For-Hire Electronic Logbook Pilot Study in the Gulf of Mexico

Final Report

Project Team:

Dave Donaldson and Gregg Bray, Gulf States Marine Fisheries Commission
Beverly Sauls, Stephanie Freed and Bridget Cermak, Florida Fish and Wildlife Conservation Commission
Page Campbell, Alice Best and Katie Doyle, Texas Parks and Wildlife
Andrew Strelcheck and Kenneth Brennan, National Marine Fisheries Service

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Consultants:
Dr. Mark Kaiser, Iowa State University
Dr. Robert Trumble, MRAG Americas
Dr. James Chromy, RTI International
Dr. Joseph Powers, Louisiana State University

ACKNOWLEDGMENTS

This pilot study was preceded by a review of nationwide data collection methods for for-hire fisheries, with participation from data collection specialists across the country, and by a workshop with stakeholders throughout the Gulf of Mexico to gather input on data needs and methods to improve regional data collections from for-hire fisheries. The design of this pilot study greatly benefitted from both sources of input. The design and analyses for this study were conducted in consultation with professionals in the fields of fisheries data collection, survey design, statistical analysis, and catch and effort estimation. All of this work was supported by the Marine Recreational Information Program (MRIP). The pilot study itself was a cooperative effort between the National Marine Fisheries Service, Gulf States Marine Fisheries Commission, the state of Texas, and the state of Florida. This pilot study could not have been successful without support and cooperation from the for-hire industry, and we are especially grateful to representatives of the industry who supported this project on the docks and fostered support among their colleagues. Credit for the success of this project is also given to the dedicated staff who worked directly with the for-hire industry to collect accurate field validation data, assist with individual reporting needs, and maintain high levels of cooperation throughout the course of the one year pilot study. We also thank Bluefin Data, Inc., for designing the electronic reporting tool, providing technical support, and maintaining the Gulf Logbook website beyond the one-year pilot study. Three peer-reviewers provided technical comments that contributed to improvements in this final report: Dr. Alicia Carriquiry and Dr. Sarah Nusser of Iowa State University, and Dr. Stephanie Eckman of the Institute for Employment Research in Nuremberg, Germany.

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ABOUT THIS DOCUMENT

This report presents methods and results from a pilot study to test the feasibility of the use of a census-style logbook reporting method for for-hire recreational fisheries. Currently, catch and effort statistics from the charter for-hire fishery are collected through regional surveys administered by the Marine Recreational Information Program (MRIP). This pilot study was conducted in direct response to recommendations at the national level that the universal use of logbook reporting be implemented as the source of catch and effort statistics for for-hire recreational fisheries. The study was conducted in the Gulf of Mexico, but was intended to test methods for use in any region.

The target audience for this report includes managers of fishery-dependent data collection programs, fisheries resource managers, and fishermen that are interested in the results of this study, including those who participated in this pilot study and those that may be affected by decisions pertaining to data collection programs that may result from this study. The purpose of this report is to fully document the methods tested, present results, and interpret in plain language the meaning and implications of results herein. A summary of key findings and specific recommendations from this pilot study are provided in the Executive Summary immediately following this page. A brief introduction into the background, primary goal, and objectives of this study are provided in the Background section of this Document. For readers who are interested in a more detailed background into the importance of collecting catch-and-effort statistics for recreational fisheries and specific challenges to collecting this information, we refer you to the National Research Council Review of Recreational Survey Methods (NRC 2006) cited in the References section of this document. For technical readers who are interested in finer details of statistical methods and results, we have included all pertinent technical documents as Appendices to this report.

EXECUTIVE SUMMARY

This report summarizes the methods, results and conclusions of a one-year pilot study conducted in the Gulf of Mexico to test the feasibility of a mandatory electronic logbook reporting system, along with methods to independently verify self-reported catch and effort data in the for-hire fishery. The expectation with a mandatory reporting system is that a complete census of effort and catch among all participants in the fishery will be obtained. This would allow managers and scientists to monitor catch and effort in a timely manner to ensure catch limits are not exceeded. However, methods to independently validate self-reported fisheries data are needed to certify whether a true and accurate census of catch and effort is actually achieved, and to account for instances when it is not. Tracking methods are also important with any mandatory reporting requirement so that late or missing reports can be identified and participants in the fishery can be contacted in a timely manner. Tracking is also important to facilitate enforcement, when necessary.

Several potential benefits from a logbook reporting system were recognized from this study, and we do not rule out logbook reporting as a feasible method for the collection of catch and effort statistics from the for-hire sector. However, based on the results and design of this pilot study, a census of for-hire catch and effort using logbooks was not achieved due to non-reporting (both at the trip-level and vessel-level) by vessels required to report. If logbooks were to be used as a census, mechanisms to enforce timeliness and accuracy of reporting would need to be improved. This Executive Summary highlights the key findings from this study. Recommendations included herein are intended to guide decision makers who are considering adopting logbook reporting as a regional data collection method for for-hire fisheries. A separate analysis was completed using data collected during this pilot study to explore the feasibility of combining self-reported logbook data with independent validation data to generate statistically valid estimates for catch and effort. That report, which is currently undergoing peer-review, will provide further guidance on the utility of logbook reporting methods for the collection of catch and effort data from for-hire fisheries.

Key Findings and Recommendations

Reporting Tools

Electronic reporting with built-in quality control features that prevent data entry errors and omissions was an effective method for receiving high quality self-reported data from a large population of participants. Paper logbooks and electronic reporting options without built-in quality control features required more follow-up with participants to verify and attempt to correct self-reported data. Electronic reporting options that allow users the ability to record and store logbook data at-sea facilitate better record keeping and accurate recall by offering more flexibility for when and how users keep track of trip details and record logbook data.

> *Recommendations:*
> Recommend that participants in the fishery be involved in the design of electronic logbooks to improve data reporting accuracy and efficiency, and to ensure data entry fields are clearly described.

Electronic reporting is preferred over paper logbook reporting and it is recommended that electronic reporting be required for participation in a fishery, whenever it is practical to do so.

Recommend that electronic reporting tools have quality control features built in to prevent data entry errors and omissions by users, and electronic reporting options be certified to include all required quality controls before they become available for use.

Recommend that electronic reporting tools include a feature that requires an entry of either inactivity or activity for each day in the reporting period. Alternative options, such as hail out/hail in requirements or vessel monitoring systems, should also be considered for reporting activity.

Regardless of whether or not real-time reporting is required of participants in a fishery, electronic reporting options that offer users the ability to record and store logbook data at-sea during reported fishing trips (example, smart-phone applications, tablets, etc.) are highly recommended to facilitate record keeping and accurate recall of logbook information.

Recommend that electronic logbook records be accessible, with password protection, to vessel owners for their record keeping purposes. This will help create cooperation and incentive for participation.

Enforcement

Current authority to enforce reporting requirements for federally permitted vessels was effective for achieving reporting compliance, but was not effective for achieving timely reporting. Under the current authority, a delinquent vessel may continue to fish until the permit is due for renewal on an annual basis. Prior to the permit expiration date, the permit holder may submit delinquent records for the previous 12 months to become compliant and clear the permit for renewal. These data are not reliable in most cases. After the permit is issued, the same vessel can be non-compliant in the same manner the following year with the same consequences and results. Authority to require and enforce charter vessel trip reporting for non-federally permitted vessels varies by state and some states require legislative changes to gain such authority.

Recommendations:

As with any mandatory reporting program, timely reporting by participants should be required for logbooks and this requirement should be enforceable. It is recommended that authority for enforcing reporting requirements be modified to enhance the timeliness of reporting. Recommended authority should include permit suspension, permit termination and civil penalties to facilitate enforcement of timely reporting.

It is highly recommended during the initial implementation of a logbook reporting requirement that planned methods are in place for initiating a quick response if compliance is low at the onset of the reporting requirement.

Recommend that follow-up procedures to track reporting compliance are designed to facilitate timely enforcement (see recommendations below under “Reporting Compliance and Timeliness”).

Reporting Compliance and Timeliness

Based on the results and design of this pilot study, a census of for-hire catch and effort using logbooks was not achieved due to non-responses (both at the individual trip-level and vessel-level) by vessels required to report. For an ongoing logbook reporting program to remain effective, a consistent and high level of effort by port samplers and law enforcement is required to validate and maintain reporting compliance and timely reporting. If logbooks were to be used as a census of catch and effort, the timeliness and accuracy of reporting would need to be improved. Throughout the pilot study, reporting compliance gradually improved and most likely would have continued to improve had this pilot study run for a longer period and fishermen became more familiar with reporting requirements. However, the issue of vessels reporting inactivity during weeks when they actively fished would continue to be an obstacle to achieving a complete census and must be accounted for. A requirement to report vessel activity or inactivity each day within a reporting period is needed to effectively track and monitor compliance for a complete census of all trips, and to conduct timely follow-up for late and missing reports (i.e. within a given reporting week, participants should be required to report inactivity or activity for each day). A large number of vessels with federal permits did not actively charter fish during the pilot study (100 of 358 in Florida and 43 of 58 in Texas), and different reporting requirements may be necessary for inactive permit holders.

Recommendations:

While we do not rule out logbook reporting as a feasible method for the collection of catch and effort statistics from the for-hire sector, logbooks are not recommended if a complete census is necessary due to the significant additional resources in manpower and funding required for a logbook reporting method to achieve a complete census.

To achieve maximum compliance and timeliness, we strongly recommend that before any logbook program is implemented, provisions for the following components are included in the initial design and implementation phases for the program, and that long-term, recurring funds are appropriated to ensure that these tasks are maintained over the duration of the program:

- A large up-front effort to inform participants of upcoming reporting requirements prior to implementation
- Methods to track and quickly identify missing and late reports both at the onset of the program and over the long-term duration of the program
- Follow-up procedures that are timely and maintain compliance and timely reporting over the duration of the reporting program
- Multiple stages of follow-up procedures that are maintained over the long-term duration of the program, including an early prompt to remind participants when reporting deadlines are approaching, notifications to participants immediately after the deadlines are missed, and later follow up if reports are still delinquent.

Reporting Frequency

The frequency with which participants were required to report during this pilot study was weekly, and this frequency was sufficient to produce precise and timely catch and effort statistics. The effort required to effectively monitor compliance with timely follow-up for missing and late reports in this study would have been much greater if the selected reporting frequency was daily, and the cost would be even greater if certifying the accuracy of daily reporting at the individual vessel level was required (such as in commercial fisheries managed with individual fishing quotas or IFQs). Decreasing the reporting frequency (bi-weekly or monthly) to further reduce costs would come at the expense of increased recall bias and is not recommended.

> *Recommendations:*
> Recommend the selected reporting frequency and required reporting accuracy be considered both in terms of the cost and necessity for management and assessment before implementing a region-wide logbook reporting methodology.
>
> Recommend a weekly reporting frequency combined with a daily reporting requirement for a logbook reporting design as the most feasible method, both in terms of cost and the benefits for minimizing recall bias and tracking compliance. Daily reporting frequency is only recommended if adequate resources can be dedicated to compliance tracking and timely follow up, and only if daily or individual vessel monitoring is necessary for fisheries management.

Validation and Estimation

The logbook reporting methods pilot tested in this study did not achieve a complete census. Logbook reports in this study were submitted for a large portion of the total effort (approximately 70% overall), which was verified through field validations of vessel status. Comparisons in this study between logbook reports and independent field validations confirm that self reported data are subject to recall bias and inaccuracies in reporting; therefore individual logbook trip reports cannot be considered a one-to-one match with independent validations. However, given an adequate sample size, aggregated logbook data are potentially very useful for developing estimators for total effort, catch-per-unit effort (CPUE), and total harvest at the regional scale. It is unlikely that logbook records can be used to provide precise daily estimates, and precision could also be low for weekly estimates, particularly during months of low fishing activity. We believe it is feasible to develop estimators for cumulative monthly catch and effort during periods of high fishing activity, and bi-monthly during periods of low fishing activity. Seasonal (lower frequency than bi-monthly) estimates would not be useful to regional fisheries managers and are not recommended.

> *Recommendations:*
> The project team worked with an MRIP Consultant to develop appropriate methods for estimating effort and catch using data from this study. A report for this task, which includes recommendations for consideration, was provided to the MRIP Operations Team in December, 2012, and is currently undergoing peer-review.
>
> Given 30% of total trips validated did not submit logbooks, it is recommended that additional research be conducted to determine if adjustment methods are needed to account for sampling bias associated with vessels that did not report logbooks.

Recommend that methods currently in place to estimate catch and effort for for-hire fisheries in the Gulf of Mexico and Texas be evaluated to determine whether sample sizes are sufficient for precise and accurate estimates. In addition, recommend that potential bias associated with non-response (both refusals and non-successful contacts) be evaluated for each methodology. If sample sizes in current surveys are not sufficient, then the cost to achieve necessary sample sizes should be compared to a logbook reporting system to determine whether a logbook reporting system is a more affordable alternative for achieving larger sample sizes.

Field Validation

If individual logbook records could be considered one-to-one equivalents of what would result from dockside sampling, then a small validation monitoring program would be sufficient. However, based on the results of this study, logbook records should not be viewed as giving values similar to dockside sampling of the same trip (e.g., a small number of dockside samples should not be expected to agree with a small number of corresponding logbooks reports). The three field validation methods employed in this study were variable both in terms of cost and the granularity of information provided for direct comparisons with logbook trip reports. Effort validation through vessel activity status verification is the least costly method and was effective for measuring reporting compliance, though additional methods may need to be considered during periods of low fishing activity or in states with low numbers of vessels. Dockside sampling is the least costly method for validation of catch, but is not effective for validation or estimation of released catch. At-sea validation is the most costly method for validating catch, but provides high resolution data on numbers and size of landed and released fish, depth of capture and area fished. The feasibility of placing fisheries observers on charter vessels to collect high quality validation data at-sea was demonstrated during this study; however, due to low sample sizes we were not able to determine necessary sample sizes for validating discards at-sea.

Recommendations:

Recommend for any census-style logbook reporting program that vessel activity validation methods to measure and account for incomplete reporting be employed. This is important both for achieving an accurate estimate for the total number of trips and accounting for unreported catch.

Released catch represents a major portion of total catch and contributes significantly to total fishing mortality for many managed fisheries in the Gulf of Mexico. In this study, neither logbook trip reports nor dockside validations provided accurate estimates for released catch; therefore, it is highly recommended that some form of at-sea validation methodology be incorporated into logbook validations. For harvested catch, data from dockside validations and logbook trip reports were similar in aggregate; therefore a combination of dockside and at-sea validation methods may be employed.

Feasibility for Regional Implementation

Several potential benefits from a logbook reporting system were recognized from this study, and we do not rule out logbook reporting as a feasible method for the collection of catch and effort statistics from the for-hire sector. Given adequate resources and long-term funding commitments, this method would be feasible for a large geographic area with a large number of vessels, but may not be feasible for small states or regions with small numbers of vessels. This study included only charter vessels with federal permits, and regional implementation would also need to consider whether to include vessels that do not possess federal permits and mechanisms to require and adequately enforce logbook reporting, or else exclude those vessels from logbook reporting and survey them separately. Challenges to surveying small, inshore guide vessels in current survey methods would also apply to field validation sampling if they were required to report in a logbook program.

Recommendations:

Recommend that if logbooks are implemented on a large regional scale, implementation should be phased in at smaller regional scales so that adequate resources can be dedicated to necessary up-front efforts for outreach and follow-up with non-respondents to achieve high compliance.

Recommend that a regional logbook reporting program exclude non-federally permitted vessels unless each state has authority to require reporting and a mechanism to enforce timely reporting.

State license frames are often not adequate for identifying all vessels in a fishery, and a complete universe of known vessels is recommended before mandatory logbook reporting is implemented for all for-hire vessels in a region.

BACKGROUND

The Gulf of Mexico supports the largest recreational fisheries in the country in terms of economic value, total effort, and contribution to total fisheries removals (Gentner and Steinback, 2008; Coleman et al., 2004; Hanson and Sauls, 2011). Significant portions of total recreational landings in this region are attributed to the for-hire sector (**Table 1** and MRIP, 2008). In 2006, the National Research Council conducted an independent review of recreational fisheries survey methods across the country (NRC 2006). The NRC review recognized that in regions such as Alaska and the Gulf of Mexico, the magnitude of the for-hire sector and the potential scale for fishery removals warrants the use of mandatory logbooks as the source of catch and effort data for the for-hire sector. The NRC recommended essential elements for this type of reporting system to meet acceptable standards for data collection. First, reporting should be mandatory, and they highly favored reporting requirements that are tied to permit renewal for continued participation in the fishery. Census-style reporting is expected to minimize the need for adjustments in catch and effort statistics associated with sample-based data collection designs. Second, the reviewers recognized that data collected through logbook programs will be reliable only if there are strict verification and enforcement components. They recommended that self-reported information collected on both catch-per-unit-effort (CPUE) and effort be verifiable. Thirdly, the reviewers recommended that information collected in a logbook program should be made available in a timely manner.

Table 1: Estimated numbers of fish landed by headboats, charterboats, and private recreational anglers, and percent of total recreational harvest landed by for-hire anglers in 2007.

	For-Hire Headboats (FL to TX)	For-Hire Charter/Guide (FL to LA)	For-Hire Charter/ Guide (TX)	Private Anglers (FL to LA)	Private Anglers (TX)	% of Total Rec Landings Caught by For-Hire
Red Snapper	174,262	502,275	11,611	615,093	33,024	**51.50%**
Vermilion Snapper	223,925	123,940	1461	139,358	245	**71.45%**
Gag Grouper	11,979	49,026		259,685		**19.02%**
Red Grouper	6,174	26,294		121,557		**21.08%**
Gray Triggerfish	34,278	66,751	781	119,108	2,460	**45.58%**

In 2009, a more detailed review of for-hire data collection methods was commissioned by the For-Hire Workgroup of the Marine Recreational Information Program (MRIP; Chromy et al., 2009). The MRIP review supported the NRC recommendations and included a list of Best Practice Recommendations for collecting and verifying self-reported logbook data. Best Practice Recommendations are summarized below:

Recommendation 1:

> Specifies that master lists to identify all for-hire vessels and landing sites should be developed and maintained and serve as the sampling frame for obtaining vessel-trip data from logbooks, identifying non-respondents, and conducting intercept surveys.

Recommendation 2:

> Provides several provisions for implementing the universal use of log-books in for-hire fisheries:

2.1. Recommends that logbook trip reports be required for each trip and specifies types of data to be collected on log-book trip reports, including effort, catch, trip-type and other data as needed for fisheries management.
2.2. Recommends a reporting frequency of no less than weekly for active vessels. Longer periods may be permissible for inactive vessels.
2.3. Recommends web-based electronic reporting as the preferred mode for submission of logbook trip reports, with back-up modes available for vessel-operators with no Internet access.
2.4. Recommends follow-up procedures for non-responding vessels and methods to independently verify fishing status.
2.5. Recommends timely tracking for missing, incomplete, or inconsistent reports and follow-up procedures to maintain compliance.
2.6. Recommends that initial estimates for effort and catch be based on raw logbook data and provides provisions for adjusting initial estimates based on known non-response levels and observed differences between self-reported logbook data and independent verifications, including intercept and at-sea surveys.

Recommendations 3 and 4:

Provides recommendations for sample selection methodologies for dockside intercept surveys specific to the for-hire mode. Sites should be selected with probabilities that are proportional to the size of the primary sample unit (defined as sites), and the time-periods for sampling should be based on fishing practices at the site that are relevant to when vessels (the secondary sampling unit) are expected to return. Also recommends that interviews to verify vessel logbook data should be conducted directly with the vessel operator.

Recommendations 5 and 6:

Defines anglers as the third-stage (tertiary) sampling unit and provides recommendations for collecting samples from anglers' catch.

Recommendation 7:

Recognizes that raw logbook estimates may suffer from non-response and missing or inconsistent data and recommends development of procedures for adjusting raw logbook estimates.

Recommendation 8:

Recommends exploration of double sampling estimation methods through the use of complementary logbook data and intercept data.

Recommendation 9:

Recommends special procedures for large-capacity for-hire vessels (headboats).

These Best Practice Recommendations served as guiding principles for the design and implementation of an MRIP pilot study to test logbook reporting methods in the Gulf of Mexico region. In the Gulf of Mexico, for-hire vessels must have federal permits to fish for reef fish and pelagic fish in the EEZ. Existing permits may be transferred to new owners, but there is currently

a moratorium on the issuance of any new federal permits. Vessels with federal permits must participate in one subsequently approved appropriate data collection system[1] as a condition for annual renewal, and loss of privilege is strong incentive to comply with reporting requirements. Currently, there are three approved regional programs in the Gulf of Mexico that collect data from for-hire fisheries:

1. The Southeast Region Headboat Survey (SRHS), which is administered by NMFS Southeast Fisheries Science Center, includes approximately 75-80 large capacity headboats operating in the Gulf of Mexico from Texas through Florida. Vessels included in this survey are required to report catch and effort on paper log sheets for each trip and submit trip level data monthly to National Marine Fisheries Service. A dockside sampling component collects length and weight measurements from harvested fish for calculating harvest by weight. The logbook program has been ongoing in the Gulf of Mexico since 1986. Logbook reporting compliance at the vessel level is high in the Gulf of Mexico, and pilot studies are currently underway to improve trip-level validation of self-reported data. Electronic reporting was also implemented in 2013.

2. The For-Hire Survey, which includes all for-hire vessels operating in the Gulf of Mexico from Louisiana through Florida that are not already reporting in the SRHS. Federally permitted vessels are required to report all trips taken during selected weeks (effort only) whenever they are randomly selected to participate in the survey. Vessel operators are contacted by telephone to collect this data. Catch data are collected in a separate dockside intercept survey, and there is no requirement for these vessels to participate in that portion of the survey.

3. The Texas Parks and Wildlife Survey, which is a field-intercept survey of boat-based fishing, including for-hire vessels. This survey estimates fishing effort and catch (harvest only) on a seasonal basis.

In the SRHS, all large capacity headboats are selected to participate and vessel operators are required to report 100% of their vessel trips. This data collection method places responsibility for submitting required information directly on the permit holder, and compliance is monitored and enforced as a condition for permit renewal. The obligation to report is periodically reinforced via certified letter to each permit holder. In contrast, the For-Hire Telephone Survey was initially designed to be a voluntary survey and the agent conducting the telephone interviews is responsible for collecting trip information from vessel operators. To enforce the mandatory reporting requirement for federally permitted vessels in the For-Hire Telephone Survey, permit holders who refuse the survey over the phone are notified by letter of their obligation to report as a condition for permit renewal. However, if a vessel operator cannot be contacted after five attempts for a selected week, the final interview status is “unsuccessful contact” and it is impossible to identify permit-holders who are passively evading the survey. Contact rates in the For-Hire Telephone Survey vary by wave (2 month sample period) and by state and region, and the percent of selected vessels that are unable to be contacted by phone is quite high in some strata. For example, during wave 3, 2009, 35% of vessels selected in the Florida Keys and 34%

[1] Participation means being identified in an active survey frame (i.e., universe of captains or vessels from which persons are randomly selected report) and, if chosen, providing the requested information (GMFMC, 2003).

of vessels selected in the western peninsula region of Florida could not be contacted in the telephone survey (GSMFC 2009). The Texas Parks and Wildlife Survey samples vessels fishing in inland, state, and federal waters and estimates from this survey are not directly comparable with the For-Hire Survey. The Texas survey estimates harvest for two sample periods, "high use" and "low use" fishing seasons, which are not easily converted to monthly or calendar year estimates. Because the Texas survey does not collect data on numbers of fish discarded, discarded fish for regional stock assessments must be estimated for Texas using proportions from data collected in other states.

Given the high non-response rates that are unaccounted for in the For-Hire Survey methods, mandatory reporting requirements that are often unenforceable, the need for more complete fishing information and compatible estimates for regional stock assessments, and the urgent need for more timely data for fisheries management, there has been strong support for moving to a new system for for-hire data collection in the Gulf of Mexico. The Gulf of Mexico Fishery Management Council has been presented with multiple industry-supported logbook data collection proposals in recent years, and these groups are urging the Council to implement a regional logbook reporting system specifically for red snapper. In response, the Gulf Council made a motion at their January 2009 meeting to request guidance from the NMFS Southeast Fisheries Science Center and the Marine Recreational Information Program (MRIP) on protocols for validation of self-reported recreational data, and recommended that MRIP establish pilot projects to evaluate and ground truth these protocols. Results of the pilot study presented in this report are intended to guide decisions in the Gulf of Mexico and other regions where data needs for for-hire fisheries are being evaluated.

Goal and Objectives

The goal of this study was to design and test the feasibility of a mandatory census-style logbook methodology for reporting catch and effort by the for-hire fishery in the Gulf of Mexico. Components of the reporting system included:

- Complete census reporting for all selected vessels
- Trip-level reporting of effort, catch (harvest and discards), and area fished
- Electronic reporting with paper reporting option
- Mandatory weekly reporting deadlines
- Independent verification of self-reported effort and catch
- Follow-up protocols for incomplete, late, and missing reports
- Enforceable through non-renewal of federal permits

The objectives of this project were to:

1. Develop a logbook reporting system and pilot test in two regions of the Gulf of Mexico. The pilot test focused on all charter vessels in one small geographic region in Texas and one large geographic region in Florida (Figure 1) that possessed federal for-hire permits for reef fish and/or pelagic fish in the Gulf of Mexico. Headboats that already participate in the SRHS were not required to participate in this pilot logbook reporting system.

2. Conduct outreach to the for-hire industry in each region to facilitate industry support and solicit feedback regarding the proposed methods.

3. Develop protocols and pilot-test methods to track missing and late reports; conduct follow-ups for incomplete, late, and missing reports; and facilitate compliance.

4. Develop protocols and pilot-test methods to independently validate self-reported effort and catch data. Methods in each region included:
    a. Statistically sound sampling methods for dockside validation of harvest.
    b. Statistically sound sampling methods for at-sea validation of discards.

5. Evaluate the reporting system and validation methods based on the following criteria:
    - Response rates
    - Verifiability of self-reported data
    - Timeliness
    - Practicality and industry support
    - Cost efficiency
    - Capacity to produce complementary landings data among regions
    - Capacity to meet reporting requirements and data needs of multiple data users
    - Employs sound statistical methods
    - Capacity to produce reasonably precise estimates at state and regional (within state) levels for stock assessment and fisheries management

METHODS

The description of methods includes six sections. The first section provides background on methods to obtain stakeholder input into the early design phase of this study. The second section describes the study area and process for selecting vessels for mandatory reporting in each of the study regions. The third section describes procedures for vessel operators to report trips in the logbook reporting system and methods for tracking compliance against weekly reporting deadlines. The fourth section describes procedures for independently verifying information reported through the logbook reporting system. The fifth section describes how data collected during this study were analyzed. The sixth section describes the methods used to survey participants at the end of the mandatory reporting requirement.

1. Stakeholder Input

In August, 2009, a stakeholder workshop was held in New Orleans to define requirements for a MRIP-funded pilot electronic logbook reporting system for the Gulf of Mexico for-hire fishery. The workshop included representatives from the for-hire industry from each state in the Gulf of Mexico, state resource management agencies, Gulf States Marine Fisheries Commission, Gulf of Mexico Fisheries Management Council, and federal fisheries managers and stock assessment scientists. The workshop was also open to public viewing and input via the Internet. Audio and visual equipment and technical support were provided by Gulf States Marine Fisheries Commission. The live broadcast was announced prior to the workshop through an MRIP Newscast, and was also announced at the August Gulf of Mexico Fisheries Management Council meeting. Participants included for-hire industry representatives that were otherwise unable to

participate in person, as well as interested parties from various resource management agencies around the country. A live chat room enabled online participants to post comments and ask questions that could be addressed during the workshop. Recommendations generated during this workshop were used to guide the design of this pilot study, and details of the workshop were summarized (see report in **Appendix A**).

2. Study Region and Vessel Selection

Two regions of the Gulf of Mexico were selected for this pilot study: the Corpus Christi/Port Aransas region of Texas and the panhandle region of Florida (**Figure 1**). These two regions were chosen so that results could be compared and contrasted between small and large geographic areas. The NOAA Permits office provided a list of all federal permit holders for Gulf of Mexico for-hire reef fish and coastal pelagic fish, and all vessels for which the home port fell within in the study region were selected for the study, with the exception of vessels that were already required to report logbook trip reports in the Southeast Headboat Survey. Most vessels selected for the study have passenger capacities ranging from 6 to more than 20 anglers. A master participant list was generated, which contained the state or federal documentation number; vessel name; home port city; and the name, physical address, and telephone number of the vessel owner/permit holder for each vessel selected in the study area.

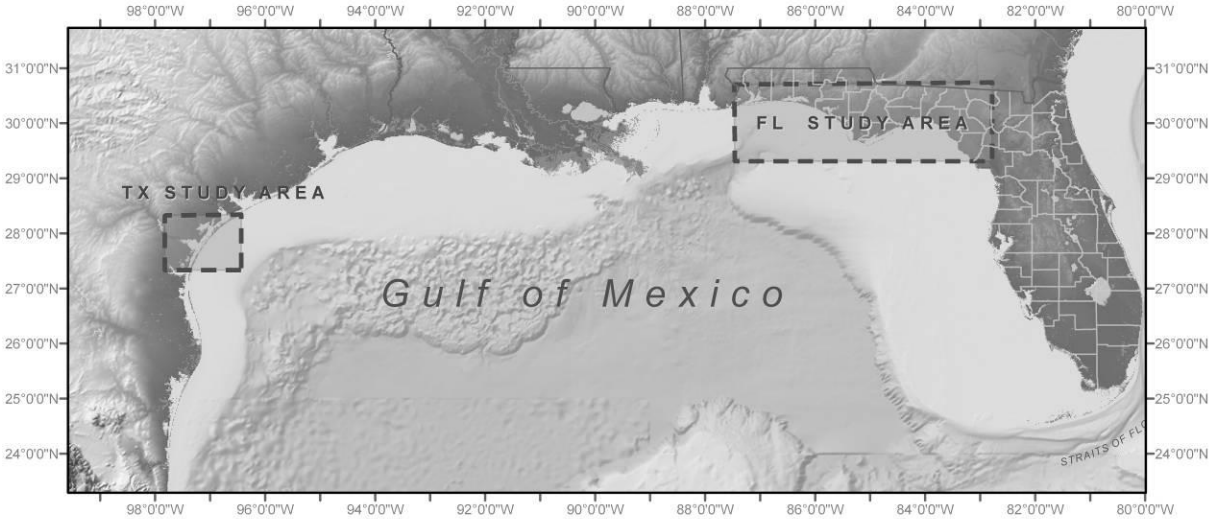


Figure 1. Study areas in the Gulf of Mexico. The Florida study area included vessels with a home port in the region encompassing Escambia County east to Dixie County and the Texas study area included all vessels with home port cities in the area surrounding Corpus Christi.

On June 1st, 2010 letters from the Regional Director of NMFS Southeast Fisheries Science Center were sent via certified mail to each permit-holder on the master participants list. The letter served to notify permit holders of their selection to participate in the logbook pilot program and the requirement to report activity or inactivity for each permitted vessel on a weekly basis beginning September 1, 2010 (letter is provided in **Appendix B**). Many Florida vessel owners who were participating in the Vessel of Opportunity Program during the summer of 2010 following the Deepwater Horizon oil spill (April 20, 2010) were difficult to contact initially, and required multiple attempts for successful delivery of their notification. Upon delivery for each certified letter, a signed and dated receipt was returned to Gulf States Marine Fisheries

Commission (GSMFC) by the U.S. Postal Service. Included in the letter were details on public meetings being held in their area, contact information to register for electronic reporting, and contact information for GSMFC. Permit-holders who contacted GSMFC regarding vessels that had recently moved out of the study area or permits that were transferred to another vessel outside the study area were removed from the study on a case-by-case basis. As receipts were returned, GSMFC entered the signature date for each vessel in the master participant list to track when representatives received their notification letter to begin reporting. Undelivered certified letters were returned to GSMFC and a list was sent to the state coordinators, who attempted to contact permit owners to verify their mailing address. Once the correct address was obtained, GSMFC mailed the certified letter again. In a few cases, certified letters were hand delivered by state Agency staff or Law Enforcement and signed and dated receipts were returned to GSMFC. The master participant list was checked against NOAA's permit list each month. Permits that were transferred to new vessels in the study area were added to the master list and permit owners were sent certified letters notifying them of the date they were required to begin reporting for the new vessel. There were two reasons an existing vessel in this study may not appear on an updated permit list provided by NOAA: 1) the permit was transferred to another vessel (either inside or outside of the study area); or 2) the permit renewal application was not approved by NOAA prior to the permit expiration date, in which case the permit owner was given up to one year from the expiration date for the permit to either be approved for renewal or revoked. In either case, the vessel was not permitted to participate in the federal reef fish and/or pelagic for-hire fishery in the Gulf of Mexico and the vessel was marked "inactive" on the master participant list. Inactive vessels were only reactivated in the pilot study if they reappeared on an updated permit list provided by NOAA. Inactive vessels were not required to report during the period in the study that they were listed as inactive, and they were also not tracked for reporting compliance during that period.

