

**NOAA Fisheries
Pacific Islands Fisheries Science Center
External Review Report**

23-25 June, 2009

Review Panel:

Dr. Norm Bartoo	NMFS Southwest Fisheries Science Center
Professor Keith Criddle	University of Alaska, Fairbanks
Dr. Paul Dalzell	Western Pacific Fisheries Management Council
Dr. Charles Karnella	NMFS Pacific Islands Regional Office
Dr. Steve Murawski	NOAA Fisheries Headquarters
Dr. Robert Olson (Panel chair)	Inter-American Tropical Tuna Commission
Dr. Clay Porch	NMFS Southeast Fisheries Science Center
Dr. Steve Reilly	Adjunct Professor, Old Dominion University

A review of the Pacific Islands Fisheries Science Center (PIFSC) was held during 23-25 June at the Japanese Cultural Center, Honolulu, Hawaii. The principal objectives were to review and evaluate the Center's current and proposed pelagic research, and to provide advice to the Center on the direction and quality of the pelagic research programs. The pelagic research programs encompass highly migratory species (such as tunas, billfishes, and sharks), cetaceans, sea turtles, bycatch modeling and mitigation, fisheries oceanography, ecosystem approaches, and international science. This is the third external review of various aspects of the PIFSC in three years, and the first that was focused on pelagic research. The 2008 review focused on the insular ecosystem research and monitoring programs.

Review Format and Report

The review consisted of a series of presentations (see agenda, Appendix 1) interspersed with questions from the Panel and discussions. The review began with introductory and overview presentations by the Center Director, Deputy Director, and International Science Advisor to the Directors Office. These were followed by a panel discussion among a diverse group of Stakeholders (see prospectus, Appendix 2) and the Review Panel. Presentations relating to highly migratory species ensued, encompassing international collaborations, biology, stock assessments, and bycatch research. Following these, the fisheries economics and social science programs, fisheries-dependent monitoring, fisheries oceanography, and ecosystem approaches and climate were reviewed. The final two presentations summarized the research programs on sea turtles and cetaceans. Following the presentations, the Panel members had informal oral discussions about their findings with the Center Director, Deputy Director, and Division Chiefs.

This report aims to summarize the oral comments and suggestions of the Review Panel for the benefit of the PIFSC leadership, as elaborated by the Panel chair. Key sections were adapted from text drafted by other Panel members (the chair thanks them). The

report does not necessarily represent a consensus of the entire review Panel, but attempts to include the salient points discussed. The following comments are structured around the principal questions posed in the prospectus (Appendix 2), which were meant to guide the Review Panel. Comments from the Stakeholders are summarized in a separate section.

Review Comments

The Review Panel members, without exception, were favorably impressed with the scope and quality of the pelagic research being conducted by the PIFSC. Much is cutting-edge research, and the Panel considered that some aspects even provide a vision forward for studies of pelagic ecosystems.

The presentations were of excellent quality, very informative, and provided an effective overview of Center activities in the pelagic sciences. Based on this information and subsequent discussion, the Panel believes that the Center is, in general, engaged in an appropriate mix of activities in broad support of Stakeholder needs and Center mandates. However, we also believe that there are opportunities for additional activities to better address those needs. Comments and recommendations follow, not in order of priority.

Current and planned activities in relation to Center mandates and requirements – are the right things being done?

Fisheries Monitoring and Assessment. Fisheries monitoring in the central and western Pacific Ocean is arguably the most essential and challenging component of the Center's mandates, cross-cutting all the pelagic programs at PIFSC. Staff of the Fisheries Monitoring and Socioeconomics Division contribute to this multi-agency effort by gathering and maintaining data on commercial and sport fishing, oversight of at-sea observer programs, monitoring catch quotas, and conducting research to support fisheries management. It was noted that the observer program run by PIRO/PIFSC is responsible for providing perhaps the best picture in the world of a longline fishery. The Review Panel did not develop specific comments about the structure or operation of routine data collection programs (e.g., logbooks, dealer reports, commercial license records, creel surveys) but instead focused on research programs. Nevertheless, the Panel underscores the fact that research programs depend on the comprehensiveness and quality of routine data collection, and that the design and administration of routine data collection programs can benefit from active research that validates information across sources. The GIS-based data visualization platform, Fishery Analyst, is a promising new development.

