



REPORT OF A GCFI WORKSHOP: STRATEGIES FOR IMPROVING FISHERY-DEPENDENT DATA FOR USE IN DATA-LIMITED STOCK ASSESSMENTS IN THE WIDER CARIBBEAN REGION

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Executive Summary

A special theme session and workshop on data-limited stock assessments was held at the 67th annual conference of the Gulf and Caribbean Fisheries Institute (GCFI) in Barbados, West Indies during November 3-7, 2014. Contributors to the GCFI special session provided presentations on a variety of topics relating to fishery-dependent data collection. The 1.5 day GCFI workshop provided an opportunity for scientists, managers, and stakeholders to identify and prioritize the optimal elements to incorporate in designing efficient data-dependent statistical collections. A pre-workshop questionnaire survey was employed to obtain information on the backgrounds of attendees and level of involvement in data collection systems. Presentations included an overview linking management to data collection, and case studies describing existing data collection systems in the region. Participants listened to presentations on best practices for biological data collections and novel approaches for engaging stakeholders in data collection. Participants also engaged in an interactive activity to design a data collection system for a specified level of resources. During the workshop, participants were involved in breakout group sessions addressing: 1) linkages between data and management needs, 2) stakeholder involvement and improving communication, 3) electronic monitoring, and 4) the use of management strategy evaluation (MSE) as a tool to simulate the effectiveness of management advice. Participants addressed key questions on what data collection practices are currently being used to minimize uncertainty in data-limited assessments. Finally, the workshop participants identified best practices relating to minimum data collection for improving data-limited stock assessments in the Caribbean region, taking into consideration financial resource availability.

Background

This special workshop, hosted by the Gulf and Caribbean Fisheries Institute (GCFI), was the second of a series of workshops proposed to assist in the strengthening of scientific capacity in the wider Caribbean region. The work group identified best practices and strategies to improve data collection efficiency to address requirements for data-deficient stock assessment methods, and to better engage stakeholders in the process. Since the late 1940's, GCFI has served as an international forum among the scientists and managers who strive to improve the ecological health and socioeconomic sustainability of living marine resources in this region. Funding for the workshop was provided by the National Marine Fisheries Service (NMFS) with the recognition that the commercially and recreationally important fisheries have significant connectivity across the many international jurisdictions of this region.



The overarching theme for the data-limited series is developing an international collaborative effort to improve the availability, quality and timeliness of scientific information used in stock assessment, including the appropriate inferences drawn from this information. This strategy operates through a series of workshops that bring together experts to address key requirements to improve data-limited stock assessments in the region. The 2013 special workshop, convened in Corpus Christi, Texas, focused on identification and characterization of the requirements of the modeling methods commonly used in the region (Cummings *et.al.* 2014). In furthering this capacity building strategy, the 2014 workshop set about to develop a plan for improving fishery-dependent data collection systems. Fishery-dependent data collection is integral to the stock assessment process, and therefore it is appropriate that the second workshop in the theme emphasizes the importance of optimizing fishery-dependent data collections.

In the Gulf of Mexico and Caribbean regions, stock assessment evaluations are challenged by the size and diversity of the resource area, costs of conducting surveys relative to value of the fishery, complexities in life history patterns of marine organisms, and difficulties in sampling habitats that are inaccessible and vulnerable to conventional sampling gear such as trawls and traps. The difficulties of managing these subtropical marine resources are further complicated by the environmental effects on the marine ecosystem, diversity of fisheries and geopolitical challenges across jurisdictional boundaries.

Fisheries stock assessments in the region are commonly characterized as “data poor” because they lack sufficient data with which to determine stock status and reliably inform management. Adequate and reliable data are critical to performing robust stock assessments and some of these concerns were highlighted in presentations provided during the 2014 GCFI special session entitled “Strategies for Improving Fishery-dependent Data for Use in Data-limited Stock Assessments in the Wider Caribbean Region” (*Appendix 1*). This theme session provided context for the overall goal of the workshop to identify approaches for improving the collection of fishery-dependent information for use in stock assessments in the wider Caribbean region. The scope of the workshop was not intended to provide a comprehensive overview of all of the data collection systems in use in the Caribbean; rather, the intent was to evaluate case studies and provide recommendations on optimal practices. During the 2014 workshop, topics included the need to: optimize fishery-dependent data collections in relation to management data objectives, incorporate budgetary concerns in designing data collections, involve stakeholders from the onset in data collection, increase efficiency and accuracy in data collection, and emphasize the importance of consistency in data collection systems across the jurisdictional boundaries in

the wider Caribbean region. Additional background information relevant to the objectives of this workshop are available from the literature and summary reports of previous workshops conducted in the Caribbean on this topic since the mid 1980's (e.g., Barnwell 2014; Brown and Hemmings 2001; CARICOM 1993, 2000; CFU/FAO 2003; CRFM 2012; FAO 2014; Mahon and Rosenberg 1988; Zollet et al. 2014).

Welcome and Introduction

The conveners thanked the presenters for contributions to the GCFI special session on identifying strategies to improve fishery-dependent data collections (*Appendix 1*), and welcomed the participants (*Appendix 2*) to the second GCFI data-limited stock assessment workshop. It was noted that the attendees represented a diverse group of fishery biologists, natural resource managers, academic professionals, fishers, and non-governmental organizations from various countries throughout the Caribbean region. This multidisciplinary effort is considered paramount to enhancing the success of fishery improvement projects and particularly those directed at optimizing fishery-dependent data collections, the latter of which is a priority for informing stock assessments.

The workshop agenda was reviewed (*Appendix 3*) and unanimously approved by the participants with agreement that the workshop structure would continue to build on the oral presentations given earlier during the formal GCFI symposium (*Appendix 1*).



Overview and Goals

The ability to conduct stock assessments in the Caribbean region is often limited by insufficient data regarding catch history, length frequency distributions, and patterns of growth and reproduction. Additional uncertainty often results from inadequate information about the capacity or operation of the different fleets in an area. Regardless of these data deficiencies, managers must still make policy decisions to maintain the sustainability of the harvested marine resources. This workshop provided the opportunity to evaluate the methods and data collection systems in use in the region, to identify strategies for optimizing statistical systems taking into account technological advances and existing challenges, to identify solutions for engaging stakeholders early in the data collection process, and to identify best practices in data collections with regard to minimizing uncertainties in data-limited stock assessments.

This workshop was the second in a series of GCFI special workshops that progress sequentially to provide recommendations for building scientific capacity to achieve sustainable marine fishery resources and healthy and productive marine ecosystems in the wider Caribbean region. This includes the fundamental requirement of improving fishery data collection programs and statistical analysis tools.

Workshop conveners provided a brief overview of the workshop goals and expected products. The objective of the present workshop is to build upon findings of the previous 2013 workshop by: reviewing data collection systems in the region, understanding minimum data requirements for data poor stock assessment methods, and identifying recommended strategies for optimizing data collection. In addition, it is desirable to identify and incorporate into practice novel strategies for enhancing stakeholder inputs into the design of data collection systems. Building consensus among scientists, managers, and

stakeholders is a key component to improving stock assessments in the region, particularly in data-limited and resource limited environments. For the purpose of this workshop, participants were asked to consider themselves as a study group who will continue to work on this effort beyond the workshop, and help guide the direction of subsequent workshops that will address fisheries-dependent and fisheries-independent data requirements.

