

Pacific Islands Fishery Science Center
Review of Information for Fishery Stock Assessments
June 25-27, 2013, Honolulu Hawaii
Prepared by Gordon Tribble, USGS Pacific Island Ecosystems Science Center

Introduction

NOAA Fisheries is doing external reviews of the data used in fishery stock assessments by its Science Centers. The review for the Pacific Islands Fisheries Science Center (PIFSC) was done June 25-27 by a panel of 7 scientists. Three of the reviews were from NOAA offices outside PIFSC, three others were non-federal, and one was employed by another federal agency. During the course of 3 days, the panel had both formal presentations and informal discussions with PIFSC staff and some associates. The dialog was candid and constructive. Reviewers were asked to submit independent reports that could be used to address the following topics:

- Relationship of current and planned fishery assessment data activities to Center fishery assessments mandates and requirements – is the Center doing the right things?
- Opportunities – are there opportunities that the Center should be pursuing in collecting and compiling fishery assessment data, including shared approaches with partners?
- Scientific/technical approach – are the Center’s fishery data objectives adequate, and is the Center using the best suite of techniques and approaches to meet those objectives?
- Organization and priorities – is the Center’s fishery data system properly organized to meet its mandates and is the allocation of resources among program appropriate?
- Scientific conduct – are the Center’s fishery data programs being conducted properly (survey design, standardization, integrity, peer review, transparency, confidentiality, PII, etc.)?

The Pacific Islands Fisheries Science Center in Honolulu, Hawaii is one of six national NOAA Fisheries science centers. PIFSC is responsible for research on marine fisheries, protected species, and ecosystems in the entire western and central Pacific Ocean, including coral reefs, insular (near island) habitats and pelagic (open ocean) environments, and the human communities that rely on these natural marine ecosystems. PIFSC spans the Pacific Basin and is responsible for over than 1.7 million square nautical miles of ocean. In fiscal year 2012 the PIFSC budget was \$30 million and supported a staff of 220 researchers, technical personnel, and administrative employees. PIFSC monitoring, research and operations are authorized by several important legislative and executive obligations. Relevant here are the Magnuson-Stevens Fishery Conservation and Management Act and international treaties related to the management of tuna fisheries.

This document is one reviewer’s attempt to synthesize the information and make recommendations that will be helpful to PIFSC as it moves forward with its mission to provide sound science as a foundation for informed fishery management. There likely are inaccuracies in the report; nevertheless, I hope that some of the recommendations presented herein are beneficial.

Observations – General

The Pacific Island Fisheries Science Center (PIFSC) has a tremendous mission in terms of geographic, political, and cultural scope. Stock assessments focus primarily on highly-migratory species (HMS), bottomfish, and reef fish. Assessments for each of these fisheries are affected by a different set of complications, as discussed below. PIFSC staff seemed focused and dedicated to their mission, although changes in some workflow practices might result in increased efficiency.

Most the information used for stock assessment is fishery dependent. Fishery independent methods for various stocks are under development, but it is unclear how cost-effective they will be and how they will support or integrate into existing assessment models. For at least the near future, stock assessments are likely to be based on fishery-dependent data. Furthermore, nearly all historic data are fishery dependent

PIFSC relies heavily on data supplied by other agencies or other parts of NOAA. In many cases, the data collection program was not designed to support stock assessments. In some cases, the data collection program has been modified to better support stock assessments. Regardless of the original intent, the operational reality is that assessment will be driven by imperfect data sets. That situation is pervasive in nearly all cases where science is asked to inform the management of natural resources.

PIFSC has a long culture of electronic data management. Stewardship is taken very seriously and the level of pride and professionalism is evident. However, there is a high degree of complexity introduced by having multiple platforms and data stewardship procedures. Current data management and information flow is complicated by multiple hardware and software systems, dispersed offices, and blurred lines of responsibility for data analysis and sharing as mission shifts require new lines of information flow. In some cases, there seem to be problems with the accessibility of data housed both within PIRSC and by partner organizations. The Center has a data management committee (DMSC) to identify and address issues. The DMSC seems to be a relatively new entity, and its not clear how deeply it can reach and untangle some of the data flow and management issues.

Data collection outside Hawaii relies heavily on creel surveys carried out by local management agencies. PIFSC provides financial support to these agencies. Despite this, staff turnover is high, and IT and other support is limited. This can result in data gaps, quality issues, and lags in processing. The challenges of building capacity with Pacific Island partners is not restricted to fisheries and not likely to readily fixed using paradigms applied in North America.

Recommendations – General

PIFSC is encouraged to continue progress to streamline data management and records flow, especially the effort required for revisions, and ensure proper documentation of changes. Consideration should be given to an “audit” of all data streams and programs that flow such data into PIFSC to ensure that they are justified and necessary, meet minimal metadata standards, and are needed for stock assessments or some other critical work by PIFSC.

PIFSC should press forward with hiring a centralized data manager to oversee the processing and analysis of data. That person will also track data requests, plus document and coordinate a response. The DMDC should be retained with the data manager as chair. The data

manager should probably have an IT background and working familiarity with the craft of fisheries biology so that they can work most effectively with staff to design and implement effective protocols.

Researchers gave a range of opinions on the availability of data. Some felt that access was not a problem, while others cited long delays before data could be accessed. PIFSC should move to develop rules and expectations for data sharing within the Center.

Stock assessments rely on multiple types of data, each with varying degrees of uncertainty. It is necessary to know the uncertainty in each component of a stock assessment in order to reduce the overall uncertainty. Therefore, PIFSC should do a series of sensitivity analyses to determine the largest uncertainty in supplied catch data, in terms of its effect on stock assessment. This will allow prioritization of effort into reducing the overall uncertainty. It may also result in some efforts being abandoned because their inherent uncertainty, even under ideal circumstances, is too high to permit calculation within an acceptable level of certainty.

For all three types of stocks, ecologic and oceanographic data are being collected to develop fishery independent assessments. However, it is not clear how information from these approaches feed into either current methods or future assessments. While the development of fishery independent methods should be pursued, there should be a clear path between the information obtained from such work and its use in stock assessments. PIFSC should consider formalizing a process, guided by broad input, to transition fishery independent survey methods from research to an operational status that supports stock assessments.

Life-history data was repeatedly referred to as a bottleneck. This is not surprising given the small staff, large number of samples, and high demand. Nevertheless, faster processing of life history data is needed. This might be done through increased internal capacity, contracting with another organization, or a combination of the two.

The financial support PIFSC provides to local fishery management agencies may need to be rethought in terms of its effectiveness for building local capacity. Obviously, the funding is important, and perhaps even essential for some agencies. However, PIFSC might need to think of other ways to increase their capacity for faster analysis and summaries of locally-collected data. Capacity building is difficult and there is no formula, so constructive dialog and creative approaches will be needed.

Observations – Highly Migratory Species

This is an international fishery spanning the Pacific basin. The US catch is a small proportion (about 10%) of the total fishery. Nearly all data used in stock assessments is fishery-dependent. The collection of fishery independent data, such as tagging studies, is very expensive and requires considerable international cooperation.

The two main methods are purse seines and long lines. The catch from the long-line fishery is higher-value. Most of the US fleet operates from Hawaii. The monitoring of catch data from long-line catches in Hawaii is complete and verified through cross checking observer logs with sales records.

The US share of the purse seine fleet has traditionally offloaded at the cannery in American Samoa, but they are increasingly using other ports. Records from purse seines are complicated by difficulty for shipboard observers to collect good records and vessels offloading at non-US ports. Furthermore, identifying species of small tuna in purse seines is problematic, so the recorded catches for each species may be inaccurate.

Striped marlin are in decline. There appear to be two distinct populations, one in the Western Pacific and the other centered near Hawaii. A researcher from PIFSC was the lead author in a recently published age-based stock assessment model. Future work will involve reducing sources of uncertainty in model parameters. Also in question is if the focus should be for more work on the Hawaii stock or work on the Western Pacific population.

PIFSC is developing models that correlate oceanographic parameters with swordfish stock. Although not ready for stock assessment, these models are becoming increasingly refined and provide insight into how climate change and other factors may affect swordfish populations.

Recommendations – Highly Migratory Species

More effort should be devoted to improving catch data from purse seiners, including collecting catch information from vessels that offload elsewhere than American Samoa, and better assessment of the species composition of small tuna. Given the difficulty of species ID during vessel offloading at dockside, this might be best accomplished by modifying the protocols used by fishing vessel observers.

The stock assessment model for striped marlin could be improved with continued work, especially with attention to the parameters that most affect model uncertainty.

There was some discussion about the collection of more fishery-independent data. PIFSC should consider if a program to tag bigeye tuna near Hawaii would help with stock assessments. It is recognized that tuna tagging projects can become expensive and may require considerable international cooperation.

Observations – Deep 7

The Deep 7 is a subset of a complex of 14 species of bottomfish. The Deep 7 live in deeper water and command high market prices. They are generally caught with handlines and effort is expended to maintain the freshness and general quality of each fish.