Although the review was primarily on the pelagic fisheries, it also touched on the difficulties in dealing with the large and diverse nearshore and coral reef fisheries. In addition to the two longline fisheries in Hawaii and American Samoa, the pelagic fisheries of the Western Pacific use a multitude of small troll and handline vessels, for which there are varied data collection programs, ranging from logbooks or Commercial Marine License forms in Hawaii, and trip tickets and creel surveys elsewhere. Added to this is the large recreational fishery in Hawaii, which is monitored through a joint project conducted between the State of Hawaii and NOAA Fisheries.

The reauthorized Magnuson-Stevens Act requires stock assessments and annual catch limits for all managed species, while the Center has had funding to assess only a small fraction of the managed pelagic and insular species in the Pacific Islands region. Stock

assessments of highly migratory species are mostly international collaborative efforts. To help fulfill U.S. obligations, the Center needs to provide an ever increasing level of scientific support to the RFMOs. Clearly, the level of funding for fisheries monitoring and stock assessment of highly migratory species is inadequate to meet the Center's needs. Limited resources force a struggle to balance the provision of scientific advice to managers and the advancement of fishery science. As a specific example, the number of quantitative personnel was judged inadequate. For stock assessments, currently 5-6 people are facing increasing demands for pelagic and coral reef fishes, including interactions with the RFMOs. At present, there is little time for research while maintaining stock-assessment demands for some 9 stocks. This situation is not unique to the PIFSC. However, a Panel member noted that the ex-vessel value of the resources in the region is on the order of \$3-4 billion, and the agency's funding is much less than a proportional magnitude. The Review Panel encourages the Center to aggressively pursue budget growth so that its reliance on "soft" funding becomes less acute.

Protected Species. The Review Panel found it difficult to evaluate if the right things are being done with respect to research on marine turtles because a substantial amount of work on turtles has been and continues to be done by other institutions (PIRO, WPRFMC, SWFSC), and that work was not presented during the review. It was, therefore, difficult to judge how the Center's work fits into the overall endeavor. The Panel suggests that a general review involving all management-related turtle research in the Pacific Islands area would be appropriate and timely, and would help to identify the directions the Center's turtle work might best be focused in the future.

Sea turtle bycatch mitigation efforts have been funded by the Hawaiian Sea Turtles initiative, a longtime earmark that may be in danger of loss or reduction. Continued funding of this and the PFRP/JIMAR program, another ear mark, will be important for continuing research and training in bycatch mitigation and for reducing the possibility of adverse fisheries and legal implications. Regarding the tagging and tracking of hooked and released turtles, the Panel appreciated the active collaboration with the SEFSC and other turtle researchers, and applauded the use of existing expertise and accomplishments elsewhere to help with this program's work. The Panel also was encouraged to hear that an active collaboration had begun with researchers from the SWFSC's turtle program, and recommended that this collaboration be encouraged and supported.

Under the MMPA and ESA, the NMFS is responsible for the conservation and recovery of protected cetacean species. The cetacean program in the western and central Pacific is off to an excellent start, but faces daunting challenges. The EEZ areas to be covered are vast, disparate, and dispersed, and currently none of the over 15 species of cetaceans in most EEZ areas have been adequately assessed. In some EEZ areas, even an elemental inventory of the cetacean fauna is lacking, and aside from Hawaiian waters there are few or no abundance estimates or status determinations. The cetaceans of the EEZs in the central and western Pacific are without doubt the most poorly known of all US EEZ areas. PIFSC's cetacean program is the most understaffed in the agency, and more research and support staff is required for more research to be done. The urgency to shore up this program possibly outweighs the priorities of other programs. The Panel noted that this item is at the top of the PIFSC's Integrated Priorities List (underfunded priorities).

