Programmatic Review of the PIFSC Commercial Fisheries Bio-Sampling Program

Hyatt Regency Garapan, Saipan

January 26–28, 2016

Review Panel Members

- Steven G. Smith, University of Miami
- Brad R. Moore, Pacific Community (SPC)
- Frank A. Camacho, University of Guam

Introduction

In 2007, NOAA Fisheries received funding from Congress to establish fisheries monitoring programs to support requirements of the Reauthorized Magnuson-Stevens Fisheries Conservation and Management Act (RMSA) of 2006. As part of additional monitoring, the Pacific Islands Fisheries Science Center (PIFSC) established the Commercial Fisheries Bio-sampling Program within the US territories of Guam, American Samoa, and the Commonwealth of the Northern Mariana Islands (CNMI). The primary effort in each case was to establish cooperative relationships with as many fishers, vendors and markets as possible to acquire species-specific length and weight metrics, supplementary catch and effort data, and otolith and gonad samples to determine key life history parameters to support more formal stock assessments. A pilot bio-sampling program commenced in 2009 in Guam, with sampling commencing in 2010 in CNMI and American Samoa.

Sound science is critical for making informed decisions about managing fisheries resources. NOAA Fisheries constantly strives to improve the quality and timeliness of its internal and externally supported science. To that end, a review of PIFSC's Commercial Fisheries Bio-sampling Program was conducted over a 3-day period (January 26–28, 2016) in Saipan, CNMI. It was anticipated that the review would help identify gaps and areas for improvement, assist in planning for future needs within the Program, and to help ensure that current methodology is appropriately designed to meet the expressed needs of management. This document is one reviewer's attempt to synthesize the information provided during the review and make recommendations that will be helpful to PIFSC and territorial project staff as they move forward with the bio-sampling program.

I. General Observations

a. Scientific/technical approach

The sample collection and analytical processes of the laboratory sampling program are efficient, effective and clearly described. Protocols for the extraction, labelling and storage of samples are standardised, logical and efficient. Otolith and gonad processing both utilize techniques that are well-accepted in the peer-reviewed scientific literature.

Given that two different labs are contracted to process and read otoliths, effort needs to be made to ensure processing and readings protocols are standardised.

Teams in all territories appear well trained in field and laboratory protocols as a result of considerable effort by project staff in the form of in-country trainings and regional workshops. Protocols are generally standardized amongst territories, although slight (and appropriate) adaptations have been made in each case to meet local conditions.

The selection and prioritization of species for bio-sampling generally appears well-founded and suitable. Priority is given to the dominant species in the catch for which limited local life history data exists, and from which samples are available year-round (i.e. not subject to species closures) and over a wide size range.

While the sample collection protocols are generally appropriate for collecting samples from suitable commercial fishers/vendors, the premise of using samples resulting solely from the commercial spear and bottom-fishing fisheries may not be. The estimations of life history parameters resulting from samples supplied through the commercial fishery are likely to be heavily influenced by fishing. In addition, it is likely that only a proportion of the total stock is being sampled through the commercial fishery (e.g. given the high selectivity inherent with spearfishing and market preferences for certain size). Excluding young fish from estimates of growth using the VBGF may result in an underestimation of K and a corresponding overestimation of L_{∞}. I recommend that a fishery-independent sampling component be conducted at both project locations and at unfished/lightly fished locations. At project locations, this will allow for the collection of samples generated not harvested in the fishery (such as those individuals at the tail ends of the length and age frequency distributions). At unfished/lightly fished locations, this would provide estimates of key life history parameters in the absence of fishing, including a more accurate estimate of maximum age/longevity from which to calculate natural mortality. Fisheries-independent sampling at project locations could also target key prey species from which to assess ecosystem-impacts of the fishery, and control species (i.e. unharvested species) from which to decouple fishing effects from larger regional and global processes (e.g. climate change).

To date the sampling program has generated a large amount of material, and a large back-log of otolith and gonad samples remain to be processed. At last count, otolith and gonad material have been collected from 11,841 individual fishes. It is likely that the current sample sizes are far in excess of those required to meet the objectives of the bio-sampling program. For example, length-at-age/growth curves could be established with much smaller sample sizes by selecting individuals at strategic lengths, saving considerable time, effort and funding in processing otoliths. Establishment of growth curves for hermaphroditic species may require fewer samples than for gonochoristic species. Staff within the Life History Group of the PIFSC should collaborate with

statisticians/PIFSC stock assessment scientists to determine minimum required sample sizes and to identify and prioritize the processing of samples which would be most informative for developing estimates of each of the life history parameters of interest (acknowledging that samples sizes and individual samples of particular interest would vary depending on the species and life history parameter being investigated).

