

2009 Science Review for Marine Mammal and Marine Turtle Research Programs at the Southwest Fisheries Science Center, National Marine Fisheries, NOAA

Response Plan Based on Review Recommendations

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BACKGROUND

On 2-4 June 2009, the Southwest Fisheries Science Center (SWFSC) hosted a review of its Marine Mammal and Marine Turtle Research Programs. The review consisted of two days of presentations by SWFSC scientists from these programs, followed by a half day discussion between research program leaders and the review panel. The panel consisted of Vicki Cornish (The Ocean Conservancy), James Harvey, Ph.D. (Moss Landing Marine Laboratories), James Lecky (NOAA Fisheries Office of Protected Resources), Timothy Ragen, Ph.D. (Marine Mammal Commission), and Frank Stone (Office of the Chief of Naval Operations). Terms of Reference (Appendix 1) provided to the panel in advance of the review indicated each reviewer would be expected to provide a written review on the quality of program research, the extent of collaboration and capacity building with research partners, the degree to which program research addresses mandates and constituent needs, gaps in existing research efforts, and recommendations for future research directions. The five written reviews provided by the panel can be found in Appendix 2.

SYNTHESIS OF PANEL COMMENTS AND RECOMMENDATIONS

QUALITY OF PROGRAM RESEARCH

Panelists agreed that SWFSC scientists are respected for the high quality of research they conduct and their productivity and problem-solving skills. Several reviewers noted the long history of SWFSC in providing leadership in addressing marine conservation issues by producing scientific results that are relevant to management needs. Two cases that were highlighted repeatedly in reviews were the development of the Potential Biological Removal (PBR) approach for assessing the impact of human-caused mortality in marine mammals (now incorporated into the Marine Mammal Protection Act) and studies developing and testing acoustic pingers and other technologies to reduce incidental mortality of marine mammals and turtles in commercial fisheries. In addition to these past achievements, reviewers noted SWFSC researchers “continue to warrant a top ranking for the quality of their science.” Notable to the panel was SWFSC’s ongoing leadership in designing marine mammal surveys, conducting protected species assessments, developing ecosystem approaches to management (e.g., Swordfish-Leatherback Habitat Overlap Project- “SLUTH” and evaluating ecosystem tradeoffs of different fishing methods in the eastern tropical Pacific), identifying units to conserve, developing acoustic capabilities and other new assessment technologies, evaluating efficacy of stock assessment efforts relative to management needs, conducting risk assessment, and analyzing tradeoffs between economic cost and conservation benefit. Panelists specifically recommended that NOAA Fisheries should ensure full support for the marine

mammal and turtle programs to maintain the quality of their science and grant them sufficient flexibility to exercise their creative and productive talents and that NOAA Fisheries should continue to fund periodic surveys of marine mammals and sea turtles to maintain time series and enable assessment of status, trends and impacts of fisheries and other human activities.

EXTENT OF COLLABORATION AND CAPACITY BUILDING WITH RESEARCH PARTNERS

The review panel noted the significant collaborations and capacity building activities the Marine Mammal and Marine Turtle Research Programs have undertaken. In particular, ongoing collaborations with the Navy on developing passive acoustic capabilities and conducting marine mammal trend analysis were noted by several reviewers. In addition, panelists felt the review demonstrated a strong collaborative relationship with faculty and students at Scripps Institution of Oceanography. The review panel emphasized the need to continue to identify and build collaborations to most efficiently use limited resources and to access capabilities the Marine Mammal and Turtle Research Programs may not maintain or have the resources to develop. For research disciplines in which the Mammal and Turtle Research Programs already maintain significant expertise, reviewers recommended NOAA Fisheries identify “Centers of Excellence” within the SWFSC and avoid duplication of those capabilities in other Centers. Reviewers also commended several capacity building activities highlighted during presentations, including those focused on international sea turtle conservation with partners in the Atlantic as well as the Pacific. Other noteworthy capacity building activities include transfer of knowledge on line-transect survey methods, acoustic monitoring and molecular methods to define units to conserve.

DEGREE TO WHICH PROGRAM RESEARCH ADDRESSES MANDATES AND CONSTITUENT NEEDS

Reviewers agreed the SWFSC Marine Mammal and Marine Turtle Research Programs are appropriately responsive to legal mandates and management needs. One reviewer commented, “I was impressed with the Center’s capability to integrate real science into conservation . . . when I see good science driving decisions I can only applaud the folks that are doing it right.” While another reviewer commented that in communications on the Swordfish – Leatherback Use of Temperate Habitat (SLUTH) project more emphasis should be given to including NGOs to help make them feel a more significant part of the process, that panelist’s review agreed with the others that SWFSC research was very oriented toward fulfilling the requirements of the Marine Mammal Protection Act, Endangered Species Act, and other legal mandates, as well as satisfying the management needs of NOAA Fisheries and international organizations.

GAPS IN EXISTING RESEARCH EFFORTS

Reviewers agreed with the proactive research model employed by the Marine Mammal and Turtle Research Programs of SWFSC. In the reviewers’ eyes, this approach has enabled the SWFSC to avoid management crises and, as a result, allowed its scientists to remain focused on conducting hypothesis-driven research to address management questions. Comments on the scope of current and planned research relative to emerging issues generally commended the SWFSC on its awareness of conservation issues likely to become more pressing in the next 5 to 10 years. Along these lines, reviewers sought to remind the SWFSC that research programs and tools must be developed to address conservation issues over relevant time scales.

In terms of research programs, reviewers emphasized the need to continue long-term monitoring and build our knowledge base in a broader ecosystem context to enable the SWFSC to assess the impacts of ocean noise, climate change, contaminants and energy development, to name a few. With respect to research tools, reviewers were impressed with the molecular genetics laboratory, particularly the collection of marine mammal and marine turtle tissues maintained at the lab and the multitude of analyses

(in addition to identifying units to conserve) made possible by maintaining such a collection. Reviewers complimented the SWFSC on building a research tool that could be brought to bear on a number of emerging conservation issues over the coming decades. Panelists specifically recommended that the SWFSC should pursue additional funding and ship time for oceanic monitoring of protected species, especially given recent analyses indicating that current survey frequency does not allow the agency sufficient statistical power to detect dramatic population declines for most species.

RECOMMENDATIONS FOR FUTURE RESEARCH DIRECTIONS

Reviewers recommended that the SWFSC Marine Mammal and Turtle Research Programs be cognizant of resources required to implement future research and, more specifically, that they develop a plan in which required personnel, funds, equipment, etc. be described in sufficient detail to justify a commitment of resources by NOAA decision-makers and Congress. In addition, reviewers recommended that SWFSC continue to build on the significant advances it has made in development of passive acoustic methods for marine mammals, predictive modeling of protected species' densities to improve user tools and enable marine spatial planning, and multi-species modeling to further ecosystem approaches to evaluating the impacts of fisheries and other human activities. Panelists specifically recommended that 1) NOAA Fisheries leaders initiate an agency-wide discussion of how the agency as a whole could better integrate its regional capabilities and efforts to provide the best national result in the most efficient manner (e.g., create centers of excellence); 2) NOAA Fisheries recognize the importance of conservation science in foreign and international waters, provide support for such efforts when resources allow, and seek to increase the level of support for such activities through its budget and planning processes.

RESPONSE PLAN FOR MARINE MAMMAL AND MARINE TURTLE RESEARCH PROGRAMS

Research conducted by the marine mammal and turtle programs is mandate-driven. Our response plan is therefore set within the framework of our mission, philosophy, and mandates. A brief overview of these is presented below. Specific responses to recommendations from the review panel are then presented in a section which represents practices that are cross-cutting across all research activities. Finally, because our primary mission is based on assessment of marine mammals and turtles, goals for the five core components which are critical to successful assessment are identified. These goals will provide a basis for decisions about the nature, scope, and relative priorities of our projects and activities.

I. MISSION, PHILOSOPHY, MANDATES

Our mission is fourfold:

1. Assess marine mammals and turtles relative to management objectives in U.S. waters and regions where our constituents have a vested interest;
2. Support users of our data;
3. Educate and build capacity;
4. Advance the science of management and conservation.

The first element of our mission, assessment, is comprised of five required components: a) abundance estimation; b) assessment of status and trends in abundance; c) identification of population structure; d) life history, condition, and health research; e) ecosystem research (to better interpret status and trends assessment).

Embedded in this mission is the basic philosophy of proactive, as opposed to reactive research. We strive to fulfill our mission in a forward-thinking manner. This philosophy is so integrated in our approach as to

be a unifying core value and it is this philosophy that drives fulfillment of the fourth element of our mission.

Two primary mandates drive our research. The Endangered Species Act is designed to prevent extinction and recover species, and requires 1) estimation of population size, 2) determination of trends in abundance, 3) identification of “Distinct Population Segments”, and 4) identification and mitigation of threats. The Marine Mammal Protection Act is designed to maintain populations as functioning elements of their ecosystem, and requires 1) estimation of population size, 2) estimation of human-caused mortality, and 3) determination of stock structure. A third significant mandate, the Magnuson-Stevens Act, provides a framework for research focused on reduction of bycatch of marine mammals and turtles in fisheries within and outside of U.S. EEZ waters. Additional significant mandates and international agreements and bodies include the Agreement on the International Dolphin Conservation Program, the International Whaling Commission, and the Inter-American Convention for the Protection and Conservation of Sea Turtles.

II. RESPONSE TO REVIEWER RECOMMENDATIONS: CROSS-CUTTING PRACTICES

Quality of Program Research

Based on reviewer recommendations, we will strive to:

- Maintain existing time series datasets to enable assessment of status, trends and impacts of fisheries and other human activities (Appendices 3 and 4);
- Continue “question-based” research (e.g. hypothesis-driven; Appendix 3) and elevate awareness of its value relevant to our mission and mandates;
- Maintain existing expertise in designing open ocean marine mammal and ecosystem assessment surveys, assessing species status, developing ecosystem approaches to management, investigating units to conserve, developing passive acoustic capabilities, risk assessment, and analyzing tradeoffs between economic cost and conservation benefit;
- Maintain program structure so as to support complementary disciplinary expertise and work to provide frequent opportunities for cross-disciplinary/taxonomic collaboration;
- Assess emerging issues and revise use/allocation of program and Center disciplinary expertise and research focus accordingly.

Extent of Collaboration and Capacity Building with Research Partners

Based on reviewer recommendations, we will strive to:

- Leverage and strengthen ties across SWFSC and utilize complementary expertise in other SW Center Science Divisions;
- Under the new Operating Agreements between SWFSC, PIFSC, and NWFSC, more broadly collaborate with other NMFS Science Centers to avoid unnecessary duplication of these capabilities within the agency, including participation in an integrated research plan for the Pacific, especially with respect to coordination and delineation of roles within and between SWFSC, NWFSC, and AFSC for the California Current and between SWFSC and PIFSC on basin-wide turtle issues and research and monitoring in the central and western Pacific;
- Seek external (to NMFS) collaborations to access capabilities outside of existing expertise and where limited resources will not allow for internal development;
- Maintain existing and develop new collaborations with scientists (national and international);
- Continue to develop innovative multi-disciplinary approaches to conservation and management science (e.g. integration of economics and biology);

- Mentor graduate students at academic partner institutions, including the Scripps Institution of Oceanography, San Diego State University, and University of California Santa Cruz;

Degree to which Program Research Addresses Mandates and Constituent Needs

Based on reviewer recommendations, we will strive to:

- Continue to satisfy mandates and meet constituent needs in a manner consistent with past success;
- Expand responses to existing and emerging mandates by providing research and assessments in support of ecosystem approaches to management.

Gaps in Existing Research Efforts

Based on reviewer recommendations, we will strive to:

- Maintain existing time series datasets so as to provide baseline data for addressing emerging issues;
- Maintain and secure the future of the Marine Mammal and Turtle Molecular Research Sample Collection as a research tool with great potential to address emerging issues (also recommended in Report of the National Research Council on “Assessment of Sea-Turtle Status and Trends” 2010);
- Conduct risk assessments and similar exercises to identify species/stocks most vulnerable to precipitous declines and focus research efforts on those species/stocks (e.g. Appendix 5).

Recommendations for Future Research Directions

Based on reviewer recommendations, we will strive to:

- Continue to build on significant advances in passive acoustic methods for detection of cetaceans, predictive modeling of species density for marine spatial planning, multi-species modeling to further ecosystem approaches to evaluating the impacts of anthropogenic perturbation;
- Develop Potential Biological Removal (PBR)-like tools (similar to those in place for marine mammals) for assessment of marine turtle populations;
- Use risk- and species-based analyses relative to future conservation challenges to set research priorities and increase transparency regarding this process (e.g. Appendix 5);
- Investigate impacts of climate change on marine populations and critical habitat;
- Develop and use new technologies, analytical methods, and models to better relate marine mammals and sea turtles to their ecosystems.

III. GOALS RELATIVE TO THE FIVE CORE COMPONENTS OF ASSESSMENT

Abundance Estimation

- Estimate abundance of populations relative to our mission, and maintain abundance estimates through time to fulfill requirements specified by mandates and management objectives

Assessment of Status and Trends in Abundance

- Understand trends in abundance through time, and place this information into a context relative to management objectives
- Advance stock assessment approaches through development of innovative analytical tools and incorporation of multiple datasets (e.g. abundance, life history/vital rates, ecosystem); (also recommended in Report of the National Research Council on “Assessment of Sea-Turtle Status and Trends” 2010)

- Recover depleted, threatened, and endangered species by providing science to allow for mitigation of anthropogenic impacts, and by documenting recovery

Identification of Population Structure

- Quantify structure of populations in order to identify units to conserve relative to management objectives
- Secure the future of the Marine Mammal and Turtle Molecular Research Sample Collection and its associated data management system, and integrate with other collections
- Continue to develop new molecular markers and laboratory and analytical tools for defining management units relevant to our mandates
- Explore unifying definitions of units to conserve across taxa under identical mandates

Life History, Condition, and Health Research

- Obtain, and maintain current, estimates of demographic parameters and monitor condition and health
- Maximize information obtained from skin and blubber biopsy samples collected from live animals, with a specific focus on hormones and stable isotopes

Ecosystem Research

Use ecosystem data to provide a broader understanding of status and trends for marine mammals and turtles

Develop a framework (to include analytical approaches and use of multiple datasets) for defining “Critical Habitat” (as required by the Endangered Species Act) for listed species and place this into a marine spatial planning context

Develop “ecosystem indicators” – physical or biological parameters or species or community metrics that inform us about the state of a particular ecosystem or species which are the focus of management efforts

Use multiple data sets and innovative analytical tools and approaches (e.g. climate model projections, physical and biological data sets) to predict effects of climate change on marine mammals and turtles

Use ecosystem data to develop Ecosystem Approaches to Management

IV. OBJECTIVES RELATIVE TO CORE COMPONENTS OF ASSESSMENT

Goals from the above five components have driven a three-year plan of major field efforts and scientific contributions and products (Appendix 4). An associated objective is to conduct an annual strategic planning exercise with Division leadership (Appendix 6), to share the results with senior leadership of the Science Center, and to use results as a tool for Center-wide strategic planning.