There is a time series of reported landing that goes back to 1948. This data set is very valuable and increasing in quality. It is felt that nearly all commercial landings are recorded. There have been continued refinements in the type of data collected, the processing of the catch logs (by Hawaii DAR) and the timeliness of reports that track total catches relative to regulatory limits.

PIFSC operates several bottomfish data bases that use information from local partners. Much effort is needed to track and document updates and revisions. In some cases, this has limited the access of data or resulted in delayed availability. Much of this seems to be based on historic practices and platforms. Stock assessments for the Main Hawaiian Islands and American Samoa have been completed within the last few years.

Reporting by fishers has increased because they feel that they need a documented record of fishing activity in case of closures. Despite regulations that all fishers (including recreational)

provide catch reports, there is still uncertainty about the level of unreported recreational catch. Also there are differences in fishing style and gear that complicate the assessment of CPUE

There is fairly good life history data for one species (opakapaka), and PIFSC has developed innovative dating methods using radioisotopes that augment and extend age curves beyond standard analysis of otoliths. Data for other species is very limited. PIFSC would like to be able to eventually do single-species stock assessments, but the data to support that currently does not exist.

PIFSC is researching a combination of fishery independent assessment methods such as camera drops, autonomous gliders, acoustic sampling, and contract fishers to determine their effectiveness in assessing fish stocks. The goal is to determine which combination of techniques provides a practical and effective fishery independent stock assessment. Each of the methods has drawbacks and benefits.

Data outside Hawaii is based on creel surveys conducted by trained interviewers. However, it is felt that the records are not that are not as complete or reliable as those for the Hawaii fishery due to the limited resources and staffing challenges.

Recommendations – Deep 7

An effort should be made to streamline processes and eliminate choke points caused by multiple bottomfish data bases. Protocols with partner agencies for database sharing and updating should be reviewed to see if redundant efforts can be reduced.

The processing of demographic data appears to be a bottleneck. The general recommendation (above) regarding demographic data is especially relevant to the understanding of the Deep 7.

It was noted that catches of uku are increasing. This species is not one of the Deep 7, and not subject to the regulatory limits for those fish. As regulations restrict fishing for the Deep 7 and demand for fresh high-quality local fish rises, fishes may be increasingly targeting uku as a shallow-water and unregulated alternative. PIFSC may consider increasing the collection of data for this species with an eye to the future.

PIFSC should continue to refine fishery-independent survey methods with a goal of developing an operational and cost effective assessment. The Center should determine the extent of resources that will be needed to develop an effective method and consider a cost-benefit analysis to prioritize approaches.

Data for recreational catches of bottomfish are uncertain. To the degree that this may be a significant part of the fishery, the reliability of stock assessments is reduced. PIFSC should evaluate the sensitivity of stock assessments to uncertainty in recreational catch data and determine if allocation of additional resources to estimating recreational catches is warranted.

Observations – Reef fish

Most reef fish are caught within 3 miles of shore. This limits the level of federal jurisdiction and involvement. Nevertheless, PIFSC has worked provides expertise on data collection,

management, and analysis. WESTPAC sets annual catch limits (ACL), mostly based on Tier 5 stock assessments, which are a “best-judgment” estimate of the percentage of the annual catch.

Analyses of reef fish transect data from Hawaii shows that fish abundance decreases with proximity to population centers and ease of ocean access. There is reason to believe that reef fish stocks in Hawaii have been significantly depleted, but it does not appear that data exist to support rigorous stock assessment models for reef fish species.

For most of the Pacific, catch data is from creel surveys operated by local agencies. Because of limited capacity and staff turnover, there are questions about the quality and robustness of the data. However, the large number of species, many islands, and scant resources may preclude more elaborate data collections efforts. PIFSC is to be commended for the diligence it has demonstrated in the face of numerous obstacles. Nevertheless, the paucity of reliable data and the large number of species limit the sophistication of models that can be used to assess and manage reef fish stocks.

There is an effort underway to use diver estimates of species counts and length distributions to estimate stocks of reef fish. This fishery-independent method may provide considerable insight but the program overseeing the data collection is not targeted towards stock assessments.

Recommendations – Reef fish

Current method seems based on very limited biologic data. PIFSC and other entities should strive where possible to improve the quality and scope of data on coral reef fisheries.

The panel saw three approaches to estimating reef fish stocks and setting management targets (Tier 5 calculation of ACL from WestPAC, an analysis of length relationships in caught fish, and underwater counts). These approaches do not seem connected and each has significant weaknesses. However, taken together they may bolster each other and provide a stronger assessment methodology. PIFSC should step back and consider a hybrid approach that might yield more robust data.

Pacific Islands Fisheries Science Center (PIFSC)
Program Review of Information of Fishery Stock Assessments
Dates: 25-27 June 2013

Background

The PIFSC's mission is to provide timely, high-quality applied scientific information to support the conservation and management of fisheries, protected species, and marine habitats in the central and western Pacific Ocean. PIFSC provides data, information, analysis and technical advice to the NOAA Fisheries Pacific Islands Regional Office, Western Pacific Fishery Management Council (WPFMC) and other conservation and management responsibilities within NOAA as well as international scientific bodies such as the Western and Central Pacific Fisheries Commission's Scientific Committee (WCPFC), the International Scientific Committee on Tuna and Tuna-like Species (ISC), and PICES (the North Pacific Marine Science Organization).

The geographic area of responsibility of PIFSC's activities is vast and includes partners with the State of Hawaii, the Territories of American Samoa and Guam, the Commonwealth of the Northern Mariana Islands. These geographically different sites are also characterized by culturally distinct communities. In terms of fisheries, the oceanic areas that PIFSC's efforts have to address/sample include open oceans, seamounts, coastal and coral reef systems. Fisheries species include highly migratory species (HMS) such as tunas, billfish and sharks; bottomfish complexes; and coral reef fish. As such PIFSC faces significant challenges logistically, geographically, scientifically and societally.

General Overview

The review of PIFSC's "Information of Fishery Stock Assessments" was conducted over a 3-day period (June 25-27, 2013). The national Terms of Reference (ToRs) call for a review and evaluation of individual Fisheries Science Centers' current fishery-dependent and fishery-independent data as related to fishery stock assessments conducted pursuant to the Magnuson-Stevens Act (MSA) including NOAA ship-based surveys, cooperative research surveys, logbook and observer data, and data management and quality control. All presentations were uniformly of very high caliber and the information was delivered clearly. The presenters also made themselves available for follow-up clarifications after their presentations. Congratulations and thanks to all involved at the PIFSC in preparing for the review.

The presentations and structure of the PIFSC review focused on information related to three typical assessments conducted by PIFSC and their partners: striped marlin, bottomfish, and coral reef fish. The information for these assessments is collected

via logbooks, creel and port surveys, and landing reports, and less so on fisher-independent survey data, e.g., information collected by NOAA fisheries research surveys. Following General Observations, comments on the five overarching questions panel was asked to consider are provided below for the three assessment species.

General Comments (in no particular order)

- In terms of database structure and management, there are very good and strong ongoing efforts with the Insular Fisheries Monitoring Program and WPacFIN – with some identified challenges in limited resources (funding and personnel) as well as increased demands on administrative components and increased security considerations. The variety and wide-range of data argues for continued consideration of a centralized and robust data center or data coordination. PIFSC underwent a review in 2010 on Data Management and the key recommendations from that review have been incorporated in their present operations. These have helped in the establishment of a Data Management Steering Committee (DMSC) that will guide future directions.
- Given the range of expertise and approaches in the field (e.g., islands and territories), continued attention to capacity building to ensure consistency and common data quality was discussed as helpful, particularly to the assessment of Bottomfish and Coral Reef Fish.
- There is a need for analysts to examine and perform “routine” data analysis. Such analyses would in turn provide feedback to the data collection efforts. Currently some delays in such “routine” analyses were identified as potentially leading to inconsistencies in the reported data not being identified in the short-term and difficulties in correcting these made more challenging. Given its importance, consideration should be given to supporting such activities.
- In the case of Bottomfish and Coral Reef Fish fisheries (and to a lesser extent the HMS), data on recreational fisheries are a recognized likely important component of the species’ assessment. The need for continued attention and improvement of this information/data was presented and encouraged.
- Enhancement of the collection of environmental data and its relation to fisheries data could/should be considered. Presently the effects of

environment are recognized and considered, but given likely variability related to Global/Climate Change, additional environmental-fisheries data could be explicitly considered in two ways: (i) collected in the field (with hopefully additional fishery-independent surveys presently under consideration eventually becoming operational), and with (ii) physiological data to be generated in the new PIFSC laboratory facilities (that would be relevant to aspects of the life-cycle histories, e.g., growth under changing/future environmental conditions of the target species).

- The role of PIFSC in the international highly migratory species (HMS) arena (data collection – largely fisheries-dependent – and associated population assessments) is essential. A large part of this work is shared with the SWFSC and the collaboration between the two Science Centers in data collection, archiving and mining should continue and be closely coordinated.