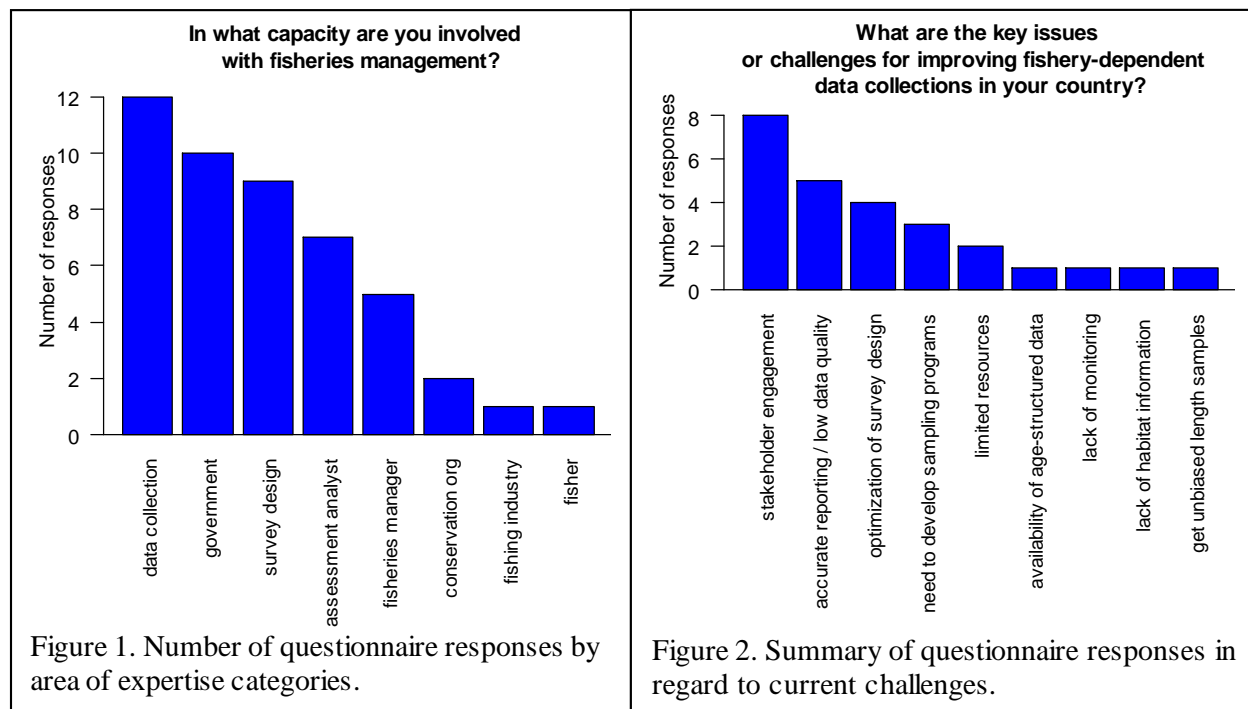
Participants agreed on the following workshop goals:

- Identify minimum fishery-dependent data collection needs for stock assessments**
- Identify options for enhancing efficiencies in sampling**
- Identify mechanisms for improving stakeholder participation in data collection**

Pre-workshop Questionnaire

Prior to the 2014 GCFI workshop, a questionnaire (*Appendix 4*) was distributed to query experts in stock assessment, survey operations, and technology, as well as resource managers, on the ongoing developments and challenges relevant to data-limited stock assessments within the larger Caribbean region. Responses to the questions were used to develop the framework of the workshop.

To open discussions among the participants on the terms of reference and objectives of the workshop and breakout group activities, a summary of the pre-session questionnaire responses was presented at the beginning of the workshop. Although responses were obtained from a diversity of experts, most of the questionnaire responses were from individuals with experience in survey design, data analysis or data collection (Fig. 1).

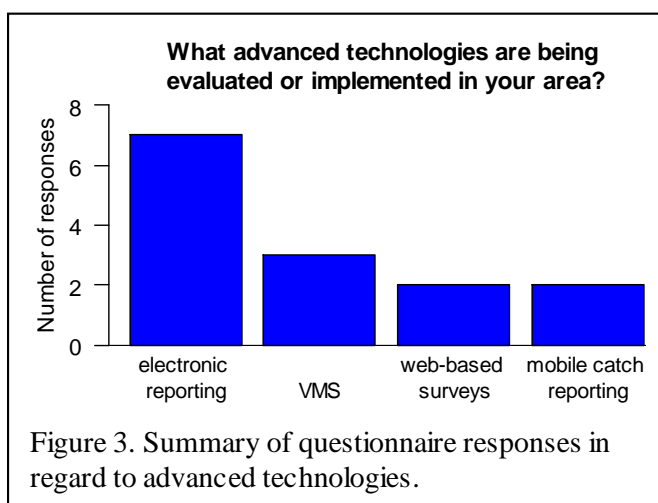


Participants were generally found to have had some level of experience relevant to fishery-dependent data collection. Over half of participants were currently working on developing or refining collection methods, and many were also active in methods that involved stakeholder participation (Table 1).

Table 1. Questionnaire responses of 17 workshop participants.

<i>Question</i>	<i>Yes</i>	<i>No</i>
Do you have experience relevant to fishery-dependent data collection systems or surveys?	100%	0%
Are you currently working on developing or refining fishery-dependent data collection methods?	59%	41%
Are you currently involved in data collection efforts that involve stakeholders?	53%	47%

Participants were asked to list key challenges for improving fishery-dependent data collections in their home countries. A variety of issues were identified, including stakeholder engagement, integrity of sampling programs, and optimizing data collection in a continual limited funding environment (Fig. 2). Finally, participants were asked to note whether advanced technologies were being implemented in their area. Participant responses indicated that a relatively small set of technologies were in use for a number of different systems (Fig. 3).



Terms of Reference

Upon review of the pre-workshop questionnaire results and goals of the workshop, the workshop participants unanimously agreed on the following terms of reference.

Terms of Reference:

- Provide brief descriptions of key fishery-dependent sampling methods used in fisheries stock assessment and relevant sampling optimization methods
- Review case studies from data collection programs in the wider Caribbean
- Provide participants with knowledge and skills to design data collection instruments
- Identify impacts on stock assessments from biases and imprecision in data collection
- Provide recommendations for engaging stakeholder involvement in data collection

After the results of the pre-workshop questionnaire were presented, several presentations were made on the topics of: matching resource management requirements to fishery-dependent sampling, characterization of data collection systems in use in the region, and recommended guidelines on best practices for biological sampling.

Best Practices in Data Collections

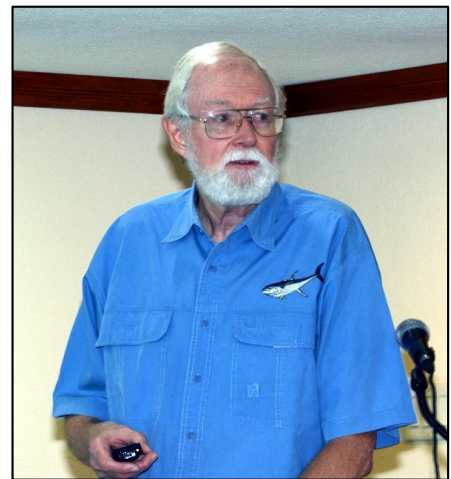
Fishery-dependent sampling and management

Nancie Cummings (NOAA Fisheries) provided a “Historical Overview of Fishery-dependent Sampling in the Wider Caribbean.” She noted that several of these sampling programs have been in existence for nearly 30 years, reflecting the recognition by managers of the importance of data collection to fisheries management. Participants obtained a snapshot view of regional data collection program reviews spanning 1988 to 2014. She highlighted the importance of defining goals at the early stages of data collection design, specifying outputs towards effective fisheries management and robust stock assessment, and gaining consensus among all users early in the design stage. The need to enhance technical capacity was noted as having a large impact on the ability to design, implement and manage data collection systems effectively. Linking data collection to management and assessment needs was emphasized as a vital component for achieving successful data collection systems, for evaluating system performance, and for minimizing uncertainty. The importance of involving stakeholders in the early phase of designing data collection programs as well as engagement in the implementation was emphasized. Design and implementation must take into consideration multiple goals across user groups, and incorporate adaptive evaluation of sampling with the recognition that effective monitoring systems evolve over time through consensus agreement across all involved in the planning. Cross-regional outreach and education on existing data collection systems is encouraged to prevent unnecessary duplication of efforts.