RESOURCE REQUIREMENTS

Implementation of the goals identified above, and the objectives in Appendix 4 is critically dependent on securing necessary resources. Ship time is essential for fulfillment of our mission (Appendix 3), as is funding for labor, major field and lab efforts, and infrastructure. Erosion of program funds due to a

variety of causes has an impact on our ability to meet these goals and objectives. Of note, several key functions identified by reviewers as particularly innovative and critical are largely funded with outside funding (from sources other than NMFS).

Setting research priorities as a mechanism for effective use of existing fund is an exercise largely internal to the SWFSC in general and to the Marine Mammal and Turtle Research Programs in particular. The review panel recommended that these programs develop a plan in which personnel, funds, equipment, and other resources required to attain the goals outlined in this response plan be described in sufficient detail to justify a commitment of resources by NOAA decision-makers and Congress. This recommendation will be followed.

Securing the future of required resources is dependent on appropriations of funds for research programs. A number of specific reviewer recommendations pertain to resource requirements. These are highlighted here:

- NOAA Fisheries should ensure full support for the marine mammal and turtle programs to maintain the quality of their science, and grant them sufficient flexibility to exercise their creative and productive talents.
- NOAA Fisheries should continue to fund periodic surveys of marine mammals and turtles at existing or higher levels, especially given recent analyses indicating that current survey frequency does not allow the agency sufficient statistical power to detect dramatic population declines for most species.
- NOAA Fisheries leaders should recognize the importance of conservation and management science in foreign and international waters, provide support for such efforts when resources allow, and seek to increase the level of support for such activities through budget and planning processes.
- NOAA Fisheries should recognize emerging issues (e.g., climate change, ocean noise, alternative ocean energy) as potential threats to marine mammal and sea turtle populations, and provide support to study their likely impacts and guide conservation management and policy efforts.
- NOAA Fisheries should endorse and support collaborative holistic ecosystem-based research that considers the role of marine mammals and sea turtles as higher predators in marine ecosystems.

Appendix 1. Terms of Reference: Review of Marine Mammal and Turtle Research Programs, 2-4 June 2009, Southwest Fisheries Science Center, NMFS, NOAA.

BACKGROUND

The Protected Resources, Environmental Research, and Fisheries Research Divisions (PRD, ERD, and FRD, respectively) of the Southwest Fisheries Science Center (SWFSC), NOAA Fisheries, and two SWFSC Senior Scientists, conduct applied research on the cetaceans, pinnipeds and marine turtles of the Pacific Ocean and, on occasion, in other oceans of the world. Researchers in these groups work collaboratively, and together they comprise the SWFSC Marine Mammal and Marine Turtle Research Programs. These programs provide the scientific basis to maintain marine mammal and marine turtle populations as functioning elements of their ecosystem, and recover those that are depleted, as directed by management objectives stated in our legal mandates. The focus of this research is to monitor these protected species and assess the effects of anthropogenic activities, including changes in ecosystems that result from those activities, with a special emphasis on depleted, threatened and endangered species. In addition, we have a strong history of, and continue to engage in, strategic research to develop new monitoring and analytical methods and tools to facilitate proactive management. Our research results form the basis for scientific advice to the NOAA Fisheries Southwest Regional Office and Office of Protected Resources, the Fishery Management Councils of the Region, and the U.S. delegations to a range of regional and international resource management bodies tasked with management of marine mammal and marine turtle populations.

REVIEW GOALS

A comprehensive overview of the SWFSC marine mammal and turtle research will be presented during a 2-day session. This overview will focus on current research activities and their relevance to program mandates, and vision for future growth areas relative to agency priorities and emerging issues.

The primary goals of the review are to assess

- To what degree do the SWFSC Marine Mammal and Turtle programs address the needs of NMFS' constituents;
- Research priorities and recommendations for future work;
- Gaps (research areas, personnel, field and ship time, laboratory infrastructure);
- To what degree the science addresses related mandates;
- The quality of science conducted;
- The degree to which the research includes, and the effectiveness of, internal (NMFS) and external collaborations, capacity building, and education.

This assessment will be provided by an independent panel of five reviewers in the form of independent, written reviews. A separate document further delineates reviewer responsibilities and requested elements of each review.

REVIEW FORMAT

The review will consist of two days (June 2-3) of presentations by SWFSC scientists describing existing research foci, their relevance to legal mandates, and directions for program growth relative to emerging issues. Presentations will be categorized into the following research disciplines: (1) abundance estimation, assessment, and reducing bycatch, (2) defining units to conserve, (3) life history, condition, and health assessment (4) ecosystem approaches to management and (5) strategic research tools. A third day (June 4) is scheduled for reviewer follow up with remaining questions or discussion, a closed session for verbal feedback to be provided from reviewers to SWFSC leadership, and writing of reviews.

REVIEW PARTICIPANTS

Presenters:

Research Program Principal Investigators: Dr. Jay Barlow, Dr. Peter Dutton, Dr. Tim Gerrodette, Wayne Perryman, Dr. Jeff Seminoff, Dr. Barb Taylor, Dr. George Watters and Dr. Steven Bograd
Research Program Directorate: Dr. Lisa Ballance and Jeremy Rusin
SWFSC Collaborators in Fisheries Research: Dr. Dale Squires and Dr. Heidi Dewar

Reviewers:

Dr. Frank Stone, Office of the Chief of Naval Operations, U.S. Navy
Dr. Jim Harvey, Professor, Moss Landing Marine Laboratories
Jim Lecky, Director, Office of Protected Resources, NOAA Fisheries
Vicki Cornish, Vice President, Marine Wildlife Conservation, The Ocean Conservancy
Dr. Tim Ragen, Executive Director, U.S. Marine Mammal Commission

Additional:

Dr. Steve Murawski, NOAA Fisheries, Director of Scientific Research Programs and Chief Science Advisor
SWFSC Director's Office Leadership
Dr. Steve Swartz, NOAA Fisheries Office of Science and Technology
Dr. John Stein, NOAA Fisheries, NWFSC
Southwest Region Leadership
SWFSC Division Directors

Audience:

Protected Resources Division scientists, SWFSC
Other interested SWFSC scientists

Appendix 2. Written assessments by the five members of the review panel: Review of Marine Mammal and Turtle Research Programs, 2-4 June 2009, Southwest Fisheries Science Center, NMFS, NOAA.

Reviewer: V. Frank Stone, Office of the Chief of Naval Operations, U.S. Navy

Review Summary Statement: Based on the presentations, discussions (both group and individual), and tours during the review (June 2-4, 2009), I am able to say that SWFSC Marine Mammal and Turtle programs addresses the needs of the U.S. Navy in support of their environmental compliance documents. I believe that the research priorities as presented are appropriate and that the recommendations for future work are based on reasonable assumptions of future requirements. Clearly, one area that could use additional funding is additional time for line-transect surveys. The science done at SWFSC is focused on the organization's mandate and the quality of the science is outstanding—cutting edge science in many cases. As an experienced collaborator with SWFSC staff, I can personally attest to the external collaboration of the center with DOD and Navy.

The challenges/concerns addressed in the Summary and Future Directions presentation that was sent to us after the meeting reflects several points I that came to mind during the review. Personnel is always an issue and having no Ecosystem Studies Program lead is a big hole that needs to be filled. The loss of three quantitative assessment scientists in the last year clearly needs to be addressed. Work that SWFSC does for Navy requires this type of person and I imagine many of the other projects need this capability.

I am very interested in how the cetacean mandates for the central Pacific is going to be handled. Since I have two big areas (Hawaii, Marianas) that need to be surveyed to determined species populations and density data addressing this concern is important to the Navy. Additionally, obtaining dedicated funding for continued acoustics work is something that the Navy supports. From a broader perspective, clearly the genetics collection needs to be supported and as well as data management since having data without the ability to turn it into information is worthless.

The future as laid out in the presentation addresses the Center's mandates and therefore I believe it is the right way to proceed. Abundance estimation, assessment and reducing bycatch is the heart of the mandate. The focus on using "risk assessment" as a tool to provide resources for species at the greatest is the right way to go. Defining units to conserve certainly is a priority. The tools that have been developed provide a great capability and additional energy should be focused on the development of new molecular markers and analytical tools to define management units.

Another priority—life history, condition, and health assessment is clearly a mandate. The outstanding science that has been developed by the center should continue to focus on additional ways to obtain information from skin and blubber biopsy samples. Lastly, the ecosystem approach to management may be the most important priority that the center has. This approach certainly impressed me and I believe that it holds much promise in the future.

From the presentations, I believe that all the gaps have been identified that would improve the quality of the science and the ability to address related mandates and meet constituent requirements. As mentioned above, the science performed by the center is directly related to the mandates (and in my opinion some leading edge and outstanding science). Lastly, I can speak directly from experience that the Center uses both internal and external collaboration to meet the Center's mandates and the needs of outside agencies. It appears to me that the internal collaboration has been a critical factor in the development of the unique capabilities of the Center. What I cannot address is to what extent that the capabilities of the center have been shared with other science centers in the form of educational seminars.

Overall, I can say with certainty that the Center is performing its duties (mandates) in an extremely professional manner within the budget limitations and at the same time developing a wide-range of cutting edge tools to support the mandates and significantly contributing to the body of science.

Observations: The primary geographical responsibilities of SWFSC came as quite a shock to me. I knew that the west coast and Hawaii were areas in which Dr. Barlow did line-transect surveys and also the eastern tropical pacific BUT I didn't realize the mandates (requirements) that were associated with those geographical areas. I was aware of

the research in the field with the small boat, aerial, shore, and ship-based surveys. I was also aware that ship surveys were abundance (monitoring) and ecosystem assessment surveys. What I wasn't aware of was that there were question-based cruises with specific focus. I was aware that the overall purpose of the surveys is to determine trends in populations of marine life. Since I've been working with Dr. Barlow for at least ten years, I was aware of the multidisciplinary approach SWFSC has taken in their assessment cruises (I believe that SWFSC has been the leader in this type of approach and this approach is now standard procedure for all the abundance and ecosystem assessment cruises). Prior to this program review, the above was what I thought was all that SWFSC did to support the SW Regional Office, Office of Protected Resources, Office of Science and Technology, Fishery Management Councils, other regional and international management bodies, and other users of the marine environment.

The entire "Research in the Lab" aspect of the Center came as a complete surprise to me. The range of research capabilities from molecular genetics, hormonal assays, photogrammetry, stable isotopes, to acoustics is impressive! Acoustics was the only capability that I was aware of prior to the review. The dual themes of proactive mandate-driven research while "advancing the science of management and conservations," along with inter-division, inter-center, inter-agency, and inter-institutional collaboration certainly represent what I observed during the review.

The Review: I am now so embarrassed that on the third day I mentioned how I was "struggling" with the review because I could not categorize all the work done at the center by requirements (mandates)! Well, the very first presentation by Dr. Ballance laid out all the requirements and I promptly forgot about those since I became so engaged in the project presentations!

Abundance Estimation, Assessment, and Reducing Bycatch - The first topic of the review was the PBR Framework which identifies the US EEZ stocks that are "strategic," those stocks where human-caused mortality exceeds their potential biological removal (under ESA), and "depleted" (under MMPA). Based on the assessment of the stocks, take reduction teams are formed for strategic/depleted stocks if bycatch and other human-caused mortality exceed PBR. To determine PBR it is necessary to be able to determine stock abundance and then monitor the stock. The Center has several projects addressing this topic.

Ship and Aerial Surveys on the US West Coast

The ship and aerial surveys of the US West coast and Hawaii have matured over the 20+ years. The addition of new technology (acoustic arrays, sonobuoys, improved photographic equipment) overtime has improved the capability to improve the quality of the stock abundance estimates.

Detecting Beaked Whales and Dwarf and Pygmy Sperm Whales on Ship Surveys

I am totally familiar with this work since I sponsored part of it over the last few years. This work is on the cutting edge and has contributed to our understanding of beaked diving patterns.

Pinger Experiment to Reduce Bycatch

This work is outstanding and I was somewhat familiar with it. The fact that pingers have reduced bycatch rates for most species by 50% and bycatch for beaked whales has been completely eliminated is an incredible accomplishment. In addition, the abundance estimates for beaked whales and pygmy sperm whales were corrected (results of new capability) resulting in an increase of PBR and these stocks no longer "strategic." It is estimated that bycatch is less than PBR for all stocks and the fishery will be reclassified a Category II.

Estimating Trends in Marine Mammal Abundance

My take away from this presentation is that SWFSC needs more surveys to be able to measure any population-level trends in abundance.

Gray Whales and Climate Change

Estimate of abundance process has improved through change in sampling techniques. Similar improvement in tracking pods has increased accuracy of estimates. Gray whale studies are impressive particularly the work on temporal distribution of seasonal ice. This work directly addresses the Center's mandate and the quality of the science is outstanding. The use of a Bayesian approach for calf estimates indicates to me that the Center's personnel are up to speed on the many tools available to answer the difficult questions contained in the mandates.

Eastern Tropical Dolphins—Effects of Chase and Encirclement in ETP Tuna Fishery

The three case studies on the ETP fishery were very interesting to me. The question the mandate asks is whether the dolphin populations are recovering. The three case studies answer the question with excellent projects.

Trans-boundary Marine Mammals

The mandate is for ESA 5-year status reviews which include biological teams for listing and re-classification. In addition, mandate includes ESA Section 7 Consultation and recovery team/recovery plans. Two case studies were presented to address fin, sperm, and humpback whale population on an ocean-basin scale. The SPLASH study showed all the good things that the SWFSC is doing. First, joint funding between fisheries and sanctuaries; secondly, the project was an international collaboration with 10 countries and 400 researchers; thirdly, used best-available science for abundance and trends; fourthly, determined population stock structure through photo-id and genetic studies; fifthly, looked at the effects of fishery interactions and vessel collisions. This is significant work and science to support the mandate.

Abundance Estimation, Assessment, and Bycatch of Pacific Marine Turtles - I don't know much about Marine turtles and the series of presentations which extremely enlightening to me. My overall comment is that the high quality of the science of the projects is outstanding. The cases studies addressing abundance, assessment, and reducing bycatch were impressive. The other main point for me was that ability of the turtles to travel thousands of miles making the conservation and assorted other requirements contained in the mandate so much more difficult. Clearly, international collaboration is required and that is what it appears the Center does very well. This capability was one of the most impressive of the review.