The Panel encourages the PIFSC to keep a clear distinction between methods that are currently operational for estimating cetacean abundance and those requiring further research and development for eventually determining the status and trends of those stocks within the EEZs of the central and western Pacific. The development of acoustic tools with limited resources is impressive, while noting that, at present, acoustic tools alone are not sufficient to estimate population or stock abundance. Estimating abundance still requires visual surveys or mark-recapture studies, and this will not likely change in the near future. Continued work on using acoustic methods to extend the value of visual sampling is strongly encouraged. Autonomous acoustic samplers are of great value in determining presence/absence, and will be a valuable tool in completing the inventory of species in the EEZs.

The Panel recommends that the Center develop a strategic plan for development of its cetacean research program and for assessing the abundance, status, and trends of cetacean stocks within the EEZs of the Central and Western Pacific. This planning should include participation by the SWFSC, PIRO, OPR, and office of the Director of Scientific Programs and Chief Science Advisor. Given the history of PIFSC, the SWFSC's Protected Resources Division has been an important contributor to conducting ship surveys and stock identification studies in the region. An essential part of this planning exercise will be to determine the relative roles of the two Centers in conducting cetacean research in the Pacific Islands region. It will also be helpful to set timetables for surveying the entirety of the zone, conducting further R&D on developing and expanding the use of acoustic tools, and adding staff to the program as it develops to a mature state.

Economics and socioeconomics. The Center's Economics and Human Dimensions Research Programs are components of the Fisheries Monitoring and Socioeconomics Division. As noted in the 2008 Center External Review, chaired by Professor Boehlert, these two programs have the potential to contribute to forwarding the NOAA agenda for an ecosystem approach to management. The diversity of scale of commercial fishing operations, their wide geographic dispersion, and the presence of sport and subsistence fisheries that target commercial species and enter into barter and cash markets contribute to the challenges of data collection and fishery monitoring, and greatly increase the need for economic and socioeconomic studies.

The Economics and Human Dimensions Research Programs are small but productive. One danger inherent in a small program is that the obligations of tabulating routine data can displace the pursuit of analytical studies. It is commendable that the Economics and Human Dimensions Research Programs have nevertheless completed some excellent studies. Two projects stood out as particularly noteworthy.

The first of these projects, the Fishing Ecosystem Analysis Tool (FEAT), involves the development of a GIS representation of spatial patterns of sources, distribution paths, and disposition of pelagic fish landed on Oahu. This project provides a helpful characterization of the extent to which the flow of fish is local rather than regional. Similar studies for other species and on other islands could serve as a basis for fishery profiles to complement community profiles.

The second noteworthy project was a bioeconomic model of the Hawaii-based pelagic longline fishery. The integration of models of economic decision-making about choices of fishing location and target species adds predictive power to biological models of the

distribution and concentration of target species and the probability of turtle bycatch rates. Extending this model to reflect heterogeneity across vessels will increase the ability of the model to predict changes in fishing effort, CPUE, and bycatch in response to contemplated management actions, changes in input or output prices, and changes in the absolute and relative abundance of the target species. Data requirements may limit the extension of this methodology to other fisheries and regions, but this approach could prove possible and useful for other major commercial fisheries, e.g., as a model of bigeye bycatch in purse seine fisheries.

Biological studies of HMS. The Panel was impressed with the quality and innovation of the biological research on highly migratory species. International collaborations for aging swordfish, striped marlin, and white marlin have been useful for distinguishing regional versus methodological differences. The Panel members saw indications, however, that sample coverage for biological studies could perhaps benefit from optimizing sampling designs. Samples are collected by observers at sea, and the Center's role of optimizing the overall sampling design might be re-evaluated and somewhat improved. There appears to be a need to go beyond opportunistic sampling when feasible.

Opportunities – are there opportunities that the Center should be pursuing?

The Review Panel members saw a clear need for increasing collaboration with other nations, particularly developing nations, for sampling and data management. To accomplish this, increased emphasis on training would be needed due to reduced longevity of hires from other regions working in the islands. The Center is aware of this need; some training has occurred and an exchange program with Shanghai University exists. It was not clear to the Panel, however if/how the training that has occurred has been beneficial. Training and sampling inadequacies were also articulated by the Stakeholders (see Stakeholders' comments), and the Panel agreed that local capacity should be developed.

