

## **Programmatic Review of the PIFSC Commercial Fisheries Bio-Sampling Program**

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### **Review Panel Members**

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

### ***Background***

The Magnuson-Stevens Reauthorization Act created greater data requirements for fisheries in territorial waters. The territorial biosampling program was developed in an effort to support of this new management regime by enhancing the capacity of U.S. territories of the western Pacific to collect life history data.

Starting in 2009, biosampling programs were implemented in Guam, the Commonwealth of Northern Mariana Islands, and American Samoa. These programs have generally adopted a market-based sampling strategy to acquire their samples. In all cases, training and support was provided by the Pacific Islands Fisheries Science Center to purchase equipment and support staff working in those territories.

A three-member external panel convened from January 26-28, 2016 to review the territorial biosampling programs and to provide recommendations to improve their performance. In particular, panel members were asked to review the following dimensions of those programs according to the established terms of reference:

- Scientific/Technical approach
- Data and data management
- Communication
- Organization and priorities
- Opportunities
- Other issues

### ***I. General observations***

#### **a. Scientific/technical approach**

The species prioritized for biosampling were generally the 20 species with the highest catches from each territory. Each territory adopted a stratified sampling approach across the known size range of the species. Sampling included length and weight estimates and, for certain specimens, otolith and gonad extraction and preservation. Otoliths are currently processed either in the territories or through third party laboratories. Gonads are preserved before transshipment to PIFSC for processing and analysis. The technical methods for processing and analyzing otoliths and gonads are based upon well-established, peer-reviewed methods that are appropriate and sound for most of the target species.

A major challenge to these programs is training personnel to identify and sample

fish in the field and to process the tissues at the laboratory. To that extent each region has made fish identification a top priority and the teams are proficient in their sampling techniques in the field. However, there is still a critical skill gap in extracting and preparing otoliths and gonads in the lab and even less local expertise in analyzing those tissues.

As mentioned above, species were selected based upon historical catch data from each region. The use of catch history to choose stocks is logical, but as the program begins to expand, there should be an effort to characterize life history parameters for other stocks that may not be commercially valuable, but may have cultural and/or ecological importance.

One issue is that the sampling strategy was developed without considering the level of effort necessary to generate life history parameters that are useful for integrating into stock assessments. The current design may in fact result in oversampling certain size classes of particular species. It is recommended that the current design be revised in collaboration with stock assessment scientists to improve the efficiency of the sampling strategy.

Another key issue is that samples are collected almost exclusively from commercial catches and the size ranges of fish that make it to market are typically different than what occur in natural populations. Program personnel are aware of these limitations and there are efforts to improve sampling individuals at the tails of the size distributions. For some stocks, I would recommend contracting skilled fishermen to augment the sampling. Furthermore, in Guam only one vendor is currently surveyed. This has created confidentiality issues with respect to vendor data. At the same time, there has been an increasing number of Micronesian-owned fish vendors on Guam. It would be useful to expand the market sampling to those vendors to augment the sampling efforts on Guam.

As the biosampling programs have grown, there is a growing backlog of biosamples remaining to be analyzed by PIFSC staff. To alleviate the backlog, territories should be responsible for as much of the processing as possible prior to sending the samples to PIFSC.

#### **b. Data and data management**

Territorial biosampling teams have converged on similar data collection protocols. The different territories have all tried to experiment with different approaches to data collection and input with varying levels of success. There is thus a need to capture the changes in how data were collected since the inception of the program. It is also apparent that sampling of market-based catches is labor intensive and requires a minimum of two team members to efficiently process the fish. Technological improvements may streamline the process, such as using photographic records of length and weight for each fish.

Regarding data confidentiality, there are standardized protocols established to

protect the identity of fishermen and vendors. The situation is complicated in Guam where there is currently one vendor supplying all of the market-based catch, creating a confidentiality issue. Expanding the market survey in Guam to include other fish vendors would mitigate that issue.

Data are stored in a WPacFIN database and data requests by are routed through the WPacFIN program. The WPacFIN database has built-in tools that estimate life history parameters and highlight outlying datapoints and thus provide some degree of quality control. In the CNMI, there is a data manager on staff, but it was not clear if other territories had similarly dedicated personnel.

It is clear that PIFSC anticipates that the life history data will feed directly into future stock assessments for those species. If successful, this would represent a clear improvement over the current approach to estimating reference points for these particular stocks. However, there has not been enough engagement with stock assessment scientists and statisticians in designing the different biosampling programs. PIFSC should re-evaluate their sampling strategy with input from stock assessment scientists and statisticians to determine if the sampling effort is sufficient to meet management needs.

### **c. Communications**

It is obvious that the success of these programs is based on the mutual trust and respect of the biosampling staff and the fishermen and vendors. One of the greatest strengths of the territorial teams is their willingness to cultivate relationships with these people. To that end, an impressive amount of effort is dedicated to minimizing the sampling burden on the participants.

The biosampling teams all effectively sample from the most productive markets in each of the territories. However, the shifting demographics of the fishery and markets in Guam are providing some emergent challenges. In particular, several fish markets have recently opened on Guam that are supplied and managed by the migrant Micronesian community. There is a clear need to develop trust among those vendors in order to sample from those markets. It should be noted that at least some of these vendors are likely supplementing their local catch with imported fish.

Communication appears to be effective between territorial and federal biosampling WPacFIN staff. All of the biosampling programs are also involved in extensive outreach and educational activities. In some of the territories, length-weight data have already been shared publicly at community events. Age and reproductive data are far more limited, however. In the future, it is hoped that products would be available for the public that summarize the results from the biosampling programs as these data become available.