Defining Units to Conserve - Again, an area that I was not familiar with prior to the review. This presentation really caught my interest since I have some background knowledge but not a lot. Discussion on taxonomy was helpful. The whole issue of genetics and the Center's collection is impressive. Again, the use of internal coloration was impressive and the capability that you have with the small staff devoted to the supporting the collection. It was mentioned that this capability would be one of the areas for a "Center of Excellence." I would agree that having other science centers send material for categorization and storage makes good sense. Of course, this would require, most likely, additional staff but it would be cheaper than having each science center develop the same capability.

Defining Units to Conserve—Marine Mammals: I am going to plagiarize one of Dr. Taylor's slides because it represents to me what I saw during the review. The case studies confirmed for me that the work the Center is engaged in is management driven science. As mentioned above, the genetic tissue collection provides a huge capability to meet your mandates. I was impressed with the lab skills that the center has specifically the ability to develop new markers which then increases the power to resolve difficult questions. In addition to the lab skills, the Center staff has the analytical skills to interpret the data within a management context. The strength of the Center seems to be the ability to synthesize other lines of evidence with genetic data to provide a more complete answer to the myriad questions. Lastly, I have said that I was impressed with the Centers capability to integrate REAL science into conservation. This may not sound like a big deal, but my experience is that there is very little real science supporting decisions both on the Navy side and the regulatory side. Therefore, when I see good science driving decisions I can only applaud the folks that are doing it right!

Defining Units to Conserve—Marine Turtles: As mentioned above, marine turtles were new to me and the earlier presentations were very helpful to me in understanding the issues associated with marine turtles. Without reservation, I can say almost the same things about the quality of the science with respect to turtles that I did in the above review of marine mammals. The quality of the science reflects the quality of the Center staff. The ability of the Center to leverage the talents of their staff to work within several disciplines and with the addition of grad students is a successful paradigm. I'm sure that the Center could use additional FTEs to reduce what I suspect is some amount of stress on the staff. However, the interaction between the various disciplines looks like it is a positive factor in the success of the Center.

Life History, Condition, and Health—Marine Mammals: The fact that the Center has an active stranding program provides an opportunity to further develop its lab capabilities and is able to train the Region fishery observers on full spectrum necropsies. I have experience dealing with stranding networks and necropsy results and realize that often you can get individual information but very little data at the population level. It came as no surprise to me that biochemical markers from blubber samples and containment loads can provide information on population life history, health and condition for protected populations. It also didn't surprise me that that Center

does an outstanding job applying its scientific strengths (genetics collection, analytical capabilities, etc.) to determine aspects of species population information.

I give credit to the Center for taking old, Navy cameras and using them to estimate numbers of animals in large groups. With the demise of the large format camera, the Center's interest in not losing the photogrammetry capability and getting an SBIR to develop a new camera as capable of the Navy camera is key to the future capability. In addition, the potential for using AUV for surveys certainly has high potential. The Delphinus Project is an excellent example of how the Center uses its scientific strengths to better understand the basic life history, health, stock structure and abundance for targeted species. I'm starting to sound like a broken record, but this project is well designed and brings good science to collect data to provide information to answer the questions. The project brings several parts of the Center together to create a team that is capable of collecting the right data, analyze it, and the data into information to provide science-based answers to key question.

Life History, Condition, and Health Status of Pacific Marine Turtles: This section of the review provided me with more new information about the Center and its capabilities. The main mandates are estimating the demographic parameters of the marine turtle populations; learning the influence of oceanographic processes on habitat use; determining connectivity with satellite telemetry; and using stable isotopes to study turtle life history. Additional mandate is health assessment of the marine turtle population. The center accomplishes this mandate by determining body condition and effects of bioaccumulation and contaminants.

The **green turtle** studies in San Diego bay showed the good science and the power of using GPS telemetry in determining green turtle movements. Also, the modeling work to determine the thermal effects of the power plant closure on the green turtle. Another project looked at exposure and bioaccumulation of silver and cadmium.

The **leatherback turtle** studies off central California provided me information on how analyzing the prey of the turtles can tell us about the turtle itself and the importance of the ecosystem. Solid science in studies on nutritional value of prey and the effect of attached transmitters on the turtles. Again, more good science in looking at the physiologic values of foraging leatherbacks off the coast of California and the metal concentrations in leatherback whole blood.

The LUTH cruise really revealed the capability of the Center. It was an ecosystem assessment which collected data using shipboard oceanographic and prey sampling, aerial surveys, and satellite telemetry. The capability of using stable isotope ecology in marine turtles for me was impressive.

These projects were all excellent science, used outside collaborators, and all appear to address the mandates.

Ecosystem-based Management

ETP Mammal Conservation

Case 1--The two approaches, empiricism and modeling, were described for determining whether changes in carrying capability were large enough to explain the low abundance of dolphin populations. The empirical approach mined ecosystem observations and resulting analysis suggested that there were no obvious shifts or trends to account for the low abundance of dolphins. The modeling, Bayesian competition, concluded that there was likely a change in the ecosystem resulting in the low abundance of dolphins.

This project clearly addresses the mandate. Both approaches used quality science to come to the respective conclusions. I cannot remember how much collaboration was involved in this project but since there were two different approaches taken I assume that there must have been internal collaboration. This project used Bayesian modeling which is not the first time that we saw it used in projects presented to the review panel. From this fact, I can start to see where this may be the beginning of building a particular capability that other centers may want to tap into to support their projects.

ETP Multiple Objectives

Case 2—“How to Sustain Ecosystem Services?” This section was completely new to me and therefore I cannot really do justice to the projects described. But I can see how taking a “broader” approach of looking at how fisheries are connected to the food webs that support them makes sense. What I found most interesting is the question “what remains” in the ecosystem rather than what was removed from it requires a very different answer. Lastly, clearly there need to be models to be able to answer the questions.

This work appears to me to be on the leading edge of science (I certainly may be wrong since I know very little in this area) and since the Center is doing the work I wouldn't be surprised if this is the case. There is collaboration with IATTC and includes internal Center collaboration.

In the final thoughts part of this section—the comment on modeling that good models are based on ecosystem observations and without ship time for cruises there is no data!!! It is clear that more ship time for a variety of cruises is necessary to the Center to do its current job yet alone future mandates.

Strategic Research Tools

Biomass, Consumption and Primary Production Requirements

The quality of science in this project is outstanding. Using survey data, the biomass of cetaceans was estimated. Then how much food was consumed by the estimated biomass was derived. Following how much food was necessary to support the biomass, then the amount of primary production is required to sustain prey that are directly consumed by cetaceans. The conclusions of this project are disturbing in that as large whales continue to recover the requirement for prey will increase resulting in the potential for large whales to find reduced abundance of food sources to support the growing populations.

Excellent science and internal center collaboration to address a mandate of the Center.

Predictive Modeling of Cetacean Density in the Pacific

Since I am intimately familiar with this project I can say that it is outstanding science and it brings a capability that the Navy and other federal agencies desperately need to be able to complete their environmental compliance documents. There was outstanding internal and external collaboration on this project. The product of this project can provide consistency in the “take” estimates that federal agencies need to do to support actions that may affect the environment. Future extensions into HI, Marianas Islands & Guam and perhaps Gulf of Alaska are recommended.

Swordfish and Leatherback Use of Temperate Habitat (SLUTH)

Interaction between fishing fleets and leatherback turtles puts the population at risk—they are endangered and declining. Main issue is that they are transboundary—they nest in the Western Pacific but migrate to multiple foraging areas around the Pacific including the U. S. West coast AND there are minimal conservation measures around the Pacific.

It appears that there is baseline data to suggest that reducing the swordfish fleet has not had a significant effect on improving the leatherback population. As domestic fishing is reduced the demand for imported swordfish has increased. In a sense, the result of reducing the domestic swordfish fleet may have increased the mortality of leatherback due to increased fishing to meet the import demand. SLUTH certainly has the potential to directly address the swordfish/leatherback issue since it brings a wide-range of stakeholders together and it identifies data gaps for decision making and provides research opportunities. What struck me as important was to look at a wider or holistic approach to leatherback conservation. Also important, the balanced approach to conservation to take into consideration a way to promote a viable and sustainable U.S. swordfish fishery.

I believe that way ahead as described will use the best available scientists and technology from a wide range of stakeholder all of whom have a vested interest in finding solutions to the swordfish/leatherback interaction.

Use of Acoustics to Improve Marine Mammal Assessments

Again, I am very familiar with these projects since I have funded them for several years. One of the key accomplishments has been the capability to detect beaked whales using the towed array. Combined with the visual contacts, the Center will be able to provide the first beaked whale density estimates from an acoustic-line transect survey.

Another project is developing classification algorithms to apply to acoustic data collected during surveys. This work is very important since it provides the capability to determine what species are vocalizing and overtime will be able to ascertain whether we have resident or transient populations of specific species. I believe that there was collaboration with SDSU on this project.

Identification of stocks using acoustics is another project that has had excellent results. This project discovered the acoustic signature of a previously unknown population structure in Minke whales.

The final project's results show how combining visual with acoustic data during line transect survey improves the probability of detection thus increasing the validity of the stock estimates. Incorporating both methods of detection is now standard procedure throughout the scientific community.

This work has been on the leading edge of science for the last five years. Key collaborations internal and external to the Center have been excellent. This work has provided additional tools for scientists to use to gather more accurate stock data, identify species by their vocalizations, and provide another means to assess presence or absence in an area. The Center has now created another tool/technology that it can share with the other centers and also can be considered an integral part of a future Center of Excellence.

Integrating Biology with Economics - This presentation contained what I would consider a major paradigm shift in the approach to conservation and proactive recovery. This was all new information to me. Clearly, this approach requires transboundary cooperation among countries to address the plight of several species. As said in the presentation that this is a "holistic" approach looks at all the variables that come into play in trying to conserve the resource and encourage recovery. This approach looks at all sources of mortality, types of institution that can directly impact conservation, and the different types of regulations available to affect change. This approach also looks into social norms, potential effects of moral suasion, and economics.

I look at this presentation as a tool to go out and get support for this approach to conservation and proactive recovery. I suspect that there is a lot of science involved to this approach (I believe that you have the scientists, technology, and methodology to implement this approach) but this way of thinking needs to get out into the scientific community. This concept was the one BIG idea that I left the review with that seems to make a dent in to way we currently do business.

Research at SWFSC-ERD—Climate Variability & Ecosystem Response

Climate Variability in the North Pacific/Climate Effects on Critical Habitat

The climate related projects focus on data that can provide insight into potential of ecosystem disruptions. The science conducted in these projects take a wide-range of data and analyze it to put together a series of data sets that in total can provide insight into what is happening in the ecosystem and may have the potential to suggest something about climate change.

The quality of the science in these projects is excellent. I seem to remember that there was a significant amount of collaboration involved in these projects. Again, the capability that the Center has to collect and analyze the data is a strong point. These projects clearly address the Center mandates

Oceanographic Influences on Marine Mammals and Turtles: Distribution, Movement, and Behavior

I am familiar with much of what was presented in this section (ie.TOPP). I know the quality of the science that is involved and the analytical tools that are necessary to tease out information. The TOPP program is one of the best programs I have seen. Information from this program whether from new types of tags, physical oceanography,

engineering, animal behavior, ocean observation, and habitat utilization all contribute to looking at the “big picture” to see what the relationships between this divergent data sets.

By design, there is collaboration between a wide range of scientists and because some of the participants are some of the best scientists in the world ensures that there is quality science.

I can say the same for the electronically tagged leatherback turtle project. I believe there was significant collaboration on this project.

Oceanographic Influence on Marine Mammals and Turtles: Marine Predator Hot Spots

The series of projects in this section were new to me though the tools used were familiar. It is interesting to note that different factors influence the distribution of turtles and marine mammals. The behavioral phases of leatherback place them in different locations based on the phase. Not only does the behavioral phase determine where leatherbacks may appear, there are hot spots where there is a series of conditions that make foraging and retention key factors in animals remaining in a particular location. The blue whale movements tend to be seasonal with SST having a role in the animal distribution.

Again, excellent science and collaboration in these projects.

Data Products and Tools for Marine Mammal and Turtle Research

The series of data products and tools presented are extremely valuable in the “painting the picture” of what all the information from the research projects “mean” or tell us about what actions need to be taken or provide a status of the condition of populations. TOPP of course has wonderful tools to see what is going on with the tagged animals. From personal experience, I know that these tools provide scientists with information to make hypotheses and inferences about what is happening within an ecosystem.

Without these high quality tools, all the research done at the Center and other locations would not have the impact they have. Certainly, Dr. Barlow’s predictive model tool provides the user with a picture of densities between particular lats and longs.

Good products supported by excellent science that provides information for the decision maker not matter at what level.

Review of Marine Mammal and Turtle Research Programs
Southwest Fisheries Science Center
2-4 June 2009

Timothy J. Ragen, Ph.D.

On 2-4 June 2009 the Southwest Fisheries Science Center (Center) hosted a review of its marine mammal and turtle research programs. The review consisted of two days of presentations by scientists from these programs, followed by a half-day discussion between program leaders and the review panel. The panel consisted of Vicki Cornish (The Ocean Conservancy), James Harvey, Ph.D. (Moss Landing Marine Laboratories), James Lecky (NOAA Fisheries Office of Protected Resources), Frank Stone (Office of the Chief of Naval Operations), and myself. The Center also asked the reviewers to submit written reviews with a focus on the quality of program research, the extent of collaboration and capacity building with research partners, the degree to which the research addresses program mandates and meets constituent needs, gaps in the existing research efforts, and recommendations for future research directions.

FINDINGS AND RECOMMENDATIONS

I recommend—

- (1) that the Service ensure continued and full support for the marine mammal and turtle programs to maintain the quality of their science and grant them sufficient flexibility to exercise their creative and productive talents;
- (2) that the Service ensure give full support to these programs to ensure that they continue to satisfy their mandates and meet their constituent needs in a manner consistent with their past success;
- (3) that these programs maintain their focus on collaboration, capacity building, and education, and give particular attention to the Pacific Marine Fishery Council and the State of California;
- (4) that Service leaders initiate an agency-wide discussion of how the agency as a whole could better integrate its regional capabilities and efforts to provide the best national result in the most efficient manner; I believe this will require locating particular specialty areas in certain centers (i.e., “centers of excellence”);
- (5) that the Service recognize the importance of such conservation science in foreign and international waters, provide support for such efforts whenever resources allow, and seek to increase the level of support for such activities through its budget and planning processes;
- (6) that Center program leaders conduct a risk- and species-based analysis of future conservation challenges, share the results with Service decision-makers, and use the information to develop future directions for the marine mammal and turtle programs; and
- (7) that Center leaders use their list of priorities to determine what resources will be needed in the future and describe those priorities, resources needed, and benefits to be obtained in a program planning document that should be available to all interested parties.