3. Vessel Trip Reporting Procedures

The following section summarizes reporting procedures for submitting logbooks. It also describes compliance tracking and follow-up procedures used to identify and reconcile delinquent reports on a weekly and monthly basis, as well as procedures for placing holds on permits for not submitting logbooks. These methods were developed to track and quickly identify missing and late reports with timely follow-up procedures to maintain compliance and timely reporting.

Reporting Frequency

Mandatory reporting authority in the Gulf of Mexico comes from Federal regulation (50 CFR 622.5(b)(1)(i) and (ii)) which specifies that charter vessels with certain federal permits for pelagic and reef fish species or vessels that fish for those species in waters adjacent to the EEZ may be required to report on a weekly basis if selected by the Southeast Regional Director (NMFS). Based on this authority, logbook participants selected for this study were required to report all for-hire recreational trips or inactivity on a weekly basis, Monday through Sunday, with the reports due the following Sunday. Vessels that were actively charter fishing were required to submit trip reports for each individual trip, including when more than one trip was taken in a given day. If a vessel was inactive (not charter fishing), vessel operators were required to report inactivity (zero trips) for each week and were allowed to report weekly inactivity up to one month in advance. Inactivity reports were not required for individual days within a week;

therefore, missing reports were defined as any week that a vessel operator did not either 1) report inactivity for the entire week or 2) report at least one trip within that week.

Electronic Reporting

Bluefin Data Incorporated was contracted to develop a secure internet website for permit holders to report trips and inactivity (www.gulflogbook.com). Participants were instructed to contact Bluefin Data to register and gain password access to the Gulf Logbook website. If a caller indicated they were unable to report electronically, the person was provided with contact information for the appropriate state Agency representative to request paper logbook trip reports. Bluefin Data used the master participants list provided by GSMFC to verify that a vessel was selected for the study before sending the vessel representative an email message with a unique access code, which allowed entry into the website. A User's Manual (**Appendix C**) and instructive video were available to users of the website upon successful registration with their access code. The website allowed registered permit holders to manage permissions for designees, such as vessel captains, to report vessel activity or inactivity for their vessels. Trip reports could be saved and edited by the registered user; however, once trip reports were submitted, users could only view the records and editing was no longer permitted. If a submitted record needed to be corrected, users were required to contact state agency personnel with administrative privileges who could make changes to submitted records at the request of a user. Trip reports were date-stamped to indicate the date the report was entered and saved by the user and the date it was submitted.

In June 2011, a smart phone application called iSnapper was made available by the Harte Research Institute based in Corpus Christi, TX. A description of the application is provided on their website at www.harteresearchinstitute.org/isnapper. The application was designed in cooperation with MRIP to collect the same information that was provided by charter vessel operators through the Gulf Logbook Website. Ten vessels that were selected to participate in the Gulf Logbook study (7 in Texas and 3 in Florida) were recruited to pilot test the iSnapper application. For those ten vessels, logbook data were submitted by vessel operators directly through iSnapper rather than logging onto the Gulf Logbook website. Data received through iSnapper was delivered to Bluefin Data Inc. for inclusion in the Gulf Logbook database.

Paper Reporting Option

For participants that contacted Bluefin Data Inc. during the registration process and indicated that they were unable to report electronically, they were instructed to contact the state coordinator for the state where the vessel operates from to obtain paper logbook reporting forms. Participants that were unwilling to report electronically were also given the option to report with paper logbooks to ensure that they were given every opportunity to be compliant with reporting requirements. Paper logbooks, instructions and a binder were mailed to paper logbook participants at the beginning of the pilot and as needed throughout the duration of the study (Paper logbook data sheets and instructions located in **Appendix D**). Participants were instructed to fill out paper logbook reports for each fishing trip, or indicate inactivity on a single logsheet for each reporting week, and mail completed logs to the state coordinator postmarked within seven days of the end of the reporting week. The state coordinator then checked for errors, contacted participants to verify corrections and entered the paper reports into the Gulf Logbook website using an administrative access code provided by Bluefin Data Inc.

Fishing Area
For each reported trip, vessel operators were required to report the primary area where fishing took place. For consistency, the fishing areas chosen for reporting charter fishing activity in this study match the fishing areas used by commercial harvesters throughout the Gulf of Mexico to report where fish were harvested from. Printed copies of fishing area maps and codes were provided to participants during public meetings and were mailed to participants that chose to report with paper log sheets (provided in **Appendix E**). A link to the map was also provided on the Gulf Logbook website and a drop-down menu provided a list of areas and codes applicable to the study area.

Compliance Tracking and Follow-Up for Non-Response
A routine process was developed to identify vessels with missing trip reports and conduct follow-up with vessel operators in a timely manner. The process that was employed during this pilot study included multiple stages of communication with logbook participants and required a high degree of communication between state, regional and federal agencies (**Figure 2**). The intent of this process was to insure that participants had ample opportunity to successfully submit missing reports in a minimal time-period, with active enforcement employed as the last resort.

To track weekly compliance, GSMFC downloaded trip reports and inactivity reports from the electronic reporting tool and compared those reports to the master participant list in order to identify vessels for which reports were outstanding. Compliance reports included vessels that had not registered for electronic reporting or requested paper logbooks, as well as vessels that were reporting but for which one or more weekly trip reports were outstanding (identified as missing reports). Compliance reports were generated on a weekly basis and each report began with the first week reporting was required (Sept. 1, 2010) up to the most recent reporting week. Compliance reports were re-generated each week to reflect reports that were received one or more weeks late.

After the first five weeks of the pilot study, compliance reports identified 114 vessels from Florida which received certified letters prior to the beginning of the September 1, 2010 reporting requirement that had not submitted any trip reports. Many of these vessels remained unregistered for electronic reporting or had not contacted their state Agency representative for paper logs. This was due in part to the initial difficulty contacting vessel owners that were participating in the ongoing Vessel of Opportunity Program for clean-up response following the April 2010 Deepwater Horizon event in the Gulf of Mexico. State Agency staff in Florida attempted to contact all representatives of unregistered vessels through January 2011 and assisted willing participants with registration and reporting as needed. In December 2010, a second (non-certified) letter signed by the Regional Administrator for the NMFS Southeast Regional Office was sent to non-compliant permit holders. This letter served as a final courtesy to inform permit holders of their requirement to report and consequences for continued non-compliance (letter is provided in **Appendix F**). In February 2011, the first official list of non-compliant permit holders was provided to NMFS Southeast Fisheries Science Center and the NMFS Southeast Regional Office. No further attempts to contact non-compliant permit holders were made by state Agency representatives.

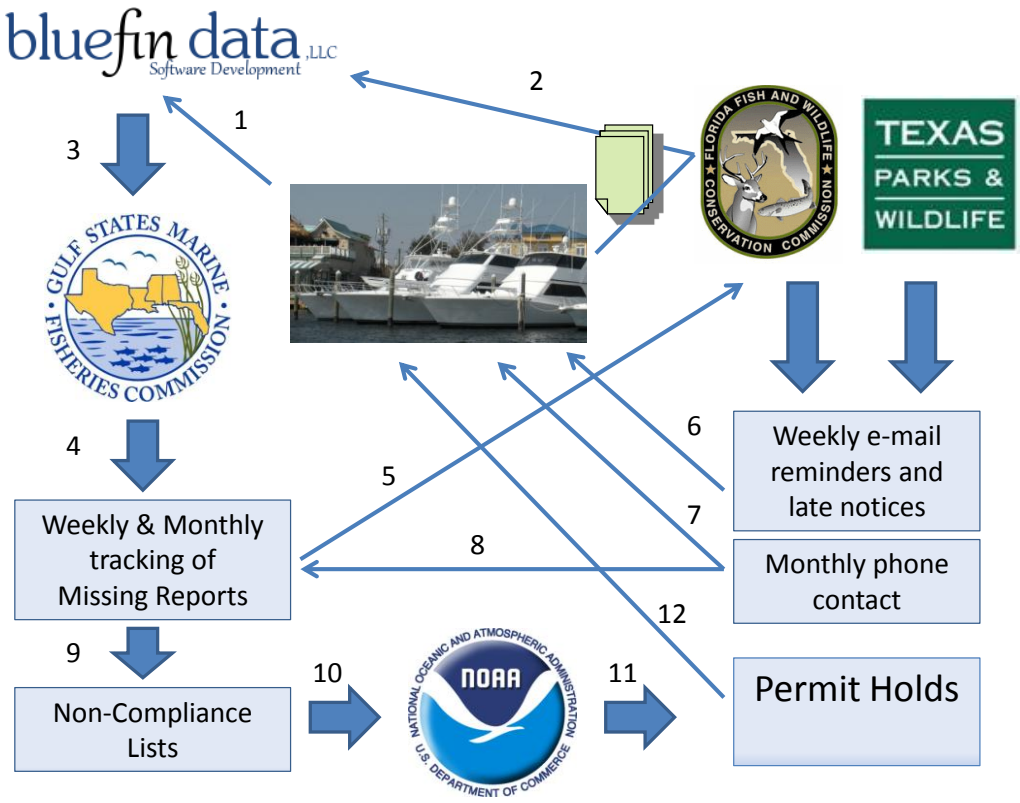


Figure 2. Gulf Logbook reporting system. Vessel operators reported weekly fishing activity electronically on the Gulf Logbook Website maintained by Bluefin Data (1). Alternatively, paper log sheets were filled out weekly by vessel operators and entered electronically into the Gulf Logbook Website by State Agency staff (2). Data were downloaded weekly by Gulf States Marine Fisheries Commission (3) and lists of delinquent vessels were developed (4) and sent weekly and monthly to State Agency staff (5). State Agencies contacted vessel operators to remind them of reporting deadlines and notify them of missing reports via weekly email notices (6). State Agencies also contacted vessel operators via telephone to notify them of delinquent reports at the end of each month (7) and notified GSMFC of vessels that remained non-compliant (8). Each month, GSMFC compiled a list of vessels identified as non-compliant (9) and provided the list to National Marine Fisheries Service (10). NMFS placed holds on federal permits for vessels identified as non-compliant (11). Vessels were removed from the Non-Compliance List during the week that missing reports were received through the Gulf Logbook Website (3). As permits expired for vessels on the Non-Compliance List, permit holders were informed by NMFS of their reporting requirement (12) and permits were not renewed until missing reports were received through the Gulf Logbook Website (3).

For vessels that were registered and successfully reporting either electronically or via paper logbooks, a bulk e-mail system developed by Bluefin Data was used by state coordinators to routinely generate weekly e-mail reminders to registered participants in the Gulf Logbook website. Weekly reminders served to notify participants of the current reporting week and reporting deadline. State coordinators also used weekly compliance reports generated by

GSMFC to notify participants of outstanding reports for their vessel(s) via weekly email notifications. At the beginning of each new month, state coordinators attempted to contact representatives by telephone regarding vessels for which reports remained outstanding for one or more weeks during the previous month. At least three telephone attempts were made during the new month to contact vessel representatives and notify them of outstanding reports. At the end of the new month, vessels that still had outstanding reports for the previous month were considered to be out of compliance. These vessels were included in an updated list of non-compliant vessels that was maintained by GSMFC and provided to NMFS at the end of each one-month calling-cycle.

Beginning in February 2011, the NOAA Permit Office at NMFS Southeast Regional Office was notified to check the Gulf Logbook non-compliance database before renewing federal for-hire permits for Gulf of Mexico reef fish and coastal migratory pelagics. If a vessel was determined to be out of compliance, a cover letter was generated by the Permit Office informing the applicant of the reporting deficiency and applicants were instructed to contact NMFS staff to resolve the deficiency. When contacted, NMFS staff explained the logbook reporting requirements, informed them of all weeks for which reports were outstanding, and directed permit-holders to the appropriate contact person for resolving logbook discrepancies. The applicant was given 30 days to resolve the deficiency. If the deficiency was not resolved within 30 days, then the permit application was abandoned and the applicant was required to re-apply for permits. Each week, GSMFC provided an updated list of vessels that cleared and were removed from the non-compliance list to the Permit's Office and SEFSC. Once a non-compliance vessel was cleared, all holds were lifted and the permit(s) could be issued.

Quality Assurance and Quality Control

Bluefin Data Inc. worked closely with GSMFC and state coordinators to make any changes necessary for the website to run effectively. Error checks were incorporated into the Gulf Logbook website at the start of the pilot study and additional entry restrictions were added to various fields as reporting errors in electronic logbook submissions were discovered. Examples of built-in restrictions included requirements that a field be entered before allowing the user to move to the next field or screen, restrictions on reporting trips into the future, not allowing users to enter multiple trips within the same time frame, not allowing hours fished to be greater than the trip length, and not allowing multiple records of catch for the same species to avoid duplicate entries.

Logbook data were downloaded weekly and run through a quality control checking program every month developed by GSMFC. The program identified missing values for number of anglers and passengers on the vessel, whether hours fished was greater than dock to dock hours, whether minimum depth fished was greater than the maximum depth fished, and whether trips were coded as multiday trips with a low number of fishing hours. Records with grossly large harvest numbers for individual species that might indicate a key entry mistake and species records that might be unusual for that area of fishing were also flagged. Restrictions were added to later versions of the Gulf Logbook website to prevent these errors in future reports. Error reports were delivered to each state and attempts were made to contact vessel operators and determine if corrections were necessary. When errors were confirmed state biologists with

administrator level privileges logged into Gulf Logbook and made the changes. GSMFC downloaded the edited records and applied those to the master data file.

End of Reporting Period

Near the end of the study period, permit owners were notified by letter, email, and personal contact (if necessary) and informed that they were no longer required to report vessel trips after August 31, 2011. A notice was also posted on the front log-in page of the Gulf Logbook Website. After the reporting deadline for the last fishing week, participants continued to have full access to the website to view submitted reports and submit late trip reports. Participants were also allowed to continue reporting on a voluntary basis.

Participant Feedback

Two surveys were developed to gain feedback from the Gulf Logbook participants, one for electronic reporters and one for paper reporters (**Appendix G**). The survey for electronic reporters was made available on Survey Monkey, and a link to the electronic survey was posted on the front log-in page of the Gulf Logbook Website, e-mailed to registered participants, and provided on a reminder postcard mailed at the end of the pilot study. This survey focused on questions related to reporting electronically, along with questions about the logbook pilot study in general. The survey for paper reporters was printed on paper and mailed to participants along with a self-addressed and postage-paid envelope to encourage participant feedback. The paper survey included questions pertaining to the reason(s) participants chose paper logbooks over electronic reporting and the importance of receiving postage-paid envelopes for returning paper logbooks, in addition to general questions about the logbook pilot study.

4. Validation Procedures

Validation procedures are critical to assessing the accuracy and completeness of submitted logbook reports. This section describes procedures for validating catch and effort dockside and at-sea. Methods for validating vessel activity are also discussed. Data obtained from validation sampling was then compared with logbook reports to determine how closely they compared.

Dockside Validation of Logbook Trip Reports (Catch and Effort)

A list of known docking sites for vessels selected to report in the pilot study was created using information collected for each vessel in the master participant list. Each unique site was listed in the site register and given a unique id code based on the state, county, and a 4 digit random site code. Other information contained in the site register included site location descriptions, site telephone numbers, contact person at the site, and GPS location coordinates. Field intercept assignments for dockside validation of catch were selected from the list of known sites each month for each region (Florida and Texas). The number of vessels selected to report in the pilot study was tallied at each site and probability proportional to size (PPS) sampling with replacement, available in the SAS Survey Select procedure, was used to randomly select sites weighted by the number of vessels at each site. This method is used in statistical sampling designs where sample clusters (in this study, sites where charter vessels dock) differ widely with respect the number of sample units (charter vessels) contained within them (Levy and Lemeshow, 1999). PPS sampling selects sites with a higher number of vessels more frequently and prevents potential sample bias by insuring that vessels at low pressure sites did not have a higher probability for selection. The goal for dockside sampling was to complete 200 sampling

days in Florida and 100 sampling days in Texas. Sample days were distributed across months and weekend/weekday strata giving more weight towards high fishing activity periods (summer and weekends). The number of sample days was input into the SAS program each month. Additional sample days were selected each month to provide states with reserve assignments that could be completed if manpower was available. Sites were randomly selected and then assigned a random number corresponding to a weekend or weekday within the month. The final draw files were provided to the states monthly. Additional variables were included that allowed states to enter the sampler name, sampler id number, and the number of dockside interviews collected for each completed assignment. These draw files were returned to GSMFC at the end of each month and GSMFC generated tallies of the number of completed assignments and successful interviews.

During an assignment, field samplers were instructed to arrive at the assigned site at least one hour before half-day charter fishing trips were expected to return. For sites where overnight fishing trips take place, field staff would call or visit the site the day before the assignment to determine if overnight trips were returning and arrive on site early if necessary to intercept those vessels. Upon arrival, samplers would survey the site and attempt to locate each vessel that was listed on the vessel register for that site. Each vessel at the site was recorded on the Assignment Summary Form (**Appendix H**) and coded as one of the following:

1 = vessel in
2 = vessel out, charter fishing (this must be verified)
3 = unable to validate (vessel sold, moved to unknown location, etc.)
4 = vessel out, NOT charter fishing (this must be verified)
5 = vessel out, fishing status unknown (use when unable to verify the fishing status)

For vessels that were coded as 2 (out charter fishing), the field sampler would attempt to verify the expected return time and record this time on the Assignment Summary Form.

As each vessel returned from fishing, the sampler recorded on a separate Dockside Intercept Survey Form (**Appendix H**) the vessel name, vessel ID number, and the return date and time. Samplers would first approach the vessel and ask the operator for permission to weigh and measure harvested fish. If the operator refused, the interview was coded as a refusal and the sampler would move to the next vessel. When permitted to inspect the catch, the sampler recorded the total number of fish for each species observed on the survey form and recorded length at the mid-line (mm) and weight (kg) of whole fish. After the catch was inspected, the field sampler would conduct the remainder of the interview in person with a crew member (captain and/or mate). If crew members were busy with their customers, samplers were permitted to collect catch data from a nearby vessel and come back to complete the in-person interview immediately after. It was important to conduct interviews directly with vessel operators, rather than with charter vessel clients, since the purpose of the dockside validation was to measure recall error and bias in trip data recorded by vessel operators on logbook trip reports that were not due for submission until up to two weeks after completion of the trip.

During the in-person interview, samplers recorded the following information:

- Departure date
- Departure time

- Number of passengers (fishing and non-fishing, not including crew)
- Number of anglers (total number of passengers that fished at any time during the trip)
- Number of crew, including captain
- Target species
- Primary area fished (crew were asked to identify the statistical area where the majority of fishing took place during the trip using statistical maps provided)
- The minimum and maximum depths (in feet) fished for the trip
- The percent of fishing time spent fishing in federal waters, state waters, and inland waters
- Primary fishing methods (bottom fishing, drifting, trolling, spear fishing)
- Hours fished (number of hours spent with gear in the water)
- For each species released or could otherwise not be observed by the field sampler, the total number released for each disposition:

  1 – Thrown back alive, ≤120' of water
  2 – Thrown back alive, >120' of water
  3 – Eaten/plan to eat
  4 – Used for bait/plan to use for bait
  5 – Sold/plan to sell
  6 – Thrown back dead/plan to throw away
  7 – Other purpose

Samplers were instructed to remain on site until the last vessel that was verified as out fishing and expected to return that day was intercepted. If the last expected vessel did not arrive as anticipated, the assignment could also be terminated. Prior to leaving the site, the sampler recorded the time the assignment was completed and, for each vessel listed on the assignment summary form, the final interview status was coded as:

1 – Questionnaire completed
2 – Refused observed catch
3 – Missed interview
4 – Vessel did not return
5 – Vessel did not fish

Below is an example of how the status of each vessel was recorded on the Assignment Summary Form at the end of a completed assignment:

Vessel ID Number	Vessel Name	Status on Arrival	Expected Time of Return from Fishing	Final Interview Status
1209999	Bandit	2	1600	1
1200000	Rebel	1		1

The first vessel was out fishing when the sampler arrived on site and the interview was completed when the vessel returned from fishing. The second vessel was in the slip on arrival at the site and was still in the slip when the sampler ended the assignment.

Validation of Vessel Activity and Inactivity (Effort)

Validation of vessel activity (or inactivity) is critical to determining compliance with logbook reporting requirements. Information on whether or not a vessel was in or out of port on a particular day can be matched with logbook records to determine if vessel activity was accurately reported. To validate vessel activity and inactivity before reporting in the logbook reporting system, sites in Florida were clustered and assigned to one of six vessel activity validation regions (**Table 2** and **Figure 3**). Vessel activity validation regions were of sufficient size that all sites within the selected region could be visited within a 6 to 8 hour time period, including driving time. Five vessels in the far eastern region of the Florida study area (Florida F) were clustered into one vessel activity validation region, and the remaining sites were clustered into vessel activity validation regions that contained between 30 and 71 vessels (**Table 2**). Up to three sample regions in Florida were selected each week using simple random sampling without replacement, available in the SAS Proc Survey Select Procedure. Control numbers were assigned by GSMFC and one to three vessel activity validation regions were assigned in order of their control number to available field staff in Florida. The study area in Texas was much smaller than Florida (**Figure 1**) and all sites in this region could be visited within a 6 to 8 hour time period. Therefore, all sites in Texas were clustered in a single region that was validated each week.

During a scheduled vessel activity validation assignment, the field sampler would visit all sites within a selected vessel activity validation region and attempt to verify the fishing status for all vessels at each site within that region. The sampler recorded the fishing status and time for each vessel on a Vessel Status Validation Form (**Appendix H**) and then entered data into an online database. The following codes were used when pre-validating a vessel:

1-Vessel in
2-Vessel out, charter fishing (must be verified)
3-Unable to validate
4-Vessel out, not charter fishing (must be verified)
5-Vessel out, status unknown

If possible, the sampler verified the fishing status with someone at the dock or in the booking booth. If unable to verify the fishing status of a vessel, the sampler would use code 5.

Table 2: Vessel activity validation regions and number of vessels assigned to each region at the start of the study (August, 2010). See **Figure 3** for map of sample regions.

Sample Region	County	Number of Sites	Number of Vessels
Florida, A	33	13	30
	113	0	0
Florida, B	91	8	49
Florida, C	91	7	52
	131	1	1
Florida, D	5	12	71
Florida, E	5	3	6
	45	2	7
	37	9	20
	129	4	8
	65	0	0
Florida, F	123	2	3
	29	1	2
Texas	1	6 ports	58

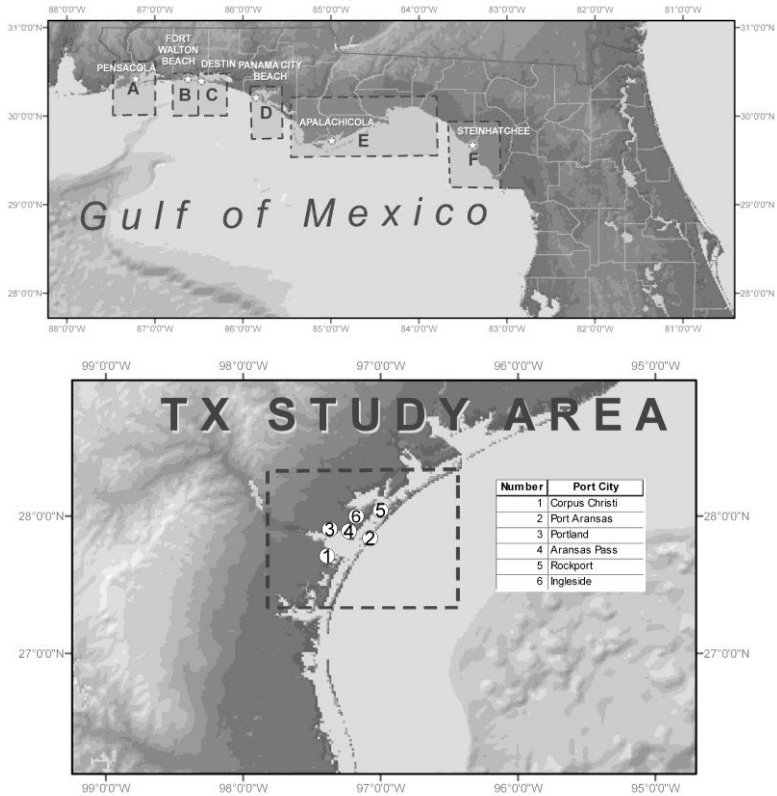


Figure 3. Vessel activity validation regions in the Florida study area (top figure, see **Table 2** for counties and numbers of sites and vessels included in each cluster designated by capital letters) and sites included in the single vessel activity validation region in Texas.

At-Sea Validation of Logbook Data

In order to directly validate self-reported logbook catch data for released fish, vessels in both regions were randomly selected to voluntarily carry at-sea observers during selected for-hire fishing trips. Neither state has authority to require that observers be accommodated on for-hire vessels.

In Texas, vessels were randomly selected from the master participant list each week to carry an at-sea observer during one scheduled recreational for-hire fishing trip. Prior to each month's draw, Texas biologists provided updates as to which vessels were actively fishing during the upcoming month. Boats that were inactive were not included in the monthly draw. In Florida, at-sea observers have been deployed on charter vessels since June, 2009. Vessels were not randomly selected from the master participant list as they were in Texas due to the established effort in Florida to identify charter vessels that were both active in the fishery and cooperative in at-sea surveys. A total of 107 active charter vessels selected to report via logbook trip reports in this pilot study also voluntarily participate in at-sea observer surveys in Florida. Vessels from this list were randomly selected each week to carry an at-sea observer during one scheduled recreational for-hire fishing trip.

The goal for at-sea sampling was 50 at-sea trips in Texas and 80 at-sea trips in Florida during the 12 month study period. Sample days were distributed across months and weekend/weekday strata, with more weight given to months with high fishing activity. The number of randomly selected sample days was input into the SAS program each month. Simple random (SRS) sampling (without replacement), available in the SAS Proc Survey Select procedure, was used to randomly select vessels each week and a monthly schedule of selected vessels was provided to field staff. Field staff attempted to contact vessel representatives prior to the week selected and arrange to accompany the fishing party during a scheduled charter fishing trip. Additional vessels were selected each week to provide field staff with the opportunity to contact alternate vessels if the primary selected vessel was not fishing or unable to take a biologist on the trip.

During at-sea trips, observers collected data that could be used to validate trip information self-reported by vessel operators in the logbook system. For each sampled trip, observers recorded the vessel name; date and time of departure and return; and the number of passengers, anglers and crew. Within a sampled trip, the approximate latitude and longitude, species targeted, and depth fished was recorded at each individual fishing station. Observers attempted to monitor every angler onboard a sampled vessel as they recreationally fished. Observers were typically instructed by the mate or captain as to where they could set up their sampling equipment on the vessel without disrupting fishing activity. Since some vessels were permitted to carry more than 10 passengers, observers were not always able to monitor every angler in the party. If all anglers could not be effectively monitored, observers selected the maximum number of anglers stationed within their line of sight that they could monitor for 100% of their fishing time. For each angler monitored, observers recorded the total fishing time and the number of discarded and harvested fish for each species caught, and also recorded lengths (mm measured at the midline) for as many harvested and discarded fish as possible.

At the end of each month, staff from Texas and Florida sent a tally of completed assignments to GSMFC, which included the sample date, names and identification codes for assigned observers, number of anglers on board and number of anglers observed. A reason was also provided for each selected vessel that was not sampled (i.e. vessel had no scheduled trips during selected week, no room for observer, primary vessel was successfully sampled and alternate vessels not used, etc.).

Quality Assurance and Quality Control
Validation data were processed through an error checking program to identify duplicate entries, missing values, values which fell outside an acceptable range, and other general data entry errors. Fish lengths and weights were compared to 95% confidence intervals for length regressed against weight to identify outliers. At-sea data sheets were reviewed and edited prior to electronic data entry, and electronic data proofed for key entry errors. Potential errors were reviewed by Florida and Texas state coordinators and corrections were made if possible.

5. Statistical Analyses

Statistical consultant support was contracted through Marine Resources Assessment Group Americas (MRAG Americas) based in Saint Petersburg, Florida. Analyses included direct comparisons between self-reported logbook data and field validations and Monte Carlo simulations to determine optimum field validation sample sizes. Methods are described in four reports submitted to the MRIP Logbook Pilot Project Team and are included as appendices to this document (**Appendices I-L**). Results presented in the appendices are preliminary, and figures and tables presented in the following results section have been updated with additional data from the consultants and represent final results for the pilot study. While figures and tables presented in this document may differ from those in **Appendices I-L**, the conclusions did not change.

6. Stakeholder Survey

At the conclusion of the logbook reporting requirement for this pilot study, participants were asked to complete a survey. Two surveys were developed to gain feedback from the Gulf Logbook participants, one for electronic reporters and one for paper reporters (**Appendix G**). The survey for electronic reporters was made available on Survey Monkey, and a link to the electronic survey was posted on the front log-in page of the Gulf Logbook Website, e-mailed to registered participants, and provided on a reminder postcard mailed at the end of the pilot study. This survey focused on questions related to reporting electronically, along with questions about the logbook pilot study in general. The survey for paper reporters was printed on paper and mailed to participants along with a self-addressed and postage-paid envelope to encourage participant feedback. The paper survey included questions pertaining to the reason(s) participants chose paper logbooks over electronic reporting and the importance of receiving postage-paid envelopes for returning paper logbooks, in addition to general questions about the logbook pilot study.

RESULTS

Results are reported in six sections. The first section presents results for the logbook trip reporting system used by vessel operators in this pilot study. The second section presents results on the productivity of validation assignments and the proportion of trips reported through the logbook trip reporting system that were validated (validation rate) during this study. The third section presents results of comparisons between validation records and logbook trip reports to evaluate the accuracy of submitted reports. The fourth section evaluates the sample sizes that were achieved during field validations in this study to determine if they were adequate, inadequate, or could be reduced to lower the cost if this method were implemented in the future. The fifth section provides information on the cost for conducting this pilot study as it was designed and tested. The sixth section presents results of a survey with participants conducted at the end of the pilot study.

1. Reporting Tools, Compliance, and Timeliness

The Gulf of Mexico For-Hire Electronic Logbook Pilot Study officially began September 1, 2010 and ended August 31, 2011. At the start of the pilot study, 358 charter vessels in Florida and 58 charter vessels in Texas were selected to report. In the Florida study area, 36 vessels were non-cooperative and submitted zero trip reports or inactivity reports during the 12 month period, and all selected vessels in the Texas study area were cooperative. The majority of vessels reported electronically through the Gulf Logbook website maintained by Bluefin Data (**Table 3**). In Florida, 73 vessels opted to submit paper logbook reports, which were entered electronically into the Gulf Logbook website by state representatives. Most vessel operators that were provided with paper forms indicated during the registration process that they were unable to report electronically (no computer/internet access or stated they were not capable of operating a computer), and a small number requested paper forms after they were registered to report electronically. In June 2011, 10 vessels recruited to a pilot study initiated by Texas A&M and switched to submitting weekly reports through the iSnapper smart phone application (**Table 3**). Trip reports submitted through iSnapper were delivered by Texas A&M to Bluefin Data for inclusion in the electronic database.

Table 3. Number of vessels that submitted weekly reports by reporting method (note, some vessels used more than one reporting tool over the course of the 12 month study). A total of 358 vessels from Florida and 58 vessels from Texas were selected to report at the beginning of the pilot study.

Reporting Tool	Texas	Florida
Gulf Logbook website	54	252
iSnapper smart phone application	7	3
Paper forms	0	79
Refusals (no submitted reports)	0	36
Ineligible, dropped from study	9	24

A significant number of reports were submitted through iSnapper with missing values for hours fished, numbers of fish released or caught, and the minimum depth fished (**Table 4**). Reports entered through the Gulf Logbook website could not be submitted unless a value was entered for these fields. Consequently, trips reported through iSnapper were not included in several analyses reported here and were only a small portion of the total trips reported through the Gulf Logbook

Reporting System. In any future electronic logbook reporting system with multiple data entry applications, consistent data entry restrictions should be incorporated into each application.

Table 4. Total number of trips reported through the iSnapper smart phone application, and numbers of reported trips with missing values for select required data fields.

	Texas (7 vessels)	Florida (3 vessels)
Total number of iSnapper reported trips	135	122
Reported trips missing hours fished data field	10	20
Reported trips missing released or harvested fish data field	7	12
Reported trips missing minimum depth data field	10	8

The amount of effort required to register vessels and achieve compliance at the beginning of this study was not anticipated. After the first five weeks of the pilot study, there were 114 vessels selected in the Florida study area for which zero trip reports were submitted, and a large effort was made by state agency staff during the initial months of the pilot to contact permit holders and assist them with starting weekly reporting. If a vessel was not registered on the Gulf Logbook website and had not contacted their state agency to receive paper log sheets, staff made multiple attempts to contact a representative of the vessel by telephone or in person (dockside). Some vessel operators were difficult to contact because they were participating in BP's Vessel of Opportunity Program following the 2010 Deepwater Horizon event, and multiple attempts were necessary for successful contact. During successful contacts, operators of many unregistered vessels did not understand that they were required to report because their vessel was used solely for commercial fishing or was otherwise inactive in the for-hire fishery. In some cases, the permit holder was not the primary vessel operator and details about the reporting requirement were not communicated to the person or persons who were most knowledgeable about the fishing activity of the vessel(s). Making personal contact and providing assistance often cleared up these types of issues and resulted in successful reporting and compliance. For operators registered to report electronically, technical support was available from staff at Bluefin Data by phone and email to provide assistance with the reporting start-up. Some vessel operators also required personal assistance from state personnel before they could begin completing paper log sheets.