The Economics and Human Dimensions research programs could benefit from the development of a 5-10 year planning document. The planning document should set forth principles for a desired mix of servicing routine data programs, responding to or anticipating WPRFMC requests for analyses, providing rapid analyses of emerging issues, and engaging in more fundamental research projects such as the two described in the previous section. In addition, the plan should outline a rough priority for projects to be undertaken in the next 5-10 years, assuming constant staffing and under steadily increased staffing. A planning document can provide a basis for demonstrating the extent to which additional staff are needed to address priority research needs.

The Review Panel offers the following ideas of additional fundamental social and economic research directions for the PIFSC. Areas to consider include investigations of price determination processes in key commercial species, bioeconomic models linking movement of fish and fishermen in time and space, and models that link ecosystem indicators and economic and socioeconomic indicators aligned with the fishery. Examples of projects that anticipate WPRFMC needs include studies to determine the potential roles, goals, limitations, and design characteristics for LAPPs, other variants of catch-share-based management programs, and MPAs. Examples of needed rapid response

projects are those that explore the likely impacts of the impending closure of fish processing operations in American Samoa and studies that look into possible mitigation strategies, *e.g.*, attracting a replacement processor and development of new marketing channels.

Scientific approach – is the Center using the best suite of techniques and approaches for meeting its objectives?

This Panel concurs with previous PIFSC External Review Panels in praising the Center's research programs. In general, the Panel members found the scientific approaches used by the Center to be exemplary. Center scientists commonly employ multiple data sources and cross-over information in their work. The number and quality of publications by Center scientists appears to be good.

One of the goals of the HMS programs' mission is to provide scientific advice to develop ecosystem approaches to management. The Center is engaged in ecological studies that address the indirect effects of fishing (primarily targeting the upper trophic levels) that act through the food web. Reliable information on the complex structure and function of the food web is essential for understanding how top-down effects of fishing are manifested on the food web and for reliable food-web depiction in ecosystem models. PIFSC scientists are not directly investigating food web linkages, but effective collaborations are maintained with researchers at the University of Hawaii who are using a suite of technological tools (stable isotopes, fatty acids) along with traditional stomach-contents analysis. These collaborations are fruitful and cost-effective, and should be encouraged. PFRP/JIMAR support of this work is essential.

The Panel also supports the Center's concept of simultaneously developing multiple ecosystem models that have differing assumptions for the central north Pacific (Ecopath with Ecosim, SEPODYM, size-based models) for improving insight on the ecological effects of fishing.

Tagging studies were an important topic of discussion. Large-scale regional tagging programs of tunas and other pelagic species are operating or being planned in specific regions of the Pacific, Atlantic, and Indian Oceans. The principle objective of tagging studies is to improve the scientific basis for estimating exploitation, movement, natural mortality, and growth rates. Most large-scale tagging programs are conducted or coordinated by the RFMOs, with support from other entities. The consensus of scientists at a prioritization workshop convened by the PFRP at the University of Hawaii in 2005 was that Pacific-wide tagging experiments are necessary for the primary market species of tuna. The Review Panel noted that spatially explicit models are needed for international management on a spatially relevant scale (which again argues for increasing sampling partnerships). The PIFSC is involved in small-scale tagging operations at cross seamount and to estimate post hook release mortality of striped marlin, but not at the scale required for international management of tuna stocks. The Panel recommends that the Center consider ways to augment and support large-scale tagging efforts currently underway by the SPC, WCPFC, and IATTC.

A Panel member emphasized the need to build up existing stock-assessment expertise and improve the models being employed.

Another Panel member recommended including cetacean observers on the oceanographic cruises, as is done in other regions.

Organization and priorities – is the Center properly organized to meet its mandates and is the allocation of resources among program appropriate?