Additional comments on the five overarching questions in each of the three assessments presented (HMS, Bottomfish and Coral Reef Fish) are provided next.

Pelagic and highly migratory species (HMS)

1. Relationship of current and planned fishery assessment data activities to Center fishery assessments mandates and requirements – is the Center doing the right things?

The nearly Pacific-wide distributional range of HMS (in this case tuna, billfish and sharks) makes this an effort international by necessity. The US's participation (PIFSC jointly with the Southwest Fisheries Science Center, SWFSC) in the management of HMS is important not just because of the economic value of the fishery but also because the US plays an important role as a model in the management discussions with other nations in the Pacific. PIFSC scientists participate as Chairs and Members of Data and Assessment Working Groups in the various international bodies (ISC, WCPFC, etc.) as well as being the Chair of the ISC for the past three years. This is a clearly significant commitment in terms of cost and time, but one that is necessary given the value of the fisheries as well as of the US's leadership role in the assessment of the species.

2. Scientific/technical approach – are the Center's fishery data objectives adequate, and is the Center using the best suite of techniques and approaches to meet those objectives?

Fishery-dependent data on HMS comes from logbooks, observers, port sampling and canneries. Data are compiled and products include CPUE indices, size (length and weight). HMS data is managed in PIFSC's Oracle database. Data includes integration from sources California, Hawaii and American Samoa logbooks, Hawaii landings, and Hawaii Longline. Reports are provided to tuna RFMOs and the WPFMC. The PIFSC objective and efforts are appropriate and accommodating to the challenges of working in the international arena.

3. Opportunities – are there opportunities that the Center should be pursuing in collecting and compiling fishery assessment data, including shared approaches with partners?

Additional biological/life-history data is needed including biosampling, age- and size-composition, and tagging (distributions). These data are necessary to help improve the assessments, but cannot be unilaterally provided or acquired by US activities alone. It will require a coordinated effort, which in turn will require international commitment to capacity building and training. Fishery-independent on HMS, such as on oceanography and habitat, is difficult by the very nature of the broad distribution of the target species and the ensuing costly logistical challenges; as such these data are limited to relatively coarsely sampled information or simple models. Some of the information may be obtained in partnership with academic partners as well as in collaboration with other agencies and NOAA line offices, as well as with international science organizations such as PICES. The PIFSC leadership is well aware of these opportunities and is actively pursuing these opportunities either directly, or in partnership with the Working Groups of the various RFMOs (e.g., WCPFC, ISC).

4. Organization and priorities – is the Center's fishery data system properly organized to meet its mandates and is the allocation of resources among program appropriate?

There are a variety of data sources contributing to the HMS PIFSC database from the PIFSC, SWFSC, WPacFIN and PIRO. Data integration challenges that were discussed include: legacy structures, some (and perhaps inevitable) inconsistencies in reporting, and unknown user requirements. It appears that some of these challenges can and will be addressed when the move to the new PIFSC laboratory is completed.

5. Scientific conduct – are the Center's fishery data programs being conducted properly (survey design, standardization, integrity, peer review, transparency, confidentiality, etc.)?

The Center's approach and policies to data collection and data serving are treated appropriately to ensure quality, integrity and confidentiality.

Bottomfish

1. Relationship of current and planned fishery assessment data activities to Center fishery assessments mandates and requirements – is the Center doing the right things?

Yes. Bottomfish are regulated and assessments mandated by State and Federal agencies. These are managed and assessed as a group of seven species (making up the overall bulk of the landings of bottomfish) and referred to as the Deep7.

2. Scientific/technical approach – are the Center's fishery data objectives adequate, and is the Center using the best suite of techniques and approaches to meet those objectives?

The Insular Fisheries Monitoring Program includes the WPacFIN, Bottomfish Fast Track and Commercial Data (from HI), and HI Marine Recreational Fishing Survey data. This is a joint effort between PIFSC and HI state agency personnel. It was interesting to learn of the cultural components of data provision, including voluntary and mandatory components (creel surveys, market-vendor sources, among others). Challenges include documentation of data collection, integration of data sets without duplication, statistical analysis of historical data, among others. Additional challenges for the coming years were pointed out in network security issues as well as certain hardware limitations (and some increased administrative overhead). There was anticipation of challenges in finding and keeping qualified people and not losing them to private industry. This latter point is of course a national concern and not one unique to that faced by the PIFSC.

WPacFIN's efforts on converting island data systems into a new environment were described. Reasons for the conversion include computing languages that were becoming obsolete, security restrictions, data sharing, web-based technologies, synching with the Oracle database. Challenges include travel costs needed to support coordinating activities, turnover in personnel, limited IT capabilities in some regions, level/decreased funding and modifications to include new data for ecosystem based management considerations.

The data systems at PIFSC were described. As a result of a review in 2010, a data management steering committee (DMSC) was formed and was described as involved in decision-making and functioning well.

3. Opportunities – are there opportunities that the Center should be pursuing in collecting and compiling fishery assessment data, including shared approaches with partners?

The present approaches are reasonable given the availability of data (and the challenges in collecting the data). Additional fisheries-independent surveys and work on life-history parameters could provide useful additional opportunities. The descriptions of various acoustic and optical technologies were exciting and can provide important fishery-independent data for the Bottomfish species.

4. Organization and priorities – is the Center’s fishery data system properly organized to meet its mandates and is the allocation of resources among program appropriate?

This comment applies both to the Bottomfish and Coral Reef Fish (addressed in the next section): given the range of expertise and approaches in the field (islands and territories), additional capacity-building to ensure consistency and common data could be helpful to the assessment of these species. The availability of analysts to examine and perform “routine” examination of the data would provide feedback to the data collection efforts. The “operationalization” of the fishery-independent surveys and the implementation of new technologies can offer important input to needed data collection.

5. Scientific conduct – are the Center’s fishery data programs being conducted properly (survey design, standardization, integrity, peer review, transparency, confidentiality, etc.)?

The Center’s approach and policies to data collection and data serving are treated appropriately to ensure quality, integrity and confidentiality.

Coral reef fishes

1. Relationship of current and planned fishery assessment data activities to Center fishery assessments mandates and requirements – is the Center doing the right things?

In some ways this might be the toughest of the three species/complexes discussed given the difficulties in data collection and the uncertainties of the recreational landings. These challenges were identified and recognized during the presentations.

2. Scientific/technical approach – are the Center’s fishery data objectives adequate, and is the Center using the best suite of techniques and approaches to meet those objectives?

Collecting the data for this species is daunting. There are many species, different fishing gear, etc., resulting in a data-poor species to assess and manage. The PIFSC recognizes these very real difficulties and is taking a proper approach that uses a combination of efforts including diver surveys, biosampling, and commercial trip reports, among others. Some of the points that were identified included enhancing recreational data collection, the improvement of the information of life-history parameters, and the creation of additional local capacity.

3. Opportunities – are there opportunities that the Center should be pursuing in collecting and compiling fishery assessment data, including shared approaches with partners?

In the area of capacity-building partnerships with units in the territories, e.g., University of Guam, could provide added and needed capacity-building.

4. Organization and priorities – is the Center's fishery data system properly organized to meet its mandates and is the allocation of resources among program appropriate?

As in my comments to Question 4 (on Bottomfish), given the range of expertise and approaches in the field (islands and territories), additional capacity-building to ensure consistency and common data could help to the assessment of these species. The availability of analysts to examine and perform “routine” examination of the data would provide feedback to the data collection efforts.

5. Scientific conduct – are the Center's fishery data programs being conducted properly (survey design, standardization, integrity, peer review, transparency, confidentiality, etc.)?

The Center's approach and policies to data collection and data serving are treated appropriately to ensure quality, integrity and confidentiality.

PIFSC External Program Review 2013

The NOAA Pacific Islands Fisheries Science Center (PIFSC) provided a well-organized and balanced overview of their data assessment and management programs, pointing out what, and by whom, data were collected as well as what was working well and what was not working well. The clarification of problems was openly and honestly communicated and proved helpful to this reviewer. The information provided to the panel for this program review was directed at three typical assessments conducted by PIFSC and their partners for: (a) highly migratory species (HMS), notably striped marlin; (b) bottomfish, both main Hawaiian Islands (MHI) and U.S. Pacific insular areas; and (c) coral reef fish.

The information presented was comprehensive, complex and detailed. It offered an accurate portrayal of the challenges inherent in data acquisition for fishery assessment across a broad geographic and cultural landscape inclusive of diverse island cultures and extensive international participation. The scale of the fisheries involved ranged greatly from artisanal harvesting by traditional practice for local consumption or sale to high-seas industrial fishing for international commodity markets and export. My report responds to that broad reach in the form of a general synthesis and provides summary statements as answers to the questions asked along with selected observations.

In many of the cases presented, PIFSC lacks full authority under federal law to singularly manage these fisheries and must acquire requisite data for stock assessments through partnerships and collaborations with literally dozens of agencies, fishery management/research organizations and industry groups. As a result, PIFSC faces daunting challenges associated with sampling/survey and data management protocols, representative geographic coverage, data quality and standardization, timeliness of data submission and acquisition, database integration, and ultimately data analysis and reporting.

