re-branding needs to show the new breadth of both the cetacean and marine turtle group with research across 5 species of sea turtles in the Pacific, including:

2 endangered green turtle DPSs and endangered hawksbill population in the South Pacific (American Samoa) and western Pacific (Guam/CNMI);

Pressing issues involving large commercial fisheries (Hawaiian Long Line deep and shallow set, Am Sam longline, and purse seine) that are still monitored and potentially fined or shut down for reaching turtle interaction hard caps;

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Research and assessment of sea turtle species, specifically leatherbacks and loggerheads, that use many habitats encompassing several international EEZs and the high seas;

Initiation of innovative research into animal-borne instrument drag, validation of techniques such as accelerometers to determine bioenergetics of free-ranging turtles, validation of blood metabolites to estimate fasting/nutritional state of turtles, and modeling resource requirements and distributions of populations.

Regional requests on T. Todd with turtles and Erin of the Cetacean group are becoming more quantitative in my opinion. Both teams will need to grow in quantitative capacity with limited staff that are largely from the era of stranding and fibropapiloma/green turtle health issue focus to a more expansive and increased species assessment and critical habitat delineation focus. Both teams are currently finding unique ways (reimbursable, RFPs) to hire and retain quantitative researchers which are critical to their needs. Hiring post-docs through RFPs have met current demands but these need to be made into permanent hard money funded positions. The wealth of data in the stranding program, pelagic bycatch, and long-term data streams should be mined and students hired through RFPs and University collaborations to analyze and publish the data.

The new turtle focus will need to move towards parameter driven research, conducting sensitivity analyses in modeling to guide field research. Uncertainty in parameters such as nesting abundance (e.g., western

Pacific Leatherbacks) or demographic/vital rate parameters (e.g., hatching success) hinder their ability to analyze stocks and meet the needs of our regional management partners. For instance, while the turtle team has maintained total nesting numbers for 30 years in the NW HI there have only been point estimates of vital rates (done nearly 2 decades ago) which are essential to population modeling. This could be accomplished with greater collaboration for example with Monk seal field camp teams working together. Several opportunities are available within Pacific Science Division for, greater collaboration with the turtle and the monk seal field objectives for cooperative research and assessment in the NW HI. Goals and objectives for the long-term ecological projects will need to be set. Opportunities are also available in the western Pacific with greater collaboration with the Cetacean team and possible combined proposals for aerial surveys, ship surveys, and tagging of cetaceans/turtles through reimbursable contracts (Navy).

The new turtle program needs to shift focus from being a service program to becoming a center of excellence for sea turtle research in the Pacific. The program has existed to date by farming out data and resources for other divisions like the SW region science centers, and domestic and international research groups to analyze, lead, and ultimately take the credit. This has hurt their capacity-building within the program and made it harder to compete for funding in my opinion. Along with the stranding network they need to build capacity in the territories creating data streams that will lead to stronger sea turtle assessment, greater alignment with the needs of the Regional Office, ability to bring in funds, and lead publications.

The turtle team needs to build better relationships with partners (PIRO) and stakeholders (Council). Shift the research focus towards basic parameter driven science and build a social network to get the message out.

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In my opinion it could be accomplished with the creative use of the existing funds to hire a needed full time quantitative ecologist and data management/mining people that I mentioned above.

### **OVERALL Reviewer Conclusions:**

Overall all 3 teams were excellent and their strengths. While Monk seals were the oldest and best funded their science was the weakest and in my opinion in need of an injection of creativity and purpose. The Cetacean team while new and very small was most impressive and creative with many challenges before them to accomplish the many regional mandates and tasks with a minimal budget and grossly inadequate number of personnel. The Team leader Erin is dynamic creative and a keeper who should be fostered and supported by an additional quantitative person and some sort of shared IT/data management person with the turtle team. T. Todd from the turtle team was a very dynamic and impressive leader who has quickly come to grips with a difficult turn- over of leadership and new direction of their mission and mandates. I was impressed by all the presentation and the commitment of Frank Parrish as a direct leader to these three important teams. The regional leadership which is quite new may take some time to come up to speed but I have confidence they will get a handle on the needs and issues and will help these three very successful and potentially excellent scientific teams of researchers. The science was excellent and their record speaks well for the region and NOAA science centers in general.