Best practices for Biological Data Collection

Jim Franks and Nancy Brown-Peterson (Gulf Coast Research Laboratory) and Eric Sailant (University of Southern Mississippi) provided workshop participants with information on biological data collection relating to age and growth, reproductive capacity, and genetic sampling. They focused on obtaining fisheries-dependent finfish data within the context of sampling design, challenges, fishing community engagement in sampling plan, biological data collection form/data variables of interest - environmental/specimen data, age/growth studies, age/size frequency information, and obtaining otoliths from fishing catches.

This presentation noted several key components integral to achieving a good overall biological sampling plan, including the need to foster collaborations among scientists involved in sample processing and data analysis. Collaborative work is necessary to improve the efficiency, standardization, and robustness of data sampling programs and to improve the reliability and minimize bias of the scientific information in the region. This effort must also include fisher collaboration in sampling programs, which is highly desirable for building stakeholder trust.



Important design issues and challenges noted included:

- Strategies to engage fisher participation in field collections,
- Proper selection of laboratory and field methodology (e.g., selection of appropriate age and growth structures, reproductive tissue staging methods, genetic assay protocols, etc.),
- Logistical demands of sample storage
- Evaluation of costs and minimum sample sizes
- Efficient and proper sampling form design
- Linkage between data collection and management measures



The ability to identify and delineate independent stock units through genetic sampling, to determine levels and patterns of gene flow between units, and the ability to identify genomic regions involved in the local adaption of populations, are important in ensuring long term sustainability and were identified as vital products resulting from genetic sampling. For data poor species/stocks identification of stock units is vital to developing a proper sampling design encompassing the geographic distribution of the species and should be a high priority. Critical considerations for optimizing a genetic tissue sampling project are: larval phase duration, oceanic current influences on larval dispersal, natural barriers to gene flow, life history stage, temporal sampling, sample sizes, and field and laboratory handling procedures to ensure sample integrity.

In closing, it was emphasized that biological data collection should be designed in collaboration with scientists who will be processing the samples and analyzing the data. It was further noted that data collection efforts for a new fishery will typically be of limited use for immediate evaluation of stock status, due to the absence of time series, but that any data should be collected with an end goal in mind. Follow-up monitoring of the resource should ensue in support of management objectives and to refine the initial sampling design.

Biological data collection programs should:

- Be designed in collaboration with scientists and stakeholders who will be collecting the samples and/or analyzing the data
- Engage stakeholders from the beginning to optimize resources, enhance buy-in and build consensus
- Recognize that initial data collection efforts may be of limited use for immediate assessment of stock status, but should be formed with end goals in mind while allowing flexibility for adaptive changes

Regional Case Studies

Fisheries-dependent data collection in Trinidad and Tobago

Ms. Elizabeth Mohammed (Caribbean Regional Fisheries Mechanism (CRFM)) summarized the data collection program for Trinidad. She first characterized the fishery operations (semi-industrial, pelagic longline, artisanal) and described fishing areas and capacity (via vessel census observations). She then

described the commercial/recreational fisheries-dependent data collected, including vessel registry, observer logbook, landed harvest, effort, area of activity, aging samples, import and export quantities, socio-economic data, and cost and earnings, and the methods used for their collection, validation, analysis, and reporting throughout the island. Elizabeth identified challenges that included:

- Training of data collectors,
- Implementation of observer program,
- Quantification of bycatch,
- Better determination of fishing location in artisanal fleet,
- Need for dressed to round weights conversions for pelagic longline harvested species,
- Need for recreational fleet surveys,
- Lack of harvest information for illegal, unregulated, and unreported catch,
- Review of current landings by area to determine if current zoning is accurate,
- Need to advance the computer data management process to improve efficiency,
- Need for validation of self-reported statistics,
- Need to continue annual data collector training workshops to enhance technical capacity of staff
- Need to verify self-reported industrial data with trade documentation and sales receipts.



Possible solutions to improve fishery-dependent data collection and fisheries assessment included:

- Implementing sampling of artisanal fleet and implementing periodic rotation of species that are prioritized for evaluation to allow for assessment updates and minimize overall program costs,
- Implementing an observer program for semi-industrial longliners to manage problem of insufficient data collectors to cover offloads, problems of lumping of by-catch species, and inability to obtain individual length and weight of some species due to fish not being landed whole,
- Further engaging industry (stakeholders) in data collection through self-reporting (logbooks) aligned with training and periodic validation through observers and dockside sampling to allow for validation,
- Enhanced collaboration with recreational fishery stakeholders to collect data at tournaments (catch effort, biological).

Advances in the volunteer reporting program were also highlighted, but proposed new legislation could create mandatory data monitoring of fisheries to advance monitoring, scientific research, and management of the Trinidadian fisheries.

As was noted throughout the workshop, stakeholder engagement and trust improved when they had an increased understanding of the sampling objectives and the subsequent use of data collections. Notably, data collected are primary inputs for determining stock status and making management decisions, and are used in negotiations for fishing agreements. In some countries data collections are the primary inputs into fisher compensation calculations, and are provided as information requests both locally and internationally. The data collection system in Trinidad emphasized the importance of random collections over time and noted the need to apportion sampling effort across landing sites proportional to effort by geographical zone.

Engaging stakeholders in data collection is an integral component in this country, as manager's use self-reporting from the semi -industrial and industrial fleet. Within Trinidad's fisheries agency, quality control and assurance procedures are in place to ensure data integrity (context-sensitive help for online

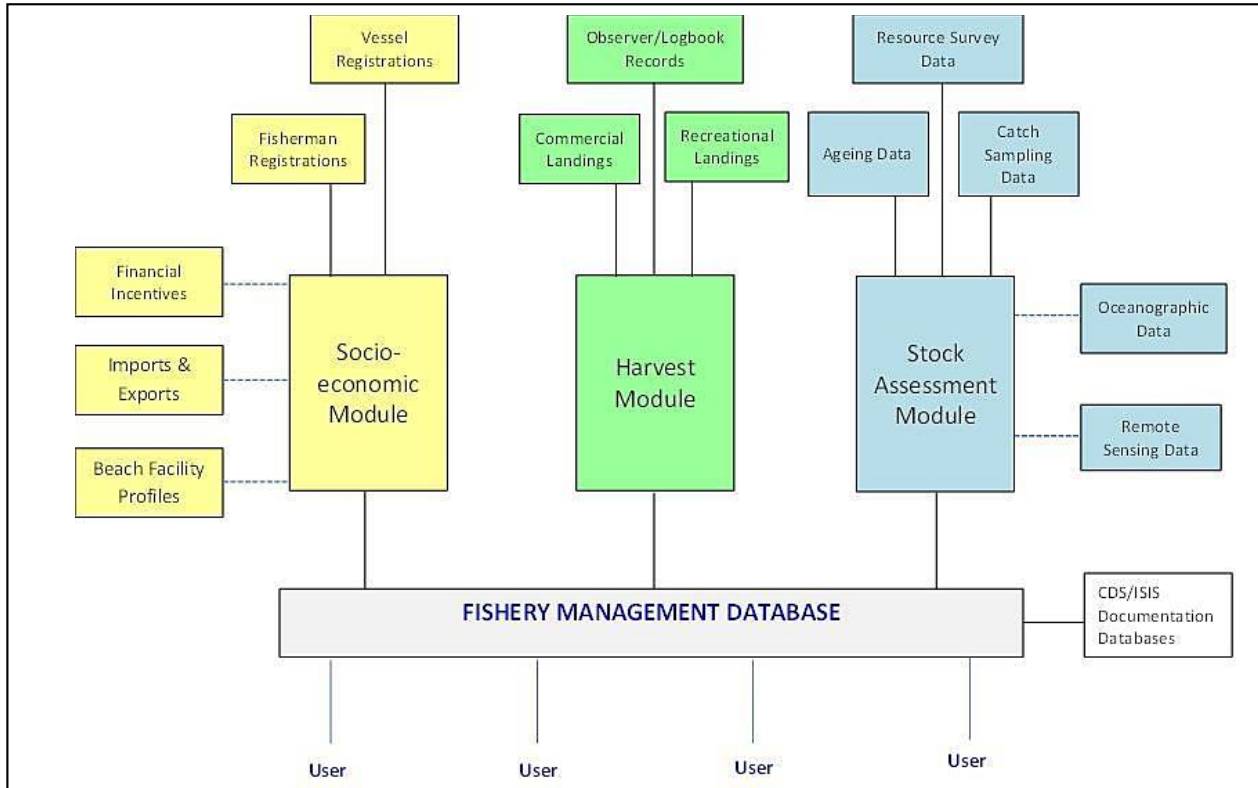


Figure 4. Fisheries management information system in Trinidad.