RATIONALE

The basis for my findings and recommendations is as follows.

Quality of science

The Southwest Fisheries Science Center has long been respected for the quality of its research. Scientists at the Center are recognized as leaders in their field, they are highly productive (as is evident in the list of publications in the review document), and they produce science that has a strong impact on marine mammal conservation. They are excellent problem-solvers and have provided important leadership for the Service as a whole. They have helped define conservation problems in U.S. waters and around the world, and then led the scientific efforts to resolve those problems. They maintain strong relationships with various collaborating organizations (e.g., Scripps Institution of Oceanography), and thereby promote multi-disciplinary approaches to complex conservation issues. They have trained a considerable number of students, many of whom now are contributing productively to marine research and management efforts in the United States and elsewhere. Center scientists also have played leading roles in addressing international issues, and have had a strong presence and record of achievement in international organizations such as the International Whaling Commission and the International Union for Conservation of Nature.

The presentations at the subject review demonstrated that the current marine mammal and turtle programs are maintaining this tradition of excellent science. The review was well attended by Center personnel working in all aspects of these programs, the presentations highlighted the important achievements of the past and the difficult challenges being undertaken currently, and the quality of presentations revealed the thorough and careful thought that gives direction to the programs' scientific efforts. By any measure, the Center's marine mammal and turtle programs have earned and continue to warrant a top ranking for the quality of their science. Therefore, I recommend that the Service ensure continued and full support for the marine mammal and turtle programs to maintain the quality of their science and grant them sufficient flexibility to exercise their creative and productive talents. They provide a showcase for the quality of science in the Service as a whole.

Addressing mandates and constituent needs

As a constituent, the Marine Mammal Commission's needs pertain directly to satisfying the mandates of the Marine Mammal Protection Act, Endangered Species Act, National Environmental Policy Act, Magnuson-Stevens Fishery Conservation and Management Act, and so on. For that reason, I have combined these two topics.

Here, again, the science conducted by these two programs provides excellent support for management aimed at addressing legislative requirements and constituent needs. The following examples illustrate such valuable support.

- *Investigating units to conserve*—Center scientists are at the forefront of efforts to evaluate marine mammal and turtle stock structure, which is essential for scaling assessment, conservation, and protection efforts. These efforts have centered on genetic studies and Center's capacity to conduct such research is the best in the country.
- *Developing the potential biological removal concept and extending that concept to turtles*—Center scientists were central to the development, testing, and implementation of this approach to assessing the effects of human-related serious injury and mortality of marine mammal stocks. This approach has been incorporated into statutes, implemented throughout U.S. waters, and used as a management model in other parts of the world. Center scientists also are evaluating potential use of this approach to marine turtles, which will provide a valuable tool for assessing human impacts on marine turtles.
- *Assessing stocks*—With the limited resources provided to them, Center scientists provide relatively comprehensive marine mammal assessments for the stocks under their purview, particularly when compared to the science centers in the other regions in the country. They are also providing extensive new information about marine turtles, and that information will be invaluable in efforts to conserve those stocks.
- *Promoting new assessment technology and methods*—Center scientists have also pioneered the integration of acoustic methods with visual sighting surveys, which promises to increase scientific assessment capabilities for many species in U.S. waters and elsewhere.

- *Reducing bycatch*—the Center has participated in the development of means and measures to address fishery bycatch issues, as illustrated by the investigation and implementation of pingers in drift gillnet fisheries.
- *Evaluating the efficacy of stock assessment efforts*—Center scientists have evaluated U.S. efforts to implement its stock assessment framework by evaluating the power to detect large declines in stock status. This kind of feedback is invaluable in understanding and correcting the strengths and shortcomings of our marine mammal management framework in the U.S. Center personnel also have been major contributors to the Service’s efforts to define Tier 2 and Tier 3 stock assessment levels.
- *Supporting management efforts*—At the review the region’s management personnel provided unqualified praise for the cooperation and collaboration from Center scientists in addressing a wide range of West Coast management issues. Such praise speaks directly to the Center’s ability to support its constituents.

Again, I recommend that the Service ensure give full support to these programs to ensure that they continue to satisfy their mandates and meet their constituent needs in a manner consistent with their past success. The scientists within the marine mammal and turtle program have demonstrated that they are fully aware of the challenges involved in satisfying statutory mandates and meeting the needs of the Service’s constituents. Providing these scientists with the necessary support to continue doing so is crucial to the agency’s scientific capability. Any shortcoming I see in this area is a function of insufficient resources, not a lack of scientific talent, rigor, or commitment.

Collaborating, building capacity, and educating

To the benefit of all involved parties, including the Service itself, the marine mammal and turtle programs at the Center are excellent collaborators, teachers, and capacity builders. These values are evident at all levels of organization: within the Center, within the Service, with other agencies and academia, and with other nations.

- *Within the Center*—The ecosystem studies in the eastern tropical Pacific are an example of collaboration within the Center. These multi-disciplinary studies provide a model for other ecosystem assessment studies and have the potential to reveal important insights into recovery processes for stocks depleted by human activities and attempting to recover in variable environments.
- *Within the Service*—The investigation of genetic structure for both marine mammals and turtles provides an example of collaboration within the Service. By storing, analyzing, and reporting results from other regions of the country, the Center has demonstrated its value to the Service as a whole.
- *With other agencies*—The collaboration of Center scientists with the U.S. Navy on acoustic methods for estimating stock distribution and abundance promises to expand greatly our collective capacity to assess marine mammal stocks.
- *With academic institutions*—The relationship between academic institutions and the marine mammal and turtle programs has been highly productive and beneficial to both the Center and the academic institutions. The Center has gained by using the academic expertise to expand its capacity to address difficult problems, and has contributed by training highly qualified students. I know from firsthand experience the value of the relationship between the Center and Scripps Institution of Oceanography.
- *Internationally*—The SPLASH project (Structure of populations, levels of abundance and status of humpback whales in the North Pacific) provides an excellent example of the Center’s involvement in a Pacific basin-wide assessment effort that has provided extraordinarily useful data on humpback whales. Similarly, the investigation of marine turtle population structure based on nesting and movement patterns has provided essential insights into the nature of these populations, their remarkable life histories, and the risks they face on nesting beaches, in the deep pelagic realms of the major ocean basins, and in the nearshore environment over continental shelves.

With regard to collaboration, capacity building, and education, three additional points warrant inclusion in this report. First, neither the review document nor the presentations discussed in detail collaboration with the Pacific Fishery Management Council or the State of California. I expect that both are considered either collaborators or constituents, and relationships with them may be mediated through the regional office. At the least, they should both benefit from interactions with the Center's marine mammal and turtle programs. In general, I recommend that these programs maintain their focus on collaboration, capacity building, and education, and give particular attention to the Pacific Marine Fishery Council and the State of California.

Second, some review discussion focused on the concept of "centers of excellence." The Center's Protected Resources Division encouraged the application of that concept while other participants at the review expressed mixed feelings. One of the reasons offered for discouraging this approach was simply related to the term and the implication, by comparison, for other centers in the Service. My sense is that too much consideration was given to the term and not enough to the efficiencies that may result from this approach. Although all the Service's Centers require certain common types of expertise, all Centers do not require all types of expertise. That is, certain Centers could specialize in providing that expertise for the Service at large. Examples where such specialty expertise could be usefully located within one center include genetics, contaminants, and disease. Such specialty laboratories would require careful management to ensure that all Centers received equal consideration, but the efficiencies to be gained by careful management outweigh the costs of redundant functions. Importantly, this discussion highlighted the need for better integration of Service science programs. Therefore, I recommend that Service leaders initiate an agency-wide discussion of how the agency as a whole could better integrate its regional capabilities and efforts to provide the best national result in the most efficient manner; I believe this will require locating particular specialty areas in certain centers (i.e., "centers of excellence"). Such integration seems particularly important in the Service's planning and budget processes.

Third, much of the material presented or discussed at the review pertained to research activities conducted in foreign and international waters. This is often a topic of debate, particularly when available resources are stretched to address national needs. That being said, the Marine Mammal Protection Act and the Endangered Species Act, in particular, mandate consideration of issues in foreign and international waters. In fact, the three major concerns leading to the passage of the Marine Mammal Protection Act involved threats to marine mammals in foreign and international waters.

Research on marine mammal and turtle issues in foreign and international waters can be justified on at least three levels. First, in many such cases the responsible management bodies may simply not have the resources available for meeting conservation needs. I would argue that, in such cases, the United States should seek opportunities to promote conservation by training local personnel or building local capacity to meet those needs. Second, in cases where a marine mammal or turtle stock occurs in the waters of both the United States and a foreign country, the United States should promote an integration of stock assessment and management activities. The movement of turtle populations between the Indo-Pacific and continental shelf areas off the U.S. West Coast illustrates the need for integrated research and management. Third, in cases where the activities of the United States or its citizens undertake activities that threaten a marine mammal or turtle stock, I would argue that the United States has a strong obligation to contribute to the resolution of such threats and recovery of the affected populations. Because the United States buys much of the shrimp from the northern Gulf of California and the shrimp fishery is a major risk factor for the vaquita, I believe the United States has an obligation to help Mexico take the necessary measures to recover the vaquita. Center scientists have played an important role in each of these types of situations, and I believe it is in the Service's best interest to encourage such activities whenever possible. I therefore recommend that the Service recognize the importance of such conservation science in foreign and international waters, provide support for such efforts whenever resources allow, and seek to increase the level of support for such activities through its budget and planning processes.

Setting research priorities and recommendations for future work

Resources for conservation are clearly limited, and research by the marine mammal and turtle programs must be prioritized to use existing resources wisely. The goal of these programs should not be just to do good research, but to do well the research that is needed to promote conservation and management of marine mammals and marine turtles.

The challenge for both Service decision-makers and Center program leaders is to prioritize program research to maximize the ratio of benefits to costs. I mention both Service decision-makers and Center program leaders because I don't think the Service can function effectively integrating priorities, at least to a degree. If, for example, the Center would like the Service to recognize it as containing certain is to develop specialty areas, then it must be willing and able to integrate the Service's needs with its own.

The term pro-active was used in the review, and I am a firm believer that anticipating and addressing problems before they become crises is one of the best ways to achieve conservation. Marine mammals and turtles will or may face a considerable number of threats in the not-too-distant future. Examples include an expansion or change in commercial fishing or aquaculture, increased military activities, offshore energy development, increased commercial shipping, persistent or expanding harmful algal blooms, coastal development, increasing interactions between marine mammals (i.e., California sea lions), increasing contaminants, and—of course—climate change. The review discussed a number of threats, but the list was by no means complete.

To be pro-active, program leaders must anticipate those threats, their relative significance, and the information base that will be needed to address them. The time scale is important. A review of past and current risk factors and efforts to identify, characterize, and address them would likely indicate that effective research and management of new or expanding threats may take decades. Certainly some risk factors may be addressed relatively quickly, but that will not be the case for many others. In my view, program leaders must maintain the still relevant strengths and proficiencies of the current program while expanding program capacity to address developing or anticipated future problems. Once all current and anticipated needs have been identified, then judgments will have to be made about how to use current and future resources to address those needs as efficiently as possible.

A portion of the review showcased the genetics laboratory, and the result was extraordinarily impressive. From tissue storage to analysis of data and quality of scientific results, the genetics laboratory has made and is making great contributions to marine mammal and marine turtle conservation. That being said, the genetics laboratory is a tool – or set of tools – used to address important needs. If I were an appropriator or someone who made decisions about the distribution of conservation resources, I would not be easily persuaded to support a tool unless I understood its value in achieving an important conservation outcome. For that reason, I would discourage program leaders from arguing for a genetics lab per se. Rather, if I were a program leader, I would put all my arguments for a genetics laboratory in the context of the problems it will solve or the conservation value of the information it will provide. By analogy, although a medical instrument may be a marvel of technology, its value lies not in its complexity, but rather in the lives it saves, the suffering it alleviates, and/or the costs it eliminates.

In the last section of this report I discuss research needs, gaps, and the resources to address them. I don't believe it is possible to discuss those matters in a comprehensive and coherent fashion unless the program has first established a clear set of priorities. In endangered species management, managers and scientists have often assumed that the factors that caused a species to decline also will be the factors that prevent recovery. I think we know enough now to know that such is not always the case and assuming it is can lead to ill-directed or misguided management efforts. For that reason, I recommend that Center program leaders conduct a risk- and species-based analysis of future conservation challenges, share the results with Service decision-makers, and use the information to develop future directions for the marine mammal and turtle programs.

Research needs and gaps, and the resources to address them

Once Center leaders have identified priorities, those priorities should serve as a basis for determining what additional capacity is needed, including personnel, expertise, equipment, infrastructure, field and ship time, and funding. Although I could propose a set of priorities, my suggestions would not be as informed as those of the Center leaders, and I would rather see the Center (in concert with Service decision-makers) develop a more rigorous and comprehensive forward-looking process for identifying gaps and projecting needs.

Funding is generally the bottom line with regard to filling needs. In 2005 dollars (i.e., corrected for inflation from 2005 to 2008), overall funding for the Protected Resources Division declined by about 10 percent and internal NOAA Fisheries funding declined by about 8 percent. In effect, the decline in discretionary funding was probably larger than that, as personnel costs tend to increase disproportionately. The key question, then, is what information, service, or other benefit was lost because of this decline in resources. Center and Service leaders must

be able to address that question in a manner that compels administrative and congressional officials to find and allocate the additional resources.

Therefore, I recommend that Center leaders use their list of priorities to determine what resources will be needed in the future and describe those priorities, resources needed, and benefits to be obtained in a program planning document that should be available to all interested parties. The plan should describe needed personnel, expertise, equipment, infrastructure, etc., in a manner that justifies the commitment of resources by decision-makers in NOAA Fisheries, NOAA, the Department of Commerce, the Office of Management and Budget, and Congress.

Addendum

For the record, I should note that my expertise is related marine mammal conservation. I have very little knowledge of or experience with conservation of marine turtles. My frame of reference for this kind of review was, therefore, biased. At the same time, I want to note that I was greatly impressed by the presentations made by leaders in the marine turtle program. I believe marine turtle conservation has progressed rapidly, that the scientists overseeing and conducting this work are making excellent use of available tools, and that they are being creative in their conservation approaches. Most importantly, I sensed that they share great enthusiasm and passion for their work, and they represented the interests of marine turtle conservation wonderfully. I was pleased to learn as much as I did from them and their presentations, and I believe they have added a strong new dimension to the efforts of the Protected Species Division.

