MONITORING THE GULF OF MEXICO COMMERCIAL REEF FISH FISHERY

A REVIEW AND DISCUSSION

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ACRONYMS

ABC ..... Allowable Biological Catch
ACL ..... Annual Catch Limit
ACT ..... Annual Catch Target
AM ..... Accountability Measure
ASOP ..... At Sea Observer Program
BCGF ..... British Columbia Groundfish Fishery
CPUE ..... Catch per Unit Effort
DFO ..... Fisheries and Oceans Canada
DMP ..... Dockside Monitoring Program
DR ..... Dealer Report
EEZ ..... Exclusive Economic Zone
EM ..... Electronic Monitoring
EMP ..... Electronic Monitoring Program
EU ..... European Union
FL ..... Fishing Logbook
FOS ..... Fisheries Operating System
GMFMC ..... Gulf of Mexico Fishery Management Council
GOM ..... Gulf of Mexico
IFQ ..... Individual Fishing Quota
IQ ..... Individual Quota
IMR ..... Institute of Marine Research
LETF ..... Limited Entry Trawl Fishery
MSA ..... Magnuson-Stevens Fishery Conservation and Management Act
MSY ..... Maximum Sustainable Yield
NMFS ..... National Marine Fisheries Service
NOAA ..... National Oceanic and Atmospheric Administration
PFMC ..... Pacific Fishery Management Council
PSMFC ..... Pacific States Marine Fisheries Commission
QMS ..... Quota Monitoring System
RF ..... Reference Fleet
RM ..... Roving Monitor
SEFSC ..... South East Fisheries Science Center
SERO ..... South East Regional Office
TAC ..... Total Allowable Catch
TIP ..... Trip Interview Program
VMS ..... Vessel Monitoring System
WCGF ..... West Coast Groundfish Fisheries
WCGOP ..... West Coast Groundfish Observer Program
WCGTF ..... West Coast Groundfish Trawl Fisheries

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EXECUTIVE SUMMARY

The U.S. Magnuson-Stevens Act (MSA), reauthorized in 2006, requires the establishment of annual catch limits and accountability measures by 2010 for federally managed fish stocks subject to overfishing and by 2011 for all other federally managed stocks. Improved monitoring and data collection measures are required to ensure compliance with and support these scientifically-determined catch limits in order to end and prevent overfishing and to rebuild depleted fish stocks. To this end, managers need an accurate and timely accounting of total mortality to track landed and discarded catch against quotas so that in-season adjustments can be made to prevent overages and overfishing. Moreover, catch and effort data are used in stock assessments, which managers use as a resource to set annual catch limits.

In the Gulf of Mexico, three commercially and recreationally popular species are overfished and undergoing overfishing while others are recovering from overfishing, and many lack the scientific information to know their status. As a result, managers are exploring enhancements to data collection methodologies to improve their ability to monitor and enforce catch limits for all federally-managed species, as required under MSA. The Gulf of Mexico Fishery Management Council, the Gulf States Marine Fisheries Commission and the National Marine Fisheries Service are in some stage of developing enhanced data collection systems in the commercial and recreational fishing sectors. NMFS and the Gulf Council have identified at least two data collection priorities in the commercial Reef Fish fishery that need attention:

1) better estimates of total catch mortality for federally managed Reef Fish species; and
2) more accurate information on the frequency and lethality of interactions of federally protected sea turtles with gear in the bottom longline reef fishery[1].

This report was commissioned to build on the efforts of managers to improve data collection and validation methodologies in the Gulf of Mexico commercial Reef Fish fishery and to offer recommendations and rationale for a step-wise approach to such improvements. In the short-term, changes can be made to the existing self-reporting system for fishermen and dealers that will fill data gaps while also improving the timeliness of reporting for more effective quota management. However, a gradual but increased emphasis should be placed on independent methods such as electronic monitoring, which reduces the potential for misreporting while increasing the accuracy of data (discards) at a reasonable cost. Electronic monitoring is a promising tool for collecting fisheries-dependent data that could complement traditional data collection methodologies such as human observers. This technology has been successfully piloted in the Gulf of Mexico and is fully operational in several U.S. and Canadian fisheries[2].

[1] Gulf of Mexico Fishery Management Council Options Paper for Amendment 31 to the Reef Fish Fishery Management Plan, January 23, 2009.

[2] McElderry, H. 2008. At Sea Observing Using Video-Based Electronic Monitoring. Background paper prepared by Archipelago Marine Research Ltd. for the Electronic Monitoring Workshop July 29-30, 2008, Seattle WA, held by the North Pacific Fishery Management Council, the National Marine Fisheries Service, and the North Pacific Research Board: The efficacy of video-based monitoring for the halibut fishery. Available online at: http://www.fakr.noaa.gov/npfmc/misc_pub/EMproceedings.pdf.

RECOMMENDATIONS

Fishing Logbooks

- Require and include the recording of all fish caught at sea, including an estimate of the weight of fish caught and released by species by area and gear type, in fishing logbooks.
- Require and include the recording of lost gear, including the amount of gear (length of groundline and number of hooks) and location of disappearance, in fishing logbooks.
- Record fishing events on a daily basis (If possible, data should be collected for set location and soak time) in fishing logbooks.
- Complete all daily Fishing Logbook trip report forms by 12:00 p.m. (noon) of the day following a fishing day.
- Develop and implement an electronic standardized template as soon as practicable.

Dealer Reports

- Require dealers who receive Reef Fish to submit to the SEFSC complete and accurate Dealer Reports which include aggregated landed weights by species for all species landed.
- Require submission of Dealer Reports on a weekly basis and receipt of Dealer Reports by the SEFSC no later than 5 days following the week during which data were received.
- Expedite and expand a mandatory electronic Dealer Report system to all reef species managed under ACLs.

Integrated Data Systems

- Require entry of Fishing Logbook, Dealer Report and VMS data into a single Fisheries Operating System (FOS) that allows for data merging, checking, and reporting.

Data Collection and System Training

- Convene Gulf Council staff and federally licensed Reef Fish fishermen each year to review the Fishing Logbook data collection program and to show how the data are used for management and science purposes.
- Provide individual fishermen on a regular basis a report identifying deficiencies and possible problems with the completion and submission of Fishing Logbooks.

Electronic Monitoring

- Undertake additional pilot studies aimed at further adapting the EM technology to support the collection of accurate catch and release data from longline and vertical gear vessels participating in the GOM Reef Fish fishery.
- Once the technology has been appropriately refined, EM should be integrated into the existing observer program and required on all permitted Reef Fish vessels with 20 percent of the fishing days by the GOM Reef Fish fishery randomly selected to audit

fishery logbooks (FLs) and to provide independent estimates of catch, discards and fishing effort.

Roving Dockside Monitoring

- Certify Roving Monitors to give them the authority to monitor 20 percent of vessel offloads and collect the required on site information (possibly modeled after Alaska's program or the dockside program under consideration in the New England Groundfish fishery).

INTRODUCTION

The Gulf of Mexico Reef Fish complex consists of 42 species of groupers, snappers, tilefish and other species that can be found in similar habitats and have similar life-histories. Some species in this grouping are considered to be overfished (red snapper, greater amberjack, grey triggerfish) or are prohibited (goliath grouper, Nassau grouper). The current data collection and management system in place for the commercial Reef Fish fishery could be improved to increase timeliness, accuracy and sector accountability. Current methodologies rely on estimates and self-reporting to account for catch discarded at sea in the target fishery and the mortality associated with those discards. The absence of accurate and timely data on discards for these fisheries requires increased precaution in setting catch limits in order to offer assurance that management actions are likely to succeed in preventing over fishing and restoring depleted populations.

BACKGROUND

The U.S. Gulf of Mexico's (GOM) marine fishery resources are managed jointly between five states (Texas, Louisiana, Mississippi, Alabama, and Florida) and the federal fisheries agency (National Marine Fisheries Service – NMFS). In the GOM, NMFS and an advisory body of stakeholders, the Gulf of Mexico Fishery Management Council (GMFMC), regulate species and species groups that exist in federal waters.

Recent amendments to US law governing federal fisheries – the Magnuson-Stevens Fishery Conservation and Management Act (MSA) – require managers to set annual catch limits (ACLs) and, in the event these limits are exceeded, appropriate accountability measures (AMs) to ensure over-fishing is ended and prevented. The NMFS technical guidance for implementing these laws[3] also recommends the use of an annual catch target (ACT) in order to provide a buffer between where the quota and the limit are set in order to provide greater assurance that overfishing is prevented. Effective data collection and monitoring systems are critical to successfully achieving this Congressional mandate.

The GMFMC and NMFS have limited staff and funding with which to manage fish stocks under seven fishery management plans, resulting in some fisheries and species having substantially less than desired amounts of information available. Improvements to current management and data collection systems will aid US state and federal fisheries agencies in the GOM management

[3] 74 Fed. Reg. 3209 (50 C.F.R. §600.310(f)(2)(v)).

region to successfully meet fishery management standards under MSA that mandate all managed fisheries be assigned a numeric annual catch limit that ends and prevents overfishing.

PROJECT OVERVIEW

This project was undertaken by a team consisting of Shawn Stebbins, Principal of Archipelago Marine Research; Robert J. Trumble, Vice President of MRAG Americas; and Bruce Turris, Principal of Fisheries Management Inc. Each author has a unique perspective and extensive expertise with the design, implementation and operation of monitoring and reporting systems for a wide variety of fishery management scenarios. The project team was contracted by the Ocean Conservancy to produce an independent review and critical analysis – including recommendations for improvements – of the current (2007) monitoring and data collection regime in place for the Gulf of Mexico Reef Fish fishery. This report reflects the authors' collective considerations and advice with respect to the challenges faced in the management of the GOM Reef Fish fisheries.

The project team was asked to carry out the project with the following overarching fishery management objectives to guide the analysis, discussion and recommendations:

1. ACLs must be based on total mortality;
2. Managers require more timely and accurate information to annually keep fishing mortality within the ACLs; and,
3. Fishery and sector based accountability must be implemented.

The project has four reporting components organized into four sections of this report:

1. Review data collection and fishery monitoring practices generally and identify issues for consideration.
2. Review existing management and monitoring practices in the GOM Reef Fish fishery and identify data gaps.
3. Provide an overview of data collection and monitoring practices used in other jurisdictions that have successfully integrated total mortality accounting systems or provide useful insight into the GOM scenario.
4. Develop and present a range of recommendations for improving data collection and monitoring processes that will best support the implementation of Annual Catch Limits and Accountability Measures.

The ultimate objective of the project is to provide recommendations to improve the timeliness, accuracy and precision of available data through enhanced data collection systems that make full use of the latest technologies. Recommendations will range from small incremental improvements that can be made under existing methodologies, programs and funding constraints to a longer term vision for an integrated data collection and fishery monitoring system to establish the best possible tracking of ACLs and AMs. The recommendations are intended to offer the GMFMC and NMFS an opportunity to examine alternatives to current data collection programs and evaluate whether reprioritization and reorganization would provide improvements leading to better implementation of ACLs and accountability measures required by the MSA.

SECTION 1: GENERAL FISHERY DATA COLLECTION AND MONITORING OVERVIEW AND ISSUES FOR CONSIDERATION

This section of the report briefly outlines common fishery monitoring and data collection techniques and provides a discussion of related considerations. A more detailed discussion of strengths and weaknesses, data credibility, coverage levels, and relative cost and effectiveness in addressing management information needs can be found in Appendix I.

This discussion is intended as a background for Section 2, which discusses current GOM practices and identifies gaps in the data. Section 3 describes case studies involving different monitoring techniques, which have been used successfully to support a management approach based on total mortality.

1.1 FISHERY MANAGEMENT DATA REQUIREMENTS

The data required to support effective management of fisheries are generally very well defined, involving detailed description of the catch and effort and in many cases biological characteristics of the catch. In too many fisheries this simple data set is either unavailable or there are data gaps or serious concerns about the reliability and/or credibility of the data that are available. These concerns can be based on many factors, including: the data source, completeness of data set, sampling protocols, data format, timeliness and quality control.

When managers establish annual catch limits they may build safety margins into their total allowable catches (TACs) due to uncertainty surrounding the data available for stock assessments. It is common for fishing mortality data to include an acceptable estimate of landed catch but not a reliable estimate of at-sea released catch from either the target fishery or from other fisheries with bycatch. Improved monitoring and data collection processes can lead to increased TACs due to the increased confidence managers have in their data set and resulting assessment process. This was the case in the British Columbia Trawl fishery after mandatory observer coverage was implemented in 1996 (Barry Ackerman, Fisheries and Oceans Canada, personal communication).

The desired data points for effective fishery management purposes can be numerous but are generally subdivided into the following categories:

Catch and catch disposition: species, pieces, weight, retained or discarded, condition if discarded, product type if retained

Fishing Gear and Effort: fishing location (lat and long, area, zone), gear type (format and specifications), gear amount, time deployed, bait detail

Biological data: sex ratios, maturity, length and/or age profiles, a variety of other biological characteristics, usually species specific

Although these categories and the examples provided appear relatively straight forward, there is a considerable amount of detail and complexity associated with successful implementation of a data collection program designed to gather the required data in a consistent and reliable manner. This challenge is magnified in multi-species and/or multi-gear fisheries and can be further magnified by a multi-jurisdictional environment. However, when program design and implementation are done properly the result will be a credible data set that can be used with a high degree of confidence to support fishery management functions and informed decision making.

The two primary opportunities for capturing fishery-dependent data are from an active fishing vessel at sea or from the site where the catch is landed.

1.1.1 Data Collection from the Sea

Many of the critical data points needed for fishery management purposes are only available at sea from active fishing vessels. This presents a difficult challenge for managers due to the complexity and cost of collecting real time data from the deck and wheelhouse of a commercial fishing vessel. In general, commercial vessels operate with the single primary motivation of capturing fish to deliver to a buyer and then return to sea again. Without incentives to do so, there tends to be little time, space or inclination for the skipper or crew to follow rigorous data collection and documentation protocols let alone make them a priority.

The critical data points that are only available from sea include:

- species catch and fishing time by area or location (numbers and/or weight)
- amount and type of gear
- species discarded (numbers and/or weight) and their condition (live, dead).
- habitat interactions
- protected species interactions

The collection of catch weight at sea can be problematic due to difficulties associated with collecting weights on a moving platform using conventional scale technology. This problem can be overcome with more expensive motion compensated scales, which are now readily available but are still quite expensive. More commonly, weights are estimated from length-weight relationships.

The most commonly used tools for data collection from sea include[4]:

- fisherman completed Fishing Logbooks
- hail-in, hail-out process
- aerial census
- VMS satellite tracking systems
- At-sea observer programs
- Electronic Monitoring

[4] See Appendix 1 for a description and discussion of these tools.

1.1.2 Data Collection from the Landing Site

The initial landing site presents another and sometimes final opportunity to collect the data required for fishery management. Collecting data from a land-based location is much simpler and less costly than at sea but the data available are much more limited. At this point, it is generally impossible to attribute the landed catch back to a specific catch location. In many cases some form of processing may have occurred such that the round catch weight and sometimes length and other biological information may no longer be attainable. The greatest limitation, however, is the inability to collect any independent data on catch that was released at sea. Contact with the skipper at the landing site also presents an opportunity to collect fishing log pages directly and interview the skipper with respect to the trip and the fishing log information.

The landing site is often the first and best opportunity to collect independent catch weights. Independently collected and verifiable landed weights are important to the credibility and success of many quota share managed fisheries. For these fisheries the landing site can be a critical data collection requirement. In cases where the catch has been processed so as to alter the round weight, which many quotas are based on, conversion factors are developed to convert the product weight back to round weight for quota tracking purposes. The data points that are available from the landing site include:

- species landed catch (numbers and/or weight)
- product type and condition
- biological data (length, sex, aging structures etc.)
- market information (buyer, shipping method, destination, price)

The method of landing the fish will have an effect on which data collection methods are viable. For example, where fish are landed in frozen blocks it may be impossible or at least impractical to count pieces or collect any type of samples. In addition with the move to maximize fish quality and financial return the industry is moving to minimize handling of the product and the amount of time spent on a landing dock. A trend in some regions has fishers hand packing catch in iced totes or sealed frozen blocks with the desire for them not to be disturbed until they reach the final point of sale. Any landing site data collection strategy needs to account for the unique fish handling characteristics of each fishery in order to minimize impact on the operation and product value. The most commonly used tools for data collection from the landing site include[5]:

- Dealer Reports
- dealer interviews and audits
- dockside monitoring

[5] See Appendix I for a description and discussion of these tools.

1.2 GENERAL MONITORING PROGRAM CONSIDERATIONS

1.2.1 Self-reporting vs. Independent

One of the most significant issues that affect scientific value, general usability and decision maker confidence in the data products from a monitoring program is the premise under which data collection takes place. The two primary options for data reporting are: 1) self-reporting by fishery or industry participants; or 2) independent data collection by an unbiased government agent or contracted third party.

Fishing Logs and Dealer Reports are examples of self-reporting scenarios where the industry participant is responsible for documenting a variety of data points. The data resulting from self-reporting methods raise questions about the accuracy and reliability of the data because of the perceived conflict of interest that exists. The focus becomes the source of the data rather than the meaning of the data. Some potential reasons for this perspective include:

- competing priorities
- potentially self-incriminating
- little or no data collection training
- conflicting motivations
- level of motivation and commitment to the quality of the product

These issues do not mean that self-reporting tools are not valuable fishery management tools, but these issues must be considered in the design of a program and use of the data. Program design and expectations of the resulting product should include a realistic assessment of these issues and strategies to mitigate against them.

Observer programs, VMS, electronic monitoring systems, and dockside monitoring are examples of independent, and theoretically unbiased, data collection methodologies conducted by a government agent or contracted third party. These methods tend to result in a less biased data product. There is no inherent conflict of interest, which results in a more credible data product in which managers and the public have greater confidence. In these programs, the focus becomes the meaning of the data rather than the source of the data. The reasons for this include:

- singleness of purpose, clear motivation
- control of data collection training and supervision
- adherence to a consistent approach and methodology
- ability to establish professionalism
- commitment to the quality of the product

Independent data collection programs allow the manager much greater latitude in establishing program objectives and sampling techniques as well as a high level of control over program design, training of personnel and quality management. The trade-off is independent programs are generally much more complex, require more resources and are more costly.

1.2.2 Government vs. Private Service Delivery

Whether data collection programs are self-reporting or involve independent data collection they have historically been designed, implemented and administered by government. Government has been and continues to be charged with managing fisheries resources but there is an increasing trend for greater involvement and responsibility by the fishing industry. The significant movement toward quota share management systems can establish an ownership ethic in the affected fishing industries, specifically with license and quota holders, which leads to active involvement in decision making regarding management strategies. Quota share fishermen have greater interest and investment in the data to inform management decisions and become involved in the design, implementation and in some cases funding of data collection programs. Their increased interest is not only due to their stake in the resource but also due to a desire to have accurate data to track quotas and create a level playing field for all quota holders.

In cases where industry is satisfied with government-led and funded fishery management and data collection programs there is likely to be minimal concern or involvement by industry. In cases where industry participants are required to fund management activities such as data collection programs they naturally want to be involved in decision making; have a say in how their money is spent and ensure they are getting the best value for their investment. This newfound interest in collection programs raises the question of whether these programs should be administered by government or private industry.

Contracts for the delivery of monitoring services by private industry are usually tendered through a competitive bidding process. This ensures the bidders are organizing the services in a cost effective manner in order to be competitive and that the contract authority, government or fishing industry can pick the best combination of service, quality and cost. Privately developed and delivered programs are also more likely to be tailored to the needs of the fishing industry and will be more adaptive and generally have a stronger customer service orientation. For the most part, private companies will only survive if they provide a quality service at a fair price as they exist in a competitive environment. Government agencies can also benefit from outsourcing monitoring services by increasing time and resources available to focusing on core priorities such as application of data to management decisions and scientific work.

The potential risks associated with outsourcing service delivery to private industry include financial viability, service reliability, concern with data quality and concern regarding data privacy and conflict of interest. Government delivered programs pose less of a concern from the standpoint of privacy and conflict of interest but data quality and service reliability may still be issues. In addition, consistent funding for government delivered programs can be put in jeopardy as conflicting and competing budgetary requirements shift agency priorities.

Consideration of outsourcing must be done in an environment that addresses the areas of risk and includes incentives for maintaining service quality to industry as well as to the agencies which receive the data. This three-way relationship must be carefully managed to ensure a successful outcome for all parties.

Conflict of interest concerns can easily be addressed by requiring bidders to be independent third parties: having no financial interest or other relationship to the commercial fishing industry or government.

Concerns regarding data privacy, conflict of interest, and service quality and format can also be effectively addressed by implementing government mandated standards for monitoring service delivery. Adherence to these standards can be legislated and/or required through a contractual arrangement. In cases where standards and an audit process are established a consistent level of data quality is established and expectations are clear to the service provider, government and the fishing industry. For instance, the National Marine Fisheries Service has developed standards for Mobile Transmitting Units authorized for use on vessels participating in the NOAA Vessel Monitoring System program.

An alternate service delivery model that is common in the US is for a combination of resources to be provided by the fisheries agency and private contractors. This model is utilized by NMFS for the North Pacific Fishery Observer Program where the agency provides program design, training, resources, briefing, debriefing and data management, the contractor employs the observers and coordinates deployment logistics, and the fishing industry pays for the contractors' services.

When private industry is used to deliver data collection services the question arises whether to award the work to a single company through a competitive tender or to certify multiple companies through some form of accreditation process to provide the service in a competitive environment. A more detailed discussion of this issue is available in a report by Karp and McElderry (1999)[6]. Awarding a contract to a single service provider for a fixed period of time can lead to increased commitment to service quality and professionalism as well as the ability to deliver consistent service to the fishery agency. It will also encourage the service provider to take a long term view, leading to investment by the company in training, data systems and new technology. Alternatively the multi-service provider approach can provide a competitive environment with service choices and price competition.

Certifying multiple service providers leads to multiple communication paths with the fisheries agency creating an environment in which it is very difficult to maintain high data quality and consistent service delivery. A significant drawback of the multi-supplier approach is the potential for inherent conflicts of interest when multiple observer providers compete for business. Customers may play one service provider against another in order to achieve discounts or preferential treatment. This can quickly lead to questions regarding the independence and quality of the data collected. For example, an independent review of the North Pacific Fishery Observer Program concluded that the service delivery model should be avoided and needs to be changed.[7]

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[6] Karp, William A., H. McElderry. 1999. Catch Monitoring by Fisheries Observers in the United States and Canada. Prepared for the International Conference on Integrated Fisheries Monitoring, Sydney Australia. Available online at: http://www.fao.org/docrep/x3900e/x3900e13.htm.

[7] MRAG Americas. 2000. Independent Review of the North Pacific Groundfish Observer Program. Prepared by MRAG Americas for National Marine Fisheries Service, Alaska Fisheries Science Center, Seattle, Washington

There is no 'correct' service delivery model for monitoring services. Different fisheries and monitoring scenarios will each be suited to different service delivery solutions depending on many factors, including the primary program objectives and constraints. These must be clearly articulated and fully explored before the best approach can be developed.

1.2.3 Coverage Levels

The appropriate coverage level for different data collection programs is dependant on the unique goals of each program. Different goals, objectives and constraints will dictate the best approach for setting coverage levels.

It is of paramount importance for a rationally constructed observer program to have a clear expression of what the managers and/or scientists need to know and, if possible, how precisely they need to know it (Parkes and Kaiser 2003)[8]. The development of such goals and objectives for a program ideally would stem from a consideration of the purposes for which data, estimates, and other potential products of the program are to be used. Issues that need to be resolved include the required spatial and temporal resolution of data and/or estimates, and the required form of data and/or estimates (e.g., counts of prohibited species caught or weight of total prohibited species catch).

Managers are increasingly aware of the need to more clearly define observer program goals and objectives before developing estimation methods and sampling designs appropriate to meet those goals and objectives. Performance criteria providing a means of measuring the achievement of a particular goal are an important element. Under this framework, the coverage level becomes part of the sampling design that meets the stated goal.

Sampling at sea is further complicated by the multi-stage sampling problem that is presented. The sampling strategy can be set up at the vessel level, the fishing event level or at the level of a subset of the catch. The approach taken will be dictated by the program goals but it should be clear that in many situations it is near impossible to collect a truly random sample. The best that can be done is some form of stratified or opportunistic sampling that takes into account concerns regarding bias.

Where 100 percent coverage is not feasible and unbiased random samples can be collected, then a sampling strategy may be adequate to produce statistically defensible data, which can be applied on a fleet basis. Random sampling of fisheries can also be problematic due to logistical challenges or simply inadequate funding. In addition random coverage may not always achieve adequate sample sizes to develop statistically significant discard rates for each of the required strata.

A further challenge is presented with fleet sampling when vessels selected as part of a sampling strategy modify their fishing behavior, sometimes significantly, as a result of having an observer

[8]Parkes, G., M. Kaiser. 2004. Defining a Basis. Background paper prepared for NMFS Fisheries Observer Coverage Level Workshop July 29-31, 2003, Seattle Washington held by the National Marine Fisheries Service. Available online at: [http://www.nmfs.noaa.gov/by_catch/CoverageWorkshopFinalRevised.pdf]).

on board. This is commonly referred to as the "Observer Effect"[9]. In general, as the level of sampling of the fleet increases the more reliable the data due to decreasing opportunity for the fleet to engage in altered behavior. The inherent problem is that the relatively high cost of monitoring each day at sea often prevents managers from implementing sampling levels high enough to lead to high data confidence.