data entry, verification of data entry, and exploratory summary analyses to identify outliers). To provide useful data for stock assessment analyses or for characterization of total landings per effort, analysis procedures are in place to adjust catch and effort data collections to totals by adjusting for non-sampled days and vessels for pelagic longline and trawl fleets, and similar efforts are underway to develop total landings estimates for artisanal fleets such as pot and line fisheries. It was recognized that an important component of any data collection system was to make it useful for public applications. Currently in Trinidad, a variety of reports are available providing artisanal nominal landings reports, total estimated landings, and other pertinent catch information including economic information. Finally, the need to ensure sharing and confidentiality within the data collection process was emphasized.

Improving data for decision-making

Dr. Steve Box (Smithsonian Institution) next spoke about fisheries data collection and management, educational outreach to the fishing/coastal community, and legal aspects of fishing regulations in Honduras. Steve spoke about the challenges of acquiring and processing fisheries data, especially spatial information using Vessel Management Systems (VMS). He also discussed efforts to gain the trust and cooperation of the fishing community. He highlighted the use of advances in technologies as a way of improving fisheries data collection



and how these advances potentially increase stakeholder support. One example was the creation of a centralized fishery registry and license system in Honduras. This information was used to quantify fleet characteristics (size, location base, fisher demographics, etc.).

Steve highlighted the use of GIS spatial analyses to evaluate effort patterns, observing cross-boundary fishing into Nicaragua, working to enforce fishing restrictions through an online reporting system, and identifying potential marine protected areas (MPAs) protected from industrial fishing activity (low % fishing areas) to justify MPA boundaries based on fishing behaviors and practices. Proper data management design provides for better through-way communication to fishers, thereby allowing information to be visualized easily and made available through dashboard whereby fishers have the ability

Spatial monitoring benefits using VMS systems:

- Defines fishing effort, activity, and patterns
- Infers fishery type
- Allows production by area (site)
- Provides support for marine spatial planning (e.g., MPA restrictions, rights based management)
- Increases stakeholder input



to retrieve their own data, a feature which enhances transparency in the process. When data collection is automatic, the data are available in a timely manner, and can be “cloud archived,” allowing managers to respond quickly. Linking VMS data and harvest by vessel provides better spatial resolution for production estimates. Additionally, it is possible to integrate environmental information with observed fishing behavior and more accurately model shifting resource availability and fishing ground delineation.

Further work in this direction will include automation of landings data, and the expansion of the project to new areas. It was noted that a promising geographical area for this type of work is Belize, where a nomadic sailboat fishery exists. These fishers, having no “home” fishing grounds, would have incentives to participate in such a program, particularly as licensing systems are currently being developed in the country. Because licenses are typically distributed to traditional users of a resource, it is in these fishers’ best interest to accurately track their spatial resource usage patterns. It was also mentioned that the work could be expanded to the U.S. Caribbean, where the demand for catch and effort validation is particularly high.

Hypothetical St. Lessant Fishery Activity Exercise

After the mid-morning break on Day 1, participants separated into four groups to discuss strategies for characterizing a previously unstudied fishery, and to develop recommendations for improving data collection priorities and a sampling approach based upon known characteristics of that fishery. This exercise was adopted from a similar exercise at a data collection review workshop conducted in the late 1980’s (Mahon and Rosenberg 1988). Participants were asked to design a sampling program for a hypothetical fishery on a small island nation with two directed fishery fleets: one targeting mainly conch and lobster, and a second harvesting mainly demersal species. Participants were given specifics describing each fishery including the number of landing sites, market locations, and fleet distributions, and a map of the general fishing area was provided. Participants were asked to make note of any information upon which assumptions were based; for example, pertaining to the financial resource levels available. A brief description of the proposed sampling programs developed by each group for this St. Lessant fishery follows.

Group 1

Group 1 developed their hypothetical fishery sampling program assuming a relatively low funding environment and a small-scale fishery supporting mostly local consumption. They designed an island-wide sampling program using a variety of technologies and of approximately five staff. One staff member was assigned to control the setup of dockside “GoPro” cameras that would monitor overall effort, including number of trips, numbers of boats, and relative effort of the fisheries in each location. Two staff members were designated as onboard fisheries observers targeting the demersal fleet, collecting information on discards, taking biological samples, and auditing logbooks. Another one to two staff would be designated as dockside observers, intercepting fishermen for the purpose of bio-statistical sampling. The observers would also visit the market location weekly to collect dealer reports. A number of incentives and outreach efforts were also discussed. For example, rebates could be offered in return for proper reporting of logbooks. The group also emphasized the value of targeting early-career fishermen who might be more amenable to novel, participatory data collection approaches.



Group 2

Group 2 focused discussions on developing the minimum data collection requirements to ensure sustainable fisheries in a restricted funding environment. One of the group’s main strategies was to collate existing fisheries knowledge on both resource use and availability, and to review traditional management strategies that may have been implemented. The group’s approach was to identify and contact key informants and involve fishers directly in the expansion to site visits. Initially, socioeconomic data would be collected to gain knowledge on fished species, the market chain, organizational structure, and ownership of fisheries. Through interviews with fishers, the group hoped to be able to map out fishing grounds and collect basic data on fisheries, target species, and gear types. Initial “on the ground” data collection would focus on obtaining catch-per-unit-effort, age, and growth rate data that might enable some basic stock assessments.

Group 3

Group 3 assumed that the conch/lobster fishery of St. Lessant was purely a diver fishery and therefore depth restricted, that catches were relatively small, and that demersal fisheries used lines and no traps. The group made several important assumptions relating to distribution of the harvest and product utilization. First, they assumed there was a single primary market for distribution. Second, they assumed that catch was consumed locally. Additionally, the number of vessels in each fishery was known by locality and there was an existing vessel registration program in place. The group discussed an initial survey contact approach of participants in each town and each fishery, to query fishers about potential spawning areas of target species and the possibility of applying protective measures in any specific areas. The group envisioned at least three inspectors to be assigned to cover different regions of the island. Inspectors would collect landings data, as well as information on age at first maturity, which could help determine a minimum size limit for the retention of conch and lobster. Because this conch/lobster fishery was a diver fishery, avoidance and/or release of undersize organisms was thought to be a feasible

approach and could serve to provide some immediate protection to the spawning capacity of the populations. The group discussed implementing a requirement to land conch and lobster whole for a period until adequate data were collected to inform the sustainability of the fishery. For the demersal fishery, the group discussed the implementation of catch logbooks. Validation of logbooks was to be carried out by local inspectors and by taking subsamples at the market town. Initially, data collection efforts would be targeted towards obtaining size frequency data, which could be used to develop minimum size limits for key species.