Acknowledgement

I would like to thank Steve Murawski, Norm Bartoo, and Lisa Ballance for inviting me to participate in this review, my fellow panel members for interesting insights and discussions, marine mammal and marine turtle program leaders for excellent presentations, and all the participants at the meeting for their involvement in and contributions to these excellent programs. The work being done at the Southwest Fisheries Science Center continues to inspire me.

REVIEW OF MARINE MAMMAL AND TURTLE RESEARCH PROGRAMS
NOAA Fisheries Southwest Fisheries Science Center
June 2-4, 2009

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This document is a review of the NOAA Fisheries Southwest Fisheries Science Center's Marine Mammal and Sea Turtle Program (MM&STRP), conducted June 2-4, 2009. The views and opinions expressed herein represent only my own, and are submitted independently of the other reviewers that also participated in the review. These comments provided expand upon some of the verbal comments I provided at the conclusion of the review.

I begin by expressing my appreciation of the SWFSC staff that worked to prepare for this review and that made my participation at the review possible. I personally benefited from being able to attend the review and to learn, in significant detail, about the various research programs being conducted at the SWFSC. I was overall extremely impressed with the quality and diversity of the work being conducted by at the SWFSC and by the expertise, dedication, and openness of the staff.

The perspective from which I participated in the review and now submit my comments is from that of my current position as an advocate for the conservation of ocean wildlife species for Ocean Conservancy, a non-governmental organization whose mission is to inform, inspire, and empower people to speak and act on behalf of the oceans. I consider our organization to be an important stakeholder and partner in helping NOAA Fisheries meet their conservation and recovery goals for U.S. marine mammal and sea turtle populations. I currently serve as a member of NOAA Fisheries' Pacific Cetacean Take Reduction Team, as well as several east coast Take Reduction Teams, and have just completed a two-year term on the Agreement on the International Dolphin Conservation Program's International Review Panel. My perspective is strongly influenced by 15 years working for NOAA Fisheries in the Office of Protected Resources, the Office of Science and Technology, and the Southeast Region's Protected Resources Division.

The primary goals of the review, as outlined in the Terms of Reference, were to assess:

- To what degree do the SWFSC Marine Mammal and Turtle programs address the needs of NMFS' constituents;
- Research priorities and recommendations for future work;
- Gaps (research areas, personnel, field and ship time, laboratory infrastructure);

To what degree the science addresses related mandates;
The quality of science conducted;
The degree to which the research includes, and the effectiveness of, internal (NMFS) and external collaborations, capacity building, and education.

My comments will touch on all of these assessment goals, but not necessarily equally. As a conservationist, my primary focus during the review was on how the science being conducted at the SWFSC is used in conservation of protected species. Hence, my comments do not include a program by program assessment of research priorities and data gaps, instead they are more directed at the application and overall effectiveness of the SWFSC's research program in meeting specific legislatively-mandated marine mammal and sea turtle recovery goals and management needs.

That said, I must commend the SWFSC for the high caliber of research being done and the leadership role that the SWFSC has taken in advancing the science around critical fields of study, including abundance estimation and stock assessment methodologies, developing and testing gear modifications to reduce incidental mortality and serious injury due to commercial fishing, defining units to conserve, understanding the role of protected species in the larger marine ecosystem and applying an ecosystem approach to management, monitoring effects of climatological factors and global climate change on protected species populations, and understanding life history and health factors critical to conservation and management. The presentations given during the review reflected the SWFSC's commitment to excellence, and show a focus on being not only responsive to management needs but also the need to be anticipatory regarding future challenges.

Overall, it appears that the SWFSC research is strongly driven by legal mandates and is appropriately responsive to management needs. The SWFSC is one of the strongest of NMFS Science Center's in being firmly focused on anticipating and responding to management needs. They are proactively addressing the legal and regulatory mandates of the MMPA, ESA, and, to a lesser degree, the MSA, as well as international obligations under the International Whaling Commission and the Agreement on the International Dolphin Conservation Program. They are also leading efforts to assess stocks at the Tier III level to facilitate an ecosystem-based approach to scientific data collection, and to better document and understand impacts from anthropogenic stressors, including climate change.

To meet the mandates of the MMPA, the SWFSC led the development of the Potential Biological Removal model in the 1994 amendments to the MMPA as the framework for assessing marine mammal stocks, both by providing expert drafting assistance to Congress and by leading the process to standardize how PBR variables were determined and PBR was calculated. These assessments are published in annual stock assessment reports (SARs). The Pacific SARs have always been detailed, well-referenced, and have included not only the minimally required information but also additional information useful to management such as maps of the survey areas and transect lines, distributional maps for each species, maps and charts illustrating fishing effort and locations of incidental takes, and descriptions of fisheries that have the potential to incidentally take marine mammals. They also indicate in each report which stock assessments have recently been updated.

For years, Jay Barlow and his staff have provided expert advice and technical assistance to assess incidental mortality of marine mammals in commercial fisheries, identifying factors associated with incidental takes and facilitating research that led to one of two strategies for reducing cetacean takes in the CA drift gillnet fishery (pingers). The Pacific Cetacean Take Reduction Team recently determined, twelve years after the take reduction plan was implemented, that the fishery has met both the short and long term goals of the plan to reduce the incidental mortality and serious injury of all marine mammal stocks to a zero rate. The SWFSC provide timely reports summarizing observer data on an annual basis, and works closely with the Southwest Regional Office to address other management needs as they arise.

The sea turtle team also provides expert scientific advice to the Southwest Regional Office and to other NMFS offices to meet the recovery goals of the Endangered Species Act for endangered and threatened sea turtles. One especially notable effort was to expand the Leatherback Use of Temperate Habitat (LUTH) to include Swordfish (SLUTH), addressing a significant management need to balance fishery interests with species recovery. They have also investigated adapting the MMPA's PBR approach to sea turtles. Further movement on this would help standardize how sea turtle populations are assessed by endangered species management staff in the NMFS regions and headquarters.

The SLUTH study is an example of how the SWFSC is striving to meet management needs to ensure healthy and thriving fisheries while ensuring endangered leatherback sea turtles meet their legally mandated recovery goals. Fishermen were clearly concerned about large closure areas to protect leatherback sea turtles during productive fishing times for swordfish, and it is appropriate to look at habitat utilization by both turtles and swordfish to predict whether there are changes that can be made to the temporal or spatial components of the closure areas that would allow for additional fishing opportunity while not adversely affect sea turtles. One suggestion going forward is for the SWFSC staff to endeavor to bring all stakeholders to the table if this effort continues. Previous meetings have not had representation by the NGO community, who would want to be involved in any discussion of changes to the Leatherback Closure Area. NGOs may also be helpful in promoting the success of the PCTRT.

Themes

I noted several themes that ran throughout the presentations, which I believe define and also affect the work being conducted at the SWFSC. Following is a brief discussion of each of these themes, and how they relate to the stated goals of the assessment.

The SWFSC is proactively positioning NMFS and NOAA to respond quickly to emerging issues and to prevent crises.

The SWFSC has a long history working in large and diverse tropical and north Pacific ecosystems to assess the health, life history, and status of protected species. This work has largely been driven by anthropogenic stressors on these populations, such as bycatch, whaling, and loss or perturbation of habitat – issues that remain challenging to this day. To understand the effects of these stressors on protected species populations, and to minimize detrimental impacts, the SWFSC has developed widely applicable analytical tools, amassed the world's largest collection of tissues and hard parts, and identified, developed, and tested changes in gear technologies and fishing practices. This history and diversity of

research has fostered a proactive approach to problem solving that positions the Center well for dealing with emerging crises from an informed and prepared position. The “arsenal” of tools and technologies that have been developed and applied by SWFSC researchers, combined with a depth of understanding of processes and procedures that are transferable to other ecosystems and other species, allows for an immediate, appropriate response and rapid problem-solving approach to minimize the expense and resources which would otherwise be required to deal with emerging crises. The advantage of being proactive is that the agency’s limited resources can be used more effectively, and solutions can be identified and applied in a timely manner, reducing the impact of the crisis.

The scientific leadership and expertise of SWFSC staff have set a high bar for other NMFS researchers and the scientific community as a whole.

The SWFSC has systematically and deliberately acquired scientists of extremely high caliber and productivity to lead its Marine Mammal and Sea Turtle Program. The scientists which presented at the review are known throughout NMFS and internationally as leaders in their field. This leadership role has earned the SWFSC recognition as a center for excellence within NMFS in genetics, population assessment, and ecosystem-based approaches to management. The research being done at the SWFSC has fostered NOAA’s reputation as a credible source of high quality, timely, responsive, trusted, and exportable information for managing human activities in the ocean.

The SWFSC uses a collaborative, multi-disciplinary approach to meet its program objectives.

An ecosystem based approach to management drives the research philosophy of the SWFSC. They work with other researchers around the world to share tools and technologies, to provide expertise and to learn from others.

The LUTH was initiated as a multi-disciplinary program to better characterize habitat use by leatherback turtles, incorporating oceanographic and environmental variables that go beyond a simple assessment and distribution analysis. The expansion of LUTH to SLUTH then moved the project even farther along, to a proactive, collaborative analysis that took into account swordfish distribution as well as economic factors in an attempt to provide better manage competing demands in the CA swordfish fishery. I was especially impressed at how market incentives and other socioeconomic considerations are being integrated into projects like SLUTH. However, as noted above, reaching out to NGOs that could facilitate market-based incentives for conservation of fish and protected species would expand the collaborative nature and effectiveness of this program. Involving stakeholders in controversial management decisions will increase buy-in and possibly avoid future legal challenges.

The assembly of scientists involved in the cruises also clearly shows a collaborative approach, involving scientists and students from various academic institutions. The cruises are intentionally multi-disciplinary, with oceanographic, environmental, food web, and acoustic data all being collected by various researchers. This collaborative, multi-disciplinary approach is fundamental to ecosystem-based management and is critical to understanding how changes in ocean health and global climate change are affecting protected species.

The SWFSC's international work is promoting a global conservation ethic.

There are examples in both the marine mammal and sea turtle programs of how the SWFSC is playing a leadership role in promoting a global conservation ethic. Expertise is shared through on-the-ground collaborations with researchers and conservation organization throughout the Pacific and around the world. Tools and technologies developed and refined at the SWFSC are being exported for use by other researchers with fewer resources to draw on to develop these tools and techniques on their own.

An illustration of this is of course the SWFSC's ongoing involvement in several internationally focused efforts, including the research and assessments in the Eastern Tropical Pacific tuna purse seine fishery and for the International Whaling Commission. The expertise and technologies shared through involvement in these projects has contributed greatly to the conservation of marine mammal globally, through significant reductions in the number of dolphin mortalities in the ETP as well as the application of rigorous assessment methodologies geared toward tracking the recovery of the great whales. And while it was not a subject of discussion during the review, the SWFSC's longstanding collaboration with international scientists has helped shine a spotlight on the possible extinction of baiji, as well as the possibility that we may see the extinction of vaquita in the next decade unless significant changes are made in the management of fishing effort in the upper Gulf of California.

The sea turtle work is having a particularly significant contribution to enhancing a global conservation ethic. Perhaps it is because the sea turtle tagging and other research is conducted on the beach, where there are frequent interactions with local communities and where researchers have increased opportunities for hands-on training and sharing of information. The tagging studies have shown that sea turtles travel thousands of miles between their foraging and nesting grounds. This kind of information connects communities and researchers at great distances from one another, and emphasizes how human activities in any part of the sea turtles' range have the potential to impact the survival of the species. The SWFSC researchers are encouraging and collaborating with other scientists and conservationists in all parts of the sea turtles' range to promote both our understanding of sea turtle life history and distribution patterns as well as the application of proven and effective conservation strategies.

The SWFSC is fostering excellence in the next generation of fishery biologists.

The high quality of research being conducted at the SWFSC attracts the top caliber of graduate students and technicians to the lab, which in turn is creating the next generation of highly qualified fishery biologists and stock assessment scientists. This is especially important considering the shrinking pool of quantitative assessment biologists to draw from, a challenge recognized by NMFS Science Centers across the country.

The SWFSC's prominence in cutting-edge research, and proven ability to produce well-qualified graduates, is facilitated by close collaboration with UC San Diego and Scripps Institute of Oceanography students and staff, as well as other US and international academic institutions and scientific organizations in California and around the world. Far from being just a source of well-qualified technicians and students, these institutions are active partners in enhancing the quality of science being conducted, and are also helping to build the braintrust for NOAA's future success.

The SWFSC will increasingly be hampered by resource limitations and lack of adequate funding - the paradox of being successful.

Circling back to the observation of how the SWFSC staff have been especially effective at assessing populations of protected species and working with managers to reduce impacts from human activities - this proactive and deliberate approach to solving problems has a potential down side. With programs throughout NMFS (and NOAA) suffering from inadequate funding and staff, limited resources are increasingly being directed to programs that have not invested in a proactive, problem-solving approach and instead are functioning in crisis management mode. As such, SWFSC may be the victim of its own success when critical funding needs in the MM&STRP are overlooked to deal with management crises elsewhere.

Even if resource allocation decisions within NMFS were more balanced and not as subject to political pressures, the reality is that there may not be enough funds available throughout the agency, now or in the future, for the SWFSC to continue its leadership role on so many fronts. Partnerships with other agencies, such as the Navy or Minerals Management Service, appear to have helped supplement some critical research needs and provide other platforms for conducting research. However, these partnerships take time to develop and maintain, and in the end may not be in sync with overall program priorities.

Under Dr. Ballance's leadership, the SWFSC has implemented a deliberate process for periodic evaluation and prioritization of scientific research focus areas. This has helped the SWFSC in its goal of achieving a balance between long-term monitoring and flexibility to address emerging issues, such as climate change and improving the science of ecosystem approaches to management. To the extent this process can be fully integrated with similar processes in other centers and throughout the agency, it may help to identify opportunities for the SWFSC to focus on research efforts in areas that have the greatest overall scientific and conservation effectiveness, and for which the SWFSC has a particular expertise or capability that cannot be replicated elsewhere. NMFS must also take a hard look at how it is allocating its resources, and prioritize according to potential to be most effective rather than just making sure everyone gets their piece of the pie.

The SWFSC would benefit from further investments in communicating the science they do and especially the successes they have achieved.