Similarly, the project group should corroborate with stock assessment scientists to determine minimum data requirements for the assessment procedure to be used. A PIFSC stock assessment scientist should be identified to work with staff from the Life History Group. It was unclear from the review whether project staff have discussed data requirements with the stock assessment team or which stock assessment procedure will be utilized. It is apparent that creel survey data, where collected, are unlikely to be of sufficient quality for use in stock assessments of species in the night-time spear fishery, due to issues with grouping species (e.g. *Scarus* spp.), incorrect species identification where individuals are identified to species, lack of individual length data for many landings surveyed and uncertainty over whether the lengths that are collected are representative of the total catch, and lack of survey effort into this fishery in general. The size-based approach recently developed by PIFSC scientists and collaborators for the assessment of coral reef fish stocks in Hawai'i (Nadon et al. 2015), using estimates of life history parameters specific to each territory, would appear the most suitable stock assessment approach in the long-term. Of note, the current data collection program (ideally 20 specimens per month per size interval for each species of interest) precludes using the age-composition data from catch curves to estimate total mortality and subsequent fishing mortality rates, as the samples collected are not representative of the proportions of age classes observed in the commercial catch.

In both American Samoa and the CNMI, multiple fishers and vendors are surveyed, helping to ensure that the data collected and samples obtained are representative of the entire catch. However in Guam, data and samples are collected from a single vendor only (the Guam Fisherman's Cooperative Association). Additional markets have recently opened up in Guam to sell catches of foreign national living on the island; however these are not presently sampled due to concerns of damaging existing relationships with locals. Accordingly, it is unlikely that catches at the GFCA are representative of total catches in Guam. Effort should be made to develop strategies and build effective working relationships with other markets without compromising the strong relationship between project staff and the GFCA.

b. Data and data management

Data collection protocols appear well documented, clearly articulated amongst territories and sampling teams and are streamlined, efficient and appropriate to the data collected. Some simple improvements could be implemented to assist project staff in

the territories, particularly with data storage. In CNMI for example, a scanner is required to digitize datasheets, which would greatly improve long-term data storage and security.

Data review, quality control, data integrity, transparency, confidentiality, and PII, etc. are treated appropriately. Data stewardship is taken very seriously and the level of pride and professionalism in data QA/QC and confidentiality is evident.

It is intended that the samples collected through the bio-sampling program data will be used to established key biological parameters of the species of interest (including age and growth parameters $L\infty$, t_0 and K, length and age at maturity profiles, length and age at sex change profiles (for hermaphroditic species)) for use in stock assessments, calculation of annual catch limits, formulate management strategies (e.g. minimum size limits based on length-at-maturity) and support and complement existing data collection programs (e.g. creel surveys). For reasons discussed above (point Ia), using individuals solely from the commercial catch, as is currently undertaken, is considered insufficient to meet these needs.

c. Communications

Working relationships between project staff and vendors/fishermen generally appear to be highly effective, resulting from significant relationship-building initiatives by territory project staff. Considerable effort has been made to incorporate the bio-sampling program into existing business operations without significantly disrupting daily operations. Significantly, the effective working relationships allow fish to be sampled from fishers and vendors without having to purchase entire fish, resulting in considerable financial savings to the program. In some cases (e.g. Guam), vendors allow project staff to take fish to the NOAA lab for extraction of otoliths and gonads and return them for later sale. This is a remarkable achievement and one that deserves to be applauded.

Communication between territorial and federal bio-sampling staff is regular, effective and at the appropriate level to meeting the needs of territorial and federal mandates. Surprisingly however, the review was the first opportunity for relevant staff from each of the territories to come together to discuss the program since its inception. It is recommended that more opportunities are provided to territory staff to come together to discuss progress, issues and learn from each other’s experiences.

At the time of the review few results from the bio-sampling work were available to communicate to stakeholders and the general public. However, it appears that few formal strategies for communicating results were developed at the conception of the project. Communication of program objectives, methodologies or results to date to stakeholders and the general public has largely been led by the territory project staff on

their initiative. In each of the territories, members of the project team have put considerable effort into community outreach and have developed a number of excellent initiatives. When providing results of the more formal stock assessments to fisheries agencies, managers and other stakeholders, the bio-sampling program could benefit from the development of a formal communication strategy, given the complex nature of stock assessment reports.

d. Organization and priorities

The PIFSC and territory partners appear well-organised, highly motivated, and capable. Key gaps and issues to the collection of data and biological samples (e.g. species identification) have been recognised and remedied (e.g. through the development of species ID guides/keys). Facilities are suitable for bio-sampling, and labs for sample collection are well-supplied. The selection and prioritization of species for bio-sampling generally appears well-founded and suitable.