Group 4

Group 4 stated the goals of the hypothetical St. Lessant fishery monitoring program would be to establish size limits and effort restrictions, taking into account complementary socioeconomic data. They planned to allocate resources among three primary sampling objectives: monitoring of catch and effort (50%), engagement of the fishing community (30%), and advanced sampling technologies (20%). The group planned to stratify sampling according to concentrations of fishing activity, noting that the fishery was concentrated in certain areas of the island. They assumed that no existing data collection activities were present, and thus planned to rely heavily on traditional ecological knowledge (TEK) to set baseline information. Priority information included fishing frequency to quantify current capacity, size information, effort, and gears used. Over time, fishery-independent data, catch monitoring, effort monitoring, and size information would become priorities. Early sampling efforts would be randomized to maximize sampling potential, and then stratified as more information was collected. Logbook monitoring programs would be implemented and results used to quantify the fishery operations spatially and temporally, and to quantify levels of removals and fishing effort by location. Surveys would begin by characterizing catch-per-unit-effort (CPUE) by region and at the beginning of the season, and would migrate toward intra-annual changes in the fishery composition and trends. Initial data collection would be via port sampling, and sex and maturity information would be collected if possible. The group also planned a socioeconomic data collection component, based initially on fisher background and mandatory registration. This would assist in stronger enforcement and the ability to reach out to the community in the future through different programs, particularly to increase awareness of how data are used. This information could further be used in developing economic incentives for fishers to participate in effective fishing practices.

Summary

The results of this workshop's hypothetical sampling survey design exercise differed from the results of a similar exercise completed by the previously mentioned 1980s workshop (Mahon and Rosenberg 1988). During the earlier workshop, participants focused largely on the use of market purchase receipts to estimate total landings, and port samplers to measure effort. In the current GCFI workshop, the St. Lessant hypothetical fishery activity had a greater focus on the use of advanced technologies, the collection of biological samples, and the involvement of stakeholders. This is not surprising given the more recent development of technologies, some of which were discussed in the morning session. The increased attention to biological data collection, such as otoliths or gonads, reflects the development of new and more complicated stock assessment methods that can make use of such data. Finally, the attention to stakeholder involvement is reflective of an environment of increased demands for management in an extremely limited funding environment, and also an increased recognition of the

importance of information exchange among scientists, managers, and resource users. As exemplified by some of the examples from the morning session, improving the understanding and participation of stakeholders in data sampling programs will lead to increasingly more efficient and more informative data collection programs and improved consensus and compliance regarding management schemes.

USVI and Puerto Rico: Paper to Mobile Catch Reporting

After the lunch break, two additional presentations provided participants with information on technological advances in data collection systems, strategies for minimizing uncertainty using analytical considerations and management advice. The first presentation emphasized the importance of technological advances, such as mobile phone applications in increasing data collection efficiency and stakeholder buy-in.

Charles Steinback (POINT 97/Ecotrust) spoke on advances in electronic reporting, especially community-based initiatives, as a strategy to encourage stakeholders to report fishery statistics using personal or provided mobile devices. This pilot project involved working with the fishing community to receive feedback on one particular mobile data reporting system. The Steinback team worked closely with the fishing community in the U.S. Virgin Islands and in Puerto Rico to design a catch reporting system that could be installed on any smart phone. Additionally, the system provided instant upload to an online server such that the information was immediately available for quality check and analysis and also provided a feature for users to extract self-reported information.



The electronic application was organized based on species, geography (a gridded spatial map developed prior to the project by managers and made available to the project thus enhancing the sharing of information), gear type, and vessel information. Repetitive information (name, vessel characteristics) was stored within the system so that it did not have to be re-entered continually. Charles identified challenges and a few limitations of the project, which was initiated on a completely volunteer basis. One of the findings was that some participants thought it would be easier to fill out logbooks online rather than through a smartphone, and thus a desktop-based application was created.

The project was leveraged through involvement with managers and also through incorporating existing products (e.g., GIS files and catch forms developed by NOAA), and emphasized the importance of collaborating with regional partners. The outreach component of the project was supported in Puerto Rico through the fishery department (DNER), while outreach was not as heavy in the USVI. This raised the point that emerged throughout the workshop; the importance of fisher buy-in in the data collection process and the need for outreach to foster stakeholder support, participation, and information validation.

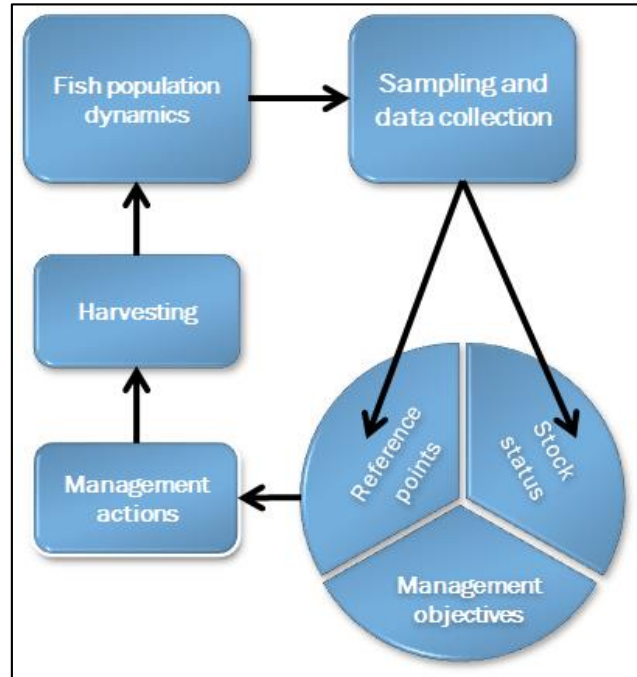
Discussion revolved around the practical aspects of implementing such a system. Paper reporting is still required in both Puerto Rico and the U.S. Virgin Islands, and it is paramount to continue to verify new systems to validate fishery information. Charles noted that the group was still working on refining a sustainable business model that provided the best incentive for fishers to use the tools. Currently the program is subsidized to prevent major costs from being borne by the fishers.

Demonstration of MSE Simulation Tools

The second afternoon presentation revealed how management strategy evaluation (MSE) simulation tools can provide guidance in improving sampling designs through evaluation of impacts on management decisions from improved information on biases and imprecision in data.

Dr. Bill Harford (University of Miami) spoke about how management strategy evaluation works and the utility of this approach in informing the data collection process. Management strategy evaluation is a powerful approach that simulates an entire management *system* (Sainsbury et al. 2000, Punt et al. 2014). A management *system* consists of an operating model that describes stock dynamics and a management strategy that describes (1) information collection, (2) scientific analysis (sometimes including stock assessment), and (3) harvest control rules.

MSE is particularly useful for identifying data collection needs because data collection is explicitly linked to decision-making about harvest tactics, which subsequently affects the fish stock. This set of links is termed as a closed-loop feedback system.



Bill presented examples that focused on the effects on data inputs on the subsequent effectiveness of fishery management. Simulations demonstrated that data inputs based on different types of sampling programs and different degrees of sampling precision could affect the performance of fishery management policies. Thus, the presentation demonstrated how simulation modeling tools can be useful in gaining insight into minimum data collection needs to inform stock assessment and management within the region. Examples were provided of age-structured population models to evaluate information quality through sampling programs, and how the sampling precision could affect the management decision process. It was proposed that a breakout group should address approaches to understanding the process of implementing an MSE (using R computer software) and an example could be provided based on the Catch-MSY approach of Martell and Froese (2012).



Breakout Sessions

Participants took part in a confidential voting activity on topics to consider for breakout activity discussions. Topics posed for possible breakout discussions were selected based on feedback from the pre-workshop questionnaire. Participants then divided into their selected groups and spent the remainder

in group discussions. At the end of the afternoon, group leaders presented to the entire workshop a summary of main points discussed.