One thing that may help address resource limitations in an indirect but significant way is to place a greater emphasis on communicating successes. The public has an intense interest in the ocean and its charismatic creatures, and opportunities to share stories about the work being done by SWFSC staff should be fully and deliberately exploited.

Peter Dutton's outreach video is a good example of making the SWFSC's research more accessible and real to people, connecting them in ways that help them see the relevance of NMFS' research. It could be used as a launch point to generate a higher level of interest from professional production companies. Another good example of communicating how science is done and why is the collaboration with Mexican researchers and private groups on highlighting the plight of vaquita. Few Americans understand the connection between the overflowing pile of shrimp at their local buffet and the environmental cost it has

on other increasingly rare species like vaquita. Raising awareness about important conservation issues and showing how scientific research is helping to understand, conserve, and recover protected species is an area where even modest investments can have a significant return. This is a natural area for greater partnership with the Southwest Region and with the NMFS Office of Public Affairs, as well as other NOAA offices involved in outreach. The SWFSC website has a wealth of information suited to this purpose and I commend their efforts to use various media formats to connect people with the science and the issues.

Recommendations:

Continue the strong focus on collaborative, multi-disciplinary ecosystem research. Ecosystem-focused research methodologies will provide a broader understanding of factors that are important to the survival and recovery of marine mammals and sea turtles.

Continue to develop tools that will help understand and predict how marine ecosystems will respond to changes in climate. Predictive modeling will help resource managers establish protected areas or other preemptive measures that could help species adapt in the face of a changing climate and warming, more acidic seas.

Support efforts to develop a PBR-like approach to management of human activities impacting sea turtles, especially fishing, and a better way to estimate cumulative impacts. Without a clear idea how many turtles of each species can be taken, and are being taken, while still allowing the population to recover is like playing Russian roulette with these vulnerable populations

Identify ecological trade-offs of alternative fishing methods. In the ETP, shifting from dolphin sets to setting on FADs or juvenile tuna, or using longline gear, all have other ecological impacts that may or may not be more harmful to the ecosystem as a whole. The modeling work presented during the review was intriguing and should be continued.

Continue to explore market-based, non-regulatory incentives that promote conservation of protected species. Market forces could, in the long run, be more effective than regulations in bringing about the desired conservation outcomes.

Look for opportunities to build stronger relationships with NGOs. The NGO community can be a beneficial partner on environmental issues, bringing fresh perspectives, new skills, and considerable expertise as well as communications abilities that can help relay how science is used to effect conservation.

Enhance external communications regarding the science being done and successes. Getting people connected to science and the oceans is an important first step in getting them to change destructive behaviors. The podcasts and other resources on the website are great ways to help tell the story of science. More social networking and outreach materials geared toward different age groups would help broaden the reach of the program.

Focus on key strengths and prioritize projects for maximum effectiveness. As resources become more limited, continued focus and minimal distractions will serve to maximize effectiveness.

Continue to develop partnerships that best leverage existing capabilities. Key government partnerships include Defense (Navy) and Interior (MMS); common goals can help attain information that otherwise would not be available if NMFS were acting alone.

Plan, prioritize, and perform. Constant re-evaluation and taking time to plan and refine goals and objectives helps make best use of limited resources. It also helps keep staff firmly focused on performance expectations.

Thank you again for allowing me to participate in the review. I hope these comments are helpful.

REVIEW OF SWFSC MARINE MAMMAL AND TURTLE PROGRAMS

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I have chosen to format my review in the form of a series of observations that were largely informed by the presentations at the SWFSC on 2-3 June 2009, by my association and collaboration with some of the SWFSC scientists, and by my past exposure to various publications (e.g. peer-reviewed literature and NMFS reports) produced by the SWFSC. After each observational section is a recommendation that relates to those observations. These recommendations are entirely mine and are based on my own thoughts and biases. I hope they will be useful for the NOAA fisheries management and the personnel at the SWFSC.

OBSERVATION ONE: It is clear that each Science Center of NOAA Fisheries has different mandates based on federal laws and treaties, and the specific concerns regarding stocks/populations/species in their area. The Southwest Fisheries Science Center (SWFSC) generally has science responsibilities that encompass marine mammals and turtles in waters off California. The SWFSC also has some studies that occur off Oregon and Washington in collaboration with the NW Fisheries Science Center (although I am unsure how much of this is a collaboration) because some species they study also are distributed off Oregon and Washington (e.g. large whales, dolphins, and Leatherback turtle). Personnel from the SWFSC also collaborate with the AFSC lending expertise for surveys and others studies off Alaska. The SWFSC also has provided personnel and expertise to the PIRO because the SWFSC was recently responsible for this area and the PIRO is only now beginning to develop their own expertise and personnel. The collaborations and relationships with other science centers in the North Pacific was argued to have benefits because it provided help to other centers, increased sample sizes for certain studies, and increased the transfer of techniques and tools among NOAA scientists.

RECOMMENDATION ONE: I personally think that collaborations among science centers are a great thing. It improves the science because it involves more heads in the thinking through of problems and solutions, it may reduce redundancies by allowing certain expertise to be developed in one center but used by all, and the sharing of resources and personnel for field work improves quality, efficiency, and maximizes cost savings. I realize this is not always possible, but any improvement in collaborative research seems worthwhile. There obviously already are collaborations or overlap, with SWFSC conducting or helping with studies off OR, WA, AK, HI and other areas, and with NWFSC personnel conducting studies off CA. Maybe this is being done already, but NOAA Fisheries should have a Pacific-wide integration of research priorities and collaborative studies. This seems particularly important for the SWFSC and the NWFSC because they are studying basically the same system (i.e. the California Current). Another example of the need for collaboration are for studies of species that move among regions, such as Leatherback sea turtles migrating across the Pacific interacting with fisheries off Hawaii (PIRO) and off California (SWFSC). Certainly another level of collaboration is cruises that integrate a number of research projects and personnel. These integrated cruises can be a logistical and personnel nightmare, but if done properly can maximize the use of precious vessel time and money. I commend the SWFSC on their use of multidisciplinary cruises and recommend their continued use in the future. Being a naïve academic, I am not sure how responsive NOAA Fisheries needs to be associated with federal mandates (especially the International Dolphin Conservation Program). Is the commitment forever, do you expend NOAA funds if there are no associated monetary allocations from Congress, who determines what should be done when the legislation is vague, or do you continue your work as you see fit until you get sued?

OBSERVATION TWO: Seems to me that the primary research mission of the science centers should be the monitoring and assessment of stocks. Stock assessment is best conducted by an agency that has the long-term resources and expertise to conduct quantitative, calibrated surveys that provide the best available data on stock size and trends. To determine the condition of stocks, periodic surveys must be completed that are complementary and comparable. This necessitates a standardized approach, with consistent personnel, vessels, equipment, and

methodology. Only the stable funding and personnel of a federal or state agency can undertake such a continuous effort. The SWFSC has developed one of the premier groups for marine mammal and turtle stock assessment. Their personnel were largely responsible for developing the analytical and conceptual tools now used in stock assessments nationwide.

RECOMMENDATION TWO: Continue to fund periodic surveys of marine mammals and sea turtles as needed to maintain the time series to assess status, trends and interactions with fisheries (e.g. PBR). Certain species (e.g. California sea lion, harbor seal, and gray whale) may be surveyed less frequently, whereas those species that are threatened or affect fishery management (e.g. Blue whales and Leatherback turtles for example) should be monitored more frequently. In fact, I do not believe there is an adequate estimate for sea turtle populations, hence this should be a priority. The NOAA fisheries should provide support and MOUs with a variety of academic institutions to make sure that highly trained quantitative population assessment personnel will be available to replace the competent group that currently resides at the SWFSC. It also seems important that more surveys in OR and WA by SWFSC are needed for Leatherback turtles because the NWFSC is not conducting these types of assessments.

OBSERVATION THREE: In my opinion, the scientists at the SWFSC are one of the best and most productive groups in NOAA Fisheries. They do a great job of determining critical information needs and then designing and conducting research to address each question. This approach has worked well for their studies of ETP dolphin issues and the tuna industry. Some urgent TRT issues were minimized with extra effort to provide more accurate estimates of population sizes of marine mammals allowing Category I fisheries to be downlisted to Category II. Their ability to direct effort and funds to specific problems has minimized the number of crises in the southwest region. They are a product of their own success, by producing good stock assessments and attacking fishery interaction problems (e.g. reduction of takes in tuna industry, use of pingers in longline fishery) much of their research is now more question-based than crises-based. I commend the SWFSC for their willingness to use non-NOAA scientists and graduate students to investigate particular science questions.

RECOMMENDATION THREE: Continue to allow hypothesis-driven research but with some limitations and planning. Many federal and state agencies hire personnel when they have a need to tackle a specific problem, and then struggle financially when a new issue arises and they have a larger payroll. I recommend continued judicious use of outside contracts that allows NOAA to use expertise outside the agency, thus allowing more flexibility to address science questions without acquiring long-term payroll commitments. Scientists within SWFSC can conduct some of the question-based science, but much of this could be more effectively and economically achieved with contracts.

OBSERVATION FOUR: The SWFSC has established an ecosystem-based approach to marine mammal and turtle research. The integration of physical scientists from ERD and scientists at SWFSC has allowed them to begin sampling the physical and biological environment that largely controls the population biology and distribution of marine mammal and turtle species. Understanding ecosystem effects can help develop strategies for fisheries management (e.g. time-area closures), assessing population trends (e.g. effects of ENSO events or global climate change), and providing input for the MMPA goal of maintaining the health and stability of the marine ecosystem. The SWFSC has largely constrained their sampling to relatively easily obtained variables (e.g. SST, temperature/salinity profiles using XBTs, and plankton tows) but we expect that distribution and abundance is largely controlled by the prey field of each species.

RECOMMENDATION FOUR: Understanding the ecosystem can be an overwhelming task, one that cannot be completed throughout the entire region or for that matter other areas outside the southwest region (e.g. ETP, Gulf of California, Oregon and Washington, and elsewhere). I would recommend that very specific areas be studied in detail to try and understand the ecosystem function, and that these be conducted primarily in areas where there are problems (e.g. reduced stock sizes). Seems there should not be wide use of NOAA resources to understand general ecosystem function unless you suspect some underlying problem exists. For instance, if blue whale stocks decreased dramatically or did not continue to increase a study of euphausiid dynamics would be of interest, but such a study would not seem to be the responsibility of marine mammal experts. Ecosystem studies are necessary but must be spatially, temporally, and system specific and mostly conducted by scientists that study the physical and prey resources.

OBSERVATION FIVE: Some emerging issues that will occur in the SW region include: (1) the effects of sound on marine mammals, not only Navy operations but all sources of sound; (2) increasing predation of some marine mammal species on protected stocks of fishes (e.g. salmon and sturgeon); and (3) global climate change and effects on stocks. These three issues have been emerging for some time, but it seems that given the lack of other crises in the SW region, that these may become priorities. The SWFSC has done an admirable job of solving or reducing various serious issues (e.g. the tuna-dolphin problem, dolphin and porpoise entanglements, exceeding PBR for some species) by improved fisheries practices, use of pingers, better population or stock assessments. The lack of many crises has seemingly allowed the SWFSC to pursue more question-based research. I do not understand, however, how the SWFSC prioritizes its research efforts. It is obvious you cannot do everything that is mandated, seems important, or is of interest, so how do you establish how vessels, personnel, and resources will be allocated?

RECOMMENDATION FIVE: Regarding the three emerging issues I outlined above, it seems the effects of sound is most tangible and immediately threatening. It is my understanding that there are few bioacousticians in NOAA Fisheries, and my recommendation would be that acoustics play a big part in hiring for the SWFSC. Some Science Center should develop the expertise, and unless other issues are considered more important I recommend the SWFSC develop the resources and personnel to study the effects of sound on marine resources and also expand their expertise in the use of passive acoustics for population assessment. I am one that has spent a fair amount of time studying the interaction of pinnipeds with fisheries. This issue has a lot to do with enforcement and policy thus involves the Regional personnel but I also think it may require at least some effort from the SWFSC scientists, most of which are currently cetaceans biologists. The SWFSC should consider hiring a few more pinniped biologists that may have research duties associated with fisheries interactions or continue to use outside contractors. The final emerging issue of the effects of global change on marine mammals and turtles is of course huge and maybe intractable. Understanding ecosystem functions and the processes affecting marine mammals and turtles may help determine possible changes to populations caused by global climate change. Large oceanography groups in academia may better conduct many of these studies. Again I recommend where possible to use contracts and grants for specific studies of relatively short duration when there is no in-house expertise.

OBSERVATION SIX: It seems that the SWFSC has taken on a variety of projects that are important and necessary but appear duplicative of other efforts in other Science Centers, other federal agencies, academia, and private business. For instance the marine mammal tissue collection and storage project to be used for genetics, contaminants, and stable isotopes seems to duplicate many other efforts in part or whole. Another example is Gray whale assessments off CA used to be conducted by the SWFSC during the northward migration and by the NWFSC during the southward migration.

RECOMMENDATION SIX: I recommend that NOAA Fisheries determine some areas of expertise in the Science Centers around the Pacific possibly create centers of expertise for all the regions. For instance, a centralized Pacific Genetic Lab may be better equipped, more efficient, and more cost-effective than genetics labs at each Science Center. There must be some financial savings in contracting out sample analysis than creating all the equipment and expertise in house. I recognize there are issues of contamination and uniqueness of marine mammal and turtle tissues, but these alternatives should be explored further. This may not work given the differences in perspectives of labs, but I think it should be reviewed.

OBSERVATION SEVEN: Other than the mention of collaboration with some academic institutions and graduate students and that more external funds should be sought, not much was mentioned about use of external funds in the research at the SWFSC. I am a bit sensitive about this subject because I reside at an academic institution where all funds for research must be secured with external funds. My biased opinion is that the salaries of NOAA scientists, the research labs, and the federal research vessels paid by the federal government provide an financial advantage if a federal scientist were to propose a study using all these resources.

RECOMMENDATION SEVEN: I do not know what types of external funds are available to NOAA scientist, but I would like to recommend that efforts to secure outside funds (e.g. non-NOAA funds) be done with some sensitivity that if it is an open competition that there may be an unfair advantage to those supported by federal funding. And harping again on this subject, for certain studies, use of graduate students and other researchers on contracts can be effective, rewarding, cost-effective, and flexible as opposed to hiring new personnel into NOAA.

SUMMARY: The scientists and support staff at the SWFSC are some of the best in NOAA Fisheries. I am impressed by their dedication, output especially in number of peer-reviewed publications, and contribution to marine mammal and turtle science. Their primary mission should be assessment of stocks, something they have done well. Moving forward the SWFSC must develop a process to prioritize the research and use of NOAA resources for future needs, which may involve more collaboration with other NOAA science centers and academic institutions. Finally I recommend that an advisory panel be established with scientists from each of the Pacific NOAA Fisheries research centers together with scientists outside of NOAA to help with prioritization and collaboration of future research directives at the SWFSC.