An alternate approach to partial coverage using random sampling is the selection of indicator vessels, also known as a reference fleet as data gathering platforms. These are generally volunteer or hand picked skippers who have demonstrated a genuine concern for the resource and have established trust with the managers. The obvious concern with this approach is the bias introduced due to the selection process. Case study 3 provides an example of this approach.

No matter what the approach, if a high degree of uncertainty exists with the resulting data, managers may need to take a risk averse approach by building significant error margins into stock assessments or produce estimates with large confidence intervals.

When individual vessel accountability is the goal, rather than fleet accountability, a sampling approach is no longer viable due to the inherent variance in the sample results. Management strategies targeting full individual accountability require 100 percent dockside accounting of landed catch by species and 100 percent at sea coverage in order to verify total catch by area (if necessary) for all species (including discards) or an audit system that effectively achieves accurate self-reporting. Where weights are not available at sea, full individual accountability may also require more comprehensive dockside monitoring.

If the goal of a data collection program is to document rare events such as by-catch of an endangered species then low at sea coverage levels may not be adequate. If an event only occurs a few times a season a high coverage level is required to have confidence in the determination of encounter rates. This becomes a significant concern when encounters have serious ramifications such as is the case in the Alaska hook and line groundfish fishery where a small numbers of encounters of short-tailed albatross can have serious implications for the fishery:[10]

> "The USFWS anticipates that up to four short-tailed albatross could be taken every two years in the hook-and-line groundfish fishery off Alaska and that up to two short-tailed albatross could be taken in the groundfish trawl fishery off Alaska over the time period in which the biological opinion remains in effect (approximately 5 years). These incidental take limits are in addition to the take limit established in 1998 for the Pacific halibut hook-and-line fishery off Alaska, two short-tailed albatrosses in a two year period. If the level of anticipated take is exceeded in any of these fisheries, NMFS must immediately reinitiate a consultation with the USFWS to review the need for possible modification to the fishery. Modifications could range from changes to requirements for seabird avoidance measures to fishery closures. The exact modifications cannot be predicted at this time."

A consideration in assessing the cost of monitoring programs with respect to coverage levels is that the cost is not necessarily directly proportional to coverage level. For example the cost of

[9] NOAA Fisheries Objectives, Protocol, and Recommended Precision Goals for Standardized Bycatch Reporting Methodologies. Available online at: http://www.nmfs.noaa.gov/by_catch/SBRMprotocol.pdf
[10] National Marine Fisheries Service Information Bulletin 03-77. 2003. Available online at: http://www.fakr.noaa.gov/infobulletins/2003/seabirdbiops.html

delivering 100 percent observer coverage is likely to be more than twice the cost of delivering 50 percent coverage. This reason for this discrepancy is the lack of flexibility and increased logistics of ensuring monitoring availability for every event rather than having the flexibility to alter your sampling strategy to maximize cost efficiency.

1.2.4 Industry Participation

Experience has shown that actively involving fishing industry representatives in analyzing a problem and developing a stakeholder-driven solution will produce better results than when government develops solutions on its own. This simple statement seems obvious but this approach is often not used for a variety of reasons.

Industry has been hesitant at times to get involved for fear that their involvement will be misinterpreted as support for unwanted government initiatives. They often feel that by not participating or by actively opposing change they will be more successful. In reality the issues affecting commercial fisheries today are significant and will not be easily resolved without input from fishermen. Proactive and forward thinking fishermen are engaging in problem solving with the goal of influencing the outcomes of government mandated management measures more acceptable to industry. In British Columbia, for example, groundfish fishermen have taken ownership of problems they face by developing creative solutions through a collaborative process that are generally a better fit and more palatable to industry than any solution that might have been imposed by government[11].

In cases where quota share systems have been implemented, quota share holders become more proactive and want a say in any changes that will affect their fishery. They now feel a more significant and long term stake in the fishery than they may have felt under an input control management regime.

Most managers who have worked closely with industry will say that fishermen are resourceful and creative problem solvers. Behind this creativity may be a need to adapt and innovate in response to new management measures such as catch limits and endangered species avoidance. Taking advantage of this resource – i.e. creating a market and/or regulatory environment for conservation innovation – as has happened with the British Columbia longline groundfish fishery will result in entrepreneurial and effective solutions to complex problems as is described in Section 3.

[11] Erikson, Wes D. 2007. The British Columbian Fishery: A Commercial Fisherman's Perspective. Proceedings of the 5th International Fisheries Observer Conference, Victoria, BC, Canada, 15-18 May, 2007. pages 60-61. Available online at: http://www.st.nmfs.noaa.gov/ifomc2009/Proceedings_ALL_FINAL_170907.pdf

SECTION 2: REVIEW OF EXISTING MANAGEMENT AND MONITORING PRACTICES IN THE GOM COMMERCIAL REEF FISH FISHERY AND IDENTIFICATION OF DATA GAPS

2.1 BACKGROUND

NMFS, based on guidance from the Gulf of Mexico Fisheries Management Council (GMFMC), regulates the fishery. The adjacent coastal states and NMFS participate jointly in the Council, which makes management recommendations to NMFS for federally managed species. NMFS then approves or rejects the recommendations, and implements regulations. NFMS may take unilateral action (but only in rare circumstances). Thus, the Council has the responsibility for setting management parameters, while NMFS regulates the fishery. As of 2008, about 800 vessels reported commercial landings of reef fish to the SEFSC log book program. Of these, about 330 vessels (approximately 80 longline and 245 vertical line) accounted for 90 percent of commercial reef fish landings from 2006 to 2008. There is also a small amount of commercial harvesting done with spears, but the total catch mortality, including bycatch, is very small relative to longline and vertical gear operations. The GOM Reef Fish fishery consists of 42 species of grouper, snappers, tilefish and other species with similar life-histories and found in similar habitat. The recent average ex-vessel value of the commercial reef fish fishery is $45.8 million (after inflation adjustment), and 47 percent of that value is from species in the shallow-water grouper fishery[12].

Amendments to the Magnuson-Stevens Fishery Conservation and Management Act (MSA) made in January 2007 require managers to set annual catch limits (ACLs) that end and prevent overfishing for all managed species by 2011 (by 2010 for currently overfished species) and institute accountability measures (AMs) to prevent overages that might compromise the health of the stock. These amendments are designed to improve accountability in management, prevent overfishing and rebuild stocks to levels that will support maximum sustainable yield. Management of ACLs requires total mortality accounting, including landed catch mortality, discard mortality, and mortality from other sources such as unreported catch (bait, personal consumption) and ghost fishing from lost gear. Effective data collection and monitoring programs will therefore be required.

In the GOM Reef Fish fishery, significant numbers of fish are released at sea due to restrictive fishing limits, prohibitions and size limits (regulatory discards) or market conditions (economic discards). The current data collection and management systems for the Reef Fish fishery do not adequately account for total catch mortality, making management actions less likely to succeed in preventing over fishing and restoring depleted populations.

2.2 CURRENT MANAGEMENT

While there are 42 different species in the Reef Fish fishery, the fleet primarily catches red snapper, vermillion snapper, yellowtail snapper, a shallow water grouper complex (red, gag,

[12] Gulf of Mexico Fishery Management Council Final Reef Fish Fishery Management Plan Amendment 30B, October 10, 2008 p 131.

black, scamp, yellowfin, yellowmouth, rock hind, and red hind), a deep water grouper complex (snowy, yellowedge, speckled hind, Warsaw, and misty), Tilefish, greater amberjack and triggerfish. Eleven of the 42 species have stock assessments and 17 are covered by, or included in, a commercial quota or annual catch limit. There are size limits for a number of species, and vessels are restricted to using only hook and line (longline and vertical) gear and spears. The commercial red snapper fishery is managed under an aggregate quota and Individual Fishing Quotas (IFQs). The grouper fishery is currently managed using species-specific ACLs (gag and red grouper), species aggregates (shallow water and deep water) with their own aggregate quotas, and commercial trip limits. Greater amberjack and gray triggerfish are managed under species specific ACLs.[13]

Data for quota management and stock assessment is collected through various programs, including Dealer Reports (DRs), Fishing Logbooks (FLs), observers, port sampling, trip interviews and vessel monitoring systems (VMS). Appendix III provides an inventory and characterization of monitoring and data collection programs currently operating in the GOM. For the most part, these programs are not coordinated or integrated and have varying degrees of success at collecting the required information. Information from DRs, FLs, and observers are used to calculate total fishery mortality by species against the stated quotas. Data from DRs, FLs, observed trips, port sampling and trip interviews are used in assessing the health of the stocks. VMS is used to monitor compliance with various fishing rules and regulations (i.e. fishing in closed areas).

Under the Quota Monitoring System (QMS), Dealer Reports collect landed catch weight information on a species basis. Not all dealers are required to report and compliance by those who are required is 90 to 95 percent. Dealer Report data only has to be submitted every two weeks. For the red snapper IFQ fishery, DRs are required for all landings, submitted electronically, and provide data in a timely manner. Fishing Logbooks, which do not include estimates of at-sea releases, are mandatory for all Reef Fish permit vessels and must be mailed to NMFS within seven days after the end of a fishing trip. NMFS monitors vessel reporting compliance on a monthly basis. Fifty percent of logbooks are received more than two weeks after the end of fishing trips.

NMFS audits logbooks, returning about 10 percent of the vessel reports to the individuals who completed them for completion or correction. Renewing permits is contingent on completed logbooks for each month throughout the year. However, logbooks are not cross-referenced to trip ticket reports for verification of information. Indeed, many logbooks are not fully or properly completed, further reducing the usefulness of the data. A supplementary form for recording at-sea releases is distributed to a selected 20 percent of vessels but compliance is only 50 percent. A Reef Fish observer program collects important biological and fishery information on retained and discarded catch, but at coverage levels of 1 percent, the data are of questionable value for accurately estimating mortality associated with bycatch and released fish. Trip interviews (and associated port sampling) provide important biological and catch per unit effort information that help inform the stock assessment process, but there is no ability to independently verify the

[13] ACLs are set in response to the requirements of the MSRA. Quotas set prior to the MRSA remain as quotas; as the Council updates them, they will become ACLs. The council is in the process of establishing an ACL for gag.

accuracy of the interview data or to monitor and confirm off load weights. The information can also be used to ground-truth DRs and FLs for species composition and catch weights, but there is no evidence that this is done.

It is fair to conclude that the current management plan for the commercial Reef Fish fishery, and the associated data collection and monitoring programs, have some information gaps which increase the risk of overharvesting various Reef Fish species (those with quotas or ACLs and those without). Many species do not have ACLs and there is little knowledge of what impact the fishery is having on these stocks. Even for stocks with ACLs, the lack of information about at-sea release mortality, and the inability to independently confirm total landed catch mortality, raises concern about the validity of the data and the use of the data for developing management measures to sustain and rebuild Reef Fish stocks. In addition, the lack of fishery independent data (i.e. surveys) to assess stock health and the reliance on CPUE and biological length and age samples from the commercial fishery, means that ongoing management changes (i.e. changing trip limits, changing species assemblages, changes to IFQs, etc.) will make it increasingly difficult to interpret relative changes in catch and effort data and accurately determine maximum sustainable yield (MSY) and set ACLs with confidence.

The September 2007 *Lenfest Ocean Program Research Series* report[14] by an expert working group of fisheries scientists and managers concluded that to set effective catch limits (i.e. ACLs) it was necessary to determine:

1. The vulnerability of the fish population to fishing pressure;
2. The uncertainties in scientific information about the status of the fish population; and,
3. The uncertainties in the effectiveness of management tactics.

The working group further concluded that where there is greater vulnerability or uncertainty, greater precaution should be employed when setting ACLs by setting wider buffers that help minimize the risk of overfishing. Therefore, if the Reef Fish population is long-lived and reproduces slowly, or the knowledge about the health of the stock is poor, or the ability to account for total mortality is deficient, then the ACL should be set lower. Improved catch monitoring and data collection reduce management uncertainty which, in turn, enables managers to use less precaution and set the ACL at a level closer to (but below) the allowable biological catch (ABC) set by their scientists (by law, ABC must be set below the overfishing level). In effect, this may translate into an increase in quota because the precautionary buffer can be narrowed.

2.2.1 Setting Monitoring and Data Collection Program Goals

The monitoring and data collection needs are directly related to the management requirements of the Reef Fish fishery, which are changing over time. By 2011 all Reef Fish species should have ACLs and total mortality data would need to be collected and measured against the established catch limits. The data needs for IFQ fisheries are more extensive and time sensitive than

[14] Setting Annual Catch Limits for U.S. Fisheries. Lenfest Ocean Program Research Series. September 2007. http://www.mragamericas.com/pdf/sr/Lenfest%20Working%20Group%20on%20ACLs.pdf

fisheries managed under input controls (as evidenced by the comprehensive mandatory electronic data reporting requirements in the red snapper fishery). IFQs also allow for greater individual accountability which results in the need for more accurate individual information and additional measures to ensure data quality and program integrity. In addition, the Endangered Species Act and the move towards ecosystem management will place increased emphasis on data collection, effective monitoring and timely reporting.

While monitoring and data collection program goals will vary with the management plan, the following goals are consistent with the current management needs of the Reef Fish fishery:

General Goals:

1. Account for all mortality associated with the commercial Reef Fish fishery, including:
    a. landed catch mortality
    b. at-sea release mortality
    c. unreported catch mortality
2. Collect biological and fishery data from the Reef Fish fishery necessary to inform stock assessments, including:
    a. Vessel characteristics and gear type
    b. Gear details – number and type of hooks
    c. Total catch and species composition (including released fish)
    d. Effort information (set location and soak time)
    e. Biological samples (length, sex, maturity, weights, otoliths, tissue)
    f. Sea conditions
3. Collect information that supports program compliance and enforcement
    a. Vessel location and activity
    b. Permit information
4. Provide quality, complete and accurate Reef Fish fishery data to scientists and managers in a time frame consistent with the in-season management and annual management planning requirements.

Specific Goals:

5. Accurate logbook reporting by statistical area from all vessels active in the Reef Fish fishery, including:
    a. Estimates of retained catch by species and area for each unit of effort
    b. Estimates of released catch by species and area for each unit of effort
    c. Estimates of catch by species used for on-board consumption or bait
    d. Reporting of lost fishing gear
6. Accurate reporting by statistical area of all landed catch from all dealers receiving fish from Reef Fish permitted vessels, including total landed weight by species by vessel for each offloading.

2.3 DATA GAPS

In general, the existing quota monitoring system is effectively accounting for landed catch. Data required for in-season management effectively have a minimum one week lag between the time

of data collection and availability for management purposes. Many of the large volume dealers report quickly so the majority of landings data are often received within a few days of the landing. Data entry usually occurs on the day the data are received. Turn around time can be accelerated for quota management purposes as the landings approach the quota. Based on current landed catch reporting practice and pace of the fishery, catch projections have been considered sufficient for quota monitoring purposes under the current management objectives. For example, shallow water and red grouper did not reach the quota in 2006 and 2007, deep water grouper exceeded the quota by about 7 percent in both years, and tilefish essentially hit the quota both years.

However, the inability to factor discard mortality into quota monitoring and accounting is an important gap preventing full implementation of annual catch limits under MSA. No in-season accounting of discard mortality occurs for Gulf of Mexico Reef Fish. In spite of a number of programs designed to obtain data on discards, the discard rates and total quantities of discard from various fisheries are poorly known. Some data cannot be used. For example, analysts could not use weight data of discards from the logbook program because fishermen report either average weights or aggregate weights in the field for average individual weight. For some species, NMFS stock assessment analysts use models to calculate mortality of discarded undersized fish by estimating lengths of the discarded fish, rather than using actual data reported in their data systems. Although 75 percent of logbook data are available to managers and scientists within two months of collection, no procedure is available to convert data into estimates throughout the season. Logbook data on discards come from only 10 percent of fishermen, and errors in entering weights render some logbook data problematic. Observers cover only 1 percent of Reef Fish vessels allowing for some discard and biological data collection but these data may not be statistically sound because they are likely not representative of actual fleet-wide fishing operations.

Several problems have arisen that will require additional at-sea observation. Recent estimates of turtle captures by the longline fishery are based on a small percentage of trips covered by observers, and a much larger sample size is required to ensure that the turtle interaction mitigation measures of the fleet are successful. In addition, at the time of the qualifying landings for red snapper IFQ nearly all landings occurred in the northern and western Gulf, west of the Mississippi River. Since the rebuilding plan was implemented, there are widespread reports of red snapper occurring throughout the eastern Gulf. Grouper fishermen in the eastern Gulf have reported high red snapper encounter rates and associated discarding of this species because they did not receive quota shares or have insufficient quota shares to land them. Red snapper discarding is likely occurring on these vessels but the quantities of discards is not known due to very low observer coverage.

The SERO and Gulf Council acknowledge a need for more and better bycatch and discard data. The SERO has conducted a pilot project for Gulf of Mexico longline vessels using electronic monitoring (EM - closed circuit TV, gear sensors, VMS) to evaluate whether EM could help supplement current at-sea monitoring[15]. At the current level of coverage, in-season management

[15] Pria M.J., H. McElderry, M. Dyas, P. Wesley, 2008. Using Electronic Monitoring to Estimate Reef Fish Catch on Bottom Longline Vessels in the Gulf of Mexico: A Pilot Study.

of discard mortality is impractical. There is no assurance that observer coverage represents the activities of the fleet. However, SERO believes that the data collected are enough to inform stock assessments, biological opinions, etc, in spite of lower than target coverage rates (Phil Steele, SERO, personal communication). To our knowledge, no desired levels of statistical accuracy and precision have been determined, against which to compare actual results.

The data collection systems currently in place (Appendix III) apparently developed independently for specific purposes related to one or more of the key functions. In the aggregate, however, the systems result in a substantial amount of overlap in collection of some types of data. The main overlap is in landings data. Observers, fishermen, dealers and port agents all report catch data at various levels and to various programs. In particular, dealers are required to report to multiple programs. For example, the trip ticket programs in Florida, Louisiana and Georgia collect information from the dealers about the harvester, the dealer purchasing the product, the date of the transaction, the county in which the species was landed, time fished, and pounds of each species landed for each trip. State fishery agencies review dealer data for errors or omissions and then provide the data to the Gulf States Marine Fisheries Commission, which maintains the data for subsequent NMFS use or entry into the Accumulated Landings System, Domestic Longline System and QMS system. Overlap also occurs in the collection of vessel characteristics, socio-economic information, and trip summary data; observers and port agents collect this information and fishers include information in logbooks. Not all programs collect the same information, so it is not clear how much overlap occurs among the programs or if the low coverage of, for example, observers and logbooks effectively eliminate duplication. The Gulf States Marine Fisheries Commission, NOAA Fisheries, and the Gulf Council are exploring an electronic dealer reporting system through which dealers enter and transmit one set of data; agencies needing components of the data set would receive the data automatically from the reporting system.

SECTION 3: DATA COLLECTION AND MONITORING EXAMPLES

There is no single monitoring solution that is a best fit for all applications. In every situation the optimum strategy will result from an informed assessment of how monitoring alternatives can be designed to best meet the management objectives while minimizing negative social and economic impact on the fishing community. It should also be expected that, whatever the strategy, it is likely to need revision over time as the fishery evolves.

The most important component to guiding monitoring program design is a clear statement of minimum data requirements to fully support fishery management. The minimum management requirements must be agreed and clearly defined in advance, as program design will often end up as a trade off between competing objectives; usually cost and quality that can end up compromising the original objectives.

Designing an effective monitoring approach must also consider a spectrum of other critical issues:

- level of accuracy and reliability desired in data products
- level of accountability desired (individual, sector, fleet)
- biological characteristics (species and stock diversity, life-history)
- fleet characteristics (number, size, gear)
- fishery characteristics (number and size of landings, landing locations, effort)
- market characteristics (product types, value, seasonality)
- funding alternatives
- compliance levels

While each individual situation needs it own unique solution it is instructive to consider established, successful monitoring systems to learn what approaches have worked well in other jurisdictions and assess the relevance for new applications. With this in mind we provide three case studies of monitoring programs that have successfully achieved the fishery management objectives. Review of these examples should help to inform discussions surrounding monitoring alternatives for the Gulf of Mexico Reef Fish fisheries.

3.1 BRITISH COLUMBIA GROUNDFISH FISHERY

The British Columbia Groundfish Fishery (BCGF) is an example of a fully documented fishery. This means that both at sea and landing activities are both fully and accurately documented with independently verifiable data available to support in season management decisions.

The BCGF is a very complex multi-species, multi-management area, multi-license and multi-gear fishery. It has the multi-species and multi-gear aspects in common with the GOM Reef Fish fishery as well as impacting a small number of species that are considered of concern. The Canadian Department of Fisheries and Oceans is responsible for oversight and management of

the groundfish resource and works closely with the commercial industry to develop an annual Groundfish Management Plan[16].

The management objectives for the BCGF have changed over time based on increasing fishing pressure, stock health concerns and an evolving management approach. In the early years Dealer Reports and Fishing Logs were the only monitoring tools. During the 90's these were augmented by a dockside monitoring program (DMP) for various fishery components as certain species moved to individual quota management. In addition, in 1996, the trawl component of the fishery became subject to 100 percent observer coverage by an at sea observer program (ASOP). More recently, hook and line and trap vessels have also become subject to 100 percent coverage by an electronic monitoring program (EMP).

The fishery recently experienced another significant change to the management regime as a result of a declaration by the fisheries agency (DFO) in 2003 that the entire fishery would be held fully accountable for all catch by 2006. The definition of catch included catch released at sea whether target or by-catch; whether marketable or not; whether an individual quota species or not and whether sub-legal size or legal size. Only legal size, quota managed catch would be deducted from vessel or fleet quotas but all catch would be accounted for.

This new management requirement meant significant changes for the affected fisheries, to the point that some sectors were concerned they may no longer be viable. The affected sectors worked collectively with DFO to develop a management and monitoring system, which effectively met the new DFO requirements and still allowed for an economically viable fishery.

An industry committee led the process of developing a workable solution. The result was described as an "integrated fishery" and involved implementation of individual vessel quotas for all remaining non-IQ quota species, a mechanism to allow quota transfer between both vessels and sectors and an integrated monitoring system that would support individual accountability. This monitoring system met the new requirement to provide total mortality accounting for all quota species and the data would be available to support in season management.

The Management Objectives:

- individual accountability
- verifiable data on all catch and discards
- discarded catch documented as legal or sub-legal size
- individual vessel quotas and fleet quotas tracked with each landing
- confidence that total catch stays within TACs

The Active Fleet:

- over 300 trawl, demersal longline, jig, troll and trap vessels
- vessel size from 20 to 175 feet, majority 45 to 80
- trawl, longline, hand line, troll, trap

[16] Pacific Region Integrated Fisheries Management Plan, Groundfish, February 21, 2009 to February 20, 2010. Available online at: http://www-ops2.pac.dfo-mpo.gc.ca/xnet/content/mplans/plans09/2009_Groundfish_IFMP.pdf

The Fishery:

- six sectors individually licensed
- each sector (except trawl) targeting one species (or group) but having by-catch of others
- fishing is 6-12 months depending on species and gear
- fishing is coast wide with 6 large volume landing ports and 20 low volume
- 3,500 landings/yr, 20,000 fishing days/yr
- aggregate annual landed weight 230 million pounds

The Market:

- product state: live, fresh, frozen (individual and blocks)
- product type: round, head off/gutted, j-cut
- value varies widely: $0.24/lb to $11.00/lb USD
- aggregate annual landed value $112 million USD

BC Groundfish Fishery Profile (2007)

	Fishery Profile						
Fishery	**Vessels**	**Trips**	**Seadays**	**Offload Hrs**	**Lbs. Landed**	**USD$/Lb**	**Total Value**
Hook and Line*	244	1,607	12,000	4,300	28,459,120	$0.24 - $11.00	$68,320,000
Offshore Trawl	48	789	4,752	7,100	81,101,245	$0.20 - $3.20	$32,400,000
Inshore Trawl	9	364	839	450	299,451	$1.20 - $5.00	$600,000
Hake (Midwater Trawl)	34	760	2,115	4,750	120,600,121	$0.08	$9,600,000

* includes halibut, sablefish, lingcod, dogfish and rockfish fisheries

Monitoring Strategy:

The monitoring approach required to collect data sufficient to support the requirement for individual accountability on a multi-sector, multi-species fishery such as BCGF is extensive and complex. It must be tailored to the management objectives as well as the requirements of industry. In this case the chosen strategy for hook and line and trap vessels (the trawl fishery uses observers) is built around self-reporting of catch by industry through their Fishing Logbooks, with an extensive audit system through electronic monitoring to validate the data provided and consequences where performance standards are not met.

- all vessels hail out and hail in
- self-reporting of all effort, catch and catch disposition through a Fishing Log
- 100 percent at sea coverage (EM for hook and line and trap or observers for trawl)
- all landings independently monitored
- full data consolidation and audit for each landing
- species problematic to identify with EM tracked as a grouping
- for the hook and line and trap fishery legal/sublegal verified by video using a visible length measurement scale mounted on the vessel
- for the hook and line and trap fishery pieces and average weights used to assess at sea discards of legal size catch
- full retention of rockfish

BC Groundfish Fishery Monitoring System Components (2007)

Fishery	Audit	DMP	ASOP	EMP
Hook and Line*	100%	100%		100%
Offshore Trawl	100%	100%	100%	
Inshore Trawl	100%	100%		100%
Hake (Midwater Trawl)	100%	100%		100%**

* includes halibut, sablefish, lingcod, dogfish and rockfish fisheries

Cost and Cost Recovery:

Most aspects of the monitoring program are funded primarily by industry, though the program receives a government contribution. DFO currently provides about 30 percent of the cost of the electronic monitoring program during its first two years of operations. It is not know whether this government funding will continue. DFO also contributes 33 percent of the cost of the trawl at-sea observer program on an annual basis.