The Fisheries Bycatch team was strong and gave excellent talks but did not really fit into this overall scheme of the science center research program. Since these folks were out in the Fisheries division I suspect we had these presentations because the salary lines were imbedded in the Turtle budgets due to the historical funds coming from the closure of Hawaiian fisheries due to turtle bycatch. While excellent I would recommend the shifting of positions into the fisheries budgets so that reporting and responsibility were more connected with function. Alternatively give them completely over to the science teams and have a better communication and strategic planning coordination.

## 2015 Program Review of NOAA PIFSC Protected Species Science

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#### General Comments:

The presentations on protected species science at the Pacific Islands Fisheries Science Center (PIFSC) between 27-30 July 2015 demonstrated to this reviewer that the program is well run, well designed, and extremely efficient relative to modest level of support in dollars and ship time. Presentations of the staff were of outstanding quality. They were clear and focused on the Terms of Reference provided to the Review Panel (Panel). Further, there was ample time to ask staff questions on presentations and written material, as well as ask questions following the Public Comment period. Overall the organization and logistics of this review were excellent.

The following recommendations are intended to apply to all of the programs reviewed during the past four days:

1. The process of allocating limited resources (i.e., funding and ship time) among projects within the Protected Species Division (PSD) should be more transparent. While there is little doubt that there is considerable discourse among PSD leadership in allocating limited funding and ship time, the relationship between allocative decisions and the strategic plans and annual guidance documents of NMFS and the PIFSC is not clear. Further, while the PIFSC does have a very detailed annual guidance document, the role of the PIRO and the Western Pacific Fisheries Management Council (WPFMC) in contributing to the priorities of the PSD is not clear. This should not be interpreted to mean that during the review any information was presented to indicate a misalignment of priorities and allocation of funding. Rather, the somewhat informal process currently followed is likely not robust to changes in agency or WPFMC priorities or changes in levels of support to the Center in the future. **Therefore, effort should be devoted to developing a process for the PSD that would 1) objectively incorporate guidance from NMFS Headquarters, PIFSC, PIRO, and the Council in setting priorities, and 2) be easily understood and explained to constituents.**
2. **The relationship between protected species leadership at the Center and Region would likely benefit from regular scheduled meetings (e.g., at least annually) that are chaired by a professional facilitator.** To a large extent, the lack of a more “seasoned” relationship between the two groups no doubt stems from the relatively recent appointments to positions of leadership at the Center and Region. At such meetings, there should be adequate time to delve deeply into the information needs of the Region regarding protected species management in the near term (i.e., 6 months) and mid-term (2-3 years), why the information is important, what other information might be important, and what the priorities are among different data sets and analyses. In addition, the roles of the PIFSC staff and the PIRO staff at Council meetings and other management venues should be discussed and agreed upon.