In the third month of the study (December 2010), permit owners for non-reporting vessels in Florida received a final courtesy letter signed by the NMFS Regional Administrator informing them again of their requirement to report. In February 2011, any vessel that had not submitted a single trip report or inactivity report was considered non-compliant and NMFS placed holds on those federal permits. Once a vessel was non-compliant, the permit holder was not contacted again until they submitted an application with NMFS to renew a federal permit. **Figure 4** shows the number of non-compliant vessels in the months following the courtesy letter and permit holds, and the decrease in non-compliance through the end of the study period. Applications to renew federal permits are submitted to the NMFS Southeast Regional Office and a permit is valid for one year following the date of renewal. For permits that expired between February and August 2011, those permits with holds placed on them were not renewed until delinquent reports were submitted. Permits for non-compliant vessels that expired prior to February 2011 were renewed before a hold was in place and notification to those vessels continued as their permits

expired after the close of this study. As of the writing of this report, there have been no permits that could not be renewed as a result of non-reporting in this study.

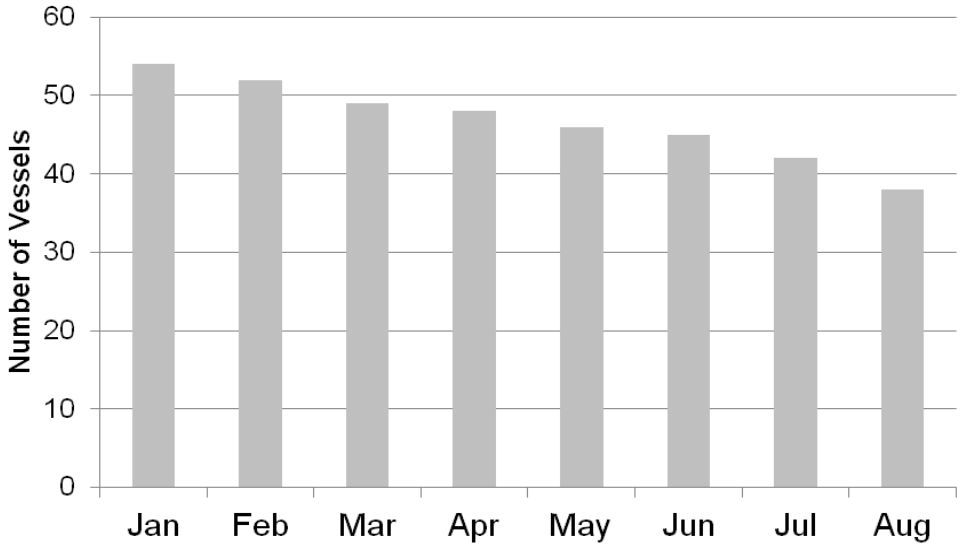


Figure 4. Number of vessels in Florida that were not reporting through the Gulf Logbook reporting system during all weeks between January 1, 2011 and the end of the pilot study (August 31, 2011). A final warning letter to non-cooperative permit-holders was mailed in December 2010 and the first holds were placed on federal permits in February 2011.

Reporting timeliness was tracked weekly for the duration of the 12 month study. Note in this report that each reporting week is numbered sequentially, starting with week 1 beginning in January 1 of a calendar year through week 52, the last week in a calendar year. Reporting weeks for this study include weeks 35-52 during 2010 (September through December) and weeks 1-35 during 2011 (January through August). Vessel operators were allowed seven days following a fishing week to submit reports electronically or provide paper reports to state personnel. Reports were due by Sunday during each reporting week, and data were downloaded each Monday a.m. from the Gulf Logbook website. Each weekly download was checked against the master participants list to identify vessels that had not submitted an inactivity report for the entire fishing week or at least one or more trip reports for any day during the fishing week. Reports that were submitted late for previous fishing weeks were also identified and deducted from the running tally of missing reports. **Figure 5** below shows the tally of vessels with missing reports for each week of the study at the close of week 35 in 2011 (the last week that reporting was required). This figure reflects the updated frequency of vessels with missing reports for each week in the study through the last week data were downloaded for. During the first weeks of the reporting requirement (beginning with week 35 on the far left side of the horizontal axis in **Figure 5**), the frequency of vessels with missing reports declined as vessels registered with Bluefin Data and started routine reporting. The solid black line indicates the baseline number of vessels in the study that were non-cooperative and for which reports were missing for every week in the study. The frequency of vessels above the solid black line indicates vessels which were cooperative in the study but had not submitted reports during some weeks of the study. The increasing trend in the later weeks (far right side of horizontal axis) illustrates the time lag for receiving late reports.

The majority of late reports were received during the weeks immediately following a missed reporting deadline, which also corresponded to the period when non-response follow-up was conducted by state personnel via e-mail notifications and telephone calls to participants. As the period of non-response follow-up was advanced forward to later reporting weeks, a residual number of late reports from cooperative vessels remained outstanding (illustrated by the reduced frequency of vessels above the solid black when moving from right to left along the horizontal axis of **Figure 5**). The following figure (**Figure 6**) is similar to Figure 5, but shows the percentage of vessels that were missing reports as of the last reporting week of the study (week 35).

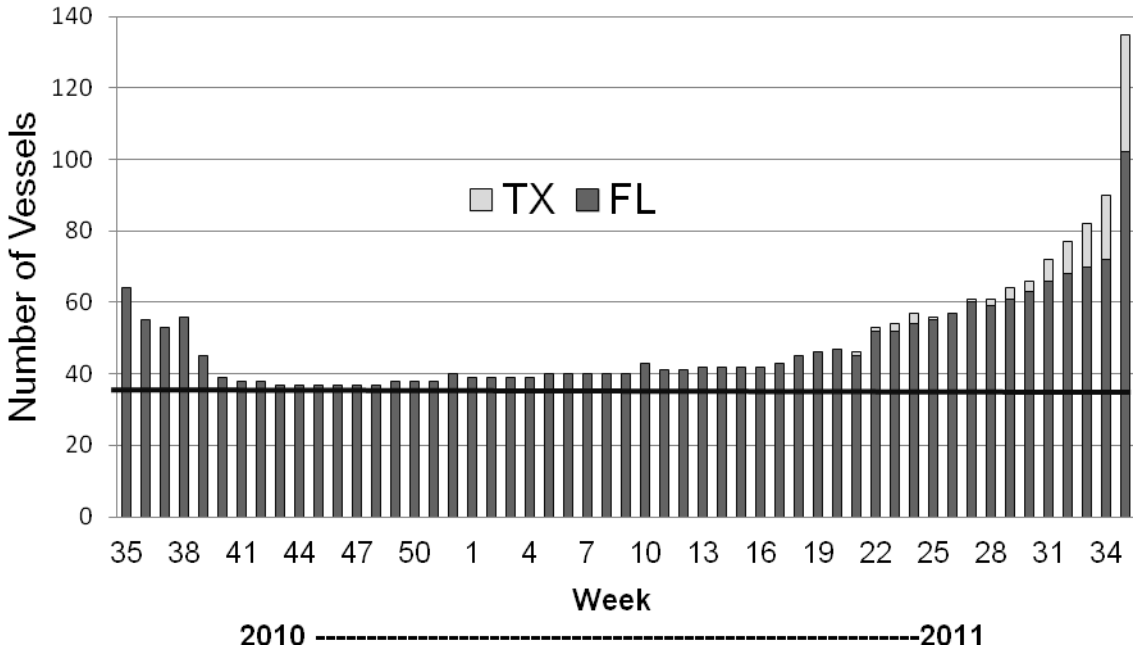


Figure 5. Number of vessels (y axis) by reporting week (x axis) that did not report through the Gulf Logbook reporting system as of August 31, 2011 (the last reporting week of the study). By this time, 36 remaining vessels in Florida had not submitted any reports for the duration of the pilot study (represented by the horizontal line). Vessels above the horizontal line represent those that were cooperative, but remained delinquint for one or more weeks at the time this report was generated. Tracking reports such as this one were routinely generated at the end of each reporting week during the course of the pilot study, and each prior week was updated for reports that were received late through the Gulf Logbook reporting system.

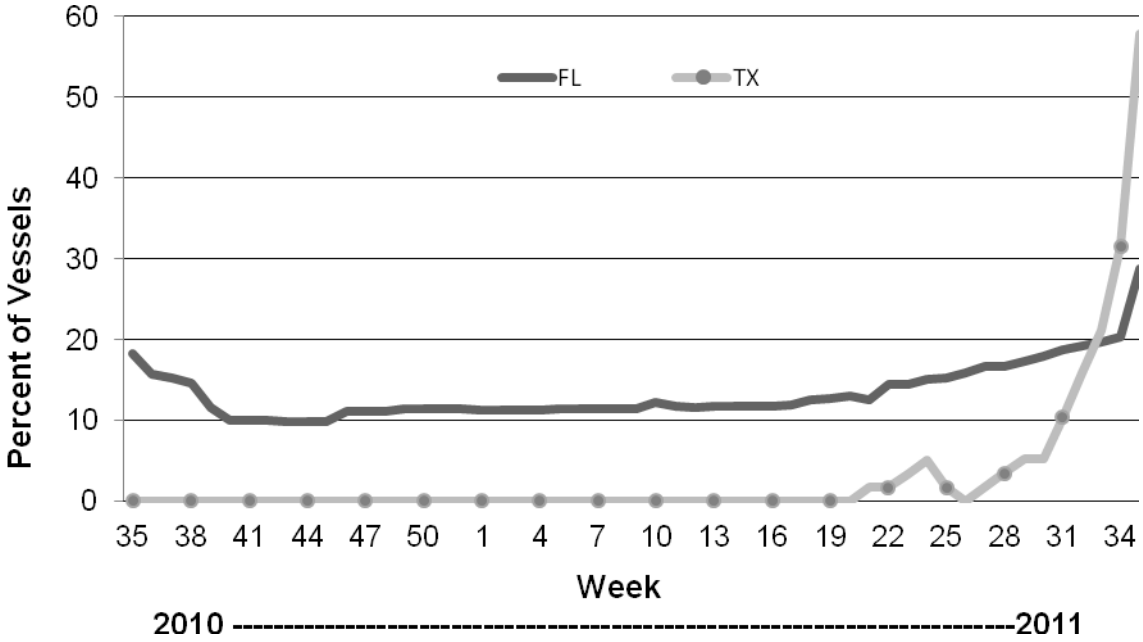


Figure 6. Percentage of vessels that did not report (y axis) by reporting week (x axis) through the Gulf Logbook reporting system as of August 31, 2011 (the last reporting week of the study).

Vessel Activity Status

A large proportion of permitted vessels selected to report in this study were inactive in the charter fishery. This is largely due to the fact that federal permits are under moratorium, which means that if an owner transfers or gives up a permit, they can not reaquire those permits unless another permit holder transferred a permit to them. Consequently, many permit holders continue to renew permits, even during years when they are not using the vessel to charter fish. In the Texas study area, 43 vessels that were required to report vessel activity or inactivity for any duration of time over the course of the pilot study reported inactivity for every week, compared to 27 vessels that reported at least one trip during the study. In the Florida study area, 100 vessels reported inactivity for every week and 234 vessels submitted at least one trip report over the duration of the study. When viewed by month, the number of vessels that were inactive in the charter fishery varied, and was greatest during winter months (**Figure 7**).

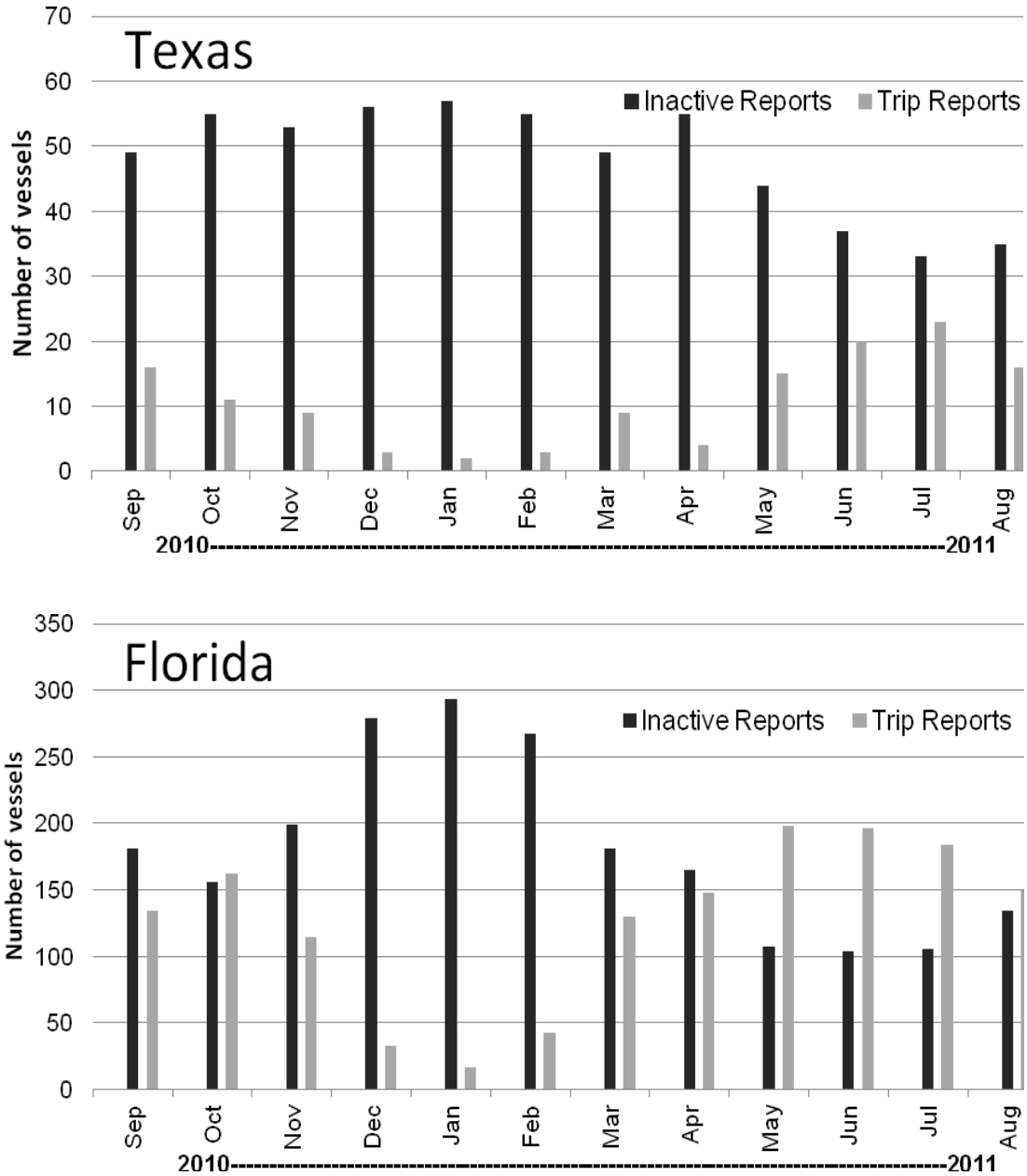


Figure 7. Numbers of vessels in Texas (top) and Florida (bottom) by month that submitted inactivity reports for all weeks, versus vessels that submitted at least one or more trip reports.

2. Validation Productivity and Percent of Trips Validated

Before discussing the accuracy of the submitted logbook reports, details about validation rates and the percent of trips validated are first provided. Validation productivity refers to how productive assignments were at validating fishing activity; for example, the number of trips that were validated each day during scheduled validation assignments. The distribution of validation

assignments is also reported in this section; for example, the number of days in a given month that fishing trips were validated. The percent of trips validated refers to the percent of total trips reported on logbook trip reports that were also verified during validation efforts.

Validation of Vessel Activity and Inactivity (Effort)

The number of days that vessel activity validation regions were visited by field staff to verify the fishing activity status of vessels in the logbook study each month is provided in **Table 5**. The majority of vessel activity validations (93%) during this study verified that vessels were at the dock and not fishing or their fishing status could not be validated (**Figure 8 and Figure 9**). Consequently, large numbers of vessel activity validations were necessary to find vessels that were confirmed to be out fishing, particularly during low activity months (September-March).

The percent of fishing trips reported by vessel operators in the Gulf Logbook reporting system that were also pre-validated during site visits was calculated as the number of pre-validated trips that were also reported in the Gulf Logbook system, divided by the total number of trips reported in the Gulf Logbook system (**Table 6**). In Texas, where fewer vessels were included in the study region, 40.1% of the overall trips were validated, but varied widely between months. In Florida, the percent of trips validated was comparatively lower (6.3%), but more evenly distributed throughout the year.

Table 5. Number of sample days that vessel activity was monitored by month. In Texas, all sites in the region of the study were visited each day to validate vessel activity. In Florida, all sites in one randomly selected region were visited (see **Table 2** and **Figure 3**). A sample day is defined as one field sampler visiting all sites in one selected region on an assigned day.

Region	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
Texas	18	25	21	14	19	15	16	6	22	20	20	18	214
Florida	18	18	14	8	19	17	22	21	19	23	23	20	222

Table 6. Percent of vessel trips reported in the Gulf Logbook Reporting system that were also validated during vessel activity validation site visits.

	Texas			Florida		
Month	**Reported**	**Validated**	**Percent Validated**	**Reported**	**Validated**	**Percent Validated**
Sep	57	18	31.6%	465	10	2.2%
Oct	42	15	35.7%	1,144	35	3.1%
Nov	11	3	27.3%	343	12	3.5%
Dec	5	1	20.0%	57	1	1.8%
Jan	2	0	0.0%	21	2	9.5%
Feb	2	0	0.0%	62	1	1.6%
Mar	26	3	11.5%	635	44	6.9%
Apr	10	1	10.0%	1,047	87	8.3%
May	39	24	61.5%	1,280	88	6.9%
Jun	114	56	49.1%	3,523	256	7.3%
Jul	215	88	40.9%	3,068	189	6.2%
Aug	130	53	40.8%	1,286	85	6.6%
Total	653	262	40.1%	12,931	810	6.3%

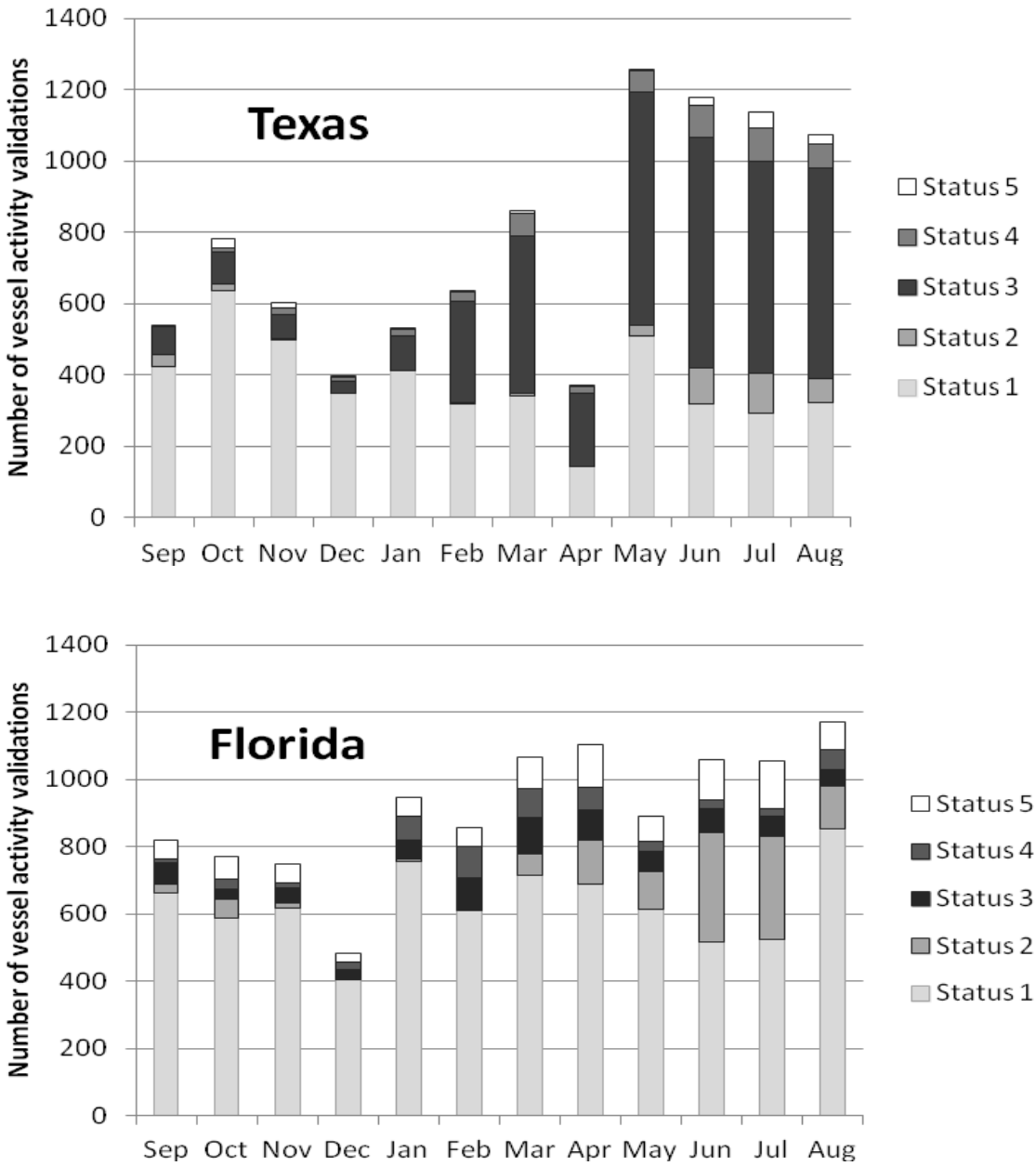


Figure 8. Numbers of validations of vessel activity collected each month by fishing status. Status 1 = vessel in slip and not charter fishing; Status 2 = vessel verified to be out of slip and charter fishing; Status 3 = unable to validate fishing status; Status 4 = vessel out, not charter fishing; Status 5 = vessel out, status unknown.

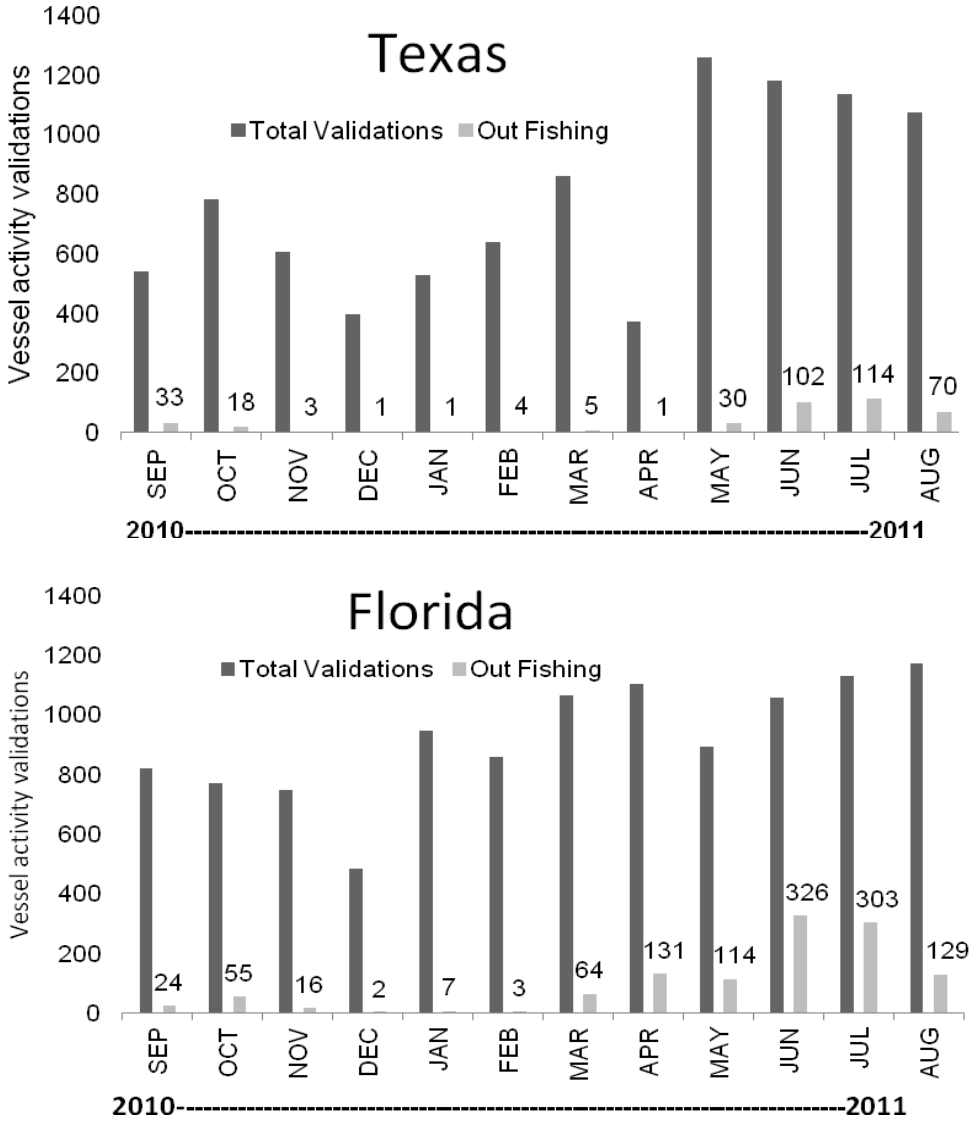


Figure 9. Total numbers of vessel activity validations and the numbers of validations where vessels were verified to be out fishing by month in Texas (top) and Florida (bottom).

Dockside Validation of Logbook Data

Over the course of the study, a total of 1,119 vessel trips were intercepted during 441 dockside validation assignments (**Table 7**). Interviews were completed for 150 trips in Texas and 945 trips in Florida. A total of 24 trips (1 in Texas, 23 in Florida) refused to be interviewed (**Table 7**). Sampling productivity (completed vessel interviews per assignment) was higher in the Florida study area, where the number of vessels per site is large compared to the Texas study area, and productivity varied seasonally in both regions (**Figure 10**). Productivity was low during winter months when many vessels were inactive (**Figure 10** below). Fewer assignments were attempted during winter months; however, given the low vessel activity, more assignments were needed to obtain adequate numbers of completed vessel interviews. Sampling productivity was highest

during summer months (May through August), which corresponds to a period of high tourist activity and open harvest seasons for red snapper and other managed reef fishes in federal waters. Recreational harvest seasons in state waters of Florida (0 to 9 nautical miles) are consistent with federal seasons (with some exceptions); and harvest is permitted year round in state waters of Texas. The federal harvest season during 2010 was June 1 through August 14; however, sampling productivity was also likely influenced by a supplemental red snapper harvest season from October 1 through November 21 (Friday through Sunday only) following the re-opening of large closed areas during the Deepwater Horizon event.

Table 7. Number of dockside assignments and vessel interviews by region and month.

	Texas			Florida		
Month	**Completed Dockside Assignments**	**Completed Vessel Interviews**	**Refused Vessel Interviews**	**Completed Dockside Assignments**	**Completed Vessel Interviews**	**Refused Vessel Interviews**
Sep	10	4	0	25	53	0
Oct	15	9	0	26	107	1
Nov	12	2	0	25	36	0
Dec	9	2	0	16	1	0
Jan	7	0	0	21	1	0
Feb	9	1	0	20	8	0
Mar	10	3	0	20	17	0
Apr	7	2	0	21	69	2
May	16	16	0	28	111	0
Jun	21	39	0	24	173	4
Jul	24	35	0	26	258	14
Aug	24	37	1	25	111	2
Total	164	150	1	277	945	23

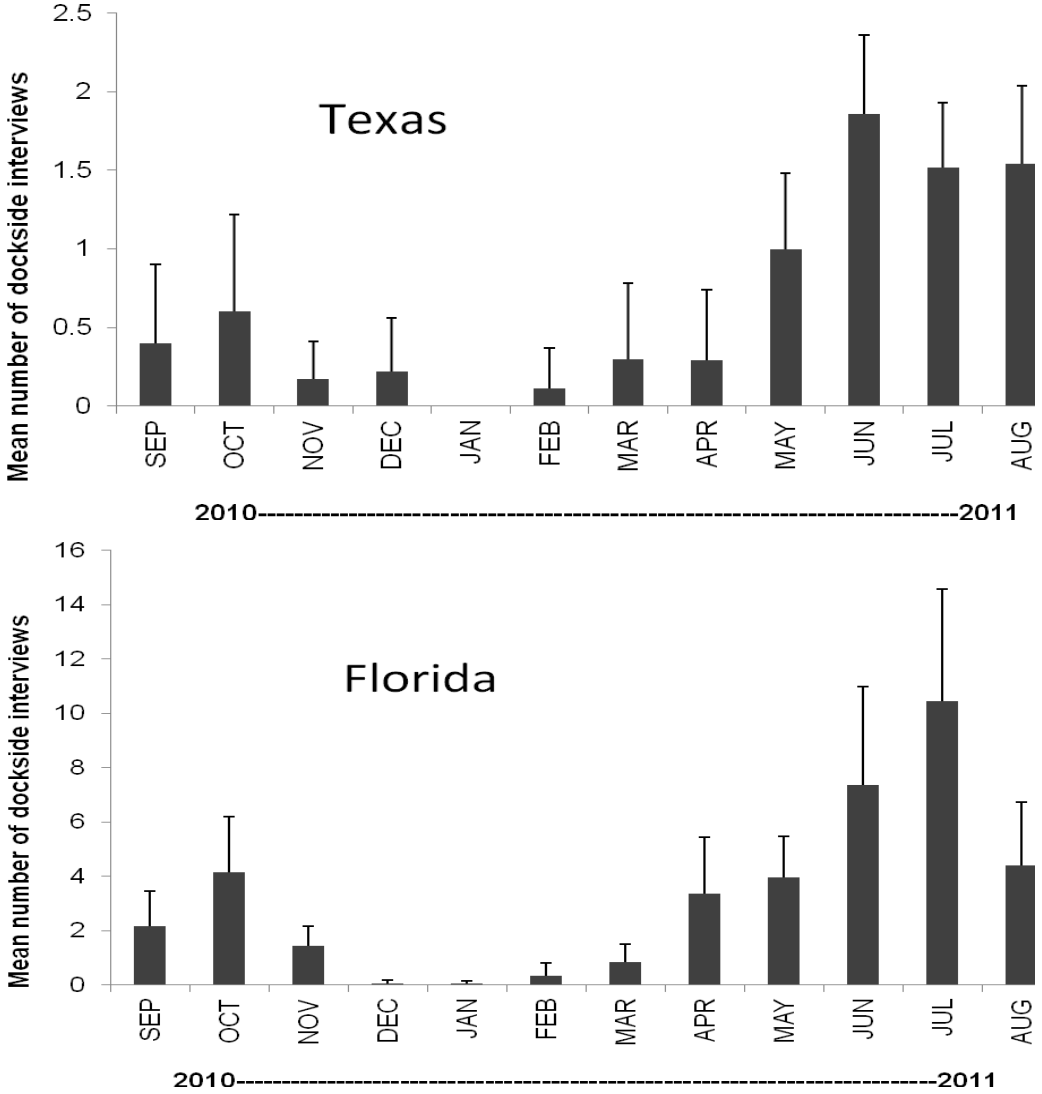


Figure 10. Mean number of completed vessel interviews obtained during dockside validation assignments for the Texas (top graph) and Florida (bottom graph) study areas with 95% confidence intervals.

The percent of trips validated was calculated as the number of trips validated during dockside assignments as a percentage of total trips reported in the Gulf Logbook reporting system (**Figure 11** and **Table 8**). To account for the fact that some vessel trips were not reported by vessel operators, the calculated percent validated uses only validated trips with a corresponding logbook trip report received through the Gulf Logbook system. The percent of trips validated ranged from 0% (during some low activity months when no dockside interviews could be obtained) to as high as 40%. The percent of trips validated was greater in Texas where fewer vessels were included in the study, and validation was especially high during winter months when vessel activity was low and at least one vessel trip was validated (for example, Texas

validated two vessel trips in December, which equated to 40%). The percent of trips validated was lower in the Florida study area; however, it was also less effected by low activity seasons and trips validated were more evenly distributed throughout the year (**Figure 11**).

Table 8. Numbers of vessel trips reported in the Gulf Logbook reporting system, and numbers and percent validated during dockside interviews.