BC Groundfish Fishery Monitoring Cost Summary (2007)

	Average Cost USD/Unit					Average Cost USD/landed pound				%
Fishery	Cost per Vessel	Cost per Trip	DMP Trip	ASOP per day	EMP per day	DMP	ASOP	EM	Total	Fishery Value
BC Groundfish										
Hook and Line	$6,819	$1,035	$340		$123	$0.019		$0.052	$0.071	3.0%
Offshore Trawl	$40,997	$2,494	$392	$446		$0.004	$0.026		$0.030	7.6%
Inshore Trawl	$10,563	$261	$53		$116	$0.064		$0.326	$0.390	19.8%
Hake (Midwater Trawl)	$8,431	$377	$272		$86	$0.002		$0.001	$0.003	3.7%

Note: Inshore Trawl receives a 30 percent subsidy from government

Effectiveness:

The trawl fishery management regime has been in place since 1996 and industry and government have confidence in its effectiveness. The newer hook and line management regime is currently in the third year of a three year trial. A full review is currently underway. Initial impressions are that:

- managers have confidence that catch levels are within TACs
- discarded catch is accounted for and fishermen have increased motivation to reduce it
- individual vessel quotas are reliably tracked on a landing by landing basis
- fishing log data quality is improving
- monitoring is creating a level playing field for license holders
- monitoring costs are leading to efficiencies in fishing activity and behavior
- fleet and quota consolidation is occurring

3.2 US WEST COAST GROUNDFISH TRAWL FISHERY

The United States West Coast Groundfish Trawl Fisheries (WCGTF) consists of a number of different fisheries. They occur under NOAA jurisdiction outside of 3 miles and under state jurisdiction inside 3 miles. The limited entry (non-whiting) trawl fishery (LETF) occurs under NOAA jurisdiction and provides an example of a total mortality management approach. Landing data are acquired from Dealer Reports and fleet wide at sea mortality is determined through measurement of discard rates. Discard rates are measured through random at sea observer coverage analyzed in conjunction with fish ticket and fishing log information.

The LETF has similar characteristics to the GOM Reef Fish fishery. It involves multi-species catch, species that are either considered at risk and a broad geographic area under multi-jurisdictional oversight. There are 82 groundfish species listed in the management plan for the LETF with seven designated as overfished.

The Pacific Fishery Management Council (PFMC) is responsible for the Pacific Coast Groundfish Management Plan[17]. The council works with state fisheries agencies from Washington, Oregon and California. The Pacific States Marine Fisheries Commission (PSMFC) facilitates data management activities in this multi-jurisdictional environment. The PSMFC coordinates various federal, and state catch monitoring systems and oversees PacFIN, a shared commercial catch monitoring database that incorporates state based Fishing Logbooks and fish tickets (Dealer Reports), as well as port sampler data. Observer data is stored independently within a NOAA database.

The WCGTF have used fish tickets to provide landed catch information for all fisheries for decades. Fishing Logbooks documenting catch and effort - with set by set resolution - and by area are a mandatory requirement for the LETF but not for all other west coast groundfish fisheries. These data sources provide the primary fishery dependant data to support stock management. In addition, VMS systems became mandatory in 2004 for NOAA managed WCGF, including LETF. VMS is used primarily as an enforcement tool.

Increasing concern over the health of certain groundfish stocks have led to efforts to independently document and set at sea discard rates for use in establishing total fishing mortality. A number of state run voluntary observer programs in the 1980s and 90s produced a better understanding of the factors that affect discard rates and the difficulties with setting fleet wide rates. The NMFS established the West Coast Groundfish Observer Program (WCGOP) in 2001 in order to provide the resources and framework for estimating fleet-wide discards in WCGF.

The WCGOP is supported by a regulation requiring all vessels participating in the commercial groundfish fisheries to carry an observer when notified to do so by NMFS or a designated agent. The observers monitor and record catch data, including species composition of retained and discarded catch. The WCGOP covers the major commercial fisheries targeting groundfish. In order to minimize the "Observer Effect" vessels are required to carry an observer for every trip within an entire fishing period. These vary in length for each fishery and are two months for the LETF. As the fishing period has species landing limits there is reduced opportunity to modify

[17] Pacific Coast Groundfish Fishery Management Plan for the California, Oregon, and Washington Groundfish Fishery. 2008. Pacific Fishery Management Council Available online at: http://www.pcouncil.org/groundfish/gffmp/fmpthru19.pdf

fishing behavior during monitored fishing trips unless the operators are willing to reduce their catch or forego their period limit. It is still likely that vessels take a more risk averse fishing approach while observers are on board.

The WCGOP samples 20-25 percent of west coast groundfish catch. Observer assignments are made using a stratified random sampling protocol aimed at selecting vessels across fishing periods. The data are then stratified across fishery, time, area, and depth in order to develop bycatch and discard rates.

The WCGF also includes two midwater trawl whiting fisheries whose discards are measured differently than in the LETF. The factory processor whiting fishery is required to have 100 percent observer coverage and the shorebased sector is monitored with 100 percent electronic monitoring and 100 percent dockside monitoring.

Limited Entry Trawl Fishery Monitoring Objectives:

- fleet level accountability
- total fishing mortality accounting
- landed catch documented through fish tickets
- discarded catch estimated through partial at sea observer coverage
- fleet quotas tracked seasonally
- maintain total catch within optimum yield

The Fleet:

- over 120 vessels
- vessel size, majority from 45 to 80 feet

The Fishery:

- limited entry
- fishing is year round
- fishing is coast wide with many landing ports
- 3,500 landings/yr

The Market:

- product state: live, fresh
- product type: round
- value varies widely: $0.50/lb to $10.00/lb
- aggregate annual landed value about $60 million USD

Cost and Cost Recovery:

The monitoring costs for both fish tickets and Fishing Logbooks are paid by the Pacific states through the PSMFC. This includes data gathering, quality control and reporting in PacFIN.

NOAA funds the West Coast Observer Program, which was budgeted at $4.5 million USD in 2004. This includes the cost of coverage for the LETF as well as coverage on other fisheries that target and/or encounter groundfish.

Industry participants in the LETF bear little cost for monitoring other than that involved with completion and submission of the Fishing Logbooks by vessel operators and fish tickets by fish buyers. In the whiting fisheries the industry is required to fund the cost of observers in the case of the factory trawlers and about 70 percent of the cost of electronic monitoring in the case of the shore based fishery. NMFS funds the other 30 percent.

Effectiveness:
The monitoring approach taken for the LETF in the US West Coast Groundfish Fishery is providing total fishery mortality accounting for this fishery with a level of accuracy that is acceptable to the managers under the current management environment. Short-comings with the current approach include data turn around time: up to three months for fish tickets and 12-18 months for observer data. Additional improvement could be made with increased Fishing Logbook compliance, which is estimated at 85 percent. One of the challenges with the current stratified random sampling approach used by the observer program is to collect a statistically significant number of discard observations across all of the required strata.

Managers are currently exploring the option of moving to a share based management approach for the WCGF that would likely involve an escalation of monitoring requirements, increased cost responsibility from industry and the possibility of moving from fleet level accountability to individual accountability.

3.3 THE NORWEGIAN REFERENCE FLEET

Norway's Institute of Marine Research (IMR) has developed an innovative and cost effective approach to the collection of data from vessels involved in their high seas and coastal fisheries. They have developed a "Reference Fleet" (RF) consisting of a small group of active vessels in the fishery that are paid to provide the IMR with detailed information about their fishing activity and catches on a regular basis[18]. The high seas RF was established in 2000 as a way to collect sufficient biological samples by area, season and gear to estimate landings at size and age in order to support stock assessments. It was decided politically to establish a reference fleet rather than to use on board observers. The RF consists of 16 large offshore vessels and the coastal version which would bear closer similarity to the GOM Reef Fish fleet was established in 2005 and consists of 18 smaller (25-46 feet) vessels.

The fleets target both groundfish (cod, pollock, haddock, saithe) and pelagic species (herring, mackerel, capelin) using a range of gear types, including trawl, seine, gillnet, longline, pot and trap depending on the target species. The fisheries are managed through limited fishing licenses or annual permits and vessel based quotas. A significant aspect of the Norwegian management control systems is the prohibition on discarding of any of the main commercial species. In 2008 this prohibition included 15 species and the list is expected to be expanded considerably in 2009. This regulation has been in place since 2007 and applies to all EU vessels fishing within the

[18] The Institute of Marine Research's Reference Fleet Program. 2007. Institute of Marine Research, Bergen, Norway. Available online at: http://www.imr.no/english/data/page/6334/No.1_2007.pdf

Norwegian EEZ. This regulation has reduced the discard problem but created the paradox of making estimation of the remaining discards more difficult.

The RF self-samples their catch and provides the data directly back to managers. Their primary sampling goals are the collection of biological sample data and total catch estimation. Both data sets are submitted electronically from the vessel. Vessels are selected for the reference fleet based on their gear type and geography as well their reputation and demonstrated interest in fishery conservation. The sampling goal is to collect samples representative of general fleet activity. Following identification of participating vessels, crewmembers are selected to receive initial training from IMR staff on proper sampling and data collection techniques, communication guidelines and supervision on the vessel.

The program does not currently include enumeration of discards but this is under consideration. Anecdotal evidence points to continued discard of unmarketable species and investigation of the opportunity to use the reference fleet to estimate discards has been identified as a future project (Kjell Nedreaas, Institute of Marine Research, Norway, personal communication).

Other monitoring in place for the Norwegian fleet includes mandatory fishing logs for all vessels greater than 40 feet. Sales notes (dealer reports) are used to track all vessel landings and for quota tracking purposes. Government inspectors monitor landing sites. VMS is required on all vessels over 78 feet. At sea monitoring is also carried out by 18 government inspectors who provided 700 days of at sea coverage in 2008. They have a control and enforcement role and monitor compliance with closed areas as well as other fishing regulations.

Cost and Cost Recovery:
The reference fleet program is funded through an annual quota set aside, which is allocated from the relevant species TACs prior to allocation of vessel quotas. This innovative funding approach enables the entire fleet to bear the cost of the program in proportion to their quota holdings. In 2007, 900 mt of Cod, 600 mt of Greenland halibut, 600 mt of herring and 600 mt of mackerel were set aside to fund the program. The total estimated landed value of the fish was $5.1 million USD. Of this, approximately 60 percent would be paid out to vessels by IMR to cover the cost of catching and selling the fish. The other 40 percent was paid out to the fisherman who collected the samples and covered other program administration costs. The value of the fisheries represented by the two reference fleets is about $1.5 billion USD.

Effectiveness:
The reference fleet approach has provided a very useful data collection platform for Norwegian managers. The data provided has been used to strengthen stock assessments and increase the confidence level of management decisions. Managers are able to improve their sampling coverage in time and space, learn about the affects of new regulations, sample species rarely encountered by research vessels and test new data collection systems and gear modifications. Coverage level achieved in the coastal fleet is about 0.5 percent due to the large fleet size. Coverage in the offshore fleet can range up to 15 percent. An area of improvement that has been identified is to improve the collection of data on discards and bycatch[19].

[19] ICES 2008. Report on the Workshop on Fisheries Sampling of Catches (WKSC), 10-13 June 2008, ICES, Copenhagen, Denmark. ICES CM 2008/ACOM:30.61pp

While the reference fleet approach is not currently used to directly enumerate discards in the Norwegian fishery it has potential to be used for this purpose in conjunction with a creative funding approach. It is also an example of collaborative management between industry and government that has led to a significant improvement in the knowledge of the fishery by managers as well as fostering a joint ownership for data and the results. Although the reference fleet concept may not be directly transferable to the GOM context there is value in considering the funding strategy used and the benefits that came from the co-operative management approach.

SECTION 4: OPTIONS FOR IMPROVING DATA COLLECTION IN THE GOM FISHERIES

In the GOM Reef Fish fishery, significant numbers of fish are released at sea due to restrictive fishing limits, prohibitions and size limits (regulatory discards) or market conditions (economic discards). The current data collection and management systems for the Reef Fish fishery do not adequately account for total catch mortality, reducing the effectiveness of management actions to end or prevent overfishing and to restore depleted populations.

The focus of this section is to provide recommendations for improvements based on the current GOM monitoring and data collection systems as described in Section 3.

Recommendations for Improved Data Collection – a Phased Approach:
There are numerous monitoring and data collection tools as described in Appendix I of this report. However, not all tools are applicable to every fishery, or reasonable given the economics of the fishery or the management system. Dockside monitoring and at-sea monitoring (observers or electronic monitoring) can be expensive and may not be affordable at the coverage levels required to collect the necessary data. There are also operational realities to consider. For example, small vessels may not have the space to accommodate an observer. Government may not have the infrastructure and systems to receive, integrate, hold and disseminate the data. Furthermore, too much change at once can lead to negative results because fishermen or managers can not adapt quickly enough to the demands and costs of new data reporting and monitoring requirements.

It may be optimal to have the following in the GOM Reef Fish Fishery: 1) independent dockside monitoring and recording of all fish landed; 2) observers on every trip collecting valuable fisheries management and biological data; and 3) a data system that provides managers with updated total mortality estimates on a daily basis. While this scenario is desirable, it is not a realistic scenario for this fishery in the immediate future. The Reef Fish fishery can, however, implement a number of changes over a relatively short period of time that will improve data collection, increase the quantity, quality and confidence in the information collected for ACL management, reduce the uncertainties associated with management tactics, and decrease the risk of overharvesting.

4.1 PHASE 1: IMPROVEMENTS TO EXISTING DATA COLLECTION

The existing management of the GOM Reef Fish fishery relies heavily on the FLs and DRs, supplemented by the trip interview program (TIP). The limited number of fishery independent surveys in the Gulf of Mexico, a very low level of at-sea monitoring, and the TIP do not provide official catch and species composition for landings. Substantial increases in fishery independent survey coverage are needed to reduce confidence intervals and improve their management value. Almost all of the data necessary to set and manage ACLs comes from the FLs and DRs. Therefore, immediate measures to improve data collection need to focus on these data sources.

A number of shortcomings have been identified with the existing monitoring and data collection systems. These can be addressed at relatively small or no additional expense.

All Reef Fish vessels must complete a Fishing Logbook, but they do not all record information on at-sea releases. It is important to account for at-sea release mortality so that managers can calculate an accurate, in-season estimate of total mortality (when combined with landed catch data). This cannot be achieved when only 20 percent of vessels are required to complete supplemental discard forms and the compliance rate is only 50 percent. Furthermore, the FL trip report form is a summary form for the entire trip and does not provide set or daily information. The summary trip report has to be provided within seven days of landing, which means that the skipper may not fill out the logbook until after the trip and could be several days after the fishing event. An accurate recording of an event is related to the time between the event was witnessed and the time it was documented. If a skipper records an event immediately after it occurs it will be more accurate than recording the event seven days later because lapses in memory of the event that can produce inaccurate data. In many parts of the world fishermen are required to complete Fishing Logbooks on a set by set basis and must have them completed on a daily basis.

Fishing Logbooks

Improvement 1: **Fishing Logbooks should require and include the recording of all fish caught at sea, including an estimate of the weight of fish caught and released by species, area, depth and gear type.**

Improvement 2: **Fishing Logbooks should require and include the recording of lost gear, including the amount of gear (length of groundline and number of hooks) and location.**

Improvement 3: **Fishing Logbooks should be changed to record fishing events on a daily basis (If possible, data should be collected for set location and soak time).**

Improvement 4: **All daily Fishing Logbook trip report forms should be completed by 12:00 p.m. (noon) of the day following a fishing day.**

Improvement 5: **An electronic standardized template should be developed and implemented as soon as practicable.**

The improvements identified above are aimed at increasing the accuracy of the data by recording all catch information (retained plus discards) on a daily basis. Greater accuracy will lead to improved CPUE estimates, stock assessments, ACL recommendations, and in-season ACL management. Monitoring and enforcement of Fishing Logbook requirements will also be enhanced. Officers boarding a permitted Reef Fish fishery vessel can inspect the FLs to determine if the trip report form has been completed for the previous day(s). Similarly, Fishery Officers can meet the vessel when landing and inspect the Fishing Logbook trip report forms for completion.

While electronic Fishing Logbooks are not widespread, they are becoming more common. Many vessels are equipped with computer plotters that can readily be used to enter and store logbook data. Some vessels have the capability to transmit e-mails and would be able to submit their electronic FLs via e-mail at sea. As technology improves and becomes less expensive, electronic Fishing Logbooks will become the norm.

Some significant changes are recommended for improving Fishing Logbook data collection. Such changes should not occur without input from those responsible for completing the logbooks and providing the information. Fisheries science, management and enforcement staff should work cooperatively with Reef Fish vessel operators on design changes to the FL, consistent with the recommended improvements that are operationally practical and minimize disruption to vessel operations.

Dealer Reports

Fish houses (dealers) are required to complete two forms. The first is the state trip ticket information for all species landed weight received at the point of sale (landing). The state trip ticket is submitted to the respective state on a monthly basis and then provided, either individually or in aggregate, to the Federal National Marine Fisheries Service (NMFS). While the states provide species specific landing information for use by managers and scientists, it is not processed for in-season ACL monitoring purposes.

The second form is used for the Quota Monitoring System (QMS), which is only for grouper species, greater amberjack and grey triggerfish. The QMS enables the federal fisheries managers to monitor in-season catches of QMS species against established ACLs, closing the fishery when ACLs are reached. Federal QMS reports are provided monthly by the dealers, but can be requested more frequently as the ACL is approached.

Currently, more than 95 percent of reef fish landings are accounted for through QMS Dealer Reports submitted to the South East Fisheries Science Center (SEFSC). Completed QMS forms are required twice a month from Gulf of Mexico reef fish and shark dealers. Therefore, data from a trip may not be available to managers for in-season management for up to 25 days or longer. This is a significant time delay for data entering the system. More timely submission of Dealer Reports to the SEFSC would benefit managers by helping to improve the precision of monitoring ACLs.

Improvement 6: **All dealers receiving Reef Fish should be required to submit to the SEFSC complete and accurate Dealer Reports which include aggregate landed weights by species for all species landed.**

Improvement 7: **Dealer Reports should be submitted weekly and received by the SEFSC no later than 5 days following the week they received fish .**

Improvement 8: **A mandatory electronic Dealer Report system should be expanded as soon as possible to all reef species managed under ACLs.**

Mandatory electronic Dealer Reports appear to be working successfully in the red snapper IFQ fishery and should be expanded to include all Reef Fish. With Council approval of an IFQ for grouper, expansion of an electronic reporting system to cover these species and possibly other IFQ species in the foreseeable future is advisable. In addition to providing the data in a more timely manner, electronic reporting will reduce data entry errors and paper work.

Accurate and complete submission of Fishing Logbook and Dealer Report data without significant delay is important for in-season management and the annual stock assessment process. Of equal importance for maximizing managers' use of the FL and DR data, however, is integration of the different datasets into a single, seamless operating system.

Integrated Data Systems

Based on these recommendations, FLs would reflect estimates of at-sea catch by location and time; DRs are actual weights of catch by species. The ratio of retained species catch weight estimates by area from the FLs can be used to assign the DR true species landed weights back to the area of catch. Further, by merging the two sources of information, the accuracy of the FL and/or DR can be checked, including species composition, landed weight, and estimates and composition of at-sea releases. For example, if comparison of the FLs and DRs for a vessel shows that the vessel is consistently underestimating total catch weight by 10 percent, it may be the case that the catch weight of at-sea releases are also under-estimated. VMS data can be checked against FL data to confirm logbook locations and trip duration. Simple data checks can also be conducted by comparing the two information sources. For example, the vessels FL may record 15 species retained, while the DR only records 13.

Improvement 9: Fishing Logbook, Dealer Report and VMS data should be entered into a single Fisheries Operating System (FOS) that allows for data merging, checking, and reporting.

The FOS would calculate total mortality by species and, in cases where species are subject to ACLs (which should include most all species by 2011), track the total mortality against the respective ACL.

The FOS should be designed so that it can be expanded to include other data sources in the future, such as hail, dockside monitoring, at-sea observer, and electronic monitoring data.

Data quality can be improved if those providing the information receive feedback. Fishermen are generally not focused on providing accurate FL data. They are focused on fishing vessel safety, catching fish and earning a living. Fishermen may not understand the relevance of the data they provide to fishery managers and the data's use in decisions aimed at maintaining healthy stocks levels. By educating fishermen on the importance and use of the FL data they may be more inclined to provide complete and accurate information. Providing feedback on the data they do provide will hopefully improve subsequent data submissions. Ultimately, data quality will not be maximized until the fishers begin to take ownership of the data.

Data Collection/System Training

Improvement 10: National Marine Fisheries Service (NMFS) and Gulf Council staff should meet with Reef Fish fishermen at least once a year to review the FL data collection program and show how the data was used for management and science purposes.

Improvement 11: Individual fishermen should receive on a regular basis a report identifying deficiencies and possible problems with the completion and submission of their FL.

Improvements 10 and 11 will also lead to two-way communications regarding program improvements and interpretation of the FL data for science and management purposes.

4.2 PHASE II: INDEPENDENT DATA COLLECTION AND AUDITING

Phase I focused on ways to improve timeliness, completeness, accuracy and usefulness of the existing data collection systems (DRs, FLs, and VMS) by expanding coverage, increasing the frequency of reporting, and integrating the data into a centralized system with minimal expense to government or industry participants. While these are important steps, they will not resolve all the problems associated with data submitted primarily (with the exception of VMS) by fishermen and dealers. In addition to possibly improving accuracy, independent data collection can collect information to corroborate industry submitted data, provide increased incentives and personal responsibility to fishermen to comply with reporting requirements, and bring credibility to existing programs and resulting outputs (i.e. trip reports, Dealer Reports, stock assessments, and ACLs). However, independent data collection is usually more expensive and can require significant investment in capital, labor and infrastructure.

The opportunities and incentives for misreporting exist under the current data collection system. An ACL on one species may limit the access to other species. For example, the managers may put a restrictive ACL on Goliath grouper to aid rebuilding efforts. Even though catch of this species is prohibited, discard data from Fishing Logbooks could be used to estimate total release mortality. Fishermen may have every incentive to underreport or not report their discards of Goliath grouper because if the ACL for Goliath grouper is reached, the fishery, or portions of it, may be closed resulting in reduced fishing access to the Reef Fish fleet. The incentive (and pressure) to misreport increases as the estimated mortality approaches the ACL and the threat of a closure approaches. Another example would be vessels purposely underreporting, not reporting, or misreporting (they may report them as some other species) discards of non-marketable fish out of concern the public will regard this as a wasteful and unsustainable fishing practice. Some fishermen may not accurately report data because they oppose government requirements or they believe the data are not used effectively.

Section 2 and Appendix I of this report identify a host of independent monitoring and data collection methods. Some methods may be currently too expensive or impractical for the GOM

Reef Fish fishery. It is unlikely that a small 30 foot bandit boat has the necessary space and financial ability to take an observer for numerous trips each year. At sea observers are expensive, often costing between $500 and $1500 a day. In a multi-species trawl fishery where species identification is difficult and large quantities of fish are caught across multiple areas and brought on board in a short period of time, observers may be the only way to collect independent estimates of species composition and weights.

There are, however, developments in electronic monitoring (EM) that have made independent on board data collection possible for smaller vessels at a reasonable cost. A recent pilot study using EM to estimate Reef Fish catches by longline vessels in the Gulf of Mexico was conducted between March and May of 2008[20]. The EM systems were placed on six vessels; each system consisted of three closed circuit television cameras, a GPS receiver, a hydraulic pressure transducer, a winch rotation sensor, and a system control box. The pilot covered 218 fishing events (sets, hauls, etc.) over a 148 day period. Observers were put on board so that EM data collection could be compared with observer collected data. EM sensor data provided accurate vessel position information and enabled identification of setting and hauling events. In terms of catch, both EM and observer methods were numerically within 2.7 percent of each other and detection of protected species categories was identical. Catch identification comparisons between observer and EM methods were generally good with 80 percent of catch pairing comparisons having a positive match on a hook-by-hook analysis. EM was not able to reliably estimate discarded catch due largely to inconsistent catch handling practices and poor camera viewing (lighting or angles), issues. These problems can be resolved through further calibration of the technology and standardization of catch handling practices.

Overall, results of this study suggest that EM shows promise for collecting fishing activity spatial-temporal data and assessing catch composition. A similar EM/observer study is underway in Morro Bay California with vertical longline gear involving more than 80 fishing events. The results from this study are expected to be available in the next several months. EM has been used extensively in hook and line fisheries in other parts of the world with a great deal of success[21].

EM has been successfully implemented in the British Columbia groundfish fishery on longline, troll, jig and handline vessels ranging from 17 feet to 90 feet (see Section 3.1). In this fishery, the EM data are used to verify the logbook data provided by the fishermen. Following each trip, 10 percent of the logbook set data is compared with the corresponding EM set data to assess logbook accuracy. If the logbook does not match up with the EM data within specified error levels, then an additional 10 percent of the logbook data is compared to EM data (at the vessel owners expense). This can continue as long as there are data mismatches and until 100 percent of the EM data is used to replace the logbook as the official trip record. If the EM and logbook data do correspond appropriately in the initial comparison, then the entire logbook report is considered accurate.

The use of EM data in the GOM Reef Fish fishery would be a valuable tool for auditing FLs and providing an independent estimate of retained catch and at-sea releases. Implementation of EM

[20] See footnote 11 on page 17
[21] See footnote 2 on page 1

coverage will require development of a coverage strategy that may evolve over time and should be integrated into existing observer programs. For example coverage could begin at a low level, say 10 percent of vessels on a rotational basis and escalate over time to higher levels or EM could be installed on every vessel with only a random selection of the data analyzed. The strategy chosen will depend on the objectives of the program and the logistical and financial realities.