Four topics evaluated during the breakout group sessions:

- Matching data collection to management needs and goals
- Reaching out to stakeholders and improving communications
- Management strategy evaluation
- Electronic monitoring and mobile applications

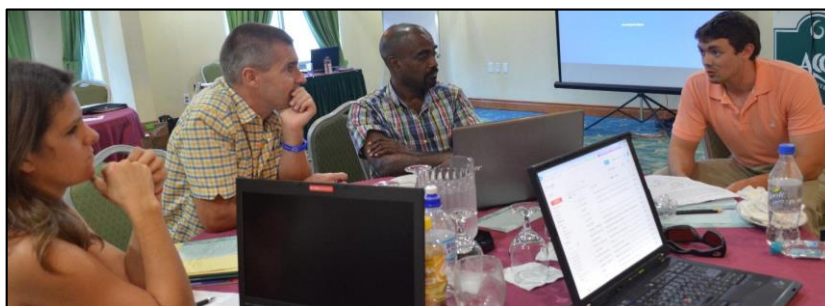
Breakout Group 1: Matching Data to Management Goals

The discussion for this group revolved around an assumption that the principal management goal in the Caribbean is to provide long-term sustainable use of resources. It was noted that in the absence of robust fisheries data, the average catch over recent years can be informative as an initial management target. The group emphasized the need to characterize the economics of fisheries, both for management purposes and to draw the attention of managers and politicians to the value of this sector to countries as a whole. Emphasizing the value of the sector is one way to potentially increase the amount of funding available for data collection.

Participants in this group generally felt that standardization of data collection programs across countries was important. Standardization of procedures across countries within the region will aid in minimizing duplication across countries, avoid inconsistencies in goals, and lead to building consensus in the data collection design and goals – factors that will ultimately lead to improved information for use in stock assessment models. In addition, the group noted that clear management goals were important as related the type of data to collect.

Participants felt that taking advantage of advances in cost-effective technologies including electronic monitoring via phone applications, VMS applications, and remote sensing, could add significant improvements to efficiencies in data collection programs. Emphasis was also placed on data entry training to minimize errors and ensure data quality. The group noted that the Trinidad fisheries office has good training and data quality control systems in place to strengthen data quality, yet additional improvements can be made through innovative technological approaches.

Enforcement issues were recognized as impacting data collection. These issues are particularly important as they influence international environmental agreements, such as import bans imposed by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Certain small-scale sub-sectors of these fisheries may be sustainably managed, yet the costs involved in providing reliable and accurate data for a stock assessment could likely be greater than the value of the fishery as a whole. Under such circumstances, however, a lack of data with which to meet such



obligations and from which to carry out reliable stock evaluations can have extreme impacts on fisheries and socioeconomics of fisher communities.

Breakout Group 2: Enhancing Stakeholder Engagement in Data Collection

This group, which included participation by two fishers from Barbados, discussed stakeholder involvement in data collection. The two fishers gave additional insights on how to improve stakeholder communication and how to make management initiatives work through appropriate incentives to fishers. In Barbados, a gasoline and boat expenditure subsidy exists whereby fishers are reimbursed after having their boats inspected. The rebate program is perceived to be generally beneficial, but potentially unfair to certain fishery sectors. It was noted that Barbados fishers pay a tax based on the species that are caught, thus there is no incentive to report catch, and it is thought by some that collected data are often underreported or inaccurate. The Barbadian fishers emphasized that fishery managers should seek to implement initiatives by first working with younger fishers who may have more flexibility in their operations and may be more open to the idea of change.



The group discussed the idea of ‘co-ops’ in which scientists work with fishers to collaboratively help to establish a common goal towards sustainability of a fishery. It was noted that co-ops have been successful in strengthening the export market for conch and lobster in Belize; however it was thought by some that they suffered some mismanagement and misuse of funds. Community organization can be helpful to encourage fishers to become custodians of their resource. Ultimately, fishers are only likely to set up co-ops if they perceive some direct benefit for their fishing operations.



The importance of bottom-up, fisher-led initiatives was discussed, and several examples of successful approaches were given. For example, in Bermuda in the 1970s, fishers led an initiative to prohibit harvest in spawning aggregations. The majority of the community was in favor of the closure, and therefore assisted in reporting violations to management. On the other hand, a top-down initiated fish trap ban was implemented in Bermuda, which caused considerable distrust within the fishing community. In Barbados, a similar top-down effort was initiated with regard to marine reserve planning, which was not well-received by the fishing community.

Breakout Group 3: Electronic Monitoring and Mobile Applications

Participants in this group voiced a strong recommendation that incorporating stakeholders in the data collection effort should be a priority, and recommended that the appropriate incentives were needed to engage stakeholders. It was noted that it was important to establish good feedback to stakeholders and that there are examples of novel tools and approaches for improving communications. For example, the previously discussed pilot electronic phone application for obtaining catch information in the U.S. Caribbean (see Steinback presentation “Paper to Mobile Catch Reporting”), and the vessel registry system established in Honduras (see Box presentation “Improving data for decision-making”) are novel tools that can enhance communication between data collectors/managers and stakeholders. These are tools that are relatively easy and quick to implement, although potentially expensive. Too often, data are collected and compiled by an agency, only to come back to the fishing community in the form of management restrictions. The electronic applications provide an excellent opportunity to make the data collection process more transparent, as stakeholders can go directly to public data access sites (i.e., dashboards) and view and retrieve their personal data, for example in the form of summary statistics. The use of these electronic tools provides a good opportunity to make the data collection process both better and more transparent. Of course, these data may still be used in additional management restrictions, but the expectation is that compliance would be increased by making clear the linkages between data collection and management action.

Breakout Group 4: Management Strategy Evaluation (MSE)

The MSE group was involved in a technical session focusing on practical implementation using existing tools. It was emphasized that MSE can be useful for a number of management questions concerning for example cost-benefit analysis of surveys, to determine frequency of assessment or frequency of data collection. The group was shown how to develop their own MSE frameworks using a simple case study demonstrating how MSE can be used to provide practical management advice, particularly in a funding-limited environment.



Summary from Day 1 Workshop

The first day of the workshop ended with brief summary remarks by the conveners. Each participant was then asked to identify one topic they would like to revisit on Day 2. Suggested priority topics to discuss in more detail included electronic monitoring and applications, survey design/analysis improvement, regional monitoring schemes, incentives for increasing fisher participation in logbooks and data collection technologies, data requirements per species group/management objective, and better quantification of catch. The conveners also asked the participants to further consider each of their own local management environments in terms of identifying at-home data collection problems or concerns to further address on Day 2. Participants were reminded to consider current management objectives and the specific challenges they faced in collection of adequate data to inform stock status.

Day 2: Applications to Real Problems

Day 2 commenced with a brief overview of Day 1 by workshop conveners. Participants were then asked to identify real situations and challenges ongoing in their country. Finally, the group was asked to make recommendations and provide solutions to these “real-life” situations. Five separate true-life data collection case studies were identified.

Gulf of Mexico Case Study

Problem statement: There is an extensive catch validation program for both commercial and recreational fisheries in the U.S. waters of the Gulf of Mexico. However, there continues to be controversy on the quality of the fishery-dependent data, especially for red snapper which is one of the most valuable species in the region. Fishing pressure on this species is increasing dramatically, which has led to a shortening of the season and discontent by many stakeholders as the population is actually increasing in size due to strict management measures. The red snapper is an important fishery for both commercial and recreational fishers, and are especially desirable for tourism. The recreational sector is composed largely of party boats which carry small groups (4-6 people), and headboats which carry larger groups of sport fishers at a time. The licenses for individuals on these recreational fishing boats are provided by the hosting boat, and permitted for either red snapper or reef fish. The management goal is to rebuild red snapper stocks to sustainable levels, and to maintain a longer fishing season, even though recreational fisher numbers are increasing. One priority data collection topic highlighted was the need to better quantify total recreational effort for this species.

Recommendations: The working group recognized that managing such a resource under continually increasing pressure is challenging for fishery managers and stakeholders. Currently there are an estimated 3.5 million fishers potentially harvesting red snapper, therefore a catch share program for the recreational sector is not feasible. One suggestion was the implementation of a lottery season to reduce fishing pressure. Remote sensing or aerial surveys could be used to better quantify effort by detecting the number of boats and location of fishing effort; however, targeted effort would still have uncertainty as it would be difficult to separate targeting of red snapper from targeting of other recreational species occupying the same habitat. Presently, implementing aerial surveys is considered too expensive for the Gulf of Mexico, but there is recognition that satellite imagery is available and has utilization for quantifying fishing effort by area. Unmanned aerial platforms are also becoming more available and feasible in regard to cost and endurance, and could be another tool to address this data deficiency in the near future. There were also suggestions on the need to improve socioeconomic data collection. One example includes a willingness-to-pay survey that could help to characterize the recreational fishing effort base lending insight to future management strategies.