	Texas			Florida		
Month	**Trips Reported**	**Trips Validated and Reported**	**Percent Validated**	**Reported Trips**	**Trips Validated and Reported**	**Percent Validated**
Sep	57	3	5.3%	465	28	6.0%
Oct	42	8	1.9%	1,144	80	7.0%
Nov	11	2	18.2%	343	30	8.7%
Dec	5	2	40.0%	57	0	0%
Jan	2	0	0%	21	1	4.8%
Feb	2	0	0%	62	3	4.8%
Mar	26	2	7.7%	635	14	2.2%
Apr	10	2	20.0%	1,047	46	4.4%
May	39	13	33.3%	1,280	85	6.6%
Jun	114	19	16.7%	3,523	140	4.0%
Jul	215	28	13.0%	3,068	205	6.7%
Aug	130	29	22.3%	1,286	63	4.9%
Total	653	108	16.5%	12,931	695	5.4%

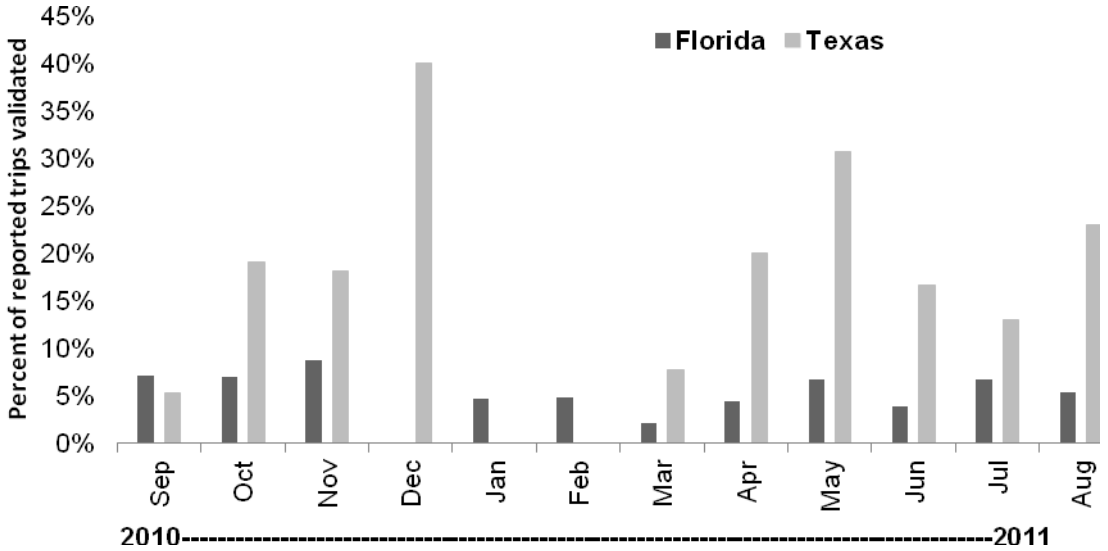


Figure 11. Percent of for-hire fishing trips reported in the Gulf Logbook reporting system that were validated with dockside interviews by state.

At-Sea Validation of Logbook Data
A total of 45 at-sea trips in Texas and 87 at-sea trips in Florida were sampled during the course of this study (**Table 9**). The distribution of sampled trips was influenced by availability of trips, with few trips sampled during winter months. In Texas, where a small number of active vessels were available to sample, no trips were sampled using at-sea methods during the months of November through February. No trips were sampled using at-sea methods in Florida during December. The highest number of trips sampled in Florida were during months that red snapper was open for harvest (October, November, and June).

Compared to dockside validation samples, the percent of at-sea trips validated was considerably lower due to the smaller sample quotas. Like dockside validations, the percentage of at-sea trips validated was higher in the Texas study area, 5.8% compared to 0.6% in the Florida study area. The dockside method is a direct validation of harvested catch and an indirect validation of released catch (subject to recall of interviewed vessel operators); whereas the at-sea method directly validates both. When considered additively, the combined dockside and at-sea validations of harvested and released catch were 22.4% of reported trips in Texas and 6.1% of reported trips in Florida.

Table 9. Numbers of at-sea trips sampled per month and percent of trips validated.

	Texas		Florida	
	Total	**Percent Validated**	**Total**	**Percent Validated**
Sep	5	7.0%	4	0.65%
Oct	4	9.5%	15	1.3%
Nov	0	0	13	3.5%
Dec	0	0	0	0
Jan	0	0	1	4.8%
Feb	0	0	4	3.2%
Mar	2	7.7%	6	0.63%
Apr	1	10.0%	7	0.57%
May	4	10.3%	8	0.55%
Jun	9	6.1%	12	0.31%
Jul	11	4.2%	9	0.26%
Aug	9	5.4%	10	0.62%
Total	45	5.8%	87	0.60%

3. Accuracy and Completeness of Logbook Reporting

Validation of Vessel Activity and Inactivity
For vessels that were verified to be out fishing (status=2) during vessel activity validation site visits, 69% of trips in Texas and 71% of trips in Florida were reported through the Gulf Logbook reporting system (**Figure 12**). For trips that were not reported through the Gulf Logbook system, 11% of pre-validated vessels in Texas and 14% in Florida reported fishing trips for other days

during the sampled week, but did not report a trip for the specific day that the vessel was verified to be out fishing (Reported No Trip for Day/Time in **Figure 12**). This could be due to inaccurate reporting (the trip was reported on the wrong day of the week), or incomplete reporting (trips were correctly reported for other days that week, but no trip was reported for the day a trip was verified). Another 17% of pre-validated vessels in Texas and 5% in Florida inaccurately submitted an inactivity report through the Gulf Logbook reporting system, indicating that the vessel did not take any fishing trips during the sampled week (Reported Inactive for Week in **Figure 12**). For 4% of vessel activity validations in Texas and 7% in Florida, no trip report or inactivity report was submitted through the Gulf Logbook reporting system for the week it was validated (no trips/inactive submitted for week in **Figure 12**). In Florida only, 3% of vessel activity validations were for vessels that were 100% non-compliant with their reporting requirement for the 12 month study period (refusals in **Figure 12**).

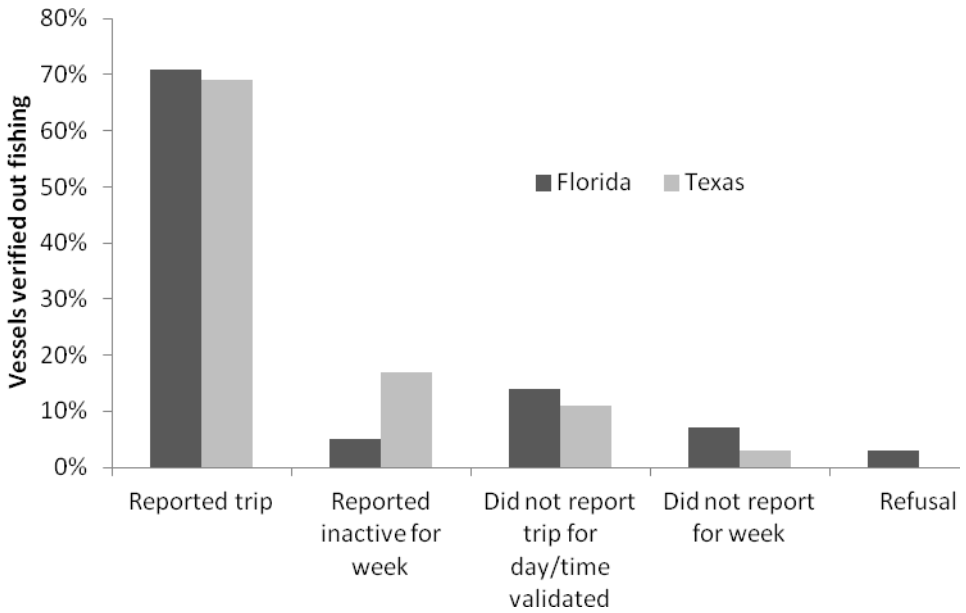


Figure 12. Logbook reporting status of vessels that were verified to be active and fishing (status=2) during a vessel activity validation. Percentages indicate proportions of validated trips that were accurately reported through the Gulf Logbook reporting system (reported trip), reported incorrectly (reported inactive for week, reported no trip for day/time), or did not report (refusals, no trips/inactive submitted for week).

The proportion of verified trips for which logbook reports were received through the Gulf Logbook reporting system was consistent across months; however, low sample sizes should be noted for some months (**Figure 13** and **Table 10**). Overall, approximately 68% of all validated trips were reported through the Gulf Logbook system, with a range of uncertainty between 58% to 77% in Texas and 63% to 72% in Florida. Given these results, logbook reports may not be considered a census under the constraints of this study design, but may provide a consistent measure of fishing effort when combined with an effective validation program.

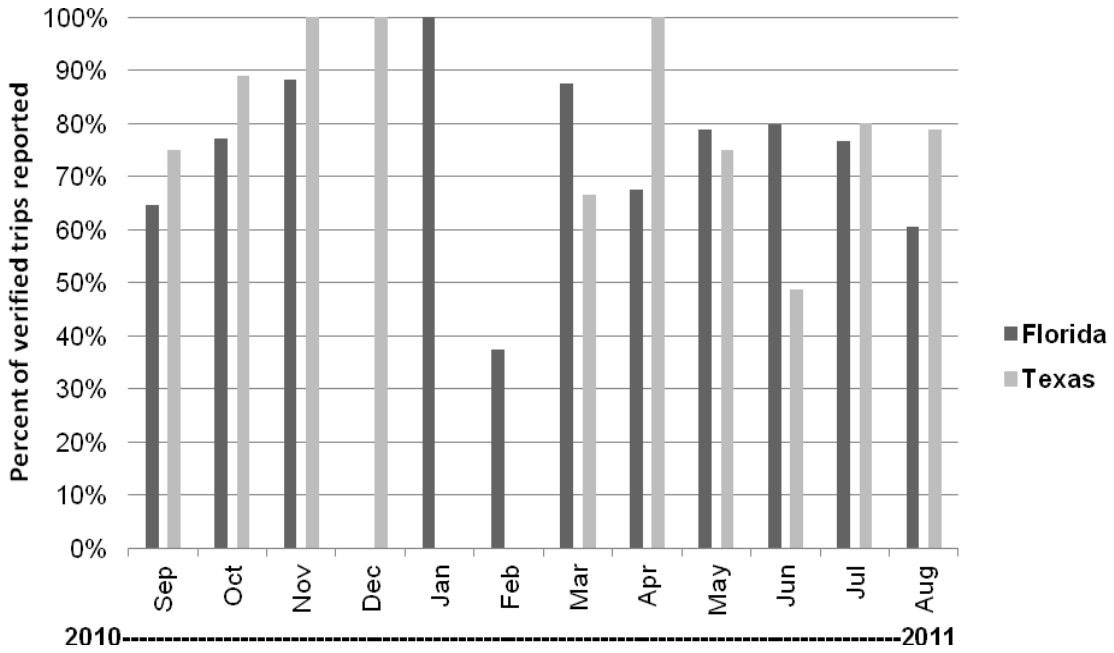


Figure 13. Percentage of vessels verified to be out fishing during vessel activity validation site visits that were also reported in the Gulf Logbook system by month and state. Note, low sample sizes during winter months (numbers provided in **Table 10**).

Table 10. Number of vessel trips in Texas and Florida that were verified to be out fishing during vessel activity validation site visits, and number and percent of validated trips that were reported in the Gulf Logbook Reporting System.

	Texas			Florida		
Month	**Trips Validated**	**Trips Validated and Reported**	**% Reported**	**Trips Validated**	**Trips Validated and Reported**	**% Reported**
Sep	33	18	55%	24	10	42%
Oct	18	15	83%	55	35	64%
Nov	3	3	100%	16	12	75%
Dec	1	1		2	1	
Jan	1	0	Pooled	7	2	Pooled
Feb	4	0	36.4%	3	1	63%
Mar	5	3		64	44	
Apr	1	1	100%	131	87	66%
May	30	24	80%	114	88	77%
Jun	102	56	55%	326	256	79%
Jul	114	88	77%	262	189	72%
Aug	70	53	76%	129	85	66%
Total	382	262	69%	1,133	810	71%

For pre-validated vessels that were verified to be inactive (not fishing, status=1 or status=4), 94% of those vessels in Texas and 86% of those vessels in Florida also reported no activity through the Gulf Logbook reporting system (**Figure 14**). A small percentage of pre-validated vessels inaccurately reported a fishing trip when they were verified to be inactive (1% in Texas, 2% in Florida). In both Texas and Florida, 5% of vessels that were pre-validated as inactive did not report through the Gulf Logbook reporting system for the week they were pre-validated (no trips/inactive submitted for week in **Figure 14**); and an additional 7% of vessels in Florida did not report during any week of 12 month study period (refusals in **Figure 14**).

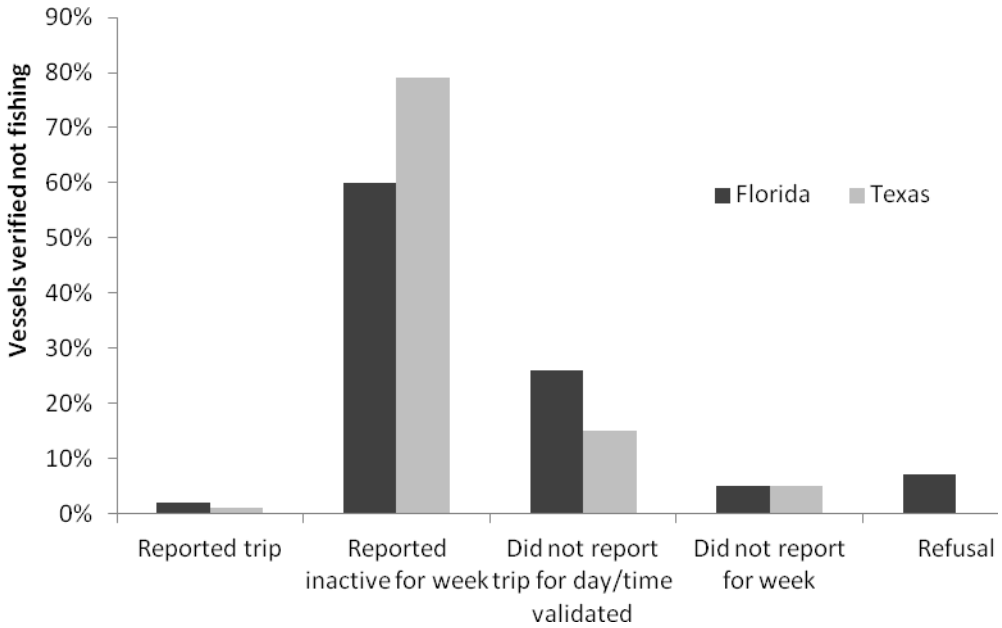


Figure 14. Logbook reporting status for vessels that were verified to be inactive (not fishing, status=1 or status=4) during the day of a vessel activity validation site visit. Percentages indicate proportions of pre-validated vessels that accurately reported through the Gulf Logbook reporting system (reported inactive for week, reported no trip for day/time), reported incorrectly (reported trip), or did not report (refusals, no trips/inactive submitted for week).

Dockside Validation of Logbook Data

The percentage of trips validated during dockside assignments with a corresponding trip report received through the Gulf Logbook reporting system was equivalent in the two study regions (72% in Texas and 74% in Florida; **Table 11**). These reporting compliance rates are only slightly higher than the percentages reported in **Table 10** for validations of vessel activity (69% in Texas and 71% in Florida). During dockside validations, vessel operators were directly interviewed by field samplers and, during validations for vessel activity, vessel operators were out fishing when samplers validated the site. Therefore, vessel operators were less likely to know when their vessel status was checked during vessel activity validations. Similar reporting compliance rates for dockside validated trips and pre-validated trips suggests that vessel operators were no more likely to submit a trip report when they were interviewed during a dockside validation. Therefore, it may be feasible to combine vessel activity validations from the two methods, which

would increase sample sizes for estimating the number of fishing trips that were not reported in the Gulf Logbook Reporting System.

The monthly percentage of trips sampled during dockside validation assignments with a corresponding trip report that was received through the Gulf Logbook reporting system is provided in **Table 11**. Note that sample sizes for validated trips are low during December through April due to low fishing activity (**Figure 8**). Not including the low fishing activity months (December – April), the percentage of validations that corresponded to a reported trip in the Gulf Logbook system ranged between 55% and 80% in Florida, and between 50% and 90% in Texas (**Figure 13**).

Table 11. Number of trips validated during dockside vessel interviews by region and month, and number and percent of validated trips with a corresponding logbook trip report received through the Gulf Logbook system.

	Texas			Florida		
Month	**Trips Validated**	**Trips Validated and Reported**	**% Reported**	**Trips Validated**	**Trips Validated and Reported**	**% Reported**
Sep	4	3	75.0%	53	28	52.8%
Oct	9	8	88.9%	107	80	74.8%
Nov	2	2	100%	36	30	83.3%
Dec	2	2	100%	1	0	0%
Jan	0	0		1	1	100%
Feb	1	0	0%	8	3	37.5%
Mar	3	2	66.7%	17	14	82.3%
Apr	2	2	100%	69	46	66.7%
May	16	13	81.3%	111	85	76.6%
Jun	39	19	48.7%	173	140	80.9%
Jul	35	28	80.0%	258	205	79.5%
Aug	37	29	78.4%	111	63	56.8%
Total	150	108	72.0%	945	695	73.5%

For dockside validated trips that were not reported through the Gulf Logbook Reporting System, vessel operators either: 1) did not report for the week the vessel was validated, 2) inaccurately reported the vessel was inactive for the week, or 3) reported trips for the vessel during other days of the week but not for the day the vessel was validated (**Figure 15**).

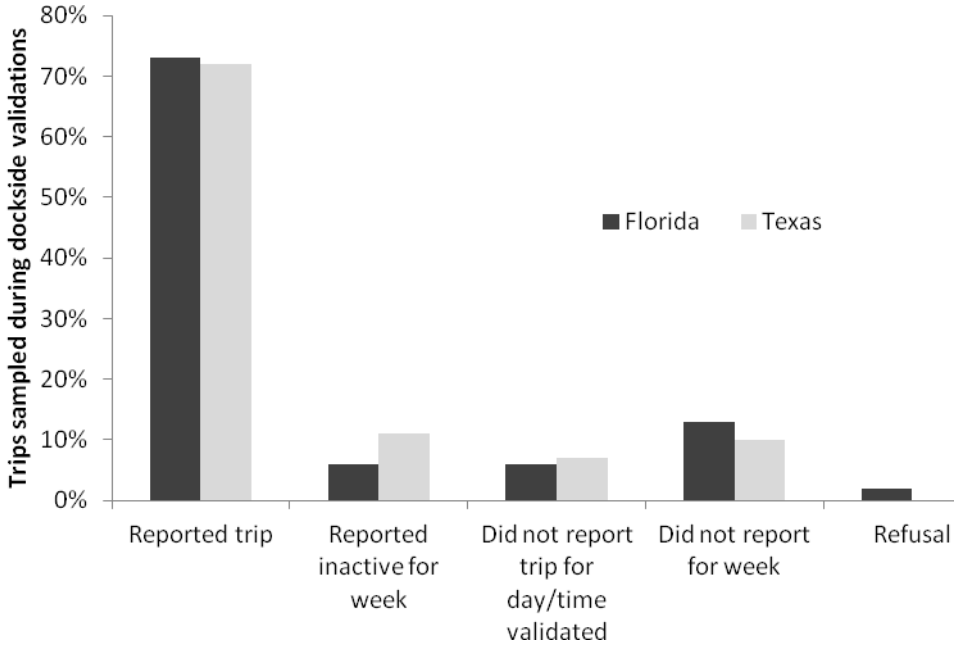


Figure 15. Logbook reporting status for trips that were sampled during dockside validation assignments. Percentages indicate proportions of pre-validated vessels that accurately reported through the Gulf Logbook reporting system (reported trip), reported incorrectly (reported inactive for week or did not report trip for day/time of interview), or did not report for the week of the interview. "Refusals" means the vessel was intercepted during a dockside validation assignment but the vessel operator refused to be interviewed.

Comparison of Dockside Responses and Logbook Reports for Corresponding Trips
Dockside validation interviews from the first nine months of the pilot study were compared directly with logbook data reported through the Gulf Logbook system for 88 corresponding trips in Texas and 674 corresponding trips in Florida. Two statistics were used to analyze differences in reporting: mean absolute mean difference and the difference of means. The mean absolute difference is the expected amount (absolute value) by which we would expect a single logbook report and corresponding dockside sample (for the same trip) to disagree and can only be positive. The more a value differs from zero, the greater the difference in expected logbook reports and dockside samples. In comparison, the difference of means (=mean dockside – mean logbook) is the difference between the average value for all dockside validation responses aggregated (mean dockside) and the average value for all logbook reports (mean logbook) aggregated. A large negative value for the difference of means would indicate values were consistently over reported on logbooks, whereas a large positive value would indicate variables were consistently under reported. The primary difference between the two statistics is that one calculates differences on a per report/sample basis and the other calculates differences in aggregate across all reports/samples. Although variables reported in logbooks might differ from dockside samples on a per trip basis, it is useful for data collectors to know whether or not those differences would exist when aggregated across all reports/samples.

The number of anglers reported on logbooks for each fishing trip is important for measuring total fishing effort in terms of angler trips and for calculating catch rates (fish per angler trip). The

number of anglers reported on logbooks exactly matched dockside validation responses for 76% of trips in both Texas and Florida (**Table 12**). The mean absolute difference between logbook reports and dockside validation responses was 0.488 anglers for any given trip in Texas and 0.450 anglers for any given trip in Florida (**Table 12**). The difference of means for numbers of anglers per trip was 0.458 anglers in Texas and -0.107 anglers in Florida, which indicates that vessel operators did not consistently over report or under report this value (**Table 12**). Large over or under reporting of fishing effort variables could preclude the use of data reported in logbooks as an expansion factor for un-reported trips. Based on the results of this study, numbers of anglers reported in logbook reports would produce similar results as estimates based on dockside samples, provided that samples for dockside validations are of adequate size to be representative. Hours fished is useful for calculating catch rate per unit of time, and can be combined with anglers fished to calculate catch rates per angler hour fished. The proportion of exact matches between logbook reports and dockside validation responses for hours fished was low compared to anglers fished (29% in Texas and 52% in Florida), though differences between means were small (**Table 12**).

Table 12: Proportion of dockside interviews and corresponding logbook trip reports that were exact matches for numbers of anglers and hours fished; and the mean absolute difference and difference of means between responses given during dockside interviews and corresponding logbook trip reports (Sept. 2010 – May 2011). See Appendix I for details on statistics.

State	Variable	Proportion Matched Exactly	Mean Absolute Difference	Root mse	Dockside Mean	Logbook Mean	Difference of Means
Texas n=24	Anglers	0.79	0.488	1.061	3.96 (3.35, 4.57)	4.42 (3.84, 4.99)	-0. 458
	Hours Fished	0.29	1.369	2.237	6.92 (6.09, 7.74)	6.41 (5.84, 6.97)	0.510
Florida n=263	Anglers	0.77	0.450	1.220	6.29 (5.93, 6.65)	6.40 (6.06, 6.74)	-0.107
	Hours Fished	0.52	0.676	1.286	3.99 (3.80, 4.19)	3.89 (3.71, 4.08)	0.098

The percentage of time spent fishing by jurisdiction (Exclusive Economic Zone or EEZ, State Territorial Seas, and Inland waters) is important for assigning effort to different state and federal jurisdictions and calculating catch rates for those areas. Exact matches between logbook reports and dockside validation responses for the percentage of time fished in each jurisdiction (EEZ, State and Inland waters) was high and ranged from 74% up to 93% (**Table 13**). The minimum and maximum depths fished during a trip were collected as a cross check for comparison with the reported fishing jurisdiction (for example, large minimum depths would not be expected in inland waters). Depth range is also an important data need for correctly assigning variable discard mortality rates (related to barotrauma) proportional to the distribution of fishing effort at different fishing depths. The percentage of trips with exact matches between dockside and logbook values was low (**Table 13**). Providing categorical choices for variables in **Table 13** (rather than allowing for continuous variable responses) could improve the degree of correspondence between logbook reports and dockside validations (example, provide categories for percentage of time fished in EEZ = 25%, 50%, 75%, or 100%, or maximum depth = <30', 30' to 60', etc.).

Area fished responses for dockside validations and logbook trip reports matched zones in the Gulf of Mexico used for reporting commercial landings (**Appendix E**). Since area fished was a categorical variable, logbook reports that were not an exact match with dockside validation responses were considered completely inaccurate. Only 62% and 63% of logbook reports in Texas and Florida, respectively, were an exact match with what was reported for area fished during dockside validation interviews. Paper logbook reporters were provided with a hard copy map to look up the area fished codes, and electronic reporters were provided with a drop-down menu on the Gulf Logbook screen which required a selection for the area fished before a trip report could be submitted. Early in the study, electronic participants provided feedback that the selections in the drop down menu were not clear, and changes were made as the study progressed to better define the area fished categories. A link to a reference map with area fished codes was provided in the upper corner of the screen; however, the link was not readily noticeable to many users. Suggestions to provide a link to the reference map next to the drop-down menu and/or provide a click-able map to select the area fished were offered as potential improvements, but those design changes could not be implemented before the end of the pilot study.

Table 13. Proportion of dockside interviews and corresponding logbook trip reports that were exact matches for area fished variables.

	Proportion Matched Exactly Texas	**Proportion Matched Exactly Florida**
% Time Fished in EEZ	0.92	0.80
% Time Fished in STS	0.79	0.74
% Time Fished Inland	0.88	0.93
Minimum depth fished	0.42	0.43
Maximum depth fished	0.33	0.43

Catch data for numbers of red snapper reported on logbook trip reports was compared to dockside validation data for corresponding trips. Harvested red snapper were directly observed and counted by field biologists during dockside interviews. Released red snapper were not directly observed, and dockside responses were based on the recall of vessel operators immediately after the trip was completed (versus what was recorded on logbooks during the same day, the same week, the following reporting week, or potentially much longer, depending on the timeliness of logbook reporting). Similar to other variables discussed above, numbers of red snapper reported on logbook trip reports and recorded during dockside validation interviews did not agree for individual trips, but average values over all trips from logbook reports and dockside samples were similar. For harvested red snapper, individual logbook trip reports and dockside samples for the same trip disagreed by 1.4 fish in Texas and 0.7 fish in Florida, whereas the difference between aggregated means was approximately one tenth of one fish per trip (**Table 14**, -0.011 in TX, -0.14 in FL). These results indicate that while individual logbook reports for numbers of released fish are dissimilar and may not be considered one-to-one substitutes for dockside validations, the two data sources are comparable when considered in aggregate (given that sample sizes are adequate). For red snapper released alive, there were greater discrepancies between individual values for logbook trip reports and dockside samples for the same trip. For example, the number of red snapper released in Florida for all release categories combined differed by 6.4 fish between individual logbook trip reports and dockside

samples for the same trip. Differences between aggregated means for total numbers of released fish were reduced (2.3 fish per trip in Texas and 1.2 fish per trip in Florida); however, these values were still large compared to those for harvested fish (**Table 14**). Red snapper are subject to a bag limit of two red snapper per angler during the open harvest season, which requires that vessel operators pay close attention to the numbers of fish harvested. Vessel operators may be less likely to keep track of numbers of released fish during a fishing trip, which could explain the larger discrepancies for numbers of released fish between logbook reports and dockside samples. Very few fish were released dead from Texas, resulting in a high rate of exact matches between logbook reports and dockside responses. In Florida, 82% of dockside responses and corresponding logbook trip reports were exactly matched for the number of red snapper released dead.

Table 14: Proportion of dockside interviews and corresponding logbook trip reports that were exact matches for numbers of red snapper harvested, released alive at depths ≤120', released alive at depths >120', released dead, and all released fish (≤120', >120', and dead released categories combined); and the mean absolute difference and difference of means between responses given during dockside interviews and corresponding logbook trip reports for all months (Sept. 2010 - August 2011). See Appendix J for more detailed statistics.

Region	Red Snapper (numbers)	Proportion Matched Exactly	Mean Absolute Difference	Root Mean Square Error	Dockside Mean	Logbook Mean	Difference of Means
Texas (n=51 trips)	Harvested	0.63	1.392	2.960	5.67 (4.24, 7.13)	5.78 (4.38, 7.19)	-0.11
	Released alive ≤120'	0.67	1.706	3.933	1.14 (0.35, 1.92)	0.65 (-0.08, 1.37)	0.49
	Released alive >120'	0.47	2.863	5.763	3.63 (1.90, 5.36)	1.86 (0.56, 3.17)	1.77
	Released dead	1.00	0	0	0	0	0
	All releases combined	0.22	4.137	6.605	4.77 (3.05, 6.48)	2.51 (0.85, 1.18)	2.26
Florida (n=547 trips)	Harvested	0.84	0.664	2.343	6.82 (6.19, 7.46)	6.96 (6.33, 7.58)	-0.14
	Released alive ≤120'	0.44	5.733	13.085	9.17 (7.65, 10.70)	8.57 (7.17, 9.96)	0.60
	Released alive >120'	0.73	3.256	8.959	3.99 (3.08, 4.90)	3.15 (2.45, 3.84)	0.84
	Released dead	0.82	0.644	2.694	0.41 (0.16, 0.66)	0.61 (0.37, 0.86)	-0.21
	All releases combined	0.35	6.428	14.226	12.33 (11.86, 15.29)	13.57 (10.75, 13.91)	1.24

Catch data for total numbers of species and total numbers of fish for all species reported on logbook trip reports was also compared to dockside validation data for corresponding trips. Similar to the red snapper analysis above, all harvested fish were directly observed, identified to species, and counted by field biologists during dockside interviews; whereas, released fish catch was based on the recall of vessel operators immediately after the trip was completed. The proportion of trips for which numbers of species caught exactly matched between dockside validation observations and logbook trip reports was 42% in Texas and 33% in Florida, and the

numbers of species caught were under reported on logbooks by less than one species per trip in Texas and slightly more than one species per trip in Florida (**Table 15**). Some under reporting of species was due to lower resolution in species-level reporting by vessel operators. For example, vessel operators were able to report some species in aggregate (e.g. "grunt, type not known"). Under reporting of species may also be due to loss of recall for low priority species the day after the trip is completed, or low priority may have been given to reporting species not considered important recreationally. As with previous comparisons, the difference of the means for numbers of fish harvested and released between dockside validations and logbook reports was not large (from less than 1 fish up to 2.7 fish per trip).

Table 15: Proportion of dockside interviews and corresponding logbook trip reports that were exact matches for numbers of species caught and total numbers of fish (all species) harvested, released alive at depths ≤120', released alive at depths >120', and released dead; the mean absolute difference between responses given during dockside interviews and corresponding logbook trip reports; means (with 95% confidence intervals) and difference between means for dockside and logbook values. Data are for the first nine months of the pilot study (Sept. 2010 - May 2011). See Appendix I for detailed description of statistics.

	All Species	Proportion Matched Exactly	Mean Absolute Difference	Root Mean Square Error	Dockside Mean	Logbook Mean	Difference of Means
Texas n=24 trips	Number of Species	0.42	0.875	1.242	3.79 (2.99, 4.59)	3.17 (2.48, 3.85)	0.62
	Number of Fish Harvested	0.33	3.167	5.809	9.79 (6.28, 13.31)	10.38 (6.55, 14.20)	-0.59
	Number of Fish Released alive ≤120'	0.50	3.917	7.200	3.83 (1.32, 6.34)	1.17 (-0.16, 2.49)	2.66
	Number of Fish Released alive >120'	0.58	0	7.853	5.25 (0.89, 9.61)	3.92 (0.40, 7.43)	1.33
	Number of Fish Released dead	0.96	0.125	0.612	0	0.13 (-0.12, 0.37)	-0.13
Florida n=263 trips	Number of Species	0.33	1.445	2.215	5.07 (4.77, 5.36)	3.94 (3.66, 4.21)	1.13
	Number of Fish Harvested	0.19	8.992	19.601	32.10 (28.00, 36.21)	30.30 (25.92, 34.69)	1.80
	Number of Fish Released alive ≤120'	0.37	9.578	20.354	17.44 (14.12, 20.76)	17.32 (13.53, 21.11)	0.12
	Number of Fish Released alive >120'	0.70	9.000	11.727	7.13 (5.21, 9.05)	5.72 (4.06, 7.38)	1.41
	Number of Fish Released dead	0.77	1.053	3.963	0.82 (0.29, 1.34)	1.07 (0.55, 1.58)	-0.25

Some misreporting of catch was due to confusion regarding common names for different species. Out of 148 dockside validation interviews in Florida where vessel operators reported releasing king mackerel the day of the trip, only 40% of corresponding logbook trip reports recorded any king mackerel releases. This is very likely due to the selection of "Gulf kingfish" instead of "king mackerel", which were both available in the drop-down menu on the Gulf Logbook website. King mackerel are often called kingfish by fishermen, but the use of this common name in the drop-down menu for the Gulf Logbook website referred to a Sciaenid species. Records submitted on paper reports for "kingfish" were verified with the vessel operators before they were entered into the Gulf Logbook website by state biologists, and those records were frequently corrected to king mackerel. During the pilot study, changes were made in the drop

down menus for the Gulf Logbook website to better distinguish species categories to minimize these types of reporting errors in the latter half of the study. For example, "Gulf kingfish" was modified to "Gulf kingfish (whiting, or ground mullet)" so it was clear that this selection did not refer to king mackerel. Also, if a reporter typed "kingfish" into the data field, selections for both Gulf kingfish and king mackerel were presented to the user. The iSnapper smart phone application provided a picture menu for species selections, and users commented that this was more user-friendly.