3. The management of digital information is a priority for all of the NMFS Science Centers. According to an Executive Order (EO), all digital data that are used in management and that have been collected a year or more prior to March 2016 are to be made available to the public. This is a major responsibility that will require significant resources to accomplish. Unfortunately, additional resources are not available to implement this EO. Further, this EO requires all future digital data used for management to be made available to the public one year after collection, as well as all publications. While the Center's PSD appears to be well underway to meeting this mandate, the approach taken varies by program, as does the level of Information Technology sophistication. **Therefore, the PSD should move towards developing a single standard for the collection and archiving of digital information that is based on best practices in IT.**
4. One of NOAA's principle goals is stewardship. NOAA has agreed by policy to adopt an ecosystem based approach to the management of living marine resources, and as practicable, this approach is to be implemented in the context of Large Marine Ecosystems (LMEs). Unfortunately, the philosophical underpinning of LME based management is very difficult to apply in the Pacific Island Region (PIR). **Nonetheless, as possible, PSD staff should strive to integrate the large amount of single species information on stock structure, abundance, and trends in abundance with environmental processes that are likely responsible, in part, for the observed distribution and abundance of these populations in the context of meso- and large-scale environmental forcing.** In addition, this approach should also provide an opportunity to better evaluate the impacts of increasing anthropogenic activities on LMR in the PIR, as well as the impacts of climate change and global warming.
5. At present hiring of permanent staff in a timely manner at all of the NMFS Science Centers is a challenge. Unfortunately, hiring protocols will not likely be significantly improved in the near future. In addition, the fiscal environment within NOAA is hard to predict and likely to worsen in the near future. This will make hiring in the future all the more difficult, but all the more important. **Therefore, PSD leadership should enter into discussions with other NMFS Science Centers or NOAA laboratories regarding the possibility of the PSD hosting non- PIFSC staff for short details (e.g., 1-3 months).** Similar arrangements where one of the Offices in NMFS Headquarters host staff from the field are quite common. This arrangement would provide for significant intellectual exchange between PIFSC staff and staff from other NOAA facilities, as well as providing for a level of expertise at the PIFSC, that would otherwise be difficult to secure in the near future. While concern over the availability of suitable NMFS scientists for such an exchange would have to be addressed, the lure of a unique experience in a very welcoming environment could be appropriately compelling. Similarly, the issue of Federal restrictions on travel would have to be addressed, but as noted above, this concern has been addressed in the past, and similar arrangements or novel solutions should be pursued.
6. NOAA base-funded ship time is a resource of considerable value to any research program, especially one in the PIR, where the marine environment in the US EEZ is more extensive than other Region. The current availability of something like 120 Days-At-Sea (DAS) on two NOAA vessels is inadequate. In addition, having the DAS

separated between the cetacean program and monk seal program is inefficient. NMFS has recently prioritized vessel use within its science enterprise. **Effort should be made on the part of the PIFSC to provide for as many as 200 DAS per year for three years out of five, and 120 DAS per year for the remaining two years, using base funded NOAA ship time, for the PSD.** A five year schedule of research cruise should be developed to provide for a schedule that could support more intensive, but pulsed use of DAS by the PSD. It is recognized that ship time needs could be addressed either with charter or NOAA run vessels. In addition problems with the reliability of the current NOAA vessels assigned to the PIFSC (i.e., the SETTE and H'Alikai) need to be addressed. One option might be to assign one of the new DYSON-class vessels on the west coast to the PIR at least on a periodic, if not annual, basis.

#### Comments Specific to Themes on Days 1 through 4:

The following recommendations are intended to improve on PSD research programs that appear to already be fully satisfying the information needs of the Region relative to the availability of staff and resources:

#### HI Monk Seal Research Program (MSRP)

##### Strengths and Challenges:

1. This is a very mature program in terms of staff experience, field programs (over 40 years), and mission objectives. In addition, the ability to follow individual animals at individual islands/atolls over time presents considerable opportunity for detailed information on life history (e.g., vital rates), foraging ecology, abundance, trends in abundance, and interactions with fisheries and marine debris.
2. The information needed by the Region for management of this ESA listed species is well understood by the program staff. The relatively recent occurrence of monk seals around the Main Hawaiian Islands (MHI) in addition to the long-standing occurrence of monk seals on the Northwest HI Islands (NWHI) creates two very different research environments. The former area has seals where disturbance is minimal, and for the most part under the control of the research community, while for the latter, disturbance of seals is for the most part out of the control of the research community. In addition, the logistics for conducting research on the NWHI is considerably different than for the MHI. MSRP staff have done an excellent job working out cooperative research solutions in the NWHI and the MHI; however, it appears the level of detailed information on demography of monk seals that utilize the MHI is considerable less than for the MHI. To a large extent, this situation is related to a lack of funding, but the presence of a large public population in the immediate vicinity of the beaches being used by monk seals is also a significant contributing factor.
3. The blend of field studies, telemetry studies, and sophisticated demographic studies among the staff is excellent.