Panel members expressed concern about the implications of having “contract” personnel in positions that require long-term continuity. Overall the ratio of “contract” full-time employees to federal full-time employees is considerably higher than at other Science Centers. Some “contract” employees appear to be critical or key to long term Center research operations. Given that Joint Institutes may be forced to reduce the duration of staff terms, advance planning appears to be desirable to avoid loss of critical functions. The situation is exacerbated by the relatively high proportions of temporary funds to permanent funds. Although the percentage of budget comprised by permanent funds has increased relative to FY 2005–2007, in the Panel’s judgment 60% funding by earmarks and contractors is a risky situation to sustain. Headquarters could help the situation by permanently allocating internal funds which are currently allocated as annual (temporary) funds.

Sea time is a pressing issue exacerbated by the vast ocean region under the Center’s purview. There is only one NOAA ship assigned to the PIFSC, and its 215 sea days planned for FY-2009 are spread across all programs. The NOAA ship Hi’ialakai and assorted small vessels play an important role in non-pelagic research, but don’t appear to have a role in pelagic research for the most part. Sea time is a critical rate-limiting factor, and a Panel member suggested that additional time on all three NOAA ships stationed in Hawaii is needed for Center research priorities. It was also suggested that some work (e.g. placing instruments *in situ*) could be done in conjunction with ship operations focused on the maintenance of oceanographic buoys.

The Panel noted that both previous external reviews encouraged initiating and strengthening interaction among Divisions on several issues. It is not clear if any of the five approaches suggested in 2008 to improve inter-division coordination have yet been implemented. A Panel member commented that research coordination between Divisions appears to be somewhat *ad hoc*, with critical oversight by the Center Directors offices. Consideration should be given to mechanisms that insure critical coordination proceeds according to a deliberate procedure that allows more formalized coordination between Divisions and Programs and is less dependent on individual personalities.

Coordination between the PIFSC and the SWFSC needs to be reformalized, as does coordination between the PIFSC and PIRO. Furthermore, it appears to be an opportune time to revisit the agreement between the PIFSC and the SWFSC on the division of responsibilities, which was drafted when the PIFSC was created. This will cover HMS, data processing and reporting, protected species, and other items, and will encourage cooperation and collaboration.

The issue of limited staff and space was apparent during several aspects of the review (see Fisheries Monitoring and Assessment, above). Staffing and space issues were also noted as impediments to progress for both the turtle and cetacean programs. In particular, the lack of office and lab space was among the top impediments to adding needed staff. For both programs, there is a need for technical support to handle administrative and

budgeting tasks so that the scientists can dedicate more time to conducting research and program building.

Scientific conduct – are the Center’s programs being conducted properly (integrity, peer review, transparency, etc.)?

This Panel concurs with previous PIFSC External Review Panels in answering yes to this question. The Center’s programs are being conducted at a high level of integrity and transparency. However, Panel members expressed the following concerns.

It appears that, especially for turtles, a considerable amount of research is being conducted by both the Fishery Management Council and the Region, in addition to the PIFSC. Concern was expressed that the amount of science being done by management agencies could result in a perception that the science is not unbiased, but driven by management. The Council’s new entrance into the external review process is an opportunity for its committee to arrange for external quality reviews to span research products from all three groups to insure the best available science.

It became apparent to the Panel that the Center needs to continue working to improve the linkage of data sets (observer, logbook, trip tickets). In particular, a vehicle for incorporating corrections to the data base should be developed (stock assessment scientists find and report errors that reappear in subsequent years).

Stakeholders’ comments

A group of invited “Stakeholders” and the Review Panel held discussions for the allotted two-hour period on 23 June 2009. The comments were positive and constructive. In addition, on the final day of the review, the staff of the Western Pacific Fisheries Management Council (WPFMC) submitted a synthesis of comments to the Chair, but too late to be considered by the Panel. The following bullet points summarize the salient points of the panel discussion with the Stakeholders and the written comments by the WPFMC staff.

Three archipelagos, Hawaiian Islands, Marianas Islands, and American Samoa, have a new generation of needs which have grown at a faster rate than the Center’s ability to address them. The different archipelagos have unique bio-geographic characteristics, human demographics, and cultures. Recognizing that the following products require a considerable investment in time, effort, and resources, the Stakeholders nevertheless underscored the following needs.