At-Sea Validation of Logbook Data

Logbook trip reports were received through the Gulf Logbook reporting system for 84.4% of trips sampled during at-sea validations in Texas and 88.5% of sampled trips in Florida (**Table 16**). These percentages are high compared to dockside validations and validations for vessel activity, due in part to the fact that only cooperative vessels volunteered to allow fishery observers to board their vessels. Consequently, voluntary at-sea validations are not useful for monitoring overall reporting compliance and are only used here to evaluate the accuracy of reporting for released catch.

Table 16. Number of trips validated by at-sea observers by region and month, and number and percent of validated trips with a corresponding logbook trip report received through the Gulf Logbook system.

	Texas			Florida		
Month	**Trips Validated**	**Trips Validated and Reported**	**Percent Reported**	**Trips Validated**	**Trips Validated and Reported**	**Percent Reported**
Sep	5	4	80.0%	4	3	75.0%
Oct	4	4	100%	15	15	100%
Nov	0	0	-	13	12	92.3%
Dec	0	0	-	0	0	-
Jan	0	0	-	1	1	100%
Feb	0	0	-	4	2	50.0%
Mar	2	2	100%	6	4	66.7%
Apr	1	1	100%	7	6	85.7%
May	4	4	100%	8	7	87.5%
Jun	9	7	77.8%	12	11	91.7%
Jul	11	9	81.8%	9	8	88.9%
Aug	9	7	77.8%	10	8	80.0%
Total	45	38	84.4%	87	77	88.5%

Released fish were directly observed and counted by field biologists during at-sea sampled trips and compared with what was recorded on logbooks during the same day, the same week, the following reporting week, or potentially much longer, depending on the timeliness of logbook reporting. In Florida, some charter vessels carry more than 10 passengers, and a portion of at-sea sampled trips from Florida (n=16) were excluded from this analysis because it was not possible to monitor all of the anglers fishing from the vessel.

The number of species released was consistently under reported on logbook trip reports by 1.4 species in Texas and 2.2 species in Florida. The total number of released species that were

reported on logbooks and observed during at-sea validation was an exact match for only a small portion of sampled trips (21% in Texas and 25% in Florida; **Table 17**). For trips validated at-sea where red snapper were observed to have been released, logbook trip reports reported red snapper in any release category for 58% of trips in Texas (**Table 18**, n=24 validated trips), and the total number of red snapper released was under reported by 3.75 fish (**Table 19,** all release categories combined). Other species could not be evaluated for Texas due to the low numbers of sampled trips. In Florida, the percent of at-sea validated trips with logbooks that reported red snapper released in any category was 79% (**Table 18**, n=56 validated trips), and aggregated mean value for the total number of released fish recorded on logbook trip reports was similar to what was observed during at-sea validations (difference of means=0.09 fish for total fish released in all categories combined, **Table 19**). For other species, including greater amberjack, gag, and red grouper in Florida, aggregated means for numbers of released fish reported on logbook trip reports were close to aggregated means for observed trips (**Table 19**); however, gray triggerfish was the exception. Larger sample sizes are necessary to evaluate reporting accuracy for other species.

In addition to providing validations for direct comparisons between observed and reported numbers for released fish, the at-sea observer dataset provides high quality information on recreational discards that could not be collected in a dockside methodology. **Figure 16** below shows the length frequency distributions for both harvested and released red snapper from trips that were validated at-sea in the Texas and Florida study regions. There are notable differences in the sizes of fish that are caught between the two regions. Charter vessels in Florida catch and release more small red snapper, and charter vessels in Texas catch a more even distribution of red snapper size classes. Measuring fish and recording such detailed information in logbooks would be difficult for vessel operators to do simultaneous with tending to rods for multiple anglers and operating the vessel. This type of information has direct applications for regional stock assessments.

Table 17: Proportion of trips validated with at-sea observers and corresponding logbook trip reports that were exact matches for numbers of species released; and the mean absolute difference with root mean square error, means with 95% confidence intervals, and difference of means (Sept. 2010 – August 2011). See Appendix I for detailed description of statistics.

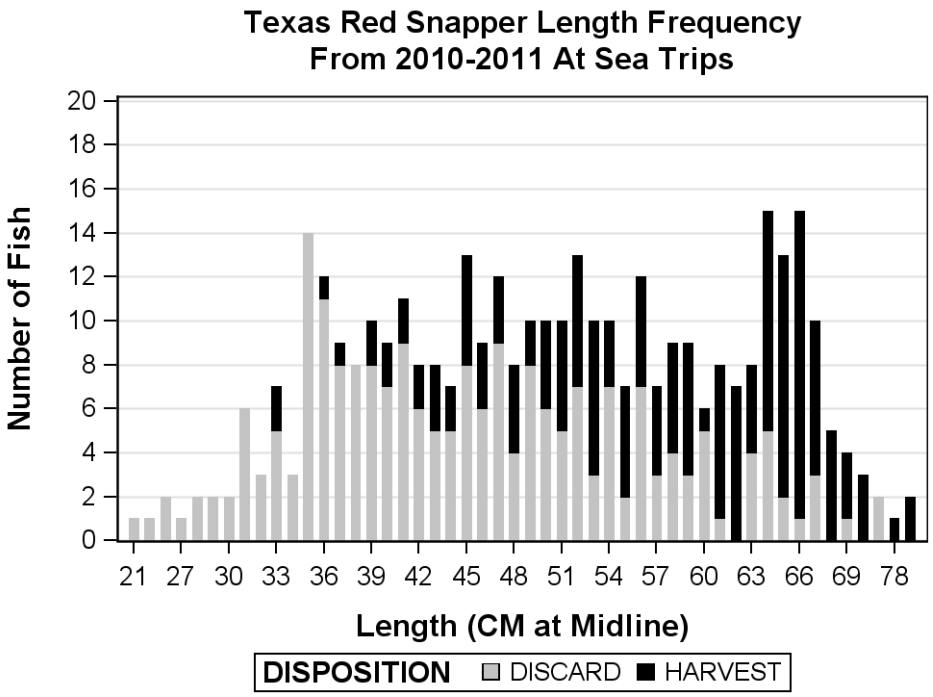
State	Number	Proportion Matched Exactly	Mean Absolute Difference	Root Mean Square Error	At-sea Mean	Logbook Mean	Difference of Means
Texas N=34 trips	Species released	0.21	1.44	1.708	2.21 (1.48, 2.93)	0.77 (0.58, 0.95)	1.44
Florida N=61 trips	Species released	0.25	2.20	3.062	4.25 (3.12, 5.37)	2.05 (1.49, 2.60)	2.20

Table 18. Number of trips validated at-sea where a given species was observed to have been caught and released (positive trips), and the percent of corresponding logbook trip reports where the released species was also reported.

	Texas		Florida	
	At-Sea Trips	**Percent Reported**	**At-Sea Trips**	**Percent Reported**
Bank seabass			11	9%
Cobia	4	25%	3	34%
Gag			26	62%
Gray triggerfish	2	50%	37	57%
Greater amberjack	4	50%	31	52%
King mackerel	4	75%	1	0%
Little tunny	5	100%		
Red grouper			18	61%
Red snapper	24	58%	56	79%
Scamp			11	55%
Sharksucker			11	0%
Tomtate			12	0%
Vermilion snapper	1	0%	9	44%
Other unreported species (positive trips <4 per species)	almaco jack, blacktip shark, blue runner, dusky shark, gafftopsail catfish, lane snapper, lemon shark, night shark, red hind, remora, rock hind, rock seabass, sandbar shark, silky shark, southern stingray		banded rudderfish, bigeye, lane snapper, lizardfish, moray, searobin, pigfish, remora, southern flounder, Spanish mackerel, spotted scorpionfish, whitefin sharksucker	

Table 19: Measured differences between numbers of released fish observed during at-sea validated trips and reported on corresponding logbook trip reports for select species, including the mean absolute difference and root mean square error (mse), means (with 95% confidence intervals), and difference of means between numbers of released fish (Sept. 2010 - August 2011). See Appendix J for details.

State	Species	Release Category	Mean Abs. Difference	Root mse	At-sea Mean	Logbook Mean	Difference of Means
Florida	Red snapper n=56 trips	Alive ≤120'	9.16	18.475	14.18 (-75.79, 104.15)	14.16 (-96.87, 104.13)	0.02
		Alive >120'	3.95	8.913	3.75 (-11.64, 19,14)	2.80 (-13.23, 18.20)	0.95
		Dead	0.95	3.254	0.04 (0.03, 0.05)	0.91 (-1.68, 0.92)	-0.88
		Combined	8.52	17.799	17.96 (-70.18, 106.11)	17.88 (-110.53, 106.02)	0.09
Texas	Red snapper n=24 trips	Alive ≤120'	3.17	6.946	2.21 (-9.52, 13.93)	2.63 (-10.76, 14.35)	-0.42
		Alive >120'	5.92	11.011	6.79 (-35.82, 49.41)	2.38 (-6.98, 44.99)	4.42
		Dead	0.33	0.816	0.04 (0.03, 0.06)	0.29 (0.07, 0.31)	-0.25
		Combined	5.75	9.713	9.04 (-33.63, 51.71)	5.29 (-12.85, 47.96)	3.75
Florida	Greater amberjack n=31 trips	Alive ≤120'	1.90	2.913	3.19 (-6.93, 13.32)	2.58 (-7.11, 12.71)	0.61
		Alive >120'	0.55	1.823	0.58 (-0.16, 1.33)	0.74 (-0.71, 1.49)	-0.16
		Dead	0.23	1.257	0.03 (0.02, 0.04)	0.29 (-0.47, 0.27)	-0.23
		Combined	1.65	2.389	3.81 (-6.30, 13.91)	3.58 (-7.02, 13.68)	0.23
Florida	Gag n=26 trips	Alive ≤120'	2.08	3.363	2.65 (-0.39, 5.70)	1.81 (-1.73, 4.85)	0.85
		Alive >120'	0.38	0.961	0.35 (0.07, 0.62)	0.12 (-0.02, 0.39)	0.23
		Dead	0	0	0	0	0
		Combined	1.92	3.282	3.00 (-0.38, 6.38)	1.92 (-1.58, 5.31)	1.08
Florida	Red grouper n=18 trips	Alive ≤120'	1.78	5.022	1.72 (-1.15, 4.59)	2.61 (-20.06, 5.48)	-0.89
		Alive >120'	0.61	1.225	1.00 (-1.34, 3.34)	0.72 (-2.96, 3.06)	0.28
		Dead	0	0	0	0	0
		Combined	2.06	5.083	2.72 (-0.80, 6.24)	3.33 (-21.18, 6.86)	-0.61
Florida	Gray triggerfish n=37 trips	Alive ≤120'	4.97	8.962	6.54 (-27.32, 40.40)	6.00 (-32.86, 39.86)	0.54
		Alive >120'	1.57	3.863	1.81 (-2.66, 6.28)	0.46 (-0.29, 4.93)	1.35
		Dead	0	0	0	0	0
		Combined	5.46	9.037	8.35 (-23.37, 40.08)	6.46 (-31.32, 38.18)	1.89



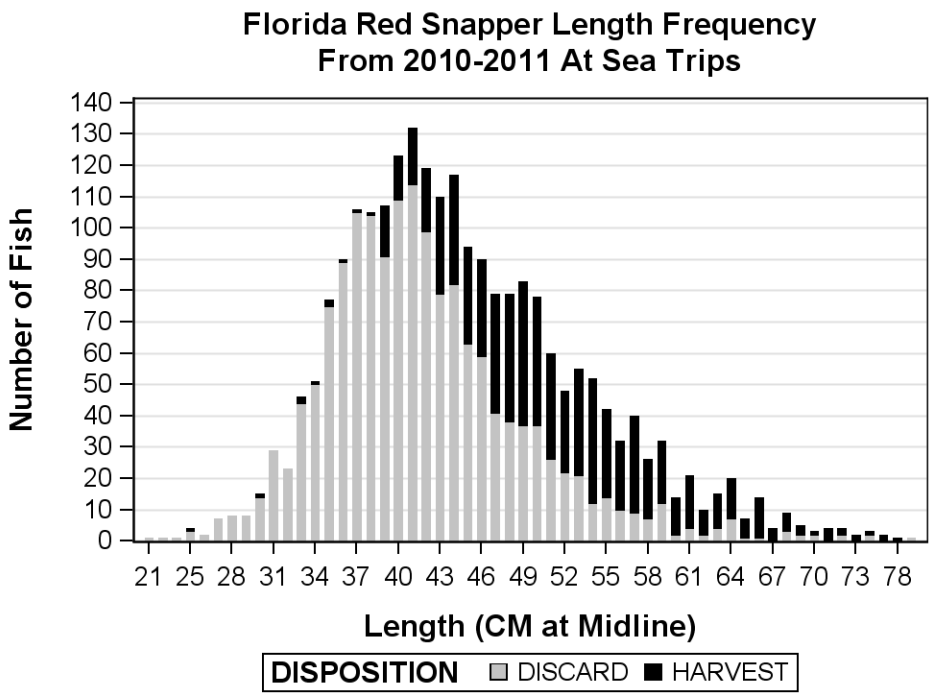


Figure 16. Length frequency distribution of harvested and released red snapper that were measured by at-sea observers during all charter fishing trips validated in Texas (top) and Florida (bottom). Harvest includes fish that were released dead. Note the differences in the number of fish harvested and released off Texas versus Florida.

4. Field Validation Sample Sizes

Validation of Vessel Activity Status

In order to assess the number of vessel activity validation sample days required to adequately measure the proportion of trips for which a logbook trip report was submitted, a Monte Carlo simulation study (see **Appendix L**) was conducted using the population of calendar days that vessel activity validation assignments were conducted during the pilot study. The purpose of the analysis was to examine how extensive a validation program would need to be in order to determine, with various levels of confidence, whether the proportion of trips having logbook records has changed or not over time. Data from Texas were not included in the analysis; however, reporting compliance across months showed similar trends in both study regions (**Table 11**).

The results of the Monte Carlo study were that a large fraction (about 75% or more) of the effort devoted to validation sampling in the pilot study would be needed to produce accurate estimates of the proportion of trips with logbook reports using any type of a hypothesis testing approach. A Bayesian procedure allows the incorporation of prior information based on past years of sampling, which then allows greater precision with smaller sample sizes. The outcome of this Monte Carlo investigation was that a modest sampling effort of 15 to 25 days be combined with a Bayesian analysis. It was also suggested, however, that additional investigation of the ability of such a procedure to detect a true change be conducted, and that a sample size greater than 25 would be preferred if feasible, which could be achieved given the number of days that vessel activity validation assignments were conducted during the pilot study (**Table 5**). For more details regarding this analysis see **Appendix L**.

Dockside Validation of Catch

In order to assess the number of dockside intercepts for individual vessels that are required to adequately assess the accuracy of catch records in logbook trip reports, a Monte Carlo simulation study was conducted for Florida using the population of vessel interviews collected during the duration of the pilot study. The sample size for numbers of trips that were validated and reported through the Gulf Logbook System were too low in the Texas study area for this analysis; however, results from the Florida study area are applicable to Texas if logbooks were to be implemented on a larger scale.

The simulations (**Appendix K**) compared the following quantities for all species reported and separately for just red snapper; 1) the number of fish harvested, 2) the number of fish released in depths <120’, 3) the number of fish released in depths >120’, and 4) the number of fish discarded dead. For Monte Carlo simulations, sample sizes (n) of 10, 20, 50, 100, 200, 300, 400, and 500 vessel trips were randomly selected from the population of all validated trips, and for each value of n the population was re-sampled 25,000 times. The primary objective was to determine whether, in aggregate, logbook reports of the quantities given above can be considered equivalent to what would result from dock-side sampling. To determine this, a statistical procedure called equivalence testing was used. Here, a “zone of indifference" is specified, and if an interval estimate of the difference in a quantity between logbook and dock-side data sources is

contained entirely within the zone of indifference, then the two data sources are declared equivalent.

Results of simulations show that for low sample sizes (n=10, 20, 50, 100), the probability of declaring equivalence between logbook and dockside sampling data sources is low (less than half of the simulations are equivalent), but increases with increasing sample size. The probability of declaring equivalence increases with increasing sample size, and beyond n=300 the rate of return for increasing sample size is diminished (**Figure 17**). For more details regarding this analysis see **Appendix K**.

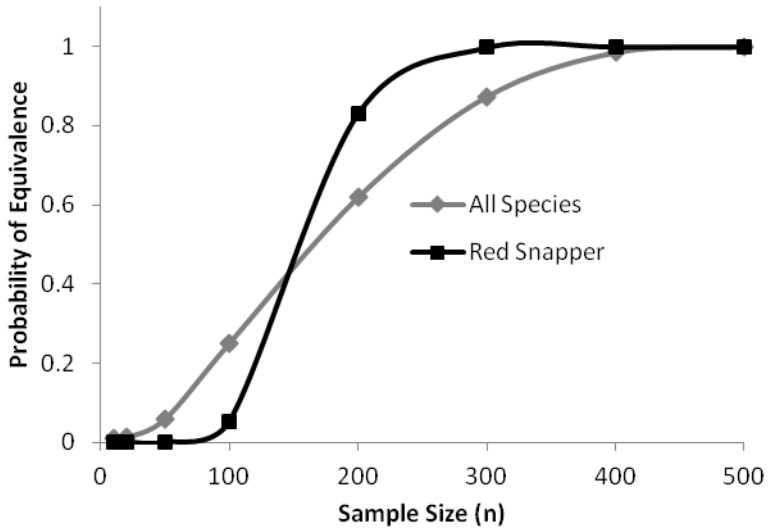


Figure 17. Probability of declaring equivalence between logbook and dockside validation data sources as a function of dockside validation sample size for all species and for red snapper.

5. Project Cost

Costs for this study are divided into two categories: start up expenses and logbook reporting and validation expenses. Start-up expenses include one-time costs associated with development and implementation of the pilot study (**Table 20**). Project expenses include the annual cost for receiving logbook reports through the Gulf Logbook Reporting System, tracking weekly compliance, conducting routine follow-up for missing or late reports, and conducting field validations for self-reported logbook data (**Table 21**). A full-time database manager was hired with supplemental funds received through NMFS Southeast Fisheries Science Center. The database manager was responsible for tracking weekly reporting compliance and coordinating with GSMFC, NMFS, and states as vessels were cleared from permit hold lists. This position was not originally budgeted for in the MRIP project proposal, but was vital to the project.

When total annual cost is calculated on a per vessel basis, the cost for this logbook reporting program was high in the Texas study area, which was a small region with a small number of vessels. In the larger Florida study area, which included more vessels, the cost on a per vessel basis was significantly reduced (**Table 21**). The annual per vessel cost for the Florida study area is a more in line with the expected cost for implementation of a weekly logbook reporting

program on a region-wide scale. The per vessel cost for a logbook reporting program with a daily or real-time reporting frequency is expected to be higher, due to the need for additional manpower to conduct more frequent compliance tracking and follow-up for non-response. Annual costs to run a logbook reporting program in Texas would be an additional expense, since the state survey conducted by Texas Parks and Wildlife would not be replaced by a logbook program. In Florida, annual costs to run a logbook reporting program could be offset if the program replaced the current For-Hire Telephone Survey and Access Point Intercept Survey for for-hire mode.

The chosen method(s) to validate self-reported logbook data also impacts the cost for implementation. This pilot study employed three separate validation methods, and each provided varied degrees of information for comparison with logbook trip reports. Validation of vessel activity is the cheapest validation method, and sample sizes in this pilot study were adequate for measuring the proportion of trips reported on logbooks. However, since this method is only useful for validating effort, it must be accompanied by another validation method for catch. Dockside validation is the cheapest validation method for catch; however, this method does not provide a measure of reporting accuracy for released catch. Based on the results of the sample size analysis, the number of dockside validations collected in the Florida study area could be reduced from 695 interviews with matching logbook trips to as few as 300 without impacting the results. At-sea sampling is the most costly validation method, but provides a direct validation for released catch and high quality data that is also valuable for stock assessments and fisheries management. Sample sizes for at-sea validations in this pilot study were low; however, money saved on fewer dockside validations in a future implementation could be invested in additional at-sea samples.

Table 20. Start-up expenses for Gulf Logbook Reporting System. Project expenses are summarized for both the Gulf States Marine Fisheries Commission and Marine Recreational Information Program.

	Gulf States Marine Fisheries Commission	**Marine Recreational Information Program**
Stakeholder Workshop		$ 48,000
Electronic Reporting Tool, development and maintenance		$125,000
Field Validation Data Entry Program	$14,000	
Certified Notification Letters	$ 2,300	
Courtesy Letter	$ 200	
Outreach meetings (2 in Florida, 1 in Texas)		$ 10,000
Workgroup meetings		$ 14,000
Consultant support		$ amount not provided

Table 21. Operating costs to run the logbook reporting system, track compliance, and conduct field validations during the one-year pilot study.

	Texas Study Area	Florida Study Area	Regional Coordination
Regional Coordinators and Field Samplers	2 full-time contract positions, $67,172	1 full-time coordinator plus overhead, $53,738	GSMFC administration costs for coordinating survey activities and administering contracts, $25,000
		2 full-time field staff plus overhead, $79,231	1 full-time database manager, $50,000 (responsible for tracking compliance and working with data for both Florida and Texas)
Training and Travel Expenses	$5,000	$12,680	
Equipment	$3,200	$3,000	
Printing, paper logbook forms		$12,000	
At-Sea Validations	Passenger fare, $5,000	In-kind staff time, travel, and passenger fare, $81,550	
Total Annual Cost	$80,366	$230,199	$75,000
Annual Cost per Vessel	$1,340/vessel for 60 vessels	$658/vessel for 350 vessels	$183/vessel for 410 total vessels

6. Post-Pilot Study Participant Survey Results

Electronic Reporting Responses

A total of 93 surveys were returned by participants at the conclusion of the pilot study (79 responses from Florida and 14 responses from Texas). A response rate cannot be reported because the electronic survey was open to anyone with access to the Gulf Logbook Website and it is not known if more than one person representing a single vessel responded to the survey. A complete summary of the survey responses is provided in **Appendix M**. When asked whether participants would support using a logbook reporting system in the future, based on their experience with this pilot study, the majority of respondents in both regions said yes (70.2% in Florida and 83.3% in Texas). In Florida, 42.5% of respondents preferred to report every week on logbooks (30% preferred not to report weekly), versus 60% of respondents in Texas who preferred to report every week (10% preferred not to report weekly). In both regions approximately 30% had no preference. The majority of participants that preferred not to report weekly on logbooks reasoned that it took too much time (100% for Texas and 75% for Florida), indicating they would prefer to report less frequently rather than more frequently.

Half of respondents in Texas reported that it was very easy to keep an accurate count of released fish (20% said it was not easy at all), compared to 28.2% in Florida (41% said it was not easy at all). In both regions, 30% of respondents agreed it was somewhat easy to keep an accurate count of released fish for weekly logbook reporting. Approximately 80% of respondents in both regions recorded the numbers of released fish either while the trip was underway or sometime during the day the trip took place.

The majority of surveys returned from both regions indicate that participants found the registration and setup process for the Gulf Logbook website to be somewhat easy or very easy (**Figure 18**). A higher percentage of respondents from Texas reported that it took longer than 10 minutes to fill out a single electronic trip report (30% versus 17.5% in Florida). Approximately 83% of respondents in both regions found the weekly email reminders helpful, although a smaller number found the monthly telephone calls as helpful. The majority of Texas respondents 91.7% found TP&W staff to be very helpful and the remaining 8.3% said they did not communicate with state staff. In Florida, 71.5% of respondents found FWC staff to be somewhat to very helpful and 26.5% said they did not communicate with state staff. One respondent did not find FWC staff helpful at all.

Paper Reporting Responses

A total of 29 survey responses were received from paper reporters. All responses were from Florida, since all reporting for vessels in Texas was through the electronic reporting tool. A complete summary of the survey responses is provided in **Appendix M**. Many of the respondents that identified themselves as paper reporters did not use the electronic reporting tool because they either did not have access to a computer and/or internet or did not know how to use them. The majority of paper reporters, 79.3%, found it somewhat to very important to receive postage paid envelopes for mailing paper logs. Fewer paper reporters kept a written account of released fish the day the trip took place than electronic reporters (55.1% for paper reporters and 82.1% for electronic reporters). A clear difference between paper and electronic reporters is seen in the percentage of respondents who would prefer to report fishing trip information every week via logbook reports: 42.5% of electronic reporters prefer to report every week, versus 24.1% of paper reporters (37.9% and 27.5% respectively had no preference with regards to weekly logbook reporting). A higher percentage of respondents that reported electronically would support using a logbook reporting system in the future (70.2%, versus 44.8% of the paper reporters). Approximately half of the paper reporters (51.7%) said they would not support a future logbook reporting system, while only 29.8% of the electronic reporters did not support this.

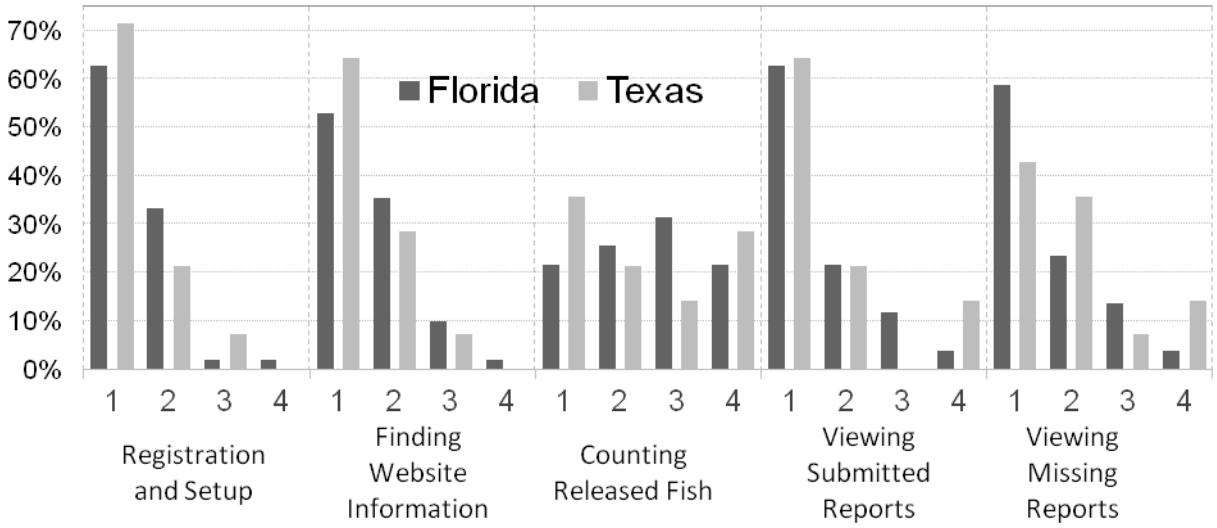


Figure 18. Percentage of responses in the end-of-pilot participant survey pertaining to the level of effort required to complete electronic logbook reports (1=very easy, 2=somewhat easy, 3=not at all easy, 4=not answered).

CONCLUSIONS AND DISCUSSION

This study was initiated with the support of stakeholders, which were consulted prior to the design and implementation. Efforts were also made in advance of the pilot start date to introduce participants to the new system and formally notify them of the requirement to report. This approach is in accordance with guiding principles identified as critical for the successful development and implementation of new fisheries monitoring programs (MRAG Americas, 2011). Reporting non-compliance in the Florida panhandle, the largest area in the study region, was a hurdle that was not anticipated during the planning of this pilot study. A directed effort was made during the first months of reporting to initiate contact with selected permit holders and bring them into the study voluntarily before resorting to warning letters and the use of enforcement. There were significant improvements in the percentage of compliant vessels immediately following that effort and, for the longer duration of the pilot study. Compliance gradually increased throughout the duration of the study as vessel permits for persistent refusals became due for renewal. By the end of the study period, permits for 39 non-compliant vessels in Florida had not come up for renewal and compliance would have continued to improve if the study had continued beyond August 2011. Prior to implementation of any new logbook reporting program, a well-thought out plan to reinforce the reporting requirement after the start date should be in place so that it can be executed quickly. Sustaining compliance and timeliness of logbook reporting required a continuous and high level of effort throughout the duration of this study. The routine task of tracking missing and late reports and conducting timely follow-up with delinquent vessels required significant manpower and interagency cooperation that was vital for maintaining

compliance and timely reporting by participants in this study. The cost for this effort should not be expected to diminish over time and should be incorporated in the initial design and long-term funding plan before the start of a new logbook reporting program. The reporting frequency and associated cost for compliance tracking and timely follow-up procedures should both be factored into the initial design and long-term funding strategy for any region-wide logbook reporting system prior to implementation. More frequent reporting than what was chosen for this pilot study (e.g. daily or real-time) would have required more frequent tracking and follow-up procedures, and would have increased the cost for this pilot study.

This study was designed to test the feasibility of a logbook reporting system under the current regulatory authority, which specifies that charter vessels with federal permits may be required to report weekly. Because 100% reporting was not achieved during this study, logbook reports collected during this study may not be treated as a complete census for effort or catch. Vessels in this study were identified as non-compliant during a given reporting week if one or more trip reports or an inactivity report was not received through the Gulf Logbook reporting system. However, if a permit holder either misreported inactivity or did not report a portion of trips for a given week, there was no mechanism in place to identify those vessels as non-compliant. Vessels were not prompted to fill in a response for each day of a reporting week in the electronic reporting tool; however, such a prompt would not resolve the issue of inaccurate reporting (reported no trip when there actually was, or reported only one trip on a day when there were multiple trips).

This study design would not be capable of measuring or certifying reporting accuracy at the individual vessel level. Fishing activity for some vessels could not be validated (field staff were unable to locate the vessel or verify the fishing status) and charter fishing vessels were dispersed across a large geographic area in Florida; therefore, alternative methods would be required to achieve 100% validation of vessel activity. Designs which can measure reporting accuracy at the level of the individual vessel have been implemented in commercial fisheries. For example, in British Columbia's commercial hook-and-line groundfish fishery, participants are required to submit logbooks for every trip and are subject to 100% dockside monitoring of harvest and 100% video electronic monitoring of discards at sea, which is used to audit an individual vessel's logbooks for reporting accuracy (Stanley et al, 2011). Electronic vessel monitoring systems have also been used in commercial fisheries to track vessel activity, including trip length and fishing location. However, 100% validation of vessel activity is costly and the costs for varying levels of vessel-activity validation should be included in the decision process for how a recreational for-hire logbook reporting system is to be designed and utilized. Costs for video-based electronic monitoring programs in three commercial fisheries using equipment and services supplied by Archipelago ranged between $80 Canadian/vessel day ($81 current US) to $250 US/vessel day and represented between 1% and 3% of the value of harvested catch for the monitored trip (McElderry, 2008). In this study, more than 13,000 charter fishing trips were reported through

the Gulf Logbook Reporting System. The value of a charter vessel fishing trip in the Gulf of Mexico is considerably lower compared to the haul of a single commercial trip, and charter fishing trips are shorter in duration and may occur more frequently. Therefore, the cost for 100% monitoring and validation could potentially be much higher for recreational for-hire fisheries.

The level of validation accomplished in this study was high when compared to current survey methods employed in the region. Logbook reports in this study were submitted for a large portion of the total effort (approximately 70% overall), which was verified through field validations of vessel status. The For-Hire Survey, which estimates fishing effort for charter vessels in the Florida study area, selects a sample size of 10% of known active vessels each week (Van Voorhees et al. 2002), and the effective sample size can be considerably less when non-contacts and refusals are factored in (MRIP 2008). Dockside intercept surveys that sample harvested catch and interview anglers about their released catch in the Florida study area also represent less than 10% of total estimated trips. It may be feasible to combine data from the large logbook sample and the smaller subsample of validated trips to estimate total catch and effort. Average values for harvested and released catch logbook reports and validation samples over all trips in aggregate were similar, at least for the species that were evaluated. However, there may be cause for concern regarding the accurate recall and reporting of released catch. When logbook trip reports were compared with information on released fish recorded during at-sea validations, not all species were reported for a high proportion of those trips. For trips where red snapper were observed to have been released during validations at-sea in the Texas study area, a high percentage did not have red snapper releases recorded on logbook trip reports and the numbers of red snapper released at depths >120’ were under reported by approximately 1.8 fish per trip (**Table 14**). However, in the Florida study area, the number of released red snapper reported on logbooks was similar to at-sea samples when aggregated means were compared. Whether this is a true regional difference in reporting accuracy for red snapper or an issue related to the low number of at-sea validations in the Texas study area could not be determined. If the species that are under-reported on logbooks are rare event species that are infrequently encountered, then under-reporting may not be detected by field validation methods with low levels of sampling.

This pilot study demonstrates the feasibility for placing observers on charter vessels to collect detailed information on recreational discards. Initial concerns during the design of this pilot study were that vessel operators would not voluntarily allow observers on board, that charter customers would not welcome the presence of observers on private trips, or that vessel capacities would limit the ability to successfully schedule trips. Charter vessel operators that permitted observers on board expressed a high degree of confidence in the information collected and the presence of observers was well received by charter customers. Such stakeholder buy-in is important for building trust in stock assessment outcomes and management decisions. While the cost for at-sea samples is high, the quality of information collected for released fish provides added benefits for stock assessments and management. At-sea validation in this study was low,

and the required sample size for validating logbooks should be further evaluated. Though sample sizes for at-sea validations in this study were low, larger differences between at-sea validations and logbook reports suggest that numbers of released fish may be under reported in logbook trip reports as well as during dockside validation interviews with vessel operators. Methods developed for commercial fisheries that employ observer data to develop independent estimators for discards (Kaiser 2006) should also be explored for for-hire fisheries.