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4. The importance of staff being able to occupy field sites on the NWHI on an annual basis cannot be overestimated. It is critical that the logistics and funding needed to support field camps in the NWHI be maintained. Given the long standing time series of data from the NWHI, it is necessary to manage each sub-population as a separate entity, as it is likely that a management strategy applied on one island/atoll to promote the recovery of this species will not be appropriate at another islands/atoll.

### Recommendations:

1. From a management perspective, it would be very informative to better understand the niche occupied by HI monk seals prior to occupation by humans. That is, did monk seals occur in large numbers (e.g., over 10,000) in the central Pacific prior to sharing the nearshore habitat with humans or were they a relatively rare species that ecologically was always somewhat “near the edge” of the extinction vortex? **Therefore, effort should be made to use currently accepted genetic techniques to better understand what the distribution and abundance of monk seals in the PIR was prior to human occupation.** This would be of considerable benefit to the Region in better characterizing an optimal recovery trajectory for this species. This would include inspection of middens for monk seal remains across the PIR, as well as using an approach similar to the approach used by Roman/Palumbi to estimate the number of gray whales in the North Pacific prior to industrialized whaling.
2. The current HMS Recovery Plan is an important document for helping identify and prioritize research activities. However, the Recovery Plan was drafted almost 10 years ago. Given the considerable amount of research and information gained since the Recovery Plan was finalized, it should be update or revised. This is a PIRO responsibility. **However, the monk seal program would benefit, as would the Agency, from effort directed at revising the recovery criteria such that they better reflect a more comprehensive understanding of the current habitat and how climate change and global warming may interact to influence the recovery of this species.**

### Cetacean Research Program (CRP)

#### Strengths and Challenges:

1. This is a relatively new research program at the PIFSC. In the past, the PIFSC primarily depended on the expertise of staff at the Southwest Fisheries Science Center. That is no longer the case, except for research related to genetics of cetaceans in the PIR. The current expertise of the staff related to stock assessment methodology and passive acoustic methodology, as applied to the information mandates under the MMPA and ESA, is excellent. The CRP is also responsible for estimating bycatch in commercial fisheries based on data provided by an observer program run by the Center.
2. The enormity of the PIR and the species diversity of the cetacean community in this Region presents a challenge for NMFS in terms of providing the Region the information needed to manage populations of cetaceans under the MMPA and ESA.

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Current funding levels and available Days-at-Sea are inadequate to provide stock status information for the cetacean community over the next decade. Additional resources or partnerships will be needed to address this information gap. The present strategy to focus on a small number of species/populations that have management concerns (e.g., fishery interactions in the US EEZ around HI) seems reasonable.

3. The program is using state of the art or developing state of the art advanced technology in the field of passive acoustics to address information needs related to distribution (e.g., presence-absence information from moored platforms or towed platforms). This is a very cost effective approach and should be encouraged. Further, efforts to address questions related to abundance or trends in abundance are of considerable interest to the PIRO, as well as the greater cetacean research community. This effort should be continued, and expanded as possible.
4. This is a relatively new research program, and has a relatively small staff size. However, the expertise in cetacean ecology and stock assessment, especially for small cetaceans, is impressive. The NMFS Whale Team, which services the Federal government's participation on the Scientific Committee (SC) of the International Whaling Commission, would benefit significantly from one or more staff participating in the annual meetings of the SC.