In response to the questions posed for panel consideration and comment, I conclude that PIFSC overall is either doing the right things or largely recognizes where things could be improved. Staff presentations often were explicit in the latter regard or such recognition became evident in the questioning by the panel and the answers provided by the staff presenters and PIFSC leadership. My perceptions of where specific adjustments could or should be made are offered below in relation to the following five questions asked of the panel:

- Relationship of current and planned fishery assessment data activities to Center fishery assessment mandates and requirements – is the Center doing the right things?
- Opportunities – are there opportunities that the Center should be pursuing in collecting and compiling fishery assessment data, including shared approaches with partners?
- Scientific/technical approach – are the Center's fishery data objectives adequate, and is the Center using the best suite of techniques and approaches to meet those objectives?
- Organization and priorities – is the Center's fishery data system properly organized to meet its mandates and is the allocation of resources among programs appropriate?
- Scientific conduct – are the Center's fishery data programs being conducted properly (survey design, standardization, integrity, peer review, transparency, confidentiality, PII, etc.)?

- (1) The relationship of current and planned fishery assessment data activities to PIFSC fishery assessment mandates, requirements and needs is appropriate. While in the case of HMS, PIFSC activities range beyond what is required strictly by U.S. law, the data compilation, integration and analysis they conduct results in valuable advice to international fishery management/research entities. These international entities comprise small-island and developing island nation states along with the more economically developed Asia-Pacific nations. PIFSC sets the "gold standard" for how things should be done for the insular Pacific and thereby significantly advances U.S. influence, however tenuous, into how HMS species populations are assessed and best managed in the Pacific. Dedicated funding to facilitate PIFSC involvement in this arena would seem appropriate.

A similar situation involving an extra-jurisdictional role and assumed responsibilities arises in regard to management of bottomfish resources in the U.S. insular Pacific. While U.S. jurisdiction under the Magnuson Fishery Conservation and Management Act pertains to management of bottomfishes within federal waters of the insular EEZs, available landings information (with exception of Hawaii) is routinely collected absent demarcation of jurisdiction of where the fish are caught. PIFSC, working with its diverse partners, has become the principal agent for data acquisition, integration, analysis and reporting for area fishery management planning. While extensively more complex, this role extends to coral reef fish population assessment and management (for upwards of 200 species) across the U.S. Pacific Islands.

- (2) I am impressed with the comprehensive (albeit exhaustive) partnering in place to collect and compile fishery assessment data. PIFSC over time has developed and helped shape a broad range of data conduits that utilize multiple channels and seem to exploit all apparent partnering possibilities. However, there are difficulties inherent in the data quality associated with these arrangements, especially when viewed in light of the high costs associated with the collection, compilation and integration of the data. That said, I conclude that PIFSC is working with the best available data at the moment through its partnering networks and clearly recognizes the need to adjust for and improve that data's quality and reliability for use in stock assessment work.

Among the problems noted, more efficient and cost-effective biosampling is needed, in part to better understand age composition to develop growth curves for multiple billfish and bottomfish species. Attention should be directed to making monitoring programs for bottomfishes and coral reef fish more responsive to assessment needs. Documentation of creel surveys could be improved, i.e., there is no set protocol or handbook to standardize methodology or assure comprehensive oversight of samplers. Greater central control is needed to integrate the database stovepipes associated with the multiple partners and to better serve the assessment staff. Dedicated analysts that "own" the data and become service providers (preparing annual, semi-annual and quarterly analysis and reports) would contribute to greater program efficacy.

- (3) Regarding PIFSC's approach to scientific/technical challenges, I find PIFSC's fishery data objectives to be generally adequate but the suite of techniques and approaches in place to meet

those objectives needs revamping in some instances. Consider two fishery-dependent data collection systems that are in place and heavily relied upon. In the case of Hawaii-based longline fishery logbook data for example, reliable qa/qc protocols are in place, with checks and balances to assurance accuracy and reliability, e.g., vessel landings log records are compared to dealer sales records by trip. There is excellent monitoring of compliance with logbook landings requirements. This data collection system also offers a great example of successful partnering with the fishing industry being regulated, taking full advantage of a major single landings location at the fish auction in Honolulu.

In contrast, the-fishery dependent data collection system for Pacific Island bottomfish and coral reef fish is administratively top-heavy (like an inverted pyramid) - tremendous output of staff time and funding to acquire assessment data of variable quality for fisheries of high species number and overall low economic value (but of high societal or cultural value). This data collection system projects a sense of being over-engineered and fraught with imperfect data in constant need of adjustment. Reporting can be irregular because of local customs and reluctance to provide numbers caught, except in Hawaii where reporting of commercial fishing is required by law. Multiple local agencies determine the kinds of data collected and sampling intensity, while PIFSC is the data gatherer/integrator/manager. The system is well managed by PIFSC within practical and fiscal limits, but it is a ponderous enterprise to administer.

- (4) The organization and priorities of PIFSC's fishery data system is generally well designed to meet its earlier mandates but is greatly challenged by changing tasking that appears to be moving PIFSC from conventional and routine monitoring activities to more demanding sampling protocols directed at standardized data collection and database integration to support annual stock assessment. The determination of annual catch limits for literally hundreds of fish species within the management purview of PIFSC is a new mandate that is especially problematic. PIFSC seems entirely capable institutionally to make needed adjustments, but likely will require supplemental funding to be fully responsive and some reallocation of resources among programs to achieve greater efficiency and cost effectiveness. That conclusion extends to the following findings as well.

A compelling element of the organization's redirection is the need to supplement its high reliance on fishery-dependent data with sources of fishery-independent data. Current efforts to achieve this objective are limited and in some cases preliminary. Efforts at gathering life history data (age, growth, reproduction, maturity, etc.) in support of stock assessment should be accelerated. Forward looking DNA sampling for genetic bar coding to assure species identification and use of radiochemical dating to determine longevity should continue. The use of remote optical and acoustic technology to assess bottomfish and coral reef fish abundance, together with GIS and LIDAR habitat mapping should be encouraged. The use of remotely sensed satellite data to model oceanographic conditions relative to HMS fishery interaction with protected species bycatch is impressive. Oceanographic monitoring and modeling using satellite data has expanded utility in

moving PIFSC towards realizing the larger goal of ecosystem-based fishery management together with assessing fisheries in the face of climate change.

- (5) PIFSC's fishery data programs, for the most part, are being conducted properly regarding survey design, standardization, integrity, peer review, transparency, confidentiality, etc. Greater attention to enterprise solutions in particular, more rigorous data standards overall and more extensive program integration is acknowledged as needed to great extent by the staff and PIFSC leadership alike. PIFSC appears to be at a "tipping point" where it needs to cope and adapt organizationally to the flux in its mandates. Some inertia is apparent in staff attitude from presentations and discussions and will have to be overcome. However, it is my impression that as an institution, PIFSC anticipates and is well poised to make any needed transition.

PIFSC Review, June 25-27, 2013, Honolulu Hawaii

The objective of this review is to determine if the PIFSC is **collecting and compiling** the right information for **fisheries assessments in the right way**, and to learn how they can **improve the collection and compilation of this information**. In my comments I have provided some general comments based on the information provided in the example material available on the wiki, and based on information given by staff presentations and the ensuing discussions that followed each presentation. The review follows with specific details on the Highly Migratory Species, Insular Bottomfish, and Coral Reefs. Lastly, I provide a list of key recommendations that relate to the overarching questions for the specified for the review panel.

In summary, my assessment of the data collection program is that there is a lot of data that has been collected over the years, but a great deal of work needs to be done in the areas of dissemination of the data to stock assessment scientists, and other interested research partners, and in house analysis of these existing data. There are a number of information systems in place (e.g., fisheries statistics, shore-side sampling, tagging programs, etc.) and no real centralized repository for all these data. There is an extensive network of sampling programs that currently exists in the Hawaiian Islands and other US territories in the Pacific. Collecting and processing of field data should be conducted on a consistent basis across all of these regions and direction and protocols should be specified from a centralized Database Administrator to improve accuracy and maintenance of these expensive data. Hardware infrastructure exists, but is dated and in need of replacing and optimizing. A centralized database administrator office should take ownership of these data, coordinate analysis of existing data with the objective of improving efficiency adjusting sampling protocols to achieve desired levels of precision. All data request should be handled through a single portal/office to ensure consistency of information. In addition, standard tools should be constructed and documented to handle routine queries for use in stock assessment and to address a large fraction of the public queries; much of this information should be made available online to minimize staff time in responding to data requests.

General comments:

In general the PIFSC is doing the right things, but more could be done to vastly improve the information required for stock assessments. Basic life history information (growth and maturity) is scant for many of the insular reef and bottom fish fisheries, and is also limited for the highly migratory species. Progressing to more complicated assessment models that directly integrate composition information will require information on growth curves and size-at-maturity information. The existing biological information state limit the choice of assessment models to those that are more likely to be biased (e.g., simple production models) given only fishery-dependent relative abundance data.