In small regions with low numbers of active vessels, acquiring adequate sample sizes to validate harvested and released catch may be too costly or not feasible. Sample sizes in the Texas study area were too low for many of the analyses that were able to be performed for the Florida study area. Even during high activity months, the numbers of trips that were validated dockside and at-sea were low for many species of interest. The cost per vessel to conduct this study was also significantly reduced in the larger Florida study area. If logbook reporting was implemented statewide in Texas, then such a system should be more feasible; however, the results for the Texas study area may still have important implications for smaller states with small coastlines and/or a low density of charter vessels.

This pilot study placed a high emphasis on electronic reporting. While a paper reporting option was available, it was not offered until participants first contacted Bluefin Data to register for electronic reporting and only if paper was a better reporting option for an individual participant. The electronic reporting tool was available to all participants at no cost, as were paper log sheets, but postage to mail paper forms was not provided. Participants in the Texas A&M study were provided free equipment and a free smart phone application (iSnapper). Electronic reporting resulted in a high cost savings in terms of data review, follow-up, and data entry. For participants that elected to report via paper log sheets, state coordinators were frequently required to contact vessel operators if data fields were left blank, illegible, or appeared to be filled out incorrectly. In comparison, data entry restrictions built into the Gulf Logbook website resulted in clean data and required much less review and follow-up with participants. The iSnapper application had less built-in restrictions, but features built into the Gulf Logbook website could easily be matched in future versions of smart phone applications. Additional manpower was also required for data entry of paper log sheets by state coordinators into the Gulf Logbook reporting system. The majority of participants in this study reported electronically, and the cost for the paper reporting option was within expected limits. Because paper reporting is more costly, the willingness and/or ability of participants to report electronically should be assessed before a logbook reporting system is implemented on a larger regional scale.

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MRIP Gulf of Mexico For-Hire Electronic Reporting Pilot Project

Workshop, August 20-21, 2009, New Orleans, LA

Organized By:

Marine Recreational Information Program (MRIP) For-Hire Workgroup, Gulf of Mexico Project Team

Beverly Sauls (project lead), Florida Fish & Wildlife Conservation Commission
Michael Burton and Ken Brennan, NMFS Southeast Fisheries Science Center
Page Campbell, Texas Parks and Wildlife Division
David Donaldson, Gulf States Marine Fisheries Commission
Michelle Kasprzak, Louisiana Department of Wildlife and Fisheries
Tom Sminkey, NOAA Fisheries Service, Science and Technology
Andy Strelcheck, NMFS Southeast Regional Office
Robert Zales, National Association of Charter Operators and charter owner/operator

Facilitator: Pres Pate, Chair, MRIP Operations Team

Contents:

BACKGROUND

Goal: Define requirements for a MRIP-funded pilot electronic logbook reporting system for the Gulf of Mexico for-hire fishery in collaboration with for-hire industry groups, representatives from state resource management agencies, Gulf States Marine Fisheries Commission, Gulf of Mexico Fisheries Management Council, and federal fisheries managers and stock assessment scientists. A list of all participants is provided in Appendix A.

Workshop Format: One workshop with invited participants, open to public viewing broadcast live on Internet (http://www.livestream.com/gsmfc). Audio and visual equipment and technical support were provided by Gulf States Marine Fisheries Commission. The live broadcast was announced prior to the workshop through an MRIP Newscast, and was also announced at the August Gulf of Mexico Fisheries Management Council meeting. Participants included for-hire industry representatives that were otherwise unable to listen in or participate in person, as well as interested parties from various resource management agencies around the country. Between 17 and 25 individuals were online during any given time during the broadcast. A live chat room enabled online participants to post comments and ask questions that could be addressed during the workshop.

Acknowledgements: The workshop organizers would like to express their thanks to Pres Pate for facilitating the workshop and keeping us on track; Joe Ferrer for his technical support during the workshop and making everything run smoothly; Josanne Fabian for her up-to-the-minute assistance with invitational travel; and Forbes Darby for putting the word out (with short notice) about the opportunity for people to participate in this workshop via the live web broadcast.

Summary of Agenda:

August 22, 2009

- Background of Marine Recreational Information Program (MRIP)
- For-Hire Review Report Conclusions
- Management Perspective
- Industry Perspective
- NGO Perspective
- Identify and recommend minimum data elements for a proposed logbook reporting system, necessary reporting frequency, state-level participation.
- Project duration and area to be surveyed.
- Reporting Options, Available Technology
- Identify preferred option(s) for pilot project

August 21, 2009

- Reporting Validation Requirements: Identify options, existing data sources for potential use in validation, additional data sources, methods for tracking non-response/non-compliance
- Develop list of recommended data sources and potential methods for inclusion in pilot
- Workshop Summary
- Review of recommendations

WORKSHOP PROCEEDINGS

Background of the Marine Recreational Information Program (MRIP):
Pres Pate, Chair of the MRIP Operations Team, gave an overview of the MRIP initiative, which was started by NOAA Fisheries to improve the collection of data on recreational fisheries in the US and Territories. NOAA Fisheries commissioned the National Research Council (NRC) to review all the state, regional and national surveys used to compile recreational data. The NRC presented its findings in a report issued in 2006. It identified a number of deficiencies in the programs relative to survey design and application of the data to management needs that have evolved since the surveys were created. It made many recommendations for survey improvements, including better matching of survey design and estimation procedures, removing biases caused by undersampling of night fishers and those using private access points, and creating a national registry of saltwater anglers. The NRC suggested that the for-hire industry be considered a commercial sector and that reporting requirements for this sector should be different from other recreational fishing activities. Specifically, it recommended that for-hire operations be required to maintain and submit mandatory logbooks documenting fishing effort and catch.

An Executive Steering Committee is responsible for MRIP direction and oversees the function of three "teams" that work on area specific aspects of the MRIP, such as the national registry, communication and outreach, and survey improvements. The Operations Team (OT) is working on the survey component and is supported by four work groups, including the For-Hire Work Group. Membership of all these groups includes constituents and representatives from state agencies with experience in management and survey design and implementation. The OT annually sets research priorities that are assigned to the appropriate work group for project development. Priority projects have been those necessary to respond to the recommendations of the NRC. Changes to existing surveys and implementation of necessary new ones will occur as results of the various studies are available.
MRIP will consist of seven regional systems of surveys adhering to national standards and best practices. In addition to providing each region with the flexibility to address local and/or regional needs, this approach will maximize efficiency by utilizing, to the greatest extent practical, existing infrastructure developed by regional Fishery Information Networks (FINs) and/or state data collection programs. Ultimately, the regional recreational data collection and data use partners will evaluate specific data needs and apply MRIP solutions. They will determine how best to administer and govern regional surveys, resolve issues, determine available funding support levels and apply funding to regional priorities, consistent with MRIP national standards and best practices.

Details about the MRIP initiative can be found at www.CountMyFish.noaa.gov

MRIP For-Hire Review Report Conclusions:
Beverly Sauls, Chair of the MRIP For-Hire Workgroup, gave an overview of the recent review of methodologies currently in use for collecting data from for-hire fisheries across the country. A major recommendation of the review was the universal use of logbooks for reporting catch and effort in for-hire fisheries. Also provided in the report were a series of Best Practice Recommendations for a logbook reporting system to be effective. The full report of the MRIP For-Hire Review and the Power Point presentation given by Beverly Sauls at this workshop are both available at www.CountMyFish.noaa.gov

Management Perspective:

State Perspectives

Representatives from state resource management agencies discussed their state-specific needs for for-hire data collections. Texas conducts an independent survey of charter vessels operating within their state. The state survey meets their needs for state-level stock assessments and fisheries management; however, it is recognized that there are additional data needs for vessels in their state targeting federally managed fisheries. Louisiana, Mississippi, Alabama, and Florida currently use the For-Hire Survey to track trends and conduct stock assessments for state-managed fisheries. Louisiana and Florida have a specific need for estimates with geographic resolution within the state (east and west of Mississippi River, north and south Florida, Florida Keys Gulf and Atlantic coasts). There was also acknowledgement from the state representatives that catches from inshore guides, which directly affect state-managed species, are not adequately sampled in the current for-hire survey methodology. A census reporting method would be useful for capturing better information on seasonal fisheries (such as cobia, king mackerel), regionally localized fisheries (such as bonefish and tarpon) , and specialized fisheries (such as guides that utilize multiple access sites, including private access sites, and fisheries that operate at night). Census data could potentially be used to better direct intercept sampling for catch data from fisheries that are thought to be under-sampled in large-scale regional sample draws.

No state in the Gulf of Mexico currently requires reporting by for-hire vessels to the state. Mississippi does not have authority to require commercial trip ticket reporting and does not anticipate gaining similar authority readily for recreational for-hire vessels. Louisiana's state Legislature mandated the development of an electronic logbook reporting system for for-hire vessels in 2008. While the Legislature did consider requiring for-hire vessels to report in this system, they elected to implement the program as a voluntary reporting system for trip level effort reporting, with an option to also report trip level catch. This reporting system will be reviewed by the state Legislature and mandatory reporting could be a consideration in the future. Alabama would require legislative approval for mandatory reporting and it was indicated that this could be supported in the future.

Florida and Texas have management authority for state territorial seas extending to 9 nautical miles. Because for-hire vessels operating within state boundaries may target federally managed fisheries without federal permits, state-level reporting for for-hire fisheries in these states will be of particular interest to state, regional, and federal managers as requirements for managing federal fisheries through annual catch limits and accountability measures are implemented. Participants in federally managed fisheries also have an interest in state-level reporting requirements if they are to be monitored accurately and managed collectively. Florida currently does not require reporting by for-hire vessels in the For-Hire Survey or through any other data collection system. A legal interpretation of the state's current authority to require reporting by commercial fishers should be done to determine if authority exists under the state's existing law or if additional authority would be necessary. If and when legislative authority were established, regulations would then need to be pursued through the state's appointed Commission. Texas intends to continue their long time-series of data collections through their existing state survey. It was suggested that the state survey in Texas could compliment a logbook reporting system as a validation component if a mandatory reporting system for federally permitted vessels and/or vessels targeting federally managed species was implemented. The state of Texas is also interested in the methods that are developed and tested as part of this pilot project to potentially improve their state survey.

Regional Data Management Perspectives
Dave Donaldson from Gulf States Marine Fisheries Commission expressed the Commission's support for an MRIP pilot project to design and test an electronic reporting system in the Gulf of Mexico. The Commission is willing to coordinate the regional data collection. Tom Sminkey from NOAA Fisheries Science and Technology indicated that his office is willing to accommodate the data needs of fisheries managers and stock assessment analysts.

Regional and Federal Management Perspectives
There is momentum at the regional Council level to move forward with specifications and requirements for an electronic reporting system, including for-hire recreational fisheries, in the Gulf of Mexico. At the August, 2009, Gulf of Mexico Fishery Management Council meeting, three motions were passed:

1) To establish mandatory electronic reporting system criteria by Feb 2010 for all Council-managed Gulf fisheries.

2) For the Data Collection Committee to pursue general criteria for mandatory electronic record keeping and reporting requirements for all sectors and all fisheries within 6 months.

3) To establish an Ad Hoc Data Collection Panel to define sector specific electronic data reporting systems requirements. Target completion is the Council meeting in June, 2010. This panel will be comprised of knowledgeable sector representatives, including the MRIP to ensure compatibility.

Carrie Simmons, staff to the Gulf Council, presented a summary of data needs from the regional council perspective. Peter Hood also provided input from National Marine Fisheries Service (NMFS), Southeast Regional Office, on their data needs for regional fisheries management.

The primary driver behind data needs within the Gulf of Mexico region is the recent federal requirement to manage fisheries with annual catch limits (ACL's), and to mitigate any ACL overages through accountability measures (AM's). Management through the use of ACL's and AM's is required by 2010 for all overfished stocks, and by 2011 for all fish stocks that are managed by the Council. In order to avoid accountability measures that could subsequently restrict or close a fishery entirely if overages occur, there is a strong need by fisheries managers for data that can support in-season monitoring. A benefit to fishery participants is that with in-season monitoring, fisheries may be managed closer to the allowable biological catch limit (ABC, set below the ACL to prevent overages before they can be detected). Some essential elements necessary for a logbook reporting system to support in-season monitoring include:

- Decreased time from entry of data to availability for use by managers. Estimates should be available on a monthly or lesser interval.
- To accomplish monthly estimates, reporting frequency in a logbook reporting system should be no greater than weekly.
- Self-reported data must be validated and validation information should be available in a timely manner for use in monthly estimates.
- Attention must be given to decreasing variability with sufficient sample sizes.

Essential data elements needed from a logbook reporting system include:

- Identification to species
- Number of fish by species harvested and released
- Length distribution of discarded fish
- Time and origin of trip

Socio-economic data elements that would also support management and allocation include:

- Cost of trip
- Price of trip
- Number of passengers
- Length of trip
- Passenger origin (zip code)

Additional data elements that would support analysis for effectiveness of various management options include:

- Trip level information on discard mortality
- Better data on both large quantity discards and rare event discards
- Depth interval fished (example: <60', 60-120', >120')
- Reason for release (size, bag limit, season, area, non-target species, catch-and-release fishing)
- Bait type (natural, artificial)
- Circle hooks and venting tools (were they used, how were they used)
- Spatial information for the Florida Keys (fishing in the Gulf versus Atlantic)

The Gulf Council is also actively involved in fisheries management decisions pertaining to allocation among and within fishing sectors. In addition, catch shares are gaining increasing attention as a potential management tool for the future. Some essential data elements to aid with these types of decisions include:

- Participation and catch history by vessel
- Participation and catch history by vessel operator

Stock Assessment Perspectives

Data needs for stock assessments are much higher in resolution than those for management. The quality of stock assessments determines the ability of fisheries managers to make sound decisions with a high level of confidence.

Dave Gloeckner from the NMFS Southeast Fisheries Science Center provided a list of data needs for stock assessment that are not provided by the current survey method for for-hire data collections. At the most basic level, stock assessment analysts desire trip level data from the for-hire sector that is similar and comparable to data collected from commercial sectors. Currently, for-hire catch and effort are estimated at a coarse area-fished level (inland, state territorial seas, or federal EEZ waters). Commercial data are collected at a higher resolution by statistical zone. Figure 1 illustrates the grid currently in use for commercial sector reporting in the Gulf of Mexico and South Atlantic. Industry

representatives present at the workshop indicated that the level of reporting currently in use by the commercial fisheries in the Gulf of Mexico could be easily accommodated in a for-hire logbook reporting system. Some issues with statistical zones that overlap states may need to be resolved (example, zones 10 and 11 in Figure 1).

Ideally, stock assessment analysts would prefer higher resolution area-fished data, including latitude and longitude recorded for each "drop" site within a trip. This information could support more complex ecosystem-based modeling approaches. Depth fished by site, rather than a trip level depth interval (minimum, maximum, average depth fished) is also highly desired for assessing discard mortality rates. Industry representatives present at the workshop voiced strong resistance to reporting area-fished data at a higher resolution than the commercial statistical zones. They were particularly resistant to recording exact lat/long coordinates for fishing sites due to the proprietary nature of private and unpublished fishing spots. Industry representatives were not opposed to recording more detailed depth-fished information since that information would not reveal the location of proprietary fishing spots.

Higher resolution area-fished information would increase the complexity of logbook reports, requiring that multiple areas fished be recorded within a trip. In addition, assessment analysts would need catch and effort data recorded for each area-fished within a trip. Validation of high resolution self-reported data would also be more costly. Stock assessment analysts also requested that hook-type be recorded for each discarded fish, further increasing the complexity of logbook trip reporting. This type of data may be unobtainable in a logbook trip report when captains and mates are also responsible for safe operation of the vessel, keeping track of harvested catch within legal limits, unhooking and properly venting non-legal fish in a timely manner, and tending to customers. The question was raised whether it was necessary to obtain such a high resolution of data for every trip in a logbook report, or whether this data could be collected by some other means. One recommendation was that detailed data could be obtained as a sample and incorporated into the selected methodology for validation of self-reported trip data. For example, if an at-sea observer program or some form of electronic monitoring is utilized to validate the number and species composition of discards for a sample of trips, that methodology could also be employed to collect site-specific data (depth, finer resolution area-fished, number of lines, number of fish) and even fish-specific data (hook-type by discard, condition upon release, etc.).

Industry Perspectives

Workshop participants included a broad range of for-hire industry perspectives from every Gulf of Mexico state. Participants represented or were active members of the Florida Guides Association, Port Aransas Boatmen Association, National Association of Charterboat Operators, Save Our Selves (S.O.S.), Mississippi Charter Boat Captain Association, Louisiana Charter Boat Association, and Destin Charter Boat Association. Three participants are current members of the Gulf of Mexico Fishery Management Council. One participant was a member of the NMFS Highly Migratory Species Advisory Panel.

Industry representatives gave clear support for collecting better data, though support for a census-style logbook reporting system was mixed. Much of the opposition was grounded in a fear within their industry that better data will be used against them. Guides and inshore fishermen are not convinced that a mandatory logbook reporting system is absolutely necessary. Industry representatives that participate in federally managed fisheries are keenly aware of the implications of ACL's and AM's that are soon to be implemented in the management of federal fisheries, and they recognize that a new data collection system can help their industry. Industry representatives with a stake in federal fisheries indicated that they are willing to do whatever it takes to stay in business and were more amenable to a

mandatory logbook reporting system. Among this group, there was also strong support for active enforcement with stiff penalties to ensure accurate and complete reporting. It was also agreed upon that self-reported logbook data should be verified and validated; however, imputation and estimation procedures should be minimized to the extent practicable.

It was recognized by everyone present at the workshop that there is a large diversity within the for-hire industry, and this diversity must be considered if a logbook reporting system were universal. Many vessel operators are not computer literate. Small boats have space limitations, power supply limitations, and a wet corrosive environment that are not conducive to carrying electronic equipment such as a laptop computer. Even the use of a voice recorder may not be possible if an operator has wet hands. There were also concerns about the expense of electronic equipment and technical difficulties of transmitting data during transit on smaller vessels. Most industry representatives expressed a preference for data entry after the trip rather than during transit. However, operators would need some way to record information during the trip so that there is a record for entering information later, such as a paper form, laminated card, or tablet. There was stronger support for weekly versus real-time or daily reporting.

It was strongly recommended by industry representatives that the required list of data inputs in a logbook trip report be kept to a manageable level. They warned that starting out with a reporting system that is too complex or burdensome would turn people off and would not foster a willingness to cooperate over the long-term.

Other comments and concerns from for-hire industry representatives include:

- Concern about unlicensed charters operating illegally, which hurts industry and can't be counted.
- Recommend including oversized charters in the Southeast Headboat Survey. In Mississippi, this would include virtually all vessels operating in federal waters and there would be no need for a new system for them.
- Industry representatives were emphatic that latitude and longitude coordinates for individual fishing sites not be included on the logbook trip report.
- Reporting system must be flexible so that the charter operator can add items and customize the program.
- Allow the technical industry to offer innovative equipment solutions and provide fishermen with a choice.

Enforcement Perspectives

Federal enforcement agents participating in the workshop encouraged that reporting requirements be kept simple to maximize compliance and minimize the need for enforcement. A mandatory reporting system will work best if it can accommodate enforcement rather than produce more burden on enforcement agents that are already stretched thin. For example, if enforcement agents can be notified when someone is non-compliant, that would facilitate more effective enforcement rather than relying on enforcement agents to conduct random checks. Enforcement is also more effective when an officer has the ability to levy fines and penalties at the time of the offense (e.g. write a ticket) rather than the longer process of building a case and prosecuting sometime later. For example, the penalty of non-renewal of permits sometime after the offense allows violators to come into compliance before the penalty can be imposed.

It was also noted by federal enforcement agents participating in the workshop that verifiable trip level reporting can be very useful for detecting violations in fishing regulations, such as seasonal or area closures. Vessel monitoring systems are very useful for this purpose.

Socio-Economic Perspectives

Rex Caffey, an economic analyst with Louisiana State University, discussed an analysis he was able to do for the commercial fishing sector in Louisiana that facilitated disbursement of disaster relief funds following Hurricane Katrina. His analysis was done at the individual fisherman level, and he was able to do this analysis because the data were available from commercial trip tickets, which is a complete census of commercial fishing revenues. If this type of data were available from the for-hire sector, funds could be more equitably dispersed.

Bob Zales, industry representative, indicated that economic data would also support the for-hire industry through implementation of National Standard 8 of the Magnuson-Stevens Act, which requires that economic impacts be considered in fisheries management decisions. Without any economic data, this National Standard cannot be considered. Harlon Peirce also commented that economic data can benefit the user by providing data on profit margins to help run a business.

Chris Leise from NMFS Southeast Science Center indicated the most urgent data need for economic analysis is trip level passenger fares. Peter Hood received a list of data needs from Stephen Holliman, a socio-economic analyst for the NMFS Southeast Regional Office, that also included trip type, targeted species, trip length, distance, number of passengers, trip revenues, trip cost (fuel, fuel price), labor cost, and other trip level expenses.

While there was strong industry support for better economic data, there was some concern about collecting this information in a logbook reporting system. Industry representatives pointed out that their trip rates are advertised and this information is readily available without requiring it on a logbook report. Industry representatives also indicated that reporting expenses at a trip level would be problematic for items purchased in bulk (for example, one captain indicated he purchases hooks by the thousands and would not want to report the trip level cost for a small number of hooks).

One suggestion posed to the group was that rather than collect complete census data, a sub-set of reporters could be selected to periodically report economic data on their logbook trip reports. Some data elements could be optional as opposed to mandatory. Michelle Kasprzak noted that the state legislation that established the for-hire logbook reporting system currently in use in Louisiana specifically prohibits collection of economic information in that reporting system. Another suggestion was to collect some data outside of the logbook reporting system, such as during dockside intercepts. Tom Sminkey noted that angler origin (zip code) is already collected in the MRIP intercept survey and a question pertaining to the trip fare could potentially be added to the interview.

Non-Government Organization Perspectives

Environmental Defense Fund and Ocean Conservancy were represented at the workshop, and the primary concern of both organizations is that data collection systems should support the implementation of new requirements specified in the Magnuson-Stevens Act. The goal of insuring that overfishing does not occur must be done in such a way that fisheries are allowed to remain open and industries can remain in business. Main points include the ability to monitor fisheries in-season so that

overages are prevented, discard mortality should be adequately measured so it can be applied to annual catch limits, and validation of self-reported data is essential.

TechnologyPerspectives
Several representatives that have experience working with or designing technological systems for reporting fisheries data were present at the workshop. Technology representatives emphasized the need for a competitive environment to stimulate creativity and innovation and discouraged against selecting a single-source vendor. Whatever data standards are selected for this project, the receiving end for the data should be set up to collect data from multiple sources. Technology representatives emphasized the need for clearly defined specifications for the data that an accepted technology should deliver so they may design a system to those specifications. Different systems should all be compatible in the data they deliver, but may use a variety of technologies to accomplish the same end point.

Scott Baker from North Carolina Sea Grant outlined his experience pilot testing a text messaging system using cell phone technology. His advice from that project was to start simple and not get participants excited about a reporting system only to roll out a cumbersome or complicated system that causes them to quickly lose interest. His advice was to introduce more complex versions later as participants become more familiar with the method. He also recommended that attention be given early in the start-up to training participants on how to use the technology and report data properly. When asked if an application (app) could be developed for use with Smart phones, Scott indicated that such an application could be developed and would support more complex data collection.

Heidi Henninger from Offshore Lobsterman's Association and a representative for OlFish Software Company also recommended that a software system should have flexibility for modifications both during testing and after implementation. Mark Griffith from Mobile Technology Solutions recommended that any subsequent changes in the data base should be shielded from necessary changes to the software or data delivery structure after the software is developed and in use.

Claude Peterson from Bluefin Data advised that cost be considered when deciding on the delivery system. Remote access and high connectivity demands (i.e. http) are more expensive than local access and low connectivity demands (i.e. ftp).

Essential Data Elements
Based on workshop discussions, we identified two types of data elements: 1) data that may be easily recorded by vessel operators in a logbook trip reporting system, and 2) data that may be more appropriately collected by some means other than a logbook. This structure was important to satisfy the major recommendation that a logbook reporting system be simple with a minimum amount of data elements. Collection of the second type of data could be integrated with methodologies designed to validate self-reported logbook data, and those data elements were further divided into data that would be best collected by a dockside sampling methodology, and data that would be best collected through some form of at-sea sampling methodology.

The recommended frequency of logbook reporting for the Gulf of Mexico electronic logbook reporting pilot design is weekly. Data elements identified as essential for the pilot study include:

1) *Self Reported Logbook Data Elements:*
    - Vessel Identifier
    - Captain Identifier
    - Date of Trip
    - Departure Time and Return Time
    - Hours Fished
    - Origin of Trip (State, County, Site)
    - Trip Level Primary Area Fished: Statistical Zone (figure 1), including codes for subzones within each zone for inland waters, state territorial seas, and federal EEZ; and codes for zones outside the EEZ (such as Bahamas, Mexico, or international waters). See also notes 2 and 3 below.
    - # Passengers
    - # Anglers
    - # Crew
    - Gear
    - Minimum and Maximum Depth Fished for Trip
    - Target Species
    - # Fish Harvested by Species
    - # Fish Released by Species
        - For a sub-set of species, # Released By Critical Depth Interval (e.g. <60', 60'-120', >120')

Note 1: Self-reported effort, harvest, and discards by species are components of the logbook trip report that should be validated. Potential methods for validating logbook information are discussed in the following section.

Note 2: Some statistical zones in the Gulf of Mexico overlap adjacent state waters (for example, zone 11 in Figure 1 includes portions of both MS and AL state territorial seas). Additional codes may need to be considered for state-level resolution.

Note 3: The current recommendation is to record one primary area fished per trip. However, if vessels conduct fishing within more than one sub-zone (ex: fished in both state and federal subzones), there may need to be some way to accommodate this in a logbook trip report. Also, for multi-day trips in particular, it is possible for vessels to fish in more than one zone for a substantial portion of time within a trip.

2) *Additional Data Elements (possibly collected during validation of self-reported logbook data):*
    <u>Dockside</u>
    - Biological data from harvested fish (length, weight, age, sex)
    - Passenger origin by trip (zip code)
    - Cost/Price of trip

    <u>At-sea</u>
    - Size, Number, Species of discards

- Fate of released fish
- Bait type
- Site-specific effort and catch
- Hook-type tied to discards
- Reason for discards (size, bag, season, area, non-target species, catch-and-release)

Validation Methodologies
Validation of self-reported logbook data serves several important purposes:

1) Validation provides a measure of non-compliance (non-reporting, incomplete reporting, false reporting) and facilitates enforcement so that non-compliance can be minimized,

2) Validation allows for comparisons between self-reported and observed catch and effort to measure under/over reporting so that it may be accounted for,

3) Validation may also serve the added benefit of collecting additional data that are not recorded on the logbook trip report (such as biological characteristics of the catch).

Workshop participants identified existing data sources that could potentially be tested for use as a validation methodology for the Gulf of Mexico pilot study, and also identified additional methods that could be pilot tested. The following is a summary of the potential validation methodologies that were discussed at the workshop.

<u>Hail-Out and Hail-In Requirements</u>
This validation method would require that for-hire vessels notify a central location both when they leave the dock and when they return to the dock. Vessel trip reports should be received for each hailed trip, which would facilitate tracking of missing or late reports. To identify vessels that are not following required hailing procedures, dockside validations of vessels in and out of slips would be the preferred method; random checks by enforcement agents may not be effective given their current low coverage. Vessels that fail to turn in reports for hailed trips or that fail to follow required hailing procedures could be identified to authorities to facilitate enforcement. The hailing requirement could be coupled with a fine for vessels that fail to hail out and then come in with landed fish.

The hailing requirement alone could effectively validate effort; however, in order to use this methodology to validate catch, vessels must also be required to fill out trip reports or electronically submit catch data before landing at the dock. A random sample of vessels that hailed for a given day could be intercepted dockside to verify that reported harvest matches what is landed. For vessels that do not have at-sea data transmission capability, additional procedures would be necessary to certify that a report is not altered before final submission. Potential methods for this could include a dockside sampler obtaining a copy of the vessel trip report or transcribing some data elements from the vessel trip report on-site during the validation procedure to certify that data are not altered after the validation. Another method that was discussed which could potentially be used to certify a logbook is not altered after landing is for the captain to provide an angler from the party or some other impartial

person with copy of trip report immediately upon landing. A random sample of trips could then be sampled through post contact with the impartial person to verify that the final report was not altered. This method would require a clear definition of what a legal "receipt" is and should also clearly define who is submitting the receipt.

Electronic Vessel Monitoring System (VMS)

Commercial red snapper vessels in the Gulf of Mexico are currently required to carry a VMS unit on their vessel at all times. For-hire vessels that also participate in the commercial red snapper fishery already carry mandatory VMS units. The VMS unit allows the vessel operator to declare the purpose of a trip so that whenever a vessel leaves the dock, it is known that the vessel is out for a commercial fishing trip or some other purpose.

This method for the sole purpose of validation of self-reported effort and catch data would not be much different than a hailing requirement; the only added benefit of a VMS validation is that vessels that fail to declare a trip are automatically detected. The VMS would provide a complete record of the fishing track for more detailed area-fished information, which would serve to validate self-reported area-fished information. However, VMS data alone could not be used to validate catch or provide information on what fish are caught at multiple fishing spots within a trip. VMS would provide an extra tool to enforcement agents for detecting potential illegal fishing in closed areas and closed seasons.

Some limitations for the use of VMS on for-hire vessels that were identified by workshop participants include limited power supply and wet conditions on smaller vessels, and added expense of purchasing the unit and paying for a monthly service.

Dockside Validation of Effort and Harvest Data

There are several dockside monitoring programs currently in use throughout the Gulf of Mexico that could be utilized with minimum modifications to validate self-reported logbook data. Dockside methods are particularly useful for validating self-reported harvest and effort for relatively low cost. In addition, dockside surveys are useful for characterizing the size, weight, age, and sex composition of harvested fish and are for collecting information from individual anglers, such as origin (zip code).

Workgroup participants identified four dockside sampling programs that could potentially be considered for validating self reported logbook data in a pilot study in the Gulf of Mexico. Details of all of these survey methodologies are provided in a report prepared by the MRIP For-Hire Workgroup (2008 MRIP For-Hire Inventory Document) and recommendations for improvements to these methodologies were provided in the MRIP For-Hire Review report (2009 MRIP For-Hire Review Report, available at www.CountMyFish.noaa.gov).

1) Texas State Survey. Texas currently conducts a state dockside intercept survey to estimate fishing effort and harvest in the for-hire fishery.

2) MRFSS Intercept Survey. The Marine Recreational Fisheries Statistics Survey (MRFSS) intercept survey has been conducted in Florida, Alabama, Mississippi, and Louisiana since the early 1980's. Methods to improve this survey methodology are in the process of being designed as part of the MRIP and will be pilot tested in the state of North Carolina in early 2010. One significant component of the pilot project that has a direct impact on for-hire sampling is a time-of-day sampling procedure to ensure that dockside sampling is distributed among morning, day time, and evening time periods. The downfall of this pilot project is that pilot testing is outside the region of the Gulf of Mexico. Additional pilot testing of methodologies specifically for use as a validation method for self-reported logbook data in the Gulf of Mexico should also be considered.

3) Southeast Headboat Survey. Dockside sampling has been included in the Southeast Headboat Survey to collect information on the biological composition of harvested fish. MRIP funding has been provided this year to evaluate the statistical design of dockside sampling procedures and recommend specific improvements. This methodology could also be used to validate mandatory logbook trip reports provided by headboat operators as part of the Southeast Headboat Survey.

4) For-Hire Survey Vessel Validations. The For-Hire telephone survey has been conducted in Florida, Alabama, Mississippi, and Louisiana since 2000. In order to account for under reporting and over reporting of fishing activity by for-hire vessel operators in the telephone survey for effort, a sample of vessels are validated each week with dockside visits to determine if the vessel is in the slip, out fishing, or out for some other reason.

<u>At-Sea Validation of Harvest and Discard Data by Area Fished</u>

Two types of at-sea monitoring were discussed: 1) Video monitoring, and 2) Human Observers. At-sea validation provides additional benefits compared to dockside validation, particularly in regards to measuring numbers of discards by species. At-sea sampling also allows for additional data to be collected from discards that may not be self-reported on a logbook, including length frequency, reason for release, handling, and release condition.

1) At-Sea Video Monitoring. Video monitoring has been employed in commercial fisheries, but is untested as a validation tool on recreational for-hire vessels. Pilot testing this methodology would require a clear definition for what the video footage would be used for. In commercial fisheries, video monitoring programs that are currently in use are designed to either augment human observers, replace human observers, or fill in where human observers are impractical (such as small vessels). Video cameras must also be strategically placed, depending on what it is you want to capture on the image. Many commercial vessels have what is called a "control point", which is a single point on the vessel where gear is hauled in and a video camera can focus in on that point. For commercial operations that do not have a control point, multiple camera angles and/or specific fish handling procedures must be employed. For a recreational charter vessel, a camera would most likely be focused on the stern of the vessel and larger

vessels would require additional camera angles up the sides and on the bow. Because fish can easily be unhooked by vessel mates over the side without bringing a fish on board or in clear view of a camera, a video monitoring system may need to include specific protocols for vessel crew to place every fish in a designated control point. Such a control point could include a measuring board with a camera focused on that area. An additional camera would also have to be focused on the deck to identify when vessel mates are not following this procedure. Some commercial video monitoring systems require that fish be placed on a special conveyor so that fish may be digitally identified to species.