**Comments on Review of the Marine Mammal and Turtle Research Programs:
Southwest fisheries Science Center, NOAA Fisheries, La Jolla, CA June 2-4 2009**
Prepared by James H. Lecky, Director Office of Protected Resources

Charge to reviews: Provide a written review of the SWFSC marine mammal and marine turtle research programs. Each reviewer's report shall reflect his/her area(s) of expertise, and not consensus opinion (or report) will be required. Please preface the review with an executive summary of comments and /or recommendations. The main body of the review should follow the organization of presentations (e.g. population biology, life history, etc.) and should consist of comments regarding each of the research areas with which the reviewer has knowledge and expertise. Please also include conclusions and recommendations.

Preface:

In general the review was outstanding, well organized, and comprehensive. The Programs have completed or have underway many projects relevant to NOAA's primary goals established by the Marine Mammal Protection Act, Endangered Species Act, Magnuson Stevens Fishery Conservation and Management Act, and International Agreements. And the background material revealed there is much more relevant work that was not presented. The presentations were well done, informative, and I appreciated the consistency of format.

I think the Program is aligned well with NOAA's responsibilities under its mandates. While keeping the goals of the MMPA, ESA, and MSFCMA in perspective, the program has focused on the key tasks needed to implement these statutes. This is to say, these statutes provide a set of tools to use in addressing their respective goals. Generally, these are aligned with some process for evaluating the effects (or impacts) of human activities on protected species and their habitats, mitigating adverse effects, and authorizing takes when effects are within acceptable levels. The life history and condition work makes an important contribution to the process of managing mortality of marine mammals incidental to commercial fisheries by providing information on key vital rates, understanding how those rates may be affected by environmental conditions and stressors. This is essential information for calculation of potential biological removals, and for evaluating the effect of other stressors in the environment of the health of protected resources. While understanding the effect of various activities on individual animals is important, our ability to fully understand individual responses to stressors, and to accumulate those individual responses into predictions of population level outcomes is limited and is likely to remain so in the foreseeable future. Therefore, I think the programs emphasis on identification of management units and population assessment provides a valuable check on how well we are doing and essential information for establishing conservation priorities.

As we move further into the era of climate change and ecosystem approaches to management, the ability to model and predict habitat changes, availability, and use and other ecosystem work will assist in understanding the role protected resources play in the ecosystem, how they help shape the ecosystems of which they are a part, and how they are likely to respond to changing environmental conditions. This information will be useful in evaluating the appropriateness of various management responses to changing distributions and population levels.

The science program undertakes projects and produces results that serve the information needs of many customers, including the internal customers in the Region, other Science Centers, Office of Protected Resources, and external customers such as the Navy, Minerals Management Service, and other offshore industries.

The Program's innovation in new techniques and optimization of work through partnerships with other government agencies, industry, and academia are to be commended. As is the programs use of graduate students to develop skills and people for the future of the program.

With respect to recommendations, I think the program should work to secure funding for its tissue bank. The work supported by that bank is important in establishing baseline reference points for animal condition. It will be important in addressing more refined questions about animal response to various stressors and will assist in further refinement of stock structure, and identification of management units. The center should continue to work through the budget process to secure funding for more frequent stock assessment cruises and so that the Center, as a "center of excellence" for marine mammal survey methodology, can provide timely assistance to other centers to ensure the agency has and maintains current information on abundance needed/required under section 117 of the MMPA. (I realize the Office of Protected Resources can and should help with this recommendation)

The Program should continue and expand partnerships with other agencies. The productive partnership with the Navy is evident. Maintaining and expanding that should be a priority. Other agencies are likely to renew their interest in waters off of California, specifically, MMS and Department of Energy. As interest in the outer continental shelf is renewed and use of the offshore for alternative energy development is explored, new opportunities for partnerships are likely to arise. Likewise other NOAA line offices are likely to look for information on protected species' habitats and habitat use as NOAA becomes active in marine spatial planning.

I recommend closer coordination of issues leading to policy development with the Office of Protected Resources and the Fisheries Service Directorate. For example, the concept of demographically independent populations is well thought out and adds the element of range to the consideration of the health of a stock, but it is not a statutory term and its incorporation in the management framework raises policy issues that leadership should have an opportunity to discuss and debate before it is adopted as agency policy.

Lastly, I found the presentation on analyzing of conservation measures for optimization of benefit intriguing and suggest additional resources be pursued to assist in developing new tools for that type of analysis. Optimizing the trade off between economic effects of a conservation measures and the environmental benefit, could help garner support from affected parties and address the issue of transferring impacts instead of reducing them. If reliable tools could be developed for these assessments, NOAA could improve its effectiveness in international fora.

To what degree do the SWFSC Marine Mammal and Turtle programs address the needs of NMFS' constituents (e.g., Southwest Regional Office, Office of Protected Resources, Office of Science and Technology, Fishery Management Councils, other regional and international management bodies, and other users of the marine environment)?

The programs are well organized to meet the myriad of information needs for management of protected resources. Information produced by these programs informs interagency consultations under the ESA, informs implementation of the incidental take program under the MMPA, including the successful implementation of the offshore cetacean take reduction team. With respect to sea turtles the work is providing information to refine management and mitigation measures for fisheries managed by two fishery management councils. It also provides support to the U.S. positions in international organizations such as the Inter-American Tropical Tuna Commission, International Whaling Commission, and the Convention on the Conservation of Antarctic Marine Living Resources. .

West coast stock assessments are up to date and minimum population abundance estimates are available to calculation of Potential Biological Removal levels for most stocks. The program's support of the CA/OR drift gillnet take reduction team has contributed to making that one of the most successful teams in reducing bycatch.

The tuna dolphin program has a long history of supporting the Regional Office and the InterAmerican Tropical Tuna Commission in dolphin conservation. Although the U.S. is a much smaller participant in the fishery now, the U.S. still has an obligation to monitor the dolphin stocks in the eastern tropical Pacific (ETP) and understand the factors limiting the recovery of stocks depleted by the fishery. The pioneering ecosystem work the program has done and continues to do in the ETP establishes a model for other centers and organization.

The turtle program is also providing support to the Region and fishery management council to minimize the bycatch of turtles and is providing valuable support in characterizing distribution and habitat use. That information supports identification of critical habitat. The information from the tracking program contributes information used by the Region is assessing effects of fishery and other activities on the turtle's present off of the California coast.

The major limiting factor in doing more is resources. The program should continue, with the assistance of the Office of Protected Resources, and relevant PPBES programs to address short falls in assessment budgets so that assessments remain current and additional information needed to inform conservation efforts can be produced. Ideally frequency and precision of assessments would increase and trend information for stocks affected by fisheries, oil and gas, and military activities could be produced.

What is your assessment of research priorities and recommendations for future work as presented?

Research priorities are well aligned to mandates. Areas for future work include passive acoustic monitoring; information on life histories, condition, health to support population assessments; securing funding for the tissue bank; investigating effects of climate change on marine mammal population health, distribution, and abundance, and continuing or expanding efforts to evaluate the effectiveness of conservation measures imposed on industry.

Species currently at the center of controversy over marine sound are those that are cryptic and difficult to assess, particularly beaked whales and other deep divers. Passive acoustic capabilities are developing and being used in monitor effects of sonar on Navy instrumented ranges and by the oil and gas industry in the Arctic. The center is already working well with the Navy on some projects, but expanding passive acoustic capabilities beyond Navy ranges into areas where survey density and frequency is low could provide valuable baseline information on distribution and abundance of these species. Information essential for informed decision making by the Agency's program for authorization of incidental take. Distributing this technology to other areas, e.g. western Pacific, mid-Pacific sea mounts, and Arctic water, could help fill important data gaps, with which the agency struggles.

We are currently able to infer a level of concern about effects of human activities on some populations from information on trends in abundance. For example humpback whales appear to be increasing throughout the north Pacific basin, therefore human activities are not precluding recovery of that species. But we are unable to judge whether the rate of recovery has been or is being affected by human activities such as offshore development, coastal shipping, or military activities. Information on condition of individuals could help improve our assessments of impacts by allowing determination of vital rates and establishing data sets that could allow for investigation of changes over time, or in response to certain events.

I was impressed by the amount of information that can be derived from tissue samples, reproductive condition, hormone levels, contaminant loads, and genetics, and the tissue bank is funded and maintained based on insecure funding. Given the role this work is likely to play in future assessments, funding for the bank should be secured.

Understanding and predicting the effects of climate change is becoming an important aspect of protected resources management. Many of our recovery plan are based on consideration of historical abundance and distribution. Such a basis for recovery plans assumes a stable environment. Climate change will likely contribute to changes in distribution, changes in habitat, and changes in carrying capacity. These changes need to be understood in evaluating effect of human activities, i.e. can we distinguish changes in distribution resulting from coastal shipping from changes due to climate change. There is opportunity here for collaboration with the fisheries assessment programs at the center.

I was impressed with Dr. Squires presentation, management measures we impose on users of the marine environment should produce a conservation benefit in an economically efficient manner. If we are in fact imposing economic cost, putting U.S. industry at a disadvantage, without achieving the intended conservation benefit, we need to know that. I would be interested in seeing more of that kind of analysis presented to leadership and perhaps incorporated as appropriate into biological opinions.

What gaps (research areas, personnel, field and ship time, laboratory infrastructure) can you identify that would improve the quality of science and ability to address related mandates and meet constituent needs?

See comments above about passive acoustics and tissue bank. Improving the precision of assessments and detecting trends in abundance of marine mammal stocks affected by human activities would provide needed support to determinations mandated by statute (negligible impact determinations, and assessments of jeopardy) prior to authorizing incidental take. There is also a need for assessment work in the western Pacific and around the Hawaiian Islands. More ship time would help fill those gaps.

Additional work on development of the PBR-like metric for marine turtles would help accelerate development of this tool and improve fishery management decisions vis-à-vis incidental mortality of sea turtles. As was discussed, poor understanding of sea turtle life history and survival rates has made assessing impacts of incidental mortality in federally managed fisheries difficult, and it has made evaluation of potential mitigation measures difficult as well. For example, the Western Pacific Fishery Management Council has periodically discussed whether incorporating beach conservation programs in fishery management plans as a way of offsetting impacts of mortality incidental in longline fisheries or buying out capacity in gill net fisheries known to take juvenile turtles could offset turtle

mortality in the long line fishery. NMFS has been reluctant to consider such offsets, in part, because age to maturity and survival from one age class to another is poorly understood, making the determination of whether there is net benefit to the population of turtles difficult. While there may be legal impediment to such offsets, those likely could be addressed through policy guidance if the science were available to determine the relative population effects associated with mortality at various life stages. The turtle program should be poised to act on the National Academy of Sciences recommendations on assessment methodology expected by the end of this year.

To what degree does the science address related mandates?

Science in the program is aligned closely to the mandates of the MMPA and ESA. The work on stock structure, abundance estimation, and incidental mortality serves the mandate managing by catch of protected species in commercial fisheries and provides information essential to evaluating effects of take incidental to activities other than commercial fishing, and developing measures to minimize that take.

The agency is beginning to reconsider the global listings of sea turtle and marine mammals under the ESA. The investigations of genetics, contaminants, migrations, inform identification of management units that are consistent with the statutes goal of maintaining diversity. The ecology and ecosystem investigations are helping to define areas to be considered for designation as critical habitat for these species and informing management decisions regarding implementation of measures to ensure human activities are conducted in ways that will maintain the value of that habitat for recovering populations.

The programs work in characterizing the eastern tropical Pacific ecosystem and the California current ecosystem are providing context to evaluation of human activities and place the region in a position to be responsive to new mandates under the MSA to focus on ecosystem approaches to management of fishery resources. This work is also establishing/documenting baseline conditions which will be essential to identifying and monitoring the effects of climate change on protected resources.

What is the quality of the science presented?

The quality is high. The program has a robust planning process that ensures studies are well designed and executed. The extensive publication record is a testament to the productivity and quality of the science conducted by the program. The scientists in the program are innovative in developing new techniques, and equipment to acquire data, placing the program on the cutting edge of survey and assessment methodologies.

Please comment on the degree to which the research includes, and the effectiveness of internal (NMFS) and external collaborations, capacity building, and education.

The Program works well within the agency collaboration with the Regional office and Office of Protected Resources is evident in how well the program provides information to serve the needs of those offices. And the collaboration with other centers contributes to consistency to the assessment programs among the centers as well as filling in gaps in those programs. This is evident in the marine mammals surveys in Hawaii and the assumption of the gray whale monitoring programs. The Splash work is an incredible example of what can be achieved with collaboration. It has provided a comprehensive view of north Pacific humpback whales that will inform many management decisions including revision of the global listing, identification of critical habitat, and evaluation of impacts from energy projects, navy exercises, fisheries, and climate change. The sea turtle program has also demonstrated an extensive collaboration with national and international partners.

The program is building capacity in several ways. The innovation in photogrammetry, chemical assay techniques to assess the health and reproductive status, and passive acoustic techniques are increasing capacity by providing alternative methods of assessing abundance and distribution of animals and determining status of stocks. Some of these techniques may also provide an ability to monitor responses of animals to stimuli such as industrial noise, vessel traffic, and Navy activities that heretofore have been difficult to monitor. The ecosystem work and modeling expertise is expanding capacity of the programs to analyze or predict effects of changes in the environment. And the extensive collaboration with academia and involvement of grad students in the program is providing opportunity for students to explore their interests, increase their knowledge, and brings qualified and motivated people into the agency.

Appendix 3. Minimum ship time requirements for Marine Mammal and Turtle Research Programs.

Overview

Ship time is required for two types of cruises:

i) Cetacean and Ecosystem Assessment Cruises are regularly repeating surveys designed to assess the abundance of cetaceans in a particular region and characterize the ecosystem of which they are a part. Two regions require regular assessment cruises: the U.S. California Current (U.S.-Mexico border to U.S.-Canada border and seaward to 300 nm), and the eastern tropical Pacific (waters within the San Diego to Honolulu to central Peru polygon). Single-page overviews of each (mandates and approach) are available upon request. Both regions are large (>1 million km² for the U.S. California Current and >20 million km² for the eastern tropical Pacific) and a comprehensive assessment cruise requires a correspondingly large amount of ship time (120 sea days for the U.S. California Current; 240 sea days for the eastern tropical Pacific).