Bermuda Case Study

Problem statement: Bermuda would like to set an annual catch limit for the black grouper, which is one of their most valuable commercial fisheries. Currently there are about 210 commercial fishing vessels, and catch under-reporting is believed to be a serious problem. Thus, historical catch data are not thought to be reliable. Bycatch data (e.g., numbers, size, condition) are also lacking, as juvenile grouper are widely dispersed over various habitats and vulnerable to the fishery. The major challenge is that fishers are widely dispersed, resulting in difficulties with implementing port sampling across the large number of potential landing and market sites. Catch is largely sold to restaurants for local consumption. The result is there is essentially no adequate port sampling program in Bermuda.

Recommendations: The group suggested that, without any additional data, the average historical catch could be a useful starting point until further data collection programs were implemented. Catch validation was identified as the immediate priority. Although port sampling is difficult because of the many points of entry, any subsampling to derive the age composition of catch can aid in gauging the status and magnitude of bycatch and recruitment of the younger age classes into the population. Improved catch validation is needed for both the commercial and recreational fisheries. Given a time series of catch data, some of the data-poor stock assessment methods (e.g. catch-only methods) could be attempted and sensitivity evaluations applied that take into account uncertainty in historical catch levels because of the under-reporting concerns. Another suggestion was that monitoring be carried out in conjunction with local restaurants, because most of the catch is sold locally. Although a restaurant may only receive one fish per day, the weight of the fish is known and could thus be converted to length because the fish are typically delivered whole. Changes in weight or length could then be monitored over time, thereby providing some empirical indication of trends in the relative status of the stock. Outreach efforts would be required to establish rapport with local restaurants and implement such programs between restaurant businesses and local management. Such efforts could lead to better overall rapport between stakeholders and management and could potentially have subsequent spill-over benefits for other fisheries. Finally, a fish tagging program was suggested, as this has been implemented successfully in other locations and has provided useful information in regions where a relatively small number of fish and fishermen are involved in the fishery.

Montserrat Case Study

Problem statement: For the Montserrat region, there is about 20 years of computerized catch per effort and price data available for the multispecies artisanal fisheries. However, there is little to no biological data sampling, and fishers use a variety of fishing gear. The management goal is to ensure long-term sustainability of stocks.

Recommendations: The long time-series of catch provides opportunities for further analyses using a variety of basic catch models and simulations. With a time series of catch and effort, at a minimum, a simple production model could be attempted. Other data-limited methods, such as catch-only methods, might also be explored. Also, the existing catch, effort and price data can be used to develop profiles of the basic fishery operations (number and size of vessels, trip costs, etc.). Harnessing traditional local knowledge could provide insight for further investigations and for developing improved sampling design. Experienced fishers may also be able to assist with data validation. The working group recommended implementing a licensing system to better track catch per effort, and a priority identified was the need to implement some minimum level of random sampling for length and age data. Educational outreach could also improve stakeholder engagement; this could possibly be accomplished in conjunction with revival of existing fisher organizations.

San Andreas Case Study

Problem statement: The primary fishery in San Andreas is for reef fish. Currently there is essentially no regulation of the fishery because of the lack of resources for regulatory enforcement. Some information on current capacity and operations of the fleets is available. The total number of fishers is known; there are about 60 fishing boats typically ranging from 25-30 feet in length. The fishery landings have been collected only for one island in the archipelago (San Andreas Island) with total catch data compiled since the 1990s. Approximately 200 species have been identified in the catch composition, but there is uncertainty around species identification. Fishery-independent surveys using diver visual methods have also been conducted for the shallower areas, but this type of data collection has not been implemented for

much of the fishing grounds located in deeper waters. The management objective is to establish some basic limits on the fishery to ensure sustainability. The fishers are licensed, but there is considerable illegal fishing ongoing relevant to the recently disputed border and increased fishing pressure from Nicaraguan and Honduran fishers.

Recommendations: As with the Bermuda case study above, an average historical catch approach could be a useful starting point. Near-term improvements in data collection should prioritize obtaining rough estimates of total effort, if possible, and then subsample the catch data to get additional information on high priority species or species of concern. Local expert knowledge should be used to aid management in developing a list of species to prioritize for sampling. Reducing uncertainty in catch composition can be attempted through improved validation of fish identifications. Developing incentives for fishers to report would be essential with any new data collection efforts. The group discussed some preliminary analyses that could be done with the existing data. Existing information on relative species composition could be used to correlate changes in population composition over time. Existing length data could also be utilized in length-based assessment methods used to obtain empirical estimates of changes in average length as a rough indicator of fishery status. While management of the fishery is challenged given the current political climate in the San Andres islands, future management will rely on a robust data collection program and further analysis of existing data, including use of data-limited methods from last year's workshop (Cummings et. al. 2014).

Turks and Caicos Case Study

Problem statement: This case study focused on the efforts for sustainable management of the conch fishery in the Turks and Caicos region. There exists a 60-year time series of catch data for this conch fishery, which includes data on sexual maturity and recent fishery-independent visual surveys. The conch fishery includes about 250 fishers with about one-third from the Turks and two-thirds from the Caicos. Some analytical exercises have been undertaken recently to determine stock status using production models. Production model results are preliminary and indicate a decline in conch since 2008. There is concern that there might be natural drivers behind this decline.

Recommendations: The group recommended looking into a change in the maturity ratio as a potential indicator of the level of stock exploitation. Catch shares or spatial quotas could be used to reduce fishing pressure, if it were determined that this was necessary. A sensitivity analysis using MSE methods could be used to determine whether the current sampling design could be improved in an attempt to increase confidence in the production model results, and also in regard to evaluating possible environmental impacts to the stock. More frequent fishery-independent surveys or evaluation of whether the survey design can be further improved would be helpful for differentiating environmental and harvesting impacts. This might also provide further insight on bias associated with catch-per-unit-effort data. Until further data are collected, precautionary management practices may be warranted.

Group Activity: Fishery-Dependent Data Collection Best Practices

During the workshop conclusion session, participants were asked to reflect back on the presentations and breakout group sessions that were undertaken during the workshop. They were then asked to independently record, on individual sticky notes, their priorities relevant to best practices and recommendations discussed for improving data collections. From this exercise, concluding recommendations on the main optimal practices were defined by the group, in order of decreasing popularity as determined by the number of sticky notes pertaining to the topic:

Stakeholder engagement (21): Of critical importance for data-limited situations, the group emphasized the need to engage stakeholders in data collection through outreach programs and training. Stakeholder training activities are beneficial because they create more human capacity with which to collect data, give fishers a greater sense of ownership, and help them understand the importance of good data in resource management. It was also emphasized that understanding fisher perspectives and creating a good incentive structure is important before implementing new data collection programs.

Enforcement (5): It was noted that good enforcement is essential for monitoring, and that it is important to consider the legal framework in which the data collection would take place.

Data quality (5): Participants expressed the importance of getting good quality data through data validation programs and training exercises.

Baseline information (5): It was noted that any baseline information should be carefully considered. Characterization of the fishery is essential before further data collection proceeds. Landings can sometimes be calculated from non-traditional data sources such as market reports. Simple indicators might also be used in lieu of conventional stock assessments to provide some guidance until data collection improves.

Management Strategy Evaluation (4): MSE is a useful tool for determining the most cost-effective approach to data collection. It can also be used to understand uncertainty and how it impacts the ability to manage fisheries.

Prioritization (4): It was recognized that most fisheries in the region are operating in a very funding-limited environment, and thus any data-collection systems should be carefully prioritized and cost-effectively optimized.

Management goals (4): Participants expressed the importance of first defining management objectives before designing data collection systems to ensure the goals are aligned with the requirements of managers and stakeholders.