Some potential impediments to this type of monitoring system that were identified by workshop participants include:

- The necessity to accommodate a hard drive for video storage on board small vessels;
- Video clarity during night-time fishing (would require deck lighting), salt spray on cameras.
- Expensive to pilot, equipment is expensive and requires someone to physically retrieve hard drives and read volumes of video footage.
- Requirements to bring fish on board in view of a camera when they could otherwise be released over the side would cause additional handling stress for many fish. Boating of some species, such as goliath grouper, is prohibited. Boating of some species, such as sharks, may cause a passenger safety issue.
- Commercial video monitoring programs have automatic switches for cameras to turn on during haul-back of gear, which may not be feasible for recreational for-hire gear. Having a camera on for the duration of the trip creates issues for the power supply of the video equipment as well as the volume of video footage that must be read. A manual shut-off could be an option, but then it could not be certified that the camera was on for the entire fishing period.
- Industry representatives expressed concern for client confidentiality and questioned the willingness of clients to be video-taped during a private fishing trip. Sound should not be recorded.

Potential advantages to video monitoring over human observers:

- Could facilitate greater coverage.
- May be utilized on vessels where passenger capacity is a limiting factor.

Workshop participants suggested the following elements if a video-monitoring validation methodology were pilot tested in the for-hire fishery:

- Goal should be to validate numbers of discards by species.
- Randomly select vessels to have video equipment on their vessel for a period of time, should be mandatory if selected.
- Establish specific protocols, including hauling and handling protocol. Work with industry on this design.
- Include overlapping human observer coverage during the testing of the methodology.

2) At-Sea Monitoring by Human Observers. Human observers are used extensively in commercial fisheries and many statistical issues with design and treatment of data have been worked out for this sector (reviewed in MRAG Americas Observer Technologies Report available at www.mragamericas.com). Placement of human observers onboard for-hire headboats was pilot-tested in the Gulf of Mexico (Alabama and Florida) during 2004-2007 with good success. The state of Florida is currently implementing an at-sea observer program onboard headboats and smaller charter boats that target reef fish in the Gulf of Mexico. The program is voluntary and vessels are currently being recruited to participate in the study. In the first two months of the Florida study, over 120 eligible vessels agreed to carry at-sea observers and new vessels continue to be recruited.

   Advantages of human observers compared to video monitoring:

   - Human observers may be utilized to collect more detailed data on species, size, handling, reason for release, and condition upon release.
   - Human observers may be able to see activities outside the view of a camera.

   Problems and potential solutions for at-sea observer sampling include:

   - Vessels may fish differently or report harvest and/or discards more accurately when an observer is present. When accompanied with a mandatory logbook reporting system, this can be evaluated by comparing logbook trip reports from observed and unobserved trips to see if vessels fish in different areas, for different durations, for different species, etc. Methods to specifically address this issue have been worked out in commercial fisheries observer programs. The need for this type of evaluation should be considered in the design of a pilot project to test at-sea observers as a validation method for a logbook reporting system in the Gulf of Mexico.
   - When an observer program is voluntary, such as the current Florida study, there is potential bias. This could possibly be evaluated if logbook reporting were mandatory. Among approximately 100 eligible vessels in the four year pilot study on headboats in Alabama and Florida, more than 90% participated in the at-sea observer study. If participation is low in a voluntary program, an alternative would be to require vessels to carry an observer when selected.
   - Some customers may be unwilling to go fishing if an observer is required to go on their scheduled trip. If observer coverage were made mandatory on selected trips, observers should have the flexibility to sample an alternate day on the selected vessel or sample an alternate vessel. Vessel operators should not be held accountable when clients decline observers.
   - Fish weight is difficult to obtain at-sea. Established length/weight relationships could be used to estimate weight of discarded fish.
   - Vessel capacity is a limiting factor. The Florida study gives observers flexibility to work with vessels to sample a trip within a selected week when the number of passengers does not exceed vessel capacity.

Florida was identified as a location where validation of self-reported logbook data through the use of an at-sea human observer sampling design could be pilot tested. At-sea observer coverage is currently funded for three years and could be coupled with an electronic logbook reporting system. FWC staff would work in collaboration with MRIP consultants to review and modify vessel selection procedures and sampling protocols for use in validating self-reported logbook data as part of this pilot.

Conclusions

There are several existing methodologies that could be readily incorporated into pilot studies for validation of logbook data in the Gulf of Mexico. Validation methods that would facilitate enforcement of mandatory reporting requirements were also identified; however, pilot testing will also require regulatory authority which may or may not currently exist. Nonetheless, enforcement is an important component of a mandatory reporting system and should be considered for pilot testing if feasible, or changes to FMPs, regulations, state laws, etc. should be identified and pursued if necessary.

WORKSHOP FOLLOW-UP

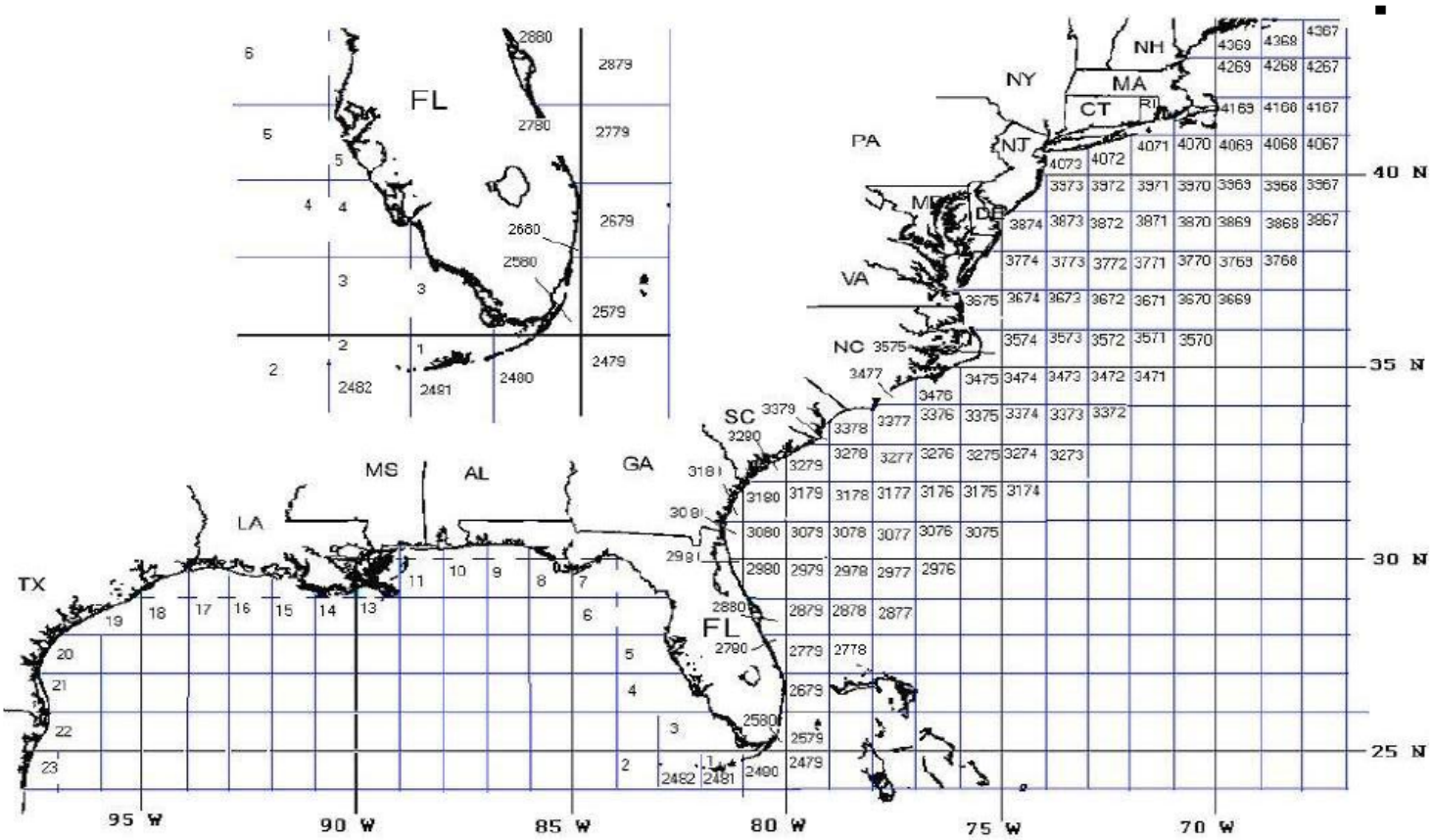
The workshop concluded with good recommendations for data elements to be included in a logbook reporting system, and participants were largely in agreement that a reporting system should be mandatory with enforcement. There was agreement by all participants that the pilot study should be Gulf-wide if possible. The next steps following the workshop include:

1) Recommended methodologies for validating self-reported logbook data for inclusion in a pilot study will be prioritized by the For-Hire Workgroup in consultation with the GulfFIN Geographic Subcommittee at their next meeting on October 12, 2009.

2) Using recommendations developed from the workshop, the For-Hire Workgroup will work with MRIP contract support to develop protocols to validate self-reported data and account for non-response/non-compliance.

The For-Hire Workgroup will develop a proposal for MRIP funding during the next funding cycle to begin outreach to industry and testing implementation of a logbook reporting system in the Gulf of Mexico.

Figure 1. South Atlantic and Gulf of Mexico Statistical Grid Map. In the South Atlantic, grid numbers follow lines of longitude and latitude. The first two digits in the four digit grid numbers are latitude degrees, and the second two digits are longitude degrees. In the Gulf of Mexico, grid numbers do not follow lines of longitude and latitude. The close-up grid map of south Florida (see inset) shows the 4 digit codes for zones in the South Atlantic Region and the 1 digit codes for zones in the Gulf of Mexico Region.



Appendix A. Workshop Participants

Kevin Anson, Alabama Department of Conservation, Marine Resources
Scott Baker, North Carolina Sea Grant
Jeff Barger, Environmental Defense Fund
Tom Becker, Mississippi Charter Boat Captain Association
Ken Brennan, NMFS Southeast Fisheries Science Center
Michael Burton, NMFS Southeast Fisheries Science Center
Rex Caffey, Louisiana Sea Grant, Louisiana State University
Page Campbell, Texas Parks and Wildlife Department
Steve Campbell, NOAA Office of Law Enforcement
Jim Chromy, RTI International
Richard Cody, Florida Fish and Wildlife Conservation Commission
Mike Dates, Destin Charter Boat Association
Dave Donaldson, Gulf States Marine Fisheries Commission
Matthew Freeman, Louisiana State University
Dave Gloeckner, NMFS Southeast Fisheries Science Center
Johnny Greene, Alabama charter operator and Gulf of Mexico Fisheries Management Council
Mark Griffith, Mobile Scheduling Solutions
Heidi Henninger, Offshore Lobsterman Association and OlFish Software
Matt Hill, Mississippi Department of Marine Resources
Peter Hood, NMFS Southeast Regional Office
Gary Jarvis, Save Our Selves (S.O.S.) and charter captain
Michelle Kasprzak, Louisiana Department of Wildlife and Fisheries
James Kejonen, NOAA Office of Law Enforcement
Pat Kelly, Florida Guides Association
Christopher Liese, NMFS Southeast Fisheries Science Center
Damon McKnight, Louisiana charter operator and Gulf of Mexico Fisheries Management Council
Mike Nugent, Port Aransas Boatmen Association
Harlon Pearce, Gulf of Mexico Fisheries Management Council
Claude Peterson, Bluefin Data LLC
Mary Poe, Louisiana Charter Boat Association
Joe Powers, Louisiana State University
Karon Radzik, Alabama Department of Conservation, Marine Resources
Chris Robbins, Ocean Conservancy
Beverly Sauls, Florida Fish and Wildlife Conservation Commission
Michelle Savolainen, Louisiana State University
Joe Shepard, Louisiana Department of Wildlife and Fisheries
Carrie Simmons, Staff to Gulf of Mexico Fishery Management Council
Tom Sminkey, NOAA Fisheries Science and Technology
David Smith, Mobile Scheduling Solutions
Bob Zales, III, National Association of Charterboat Operators

Appendix B.
Comments Received Before the Workshop or During Online Viewing

Dick Stone
I strongly support the logbook methodology instead of the for-hire telephone survey for charter and headboats.

Mark Cedergreen, Westport Charterboat Association, Washington
* Washington coastal "for-hire" and private recreational fishing trips are currently covered by dock sampling. With a potential 24 hr turn-around on data when we are getting close to salmon quotas, this appears to be working very well and I doubt many would be in favor of replacing it.
* On the other hand, a logbook could gather other useful information not needed in the immediate context including a "ground-truthing" of the dock sampling, and other elements that could enhance pre-season regulatory actions.
* If we were to do it on the WA coast, it would be good to start with a pilot program to work out the bugs and I'm not sure that one size would fit all.

Michael Bucko, Advisor Chairman, Atlantic Coastal Cooperative Statistics Program
I 'm writing this letter since there is a good chance I will not be able to attend the Virtual Workshop. I concur with the MRIP For-hire work shop report that MRIP should rely universally on logbooks instead of the survey to gather data from the for-hire operators. I believe to meet fishery manager needs that it should be as close to real time data as possible.
I was somewhat involved when the For-hire survey as it is now was rolled out. The reporting vehicles were telephone, internet and mail. Yet almost all reporting was telephone reporting. I notice that even captains that were computer literate preferred the telephone contact and few took the initiative to report on their own. My thought is that when you have voluntary reporting, it took external action to get them to comply.
I was involved in submitting a grant to ACCSP which was not funded for 2007. The PI's were Eleanor Bochenek, Thomas Lukegord and Michael Bucko. It was basically submitting Head Boat VTR information electronically using a VMS for real-time reporting. Thomas Lukegord who himself is a Charter Captain felt that exploiting the free time a Charter Captain has in returning from a trip was the opportune time to get them to report data on the fishing trip. This would be the best time because this time would not present any undue burden on the for-hire captains and also the best to record the most accurate data on catch and effort. The point being that once at the boat dock the captains have busy lives and reporting after that would provide a burden on the for-hire captains and it would be harder to get them to submit voluntary reports electronically.
Eleanor Bochenek had work out the process to verify the accuracy of the data we would collect. I believe from her work that the validation for a electronic log-book would only need a basic modification of the intercept procedure currently used for the For-hire survey for head boats and the charter boat <6 passengers and that a scaled down version could also be developed.
As for a data to be collected, I believe the top priority is for effort data but also we need to collect catch data and discard data since ACL's managements will need real time catch and discards data in the future. It is urgent that we develop a validation method that would be used with the log-book.
From what I have witnessed I feel we need to exploit the time a for-hire captain has when returning to port. So as you write the electronic format for the log-book keep this in mind since this may be a little out of the box thinking.

Develop the electronic log-book program as an APP for the Apple Iphone so the captains can use their phone to report at location. The data can be stored on the phone and passively uploaded when they come to port. The APP could be cross platform developed to work with the all new smart phones and providers that handle APP's.

Dave Pecci

I think it is very important note that though Mike is chair of the ACCSP Advisory Panel he does not in fact speak for all the members of the Panel. This letter is his viewpoint expressed. There are members of the ACCSP AP who strongly disagree that there is a need for electronic trip reporting from all sectors of the for hire fleet and feel survey data collection is adequate with a few corrections or improvements.

It is also very important to know that the vast majority of the for hire fleet country-wide are six pack operations and guide skiff operations many of which do not have crews, do not have "long down times while steaming and work out of open center console boats.

I know the Gulf of Mexico pilot program is being implemented on head boats. But as this program unfolds it will encompass skiff guides and six pack operators.

Harold J. Deibler Jr., Virginia charter operator

Virginia has an electronic reporting system, but also a written report that must be sent in 15 days after the Striped Bass seasons. The written report is for those who don't use the electronic system and it's for Striped Bass only. Maryland has a logbook reporting system that must be sent in weekly, even if I haven't fished in Maryland that week. It includes a variety of fish that Maryland governs the size and/ or creel limit on. My thoughts are:

1. Will the new MRIP information be able to be extracted from the reporting systems already used by the various states?
2. Can the new MRIP information be sent to the various states with the reporting persons identification instead of sending in the states report?
3. Will the new MRIP be set up where it is more interested in the number of fish caught per rod hours spent by location, instead of number of passengers taken out of what ever port?
4. Will the new MRIP system be set up by fish found in the local areas used by the reporting person? IE. We don't get Blue Marlin in the middle Chesapeake Bay.

The reasoning behind these thoughts are:

1 & 2. The program would more than likely have a better chance of success if it could reduce the amount of paperwork the Captains have to fill out rather than increase it.

3. There are many occasions where some of my passengers just come out with the group to enjoy the day. They don't even touch a fish pole. The numbers are skewed if you go by the number of passengers compared to the number of fish caught.

4. The new MRIP is set up for failure if it list every fish found in the world and the reporting person has to scroll through it to get to the species they are reporting on. It would be more time consuming and less likely to be reported accurately.

Capt. Monty Hawkins, Maryland charter operator

Might add that electronic reporting is scary if it requires layout of cash for wireless internet, computer for the boat - stuff. Good 'ol FVTRs for me!

Captain Wally Phinney, South Carolina charter operator
What I would like to see a fishing report that all agents can use. I give one to the D.N.R. each month then I have someone calling me at least once a month. Why not get together and have one report going to each agent, just add in your wanted data along with S.C. DATA

Comments Received in Response to the Workshop
Scott Meyer, Alaska
From yesterday's discussion:
- I agree with Bob Zale and others that said you can't let stock assessment needs drive the data collection - there will never be enough data for the stock assessment people. You have to start with the basics (effort and harvest by species and location) and make sure you're getting them as accurately as possible. Once the logbook data are validated and there is buy-in from the fleet, then you can start to add other data, but the limit will always be what the operators can reliably provide. For example, there are 34 species of rockfish in Alaska, but we ask operators to record them in three categories - pelagic rockfish, yelloweye rockfish, and all other rockfish. We figure most of them can't reliably determine species beyond those groups. Some operators and commercial users think logbooks should be used to gather length data on kept and released fish, but it would make the logbook very complicated. Many commercial users and scientists are skeptical of self reported length data, especially for species with size limits or annual quotas. You can always augment logbook data with onsite sampling or onboard observers for accurate species ID, age and size sampling, etc.

- Our reporting started out trip-based, but now each report is for a calendar day. If a boat fishes multiple days they fill out a report for each day. We have other ways of determining the number of trips for multi-day trips. Boats report the statistical areas that account for most of the salmon or bottomfish harvest. But you could certainly make it site based (with date) - you'd get the data either way.
- We now require operators to report fishing license number and name of each licensed angler, and numbers of fish kept and released by each angler. I know that sounds burdensome, especially for a headboat. We didn't always do it that way, but it was suggested by the charter fleet and has improved the accuracy and usefulness of the data: (1) it prevents inflation of catches to qualify for more quota share or other performance-based programs, (2) the printed name allows us to ferret out problems with digit transposition in the license number, (3) having catch by angler allows us to better analyze data for the effects of proposed bag limits or annual limits, and (4) it facilitates validation through follow-up mail or phone surveys with reported clients.
Validation:
- We assess logbook quality by comparing logbook data reported by charter skippers to mail survey estimates reported by the anglers, by comparing "dockside" counts of fish to what was reported in the logbook, and by comparing logbook numbers to numbers from a mail survey of a sample of clients whose license numbers were reported in the logbooks.
- We reached the conclusion last year that the only complete validation can be achieved using a covert observer. Not very practical, however.

Electronic logbooks:
- I didn't catch whether you are definitely going electronic, or a paper-electric combination. We have noted several technological hurdles. One is writing and deploying standardized software on a multitude of devices (laptops, mobile devices, I-phones, etc.). We could get around that by requiring the operator to supply a device of specific compatibility and update and use the most current version of the software. That alone might be a lot to ask of some operators. Another is that the data must be finalized and locked

or submitted by the time the vessel arrives in port. Otherwise an operator could overreport or underreport if they weren't contacted by enforcement or dockside samplers upon arrival in port. On the other hand, you would want them to be able to amend their report if they discovered a mistake. Our current paper logbook must be completed before fish or anglers are offloaded, but operators can amend them before submitting (which does allow them to overreport or underreport). This is addressed somewhat through the validation efforts.

- I only heard small portions of your meeting, but I didn't hear any discussion about enforcement. Most of our logbook enforcement is done by Wildlife Troopers, a branch of the state Department of Public Safety. Most tickets are for failure to submit logbook data and late logbook data. Some have been for overharvest or crew retaining fish when not allowed to (and that was reported in the logbook!). I know of only one for false data entry (fabricating clients and harvest), but there may have been others.
- Our enforcement people don't like the idea of electronic logbooks. We're thinking that for it to work, the record must be submitted to a central database before the boat is checked dockside. Enforcement people would have to have a device that allows them to access the database so they can compare the logbook report to the numbers of anglers and fish on board.

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southeast Fisheries Science Center
75 Virginia Beach Drive
Miami, FL 33149

June 18, 2010

Vessel name
Owner name.
Address

Dear

I am writing to inform you of reporting requirements for owners and operators of charter boats in the Gulf of Mexico. As provided for in the Code of Federal Regulations (CFR) Title 50, Part 622, owners and operators of all charter boats in your area that fish in state and/or Federal waters of the Gulf of Mexico have been selected to keep records of catches (see attached excerpt – 50 CFR part 622.4 and part 622.5). Catches from state waters as well as from Federal waters must be reported. If you do not operate your charter boat yourself, you should inform the captains of your vessels of these requirements. Records must be submitted within seven days of the end of each week. For permitted vessels that are inactive with no chance of actively charter fishing, you may report your inactivity weekly or during the first week of each month if no trips will be conducted for the duration of that month. For each trip there must be an accurate record of the name and official number of the vessel, the operator's U.S. Coast Guard license number, the number of fish of each species taken, number of each species released (alive and dead), the number of anglers aboard, the date(s), location and duration of fishing, number of anglers actually fishing, distance from shore, number of crew, gear used, minimum and maximum depth fished, and target species.

Outreach meetings will be held in July 2010 in your area to provide an overview of the logbook pilot program, explain the electronic reporting options, and answer questions about the project. All proprietary commercial or financial information that you provide will be confidential to the National Marine Fisheries Service as required under the applicable federal laws.

Accurate and timely reporting of logbooks in the charter boat fishery is a requirement for maintaining and renewing your charter vessel/headboat permits. If you have any questions about the required permits you possess or need to possess in order to participate in these fisheries, please contact the NOAA Fisheries Southeast Region Permits Office at (727) 824-5326, or go to their website for more information:
http://sero.nmfs.noaa.gov/permits/permits.htm. If you have any questions about reporting options and available vendors, you can contact either Dave Donaldson or Gregg Bray at the GSMFC office at (228) 875-5912.

Sincerely,

Bonnie Ponwith, Ph.D.
Science Director

Gulf Logbook Manual

Web Edition

Last Updated: September 01, 2010

Table of Contents

INTRODUCTION / INITIAL REGISTRATION

The Gulf Logbook is a trip-level, self-reporting tool provided to federally permitted charter boat captains ported in the Gulf of Mexico. The website used for the Gulf Logbook is www.gulflogbook.com. This user's guide describes how to use the website.

Vessels required to report are setup in the website ahead of time. At least one captain is assigned to a vessel initially. Each captain assigned to a vessel will be given an Access Code. The Access Code uniquely identifies the captain and should be considered confidential. The Access Code is used to allow the captain to setup their own Username and Password for normal login to the website. After the Access Code is used to establish a Username and Password, it will be retained as a means to identify a captain, but it will not be needed by the website anymore.

a. If you have an Access Code and have not created a Username and Password, click on the link that says **Click Here for Initial Registration with an Access Code** on the website login page (Figure 1.0).

Figure 1.0

b. This brings you to the Registration screen (Figure 1.1). Fill in all of the fields on this screen, then click on the **Save** button.

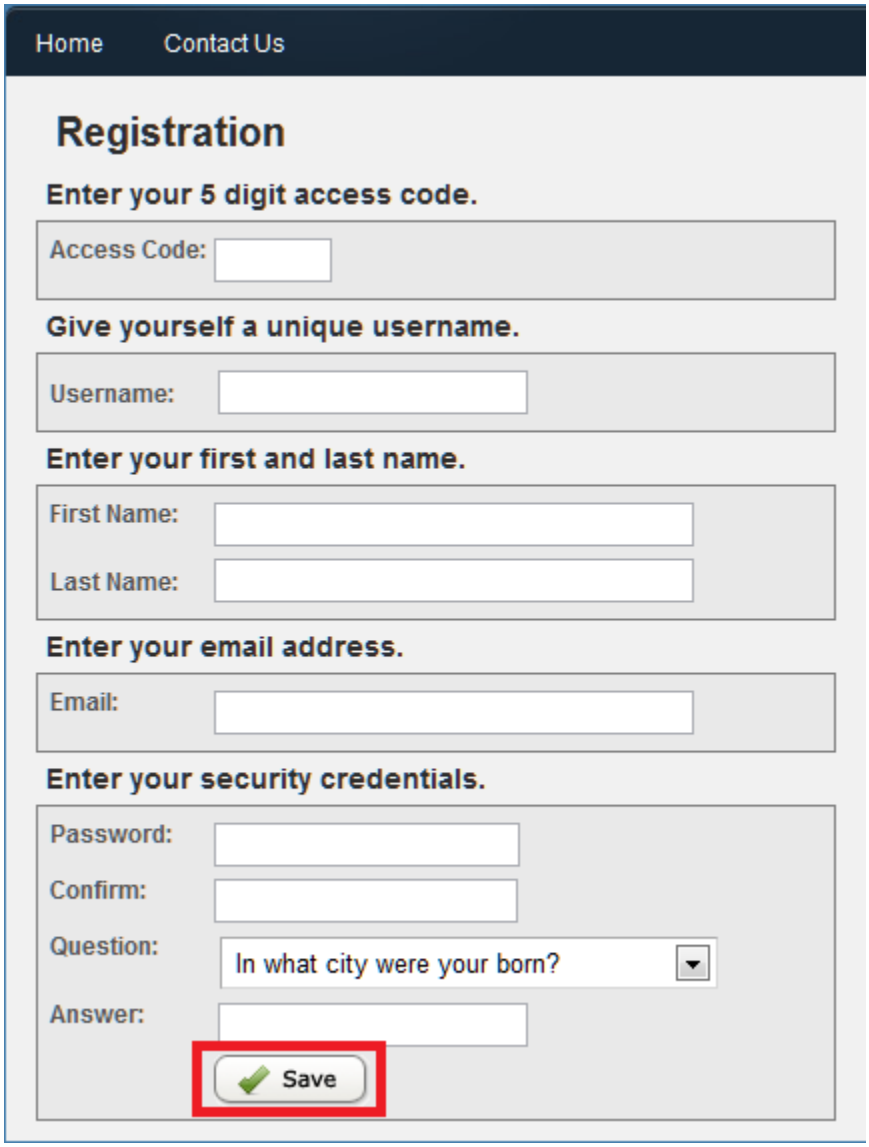


Figure 1.1

Note 1: Usernames and Passwords are case-sensitive and must be anywhere from 5 to 15 characters containing letters, numbers and special characters.

Note 2: Email is not required, but we hope you enter one so that you may receive related news and updates conveniently. The email address will only be used for issues related to the Gulf Logbook.

c. After saving the Registration information, click on the Home menu item to access more options.

ACCOUNT SETTINGS

After your initial account setup, it is recommended that you view the various settings available to you. To change your settings, move your mouse over **Settings** in the menu bar, and then click on the item you wish to view or edit. You may also click the **View My Settings** link or the image of the paper above this link (Figure 2.0).

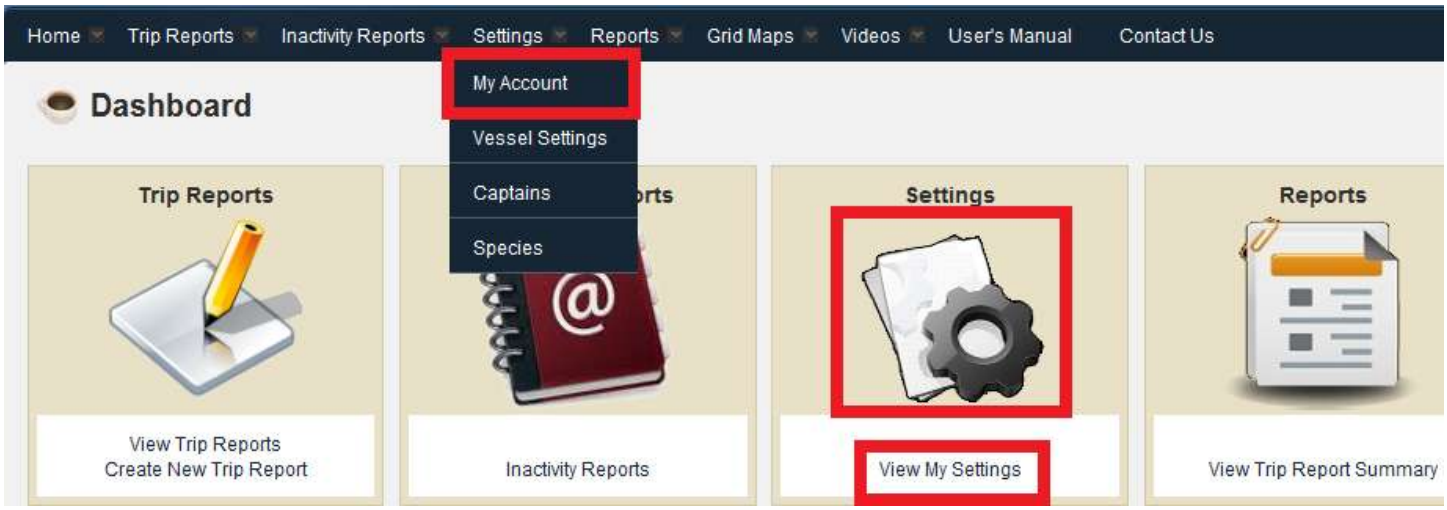


Figure 2.0

a. **My Account** allows you to edit information that was input during the Initial Registration; except for User Name.

b. **Vessel Settings** (Figure 2.1) allows you to view the vessel's name and registration number. You are not allowed to change the vessel information. Please contact support if this information needs to be edited.

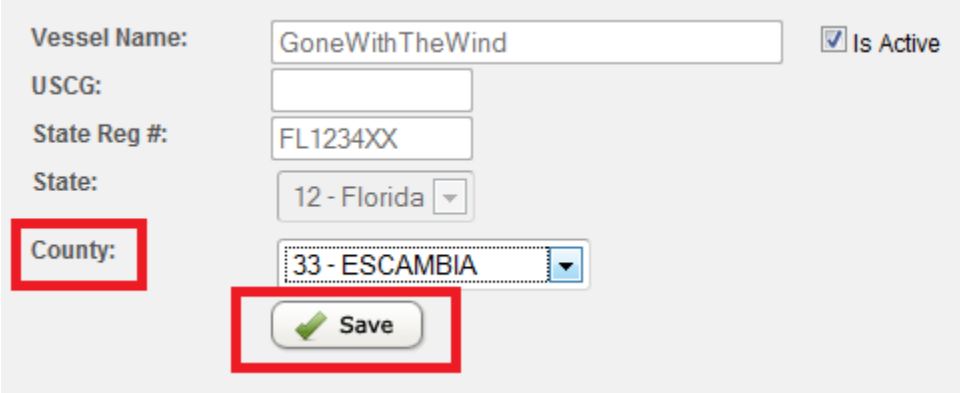


Figure 2.1

The vessel settings screen also allows you to set a default County that will fill in automatically on the Trip Report screen. A default is not required to be set. If the defaulted value is not correct for any given trip, it may be changed on the Trip Report screen.

c. The **Captains** settings screen (Figure 2.2) allows you to edit a captain's information.