As mentioned above, sample collection has been one of the key priorities to date (along with building effective working relationships with fishers and vendors). This has generated a large amount of biological material that remains to be processed. It is recommended that processing of existing biological material be prioritized over continuing the sample collection. This is to ensure life history and stock assessment results are provided to stakeholders within a timeframe relevant to management (noting that sample collections commenced approx. 6 years ago). This is particularly important given that it is likely the data from the bio-sampling will be used for stock assessment in view of the inadequacies of using data resulting from the existing creel survey programs for stock assessment purposes as previously described.

e. Accomplishments relative to management needs

Although few formalized life history results have been supplied to date, significant in-roads to improving management in the territories have been made. For example, life history data are currently used to provide length-weight info for species underrepresented in creel survey programs, allowing for both a more efficient creel survey program (as weight data does not need to be collected for all species) and a better estimate of annual total catch (by weight). The bio-sampling program also provides valuable information from fisheries not targeted or are seldom targeted during the current creel survey programs (e.g. the night-time spear fishery in Guam), and has significantly improved staff species identification skills, greatly improving data quality in the creel surveys. Perhaps most significantly, the excellent effort by project staff to work with and include fishers and vendors has helped to build trust amongst the parties, to the benefit of data collection and quality.

f. Opportunities

Several presentations spoke to the bottlenecks in processing otolith and gonad material. Tremendous scope exists for capacity building of territorial project staff in preparing otolith sections and gonad histological slides to a stage where they are ready to be provided to experts for reading/interpretation. This would help to reduce the back-log of collected samples and make for more efficient processing, whilst significantly building capacity in the region. Similarly, engaging students from relevant academic institutions (e.g. University of Guam, University of Hawai'i) to work up samples as part of student projects may also be a viable option. As with training of territorial fisheries staff, this would help alleviate the back-log of otolith and gonad samples whilst fostering the next generation of fisheries biologists in the region.

g. Other

In all three territories, the bio-sampling work in being conducted in conjunction with other data collection programs, in particular creel surveys and vendor logs. Care needs to be taken to ensure the bio-sampling work remains complementary to, rather than in competition with, these programs, and especially the creel surveys. In American Samoa for example, there is evidence that the incentives offered to fishers for allowing access to their catch are actively impairing the creel survey program.

Considerable scope exist for project staff to collaborate with those working in tropical, data-poor fisheries, such as the Southeast Fisheries Science Centre and other parties and neighboring countries and territories in the Pacific that are also implementing bio-sampling and creel survey programs (e.g. SPC). Given the likelihood of shared stocks, it would be highly beneficial to ensure data collection, sample processing, analytical protocols and stock assessment criteria are standardised not just among the three US Pacific territories but with other Pacific neighbors.

II. Key (Specific) Recommendations

The below list represents my key recommendations for moving the Commercial Fisheries Bio-sampling Program forward and to ensure that it addresses the expressed needs of management:

- Include fishery-independent sampling at project locations and unfished/lightly fished populations. For project locations, this will help to ensure the entire stock is sampled (including the tails of the length and age frequency distributions), while at unfished/lightly fished locations this will provide an assessment of life history parameters in the absence of fishing, in particular species longevity/maximum age. Fisheries-independent sampling could also target key prey species from which to assess ecosystem-impacts of the fishery, and control (i.e. unharvested) species from which to

decouple fishing effects from larger regional and global processes (e.g. climate change).

- Collaborate with statisticians/stock assessment scientists to determine the minimum data requirements for determining life history parameters from samples collected to date and to prioritize which individual samples would be most informative (acknowledging that samples sizes and individual samples of interest would vary depending on the species and life history parameter being investigated). Similarly project staff should work closely with stock assessment scientists to determine the minimum data requirements of the stock assessment approach to be used. To this end, a dedicated PIFSC stock assessment scientist should be identified to work with colleagues in the Life History Group.

- Expand data collection and bio-sampling operations in Guam beyond the GFCA to alleviate issues with data confidentially and whether samples from this vendor are representative of the fishery as a whole.

- Provide material required to ensure safe and secure long-term storage of datasheets (e.g. scanners for digitizing sheets).

- Prioritize processing of existing biological material over further sample collection (to ensure that results are provided within a timeframe relevant to sample collection, noting that collections commenced approx. 6 years ago).

- Should additional species be warranted, it is recommended that their selection be based not only on criteria described above (i.e. importance in the catch, data gaps etc.) but also based on the readability of otolith samples. A subsample of otoliths of additional species of interest, covering a range of sizes and locations, should be assessed for readability prior to wholesale collections are undertaken for bio-sampling. Given that two different labs are currently contracted to process and read otoliths, effort needs to be made to ensure processing and readings protocols are standardised.

- Develop a strategy for communicating complex stock assessments results to fisheries managers, other key stakeholders and the general public.

- Examine the potential for using otolith morphometrics to provide an estimate of age, such as those recently performed on eteline snappers in the western Pacific (Williams et al 2015).

- Explore opportunities for leveraging the lessons learned and improved capacity of territorial staff to improve the creel survey programs in each of the territories.

III. Conclusions

Overall, the Commercial Fisheries Bio-sampling Program has made considerable progress to date. Significant achievements have been made with respect to building trust and effective working relationships with fishers and vendors in each of the territories, and considerable advancement has been made on data and sample collection. The bio-sampling program has significantly improved overall staff capacity and data quality of complementary activities such as the territorial creel survey programs. Strategic planning is now required to address the processing of collected biological material and the data requirements for stock assessments.