Electronic Monitoring

Improvement 12: The Southeast Fisheries Science Center (SEFSC) and the Southeast Regional Office (SERO) should undertake additional pilot studies aimed at further adapting the EM technology to support the collection of accurate catch and release data from longline and vertical gear vessels participating in the GOM Reef Fish fishery.

Improvement 13: Once the technology has been appropriately refined, EM should be integrated into the existing observer program and required on all permitted Reef Fish vessels with 20 percent of the fishing days randomly selected to audit FLs and to provide independent estimates of catch, discards and fishing effort.

Consistent with Improvements 10 and 11, EM data should be used as part of the feedback process to industry and individual fishermen on the accuracy and completeness of their Fishing Logbooks. This is important in all cases, but especially if the industry is funding part or all of the program. In addition, industry should be consulted on program design, operating procedures and data interpretation and analysis, as user input helps build a program with their needs in mind.

There is considerable upfront expense and work involved in starting and operating an EM program but relatively little expense once the program is implemented. The purchase of EM equipment (cameras, GPS receivers, hydraulic pressure transducers, winch rotation sensors, system control boxes, central processing unit, keyboard, and replacement hard drives) is required. Technicians have to be trained to install, remove and repair the equipment, as well as review and computerize camera data. Te centralized Fisheries Operating System identified in Improvement 9 needs to be designed to accommodate EM data. Various operational details will need to be worked out, such as who owns and pays for the program (industry or government or shared) and who operates the program (independent service provider or government or shared). If a pool of EM systems are placed on vessels during the season (based on a statistical sampling design), a hail out requirement may be necessary to alert the government or service provider to a vessel's fishing activity.

Independent dockside auditing of landed catch data is also useful to ensure DRs are accurate and complete. Fishery Officers can provide some assistance in this area, but generally there are insufficient resources (human and/or financial) to support existing program demands. The use of independent dockside monitors is becoming common, with programs in development or under consideration in Alaska and New England fisheries. The dockside monitor is usually an employee of a third party service provider, contracted by either the government or industry to

attend offloadings and confirm species sorting, record offload weights by species, and provide an independent account that can be either compared to the DR or used as the official record for the offload. In some fisheries, 100 percent of the landings are subject to independent dockside monitoring (either at the expense of the vessel or the government). In other fisheries a Roving Monitor (RM) is used to attend selected offloads based on statistical sampling protocols or areas of need (i.e. where reporting problems are greatest). The information collected by the Roving Monitor is compared to DRs to ensure that the information is accurate. Roving Monitors can also attend landings where the vessel's catch is offloaded and taken to the fish house (dealer). The New England Fishery Management Council is considering an amendment to the Multispecies Groundfish Fishery that would require the implementation of an independent dockside monitoring system.[22] RMs can also check to see that vessel FLs have been completed.

Roving Dockside Observation

Improvement 14: Roving Monitors should be used to monitor 20 percent of vessel offloads. RMs should have official observer designation providing them with authority to attend offloads and collect the required on site information.

Just as in the setup of the EM program, development of an independent landings monitoring program requires the hiring/contracting and training of monitoring staff. Government may chose to internalize the program, but it is common to contract service providers to deliver the program, subject to government standards, protocols and direction for program delivery and meeting certification requirements. The Fisheries Operating System would need to be expanded to accommodate data collected from RMs.

4.3 PHASE III: FUTURE FISHERY MONITORING REQUIREMENTS

If the recommended improvements are implemented in the GOM Reef Fish fishery, the result should be an integrated data collection program with appropriate checks and audits to ensure quality and credible data for timely in-season ACL management and annual stock assessments under the current management system.

However, external and internal forces are likely to change the way the GOM Reef Fish fishery is managed in the future. Congressionally mandated annual catch limits, legislation to protect endangered species, eco-certification (such as Marine Stewardship Council certification), Individual Fishery Quotas (IFQs) and associated species quotas, international market requirements (such as chain of custody tracking), economic forces (i.e. high fuel prices, currency exchange rates, and low landed prices for fish), or the public's requirement for improved

[22] Draft Amendment 16 to the Multispecies (Groundfish) Sector Monitoring Provisions (Draft), New England Fishery Management Council

resource stewardship could result in the demand for more comprehensive fishery monitoring programs.

The recent GOM Fishery Management Council decision to move the grouper fishery under IFQ management may also lead to expanded monitoring programs. IFQs change the fisherman's perspective on resource management. The size and value of each vessel operator's IFQ is related to the overall health of the resource. If the resource is poorly managed and overfished, then the ACL will decline as will the annual allocation each vessel operator receives. If the landed price remains unchanged, the annual income earned from the IFQ will also decline. Similarly, if the IFQ can be traded, then the trading value (asset value) of the IFQ may be negatively impacted if the fishery is poorly managed and the trajectory of the ACL is downward. Under IFQs, fishermen have the incentive to protect the health of the resource in an attempt to protect the value (both landed and traded value) of their allocation. To achieve this, fishermen may ask for improved monitoring programs to ensure that accurate information is collected and that all permitted vessel operators are staying within their assigned IFQ allocations. IFQs often result in improved economic returns to the vessel operators (due to quality and product form improvements and consistency of supply) who are willing to use a portion of their additional revenues towards improved monitoring.

IFQs, combined with comprehensive monitoring, can provide managers with greater management flexibility and more effective management tools. For example, if the catch and mortality of endangered turtles by the commercial Reef Fish fishery exceeds a specified level during the year, the entire fishery may need to be closed. The incentive for fishermen is to race out and maximize their Reef Fish catch before the fishery is closed down. Managers can impose gear and area restrictions and bycatch devices, but the fishermen's incentive remains the same – catch as much Reef Fish as they can before the fishery closes. Turtle conservation is someone else's problem. IFQs allow the manager to individualize the problem by assigning bycatch IFQs for turtles. Now, if the vessel exceeds his turtle bycatch allocation (IFQ), he can no longer continue to fish. If the turtle bycatch quota is tradable, the vessel will need to find allocation to continue fishing. The fishermen's incentive is to minimize turtle bycatch by changing fishing behavior. Of course the success of turtle bycatch IFQs is directly related to the effectiveness of the catch monitoring program used.

Fisheries are generally non-selective by nature (there are some exceptions, such as some dive fisheries). Fishermen send down a series of hooks and can catch an array of different fish species and sizes. While gear modifications, and time and area adjustments can improve selectivity or change the mix of species caught, hook and line fisheries are essentially multi-species fisheries. A fisherman may target red snapper but also catch vermillion snapper and grouper. Similarly, a grouper fisherman also catches red snapper as a bycatch when targeting grouper. It is entirely possible that future fisheries management will require vessels to be individually accountable for all the mortality associated with the fish they catch (retained and released). If they catch a species for which they do not have IFQ, the management agency may require them to acquire equivalent IFQ mortality from a vessel that holds uncaught IFQ for that species. Such a system of multi-species integrated fishing requires effective and comprehensive at-sea and dockside monitoring.

Given the movement in the Gulf of Mexico towards IFQs, it is possible that in the near future (perhaps by the year 2015), all species will be managed under species specific ACLs that are allocated out as IFQs. Vessels will freely trade IFQ to fit their business plans, including requirements to cover bycatch mortality. While FLs and DRs will continue to be essential sources of information, managers and fishermen will demand more credible and meaningful at-sea and dockside monitoring programs. EM can support IFQs by increasing the transparency and accuracy of catch and reassuring fishermen that fellow fishery participants are accounting for all catch and not undermining quota management.

EM data can be used to audit the FLs based on a statistical sub-sampling comparison of the fishing sets recorded by the vessel operator and the camera. This can be done on a trip basis, across multiple trips or over an entire season. The frequency of the audit depends on balancing program costs with the need for accurate and timely in-season vessel catch mortality estimates. Dockside monitoring will also likely be expanded as all species are sorted and accounted for individually against species and stock specific ACLs. Given the importance of having accurate landing information for the management of individual allocations and to avoid the possibility or even perception of collusion between harvesters and dealers, 100 percent dockside monitoring will likely be a form of insurance against fraud that both government managers and fishermen will want.

Ramping up to these coverage levels (i.e. having sufficient EM equipment, trained staff, infrastructure, and programming) takes time. Starting off with reduced coverage levels as identified in the above suggested improvements will help the industry and management agencies work out problems and identify, obtain and/or redirect the necessary resources. It will also allow all fishery participants to adapt to controlled changes that will improve the overall management of the Reef Fish fishery.

APPENDIX I: INVENTORY OF FISHERY MONITORING PRACTICES

1.0 DATA COLLECTION FROM SEA

Many of the critical data points needed for fishery management purposes are only available at sea from active fishing vessels. This presents a difficult challenge for Fishery Managers due to the complexity and cost of collecting real time data from the deck and wheelhouse of a commercial fishing vessel.

Some of the most commonly used tools for data collection from sea are described below and include:

- Fishing Logbooks
- Hail Process
- Aerial Census
- VMS satellite tracking systems
- At Sea Observer Programs
- Electronic Monitoring

1.1 Fishing Logbooks

Skipper completed fishing logs are one of the most basic and commonly used tools used by managers around the world to collect data from active fishing vessels. Fishing logs can also be known as diaries or simply logbooks. Fishing logs are usually designed and produced by the fisheries agency and supplied to the vessel operator to be completed by him during each fishing trip. Fishing logs generally contain significant detail regarding catch, catch disposition, fishing effort, area and time of catch and details of the gear used. In most cases the logbook will have multiple copies with removable pages so that copies can be provided to the fisheries agency while the skipper retains the logbook and a copy for themselves.

Fishing logs can be a mandatory, legislated requirement with rules surrounding their completion and delivery or simply completed on a voluntary basis. Coverage levels of fisheries using fishing logs can vary from 100 percent down to a small percentage of fishery participants that may be picked through a variety of methods. Another approach that can be used is to require all participants to complete logs but only census a random sample of these for analysis.

Fishing log design is critical to its success as a data collection tool. It must be practical and easy to use and see. If it is too complex or difficult to use the compliance rate and data quality will decline. In addition the requested content must align exactly with the needs of the fishery management data requirements. This sounds simple but there are many examples where this alignment in not achieved. This can happen as a result of managements evolving over time or simply through a lack of clarity to the fisherman as to what to record and how. Experience has shown that where an effective audit and feedback mechanism is in place data quality can be improved greatly.

The effectiveness of fishing logs as a data gathering tool and the reliability of the data is also dependant on the circumstances of the fishery and the individual motivations and abilities of the skippers completing them. Where an individual is highly motivated to record the best data possible, the results can be good. In general though timely and accurate completion of the fishing log is not among the top priorities of a skipper for the following reasons:

- A skipper's foremost priorities revolve around safety and maximizing financial return.
- Discarded fish are rarely acknowledged let alone evaluated unless they become a detriment to catching the target species.
- There may be disincentives, real or perceived, involved with accurate reporting of catch and or location.
- Skippers generally see little value in following tedious and timely reporting routines.
- Skippers may fear the release of private fishing location information.

A common problem is for skippers to maintain two logbooks. One is for the vessel and is kept confidential and another that is provided to the Fishery Manager. It is also common for the fishing log to not be completed at the time of the fishing activity but later on from memory when the fishery agency is requesting it. In other cases, fishing logs are completed at the dock during offloading when the skipper can use the actual landed weights by species to ensure the log data is a good match with the offload data.

Fishing log data has traditionally been collected on a paper form often mailed in by the skipper or sometimes collected by a representative of the fisheries agency. With paper based methods there is often a significant lag between the fishing event and when the data has been entered by the agency and is available for management purposes. More recently, electronic logbooks have been introduced that can significantly reduce data turn around time, reduce recording errors and inconvenience to fishermen.

Some of the issues with logbooks can be addressed through regulation but even with effective regulations there can be difficulties with enforcement due to limited resources and difficulty proving that a fishing log has not been properly completed.

The fishing logbook can be a useful tool for fishery management where alternative and more effective at sea data collection tools are not possible. The effectiveness of the fishing logbook as a tool and the value of the data collected is completely dependent on the individual characteristics of each application.

1.2 Hail Process

Instituting a hail process is a relatively simple and inexpensive approach to tracking fleet activity. Hail processes can also be known as fishing reports. The process is usually a condition of the fishing license and requires all license holders to report to a central service by phone or email every time they leave port to go fishing and every time they intend to land. Where an effective VMS program is in place hails may not be needed.

Fishing hails generally include identification of the vessel and skipper as well as the intended fishing plan including target species and intended fishing location and time period. Landing hails generally include all of the details regarding landing location and time and may require information about what is to be offloaded.

Hail processes are often used in conjunction with other monitoring tools such as aerial census, at sea Observers, electronic monitoring, landing audits and dockside monitoring to facilitate logistics and planning. They can also be used for regulations compliance monitoring to verify reported fishing activity and offload activity.

1.3 Aerial Census

Aerial census or aircraft based over flights are a technique, which may be used by fishery agencies to collect data on numbers of active vessels by location, time and sometimes activity. This technique is more common for recreational fisheries where the number of participants is large and there is a limited amount of other data available or for surveillance purposes to monitor fishing activity in closed areas and to deal with vessel specific concerns.

This tool is of limited value to Fishery Managers due to the inability to collect the critical catch and discard data. The data available is based on a sampling approach and would have limited value when applied on a fleet or fishery basis. In addition this method is relatively expensive and can be significantly hampered by poor weather or visibility and coverage area. Aerial censuses often occur on an opportunity basis when flights for other purposes can take personnel to collect fishery date.

1.4 VMS

Vessel Monitoring System (VMS) is an electronic technology used to track the movement of fishing vessels. Its use is almost always legislated by the fisheries agency and it provides data via satellite, on vessel location, speed and heading usually with broad time intervals, generally 30 minutes to two hours. The vessel location, speed and heading are passed directly to the fisheries agency or a contracted third party on a real time basis. The data provided are independent, accurate and timely but contain no detail regarding vessel activity, catch or gear.

The biggest shortcoming of VMS is the inability to definitively determine vessel activity using the time, location, speed and heading data provided. VMS can be used effectively as an enforcement tool to monitor adherence to areas closed to fishing vessels, but cannot be used to verify whether a vessel was actually fishing while transiting a closed area. The VMS data, by itself, are of limited value for management purposes due to the lack of information regarding catch, discard and effort data, but when integrated with other data collection tools it may form part of an effective monitoring strategy.

1.5 At Sea Observer Programs

At Sea Observer programs are the most commonly used tool to independently collect catch, discard and effort data from fishing vessels. Although at sea observer programs are one of the most expensive and logistically complex solutions they are also considered one of the most effective tools to independently and systematically collect accurate, unbiased data on catch and effort from an active commercial fishery. Observer programs are commonly used as an at sea data gathering tool in fisheries worldwide.

The utility of the data collected by an at sea observer program for fishery management purposes will depend on a variety of factors including:

- level of coverage of vessel fishing activity
- access to the fish and cooperation of the skipper and crew
- experience and integrity of the observer

As long as data collection remains a sampling approach, at sea observer data can be used to support fleet accountability initiatives that require at sea discards and catch by area data. It needs to be recognized that if the sampling approach involves random vessel selection or even volunteer vessels the sample is very likely to contain significant bias which must be taken into consideration by the Fishery Manager. It has been seen that where vessels are selected as part of a sub-sampling strategy that these vessels are likely to modify their fishing behavior, sometimes significantly, as a result of having an Observer on board. This is commonly referred to as the "Observer Effect" described in Section 1.2.3 Coverage Levels in the main report. In general the higher the level of sampling of the fleet, the more reliable the data due to the decreasing economic ability of the fleet to pursue artificial behavior. The problem is that the relatively high cost of monitoring each day at sea often prevents Fishery Managers from implementing sampling levels high enough to lead to high data confidence.

Coverage levels of fisheries using Observers can vary from 100 percent down to a small percentage depending on the objectives. At Sea Observer data are unlikely to be sufficient to promote individual vessel accountability with low coverage levels. The higher the coverage level the more the better the data; however, in order to hold a vessel fully accountable for its individual catch and discards by area it is necessary to have some form of independent data collection on the vessel. Without this approach it is difficult to bring about the desired individual behavioral changes required to reduce by-catch levels and accurately account for total catch by area for each fisher and the fishery as a whole.

At Sea Observer coverage may be attained through a number of approaches but the standard approach is for Observers to depart with the vessel as they leave for a fishing trip. The observer usually lives aboard the vessel during the trip and is free to collect data from the bridge and fishing deck based on structured predetermined protocols. In this case the vessel must be of sufficient size to safely accommodate the extra person on board. In some small boat fisheries this may be an irresolvable issue. The Observer will usually need to be able to work side by side with the crew and skipper but with their own priorities and motivations. The Observer will normally require cooperation from the skipper and crew.

Other less common approaches to obtaining At Sea Observer data include use of a mother ship which deploys Observers to active fishing vessels and picks them up and redeploys them to new vessels as needed or having a mobile Observer who travels from ship to ship with the skipper's support. These last two methods of obtaining Observer coverage can involve significant safety risks due to the inherent issues with transferring personnel at sea.

Program costs are usually quoted in sea days and may include many components beside the actual Observer labor cost. Cost for all components of At Sea Observer programs can vary widely depending on how the program is administered and which cost components are included, but are generally in a range of $500 to 1,500 USD/sea day. Program costs include, Observer labor on and off the vessel, travel and accommodation, equipment, and administrative labor for recruitment, training, briefing and debriefing, data entry, analysis and management.

A detailed overview of At Sea Observer programs, capabilities and limitations with a range of examples can be found in the WWF report Observer Programmes, Best Practices, Funding Options, and North Sea Case Study[23].

1.6 Electronic Monitoring

Electronic Monitoring (EM) of active fishing vessels is the most recent technology to be employed to gather fishery management data from sea. EM, with digital video, can provide a full time presence with a complete and independent record of all fishing activity and a visual record of catch in much the same way an At Sea Observer does but usually at a fraction of the cost.

Electronic Monitoring involves the placement of tamper-resistant automated computing systems aboard fishing vessels to independently monitor a variety of activities in order to log data on catch and effort. Recent technology developments enable data capture for many routine fishery operations to address specific fishery monitoring and management objectives. EM-based monitoring has been successfully used for a variety of fishery information needs including:

- fishing time and location
- gear deployment and retrieval
- gear enumeration and ownership
- gear specifications
- catch identification and enumeration
- protected species interactions
- catch handling and disposition

The fishing industry has been actively involved in developing and implementing EM-based monitoring solutions. Their motivation often comes from a desire to develop an alternative to on board observers in order to reduce cost and inconvenience. Prior to EM there had not been a

[23] MRAG. 2006. Observer Programmes: Best Practice, Funding Options, and North Sea Case Study. Paper prepared for World Wildlife Fund, European Policy Office. 61pp. Available on line at: http://www.panda.org/about_wwf/what_we_do/marine/publications/?88320

viable alternative to on board observers to collect data, other than vessel location, speed and heading (VMS), from active fishing vessels.

As with observers, coverage levels using EM can vary from 100 percent down to a small percentage depending on the goal of the coverage. Similar to observers, the cost of EM will vary widely by application; however, experience has shown that EM technology based monitoring programs can be expected to cost less than 40 percent and as low as 15 percent of an equivalent Observer program.

EM can be an effective tool to implement individual accountability in a fishery due to its cost effectiveness; however, it has limitations and may not be an effective solution for all monitoring needs. Where catch speciation and enumeration is the goal, EM technology may not be effective where catch comes in large mixed batches such as a multi-species trawl vessel or where catch species are virtually indistinguishable based on a video image such as with some rockfish or salmon species. However, where industry is willing or required to modify their deck procedures, many shortcomings of the EM technology can be overcome.

Although the EM technology is not yet widely used there are a variety of established programs in Canada and the US where it has been used successfully since 2000 to address fishery management data requirements. Some example programs include:

- British Columbia crab fishery to verify ownership, number and location of trap setting and hauling (8 years)
- British Columbia groundfish long line fishery to audit skipper logbooks to verify catch species, number, disposition and effort (4 years), see main report Section 3.1
- US West Coast whiting fishery to verify 100 percent retention and identify and characterize any discarding activity (5 years)

There is significant interest in this technology from many fishery agencies with pilot programs currently underway in the US, Europe, New Zealand and Australia. A detailed overview of EM capabilities and limitations with a range of example applications can be found in the report, At-Sea Observing Using Video-Based Electronic Monitoring[24].

[24] McElderry, H. 2008. At Sea Observing Using Video-Based Electronic Monitoring. Background paper prepared by Archipelago Marine Research Ltd. for the Electronic Monitoring Workshop July 29-30, 2008, Seattle WA, held by the North Pacific Fishery Management Council, the National Marine Fisheries Service, and the North Pacific Research Board: The efficacy of video-based monitoring for the halibut fishery. Available online at: http://www.fakr.noaa.gov/npfmc/misc_pub/EMproceedings.pdf.

2.0 DATA COLLECTION FROM THE LANDING SITE

Collecting data from a land-based location is much simpler and less costly than at sea but the data available are more limited. At this point, it is generally impossible to attribute the landed catch back to a specific catch location and in many cases some form of processing may have occurred such that the round catch weight and sometimes length may no longer be attainable. Contact with the skipper at the landing site also presents an opportunity to collect fishing log pages directly and interview the skipper with respect to the trip and the fishing log information.

The landing site is often the first and best opportunity to collect and independently verify catch weights. Independently collected and verifiable landed weights are important to the credibility and success of many quota share managed fisheries. Some of the most common tools for data collection from the landing site are described below and include:

- Dealer Reports
- Dealer Interviews and Audits
- Dockside Monitoring

2.1 Dealer Reports

Dealer reports, also known as sales slips or fish tickets, are likely the most common tool used by fisheries agencies to track landed catch for a fishery. This requirement is generally imposed on the fish buyer, often as a condition of the privilege to participate in the fish buying business. In jurisdictions where fish buying privileges are not regulated, or this reporting requirement remains voluntary, implementing an effective dealer reporting program can be problematic.

As with fishing logs, dealer reports are completed by an industry participant. The completeness and accuracy of data provided will be influenced by the inherent biases which are likely to affect fish buyers as well as the level of attentiveness and commitment of the individual completing the paperwork among their competing priorities. A common problem with dealer report data is for the species to be documented either incorrectly or in a broader grouping with other species, which does not match management data requirements.

In some fisheries there may be financial motivations to report landed catch data inaccurately. This is often the case with share-based fisheries where each pound of quota can have significant value or where quota is in short supply. This could also be the case with trip limit managed fisheries where a vessel has exceeded its limit. Due to the business relationship between the fisher and buyer there is the opportunity for collusion and misreporting of the data.

Experience has shown that timeliness and quality of dealer data is dependant on the level of feedback and interaction by the fisheries agency. Where little feedback is given, data quality is likely to be poor. When dealer interviews or audits are conducted the resulting product will improve and may be able to be verified through administrative checks with other data sources. In cases where there are consequences for poor quality or untimely data further improvements will occur.

Dealer reports have historically been provided on paper forms but are commonly filed electronically today. Electronic filing significantly reduces the labor requirement of the fisheries agency and the turn around time for the data. Electronic reports also reduce data recording errors due to the use of pick lists and a variety of other data validation techniques that can be applied at the time of entry.

Although dealer reports can be a relatively inexpensive data gathering tool the quality of the data is completely dependant on the structure of the program. The resulting data are not always useful to managers as a primary driver for management decisions due to concerns regarding data accuracy and completeness and the lack of independence of the data source. These data are more commonly used for very high level statistical reporting regarding landed catch volumes and value.

2.2 Dealer Interviews and Audits

Dealer interviews and audits are a variation on dealer reports where a representative of the fishery agency will visit landing sites to collect and/or verify data on landings. In the simplest case the agent may simply collect dealer reports and interview the buyer to verify data and resolve data quality issues. In other cases the agent may review the books or conduct a forensic audit of the books in order to verify the data and cross check with other data sources such as VMS, hails or fishing logs to ensure integrity. This approach to collecting landing data can be a significant improvement over the basic dealer report as it provides an independent and theoretically unbiased product, collected through a standard protocol by a trained technician dedicated to this task.

In cases where a full dealer record audit system is implemented with well structured processes, standards, independent audits and consequences, dealer reports can become an effective management tool for the tracking of individual vessel quotas of high value fish as in the Alaskan halibut and black cod fisheries which use self reporting through a credit card system to track landings and manage individual quotas.

Dealer interviews and audits do not generally target 100 percent coverage as they are usually based on a sampling approach to minimize cost. Where combined with an audit process with consequences for false or negligent data this approach can be very effective. Although this approach is more expensive than a dealer report system by itself, it can produce a much more credible data product.

2.3 Dockside Monitoring

Dockside monitoring is a process used to independently collect and verify data from a commercial vessel landing site. In this situation, trained agency representatives, often called dockside monitors or observers, will attend a vessel offload event and oversee and independently verify species sorting activities and weighing and counting processes and results. Dockside monitors can also be used to collect species composition and biological samples, sometimes without the verification of landings. The landing site is generally the best location to collect fish

weight and generally the first opportunity to independently verify weight without having to send an Observer to sea.

The dockside monitoring process creates an independent record of the offload event, which the agency can use with a high level of confidence. An additional advantage of this process is that the verified data record can be available to the fisheries agency within a few days.

Coverage levels using dockside monitoring can vary from 100 percent down to a low level depending on what the management objectives are. 100 percent dockside monitoring is a commonly used solution to meet the requirements of tracking and accountability for quota share fisheries in British Columbia. Where dockside monitoring levels are less than 100 percent, selection of offload events can be random, opportunistic or selective depending on the goals of the program.