The Center has done a lot of great work in recent years with respect to the standardization of fisheries dependent data, but this does not guarantee that the standardization process will lead to an abundance index that is proportional to stock

size. Additional metrics on abundance or other information relating the effects of fishing mortality rates (i.e., tagging, changes in mean size, catch-curves) would provide valuable insights into the level of proportionality in the existing fisheries dependent data. I view the pilot programs on developing fisheries-independent abundance indices for the bottomfish fishery a positive step in this direction.

The importance of having a good index of relative abundance cannot be over-stated. The general evolution of assessment models from simple biomass production models to more comprehensive integrated models will require additional data—assumptions, and the output from these models is only as good as the information that goes into it. For example, integrated assessment models fit to age-composition data can be very informative about absolute abundance based on catch-curves (and assumptions about selectivity etc.). Significant changes in selectivity could give the false appearance of changes in abundance if selectivity is assumed to be constant. Therefore, the integrated assessment models will be very dependent on a reliable CPUE index that is proportional to stock size.

It goes without saying that obtaining the necessary information to provide good advice and setting appropriate Annual Catch Limits will be too expensive, or exceed the value of the fishery, or simply not possible for logistic reasons. The Center's would benefit from Management Strategy Evaluation simulations designed at evaluating the utility of new data collection programs (i.e., AUV transects for bottomfish); simulations could address potential cost benefit of implementing the programs, versus maintaining status quo and using conservative estimates for setting ACL's. Conducting MSE is relatively inexpensive in comparison to operationalizing an untested full-blown fisheries independent survey.

Personal, infrastructure, and procedures for obtaining fisheries-dependent catch and effort statistics appear to be in place and is doing a reasonable job (based on staff comments); however, additional resources are necessary for analysis of the existing data and verifying if the sampling design framework is sufficient to achieve the desired level of precision in estimates of total catch and effort. Sampling objectives should be defined, *a priori* (e.g., achieve a CV of 0.25), in estimates of catch and analysis of the existing creel survey information should be examined to determine if sampling effort should increase, decrease, or be re-allocated to different areas to achieve the stated objectives.

Highly Migratory Species:

In general the HMS fisheries do not fall entirely under the Magnuson-Stevens Fisheries Conservation and Management Act and much of the assessment and management of these fisheries is done through Regional Fisheries Management Organizations (ISC, IATTC, etc.). However, these fisheries are extremely valuable to the US and all efforts to uphold excellent data collecting and dissemination should be given high priority.

Based on the example study (striped marlin), the formal process of selecting and weighting data for fitting should be documented for future analysts (ensure the process is repeatable by an independent analyst). The same documentation is also necessary for assembling the data that are provided to the analyst each year. It is natural for the relative abundance indices to change slightly over time (via GLM standardizations and learning about factors that affect catch rates) and clear justification should be given as to why the data weighting process in assessments that used multiple indices of abundance changes from year to year. The point here is that the science (i.e., assessment results) should be repeatable by an independent analyst or successor to the program.

Resolving catch to species in each of the HMS fisheries should be given high priority as accurate catch information is a very important scaling parameter (related to reference points and important for output controls) in stock assessments. High priority should be given to species id in the purse seine FAD fishery to distinguish juvenile bigeye and yellowfin tuna.

Bottomfish:

The long-term objective for assessment and management of this species complex in the main Hawaiian Island is to move towards single-species assessments. The current assessment of the deep 7 complex is done in aggregate (i.e., assumes all species have the same distribution of parameters and are subject to the same annual production anomalies, and the proportion of each species does not change over time). This poses several problems in defining appropriate reference points and ensuring that any single species is not overfished or subject to overfishing. Improvements in the data collection process, CPUE standardizations can be considered progress. I would highly recommend that efforts to operationalize a fisheries-independent survey for the Hawaiian bottomfish complex as soon as possible such that these data can be used to help tune single-species assessment models, or even refine multi-species model that explicitly attempt to model the non-linear relationship between fisheries-dependent CPUE data that has been attempted for this fishery.

Continued random sampling of the length composition from the commercial and recreational fisheries for bottomfish is also necessary.

There is the potential to use the estimates of habitat information to aid in developing a prior for the carrying capacity (or unfished sates) for the bottomfish species. Estimates of density in closed areas (or pristine areas) could be used to infer what the lower bound of the potential unfished density. An upper bound may be difficult to define. Similar extrapolations could be used to refine estimates of absolute abundance based on underwater visual census data. At a bare minimum, the habitat information should be used to define strata for a stratified random sampling survey. Ground truth the habitat data and the habitat use by various life-history stages, especially those stages that are defined in the stock assessment model (i.e., fully recruited fish).

Plot the cumulative catch of each species in the deep 7 complex and look at how the species composition of the catch changes over the course of the fishing season. If all species increase at the same rate, there is little reason for concern, if however one or more species asymptotes early, then ask why the catch composition is changing over time.

Coral Reefs:

The current and planned fisheries assessment activities for coral reef fisheries are moving in the right direction; however, substantial improvements could be made in trying to integrate all of the available information as well as improving the quality of the creel survey programs in remote island regions.

The catch-MSY method that is currently being considered by the Council suffers from the subjective *a priori* decisions that ultimately define the median and upper bounds of the resulting MSY distribution. The method is appropriate for defining the lower bound of this distribution. There is an opportunity to combine some of the information from the RAMP program and mean length surveys collected by NOAA-PIFSC. Density information from the more pristine (less populated reefs) could be used as the basis of a prior distribution for carrying capacity in the Catch-MSY methods. Using an age-structured model in lieu of the production model in the Catch-MSY method could be used to predict the mean size, and standard deviation in the mean size, for the dive surveys using the same same assumptions for growth parameters and length-at-first capture that are currently used. Integration of these additional data sources into the catch-MSY method would better resolve estimates of stock-status, current fishing rates, and better define the upper bound of the MSY distribution.

Key Recommendations:

Question 1: Relationship of current and planned fishery assessment data activities to Center fishery assessments mandates and requirements – is the Center doing the right things?

- Continue to actively collect fisheries catch statistics in the US longline fleet for HMS, as well as length-composition samples for used in assessment related activities with other RMFOs.
- Collect species catch and length composition in US purse seine fisheries for use in RFMO assessment activities.
- For the insular bottomfish fisheries, conduct a cost-benefit analysis of operationalizing a fisheries-independent survey and single species assessments vs. status quo. Note that this should be conducted in a Management Strategy Evaluation (MSE) framework, where the operating model consists of the deep 7.
- Bottomfish: conduct a similar data filtering exercise that was conducted in the most recent assessment, where a range of percentages of the total trip catch (10% to

90%) consisted of the deep 7; however in this case, examine trends in trips with onaga and opakapaka.

- Deep 7 CPUE standardization: explore interaction effects with catch of Ulua's or other species.

Question 2: Are there opportunities that the Center should be pursuing in collecting and compiling fishery assessment data, including shared approaches with partners?

- Improve communication between groups within and outside the center about what data are available.
- Coral reef programs, there is an opportunity to integrate information from the RAMP program, mean-size based assessments, and catch-MSY methods into a single integrated approach (e.g., use the density estimates from pristine locations to formulate informative priors for carrying capacity in the catch-MSY models).
- Ensure that coral reef sampling occurs across a broad range of "pristine" to "heavily" impacted reefs to get reasonable estimates of the range of densities and mean sizes.

Question 3: Are the Center's fishery data objectives adequate, and is the Center using the best suite of technique and approaches to meet those objectives?

- With respect to stock assessment, the centers data objectives are not clearly defined. Priority should be placed on collection of 1) catch statistics, 2) life-history information, 3) size-at-maturity information, 4) size-composition, or mean size information, 5) fisheries independent relative/absolute abundance, 6) other auxiliary information such as tagging data. Available information will dictate the potential tier that each stock (stock-complex) can be ranked in, conditional on a n acceptable, peer reviewed, assessment.

Question 4: is the Center's fishery data systems properly organized to meet its mandates and is the allocation of resources among programs appropriate?

- Continue to merge and integrate all available information into a centralized data repository with a dedicated Database Administrators office to handle QA/QC, statistical analysis of raw data, and provide a single outlet for data requests.
- Develop appropriate tools and documentation for handling routine data requests for annual/quarterly summaries.
- Work in close collaboration with the stock assessment scientists and develop and document specific queries for routine stock assessments such that they are repeatable from year to year.
- Provide a port for public access to non-confidential information via on-line system; the objective here is to minimize staff time responding to individual requests and provide consistent information to all interested parties.

Question 5: are the Center's fishery data programs being conducted properly (survey design, standardization, integrity, peer review, transparency, confidentiality, PII, etc.)?