Closing Statements

A summary of the recommended best practices of the interactive group exercise led into the final plenary discussion to close the workshop. The plenary discussion highlighted the importance of the above mentioned best practices and made the following recommendations:

- Link data collections to support the management decision process.
- Identify examples of management approaches and methods.
- Identify data gaps relevant to stock assessment priorities.
- Incorporate optimal sampling designs.
- Build scientific capacity and best practices.

The group summarized some of the lessons learned from the data collection case studies based on minimal and moderate funding scenarios. The group stressed the need to optimally engage stakeholders, and expressed thanks for the participation of several fishers who provided particularly useful insights in this respect. Workshop conveners provided recommendations on relevant topics that should be addressed in future workshops, and the conveners suggested that the preliminary focus topic for next year's workshop might be how to optimize fishery-dependent versus fishery-independent data collections in data-limited regions subject to limited funding situations. Finally, workshop participants were reminded

to continue their communications, collaborations, and guidance as an ongoing study group on these workshop topics throughout the year.

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Zollet et al. 2014. Guiding Principles for Fisheries Monitoring Programs Making the Most Out of Limited Resources. FAO Workshop report.

Appendix 1. List of oral presentations of the GCFI special session entitled “Evaluation and Application of Data-limited Stock Assessment Methods” which was conducted in conjunction with this GCFI data-limited methods workshop.

Box, Steve; Iliana Chollett, and Andres Alegria. Improving data for decision making.

Cummings, Nancie and Mandy Karnauskas. Review of fishery-dependent sampling in the wider Caribbean and linkages to fishery management.

Ferreira, Lara; Elizabeth Mohammed and Louanna Martin. Fisheries dependent data collection systems in Trinidad.

Franks, James; Nancy Brown-Peterson, and Eric Saillant. Biological data collection-Best Practices.

Harford, William. Management strategy evaluation: connecting monitoring, assessment, and decision-making.

Michaels, William. 2014 GCFI Workshop on improving fishery-dependent data for data-limited assessments.

Steinback, Charles. USVI & Puerto Rico paper to mobile catch reporting.

These abstracts and manuscripts will be made available through the proceedings of the 66th Gulf and Caribbean Fisheries Institute Conference at www.gcfi.org

Appendix 2. Participant list for the 2014 GCFI data-limited assessment workshop.

Last Name	First Name	Organization
Acosta	Alejandro	Florida Fish and Wildlife Commission
Alagria	Andres	Centro de Ecologia Marina, Tegucigalpa, Honduras
Arnold	Bill	NOAA Fisheries, Southeast Region Office
Box	Steve	Smithsonian Institution, Fort Pierce, FL
Brown	Jonathan	University of Virgin Islands
Brown-Peterson	Nancy	University of Southern Mississippi
Clerveaux	Luc	Department of Environment and Maritime Affairs, Turks and Caicos Islands
Cummings *	Nancie	NOAA Fisheries, Southeast Fisheries Science Center
Franks	James	University of Southern Mississippi
Harford	William	Cooperative Institute Marine Science (CIMAS), University of Miami
Ingram	Walter	NOAA Fisheries, Pascagoula Laboratory
Jara Baquero	Andrea	Oregon State University
Karnauskas *	Mandy	NOAA Fisheries, Miami Lab
Karr	Kendra	Environmental Defense Fund
Leaf	Robert	University of Southern Mississippi
Malla	Estrella	University of Miami
Marshak	Tony	NOAA Fisheries, Office Science and Technology
Matthews	Tom	Florida Fish and Wildlife Commission
Michaels *	William	NOAA Fisheries, HQ
McDonald	Gavin	Sustainable Fisheries Group, University of California Santa Barbara
Mohammed	Elizabeth	Caribbean Regional Fisheries Mechanism(CRFM)
Moore	Owen	Western Fisherfolk LLC
Pitt	Joanna	Bermuda Dept. of Environmental Protection
Ponteen	Alywn	Montserrat Fisheries Department
Posada	Juan	Fundacion MarViva
Prada	Martha	CORALINA – CORIS
Rindone	Ryan	Gulf of Mexico Fishery Management Council
Saillant	Eric	University of Southern Mississippi
Shivlani	Manoj	NTVI Communications, Inc.
Steinback	Charles	Point 97/Ecotrust
Thomas	Chelston	Western Fisherfolk
Thomas	Lennon	Sustainable Fisheries Group, University of California Santa Barbara
Valles	Henri	University of West Indies

* *Workshop conveners*

Appendix 3. Agenda for GCFI data-limited assessment workshop.

Workshop agenda: Day 1 (Sunday, November 2)

8:00 - 8:15	Arrival and coffee
8:15 - 8:45	Welcome and introductions, workshop theme (William Michaels)
8:45 - 9:00	Workshop goals, expected products, questionnaire responses(Mandy Karnauskas)
09:00 - 10:00	Morning Seminars
9:00 - 9:20	Fishery-dependent sampling and management(N. Cummings and M. Karnauskas)
9:20 -10:00	Best practices bio collections(J. Franks / N. Brown-Peterson, E. Saillant)
10:00 - 10:30	Coffee and Group Photo
10:30 - 10:50	Interactive Activity 1
10:50 - 11:00	Summarize interactive activity
11:00 - 12:00	Case Studies from the Region
11:00-11:30	Elizabeth Mohammed (Trinidad)
11:30-12:00	Steve Box (Honduras)
12:00 - 1:00	Lunch (on your own)
1:00 - 1:25	Advancements in data collection and engaging stakeholders (Charles Steinbeck)
1:25 - 1:45	Demonstration of simulation tool (Bill Harford)
1:45 - 1:50	Breakout group leaders identify content; participants select breakout groups
1:50 - 3:30	Breakout groups
3:30 - 3:45	Coffee
3:45 - 4:45	Breakout group summaries and group discussions
4:45 - 5:00	Interactive activity 2
5:00	Workshop close Day 1
6:30 pm	Informal gathering

Workshop agenda: Day 2 (Monday, November 3)

1:30 - 1:45	Summarize interactive activities and Day 1 breakout group work
1:45 - 3:00	Breakout group discussions continue
3:00 - 3:15	Coffee
3:15 - 3:45	Interactive activity 3
3:45 - 4:00	Participants share as a group ideas on country-specific fishery-dependent needs
4:00 - 4:15	Breakout group leaders present summaries of interactive activity 3
4:15 - 4:30	Participants discuss interactive activity 3 results
4:30 - 4:45	Summarize and wrap up
4:45 - 5:00	Course Evaluation
5:00	Workshop Close

Appendix 4. Pre-workshop survey questionnaire.

2015 Fishery-dependent Data Collection GCFI Special Workshop – Questionnaire

Please indicate your name, geographical location, affiliation, and email:

1. Do you plan to attend the GCFI workshop on fishery-dependent data collection in Barbados beginning Sunday morning of Nov 2nd, and if so, will you be arriving in Barbados the evening of Saturday Nov 1st? YES / NO

2. In what capacity are you involved with fisheries management? (check all that apply)

Fisheries survey design _____ Stock assessment analyst _____

Fisheries data collection _____ Fisheries manager _____

Conservation organization _____ Government _____

Fishing industry _____ Fisher _____

3. Do you have experience (e.g., research, data collection, program management) relevant to fishery-dependent data collection systems or surveys? YES / NO

If YES, please briefly describe your role and type of experience:

4. Are you currently working on developing new or refining existing fishery-dependent data collection methods or protocols in your country of focus? YES / NO

If YES, please briefly describe (please provide if possible a reference for this data collection system):

5. Are you currently involved in data collection efforts that involve stakeholders in your region? YES / NO

If YES, please briefly describe (please provide if possible a reference describing this process):

6. What advanced or innovative technologies (e.g., electronic reporting, monitoring) are being evaluated or implemented for improving fishery-dependent data collections in your area?

7. What are the key issues or challenges for improving fishery-dependent data collections in your country that you would like to be discussed at the workshop?

8. Please tell us about any goals that you hope to achieve from this workshop?



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