It is important that dockside monitoring activity is carried out in a way that minimizes impact on the offloading process. It may be necessary for the dockside monitor to be present at all times during the offload and personally witness the sorting and weighing procedures and independently record the weights where possible. In order to carry out their responsibilities, the dockside monitor requires the cooperation of the buyer, vessel skipper and the offloader.

The dockside monitor can verify counts and weights of all species offloaded even those that are normally discarded and left undocumented due to damage, size or general undesirability. They will also document product type and condition as required. Any landing site data collection strategy needs to account for the unique fish handling characteristics of each fishery. Complications that can be encountered include live, frozen and/or pre-packed product which is either difficult to count or cannot be easily verified without disturbing the packaging or damaging the product. In cases where the catch has been processed so as to alter the round weight, which many quotas are based on, conversion factors can be developed to convert the product weight back to round weight for quota tracking purposes.

The method of landing the fish will have an effect on which data are viable. For example, where fish are landed in frozen blocks it may be impossible, or at least impractical, to count pieces or collect any type of samples. In addition with the move to maximize fish quality and financial return, industry is moving to minimize handling of the product and the amount of time spent on the landing dock. A trend that is common in Europe has fishers hand packing catch in iced totes or sealed frozen packages with the desire for them not to be disturbed until they reach the final point of sale. Any landing site data collection strategy needs to account for the unique fish handling characteristics of each fishery in order to minimize impact on the operation and product value.

Having a dockside monitor at offloading events also presents an opportunity to carry out other peripheral activities that may also be of benefit to the industry or fishery agency. Some examples of these are:

- product quality and marketing initiatives
- collect and quality check fishing log pages

- collect biological samples
- general outreach and communication

The cost of dockside monitoring is completely dependant on coverage levels but is significantly more expensive than dealer reports. In British Columbia, where 100 percent dockside monitoring is common, program costs range from $60 to $125 USD/hour of monitoring time, depending on the program characteristics. In these programs, private companies provide the service to industry and deliver the data to managers as a condition of their license.

Dockside monitoring is the most powerful tool available to managers to collect an accurate, complete and credible record of fishery landing data. Although it is more expensive than other options it provides a data set that can be used with a very high level of confidence by both managers and stock assessment scientists on a timely basis.

APPENDIX II: GULF OF MEXICO FISHERY DESCRIPTION AND DATA PROGRAM INVENTORY

1.0 DESCRIPTION OF CURRENT FISHERY

1.1 Species/stocks.

Of the 42 species in the reef fish management unit, the fishery primarily harvests a subset of the species with the highest abundance. The reef fish fleet tends to fish opportunistically, targeting areas that typically hold fish. In general, the fleet focuses on American red snapper in the northern and western Gulf and on groupers in the eastern Gulf. The red snapper fishery also harvests vermillion snapper. Yellowtail snapper harvest occurs mostly in the eastern Gulf. The grouper fishery is centered in the eastern Gulf, and focuses on shallow water and deep water groupers. Eight species make up shallow water grouper complex (red, gag, black, scamp, yellowfin, yellowmouth, rock hind, and red hind grouper) and five species make up the deep water complex (snowy, yellowedge, speckled hind, Warsaw, and misty grouper). Goliath grouper and Nassau grouper are prohibited from harvest because they experienced severe depletion in the past. Grouper fishermen encounter yellowtail snapper and mangrove snapper either incidentally when fishing for grouper or directly as a targeted species. Tilefish, greater amberjack, and gray triggerfish make up the remainder of the actively managed species. No genetic substocks have been identified for any reef fish species in the Gulf of Mexico and no quotas for subareas exist.

The Council and SERO have designed and implemented management programs for managed reef fish species to meet the conservation of the MSA; other reef fish species have no explicit management. Of the reef fish species, four fall in the category "undergoing overfishing", two in the "overfished" category, and two have total prohibition of harvest (Table 1.1). Stock assessments have been completed for 11 species, and 17 have quotas, either individually or as part of a complex. A number of species in the management unit have not been evaluated and have undetermined status.

Table 1.1 Status of species in the Reef Fish Management Plan[25]

Species	Commercial Quota/ACL	Stock assessment	Overfishing	Overfished
Red snapper	Yes	Yes	Yes	Yes
Greater amberjack	Yes	Yes	Yes	Yes
Gray triggerfish	Yes	Yes	Yes	
Gag	Shallow water	Yes	Yes	
Goliath grouper	Total prohibition	Yes	No	Undefined
Nassau grouper	Total prohibition	No	No	Undefined
Mutton snapper	No	Yes	No	No
Vermillion snapper	No	Yes	No	No
Red grouper	Shallow water	Yes	No	No
Rock hind	Shallow water	No	Unknown	Undefined
Speckled hind	Deep water	No	Unknown	Undefined
Yellowedge grouper	Deep water	Yes	Unknown	Undefined
Red hind	Shallow water	No	Unknown	Undefined
Misty grouper	Deep water	No	Unknown	Undefined
Warsaw grouper	Deep water	No	Unknown	Undefined
Snowy grouper	Deep water	No	Unknown	Undefined
Black grouper	Shallow water	No	Unknown	Undefined
Yellowmouth grouper	Shallow water	No	Unknown	Undefined
Scamp	Shallow/deep water	No	Unknown	Undefined
Yellowfin grouper	Shallow water	No	Unknown	Undefined
Tilefish	Yes	No	Unknown	Undefined
Yellowtail snapper	No	Yes	No	No
Hogfish	No	Yes	Unknown	Undefined
Lesser amberjack	No	No	Unknown	Undefined
Almaco jack	No	No	Unknown	Undefined
Banded rudderfish	No	No	Unknown	Undefined
Queen snapper	No	No	Unknown	Undefined
Schoolmaster	No	No	Unknown	Undefined
Blackfin snapper	No	No	Unknown	Undefined
Cubera snapper	No	No	Unknown	Undefined
Gray (mangrove) snapper	No	No	Unknown	Undefined
Dog snapper	No	No	Unknown	Undefined
Mahogany snapper	No	No	Unknown	Undefined
Lane snapper	No	No	Unknown	Undefined
Silk snapper	No	No	Unknown	Undefined
Wenchman	No	No	Unknown	Undefined
Goldface tilefish	No	No	Unknown	Undefined
Blackline tilefish	No	No	Unknown	Undefined
Anchor tilefish	No	No	Unknown	Undefined
Blueline tilefish	No	No	Unknown	Undefined
Dwarf sand perch	No	No	Unknown	Undefined
Sand perch	No	No	Unknown	Undefined

[25] Available online at: http://www.nmfs.noaa.gov/sfa/statusoffisheries/SOSmain.htm and http://www.nmfs.noaa.gov/sfa/domes_fish/StatusoFisheries/2007/Appendix%203_2007SDC.pdf

1.2 Fleet and Fishery Characteristics.

The Gulf of Mexico reef fish fleet has approximately 1000 vessel permits, of which about 300 are considered the active fleet that harvests the majority of the reef fish species. Two gear types harvest most of the fish: 1) longline with about 100 core vessels and 2) vertical gear with about 200 core vessels. Vertical gear consists of bandit gear and rod and reel/hand line. A substantially smaller harvest occurs with spears.

Red snapper and vermillion snapper are primarily harvested commercially with hook-and-line and the more prevalent bandit gear. Longline gear capture a small percentage of total landings (< 5 percent) and are prohibited from use inside of 50 fathoms west of, and 20 fathoms east of, Cape San Blas, Florida. Additionally, the fishery typically operates in association with natural or artificial structures with higher relief from the bottom.

The primary gear types used in the commercial grouper fishery are bottom longlines and bandit rigs. Recreational fishermen predominately use rod and reel. Spearfishing also constitutes a small part of both recreational and commercial grouper fishing. Fish traps were used in the commercial fishery until February 7, 2007, when their use became prohibited in the Gulf of Mexico EEZ. Longlines catch the majority of grouper landings – approximately 60 percent – each year.

Longline vessels generally range from 50-70 feet in length with a crew of 3-4 including the captain. Vertical gear vessels generally range from 30-40 feet in length with a crew of 1-2.

Over the period 1993-2006, landings of all reef fish averaged 18.4 million pounds (MP) annually, with an average ex-vessel value of $40.3 million in current terms or $45.8 million after adjusting for inflation. The reef fish fishery is dominated by landings of snapper and grouper. Four snapper and four grouper are among the top 10 landed species, with greater amberjack and tilefish completing the set (Table 3.2).

Table 3.2 Catch of the top 10 reef fish species, 2003-2007

SPECIES	2003	2004	2005	2006	2007
AMBERJACK, GREATER	1,429,478	1,655,585	1,422,685	979,513	947,261
GAG	2,889,307	3,231,769	2,815,202	1,483,200	1,578,599
GROUPER, BLACK	540,669	519,999	329,969	286,830	236,661
GROUPER, RED	5,856,836	6,811,975	6,297,650	5,707,369	4,373,204
GROUPER, YELLOWEDGE	1,281,950	1,047,354	911,214	859,487	1,022,280
SNAPPER, GRAY	384,555	381,489	345,287	286,420	225,074
SNAPPER, RED	4,499,824	4,773,271	4,151,452	4,210,586	3,006,427
SNAPPER, VERMILION	2,563,137	2,362,301	1,911,856	1,804,239	2,438,622
SNAPPER, YELLOWTAIL	1,589,005	1,633,368	1,408,287	1,253,469	1,064,700
TILEFISH	573,918	610,869	818,589	646,442	624,822

Source, Gulf States Marine Fisheries Commission

The grouper fishery overall is distributed almost exclusively in Florida (Table 3.3). The other states account for a minor amount. Texas fishermen take more that the remaining three states combined, but still far below the Florida landings.

Table 3.3 Distribution of Gulf of Mexico grouper landings by state

State	Year				
	2003	2004	2005	2006	2007
FL	10,525,072	11,534,663	10,265,031	8,296,931	7,255,653
AL	47,111	53,205	49,893	64,106	32,509
MS	7,921	1,340	5,722	208	103
LA	188,762	194,040	193,448	186,700	133,902
TX	416,238	328,738	302,974	220,500	143,554
Total	11,185,104	12,111,986	10,817,068	8,768,445	7,565,721

Source: Gulf States Marine Fisheries Commission

The shallow-water grouper fishery has accounted for 43 percent of all reef fish landings and 47 percent of ex-vessel values for all reef fish. Red grouper and gag are the two major components of the shallow-water grouper fishery accounting for 85 percent of shallow-water grouper landings and 84 percent of corresponding ex-vessel values. For all shallow-water grouper, 95.9 percent of all landings went to Florida, with West-Central FL as the dominant region in Florida and throughout the Gulf (see Figure 3.1). Peak shares occurred in 1998 for Southwest FL at 29.6 percent, in 1999 for West-Central FL at 53.7 percent, in 2001 in Northwest FL at 23.5 percent, and in 1993-1994 for the rest of Gulf at 14.9 percent.

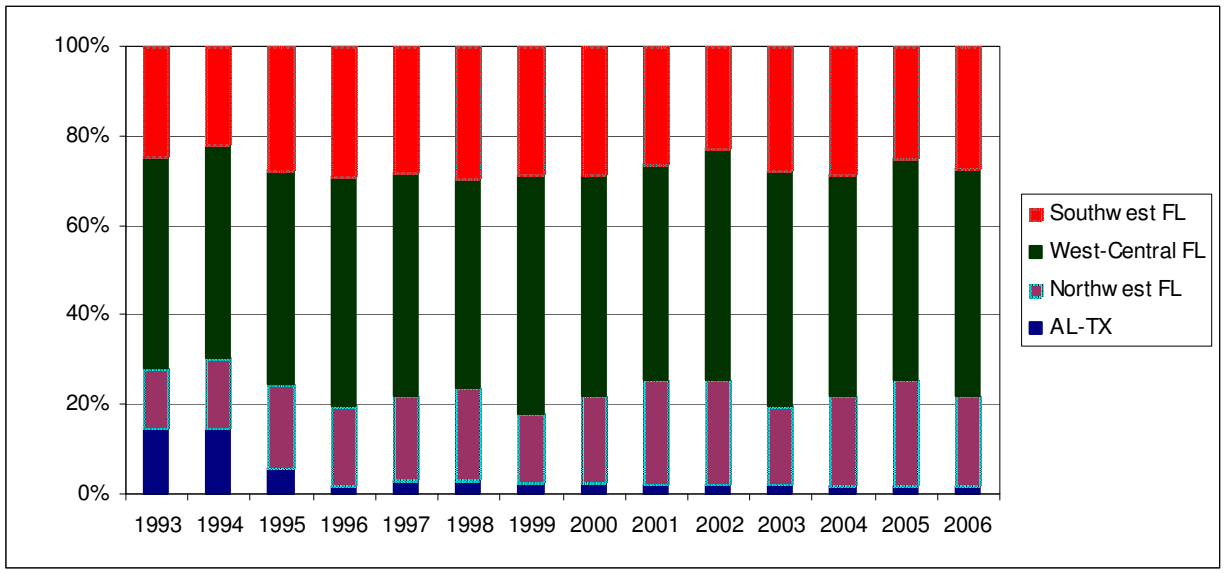

Figure 3.1. Percent distribution of shallow-water grouper landings by area, 1993-2006

In the Gulf of Mexico, snapper landings are distributed among several states (Table 3.4). Florida leads with approximately half the total landings, followed by Texas and Louisiana. Red snapper and vermillion snapper make up the majority of the snapper landings. Fishing mortality rates of red snapper are highest in the western Gulf shrimp fishery, followed by that

of the eastern Gulf recreational red snapper fishery, and then the western Gulf commercial red snapper fishery. The eastern and western red snapper fisheries are separated by the Mississippi River delta.

Table 3.4 of Gulf of Mexico snapper landings by state

State	Year				
	2003	2004	2005	2006	2007
FL	5,176,725	4,869,524	3,906,703	3,619,357	3,862,884
AL	170,595	210,175	291,173	336,367	195,884
MS	90,771	52,679	687,093	5,106	81,731
LA	2,016,865	1,901,197	1,567,866	1,363,160	926,678
TX	1,807,108	2,462,000	2,228,919	2,467,606	1,899,072
Total	9,262,064	9,495,575	8,681,754	7,791,596	6,966,249

Source: Gulf States Marine Fisheries Commission

1.3 Management Approach.

The Gulf Council and NMFS have implemented a series of controls for the reef fish fishery. General regulatory restrictions are put in place through an amendment to the Reef Fish Fishery Management Plan, and the restrictions change at irregular intervals. The restrictions applied in the Gulf of Mexico for reef fish include:

- Gear restrictions
- Quotas (including IFQ)
- Size limits
- Limited entry
- Possession (trip) limits.
- Closed areas
- Closed seasons

Lawful gear consists of hook and line (longline and vertical gear) and spears. The management system has banned trawls, other nets, and traps/pots from the fishery. A vessel permit limitation program restricts the number of eligible vessels, and applicants for renewal permits must (with limited exceptions) meet earned income from fishing. The grouper fishery has a 6,000 pound trip limit to help spread the fishery out over the year. The fishery is closed to harvest of gag, red grouper, and black grouper from February 15 to March 15; the closure was set to protect spawning aggregations of gag grouper. The Council is replacing this limited seasonal closure with a closure that would apply to all shallow water grouper within a defined spawning area for a larger period of time (to be implemented in 2010).

The reef fish fishery operates with longlines prohibited from use all year inside of 50 fathoms west of, and 20 fathoms east of, Cape San Blas, Florida. A number of seasonal and area closures apply to commercial reef fish fisheries throughout the Gulf:

The Alabama artificial reefs and surrounding areas
The Florida Middle Grounds HAPC
The Tortugas Marine Reserves HAPC

The Reef Fish Stressed Area
The West and East Flower Garden Banks HAPC
The Madison and Swanson sites and Steamboat Lumps

The Gulf Council and NOAA Fisheries use in-season and post-season quota management for a subset of the reef fish species, and general regulatory restrictions without quotas for another subset.[26]

As stock assessments occur on a multi-year cycle for a given species, quotas remain constant during the period between stock assessments. Quotas for reef fish species are adjusted through a plan amendment when analysis and review determines a new stock status with Bmsy and OFL. Quota management applies to all species with quotas, except red snapper, and requires accurate and timely submission of landings data. Quotas do not incorporate bycatch or other sources of mortality in either in-season or post-season management.

Currently, the red snapper fishery is managed through a recently implemented IFQ program, in which vessels must have an IFQ endorsement for the commercial vessel permit. Under the IFQ program, there are 136 Class 1 licenses and 628 Class 2 licenses (may land <200 pounds per trip). The Gulf of Mexico commercial red snapper fishery has a quota of 2.55 million pounds round weight. The ITQ program apportions the quota among eligible fishermen, allows transfers among eligible fishermen, requires electronic, on line landing transactions, requires notification to NOAA Fisheries of departures and arrivals of fishing trips, restricts off-loading fish to certain hours, and allows for collection of a fee.

Species caught together may be combined into a management complex if insufficient information exists to manage the species separately. MSA National Standard 1 sets criteria for management by stock complex. If stock assessments exist for one or more species in a complex, the Council and NOAA Fisheries may designate it (or them) as indicator species. If no indicator species are designated, the complex is managed as a whole. The Gulf Council has established two reef fish complexes: shallow water grouper and deep water grouper.

Regulations set a commercial shallow water grouper quota that will close the fishery if it catches either 7.48 million pounds gutted weight of shallow-water grouper species combined or 5.31 million pounds gutted weight of red grouper each year; an interim rule effective January 1, 2009 set a quota of 1.32 million pounds gutted weight for gag. The deep water fishery closes when it lands 1.02 million pounds gutted weight of deep-water grouper species combined for a year. Scamp is considered a deep-water grouper if the shallow-water quota is filled. Nassau and goliath grouper are managed as single species and are prohibited from harvest. The shallow water grouper fishery closed during October or November in 2004 and 2005 upon reaching the quota, but did not reach the quota in 2006 or 2007. The deep water fishery generally closes upon reaching the quota in May-July. Additional restrictions include a 6,000-pound gutted weight trip limit for all deep-water and shallow-water grouper species combined. Amendment 30B of the Reef Fish Fishery Management Plan has a preferred alternative to add a quota for gag within the shallow water grouper complex which would close the fishery when reached; if approved, this

[26] 50 CFR Part 622—Fisheries of the Caribbean, Gulf, And South Atlantic. Available online at: http://sero.nmfs.noaa.gov/regulations/pdfs/Vr080804.622.pdf.

would make permanent the current interim rule for the gag quota. Amendment 30B would also increase the quota for red grouper to 5.75 million pounds gutted weight. Amendment 30B has a preferred alternative to establish trip limits for gag or red grouper when the catch reaches 80 percent of the species-specific quota to reduce the likelihood of closing the entire complex.

Commercial quotas also exist for tilefish (0.44 million pounds gutted weight), greater amberjack (.0503 million pounds round weight), and gray triggerfish (80,000 pounds round weight, but increasing in 2009 and 2010).

Gulf of Mexico species managed under the commercial quota system require in-season monitoring with closures when a fishery reaches or exceeds the quota, and applies to the remaining quotas. Reductions of quota for the next year may occur if a fishery exceeds the quota for the preceding year. ACLs and accountability measures for the Gulf of Mexico have been set only for gray triggerfish and greater amberjack.

In addition to species or species-complex quotas, vessel limits exist for deep and shallow water grouper. The shallow and deep water grouper fisheries have a 6,000 pound trip limit during the open period for the fishery. A grouper IFQ program is under development, with a referendum for permit holders to determine whether to implement the program initiated in December 2008. Approximately 80 percent of the respondents voted for the IFQ program, leading to an implementation schedule of 2010. After implementation of the IFQ program, the trip limits for grouper would no longer apply.

The Council and NOAA Fisheries have set minimum size limits for a number of species. A person aboard a vessel that has a Federal commercial vessel permit for Gulf reef fish and commercial quantities of Gulf reef fish, i.e., Gulf reef fish in excess of applicable bag/possession limits, may not possess any Gulf reef fish that do not comply with the applicable commercial minimum size limit.

2.0 DESCRIPTION OF CURRENT DATA COLLECTION SYSTEMS / PROCESSES

2.1 Flow of data collection from the fishery

- All reef fish vessels must have an operating VMS system on board at all times that transmits hourly signals, unless exempted by NOAA Fisheries under power down exemptions. Prior to departure for each trip, a vessel owner or operator must report to NOAA Fisheries any fishery the vessel will participate in on that trip and the specific type(s) of fishing gear, using NMFS-defined gear codes, that will be on board the vessel. NOAA Fisheries collects the data, and monitors vessel activities. The data are available immediately.

- Reef fish fishermen must complete a logbook for each fishing trip describing catch and effort for the trip. The logbook must be submitted to the SEFSC within seven days of the end of a trip. If requested, fishermen must also complete an additional logbook that describes discards. The SEFSC requires bycatch logbooks from 20 percent of the fishermen, but generally get 10 percent coverage. The bycatch data on weight of discards is now considered unusable because some fishermen record total weight of discards instead of average weight of discards. The logbook data are available within two weeks of submittal.

- A vessel selected by NOAA Fisheries must carry an observer as part of a program to provide onboard monitoring of finfish and to assess protected species interactions with the fishery. The SEFSC maintains the observer data, which are available about four weeks after the end of a trip. The observer program targets 5 percent coverage, but achieves around 1 percent.

- No check in is required of reef fish fishermen except those landing red snapper under the IFQ program. Red snapper fishermen report to NOAA Fisheries three hours before landing. The three hour notice combined with tracking through the VMS allows the NOAA Fisheries Office of Law Enforcement to decide whether to monitor the IFQ landing.

- Port monitors may collect catch, economic, and biological data from a vessel under the trip interview program. The turnaround time varies, running months for age data to weeks for fishery and socio-economic data.

- Fishermen's landings are reported through the accumulated landing system (ALS). The dealers collect landings from individuals, and must report to the states. Some states (Florida and Louisiana) require trip tickets from each trip. The dealer must maintain records the name of each fishing vessel from which reef fish were received and the date, species, and quantity of each receipt. If fish are trucked from the vessel to a final destination, the trucking operation must retain records of the vessels for which transport occurred, and provide the information on request. Trucking operations must deliver fish to a licensed dealer, which maintains the more detailed record requirements. Dealers

submit required data to NOAA Fisheries monthly and to the Gulf States Marine Fisheries Commission. The Commission consolidates information from the states.

- The species with quotas require more frequent reporting. For species with quotas, NOAA Fisheries can request data at two week intervals, and daily as the catch approaches the quota. More frequent reporting allows catch to come close to the quota without leaving uncaught fish. The in-season quota monitoring system has resulted in landed catches approaching the quotas with occasional overages (Table 3.1).

- Under the red snapper IFQ program, dealers must report catches by vessel electronically at the time of offloading. NOAA Fisheries monitors the catch of each vessel continuously.

Table 3.1 Comparison of catch and quota for the 2006-2007 grouper fishery. Data from the SERO Quota Monitoring System.

2007	**Shallow-water Grouper**	**Red Grouper**	**Deep-water Grouper**	**Tilefish**
Total Catch	5,010,453	3,535,051	1,092,780	441,980
Quota	8,800,000	5,310,000	1,020,000	440,000
% of Quota	56.94	66.57	107.14	100.45
2006				
Total Catch	6,787,801	5,143,997	1,091,982	434,117
Quota	8,800,000	5,310,000	1,020,000	440,000
% of Quota	77.13	96.87	107.06	98.66

http://sero.nmfs.noaa.gov/quotas/grouper_tilefish/grouperlandings06.htm

- Overflights occur on an opportunity basis and for on-going investigations. NMFS Office of Law Enforcement does not have aircraft, but collaborates with the US Coast Guard and Immigration and Customs Enforcement for overflights.

2.2 Summary of data collection tools currently used.

On a broad level, there are two kinds of data systems, commercial and recreational. The commercial systems are more extensive than recreational, and for the most part, commercial systems play a role when in-season monitoring and control is required. We have identified 15 separate commercial and five recreational data collections systems, which are individually defined and described in Appendix III. This report focuses on the commercial systems. The data systems are conducted partly in-house with NMFS staff, partly with other agencies, and partly with contractors. Contractors primarily provide observer employees to the observer programs. Table 2.1 characterizes the commercial data systems relevant to the reef fish fisheries.

Table 2.1 Summary of data collections systems in the reef fish fishery

Program	Service delivery	Coverage level	Turn around time
Quota Monitoring System	SEFSC	100%	5-19 days (data due 5 days after each 2 week period, available immediately)
IFQ Electronic Reporting System for Red Snapper	SEFSC	100% (mandatory)	Real Time
Reef Fish Observer Program	Galveston Lab	1%	Four weeks
Trip Interview Program	SEFSC	Agents are assigned target sample sizes that are adequate for inclusion into stock assessment – varies by species/fishery/population	15 days for length/frequency data; age and biological data take much longer (months), and samples from species under assessment get priority
Accumulated Landings System	State Fisheries Agencies collect landings data and submit it to the SEFSC	100%	Six months
Domestic Longline	SEFSC	100%	Six weeks
Fisheries Logbook System	SEFSC	100% (10% for discard logbooks)	Two weeks (collected monthly)
Gulf of Mexico Shrimp Statistics	Overall Program managed by SEFSC, Port Agents are both state and federal, Electronic Logbook program run by LGL Ecological Research	Trip ticket data coverage 100%; Sample size by port agents unknown; Electronic logbook program covers 25% of the fleet.	Trip ticket and port agent data available annually by the end of May for assessments starting in June; ELB data available monthly.
Commercial Shrimp Trawl Fishery Observer Program	SEFSC Galveston Lab, Gulf and South Atlantic Fisheries Foundation (Observer Employer, either Johnson Controls or IAP World Service)	1%	4 weeks
Vessel Operating Units	NOAA/NMFS (nationwide program)	100% census of vessels over 5 tons	9 months after the end of the fishing year
Commercial Reef Fish VMS Program	NOAA/NMFS Office of Law Enforcement	100% on commercial reef fish vessels	Real Time

The SERO and the Gulf Council report that catch data systems are satisfactory for management and assessment purposes. The data meet time requirements for in-season management of quota and the red snapper ITQ program. Dealers consistently report catches under the mandatory reporting requirement, but often do not record separate species (aggregate similar species), and often record purchase location rather than location of catch. SERO has no concerns for data quality in the ITQ program, which has inherent incentives to underreport. While no auditing of fishermen and dealer records confirm accurate reporting, SERO believes that the level of enforcement (3-hour check in, on the dock monitoring) and fishermen monitoring other

fishermen (underreporting adversely affects other fishermen) prevent the collusion between fishermen and dealers necessary for underreporting. Data from fisheries without in-season management take several months to become available.