- A dedicated Databased Administration office is necessary to oversee the development of a centralized data repository and dissemination portal.
- Redundant staff (at least 2 FTE's) to develop/oversee/implement all business procedures. These individuals should be familiar with all procedures used for data collection, entry and transformation, statistical analysis, and quality control. Moreover, there should be a general understanding of what each data field represents and what these data would be used for.
- A big challenge for new analyst/stock assessment scientist who arrive on the scene is not knowing what data are available. Header tables should provide necessary information about the origins and genesis of these data such that they can be used in an appropriate manner in stock assessment models.

PACIFIC ISLANDS FISHERIES SCIENCE CENTER PROGRAM REVIEW
OF
INFORMATION
FOR FISHERY STOCK ASSESSMENTS

June 25-27, 2013
Honolulu, Hawaii

Introduction

The Pacific Islands Fisheries Science Center (PIFSC), located in Honolulu Hawaii, is one of six NOAA Fisheries (National Marine Fisheries Service) science centers. Its mission is to provide timely, high-quality applied scientific information to support the conservation and management of fisheries, protected species, and marine habitats in the central and western Pacific Ocean. To achieve that mission, PIFSC provides data, information, analysis and technical advice to the NOAA Fisheries Pacific Islands Regional Office, Western Pacific Fishery Management Council and other conservation and management responsibilities within NOAA (e.g., the National Marine Sanctuaries Program) as well as international scientific bodies such as the Western and Central Pacific Fisheries Commission's Scientific Committee, the International Scientific Committee on Tuna and Tuna-like Species (ISC), and PICES (the North Pacific Marine Science Organization).

The PIFSC partners with the State of Hawaii, the Territories of American Samoa and Guam, the Commonwealth of the Northern Mariana Islands, and with U.S. representatives participating in international fishery negotiations as well as the fishing industry, other agencies of NOAA and the Federal government, the U.S. Fish and Wildlife Service, university and other scientific research partners, both domestic and international, and the general public.

In response to a NOAA Fisheries initiative to establish a standardized five-year cycle to peer review science conducted within the agency, the PIFSC has organized a review of the Center's program with a thematic focus on the information collected and compiled for fishery stock assessments. To achieve this, the PIFSC has invited a number of professionals in the field from both inside and outside the federal government to evaluate approaches to the information used in assessments of highly migratory species, and insular species such as bottomfish and coral reef species. I am one of those invited. This constitutes my report.

Each of us on the panel was asked to provide insights on the following questions:

- 1) Relationship of current and planned fishery assessment data activities to Center fishery assessments mandates and requirements – is the Center doing the right things?
- 2) Opportunities – are there opportunities that the Center should be pursuing in collecting and compiling fishery assessment data, including shared approaches with partners?
- 3) Scientific/technical approach – are the Center's fishery data objectives adequate, and is the Center using the best suite of techniques and approaches to meet those objectives?
- 4) Organization and priorities – is the Center's fishery data system properly organized to meet its mandates and is the allocation of resources among program appropriate?

5) Scientific conduct – are the Center’s fishery data programs being conducted properly (survey design, standardization, integrity, peer review, transparency, confidentiality, PII, etc.)?

The review was conducted through presentations describing the three major program areas Highly Migratory Species, Insular and Coral Reef Fish Species. Additionally there were overarching issues related to data management and processing which affect all programs. Because of my expertise I focus on the assessment and data collection that supports that assessment. But I do have a few observations on data management, as well. Through my observations and recommendations, the objectives of the review are addressed.

Overarching issues

Much of the focus of the questions and responses at the review were basically addressing scientific priorities between HMS, Insular and Coral Reef Fish programs. However, this in turn depends upon management objectives and the mix of resources that are desired. Large shifts in priorities are a product of the interaction of constituents with the Council and other management and legislative bodies and, thus, are not a scientific decision. Ultimately it occurs through the political process. But lacking guidance on these issues, a manager of the scientific enterprise within NMFS is left with a strategy of distributing risk. The PIFSC needs to be able to respond quickly to new management issues. This is achieved by making sure that there is baseline information for all program areas. This implies that the information be evaluated through stock assessments in order to have that baseline. This is especially important in a period of stringent budgets

Highly Migratory Species

The PIFSC has data collection responsibilities: logbooks, landings and observer data, for a segment of the US fishing fleet, primarily longliners. After two decades of development, these data have proven to be of high quality and useful for assessments of the species occurring in the longline fleets. The United States has the obligation to provide these data to the international RFMOs to assist in the management of HMS in the Pacific. Additionally, it is strategically advantageous for the US to participate in the RFMOs at all levels: management, compliance and scientific committees, as there is a substantial commitment of US tuna vessels to the Pacific.

It is important that the US maintains the expertise to participate in these scientific arenas. PIFSC scientists have established that role within the relevant RFMOs and are important players within the scientific working groups. This improves data collection in other countries, in other US fisheries and improves the quality of scientific advice through stock assessments. This role extends beyond the obligations for data collection of the US longline fleet and should be continued.

Insular Species

The emphasis of Insular assessments have been on the “Deep 7” species. The choice of these species is reflective of the history of fishing and the economic interests of the fishers. However there are obvious data limitations. Most notably total catch estimates and the aggregation of species. I believe that the disaggregation of the catch into separate species is being addressed but that it will take time for these data processes to evolve. But large “unreported catch” is still a major problem. The assessment scientists have addressed this through several scenarios (assumptions) in order to provide catch limits. However, the lack of these data degrades the usefulness of the assessments beyond trends in abundance. Data to support full estimation of the catch are needed.

Coral Reef Fish

A common comment about individual research programs was that “the data collection was not designed for stock assessments.” I find this to be irrelevant. The data exist and the US government has the obligation to evaluate its usefulness in assessments. Indeed, that is why more elaborate statistical models are used. It is not to obfuscate understanding; but rather to utilize all of the available data at a relevant scale and to make fewer assumptions about those data. I would encourage the exploration of these data sets.

In particular the Coral Reef Fish program is providing a set of sampling density estimates that appear to have potential for assessment. They are spatially distributed; reflect different exploitation histories and thus different productivity regimes. I was not aware of their availability prior to this meeting and I am not sure that all of the PIFSC assessment scientists were aware of them either. I believe these data should be explored through alternative population models and (perhaps) Bayesian priors on absolute or relative abundance.

Beyond ACLs

Considerable assessment activity within NMFS in recent years has been the adoption of Annual Catch Limits (ACLs) as required by the Sustainable Fisheries Act. The PIFSC has been heavily involved in those activities. But having addressed those requirements, the next step of management actions that are likely to be considered will require the development of control rules and spatial management. These will be especially important with data poor stocks. But “data poor” means that we do not know the status. Therefore, there is a need for adaptive, robust management strategies that can respond relatively quickly to new data or misinterpretation of previous data. This in turns implies the need for Management Strategy Evaluation (MSEs). In order to do this requires operational model or models that depict the current understanding of a population or an ecosystem which can be tested against alternative hypotheses how the system works, how management can respond to uncertainties and the effectiveness of proposed scientific programs. I precommend that a suite of operational models be developed which can be used for MSE. Additionally, these can be useful to determine precision likely to be useful from new data collection programs such as fishery independent surveys.

Organizational Issues

Regulatory Scenarios: One concern I have is that as management evolves there will be increased demands on the assessment scientists to provide not only the status of a stock, but the likely consequences of alternative management actions. They will be asked; “what are the consequence of a particular bag limit; or a particular closed area.” Because it often involves projections of the assessment population model, responses can be both time-consuming and iterative. And usually it is the assessment scientist who has to run the projections. I suggest the suite of people available to do these tasks be broadened (including economists? Biologists? There feedback would be useful). This requires some standardization of the projection software to address likely issues.

Data Management: There appears to be difficulties in data management which have been identified and are being addressed. In particular, responses to outside requests seem to occur at a personal level. This leads to multiple interpretations of the same data and duplications of effort. Ultimately, responses are a product of the Center and should be reviewed in that context. Thus, requests should be centralized. However, in order to make this operationally feasible a suite of standard, periodic displays of the data must be developed. I believe these efforts have been initiated. Their continuation should be supported. This may require an overarching data manager.

Communication between data collection-analysis. There is always a need for understanding by analysts about how the data were collected and conversely the understating of the data collectors on how the data are to be used. This could be addressed by alternative organizational arrangements. However, a first step is to support an analyst within the data collection team. Such a person(s) would provide basic catch estimates, precision, understanding of biases, raising of size frequency data etc. Such a person would be an important communicator between assessment scientists, life history scientists and data collection.

Life history sampling: Life history studies are an extremely important source of data for assessments. These data are the basic building blocks used to estimate productivity within an assessment. Work needs to be focused on the assessment needs both short term and long term. In other words, what species are to be needed with the next 3-5 years? This requires discussion with assessment people and data collection analyst(s) as well as determining Council strategic plans to make sure that the expectations match with the models, fisher data and biological data.