### Recommendations:

1. The WPFMC is very interested in the Potential Biological Removal (PBR) level for pelagic false killer whales. They have raised concerns as to whether the PBR calculation for this stock is unnecessarily precautionary and have asked that their SSC review a draft of the Stock Assessment Reports (SARs). It is not clear whether the SSC is adequately informed about the guidelines used by NMFS authors in drafting SARs, but it seems reasonable for the Council to be able to provide the Agency with comments regarding SARs, if offered. **Therefore, the necessary background information should be provided to the Council and adequate lead time provided for the Council to be able to provide comments to the CRP on draft SARs, as requested.** Recommendations from the Council should be incorporated or otherwise addressed prior to finalizing the SAR. The final SAR should be one that is fully supported by PIFSC and PIRO leadership. In addition, Management Strategy Evaluation simulations should be undertaken to explore how certain decisions regarding the calculation of the PBR influence the likelihood of achieving the objectives of the MMPA in managing interactions between pelagic false killer whales and commercial fisheries.
2. **The CRP should complete an analysis of the likelihood of the pelagic false killer whale population being depleted, based on a stock structure of animals only in the US EEZ and best estimates of abundance and anthropogenic removals.** Uncertainty in such an analysis is expected to be considerable; therefore, it will be necessary to fully specify uncertainty for all parameters used in the simulation. Where available information is inadequate to estimate case specific parameters, the default values used in Wade (1998) for cetaceans should be used.

3. **The CRP should continue to work toward using passive acoustic methods to supplement traditional Line Transect and Mark-Recapture methods for providing estimates of abundance, consistent with the requirements of the NMFS PBR protocol.** In addition, on-going efforts by the CRP working with the Southwest Fisheries Science Center staff to derive abundance estimates based on information on availability of suitable habitat and density per habitat type should be pursued.

### Marine Turtle Research Program (MTRP)

#### Strengths and Challenges:

1. The Marine Turtle Research Program (MTRP) is a mature program, which has focused over the last few decades on marine turtle issues in the US EEZ around HI. More recently, efforts to expand the programs portfolio to include information needs of the PIRO regarding marine turtle management in the US EEZ in other parts of the PIR have been achieved. This is commendable.
2. The MTRP works closely with staff at the Southwest Fisheries Science Center on development of methods and assessment. This interaction is benefitting both Centers. The role of the MTRP in providing management support to the PIRO is considerable. However, this role may be interfering with the more fundamental research role of the MTRP. An evaluation of whether the current roles of MTRP and the PIRO are appropriate is needed.
3. The MTRP is responsible for assessment information on marine turtle populations that include 1) populations that mostly nest and forage in the US EEZ around HI or other parts of the US EEZ in the PIR, 2) populations that nest and forage in the US EEZ, but also in non-US EEZs, and 3) populations that forage in the US EEZ in the PIR, but nest elsewhere. This creates a hierarchy of research capability for different species/populations. It also creates a situation where international cooperation is critical to the MTRP providing the PIRO the information it needs to successfully manage marine turtle populations under the ESA.
4. Fishery interactions with marine turtle populations are one of the significant threats to the recovery of these populations. Information on estimated “takes” is mostly provided for by an on-going observer program separate from the MTRP. Effort to develop methods to mitigate commercial fishery – marine turtle interactions is done to a large extent by staff outside of the MTRP. It was not possible to ascertain during the review as to whether this arrangement is optimal.
5. One or more of the populations of marine turtles listed under the ESA are critically threatened with extinction in the foreseeable future (e.g., several of the Pacific leatherback turtle populations). These populations mostly or entirely nest outside of the US EEZ in the PIR. Increased US leadership and involvement to reverse on-going declines and promote recovery is needed. The resources needed to support this effort should be estimated and a request to NMFS Headquarters should be submitted immediately.

6. Funding to support this program is in part dependent on temporary or one-year funding from the NMFS S&T Office. As possible, arrangements with NMFS leadership should be sought to provide either permanent funding for marine turtle research in the PIR, or at least secure funding for a minimum of two years.
7. The information products the MTRP provide to the PIRO are of very high quality. However, it appears that in some cases the format used to provide this information is informal (i.e., memorandum). This practice should be discouraged, as it creates considerable opportunity for inadequate peer-review. As possible, the information required by the PIRO for management decisions regarding marine turtles should be in the format of a peer-reviewed publication, as scheduling constraints allow.