APPENDIX III: DATA AND MONITORING PROGRAMS IN THE GULF OF MEXICO

1.0 COMMERCIAL FISHERIES SYSTEMS

1.1 SEFSC Quota Monitoring System (QMS)

The Quota Monitoring System (QMS) of the Southeast Fisheries Science Center (SEFSC) is responsible for monitoring quotas of groupers and tile fish of the South Atlantic. The QMS program is a dealer reporting system, collecting data on the purchases of shallow water and deep water groupers in the Gulf of Mexico on a monthly basis. Dealers are selected by the SEFSC based on the amount of volume purchases in the GOM and SA, 90 to 95 percent of all landings. While the landings data are available immediately to managers for the purposes of quotas in season, there is a lag period between as the reporting periods range from two weeks to one month.

1. **What data are collected?**
   - The system collects purchases of shallow-water and deep-water groupers in the Gulf of Mexico.
   - The species, product type (round or gutted weight) and the amount of each species purchased during each month is recorded.

2. **What programs are in place to collect data?**
   - The program is a dealer reporting system.
   - Approximately 100 dealers are selected to report from the GOM and South Atlantic; these dealers purchase 90 to 95 percent of all landings in the GOM and SA (not just grouper).
   - Dealers that have been selected to report are required to submit a completed form once a month (or every other week if notified).
   - An online data entry system is in place to assist the dealers who have been selected to report; only about 10 percent of the fishermen use this system, its use is not mandatory.

3. **What are the program goals?**
   - 100 percent of selected fishermen reporting when required.
   - Accurate in-season monitoring of quota

4. **Is the program achieving its goals?**
   - Compliance is 90 to 95 percent, but the SEFSC has to constantly stay on top of the dealers.
   - The Southeast Regional Office of NMFS is able to manage quota, but there is between a 5 and 19 day lag on data, because the shortest possible reporting period is two weeks, and forms are due 5 days after each period ends.

5. **Is inherent sampling error within acceptable limits?**
   - No real sampling scheme, the SEFSC selects dealers who purchase the most volume.

6. **How are data elements aggregated? By whom? How long does this take?**
   - SERO staff aggregate the data every two weeks and input them immediately upon receiving the forms.

7. **When is aggregated information available to management?**
   - Forms are due five days after each reporting period ends
   - Landings data are available to management immediately.

8. **How are the data used in the management process?**
   - Data are used for managing quotas in season.

References:
- https://grunt.sefsc.noaa.gov/QMS/OnlineUserInstructions.htm
- Personal Communication with SEFSC staff (April 23, 2008)

1.2 IFQ Electronic Reporting System for Red Snapper

In 2007, the Southeast Fishery Science Center set up a mandatory electronic reporting system to track IFQ shares and allocations, and the poundage and value of landed red snapper. The dealers and fishermen enter the data jointly at the time of landing using pin codes. These data are available for management use immediately. An annual report summarizing share and allocation transfers, consolidation, quota use and price per pound fluctuations is available to the public. The Gulf of Mexico Fishery Management Council will do a five-year review.

1. **What data are collected?**
   - Landings transactions (number of pounds sold to the dealer)
   - Average price paid for that allocation sold
   - Dealers submit information on price paid so they can obtain cost-recovery fee of 3 percent for red snapper. NMFS takes this for administrative cost of running the program.
   - Dealers have to remit to NMFS the cost recovery fees equivalent to 3 percent of the ex-vessel value of red snapper purchased from IFQ shareholders on a quarterly basis. Although IFQ shareholders pay this fee, it is the responsibility of dealers to collect and remit these fees to NMFS.
   - In addition to this quarterly remittance, dealers would be required to submit to NMFS a year-end report summarizing all transactions involving the purchase of red snapper.
   - Transactions between shareholders are also recorded – IFQ shareholders can transfer allocations (only valid for current season) and shares (valid every year)
   - There is a field for average price paid for allocation and shares, but it is not required.

2. **What programs are in place to collect data?**
   - Data collection occurs jointly between dealer and shareholder
   - They submit information to the system via pin codes
   - When data are submitted, both have to enter the information to make the transaction

3. **What are the program goals?**
   - Mandatory reporting, all participants have to have an IFQ permit or an IFQ account and a Vessel Endorsement to sell IFQ allocation or shares
   - Consolidation of shares and allocation
   - Increase in price per pound

- Reduction in bycatch
- Safety at sea
- Aid for law enforcement

4. **Is the program achieving its goals?**
   - Yes, since reporting is mandatory and there are very strict penalties
   - The VMS system helps them to monitor reporting with 3 hour notification prior to landing.

5. **Is inherent sampling error within acceptable limits?**
   - NA, 100 percent coverage

6. **How are data elements aggregated? By whom? How long does this take?**
   - The SEFSC reviews the required data thoroughly for QA/QC, there are procedures for correction if there is a mistake
   - They do not review optional information (price paid for allocations or shares) as thoroughly
   - They produce a final end of year report. The information summarized in the report mainly includes information on share and allocation transfers, consolidation of quota and how much quota is used relative to allocation.

7. **When is aggregated information available to management?**
   - Data are available real time
   - Final report is available to the public
   - Actual database is private

8. **How are the data used in the management process?**
   - Landings go into stock assessments
   - The data are used to monitor the program relative to the objectives (what's achieved and what's not)
   - In 2007 there was some consolidation of shares (546 shares at beginning of year, 489 at end of year; approx 15 percent reduction)
   - The price increased by about 15 percent per pound over the course of the year
   - There was a reduction in bycatch, but the data collected via this program doesn't aid in this objective, this was gleaned from observer data. They think that the discard to landings ratio was lowered from 4 to 1, but they believe that this has to do with the fact that they lowered min size limit.
   - In eastern gulf, some vessels did not receive much allocation and there were some complaints about increases in bycatch because of limited shares and the high cost to purchase more shares.
   - The Council will have a 5 year review on the program in 2012.

References:

- Personal Communication with Andy Strelcheck, Fish Biologist, SERO, 727-824-5374

1.3 Reef Fish Observer Program

The NMFS had a voluntary reef fish observer program from 1992 through 1995, following which there was an extended period (11 years) with no coverage. Beginning in July 2006, mandated coverage was required for the commercial reed fishing operation in the Gulf of Mexico to fill the need for more accurate data. The long term goal of the program is to provide onboard monitoring of finfish as well as the assessment of protected species interaction. Vessels are randomly selected and stratified by season, gear type and geographic location. Data collected are aggregated and processed at the Galveston Lab. Data are available to managers roughly four weeks after the observation, and is used in stock assessment and presented as part of the National Bycatch Report.

1. **What data are collected?**
   - Data obtained by the observer program include vessel characteristics and gear type (longline vs. bandit gear), retained species composition, soak time and commercial landings amount.
   - Additionally, observers collect set specific information (location, lat/long/depth, etc.) as well as biological data of discards. The data include a biological sample of the fish. Observers always take lengths and state (released alive, released dead, dead, unknown, etc.); they sometimes take weights (weather dependent).

2. **What programs are in place to collect data?**
   - The NMFS had a voluntary reef fish observer program from 1993 through 1995.
   - Mandatory coverage for the commercial reef fish fishery operating in the Gulf of Mexico began in July 2006.
   - Vessels are chosen based on historical fishing data from Miami and stratified by Eastern and Western Gulf, gear type and season. NMFS randomizes and stratifies the permit list and selects vessels based on the stratifications.
   - Vessels that are selected to carry an observer are notified by a certified letter
   - Vessels are required to take an observer just once during a selected period (i.e., Jan-March).

3. **What are the program goals?**
   - Provide bycatch characterization for finfish species
   - Manage finfish discard and mortality
   - Manage protected species bycatch levels
   - Assess protected species interactions (esp. sea turtle) and gather life history data.
   - Would like to have 5 percent coverage.

4. **Is the program achieving its goals?**
   - The current coverage level is approximately 1 percent, but NMFS is trying to increase to 5 percent coverage, funding dependent.
   - Enough data are gathered to inform biological opinions, stock assessments and the National Bycatch Report.

5. **Is inherent sampling error within acceptable limits?**

- With only 1 percent coverage, data may not be representative of the fleet, and may not accurately characterize total bycatch. Acceptable limits for error are not known.

6. **How are data elements aggregated? By whom? How long does this take?**
   - The observers are debriefed and their data are reviewed by observer coordinators.
   - Once the data are received at the Galveston lab, it takes about 4 weeks to enter and approve it.
   - The data are then housed at the Galveston lab.

7. **When is aggregated information available to management?**
   - Data are collected as part of an ongoing process
   - As soon as data are entered into the system (approximately 4 weeks after the end of a trip), they are available for use.
   - Management must request data that it wants to use
   - Under the National Observer Program there are confidentiality issues, so data are aggregated, and each field must have at least 3 vessels within it in order to be released.

8. **How are the data used in the management process?**
   - To date the data have gone to Steve Turner's group at the SEFSC for use in stock assessments.
   - Data have also been used to inform the biological opinion for sea turtles
   - Bycatch information will be presented in the National Bycatch Report (National Observer Program)

References:

- Personal Communication with Elizabeth Scott-Denton, Research Fish Biologist, Galveston Laboratory, Elizabeth.scott-denton@noaa.gov, 409-766-3571
- Sea Turtle Program Overview, SEFSC Observer Programs http://www.sefsc.noaa.gov/PDFdocs/Program_Overview_Observer_Program_2_01_06.pdf

1.4 The Trip Interview Program (TIP)

The Trip Interview Program is one of the major components of the region-wide State-Federal Cooperative Statistics Program in the Southeastern United States. The TIP is a major component of the Atlantic Coastal Cooperative Program (ACCSP) and the Commercial Fisheries Information Network (COMFIN). The TIP program is a shore based sampling program developed to collect information on species age at length and size frequency data; the program also provides catch per unit and composition of the species caught and landed. Data collected allow for time series analysis providing valuable age distribution analysis used in the assessment of the population. TIP also serves as a quality assurance on catch as trained port agents are able to validate species composition of catch first hand.

Commercial vessels landing in SA and GOM region are targeted by port agent's collection of fishery-dependent biological and socio-economic data, by interview, as well as biological samples of age, reproductive, prey and genetic data for targeted species. Biological samples are sent to one of two SEFSC laboratories where age is determined and used in conjunction with

species length data, collected at the port or dealer site, to estimate the age distribution for the entire population or stock of species.

1. **What data are collected?**
   - Port agents collect interview and other fishery-dependent biological and socio-economic data required for fishery management.
   - An initial step in the data collection procedures is to identify fisheries which regularly land species that are the subject of current assessments or for which assessments are planned. These are the targeted fisheries.
   - Port agents in coastal areas of the SA and GOM conduct data collection. They interview fishermen at docks and fish houses and take length and weight samples from their catch, record size frequency, CPUE and species composition of catch and bycatch.
   - The port agents also take hard part and tissue samples for some of the fish they measure. Biological samples provide age, reproductive, prey, and genetic data.
   - Port agents attempt to interview the captain or a crew member to collect data on the fishing trip - i.e., fishing area, type and quantity of gear, fishing time, etc.
   - The preferred method is to sample the catch at the initial point of off-loading. Selected trips should be commercial in nature.

2. **What programs are in place to collect data?**
   - Port side biological sampling and fisher interviews.

3. **What are the program goals?**
   - The primary focus of the TIP is the collection of random size-frequency data and biological samples from commercial marine fisheries. Biological samples provide age, reproductive, prey, and genetic data.
   - In addition to collecting biological data, the TIP serves as a quality assurance on catch and effort data. It validates species composition of catch and type and quantity of gear through first hand, trained observation. Other important information, obtained through personal interviews with the fishermen and dealers, also serves the quality assurance purpose.
   - The major impetuses for the TIP were the new federal requirements resulting from the MFCMA but this kind of information has become more and more desirable and necessary simply to monitor and/or evaluate and/or understand the status of the biological stocks and the fishing industry.
   - TIP also aims to achieve representative samples from targeted fisheries. A representative sample is a sample that meets sound statistical criteria for (at minimum) describing a population. Agents are assigned target numbers of measurements needed for stock assessment. Sampling targets will be assigned according to the historical landings within the fisheries.

4. **Is the program achieving its goals?**
   - It differs from species to species. Recommendations for future sampling requirements will be in the SEDAR documents, as well as opinions on the validity of the data.

5. **Is inherent sampling error within acceptable limits?**
   - Ports chosen based on landings information provided by NOAA fisheries and SEFSC species assessments by county and month; location where sampling takes place will vary trip by trip. In the TIP, there are typically two locations involved; the landing dock and the dealer site. Vessels will not always land at the same dock or sell to the same dealer.

6. **How are data elements aggregated? By whom? How long does this take?**
   - Samples are sent to one of two Southeast Fisheries Science Center laboratories for biologists to analyze and determine the age of the fish.

7. **When is aggregated information available to management?**
   - Typically under FIN and ACCSP, length/frequency is available within 15 days of the following month, but there may be some time for data validation required that takes a bit longer. TIP online allows for data entry right into the database. Data go through checks during entry (look-up tables and size validations that they are checked against)
   - Age and bio data take considerably longer to process, and species in assessment or due for assessment take priority over species that are not undergoing an assessment in the near future.

8. **How are the data used in the management process?**
   - The age and length of the fish are used to determine the age-at-length for a sample of the fish population, which then is used to estimate the age distribution for the entire population or stock of the species.
   - The data provide information on age distribution of fish in the population and how the distribution has changed over time; this is critical information for the assessment of the population.
   - These pieces of information are used in the stock assessment process.
   - Data also provided to the Commercial Fisheries Information Network (COMFIN; a state-federal cooperative program among agencies to collect, manage, and disseminate statistical data and information on the commercial fisheries).
   - The Fisheries Information Network is designed to provide sound scientific information on catch, effort, and participation to managers.
   - The TIP also serves as a quality assurance on catch and effort data, validates species composition of catch and type and quantity of gear through first hand, trained observation.
   - Primary data users are the Memorandum of Understanding (MOU) signatories that assess stocks, forecast trends, and monitor fishery regulations. Also benefiting from the FIN information will be other agencies responsible for the conservation and management of living marine resources in the region.

References:

- http://www.sefsc.noaa.gov/tip.jsp
- http://www.sefsc.noaa.gov/tip/
- http://www.sefsc.noaa.gov/tipdocumentation.jsp
- http://www.sefsc.noaa.gov/PDFdocs/Data-Collection.pdf
- Personal communication: Josh Bennett:, TIP Coordinator, SEFSC Miami, FL, Joshua.Bennett@noaa.gov, (305) 361-4485

1.5 Accumulated Landings System (ALS)

Various organizations have collected and processed commercial landings statistics from 1960-present, the period covered by the Southeast Fisheries Information Network (SEFIN) dataset. In the early 1980s, the NMFS and the state fishery agencies within the Southeast began to develop a cooperative program for the collection and processing of commercial fisheries statistics. With the exception of two counties, one in Mississippi and one in Alabama, the state fisheries agencies collect all of the general canvass statistics and provide them to the SEFSC under a comprehensive Cooperative Statistics Program (CSP).

1. What data are collected?

- Quantity and value of seafood products caught by fishermen and sold to established seafood dealers or brokers.
- These data, called general canvass landings data, are consolidated monthly summaries of the quantities of all species landed at (i.e., purchased by) each licensed seafood dealer; they do not contain vessel or fisherman ID.
- Local field agents estimate information on gear and fishing location (relative to fishing activity) and add it to the general canvass data (not available for all states).
- Several states in the Gulf of Mexico do collect landings statistics for individual trips (trip ticket programs in Florida, Louisiana and Georgia, implemented in 1985, 1997 and 1999, respectively).

2. What programs are in place to collect data?

- Dealers or brokers report these data to the fisheries agency in each state on a monthly basis. The National Marine Fisheries Service (NMFS) in the Southeast Region has established cooperative agreements with all of the states in the Southeast and rely on the states to collect and process these data. The dataset maintained by the NMFS Southeast Fisheries Science Center (SEFSC) begins in 1960 and continues today.
- In many coastal areas, trained field (port) agents assist with the collection of fisheries statistics. These individuals are strategically located so they can maintain contact with the fishermen and are integrally involved with the fishing communities.
- These port agents provide information on the types of gear, fishing area and distance from shore for the general canvass data. The port agents are also involved in the collection of Gulf shrimp statistics, biological data collection and the vessel operating unit survey.

3. What are the program goals?

- The primary goal is to collect monthly summaries of the quantity and value of seafood products landed in US.
- Secondary goals are to collect information on gear type and fishing location.

4. Is the program achieving its goals?

- It differs from species to species. Recommendations for future sampling requirements will be in the SEDAR documents, as well as opinions on the validity of the data.

5. Is inherent sampling error within acceptable limits?

- To improve the quality of data on fishing effort and location, the Southeast Fisheries Science Center implemented vessel logbooks for several federally managed fisheries (see Fisheries Logbook Program).
- Shortcomings associated with fishery statistics from seafood dealers include: 1) dealers do not always record the specific species; and 2) fish or shellfish are not always purchased at the same location where they are unloaded, i.e., landed. [Dealers have always recorded fishery products in ways that meet their needs, which sometimes make it ambiguous for scientific uses. Although the port agents working for the Trip Interview Program can readily identify individual species, they are not usually at the fish house when fish are unloaded].
- Obtaining accurate information on the gear used and the fishing location can be problematic. For states with trip ticket programs, information on the gear and area fished is collected on the trip ticket form. For other states, this information is estimated, usually by the local port agent.

6. How are data elements aggregated? By whom? How long does this take?

- The landings data, maintained by the SEFSC, are monthly totals of the quantities landed and the value of the landings for each species.
- Data are submitted from state partners and state partners get the data from the industry

7. When is aggregated information available to management?

- Roughly 6 months before all data are available.
- Mailed data are entered later than electronically entered data.
- Varies state to state and dealer to dealer

8. How are the data used in the management process?

- Data are used in stock assessments
- TIP data are combined with accumulated landings data to get a more detailed description of commercial catch
- Fisheries statistics for the United States are available online through the National Marine Fisheries Statistics home page: http://www.st.nmfs.gov/st1/commercial/.

References:

- http://www.sefsc.noaa.gov/alsprogram.jsp
- Balchowsky, H and J Poffenberger (2005). Description of the Databases that Contain Landings of Shark Species from the Atlantic Ocean and Gulf of Mexico. Southeast Fisheries Science Center Document LCS05/06-DW-04-V2.
- http://www.sefsc.noaa.gov/PDFdocs/Data-Collection.pdf
- Personal Communication with Josh Bennett, Data manager for the general canvass data (AL, MS, LA, TX, Puerto Rico, and USVI) SEFSC Miami, FL, Joshua.Bennett@noaa.gov, (305) 361-4485

1.6 Domestic Longline System (DLS) Database

Two programs collect data on swordfish and other large pelagics in support of the Domestic Longline System. The first is the dealer pack-out or weight-out program and the second is the

logbook program (or Pelagic Longline System – PLL). The logbooks are mandated by federal regulation, and the Fisheries Logbook System (FLS, section 1.6) is incorporating PLL. The dealer program obtains information on size-frequency of the landed catch from the dealers and vessel captains who submit the weight of individual carcasses on their weigh-out sheets.

1. What data are collected?

- The Domestic Longline Database contains information from the early 1960's (limited) to the present and includes, almost exclusively, data collected from the U.S. domestic pelagic longline fishery and the directed swordfish fisheries. Data from other gear types (harpoon, gillnet, handline, rod and reel, etc.) have been recorded from vessels voluntarily submitting the information or from landings reports that were previously mandated by regulation.
- Although swordfish are the primary commercial species caught and recorded on the sales receipts, the weights of other species are also listed on the tally sheets. Prior to 1985, the weight-out data for the other (non-swordfish) species were not recorded in the database.
- Beginning in 1986, the SEFSC began to enter all the weigh-out data for all species listed on the tally sheets received. At this time, the individual dress weights of other species listed on tally sheets from earlier years were entered as well.
- Each record in the database includes a vessel code, date of landing, state and port landed, code of the dealer purchasing the catch, gear fished, data source, location code of general fishing area, total hooks fished, days of actual fishing, total number of sets, and a species code along with the individual carcass weights for each species.
- The trip summary form (date of departure, date of landing, vessel name, dealers, ports of departure and landing) is used to link the pelagic logbook (set forms) data and the weigh out data.
- Additional economic data (expenditures for ice, bait, crew share, etc.) are collected from approximately 20 percent of the vessels.

2. What programs are in place to collect data?

- Prior to 1986, effort information (hooks, days fished, number of sets) was recorded from personal vessel logbooks voluntarily submitted by vessel captains/owners.
- Beginning in 1986, dealers were required to submit weight-out data once a month on a trip-by-trip basis. Additionally, all pelagic longline vessels that actively fished were required to submit daily logbook set records for each trip on a monthly basis. Based upon this information, fishing effort is determined and, subsequently, added to the longline database.

3. What are the program goals?

- The main goal of the program is to obtain logbooks and trip summary data from 100 percent of vessels and weigh-out data from 100 percent of dealers.
- The SEFSC would like data available to management within six weeks.

4. Is the program achieving its goals?

- Generally, logbooks and weigh-out data arrive within a week or two of landing.

- Staff at the SEFSC spends a lot of time making sure they get all three pieces of data from each trip (summary, logbook and weigh-out).
- Some vessels take much longer to submit forms, but on average, compliance is good.

5. Is inherent sampling error within acceptable limits?

- There is a 100 percent reporting requirement, so there is no sampling error.
- Quality control procedures compare new data with previously entered data to avoid duplication.

6. How are data elements aggregated? By whom? How long does this take?

- Data are not aggregated, the database contains raw data
- The Domestic Longline database is continually updated as new information becomes available.
- All of the data are coded and stored by individual vessel.
- SEFSC staff strives to have data checked and entered within 6 weeks of receipt.

7. When is aggregated information available to management?

- The SEFSC has recently stipulated that data should be available within six weeks of receipt. However, it sometimes takes months to a year to complete.
- The complete set of 2007 data was available in early-mid April 2008.

8. How are the data used in the management process?

- Based upon the information collected, the amount and distribution of fishing effort is determined and, subsequently, added to the longline database.
- The logbook data are used in stock assessments and in calculating catch rates
- Effort data and observer data are used to estimate discards
- The data are used to determine observer coverage
- The weigh-out data are used to monitor quotas in season.

References:

- http://www.sefsc.noaa.gov/dls.jsp
- http://www.sefsc.noaa.gov/PDFdocs/Data-Collection.pdf
- Personal Communication with Steve Turner, Fishery Biologist, NMFS Sustainable Fisheries Division, steve.turner@noaa.gov, 305-361-4482 x 482

1.7 Fisheries Logbook System (FLS)

Federally issued logbooks, which record fishing and non-fishing activities, are the result of a mandate requiring all fishermen to submit a written report of their fishing activity for specific federally managed species. This mandate aims to improve the quality of data on fishing effort and location. The FLS consolidates all individual logbooks including the Pelagic Longline, Snapper, Grouper, Gulf Reef, Shark, and Golden Crab fisheries in the South Atlantic and Gulf of Mexico, as well as Northeast fisheries. Relevant to the Gulf of Mexico, in 1986, a comprehensive program was initiated for the pelagic longline fisheries along the eastern seaboard, in the Gulf of Mexico and in the Caribbean. In 1990, logbook reporting was initiated for the vessels catching species in the Gulf reef fish management plan. In 1993, a

comprehensive logbook was initiated for the federally managed shark fisheries, and in 1999, logbook reporting was initiated for vessels catching king and Spanish mackerel in the Gulf of Mexico and the South Atlantic.

1. **What data are collected?**
    - The Fisheries Logbook System records the fishing and non-fishing activity of fishermen who are required to report their fishing activity via logbooks submitted for each trip. There are two types of reporting forms currently in use. One form is used for the pelagic longline fisheries. Because this fishery uses gear that are set (deployed) for a relatively long period (6 to 10 hours), catch and effort data are collected on a separate form for each set.
    - For the pelagic longline fisheries, fishermen are required to report the numbers of each species caught, the numbers of animals retained, discarded alive or discarded dead (longline gear is nonselective and unwanted or prohibited species such as billfishes, sea turtles, etc., must be returned to the water), the location of the set, the types and size of gear, and the duration of the set.
    - Because some of the needed catch/effort information for pelagic longline fisheries remains the same for the entire trip, a supplemental Trip Summary form is used to report information on the port of departure and return, unloading dealer and location, number of sets, number of crew, date of departure and landing and costs associated with the trip.
    - The second type of logbook form is used to report catch and effort data for the Gulf reef fish, coastal shark and king and Spanish mackerel fisheries. Because the soak time for these fisheries is relatively short, the catch and effort data for the entire trip are reported on a single form for each trip.
    - For the Gulf reef fish, coastal shark and king and Spanish mackerel fisheries, the types of information required are nearly the same as the pelagic longline logbook. Information on the quantity (reported in pounds) caught for each species, the area of catch, the type and quantity of gear, the date of departure and return, the dealer and location (county and state where the trip is unloaded), the duration of the trip (time away from dock), an estimate of the fishing time, and the number of crew are included on this form.
    - In response to the increased need for data on the amount of fish that are discarded, the SEFSC is now using a supplementary form that selected fishermen (approximately 20 percent of the fleet) use to report quantities of fish that are discarded, but these data are currently unreliable and inaccurate due to incorrect completion of the form.