### **d. Organization and priorities**

The territorial biosampling programs have developed very quickly with very modest levels of funding. The different territories essentially manage their biosampling efforts with relatively modest oversight from PIFSC. This has allowed for a great deal of

flexibility in how these programs adapted to local challenges and leveraged available strengths. Nevertheless, the regional programs could benefit from additional guidance from PIFSC in terms of project design. Perhaps PIFSC might consider a program coordinator who could interface with stock assessment and life history personnel to oversee the biosampling operations in the territories.

There is a need to prioritize processing tissue samples for analyses for those stocks with potentially robust sampling across their size range. Future sampling designs should also include non-commercial species, such as those that may be important ecosystem component species or that be an important prey item for target species.

#### **e. Accomplishments relative to management needs**

A significant achievement by the territorial biosampling programs has been the cooperative participation with vendors. The biosampling program has substantially improved the taxonomic resolution of the data collected, in most cases to the species level. This represents a major improvement for many of these taxa. In addition, the market-based catch has also allowed the territories to calibrate the accuracy of their creel surveys. These programs have also made progress toward securing equipment and training for staff on tissue sampling and analyses.

#### **f. Opportunities**

A number of excellent opportunities are available to the territories and PIFSC to support and enhance the biosampling programs. There are already partnerships with the University of Guam that have provided additional capacity to process samples for PIFSC. In addition, the UH Medical School has been contracted for the histological preparation of gonads from American Samoa and similar partnerships could be developed in other territories.

Interestingly, this program review represented the first time all the key territorial and federal biosampling personnel had met to discuss their individual programs. More than anything else, there must be more frequent dialog and coordination among the territories and with PIFSC. There also exist opportunities to share training, expertise and data with other life history labs in the Pacific, such as the SPC, as well as with the Southeast Fisheries Science Center and other laboratories working on reef stocks in the Caribbean. However, the territorial biosampling programs must also interact more frequently with each other in order to share ideas and solutions.

With the creation of biosampling laboratories in the territories, there is a tremendous opportunity for capacity building. There are two-year colleges in the territories that could provide student for training and to assist in the analyses. An undergraduate from the biology program at the University of Guam is already volunteering with the Guam biosampling program and is currently processing otoliths as part of a research project.

A recurring theme identified by biosampling team members is the need for accurate, comprehensive fish identification keys. In some cases, territories have

developed their own key, which has minimized the potential for misidentification. It would be valuable for the staff in the territorial fisheries agencies to continue to develop their skills in fish identification and life history sampling.

### **Other**

A critical question that needs to be asked is whether local fisheries agencies will eventually inherit the biosampling programs. In some jurisdictions, the biosampling programs compliment the territorial creel surveys and personnel from the local agencies already assist with the sampling. In other areas, biosampling is proceeding with little to no participation from local agency staff.

At the federal level, there is concern that there currently are no stock assessment personnel dedicated to territorial nearshore fisheries. It is also unclear the process by which stocks would be chosen for assessments, although this is beyond the scope of this report.

## ***II. Key Findings and Recommendations***

- A significant amount of effort is being placed on collecting fish lengths and weights from market samples. **A more strategic sampling design is needed in order to improve the sampling efficiency. This re-evaluation should be in collaboration with statisticians and stock assessment scientists.**
- Certain size classes of stocks are underrepresented in the biosamples. **The territories should explore contracting fishermen to target areas where size classes of those individuals might occur.**
- Catch history was the primary way stocks were identified for biosampling. **In the future, culturally and ecologically important fish (and invertebrates) should be considered as well.**
- There is a significant amount of heterogeneity in training and equipment among the territories for processing and analyzing tissue samples. **PIFSC and the territories must continue to identify funds to enhance the skills of biosampling staff to a level of proficiency suitable for basic ageing and staging. The territories must also interact with each other and with other groups engaged in life history research in tropical nearshore systems.**
- Several of the territorial labs lack the equipment to reliably age otoliths. **Some funding sources should be identified to assist with modernizing and standardizing equipment between the different territories.**
- The lack of other vendors being sampled in Guam has raised concerns about data confidentiality. However, there is evidence that the catch among other vendors may be a mixture of local and imported fish. **If the Guam program wants to continue with a market-based approach, then the sampling effort must be expanded to other vendors, with the understanding that the source of the fish samples (local or imported) must be validated.**
- There is a growing backlog of tissue samples in need of analysis by PIFSC staff. **It is recommended that biosampling teams redirect more of their efforts to processing the samples in the territories in order to allow PIFSC to focus primarily on analysis.**

- Data collection in the field is labor intensive and often requires more than one staff member. **Biosampling teams should continue to investigate technological solutions (e.g., photographic records, optical character recognition, voice recognition software, etc.) to minimize the sampling and data transcription times.**

### ***III. Conclusions***

Overall, the territorial biosampling programs have successfully developed a sound framework for collecting and analyzing biosamples. The primary programmatic issue is that there has not been enough engagement with stock assessment scientists and statisticians to determine the most effective sampling strategy for these fish. Furthermore, there must be more collaboration between the territories and with other national and international science centers investigating similar systems. PIFSC life history staff should guide these efforts.

One of the strengths of these programs is the degree of trust cultivated between program staff and the participants. It is clear that these programs would fail without the cooperation of the fishermen and vendors. Other sampling programs would benefit from studying the approach that these programs have taken.

There remain significant challenges to removing bottlenecks in the sample pipeline. Improving the skills of the program staff is one obvious way to catalyze these analyses. Leveraging partnerships with local community colleges and universities has also been effective at relieving some of the backlog. In the limited funding environment of the territorial biosampling programs, it is likely that student and community volunteers will continue to be essential in to the success of these programs.

Finally, there is a tremendous value in biosampling staff sharing ideas and solutions to similar problems. That these teams have been able to create these programs in such a short time with fairly limited resources is a testament to the creativity and hard work of the territorial and federal program staff.