The ideal interval for Cetacean and Ecosystem Assessment Cruises can be precisely determined, but is species-specific and appropriate to a particular management objective. Because both regions target all cetacean species and because management objectives are often not quantitatively defined, a survey interval of 3-4 years represents the best practice given multiple species and general management objectives.

U.S. EEZ regions of the central Pacific also require regular assessment cruises. These regions (main Hawaiian islands and the northwestern archipelago, U.S. EEZ waters surrounding Johnston, Palmyra, Wake, Howland, Baker, Jarvis, Marianas, American Samoa) are the responsibility of PIFSC, however SWFSC has continued to take primary responsibility for most of the surveys of these regions to date because PIFSC does not yet have the expertise and infrastructure to do so. Ship time requirements are known for previously surveyed regions and can be estimated for regions never surveyed; the below does not include ship time requirements for any of these regions. Determinants of survey interval are the same for these regions as for the U.S. California Current and the eastern tropical Pacific.

ii) Question-Based Cruises are question/hypothesis driven cruises designed to elucidate mechanisms or to answer a particular management question. These cruises are conducted on a single occasion and not repeated. General questions focus on mitigation of anthropogenic effects, research and development of new methods, calibration of new platforms, reducing uncertainty in analytical products resulting from Cetacean and Ecosystem Assessment Cruises, investigation of seasonality patterns, and addressing species-specific issues. Because the question and region varies, ship time requirements can vary widely.

Minimum Ship Time Requirements

Year 1

240 sea days, 2 research vessels
Eastern Tropical Pacific Cetacean and Ecosystem Assessment Cruise

Year 2

120 sea days, 1 research vessel
U.S. California Current Cetacean and Ecosystem Assessment Cruise

Year 3

~120 sea days, 1 research vessel
Question-Based Cruise
Note that this ship time requirement will vary depending upon the question, from as little as 30 sea days to as much as 150 sea days.

Year 4

None

Appendix 4. Three-year plan (2010 – 2012) of major field efforts required to meet goals of the Response Plan for Marine Mammal and Turtle Research of the SWFSC, and major scientific contributions and products planned from resulting analytical research.

Major Field Efforts

Annual Field Efforts

Gray Whale Calf Production Survey
Mar-May; Piedras Blancas Lighthouse Station, CA

California Current Humpback and Blue Whale Photographic Identification
Jun-Nov; small (4m) boat

San Diego Bay Green Turtle Biology
Nov-Apr; small (4m) boat; San Diego Bay

Monterey Bay Leatherback Ecology
Aug-Sept; SHIELA B. (charter vessel from Moss Landing Marine Laboratories) and 60 h Partenavia (charter aircraft from Aspen Helicopters); Monterey Bay

Indonesian Leatherback Nesting Abundance
May-June; ground-based efforts at nesting sites; Papua Indonesia

St. Croix Leatherback Life History
June-Oct; ground-based efforts at nesting sites; St. Croix

Year-Specific Field Efforts

Calendar Year 2010

Eastern Tropical Pacific Cetacean and Ecosystem Assessment Cruise (STAR)
Aug-Nov; 240 sea days (in study area); MCARTHUR II and SHIMADA (120 sea days each)
Repeated at 3-4 year intervals

Gray Whale Abundance Survey
Jan-Feb; Granite Canyon, CA
Repeated 2 back-to-back years every 3-4 years

Southern California Coastal Bottlenose Dolphin Assessment
Fall-Winter; small (4m) boat
Repeated at 4 year intervals

California Northern Elephant Seal Survey
Winter; 40 h fixed-wing aircraft (charter)
Repeated at 3 year intervals (last survey in 2005)

Oregon and Washington Leatherback Abundance and Distribution Survey
Sept; 70 h NOAA Twin Otter
2010 and 2011

Southern California Loggerhead Abundance and Distribution Survey
Sept; 60 h NOAA Twin Otter
Repeated irregularly during El Niño conditions

Calendar Year 2011

Hawaiian Archipelago Cetacean and Ecosystem Assessment Cruise (HICEAS) – *collaboration with PIFSC; pending SWFSC & PIFSC Director approval*

Aug-Nov; 120 sea days (in study area); Research Vessel TBD

Repeated at 3-4 year intervals

North Pacific Fin Whale Abundance and Stock Structure Cruise

Aug-Nov; 120 sea days (in study area); MCARTHUR II

Gray Whale Abundance Survey

Jan-Feb; Granite Canyon, CA

Repeated 2 back-to-back years every 3-4 years

California Sea Lion and Steller Sea Lion Survey

July; 75 h fixed-wing aircraft

Repeated at 3 year intervals (last estimate in 2008)

California Harbor Porpoise Survey

Aug-Nov; 100h fixed-wing aircraft

Repeated at 4 year intervals (last estimate in 2007)

Antarctic Pinniped and Penguin Abundance

Jan-Mar; 40 h UAS

In collaboration with AERD

Oregon and Washington Leatherback Abundance and Distribution Survey

Sept; 70 h NOAA Twin Otter

2010 and 2011

Calendar Year 2012

California Current Cetacean and Ecosystem Assessment Cruise (ORCAWALE)

Aug-Nov; 120 sea days (in study area); NOAA Research Vessel MCARTHUR II

Repeated at 3-4 year intervals

California Harbor Seal Survey

May-Jul; 65 h fixed-wing aircraft

Repeated at 3 year intervals (last estimate in 2009)

Note: Pacific Islands EEZ Cetacean and Ecosystem Assessment Cruises needed for Palmyra and Johnston Atoll (last conducted 2005), Howland and Baker (never conducted), Jarvis (never conducted), American Samoa (never conducted), Wake (never conducted)

Major Scientific Contributions and Products

Population Abundance Assessment and Trends

- Status of north Pacific humpback whales with implications for down or delisting
- Abundance estimation of beaked whales using acoustic data
- Marine mammal stock assessment reports (produced annually)
- Cetacean abundance trends in the California Current during the past 20 years
- Assessment of status of depleted eastern tropical Pacific dolphin stocks
- Collaboration with Mexico to design and implement an acoustic monitoring program for vaquita

- Abundance and assessment of vaquita
- Designing a quantitative framework for making listing decisions
- The use of unmanned aerial surveys for assessment of living marine resources
- Eastern Pacific gray whale abundance: 2006 – 2011
- Management tools to mitigate anthropogenic impacts on marine mammals and turtles
- Abundance and trends for Pacific leatherback turtles
- Abundance and trends for Pacific loggerhead turtles
- Abundance and trends for Pacific green turtles

Population Structure

- Defining marine mammal species and subspecies globally
- Performance testing of methods used to identify stock structure based on genetic clustering
- Defining units to conserve:
 - Endangered Species Act
 - Sperm whales in the north Pacific
 - Fin whale taxonomy
 - Blue whale taxonomy
 - Killer whale taxonomy
 - Hawaiian false killer whale Distinct Population Segment clarification
 - Marine Mammal Protection Act
 - Bowhead whale stock structure
 - Coastal versus offshore bottlenose dolphin stock structure in California
 - Beaked whale stock structure in the Atlantic
 - Long- and short-beaked common dolphin stock structure in California and Mexico
 - Melon-headed whale stock structure in the Pacific Islands region
- Marine turtle stock structure
 - Leatherback turtles (global analysis)
 - Pacific loggerhead turtles
 - Pacific green turtles
 - Caribbean hawksbill turtles
- Stock identification of marine turtle bycatch in U.S. Pacific and Atlantic fisheries and Chile and Peru
- Evaluation of Distinct Population Segments for loggerhead and green turtles through molecular genetics

Life History

- Fishery-exposure index for interpretation of abundance and life history patterns of depleted eastern tropical Pacific dolphin stocks
- Feasibility of quantifying chronic stress using skin and blubber biopsy samples
- Life history parameters and reproductive biology of long-beaked common dolphins in waters west of southern California and Baja California, Mexico
- Correlation of yellowfin tuna purse-seine fishing with pregnancy rates and fetal mortality in spotted and spinner dolphins in the eastern tropical Pacific
- Abundance and ecology of leatherback turtles through mark-recapture methods and genetic tagging
- Oceanic life-stage elucidation for green and loggerhead turtles through skeletochronology and stable isotope analysis

Marine Mammals and Turtles in an Ecosystem Context

- The role of climate and weather in driving gray whale calf production
- Effects of Humboldt squid invasion on trophic dynamics of California Current cetaceans
- Method-specific ecosystem effects of tuna fishing in the eastern tropical Pacific
- Biological effects of 1977/78 regime shift on mid trophic-level fishes and apex predators in the eastern tropical Pacific
- Atlas of seabird distribution in the eastern tropical Pacific, 1986-2010

- Cetacean species richness hotspots in the eastern tropical Pacific
- Marine mammal and sea turtle habitat utilization in the California Current, in relation to oceanographic variability and climate change
- Mid trophic indices as a predictor of cetacean distribution and density in the California Current and eastern tropical Pacific
- Species-habitat relationships as a tool for improving assessments of depleted eastern tropical Pacific dolphin stocks
- Trophic status and stock identification of Pacific marine turtles based on stable isotope analysis
- Hawksbill turtle habitat preferences and migratory pathways
- Ecosystem-based stock assessment of east Pacific green turtles
- Identification of leatherback turtle distribution and density hotspots along the U.S. West coast
- Best-practice telemetry attachment methods and hydrodynamic drag effects for marine turtles
- Leatherback habitat use patterns in Monterey Bay, CA
- Indicators of marine mammal and turtle and ecosystem state
- Incorporation of marine mammal and turtle assessments into California Current Integrated Ecosystem Assessment

Appendix 5. Example strategic tool for assessing research priorities for marine mammal stocks. Here, each stock is assigned a score for a variety of factors listed across the top (e.g. population size, population trends, intensity of anthropogenic threats). The scores are then totaled into an overall score.

Species	Stock Area	N est	N score	strategic score	trends score	Fisheries bycatch	Anthropogenic reduction in prey	Disease (including HABs)	Pollutants	Marine debris	Ocean Noise	Behavioral disruption	Ship strikes	Rapid habitat alteration	Whaling/Hunting	Risk score	Management concern	Indicator species	Overall Score
vaquita	Mexico	245	10	1.0	3.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	14.5	1.0	0.0	15.5
Humpback whale	CA/OR/WA	1391	1	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	1.0	0.0	0.5	2.0	1.0	2.0	5.0
Gray whale	E. N. Pacific	18813	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.0	1.0	1.0	1.0	2.0	4.0
Sperm whale	CA/OR/WA	NOT SMALL	0	1.0	1.0	0.0	0.0	0.0	0.0	0.5	0.3	0.0	1.0	0.0	0.5	2.8	1.0	0.0	3.8
California sea lion	U.S.	238000	0	0.0	0.0	0.5	1.0	0.5	0.5	0.0	0.0	0.0	0.0	1.0	0.0	1.0	0.5	2.0	3.5
spotted dolphin	ETP, coastal	29800	0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	2.5	1.0	0.0	3.5
spinner dolphin	American	na	0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	2.5	1.0	0.0	3.5
spotted dolphins	ETP, Northeastern	730900	0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	2.5	1.0	0.0	3.5
spinner dolphin	ETP, eastern	631800	0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	2.5	1.0	0.0	3.5
spotted dolphin	Southern	1298400	0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	2.5	1.0	0.0	3.5
spinner dolphin	ETP, Whitebelly	1019300	0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	2.5	1.0	0.0	3.5
sperm whale	ETP	NOT SMALL	0	1.0	1.0	0.0	0.0	0.0	0.0	0.5	0.3	0.0	0.5	0.0	0.5	2.3	1.0	0.0	3.3
Sei whale	Pacific Northern	NOT SMALL	0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.5	0.0	0.5	2.3	1.0	0.0	3.3
Harbor porpoise	CA/Southern OR	39581	0	0.0	2.0	1.0	0.0	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	3.0
Common dolphin, long-beaked	CA/OR/WA	15335	0	0.0	1.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	2.0	3.0
Bottlenose dolphin	California Coastal	323	1	0.0	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	2.0	3.0
common dolphin, short-beaked	ETP, central	406100	0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	1.5	1.0	0.0	2.5
common dolphin, short-beaked	ETP, northern	476300	0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	1.5	1.0	0.0	2.5
striped dolphin	ETP	NOT SMALL	0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	1.5	1.0	0.0	2.5
common dolphin	ETP, southern	2210900	0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	1.5	1.0	0.0	2.5
Harbor seal	California	34233	0	0.0	0.0	0.0	0.5	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	2.0
Guadalupe Fur Seal	Mexico to California	7408	0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	2.0	0.0	0.0	2.0
Fin whale	CA/OR/WA	2636	0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	1.0	0.0	0.5	1.0	1.0	0.0	2.0
Blue whale	Pacific	2842	0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	1.0	0.0	0.5	1.0	1.0	0.0	2.0
Short-finned pilot whale	CA/OR/WA	NOT SMALL	0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	1.5	0.0	0.0	1.5
Brydes whale	ETP	NOT SMALL	0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.5	1.0	0.0	0.0	1.0
Harbor porpoise	Monterey Bay	1492	1	0.0	0.0	1.0	0.0	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	1.0
Harbor porpoise	Morro Bay	2044	1	0.0	0.0	1.0	0.0	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	1.0
Minke whale	CA/OR/WA	NOT SMALL	0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.5	0.8	0.0	0.0	0.8
melon-headed whales	ETP	NOT SMALL	0	0.0	1.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.5
bottlenose dolphin	ETP	NOT SMALL	0	0.0	1.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.5
false killer whales	ETP	NOT SMALL	0	0.0	1.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.5
Mesoplodont beaked whales	CA/OR/WA	NOT SMALL	0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.5
rough toothed dolphin	ETP	NOT SMALL	0	0.0	1.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.5
Risso's dolphin	CA/OR/WA	11621	0	0.0	1.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.5
Baird's beaked whale	CA/OR/WA	NOT SMALL	0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.5

Appendix 6. Agenda from the 2010 Protected Resources Division Strategic Planning Workshop, 16-18 March, 2010.

Part 1: The Past (~2h; Tuesday PM)

Review of 2009 PRD Strategic Planning Workshop, Action Items, Status and Discussion

Part 2: The Future (~1.5 days; Wed – Thurs AM)

Emerging Issues – What are they? How can we (should we) address them?

Priorities - What are they; in what order? Why? How do we balance growth with a flat budget?

PRD's next three-to-five years

Science – How can we get more out of our field efforts and data?

The 2009 Review of Mammal & Turtle Science – and PRD Response

Part 3: Day-to-Day Functioning and Challenges (~.5 day; Thurs PM)

The Balance Between Administration and Science – How do we achieve this? Is it a problem?

Employee Morale

Next Steps