2. **What programs are in place to collect data?**
    - Mandatory logbook program (selected 100 percent)
    - Selective discard logbook program (10 percent is on very low side of response)

3. **What are the program goals?**
    - The program aims to collect catch and effort data to inform stock assessments
    - 100 percent reporting compliance

4. **Is the program achieving its goals?**
    - For mandatory logbooks, no one compares number of trips with number of received logbooks – but NMFS has to receive something from fishermen each month in order to get permit renewals
    - If fishermen do not fish in a particular month, they have to enter a zero catch report.
    - For the selective discard logbook program, NMFS obtains at least 50 percent compliance, but compliance is getting progressively better.

5. **Is inherent sampling error within acceptable limits?**
    - 100 percent of fishermen are required to report, so there should be no sampling error

6. **How are data elements aggregated? By whom? How long does this take?**
    - NMFS staff solicits and computerizes the catch and effort data as soon as they become available.

7. **When is aggregated information available to management?**
    - Logbooks are available in the computer system two weeks after they are received.

8. **How are the data used in the management process?**
    - Data are used in stock assessments (but the most recent data is not used, typically they are several years old)
    - Data are used to improve the quality of data on fishing effort and location and increase available information on the amount of fish that are discarded.

References:

- http://www.sefsc.noaa.gov/fls.jsp
- http://www.sefsc.noaa.gov/PDFdocs/fls_summary.pdf
- http://www.sefsc.noaa.gov/PDFdocs/Data-Collection.pdf
- Personal Communication with Kevin J. McCarthy, Fishery Biologist, Sustainable Fisheries Division, Kevin.j.mccarthy@noaa.gov, 305-361-4492
- Personal Communication with SEFSC staff (April 23, 2008)

1.8 Pelagic Dealer Compliance (PDC)

The Pelagic Dealer Compliance program (PDC) was referred to as the Quota Monitoring System (QMS) from 1997 to 2002, as well as the Swordfish Dealer Compliance (SDC) program from 1993 to 2000 (please note that 'QMS' now refers to a separate system used by the SEFSC to monitor the quotas of several reef species, including red groupers and tilefish, refer to section 1.1). The Pelagic Dealer Compliance (PDC) database contains data collected by the SEFSC from dealers that meet the following criteria:

1. The dealer has a Federal dealer permit for sharks, swordfish and/or tuna (except Bluefin tuna; required to purchase shark, swordfish, and/or tuna products from a federally permitted vessel);
2. The dealer is selected by the SEFSC to report; and
3. The dealer is located in the Southeast Region (North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Texas, Puerto Rico, or the U.S. Virgin Islands).

A dealer must have a federal permit in order to purchase shark, swordfish, and/or tuna products from a federally permitted vessel.

1. **What data are collected?**
    - Dealers are required to provide dressed weight, price per pound and vessel information on each HMS species.
    - If no purchases of HMS products are made during a reporting period, the dealer is required to send a report indicating such.

2. **What programs are in place to collect data?**
    - When selected, the dealers are required to submit a report with the landings (purchases) of any species in the highly migratory species management unit that were purchased from U.S. vessels fishing in the Gulf of Mexico and Atlantic Ocean.
    - Currently all dealers with one or more highly migratory species permits must report.
    - The dealers are required to submit a report twice a month and the report must be submitted within five days of each two-week reporting period.

3. **What are the program goals?**
    - All dealers are required to report, so they aim to get 100 percent on-time compliance

4. **Is the program achieving its goals?**
    - There are some dealers who are delinquent, and some who are not timely
    - NMFS hopes to partially correct this by reducing the number of systems that people report to (there is a lot of duplicity within the system).
    - The SEFSC has shifted to mainly working with dealers that account for 95 percent of the landings (rather than 100 percent)
    - There is 50 to 75 percent compliance within 10 days of 2 week period.

5. **Is inherent sampling error within acceptable limits?**
    - SEFSC selects dealers purchasing 95 percent of the landings, so there is virtually no sampling error.

6. **How are data elements aggregated? By whom? How long does this take?**
    - Data are already aggregated across trips when they are submitted.
    - The SEFSC summarizes the data from the PDC into monthly reports and sends it to the Highly Migratory Species Division, National Marine Fisheries Service.

7. **When is aggregated information available to management?**
    - Data from dealers who purchase 95 percent of the landings are in within a couple of weeks
    - Complete data are available within six months

8. **How are the data used in the management process?**
    - The data in the PDC provide greater detail in species composition for sharks than is available in the general canvass statistics (and is more timely).
    - The summarized data are used in-season to monitor the respective fishery quotas for sharks (but the seasons are short, so this is not always possible).

- The PDC database also provides managers with a method to compare and quality control the landings data for species in the HMS Fishery Management Plan.

References:

- http://www.sefsc.noaa.gov/sdcprogram.jsp
- Balchowsky, H and J Poffenberger (2005). Description of the Databases that Contain Landings of Shark Species from the Atlantic Ocean and Gulf of Mexico. Southeast Fisheries Science Center Document LCS05/06-DW-04-V2.
- Personal Communication with Steve Turner, Fishery Biologist, NMFS Sustainable Fisheries Division, steve.turner@noaa.gov, 305-361-4482 x 482

1.9 Gulf of Mexico Shrimp Statistics (GSS)

The Gulf Shrimp System is the Southeast Fisheries Science Center's (SEFSC) data collection program for commercially harvested shrimp statistics. The shrimp harvest data excludes all non commercial catches, including part time commercial fishermen or illegal catches. Data are collected at the port by port agents, who are responsible for a geographic region. Two types of data are collected, landings data are collected from seafood dealers includes the amount and value of shrimp harvested, and interview data which is collected from the captain or crewmember of the vessel records information regarding fishing effort. All data collected in the Gulf Shrimp System are based on a trip by trip basis; the data collection procedure includes two modifications (described in Point 5 below) to achieve a representative sample.

1. **What data are collected?**
   - The SEFSC data collection program for shrimp statistics includes only the commercial harvesting sector; the Gulf shrimp statistics do not include shrimp that are caught by recreational shrimpers for personal or family consumption.
   - Data for the Gulf shrimp program come from three sources
     - Data on the amount and value of the shrimp are collected from seafood dealers and are referred to as "landings" data.
     - The second type of data includes detailed information on fishing effort and location for individual trips and is collected by interviewing either the captain or a member of the crew, referred to as interview data.
     - The electronic logbook program collects effort data.
   - For inshore fishing trips, the port agents combine the landings statistics for all of the trips that were made by the smaller, undocumented boats.

2. **What programs are in place to collect data?**
   - Port agents employed by either state or federal agencies that participate in the SEFSC shrimp program are located in coastal ports along the Gulf of Mexico collect shrimp statistics.
   - The port agents visit shrimp dealers in their assigned areas and collect landings statistics for individual fishing trips for all of the vessels identified as fishing offshore.
   - The electronic logbook program collects effort data. In 1999, pilot studies were in place; in 2004, the NMFS took over the program and implemented the ELB. As of March 2007, it became mandatory (in Shrimp Amendment 13) to participate if selected. Currently

LGL Ecological Research Associates (out of Bryan TX) handles the data. They match the trips to the landings for each vessel.

3. What are the program goals?

- The objective of the data collection program for Gulf shrimp statistics is to provide catch, value, area caught and effort data for individual commercial fishing trips.
- The logbook program goal is to install 450 electronic logbooks in selected vessels (out of 1932 vessels with shrimp moratorium permits).

4. Is the program achieving its goals?

- Although the SEFSC never totally achieves the overall objective, their data do provide the most comprehensive data on offshore, commercial catches, the majority of which are for individual trips.
- The SEFSC has exceeded the program goal of 450 electronic logbooks with 485 currently installed. This is due to the fact that the cost of manufacturing logbooks has gone down.
- Electronic logbooks have been a giant leap forward, and the fishermen are really happy about it. The better the data, the better the management decisions.

5. Is inherent sampling error within acceptable limits? What are the shortcomings?

- Because the fishing trip is the basic data collection or sampling unit, the fundamental principle of the data collection procedures would be to collect both landings and interview data on a trip-by-trip basis. However, because the number of fishing trips that occur in the Gulf shrimp fishery is so large, it is impossible for a record to be made of every single fishing trip. Consequently, the data collection procedures include two modifications to this principle.
- The first modification is that the port agents are required to record landings statistics only for individual fishing trips made by large vessels that fish offshore. For trips made inshore by smaller vessels, the port agents combine the landings statistics and record only monthly totals for the pounds, value and number of trips. This consolidation is also used for offshore trips when the vessel name or number is not available from the dealer's records.
- The second modification is that the port agents conduct interviews with only a sample of the vessels that fish offshore. The intent of the sampling protocol is to select a few individuals that are representative of the total population and collect the needed information from the sample rather than the entire population. The logistics of fishing, however, make it impossible for the port agents to target specific vessels in advance for selection. As a result, the port agents are instructed to regularly visit the docks in their assigned areas and interview vessel captains as the opportunity arises and using a "random" process, thus trying to avoid as much systematic bias as possible.
- Unfortunately, this system provides an incomplete picture of vessel participation due to the practice of consolidating trips in such a manner that the landing vessel's identity is sometimes suppressed.
- There is always some level of uncertainty associated with partial coverage. However, the SEFSC has some of the best statistics in the US, and the program is pre-1960, so they feel that the error is with acceptable limits.

6. **How are data elements aggregated? By whom? How long does this take?**
   - Trip ticket data (landings), are aggregated by state for each vessel, and each state puts the data into a database held by the SEFSC (GSS).
   - LGL gives data to SEFSC directly
   - On an annual basis, information is available by the end of May the following year. New stock assessments are started in June each year.

7. **When is aggregated information available to management?**
   - The electronic logbook data are downloaded each month, approximately, but it is a function of the memory capacity of the card. LGL employees coordinate with vessel owners and visit the ports when vessels are there to download the data. There is an algorithm present in the logbooks that determines what the vessel is doing, and where it is located. Vessel activity is translated into effort from this algorithm, and knowing the vessel number, they can match it to the landings data from the port agents or trip tickets data.
   - This is not a real-time tracking system.
   - They get some monthly updates, but mostly these data are available on an annual basis

8. **How are the data used in the management process?**
   - Used in stock assessments (most recently, red snapper).
   - Data were recently used in bycatch management.
   - Data collection is driven by questions that the GMFMC may have and want resolved.

References:

- http://www.sefsc.noaa.gov/gssprogram.jsp
- http://www.sefsc.noaa.gov/PDFdocs/Data-Collection.pdf
- Personal communication with Rick Hart, Research Fish Biologist, Galveston Laboratory, rick.hart@noaa.gov, 409-766-3404

1.10 Pelagic Observer Program (POP)

The Pelagic Longline Observer Program (POP) was designed to store data collected from U.S. commercial longline vessels. While the NMFS has used fisheries observers to record fisheries data since 1972, the Pelagic Observer Program (POP) began at the Miami Laboratory in May of 1992. The POP employs 10-12 observers, whose responsibility is to monitor a mobile U.S. pelagic longline fleet ranging from the Grand Banks to off the coast of Brazil and the Gulf of Mexico. The observed trips generally last between 2-45 days. The POP observer corps generally spends a total of 900 days at sea on 70-75 vessel trips with a cumulative observation of 500 longline sets per average year. The program has surpassed the targeted goal of eight percent coverage based on fishing effort of the fleet. The data are valuable for use in ICCAT stock assessments.

1. **What data are collected?**
   - Observers on the vessels describe gear information, record landings data, and describe the fish and where the fishing took place. They record fish species, length, weight, sex, location, and other environmental information. There are three database files within the POP system.

  - Observers record whether the animal was alive or dead, and ultimate fate.
  - Gear characteristics by trip are recorded on a "Long Line/Line Trawl Gear Characteristics Log" form for entry into a Gear Log database file.
  - Haul information is collected and recorded on a "Long Line/Line Trawl Haul Log" form and entered into a Haul Log database file.
- All fish observed for a haul are recorded on a "Large Pelagic Individual Animal Log" form for entry into an Animal Log database file.

2. **What programs are in place to collect data?**
   - All data are collected by observers placed on US commercial longline vessels.

3. **What are the program goals?**
   - The POP targets eight percent coverage of the vessels based on the fishing effort of the fleet.
   - During an average year, the observer corps will spend about 900 days at sea based on 70-75 vessel trips, and observe about 500 longline sets.

4. **Is the program achieving its goals?**
   - 8 to 10 percent coverage is obtained, higher than their program goal
   - During this year from March 9-June 9, there is a 100 percent coverage requirement, in reality observers are obtaining ~70 to 80 percent coverage.
   - Last year from April 15-June 15 the SEFSC attempted same thing, and got 60 to 70 percent coverage.

5. **Is inherent sampling error within acceptable limits?**
   - There is always some level of error associated with coverage of less than 100 percent.
   - The three-month, 100 percent coverage periods help to reduce error, but it is unclear whether acceptable error rates have been defined.

6. **How are data elements aggregated? By whom? How long does this take?**
   - The National Marine Fisheries Service receives the data four days after landing
   - NMSF staff enter the data
   - Data are available in the system about a week afterwards (an Oracle database is used)

7. **When is aggregated information available to management?**
   - Fisheries managers have almost instantaneous access, but they have an agreement to wait for the end of a quarterly period before considering the data final – this takes 45 days from the end of any given quarter.

8. **How are the data used in the management process?**
   - The main purpose of the data is for use in ICCAT stock assessments
   - The data collected and stored in this system are used to prepare biological and statistical summary reports with emphasis on Tuna and Swordfish.
   - Secondary purpose is to create take estimates for turtles, mammals and seabirds.

- The information collected is also used to evaluate the harvest and status of the pelagic fish stocks and is important in evaluating the effectiveness of management measures to control harvest levels.

References:

- http://www.sefsc.noaa.gov/pop.jsp
- http://www.sefsc.noaa.gov/PDFdocs/Data-Collection.pdf
- Personal communication with Larry Beerkircher, Pelagic Observer Program Coordinator, Lawrence.r.beerkircher@noaa.gov, Observer Program Office 1-800-858-0624

1.11 Shark Bottom Longline Observer Program

In 2005 the responsibilities of the Southeast commercial shark bottom longline fishery monitoring program were transferred from the University of Florida to the NOAA Fisheries Service Panama City Laboratory Shark Population Assessment Group in Panama City, FL. The program has been designed with the intent to meet the specifications of the Endangered Species Act and the Fishery Management Plan for Highly Migratory Species. Vessels carrying a valid shark fishing permit are randomly selected for carrying observers who collect data, onboard the vessel, describing gear information, fish catch location, fish species, length, weight, sex and environmental information. The data are sorted by gear characteristics, catch and bycatch and protected species interactions. The data are used to compile shark stock assessments and evaluate snapper-grouper bycatch rates in proposed SAFMC MPAs.

1. What data are collected?

- Observers on the vessels describe gear information, record landings data, and describe the fish and where the fishing took place. They record fish species, length, weight, sex, location, and other environmental information.
- Observers complete three data forms (Longline Gear Characteristic Log, Longline Haul Log, and Individual Animal Log, as in the Pelagic Observer Program) and are also required to fill out additional sea turtle or marine mammal forms when applicable.

2. What programs are in place to collect data?

- Owners/vessels possessing current valid shark fishing permits are randomly selected for carrying observers.
- Observers placed on US commercial longline vessels collect all data.

3. What are the program goals?

- The target observer coverage level is 4 to 6 percent.

4. Is the program achieving its goals?

- Yes, the program is achieving its goals.

5. Is inherent sampling error within acceptable limits?

- Yes.

6. How are data elements aggregated? By whom? How long does this take?

- Data are sorted by: (1) Gear and haul characteristics, (2) catch and bycatch, (3) protected species interactions.
- Data from each trip are submitted to SEFSC staff on a per trip basis. The data are entered and reviewed by SEFSC staff and reviewed with observer contract staff to resolve any questions.

7. When is aggregated information available to management?

- Data are available upon request.

8. How are the data used in the management process?

- Data from observer coverage provides information to support shark stock assessments and evaluate snapper-grouper bycatch rates in proposed SAFMC MPAs.
- Information has also been gathered to support future stock assessments for groupers and tilefish and derive protected species bycatch rates by both the shark and snapper/grouper bottom longline fishery.

References:

- Sea Turtle Program Overview, SEFSC Observer Programs http://www.sefsc.noaa.gov/PDFdocs/Program_Overview_Observer_Program_2_01_06.pdf
- http://www.pclab.noaa.gov/content/60_Observer_Programs/20_Bottom_Longline_Observer_Program/Bottom_Longline_Observer_Program.php
- Hale, LF. LD Hollensead and JK Carlson. 2007. Characterization of the shark bottom longline fishery, 2007. NOAA Technical Memorandum NMFS-SEFSC-564, 25 p.
- Hale, L.F. and J.K. Carlson. 2007. Characterization of the shark bottom longline fishery,
- 2005-2006. NOAA Technical Memorandum NMFS-SEFSC-554, 28 p.
- Personal communication with John Carlson, Research Fish Biologist, Panama City Branch, john.carlson@noaa.gov, 850-234-6541 x 221

1.12 Commercial Shrimp Trawl Fishery Observer Program

The Commercial Shrimp Trawl Bycatch Observer Program is a cooperative effort between the NOAA Fisheries Galveston, Gulf and South Atlantic Fisheries Foundation, Texas Shrimp Association, North Carolina Division of Marine Fisheries and the Georgia Department of Natural Resources. The objectives of this program are to refine catch rate estimates of shrimp and bycatch species and to evaluate the Bycatch Reduction Device (BRD) and Turtle Excluder Device (TED). Data collected by NMFS trained observers has been used in the National Bycatch Report.

1. What data are collected?

- NMFS observers collect data aboard commercial vessels to evaluate various TED and BRD designs against bycatch reduction criteria, and compare catch data between control and experimental nets.
- For each tow, environmental parameters, bottom time and operational aspects relative to each net are documented.
- Total catch weight and counts of the target species are noted, and all sea turtles that are brought on board are identified to species, measured, tagged, photographed and released.
- Additionally, a sub-sample of approximately 70 lbs of bycatch is processed from each of the two nets (experimental and control), time permitting, for characterization.

2. **What programs are in place to collect data?**
   - Observers are placed on vessels to collect data.
   - Coverage was voluntary until July 2007, then mandatory beginning in July 2007.
   - Selection is based on historical landings and is divided by area (depth, nearshore, offshore) and season (Jan-April, May-Aug, Sept-Dec).
   - Fishermen are only required to take an observer one time per seasonal selection

3. **What are the program goals?**
   - The main goal is to provide temporal and spatial data on the catch of shrimp and bycatch species
   - The program also provides data on bycatch levels of selected finfish of which there are approximately 20 species that are recorded individually (Red Snapper, Croaker, etc.). If a species not on this list is caught, it is grouped under "finfish"
   - The observer coverage in this fishery is meant to estimate the annual mortality of sea turtles as a result of trawl capture.
   - Annual coverage would ideally be 5 percent

4. **Is the program achieving its goals?**
   - This program does not cover the skimmer trawl fishery for shrimp, and very little data are available relative to catch composition and directed effort of operational aspects of this sector.
   - Approx 1 percent coverage. Looking to increase to 3 to 5 percent dependent on funding

5. **Is inherent sampling error within acceptable limits?**
   - With only 1 percent coverage, data may not be representative of the fleet, and may not accurately characterize total bycatch. Acceptable limits for error are not known.
   - However, the program is viewed as successful.

6. **How are data elements aggregated? By whom? How long does this take?**
   - Variable, but on average it takes about 4 weeks for data to get into the system
   - Observers are debriefed page by page on observer reports by observer coordinator
   - Data are checked and archived

7. **When is aggregated information available to management?**
   - Data are available upon entry into the system (4 weeks).

8. **How are the data used in the management process?**
   - The data are used for various analyses
   - The data are used for SEDAR and for determining BRD and TED effectiveness (by Pascagoula lab)
   - Bycatch data used by SERO in Biological Opinions.
   - Data have been used in two Reports to Congress and in the National Bycatch Report.

References:

- Sea Turtle Program Overview, SEFSC Observer Programs http://www.sefsc.noaa.gov/PDFdocs/Program_Overview_Observer_Program_2_01_06.pdf
- Personal Communication with Elizabeth Scott-Denton, Research Fish Biologist, Galveston Laboratory, Elizabeth.scott-denton@noaa.gov, 409-766-3571

1.13 Vessel Operating Units (VOU)

In 1979 NMFS initiated a system that provided data on vessels that actively participate in commercial fishing during each calendar year, known as the Vessel Operating Units (VOU). The objective of the program is to inventory the number and characteristics of commercial fishing vessels. The inventory only includes vessels greater than five net tons with a current US Coast Guard documentation number. The NMFS and state port agents collected a count of smaller, undocumented boats once a year from 1979-1995, however this dataset does not include characteristics of the smaller boats. VOU data are now available through 2006 and are primarily used for socio-economic analysis.

1. **What data are collected?**
   - The VOU provides an inventory of vessels actively participating in commercial fishing during each calendar year. Only vessels greater than 5 net tons and have a current US Coast Guard documentation number. These data are available through 2006.
   - NMFS also has counts of smaller undocumented boats, conducted once a year by NMFS port and state agents (from 1979 – 1995), characteristics of these individual boats are not recorded (this is referred to as boat and shore data).
   - Coast Guard vessel database is publicly available to access information on vessel characteristics, documentation and ownership data. The database is updated monthly (data is current through April 5, 2008, as of 4/10/08). Program only retrieves data for vessels 5 net tons or larger. Available at: http://www.st.nmfs.noaa.gov/st1/CoastGuard/index.html
   - The coast guard data are only part of what is in the VOU data. Vessel attributes are collected from CG information, but additional data are collected on fishing gear used, landing ports and number of crew. This data takes a while to collect, either directly through interviews with vessel captains or by examination of landings data for the previous year. Currently, only 2006 data are complete (both vessel info from CG and fishing info from interviews) in the VOU database. CG documentation data are not the same as the VOU database.

2. **What programs are in place to collect data?**
   - Coast Guard (for vessel characteristics), NMFS and state port agents (fishing gear used and number of crew) collect data based on vessels that have a current USGC documentation number.
   - Accomplished through interviews (port agent interviews each captain to find out what gear and configuration was used during the year and number of crew employed) and also through a query of state landings databases.

3. **What are the program goals?**

- The object of this system is to provide an inventory of vessels that answer two fundamental questions: (1) how many vessels are fishing commercially? And (2) what are the characteristics of these vessels?

4. **Is the program achieving its goals?**
   - The program goals of determining the number of vessels fishing commercially and the characteristics of those vessels (gear used, port, horsepower, length, year built, hull material, county of landing).

5. **Is inherent sampling error within acceptable limits? Are there any shortcomings?**
   - Not a sample, this is a census, so there is no estimated error.
   - The VOU's primary weakness is its reliance on the dockside observation of vessels and their gear for purposes of determining current participation in the fishery, though it is also hampered by the fact that it tracks only Coast Guard documented vessels (i.e. state registered boats are not taken into account)

6. **How are data elements aggregated? By whom? How long does this take?**
   - Data elements are aggregated into an Oracle table by the database manager or entered by the NMFS agent that collected the data. Collection of data usually takes about a month but there is a 9 month lag from the end of the fishing year for state personnel to process landings information. We must wait for this data to become available to gather fishing information on vessels.

7. **When is aggregated information available to management?**
   - Data are available about 9 months after the prior fishing year.

8. **How are the data used in the management Process?**
   - Data are used primarily for socio-economic analyses.

References:

- http://www.sefsc.noaa.gov/vou.jsp
- Personal Communication with David Gloeckner, Fishery Biologist, Sustainable Fisheries Division, david.gloeckner@noaa.gov, (252)728-8721

1.14 Commercial Reef Fish VMS Program

The Commercial Reef Fish VMS Program was implemented through Amendment 18A to the Fishery Management Plan (FMP) for the Reef Fish Fishery of the Gulf of Mexico. The purpose of Amendment 18A was to resolve issues related to monitoring and enforcing existing Gulf of Mexico reef fish fishing regulations as well as reduce bycatch mortality of incidentally caught endangered species including sea turtles and smalltooth sawfish. Under amendment 18A all owner/operators of vessels with a commercial vessel permit for Gulf reef fish are required to have an operating VMS unit onboard. This includes charter vessels and headboats with a commercial vessel permit for Gulf reef fish, even when under charter. While the data collected are primarily used in surveillance and enforcement, the aggregated data are used in regional analysis on fishing effort and pressure.

1. **What data are collected?**
   - All commercial reef fish vessels must have a VMS unit which sends a position report to NOAA Office of Law Enforcement (OLE) once an hour, 24 hours a day, except when in port. If the vessels are required to submit landings and other reports, The VMS Unit collects that as well.
   - When in port, the following exemptions apply:
     (1) An in-port exemption allowing a VMS unit to send a position report once every four hours, rather than every hour.
     (2) Expansion of the power-down exemption to include a vessel that is "in port" for 72 consecutive hours or more.