Conclusions

The PIFSC has developed considerable scientific expertise and supporting data collection over the last two decades. This review confirmed the benefit of those activities by the demonstrated ability of the PIFSC to respond to Congressional mandates and international obligations. However, mandates and requirements are now shifting. The recommendations and observations noted above should be helpful in guiding the PIFSC as they move into the future.

Review of Pacific Islands Fishery Science Center data collection and management in support of stock assessments

Reviewer xxx

July 8, 2013

General observations

The PIFSC and its partners (WPacFIN and HDAR) have substantial fishery dependent data collection and data systems and sample processing problems. Improvements to those systems could enhance the timeliness and/or quality of the management advice the PIFSC provides. The problem areas include basic data collection, sample processing and data base management activities including IT infrastructure and dedicated analytical capability within data collection/processing groups.

The biological sample processing group is producing very valuable information on longevity of some species. The current activities are progressing at a very deliberate pace. Some components of the program (such as maturity determination and perhaps aging of some species) probably could be executed in a more production oriented mode. To support higher level stock assessment shift of some processes from a research mode to a production mode will be needed.

Specific observations

Fishery Independent Surveys

The PIFSC appears to be doing fine work on fishery independent monitoring (RAMP) and developing fishery independent methods for deeper water resources. The inshore (RAMP) has been enhanced to have a greater focus on monitoring fisheries resources; that focus must be maintained.

Territorial fishery surveys

The PIFSC/WPacFIN should be commended for developing statistical fishery surveys in the territories during the 1980s; the difficulty with reporting accuracy and compliance from log books (whether mandatory or voluntary) means that in many cases statistical surveys are the only reliable methods to obtain catch estimates and representative size samples. The PIFMC initiated a needed review of the territorial survey programs and the PIFSC has followed up on that review with further study of the utility of survey data for catch estimation with the intention of using the results of the study to review the design to determine if improvements can be made and if assessment needs can be met. These efforts should be continued and if the surveys are considered useful sufficient funds should be provided to support the collection of information needed for assessments (whether this be total effort and removals or species/ species group specific catches).

The PIFSC and/or its partners should consider obtaining funding from the MRIP program to support the execution of these surveys because they directly relate to the MRIP goals of obtaining information on non-commercial catch and effort. Apparently this may be underway already.

Biological sample collection

It appears that the biological sampling programs in the territories and in Hawaii have been concentrated at high volume dealers/markets. In Hawaii this apparently has been a reasonable approach because a very high percentage of the landings passed through one location; however recently it seems that fishers have begun using additional landing locations. The PIFSC should review landing locations and volumes and sample sources (bio-sampling program, territorial surveys, ...). The center should consider how to optimally use the sampling from those programs. Designing bio-sampling programs to meet assessment objectives should be investigated.

The PIFSC should initiate HMS bio sampling to define at least age composition and maturity for some species including billfish and perhaps bigeye. The PIFSC should also consider collection of aging tissues from exploited shark resources including coastal resources which might be more heavily exploited even if processing is not yet feasible.

Bio sample processing

The life history group is developing essential information for stock assessments. The otolith chemistry information is critical. The time to develop growth estimates from otolith reading is quite long; if possible these should be reduced.

Do the age estimates from relatively young animals correspond to age estimates from the otolith chemistry methods? If so perhaps ages could be estimated for just young and moderate aged fishes.

The otolith chemistry information indicates substantially older maximum ages than the otolith reading. Are the counts of rings by age readers always under-estimates of age or are the counts acceptably accurate for some younger ages? If ages can be accurately counted for smaller and/or younger fish the PIFSC should consider using visual aging for some sizes/ages and population models which make use of life stage information.

The life history group is focused on providing the basic parameters – growth, longevity and maturity for one species at a time. Having developed parameters for 30-40 species, the group should begin conducting routine aging for one or more important species for which production aging is feasible. It is critical that the group begin to shift its focus from a slow, methodical species by species approach to a production approach. This will likely require additional staff.

A simple metric about the potential impact of fishing on a population is whether the sizes exploited are above or below the size at maturity. The life history group should consider rapidly developing the average size at maturity at least for the species which account for substantial proportions of the landings in each area. This could provide additional guidance to life history scientists, assessment scientists and managers to prioritize the species to focus on.

Are the samples obtained through biological sampling program designed to meet the objectives of both that program and stock assessment? With a high concentration of biological sampling in a small number of locations sampling efficiency (fish / hour) might be optimized, but it is not clear whether stock

assessment needs (such as a representative sample of size composition) are being met. Ideally the objectives of both programs would be met simultaneously, though the numbers of fish sampled per hour might not be optimized.

Data processing improvement

Primary fishery dependent data systems and processing should be integrated so that there is one primary copy of the data and reports derived from the data are created from that one source or a frequently (daily) updated mirror of that data. Derived products are frequently needed from such data (such as linked log books, observer reports, landings reports and size composition information or some combinations of those data sets). Such derived products are useful for identify gaps in reporting and differences among sources, and they are often are very useful for higher level analyses. Data systems and processes need to be designed to accommodate such integration and to minimize the need for human involvement in integration steps when data are updated. If codes differ among programs cross-reference tables should developed (if not already available) to support integration and translation and to support ease and consistency of extraction.

Preferably all data would be stored in a centralized Oracle system with integration as a core feature though it is likely that the different partners would prefer to house their own data sets. If the partners choose to house their own data, the partners would have to work together to optimize integration. Current systems might have to be updated to and the PIFSC might have to provide extensive support (financial and/or programming and design) to achieve the long term goal.

At minimum all PIFSC data collection systems should reside within an integrated system. Separate applications within the system would support the various programs so that modifications could be made as programs change. Data entry and quality control, basic data processing and reporting/extraction would reside within the system. Apparently initial progress has been made on such an approach in recent years; this progress should continue.

The system must be able to track data set changes so that what was changed, when and by whom is recorded. If the state or WPacFIN are to maintain their own systems then these systems must fit seamlessly together, which would entail agreement on standards and procedures. Currently the lack of integration of systems within PIFSC and within the PI partners causes inefficiencies.

Analytical capability within data management

Data management groups need dedicated analytical support; it should not be assumed that an assessment group will have the time to provide such support. Dedicated analytical personnel are needed to monitor sampling with respect to targets, review sampling designs, estimate quantities such as catches and confidence intervals, tabulate landings with respect to quotas and project closure dates. Having such capability within a data management group can increase the chances that programs are meeting/addressing objectives and to promote buy-in / understanding of goals within the data management group.

Large pelagic average size

Apparently PIFSC personnel use length samples from dockside or observer sampling to determine average weight for use in stock assessments. The PIFSC should consider using the individual carcass weights from dealer/market reports for calculating average weight in the landings. The proportion of landed fish with recorded weights is likely very high (and much higher than the proportion of fish sampled for length) and no uncertainty would be introduced through converting length to weight.

Targeting in the deep bottom fishery

The PIFSC should consider reviewing with fishers the information collected on the bottom fishery log book form to determine if fishery effort data might be used to indicate targeting for some species or species groups. If fishers split effort among methods/equipment indicative of targeting during a trip, time fishing with each type would probably have to be recorded.

Overarching questions:

Is the Center doing the right things?

The Center is doing many things very well. Certainly the Center is setting an example for the world in fishery independent data collection in shallow (<30m) waters and its program to develop methods of surveying deeper waters. During the RAMP presentation it was stated that the presenter was most comfortable with using the data from trends in abundance rather than estimates of abundance. For optimal use of the RAMP data to inform stock assessment emphasis should be placed on providing abundance estimates; perhaps this will entail maintaining the current increased sample sizes into the future.

It is very likely that the PIFSC and WPacFIN will need to greatly simplify the sampling design of the statistical surveys used to estimate the landings of the fisheries in the territories. It is likely that too many sampling strata are being used in the current design.

If species can be identified for which routine aging is feasible, then the PIFSC should try to provide that capacity to the life history group. Routine aging might involve reading ages for younger or smaller fish but not older fish if aging is shown to be reliable for only the younger ages. The Center should consider conducting routine aging for both HMS and island species.

Are there opportunities the Center should be pursuing in collecting and compiling fishery assessment data including shared approaches with partners?

The Center should work with its partners to integrate data systems so that data extractions and reports are derived from one primary source, so that information is easily linked across systems and so that changes to the basic data (records, data elements) are easily identified and incorporated in other

components of the system which rely on that data for derived products (such as matrices to link trip identifiers in multiple data sets). See below.

Are the Center's fishery data objectives adequate and is the Center using the best suite of techniques and approaches to meet those objectives

As stated above, life history processing should move into production mode where possible.

It is not clear whether the biological samples (lengths) obtained from the island fisheries are adequate for stock assessment (is the resulting length composition representative of the landings). The PIFSC should determine whether the samples being obtained by the life history group are sufficient to support stock assessment (are representative of the fishery) and if not consider revising the biological sampling approach to provide adequate samples.

The Center should have as one of its data management objectives that there should be only one official copy of a data set and that requests for information generally should be extracted from that data set or a frequently renewed mirror or automated summaries of that data set. Standardized systems for extracting reports should be used to meet most data requests so that extracts and reports can be as consistent as possible. The Center should work with its partners to facilitate achieving this goal.