- Stock assessments of lesser pelagic species, including mahimahi (dorado, *Coryphaena hippurus*), ono (wahoo, *Acanthocybium solandri*), opah (moonfish, *Lampris regius*), and monchong (pomfret, *Taractichthys steindachneri*). There is apparently a consensus among the Stakeholders and Center scientists about the species composition of this list. Stock assessments of marlins and sharks are also needed. The WPFMC also highlighted a pressing need for more support of their demersal programs, particularly life history studies of reef fishes and corals, as well as species assessments. The Center was encouraged to develop a timeline for providing stock assessment information on species that are risk-ranked by archipelago plan teams, and for more participation in meetings in other island areas.

- Ecosystem indicators and long-term ecosystem monitoring are needed to address new challenges of climate change, eutrophication, ocean acidification, marine protected areas, etc. Participants were quick to point out, however, that there have been important contributions by the Center, highlighting Ecopath and TurtleWatch. As an initial step, the Center might focus research efforts on determining effective methods of ecosystem monitoring for the archipelagos. Modern technologies are encouraged (acoustics was mentioned as an example), while a CALCOFI-style program of *in-situ* monitoring is too costly for such a vast, remote area. The Center was encouraged to more actively pursue new funding sources to gather data on archipelago ecosystem processes and to do more modeling and analysis.
- Capacity building. Several participants expressed concern about a shortage of trained people to meet the needs of the U.S. Pacific Islands. The retirement of a professor in the marine mammal program at UH will exacerbate the problem. Needs include sampling of the catch, including otoliths, gonads, and stomach contents. There is strong perception of the importance that training opportunities be initiated or expanded locally so trainees are more likely to stay and work in the islands. More human resources are needed for increased data collection, monitoring, and research *in situ* in the island areas. It was noted that there are no fisheries schools in the entire western Pacific. Ideas included funding a faculty position in fisheries science at UH, establishing a training facility in Hawaii, establish satellite laboratories to study basic life history process, and public-private partnerships. CTI may provide opportunities for training funds. There also was some concern expressed that the Center should increase its capacity for conducting studies on the effects of economics and fishing capacity on the fisheries and the affected species. This would be particularly useful in the future as RFMOs begin to deal with these matters in greater depth.
- Data mining. The state of Hawaii has some 50 years of data (including pelagic species) that were underutilized due to shortage of staff. The sources include fisheries-dependent data such as commercial landings and logbook data. Some of these data provide opportunities for looking at long-term trends in the pelagic habitat, for example. Some of these data have been utilized, *e.g.* coral reefs, but further opportunities exist.
- Modeling. The need for models that support spatially-explicit management was expressed by the Stakeholders. The impact of catches is area-dependent, and spatially-explicit modeling tools (decision frameworks) that incorporate economics would be useful. This ties into the idea of increased localized monitoring of systems (above), for improved inferences about populations and movements.
- Cooperative research. A participant expressed the need to continue, and if possible increase, cooperative research funds in the Center budget. It is important to continue and encourage more interaction with the fishermen and the island communities. The cooperative research program was indicated as an example that would benefit from improved communication between the Center and the WPFMC.
- Education and outreach. There is perception that more can be done to disseminate the good science that is being done at the Center and elsewhere. Members of the Review Panel agreed that this is a NOAA-wide issue, whereas other federal agencies (the

Office of National Marine Sanctuaries, for example) encourage “getting the word out.” The Center’s outreach and education personnel were encouraged to better coordinate with the WPFMC regarding communicating information that has fisheries and protected species ramifications to the media and addressing misinformation in the media.

The Stakeholders requested research to support the development of 1) catch-share based management structures and 2) models of fishermen’s choices of fishing location and how those choices depend on regulatory measures and management actions.

Concluding remarks

On behalf of the entire Review Panel, I wish to thank the Center and its staff for a stimulating three days and for making us feel welcome. I can confidently report that the panel members were impressed with the Center’s pelagic research program. I hope that the comments summarized herein prove to be useful.