2. **What programs are in place to collect data?**
   - Currently, all owner/operators of vessels with a commercial vessel permit for Gulf reef fish are required to have an operating VMS unit onboard. This includes charter vessels and headboats with a commercial vessel permit for Gulf reef fish, even when under charter.
   - About 18 fisheries around the nation are required to use VMS units. In the Gulf of Mexico, Rock Shrimp and HMS vessels (only a few are present) are also required to report
   - In the Gulf, the VMS units report hourly.

3. **What are the program goals?**
   - The VMS program was developed by Regional Fishery Councils in conjunction with the NMFS region
   - VMS is reactionary – the program responds to requests by region and FMCs. The VMS program doesn't have particular goals of its own- it supports the regional office and council goals.
   - Example: Snapper vessels are required to submit landing reports three hours before they land.

4. **Is the program achieving its goals?**
   - There is almost 100 percent compliance with equipped vessels
   - Not all vessels are equipped, and that percentage is undetermined, but if not equipped, the vessel either must lose their permit or sell it.

5. **Is inherent sampling error within acceptable limits?**
   - 100 percent of reef fish, rock shrimp and HMS vessels must carry a mandatory VMS to retain their permit, so there is no error.

6. **How are data elements aggregated? By whom? How long does this take?**
   - The VMS data go into an active monitoring and surveillance system
   - The agents can see where all the vessels are at all times, but they manage the exceptions, they are not actively watching vessels
   - The system alerts them and gives them notices when there is a potential violation
   - The presence of a vessel in a closed area is not necessarily a violation, but if an agent or officer sees a vessel which might be fishing in a closed area, they investigate it further.

7. **When is aggregated information available to management?**
   - Data are available in real time.
   - Data are also aggregated by area, time, etc. for use (in limited form) by the scientific community and research agencies.

8. **How are the data used in the management process?**
   - Data are used for surveillance and enforcement purposes
   - Data are very flexible and are used in several different analysis programs.
   - Some of the regions produce reports of areas fished to assess effort and fishing pressure, but they omit all identifying information beforehand, and they look at data in aggregate.

References:
- http://sero.nmfs.noaa.gov/hot_topics/VMSandIFQupdates.pdf
- Personal Communication with Jonathan Pinkerton, NOAA National VMS Program (301) 427-2300, jonathan.pinkerton@noaa.gov

1.15 Reef Fish Visual Census (RVC)

Interest in visual methods for censussing reef fishes has greatly increased in recent years because of the inadequacy of some traditional sampling techniques and the need for reliable non-destructive, fishery-independent sampling methods. The RVC methodology entails divers recording all species observed within an imaginary 7.5m cylinder for 5 minutes. Abundance of individual species, length and community composition is collected and then entered into an electronic web-based database using the RVC (Reef Fish Visual Census) Data Entry Program. The objective of the program is to assess trends in reef fish populations as well as assess the reef fish community responses to management actions and natural disturbances. The stationary sampling methods have been found to be extremely effective under a variety of field conditions.

1. **What data are collected?**
   - Data are collected on frequency of occurrence, abundance of individual species as well as community composition.
   - Divers begin each sample by facing in one direction and listing all species within the field of view. When no new species are noted, new sectors of the cylinder (15m diameter) are scanned by rotating in one direction for the 5 min period. After the initial 5 min, data are then collected on the abundance and minimum, mean, and maximum lengths for each species sighted.
   - Depth, bottom composition, estimated percentage cover, and maximum relief are recorded for each plot from the polar perspective of the centrally located observer

2. **What programs are in place to collect data?**
   - Divers record all species observed in five minutes within an imaginary cylinder (radius 7.5m) extending from the surface to the bottom.
   - It is a fishery-independent, in situ, non-destructive method of collecting data.
   - Visual Censuses are conducted annually in the Florida Keys (from May-September) and every other year in the Dry Tortugas (since 2000).
   - Survey sites are generated by UMiami-RSMAS, based on input from the SEFSC.

- At the beginning of the year, SEFSC staff calculates how many sites they think they can sample based on 3 days per week, 7.5 sites/day then UM generates a plan based on this.
- They sample until they run out of time and/or funding. The number of sites visited varies depending on whether they are sampling in Dry Tortugas that year. Sampling in the Keys decreases in Tortugas years (even years). They sampled 325 sites last year (4 dives at each site). This year, they might sample 200-250 sites in the Keys because they are also sampling Tortugas sites.
- This year the SEFSC is partnering with state of FL, trying to developing a methodology that both agree on. This will allow them to increase sample size. Hopefully will eventually sample 450 sites in the Keys per year, 500+ in non-Tortugas years.
- State and Federal waters are surveyed, all sites are < 110' depth
- Stratified by habitat
    - Area / coverage of habitat
    - Habitat-specific variance
- At each site:
    - Habitat is verified if possible
    - Two teams of two divers deployed (separated spatially; ~50-70m)
    - Each of four divers performs fish / habitat survey
    - "Team" surveys later combined to one survey
    - Two replicates per site (individual data are available)

3. What are the program goals?

- Assess trends in reef fish populations (spatial and temporal)
- Assess reef fish community responses to:
    - Management actions (SPAs, Regulatory changes, CERP)
    - Natural disturbances (i.e., hurricanes)
- Often dictated by the research and management needs for any given year.

4. Is the program achieving its goals?

- Stationary sampling was found to be extremely effective under a variety of field conditions.
- Black and Red Grouper average size increased between 1999 and 2004, determined with the RVC program.

5. Is inherent sampling error within acceptable limits? What are the shortcomings?

- Censusing fish in reef environments is difficult because of the structural complexity of the habitat, and the mobility, diversity and abundance of reef fishes. The larger the reef, the more difficult the census.
- Minor errors in estimating sample radius are unlikely to have a statistically significant effect.
- Crevice dwelling, cryptic and secretive species are likely under-sampled.
- An all purpose tool (APT), consisting of a ruler connected perpendicularly to the end of a meter stick, is used to as a reference device to reduce apparent magnification errors in fish size estimates.

- The SEFSC has also designed and deployed an innovative state-of-the-art digital laser video camera system for increasing the precision of the process for both sizing and counting reef fish species.
- Highly mobile species that are unlikely to remain in the area (e.g. sharks, carangids, *Clepticus parrai*) are tabulated when first observed and then ignored. For common species (e.g. damselfish, wrasses, etc.) one 360^{o} rotation is made for each species by working back up the list in reverse order of recording to reduce potential bias by avoiding counting a species when they were particularly abundant or obvious.

6. How are data elements aggregated? By whom? How long does this take?

- Visual survey data are entered into an electronic web-based database using the RVC (Reef Fish Visual Census) Data Entry Program. This program was designed to standardize data entry and help eliminate errors during the data entry process.
- Data are entered into the RVC program through four 'cards' or data entry screens. The first screen accepts sample identifier information. The second screen accepts bottom-type classification data. The third screen accepts reef fish length-frequency data and the fourth screen is for recording species seen after the initial five minutes allowed by the sampling protocol. The RVC program then checks the data for errors and, once corrected, processes the data for future entry into a database program.
- Initial data entry is done by the data collectors. There is no set time frame, but almost all the data are entered by the end of the sampling season, and typically within a week of collection.
- There are multiple levels of QA/QC, Doug Harper will match up the dives with entered data, determines if data are missing, and contacts surveyors.
- There are a number of additional QA/QC steps (Steve Smith at UM-RSMAS looks for outliers)
- Data ends up in dbase files.

7. When is aggregated information available to management?

- Sampling wraps up by September, and by October, all the data are entered. 98 percent of data are entered by the end of the sampling season.
- Data are made available to public via the coral reef information system (CORIS). The SEFSC submits data to CORIS, but there are a few years of lag before it shows up there to allow the managers and staff at the SEFSC to analyze the data thoroughly prior to releasing it.

8. How are the data used in the management process?

- Data are used for stock assessments/SEDAR reports
- Data are used to determine fish population response to management actions
- Other research and assessments
    - Goliath and Nassau grouper status
    - Keys gradient
    - Fish-habitat modeling

References:

- Technical Report NMFS 41, dated July 1986, titled, A Stationary Visual Census Technique for Quantitatively Assessing Community Structure of Coral Reef Fishes by James A. Bohnsack and Scott P. Bannerot.
- Jerald S. Ault, Steven G. Smith, Geoffrey A. Meester, Jiangang Luo, James A. Bohnsack, and Steven L. Miller (2002). Baseline Multispecies Coral Reef Fish Stock Assessment for the Dry Tortugas. NOAA Technical Memorandum NMFS-SEFSC-487, August 2002.
- Personal Communication with Todd Kellison, Research Fish Biologist, Protected Resources and Biodiversity Division, todd.kellison@noaa.gov, 305-361-4496

2.0 RECREATIONAL FISHERIES SYSTEMS

2.1 Recreational Landings / Marine Recreational Fisheries Statistics Survey (MRFSS)

The National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS) is required to collect statistics on marine recreational fishing. The Coastal Household Telephone Survey (CHTS) and the For-Hire Telephone Survey (FHS) are used to collect fishing effort data.

However, the MRFSS is undergoing a redesign for the coming years, and so recreational fishery data collection system will be changing. As such, any data that was not available online was not tracked down.

1. **What data are collected?**
   - Information is collected on the participation, fishing effort, and catch in marine recreational fishing, and the demographic, social, and economic characteristics of the participants.
   - Catch, effort, and participation estimates for marine recreational fisheries have been produced since 1981.
   - Effort data collection in both the CHTS and FHS occurs during a two-week period at the end of each two-month sample period (or "wave"). In 2006 the survey was conducted for the entire year (or all six waves) on the Gulf of Mexico coast. In the Gulf, the CHTS specifically excludes Texas, who conducts their own recreational fishing surveys.
   - The access-point angler intercept survey is conducted at public marine fishing access points (boat ramps, piers, beaches, jetties, bridges, marinas, etc.) to collect individual catch data, including species identification, total number of each species, and length and weight measurements of individual fishes, as well as some angler-specific information about the fishing trip and the angler's fishing behavior.
   - There is a large pelagics survey as well, but it only collects data from the Atlantic, not in the Gulf.

2. **What programs are in place to collect data?**
   - The basic design for collecting recreational fishing statistics consists of a complemented surveys approach that includes telephone surveys of fishing effort and an access-site intercept survey of angler catch.
   - The CHTS collects fishing effort data from shore and private boat anglers living in coastal counties.

- The FHS was implemented as the 'official' methodology for obtaining Gulf of Mexico Charter boat effort in January 2000.

3. **What are the program goals?**
   - The National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS) is required to collect statistics on marine recreational fishing.
   - The NMFS uses several surveys to gather information on the participation, fishing effort, and catch in marine recreational fishing, and the demographic, social, and economic characteristics of the participants

4. **Is the program achieving its goals?**
   - The program is undergoing a redesign in the coming years, to address shortcomings and errors in the data.

5. **Is inherent sampling error within acceptable limits? What are the shortcomings?**
   - For the CHTS, correction factors derived from the intercept survey are used to account for trips taken by non-coastal resident and out-of-state anglers, as well as anglers who live in households without telephones.
   - The CHTS does not capture the majority of for-hire angling effort in most states because most anglers who take trips on Charter and Head (or Party) boats do not live in coastal counties. The FHS was developed to resolve under-coverage of Charter and Party boat angler effort by the CHTS. It overlaps the Southeast Regional Headboat Survey (SERHS).
   - The Access Point Angler Intercept Survey interviews are conducted in person by trained field staff, and the sites and dates are selected by a proportional random selection process such that those sites that have the most activity within a sample month will be selected for interview collection most often. The sampling schedule is independently determined by fishing mode (shore fishers, charter boat fishers, or private or rental boat fishers) and target sample sizes are based on statistical power and available funds.
   - Questions are asked that provide the information to adjust for non-coastal residents' effort, fishing activity by anglers living in households without traditional landline telephone service, and charter boat anglers fishing from boats that are not in the FHS sample frame for the wave.

6. **How are data elements aggregated? By whom? How long does this take?**
   - For the CHTS, all effort estimates are computed by fishing mode, then all mode-level estimates are aggregated to obtain the total statewide estimates.

7. **When is aggregated information available to management?**

8. **How are the data used in the management process?**
   - The quantities taken, the fishing effort, and the seasonal and geographical distribution of the catch and effort are required for the development of rational management policies and plans.

- Continuous monitoring of catch, effort, and participation is needed to monitor trends, to evaluate the impacts of management regulations, and to project what impacts various management scenarios will have on a fishery.
- From the angler-interviews a catch per trip estimate (CPUE) can be made for each type of fish encountered, either observed or reported. These CPUE estimates are combined with the effort estimates by sampling stratum to produce the catch and harvest estimates.

Reference:

- http://www.st.nmfs.noaa.gov/st1/recreational/overview/overview.html

2.2 Texas Recreational Survey

Past NMFS surveying has identified recreational fishing as placing a stress on GOM fish stocks. The Texas Recreational Survey has been in place since May of 1974 and has provided valuable information used in stock assessments. Texas uses a saltwater creel survey method in which the surveyor collects information on number, size and species of fish landed, trip length, number of anglers, area fished, gear used and targeted species. The objective of the program is to estimate daytime fishing pressure (angler-hours), landings, catch rates, species and size compositions for sport-boat anglers on trips in Texas marine waters.

1. **What data are collected?**
   - Number, size and species of fish landed, trip length, number of anglers, county of residence, species targeted, activity (fishing, sailing, etc.), area fished, gear used (rod and reel, gig, etc.) bait used, trip satisfaction

2. **What programs are in place to collect data?**
   - Texas uses a saltwater creel survey which has been in place since May 1974.

3. **What are the program goals?**
   - The main goal of the Survey is to estimate daytime fishing pressure (angler-hours), landings, catch rates, species and size compositions for sport-boat anglers on trips in Texas marine waters.

4. **Is the program achieving its goals?**
   - Yes

5. **Is inherent sampling error within acceptable limits?**
   - Sampling error differs for each species, with the more commonly landed species having lower sampling error than uncommon species.
   - In general there is acceptable error to reliably estimate landings for each bay system, not just coastwide.

6. **How are data elements aggregated? By whom? How long does this take?**
   - The basic unit is a trip, but data are aggregated by survey location/survey-day, as that is the sampling frame

7. **When is aggregated information available to management?**

- Texas Parks and Wildlife generates estimates twice per year, once for each high-use and low-use season (high-use runs from May 15—Nov 20).

8. **How are the data used in the management process?**
   - Landing and sizes are used to monitor trends and are also used as input into stock assessments.

Reference:

- Personal communication with Mark Fisher, Texas Parks and Wildlife Division, Recreational Fishing Index Program, (361) 729-2328

2.3 RecFIN/GulfFIN Programs – GSMFC

The Fisheries Information Network (FIN) is a collaborative effort between federal and state agencies to collect, manage and distribute statistical data on the commercial and recreational fisheries of the Southeast Region. The program goals are to collect the data on commercial and recreational landings, and gear, vessel and fishermen data associated with each catch for the purposes of the conservation and management of fishery resources in the Southeast Region and to develop a national program. While the program is young in some of the southeastern states, other states have a strong participation, with four Gulf states participating. With an increase in funding the program's goals are to decrease dealer's duplicate efforts by instituting and implementing an electronic reporting system.

1. **What data are collected?**
   - The program collects vessel and fisherman name, commercial and recreational landings
   - The primary gear used, gear fished, price info, market info (size category) and shrimp counts are also collected
   - Some biological sampling is conducted for ~15 selected species

2. **What programs are in place to collect data?**
   - Commercial data are collected via trip tickets
   - Four states are mandatory in Gulf (MS collects limited info – trip level info for oysters only)
   - Menhaden port sampling is performed in LA to better understand catch and effort for menhaden in Gulf
   - The dealers submit the information and are required to report on a monthly basis to the states

3. **What are the program goals?**
   - The main purpose is to improve the quantity and quality of data available to fisheries managers
   - The program is still undergoing development and full implementation is an immediate goal
   - Establish data management system
   - Feed into a national program (similar to ACCSP)

4. **Is the program achieving its goals?**
   - The program has been developed but is not fully implemented, but lack of funding limits amount of data collected
   - For recreational fisheries, states collect intercept info and effort is collected by MRFSS on federal side
   - There has been some headboat at-sea sampling, but not right now because of lack of funding
   - There is not 100 percent compliance; it varies by state, but is ~80 to 85 percent Gulfwide. There is not as much information from Texas because the program just started there.
   - Eventually the regional and state data will fed into FIS, but there is a breakdown in the system right now. The program is not fully vetted and developed. It should be functional by end of this year.

5. **Is inherent sampling error within acceptable limits?**
   - There are large errors in HMS sampling (billfish and tunas on recreational side), because of low landings amounts, The GSMFC would like to increase sampling, but have a lack of funding
   - For a majority of species (red snapper, king mackerel, commercial HMS), there are reasonable levels of uncertainty Gulf-wide. There are more issues by state/county, but Gulf-wide is robust with under 10 percent PSE.

6. **How are data elements aggregated? By whom? How long does this take?**
   - Trip tickets go to the states; states run QA/QC measures on the data
   - Data are submitted electronically
   - GSMFC also runs QA/QC and ask states if they have any questions
   - The GSMFC is still working out kinks on getting state data to the national folks (confidentiality issues)
   - They would only make available certain data to federal folks for them to query.

7. **When is aggregated information available to management?**
   - States send data to the FIN data management system on a monthly basis. There is a month or two (two is more likely) lag behind the data collection. March data will be received on May 1st.

8. **How are the data used in the management process?**
   - Data are used in the SEDAR stock assessment process (historical landings, biological sampling)
   - GSMFC staff work with NMFS on quota monitoring through electronic reporting, but that is not the official reporting method. The GSMFC is looking at this option if they can get enough dealers using electronic reporting. Currently dealers fill out QMS forms and submit trip tickets which duplicates effort, if they will utilize an electronic system, one of the systems can be eliminated.

Reference:

- Personal communication with Dave Donaldson, Gulf States Marine Fisheries Commission, (228) 875-5912

2.4 Southeast Regional Headboat Survey

The Southeast Regional Headboat survey is a longstanding surveying program that has been instrumental in providing information applied to fisheries issues in the region as well as basic reef fish ecology. The objective of the program is to sample between five and eight percent of all headboat vessels. The sampling program includes both logbook, self-reporting, and port agent sampling. Data collected include information on catch and effort data from trip by trip self reporting and biological data including length, weight and otoliths from port agents. The data are used in support of stock management activities and stock assessment.

1. **What data are collected?**
   - The Beaufort Laboratory's Southeast Region Headboat Survey collects fisheries and biological data
   - Approximately 165 vessels are monitored throughout the southeast, and in 1996, biological samples were collected from 37,435 fishes of 124 species.
   - Survey has been in existence since 1972 (SA), and has operated in the Gulf since 1986

2. **What programs are in place to collect data?**
   - There are two major components. The first is the logbook which is self-reported on a trip-by-trip basis and compiles catch and effort data (also some ID and some location data – accurate to 10 sq miles). These are filled out by captain after each trip.
   - The second is the port agent sampling program. Port agents sample vessels dockside from Cape Hatteras, NC to Brownsville, TX and collect biological data, length, weight and otoliths.

3. **What are the program goals?**
   - Sampling goals, each vessel once/week.
   - Once/month at the very least if there isn't an opportunity for once/week.
   - Percent of trips sampled averages between 5 percent and 8 percent.

4. **Is the program achieving its goals?**
   - Varies with weather and boat schedule, but for the most part, yes.

5. **Is inherent sampling error within acceptable limits?**
   - Level of sampling is useful - percent of trips sampled is higher than the MRFSS survey

6. **How are data elements aggregated? By whom? How long does this take?**
   - Logbook data represent the catch and effort data; sampling data represent mean weight and length composition of the catch.
   - Each species is assigned a mean weight based on the sampling data, and SEFSC staff in Beaufort, NC are able to estimate landings based on estimated numbers of fish reported in the logbook data.
   - The database is maintained in Beaufort, NC and Miami, FL; Beaufort has the main database.
   - Landings are generated in Beaufort and sent to Miami.

7. **When is aggregated information available to management?**
   - Calculations are performed on an annual basis – the SEFSC is just finishing '07 landings six months after the end of the year.
   - There is some lag time picking up the last of the logbooks
   - Data entry is typically performed only in second half of the year because enough logbooks must accumulate before they can be sent to the data entry company

8. **How are the data used in the management process?**
   - The data collected support stock management activities.
   - Data are used in all SEDAR stock assessments
   - The data are used to create indices of abundance and to calculate CPUE
   - The data are used to calculate landings for comparison to historical data to interpret trends that may be developing.
   - The calculated catch amounts are compared to reported catch amounts as a QA/QC measure.
   - These data sets are also used to examine patterns in the fishery and to study the structure and distribution of reef fish communities.

References:

- http://www.sefsc.noaa.gov/headboatsurveyprogram.jsp
- Personal Communication with Kenneth Brennan, Research Fish Biologist, Beaufort Laboratory, kenneth.brennan@noaa.gov, 252-728-8618

2.5 Cooperative Tagging System (CTS)

Cooperative tagging (mark-recapture) activities in the Southeast region, particularly for red drum and king mackerel, have expanded to include work by most coastal state fishery management agencies, several universities and laboratories, recreational and commercial fishermen, private tagging organizations, and laboratories of the SEFSC of the NMFS.

The National Marine Fisheries Service's (NMFS) Southeast Fisheries Science Center (SEFSC) formed the Cooperative Tagging Center (CTC) in 1992 in response to an expansion of tag release and recapture activities, data requests from other tagging agencies, and domestic and international tagging research needs. The CTC encompasses a variety of functions and responsibilities. The CTC also includes the Cooperative Tagging System (CTS), as well as other research projects such as tag development and performance research and cooperative work with endangered species.

1. **What data are collected?**
   - The Cooperative Tagging System program targets HMS (tuna, billfishes and swordfish)
   - Over the years, the target animal has also included species such as amberjack, but mainly focuses on HMS
   - Program started in 1954 w/ bluefin tuna. Now it also encompasses yellowfin tuna, bigeye tuna, albacore blue marlin, white marlin, sailfish and swordfish.
   - The CTC uses a spaghetti tag; ideally, they would collect time of tagging, lat/long, estimated (or measured) size, equipment used, general condition of fish and weather

2. **What programs are in place to collect data?**
   - The CTS is a constituent-based tagging program, therefore they don't have total control over the data collected or the fish that are tagged. The HMS species are the only fish that are supposed to be tagged, but they have gotten tag returns for walking catfish, conger eels, peacock bass, sharks, etc.
   - Fishermen call in and report the information from the tag when it is caught. There is no timeframe for calling in a tag.
   - Conventional tagging is a very old technology; a tag must be recovered in order for the information to be obtained. New electronic tagging is much more advanced.

3. **What are the program goals?**
   - To monitor the movement patterns and seasonal migrations of these species
   - To provide direct data to the assessment process for determining management unit and stock structure
   - To determine minimum estimates of longevity (sailfish live at least 17 years – used to think only 3-4 years)

4. **Is the program achieving its goals?**
   - Program goals are achieved to some extent
   - The amount and type of information gathered on billfish via constituent-based tagging programs would be difficult, if not impossible to obtain with other tagging methods, due to cost and limited access to live fish
   - Much of what the CTC and fisheries managers know about these HMS species comes from the conventional tagging database, so the data are useful, even though newer methods of electronic tagging are producing quicker, more reliable and detailed data

5. **Is inherent sampling error within acceptable limits? What are the shortcomings?**
   - There is no true sampling scheme; the program is based on volunteer tagging by constituents only
   - The fishermen do not typically report all of the requested information, and sometimes tag reports are delayed, if they are reported at all.
   - Tags only provide data on the points of release and recovery, movements between these points is not known
   - Some people are not very conscientious about reporting tags; the CTC often gets tag recoveries from tags with no release data
   - The CTC has a lack of control over tagging process
   - Issues have arisen with overestimates of size at release
   - Fishermen often use up valuable resources by tagging the wrong species
   - The NMFS CTC has been impacted by the recent down sizing of the Federal Government. Volunteer tagging activities continue to emphasize highly migratory species (tunas and billfishes). Tagging of non-target inshore pelagic and demersal species (tarpon, grouper, snapper, mackerel) while still important, will be gradually reduced or eliminated due to limited resources.

6. **How are data elements aggregated? By whom? How long does this take?**

- The CTC has interns who enter the data daily. Data are typically entered as soon as a tag is called in, but in the busy season there could be a lag of a few weeks to a few months.
- The CTC is responsible for providing data summaries at any time, but particularly when ICCAT asks
- Due to funding shortages, over the short term, the CTC will process all incoming data as in the past. However, there are delays involved with processing non-target species as these species are not a top priority. All tagging data, including the non-target species, will be maintained permanently in the computer database.

7. When is aggregated information available to management?

- The main data user of the HMS database is ICCAT – they request information every year, and NOAA provides them with this and other data.
- Data are available to be used as soon as they are entered, but there is a several month lag before all the data are checked and entered.

8. How are the data used in the management process?

- ICCAT uses the data in their stock assessment process
- The CTC provides their own team to ICCAT for assessment services
- Data are used for setting domestic regulations
- Data are used in the assessment process to determining stock structure and id'ing specific management units and movement and migration patterns
- Data are used to calculate estimates of minimum longevity for modeling
- Data are used to calculate estimates of age and growth

References:

- http://www.sefsc.noaa.gov/ctsprogram.jsp
- http://www.sefsc.noaa.gov/PDFdocs/Data-Collection.pdf
- Ortiz, M., E. Prince, J. Serafy, D. Holts, K. Davy, J. Pepperell, M. Lowry and J. Holdsworth (2003). Global overview of the major constituent-based billfish tagging programs and their results since 1954. *Marine and Freshwater Research*, 54: 489-507.
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