Another data management objective which the Center should adopt would be that most or all of the information for similar things such as a fishing trip should be linked across data sets. For example landings, vessel log books, observer information, size information and biological sampling results (ages, maturity, ...) should be easily cross-referenced and preferably easily extracted together. The Center should work with its partners to facilitate achieving this goal.

An important component of an integrated data management system would be to have data corrections fully documented in the data system (ie who made a change to which element and when) and propagated through the system automatically in such a way that data managers of derived products using that element (such as links pointing to landings and log book records from the same trip) are automatically notified so that appropriate action can be taken. This approach would replace the current approach used by at least some programs and partners in which large blocks of data are replaced when even a small number of elements within the block have been updated which forces data managers to repeatedly review and rebuild derived products.

Is the Center's fishery data system properly organized to meet its mandates and is the allocation of resources among programs appropriate?

Continued work to modernize and integrate data management systems within PIFSC and among the PIFSC and its partners is needed. See above.

Are the Center's fishery data programs being conducted properly (survey design, standardization, integrity, peer review, transparency, confidentiality, PII, etc.)?

It is highly likely that the statistical surveys used to estimate territorial landings and to obtain size information use too many strata. Simplification of the sampling designs will likely be needed to provide information with useful coefficients of variation.

It is likely that biological sampling / size data collection programs from markets/ dealers should be expanded to ensure that the samples obtained are truly representative of the fishery.

Overarching Questions for Reviewers for Final Report

The primary focus of this document is data management.

1) Relationship of current and planned fishery assessment data activities to Center fishery assessments mandates and requirements – is the Center doing the right things?

Several analysts commented on continued difficulties in getting access to in-house data. Part of the problem may lie in the fact there may be IT staff who may not have a strong grasp of the fisheries side of the data but rather are straight IT folks. The upshot of this is that when analysts request a certain specific dataset they may get all the data and have to figure out its underlying structure. Adding analytical staff to the IT group (I think Evan provides some of this) helps. In addition, giving these same people reporting responsibilities would also alleviate this problem. The value of including reporting requirements of these staff forces ownership onto them. If they are reporting our data, they will be better able to uncover and understand data anomalies before other analysts require the data.

With regards to the WPacFIN creel survey work, before investing significant resources to expanding or otherwise augmenting this work, a better understanding of the strengths and weaknesses should be gleaned. It may not be possible to further expand this program given the paucity of remote resources in remote locations. This comment holds for all data collection exercises under consideration.

Some analysts suggested documents describing survey techniques as well as a description of techniques used for extrapolation of data to some total numbers or counts for different data collection exercises were either unavailable or non-existent. If this is true, this is a relatively easy problem to solve.

Many times during different presentations comments were made that the structure of data collection for a particular project were not collected for the purposes of stock assessment. An overarching driver to the current structure of data collection programs is for monitoring of landings for the purpose of fishery quota management.

To the extent this is a problem, some programs would require significant levels of effort to point these data collections to a structure that better supports stock assessments. With the ACL requirements NMFS now faces, the lack of stock assessment focused data collection is an important shortcoming that needs additional resources to be addressed. Long time series are expensive to abandon.

Recommendations:

- Consider adding more analytical expertise in the IT staff with knowledge of fisheries data as well as IT skills.
- Provide documentation of data collection programs and techniques used in reporting.
- Review various data collection programs for possibilities of expanding collection of more and better stock assessment data.

2) Opportunities – are there opportunities that the Center should be pursuing in collecting and compiling fishery assessment data, including shared approaches with partners?

The Center has what looks like a fairly strong relationship with the University of Hawaii. This appears to be a very valuable collaboration that allows the Center to expand its technical and analytical capabilities.

Several presentations spoke to the bottlenecks, need for more and faster bio-processing. As I understand the structure, the Center has a staff of 4 to complete this work. In general, field data collection is much more expensive than in-house processing. The Center should focus more resources, wither internal staff or external contracts to expedite work on these specimens to provide more data to analysts. Otherwise the Center could be well on its way to becoming a storage point for bio-specimens.

Recommendation:

- Expedite the processing of bio-specimens through internal staff reorganization or external contracts.

3) Scientific/technical approach – are the Center’s fishery data objectives adequate, and is the Center using the best suite of techniques and approaches to meet those objectives?

There are differences of opinions to the status of a GIS shop at the Center. Like the opposite opinions on Oracle, there is either a strong GIS presence available for Center wide use or GIS capabilities only exist within various programs. With the obvious need for a GIS presence in the Center, providing some level of Center-wide support would seem appropriate.

Recommendation:

- Consider the development of Center-wide GIS support.

4) Organization and priorities – is the Center’s fishery data system properly organized to meet its mandates and is the allocation of resources among program appropriate?

With respect to the data portion of their tasking, in many ways the Center appears to be focused on the correct data tasks. Continuing tasks like combination and integration of various bottomfish datasets is very valuable in creating a richer data set for analysts assuming sufficient documentation on assumptions made to combine different data. Expanding these tasks to other datasets as possible and practical should be encouraged. Further work on these types of exercises should be done working closely with analysts to understand and incorporate their needs.

The move to a centralized Oracle database, in its infancy at the 2010 review, seems to be moving forward. This move with its data standards, metadata requirements, availability of support for database design and access is an important process that should continue. Centralization allows for easier data access and sharing across the Center. Providing routine support such as data backups, software patches, etc. relieves the analyst from these chores and allows them to focus on their primary tasks.

At the same time there appears to continue to be ‘turf’ issues and/or hesitancy to change and adapt the current systems/methodology because it’s always been done that way. As such, there are a number of databases that have either not been migrated or only perfunctorily migrated. Some but not all of the data are in Oracle, the data are in Oracle as a flat file or all the data are in Oracle but permissions to access the data are only granted to the data owner or few analysts. This was a problem identified in the 2010 review. Again, progress has been made but that is not complete. This is a structural problem without easy solutions.

Having said this, it is not clear how widespread this problem is in the Center. Over different discussions I heard it’s either not a problem, it’s still a big issue or it’s somewhere in between. Depending on where the reality lies, this may be a non-issue.

One positive change since that time is bringing analytical staff into an IT role. IT staff with fisheries knowledge helps bring a richer understanding of the data to better support end users. This knowledge will also be beneficial in establishing new data initiatives moving forward, ensuring a smoother incorporation into the larger centralized data structure.

A common thread throughout several presentations is the amount of time needed to answer external, non-stock assessment data requests. My understanding is many of these requests are being fulfilled on an ad hoc basis with no central oversight to prioritize requests and allocate resources appropriately. With no central clearinghouse to process requests there will be duplicative efforts on the same or similar requests which wastes valuable staff resources.

One solution in the works is what appears to be a data request tracking tool being developed by Center staff to capture information about requests allowing staff the possibility to mine old requests for repeat questions. This could potentially lead to simplifying data requests by rerunning existing queries.

A related solution is to develop a handful of data reports or tables (10-12?) to satisfy many/most data requests. These reports should be automated and made available monthly, quarterly, annually, or whatever time period seems appropriate. Making standardized non-confidential data reports public and easily accessible greatly circumvents the number of data requests that the Center may see annually. Part of the initial investment of time would be to develop these reports with a transparent documentation of assumptions used so the data provided is understood by the end users. These assumptions should be vetted through the appropriate data review committee for guidance and advice on their value.

A minor point – There were several mentions suggesting freezing datasets at a point in time and provide that dataset for data requests. The logic seems to be based on the assumption that if the information in a large database is frozen different analysts reporting on the same data will arrive at the same results. This is not always the case. There are many cases of analysts coming up with different answers when querying the same dataset (aka the ‘Marasco Problem’). In addition, given the fluid nature of large datasets, the value of this freezing approach is questionable.

Recommendations:

- Continue work to combine and report out datasets from different sources.
- Continue move to Oracle database.
- Given increasing workload with move to Oracle support, consider hiring additional IT staff to support expanding science staff needs.
- Eliminate/reduce redundant data request exercises through the use of a request tracker tool.
- Develop a series of canned reports made available to the public on a routine basis to reduce the total number of requests to those that really are unique.

5) Scientific conduct – are the Center’s fishery data programs being conducted properly (survey design, standardization, integrity, peer review, transparency, confidentiality, PII, etc.)?

The scientific conduct of the data programs in terms of confidentiality needs direction in describing and defining what data are confidential. Once this is defined there should not be mechanical impediments to providing access appropriately. On the other hand, it appears, not unique to this Center, that some data have restricted access due to the lack of confidence in external analysts to use the data appropriately, not due to legal restrictions for confidentiality. Rules for how analysts are categorized as well informed and trusted vs. not should be made transparent. Resources should be allocated to insure more analysts can come up to speed on the data structures and dependencies and thus can be trusted to use the data appropriately if they are legally allowed access to the confidential data.

Recommendations:

- Identify confidential datasets within the purview of the Center.