#### Recommendations:

1. **Working with PIRO leadership, MTRP leadership should evaluate the scientific merits and management merits of the information provided by necropsies of stranded sea turtles by species and by EEZ region.**
2. The MTRP has made as a priority long-term collaborations with partners in the PIR outside of Hawaii. This effort is very important in terms of cost-effective research in areas where logistics are both difficult and expensive, training local community members to carry out important components of a research program, and trust between researchers, managers and local community members. **This effort should be continued as a priority.**
3. The age- and sex-composition of anthropogenic removals has a significant effect on how the population responds to such removals. This appears to be of potential interest to most of the NMFS Science Centers. While referred to as “adult nester equivalence” in this review, similar issues are common (e.g., take of juvenile king salmon as bycatch in the groundfish fisheries in the Bering Sea). **A Working Group of experts should be identified nationally and asked to review Center specific research programs in an effort to ensure a best-practices approach.**
4. It is very difficult to evaluate the impact of anthropogenic removals to a population without adequate information on population size. **Additional effort is needed to use all available information to attempt to improve on abundance estimates on a population specific basis to better evaluate the impact on recovery of bycatch in fisheries managed by the PIRO.** In addition, there would be significant benefit to management if Management Strategy Evaluation methods were applied to an improved set of population estimates and estimates of bycatch to evaluate the merits of alternative management strategies relative to the status quo management strategy.

#### Program to Address Bycatch of Protected Species in the PIR Strengths and Challenges

1. Efforts to quantify the degree to which commercial fisheries in the PIR are interacting with marine turtles, monk seals, and cetaceans is daunting, considering the number of fisheries, the logistics and cost of putting observers on commercial

vessels, the region over which these fisheries are prosecuting, and the seasonality and spatial variability in the rate and nature of these interactions.

2. At present, it appears that most of the cost of training observers, placing observers on commercial vessels, debriefing observers, and data management is the responsibility of the NMFS/PIRO, and not the industry. Federal funding to support adequate coverage (i.e., coverage levels that are needed to provide reliable estimates of bycatch of protected species by fishery by year) for all commercial fisheries in the PIR is not available, although coverage rates for at least two commercial fisheries in the US EEZ around HI are adequate. Efforts to focus observer coverage on species of greatest concern in the US EEZ around HI seems reasonable, but is not entirely satisfactory.
3. As noted above, efforts to develop methods to mitigate interactions between commercial fisheries and protected species in the PIR is for the most part the responsibility of PIFSC staff outside the PSC. Additional efforts are on-going at the Southwest Fisheries Science Center. It appears that this effort would benefit in terms of efficiency from the development of a 5-year action plan that involves all of the key participants.

#### Recommendations:

1. **Working with PIRO and PSD leadership, the MTRP should evaluate the scientific merits related to protected species management and fisheries management provided by existing fishery observer programs.** As practicable, the proportion of funding of these programs from protected species budget lines (i.e., PPAs) should reflect the importance of these data to the research programs of PSD. The remainder of funding should come from fishery budget lines. At present, funding from PSD to support observer coverage seems arbitrary, especially in light of the value of these data for fisheries management.
2. Program staff currently make it a priority to establish long-term relationships with international partners relative to mitigating the impacts of bycatch of sea turtles associated with artisanal fisheries. Such efforts, while demanding considerable logistical effort and long-term planning, are important because they provide a basis for trust, as well as cost-effective partnering. **These efforts should be continued.**
3. Program staff are currently making considerable progress in mitigating bycatch rates by the integration of visual and auditory cues into fishing gear without adversely affecting catch rates of target species. Efforts are underway to optimize this approach through the use of multiple sensor modes. **These efforts should be continued.**
4. **The long-line observer program run by the PIRO in the PIR should report all cetacean bycatch to the NMFS IWC Whale Team coordinator (Melissa Garcia).**