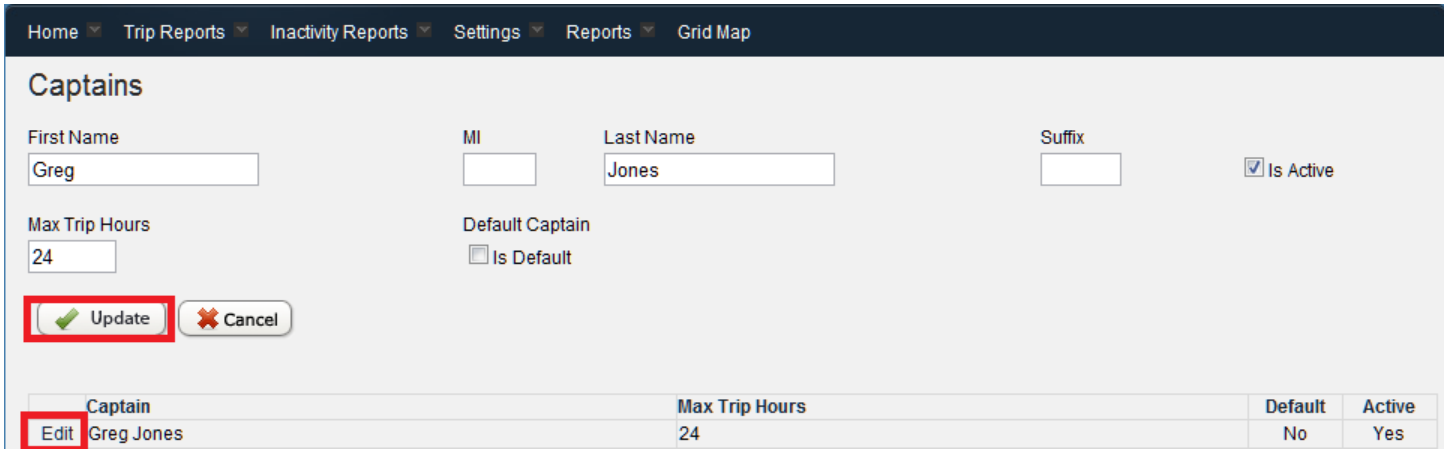


Figure 2.2

d. The **Species** settings screen provides you with a list of all available species. The Species Code in this list, which is not an official code, is there to help you select a species on the Trip Report screen quickly. If you do not care for the given Species Code, then you may create your own Captain's Code which will show up in the Trip Report screen instead of the species code.

e. To create your own species code, click the edit box next to the species you want, enter the code of your choice in to the **Captain Code Box**, then click **Save** (Figure 2.3 and 2.4).

Figure 2.3

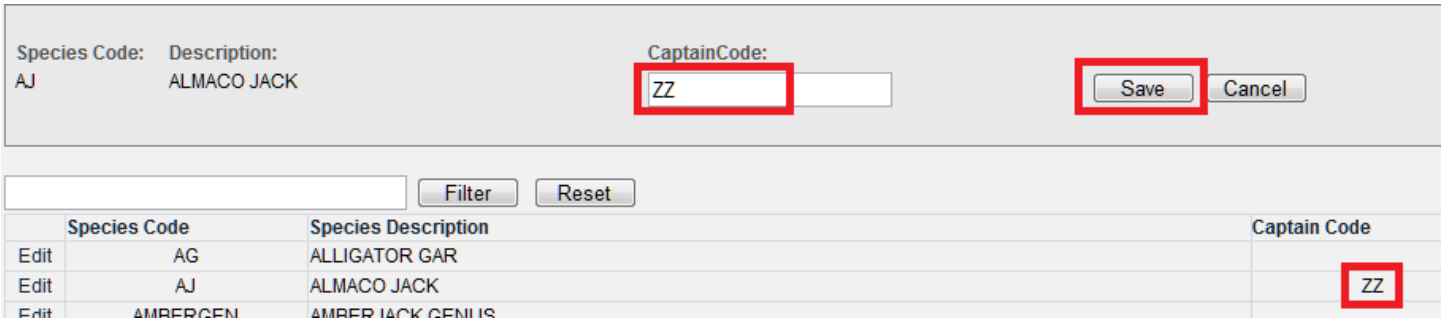


Figure 2.4

f. Your new captain's code will appear in the species list on the Trip Report screen (Figure 2.5).

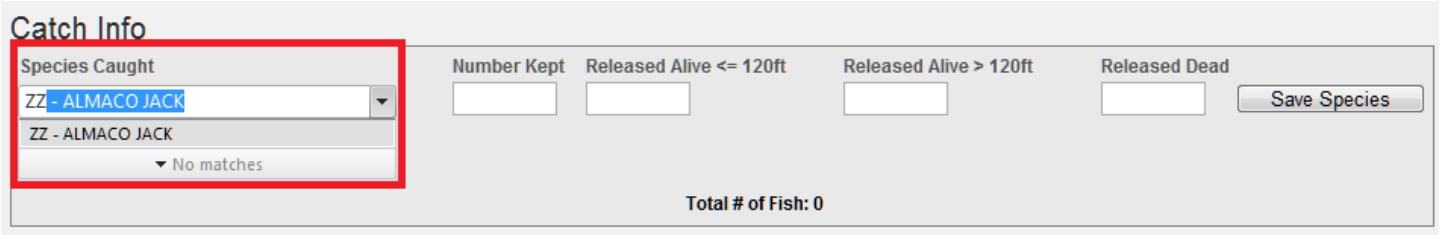


Figure 2.5

INACTIVITY REPORTS

The Gulf Logbook has a weekly reporting requirement and the week is defined as starting on Monday and ending on Sunday. If you make a charter trip any time during the week, you were "actively" fishing and a Trip Report should be generated for that trip. If you did not attempt to fish during any given week, then you must file an Inactivity Report for that week. A special Inactivity Report screen has been developed for this purpose.

Note 1: If a charter trip is conducted and no fish are caught, that still qualifies as a trip and should be reported on the Trip Report screen. In this case, select No Catch in the Trip Report's species list.

a. From the home page, click the **Inactivity Report** link under the image of the notebook or click on the image itself. You can also move your mouse over the **Inactivity Reports** in the top menu bar, or click on **My Inactivity Reports** from the drop down menu (Figure 3.0).

Figure 3.0

b. To complete an Inactivity Report, select the appropriate vessel, then click on the box under the inactivity column for the appropriate date range. Be sure to click the **Submit** button (Figure 3.1) to save your report. The reason column is not required.

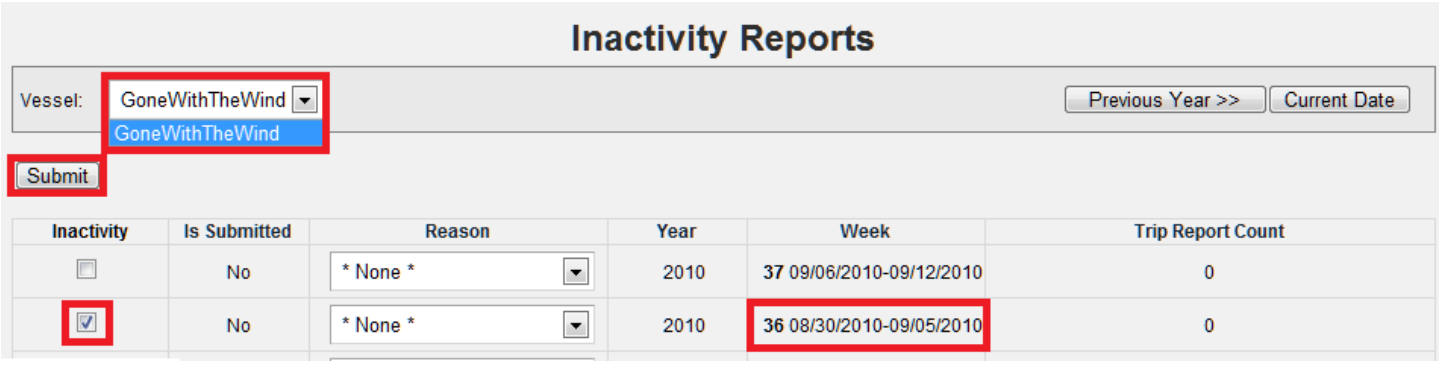


Figure 3.1

CREATING A NEW TRIP REPORT

a. From the home page of the website, click the **Create New Trip Report** link under the image of the pencil and paper. You can also move your mouse over **Trip Reports** in the top menu bar and click on **New Trip Report** from the drop down menu (Figure 4.0).

Figure 4.0

b. On the new Trip Report screen your vessel and state will fill in automatically. The county and captain may default automatically if they are setup that way.

c. The Trip Report screen is divided into two major sections. The top or header section collects the general information about the trip. Some of this information is called Effort Data. Fill out all fields with the information from your trip and click **Save** (Figure 4.1).

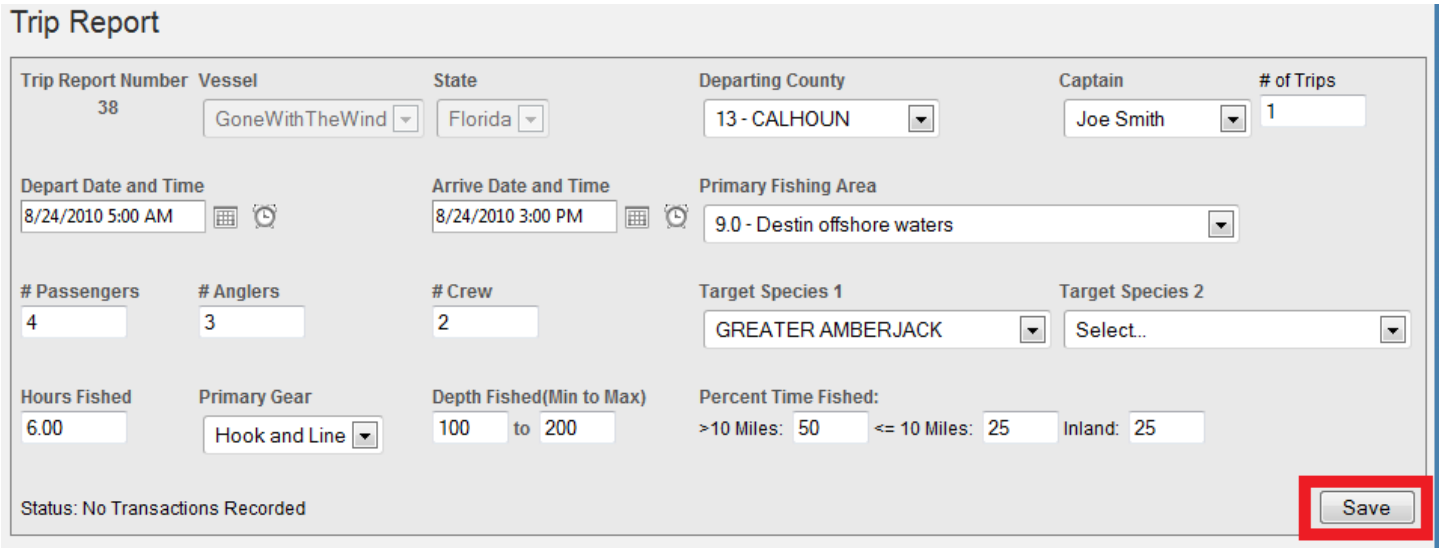


Figure 4.1

Note 1: All header fields must have a value entered before the header is saved, except for the Target Species 2 field, which may be left blank.

Note 2: Depart and Arrive times are defaulted to Midnight. The program will not accept midnight as a time, so you must edit these times before saving the header.

Note 3: Number of Trips refers to the Depart Date. If you make more than one trip for any given Depart Date, enter that number in # of Trips. Otherwise, enter 1.

Note 4: Number of Crew includes the captain and all deck hands employed by the captain.

Note 5: The three Percent Time Fished fields must add up to 100.

d. After you have saved your trip report header, fill in the catch information and click **Save Species** (Figure 4.2). All fields are required. Repeat this process to add multiple catches.

Tip: If you do not want to scroll through the entire list of species, select the **Species Caught** box and start typing the species you would like to select.

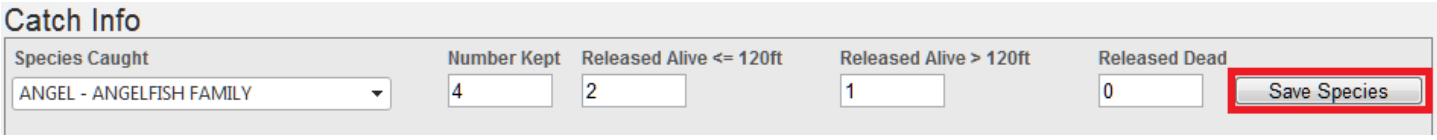


Figure 4.2

e. If you would like to edit a species entry in the catch info section, click on the **Edit** link next to the species you would like to update. Make your changes, and then click **Update** (Figure 4.3).

f. If you would like to delete a species in the catch info table, click on the **Edit** link next to the species you would like to delete, then click **Delete** (Figure 4.3).

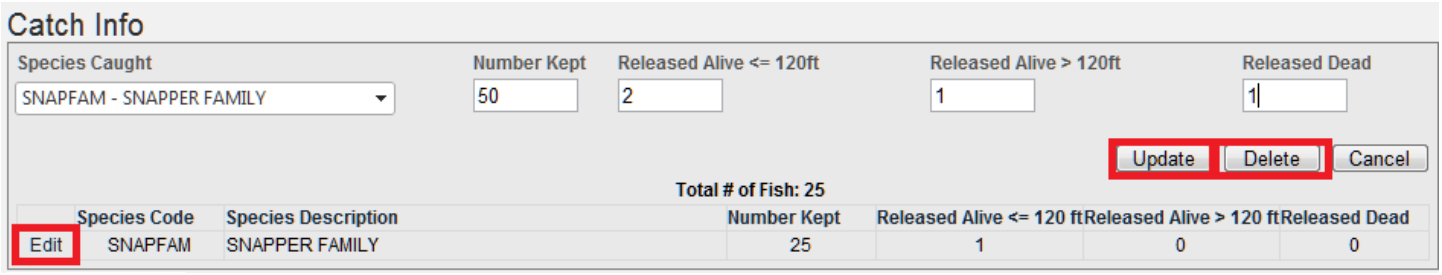


Figure 4.3

Print out a copy of the Trip Reporting by clicking the menu item Print Trip Report (Figure 4.4).

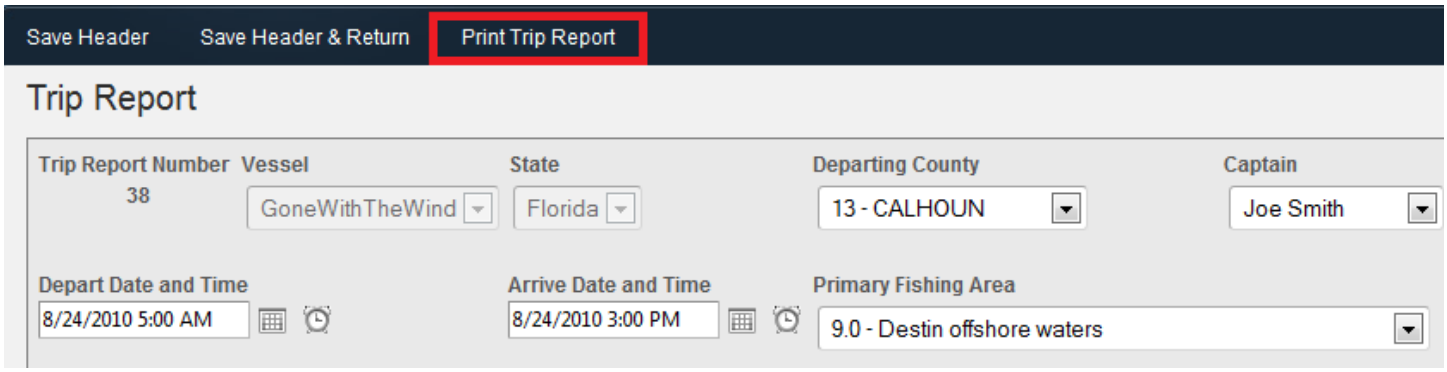


Figure 4.4

Submitting Your Trip Data

Just creating a Trip Report and entering your trip data does not by itself send the data to the agency. The agency does not consider the trip data sent by you and received by them until you click on the **Submit** button located on the Trip Report Screen.

When you click on the Submit button, you will lose the ability to edit or delete any of the information. Contact technical support for assistance with editing or deleting a Submitted Trip Report.

g. When you are ready to send your trip report information to the agency, click **Submit** in the top right corner of the screen (Figure 4.5).

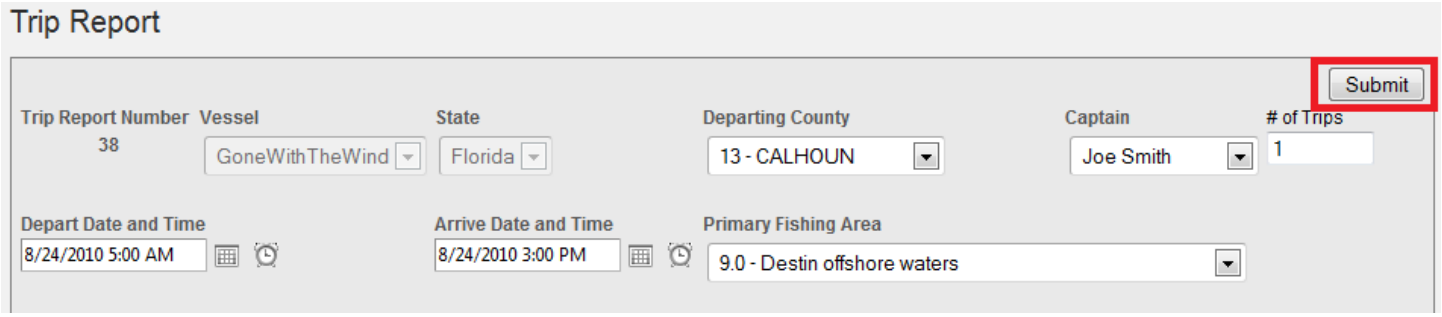


Figure 4.5

VIEW EXISTING TRIP REPORTS

a. If you would like to open an existing trip report, click the **View Trip Reports** link under the image of the pencil and paper or click on the image itself. You can also move your mouse over the **Trip Reports** menu item and click on **My Trip Reports** from the drop down menu (Figure 5.0).

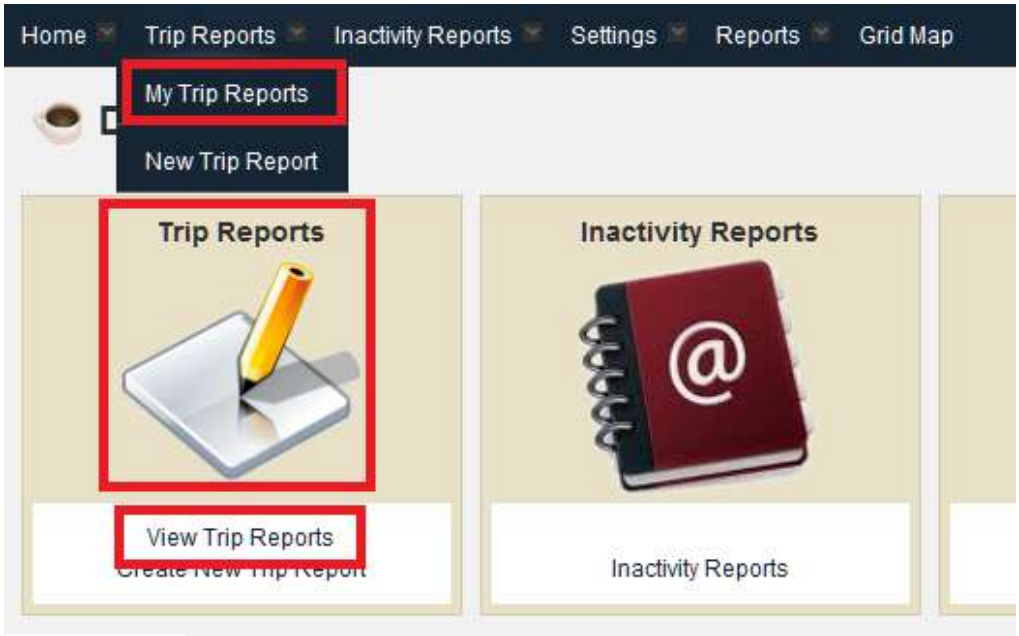


Figure 5.0

b. To find a trip report use the search options at the top of the screen, then click **Search** (Figure 5.1).

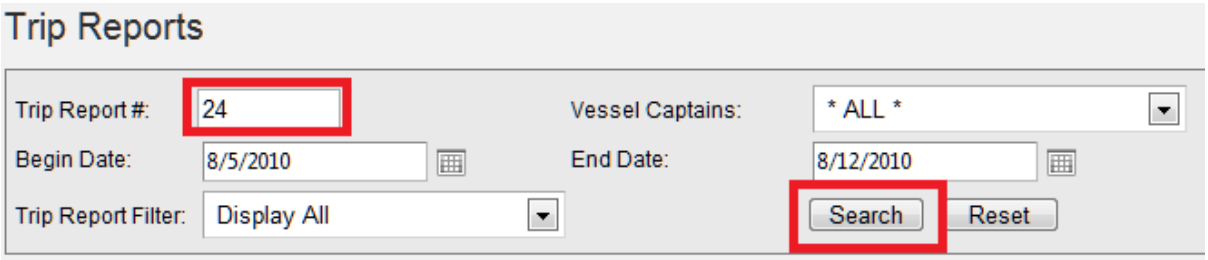


Figure5.1

c. Once you have found the trip report, click **View** next to the trip report number (Figure 5.2).

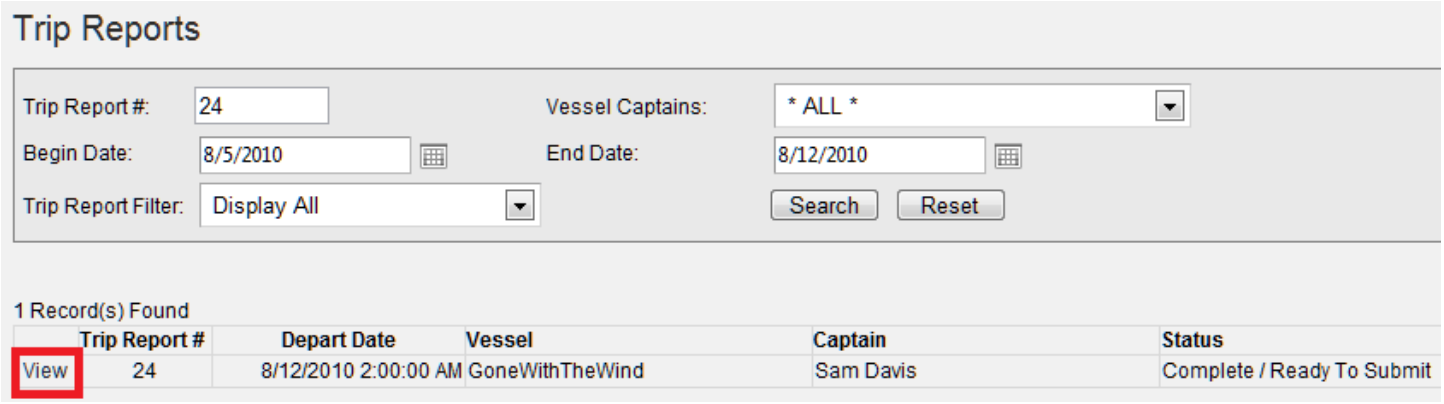


Figure 5.2

d. If the Trip Report has not been submitted, then you may edit and save any changes you may have.

SUMMARY REPORTS

A vessel's historical data may be accessed via Summary Reports.

a. If you would like to print out a Trip Report summary, click the **View Trip Report Summary** link or click on the image itself. You can also move your mouse over the **Reports** in the top menu and click on **Trip Report Summary** (Figure 6.0).

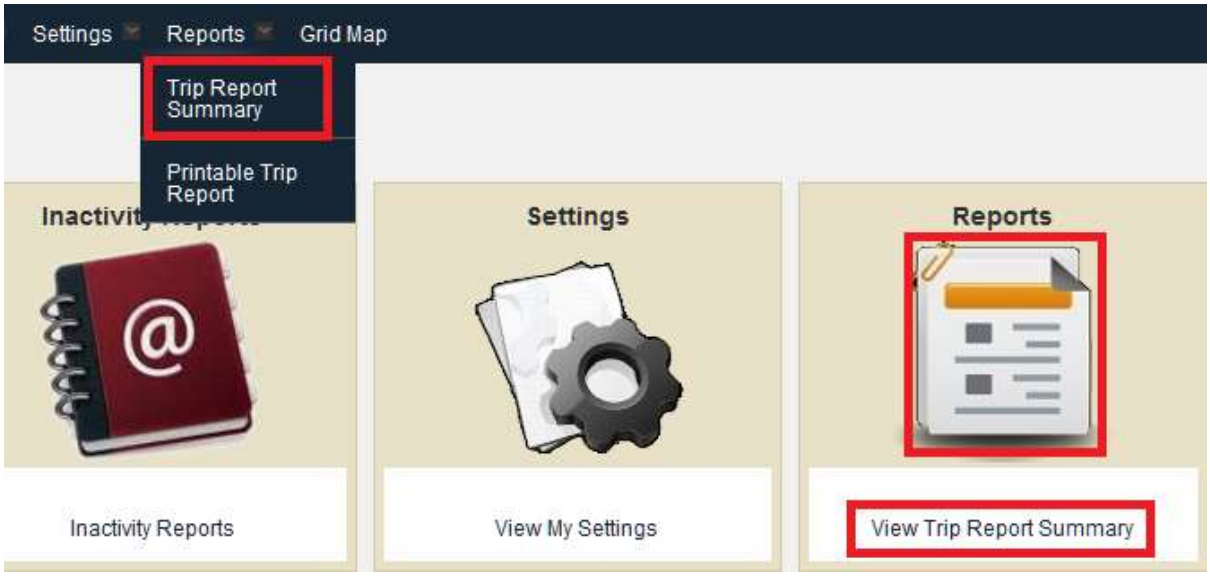


Figure 6.0

b. Creating a summary report (Figure 6.1) requires 3 basic steps: 1) Select a date range, 2) Click on the Search Button, 3) Click on either the Summary or Transactions printer icon in the upper right-hand corner of the summary screen.

c. You may narrow down what you want from the summary reports by selecting various filters. If you have multiple captains, you may select only one of them by moving the desired captain into the Selected Items column. The same is true for species. If you wish to narrow the summary report to just a handful of species, move the desired species into the selected items column. You may also filter by either submitted or non-submitted Trip Reports.

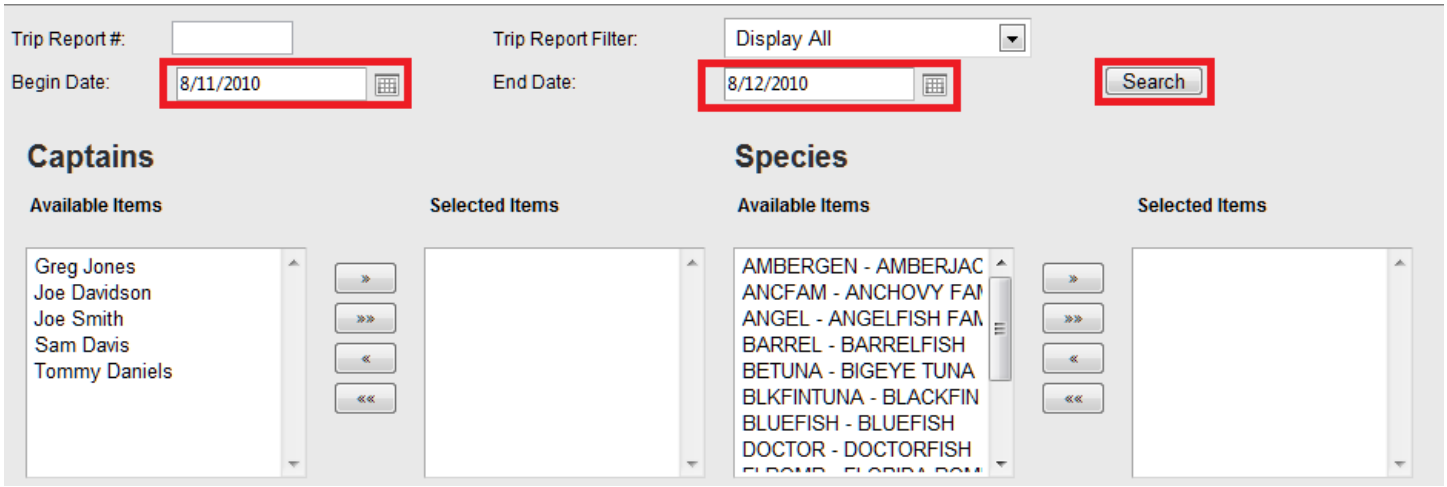


Figure 6.1

d. Remember, the three steps to printing a summary are: 1) Selecte the appropriate filters, 2) Click the Search button, then 3) Click on the either the Summary or Transactions printer icon in the upper right-hand corner of the summary screen (Figure 6.2) .

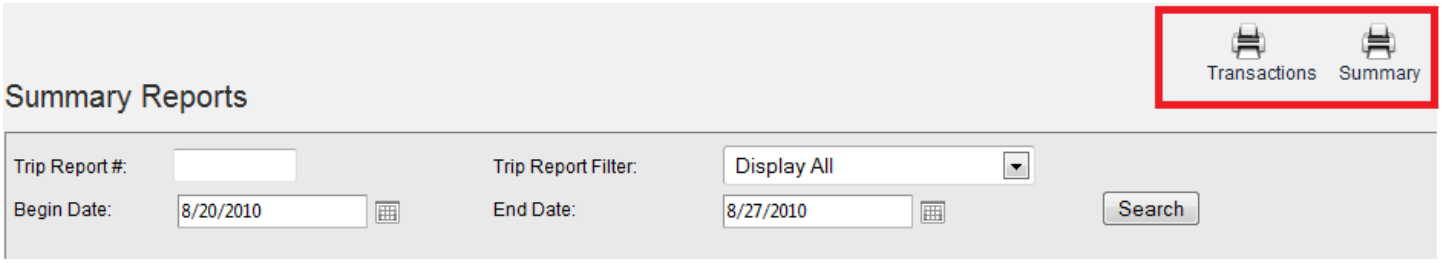
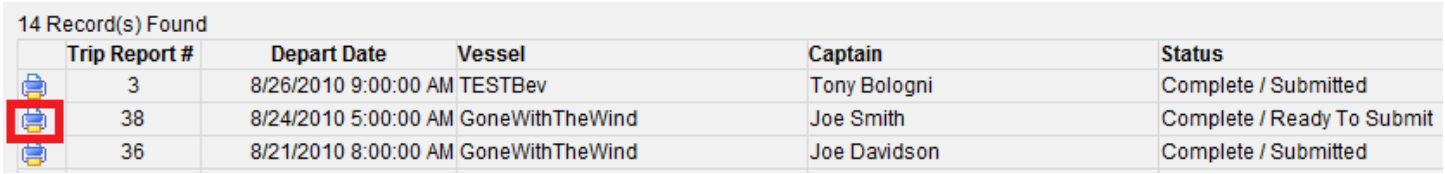


Figure 6.2

e. You may print a single Trip Report from the summary screen. After you select the selection criteria and click on the printer icon next to the trip report number (Figure 6.3).



14 Record(s) Found

Trip Report #	Depart Date	Vessel	Captain	Status
3	8/26/2010 9:00:00 AM	TESTBev	Tony Bologni	Complete / Submitted
38	8/24/2010 5:00:00 AM	GoneWithTheWind	Joe Smith	Complete / Ready To Submit
36	8/21/2010 8:00:00 AM	GoneWithTheWind	Joe Davidson	Complete / Submitted

Figure 6.3

CONTACT US

Claude Petersen

claude@bluefindata.com

Andrew Petersen

andrew@bluefindata.com

Office #: 225-744-0807

Fax #: 225-744-0808

www.bluefindata.com

MRIP Log Form Instructions:

IF THERE IS NO FISHING FOR THE DAY:

VESSEL NAME: Please write the name of the vessel. If vessel has no name leave blank.

USCG DOC#: Please write the U.S. Coast Guard documentation number.

STATE REG#: Please write the state vessel registration number.

NO FISHING: Please check the No Fishing box on the top-right hand side of the front of the form.

Please sign and print your name on the back of the form.

IF THERE WAS A CHARTER FISHING TRIP FOR THE DAY:

VESSEL NAME: Please write the name of the vessel. If vessel has no name leave blank.

USCG DOC#: Please write the U.S. Coast Guard documentation number.

STATE REG#: Please write the state vessel registration number.

DEPART DATE: Please record the 2 digit Month and 2 digit Day the trip departed from the dock.

(January=01, February=02, March=03, April=04, May=05, June=06, July=07, August=08, September=09, October=10, November=11, December=12)

RETURN DATE: If RETURN DATE is different from DEPART DATE, please record the 2 digit Month and Day the vessel returned to the dock.

DEPART TIME: Please write the time the vessel left the dock. Please also check either A.M. or P.M.

RETURN TIME: Please write the time the vessel returned to the dock. Please also check either A.M. or P.M.

NUMBER OF PASSENGERS: Please write the number of passengers (fishing and non-fishing not including crew) on the vessel.

NUMBER OF ANGLERS: Please write the number of anglers on the vessel.

NUMBER OF CREW: Please write the number of crew (including captain) on the vessel.

TRIP TYPE: Please check the type of fishing trip that best describes the days fishing.

TARGET SPECIES: Please check the type of fish that the trip was targeting.

PRIMARY AREA FISHED: Please write area fished using the coding list and statistical maps provided.

DEPTH FISHED: Please write the minimum and maximum depth (in feet) fished.

PERCENT OF TIME FISHED: Write the percent of fishing time spent in federal waters, state waters, and inland waters. The total should equal 100%.

DID YOU PRIMARILY: Please check the one box that best describes how you spent the majority of your fishing time (bottom fishing, drifting, trolling, spear fishing)

HOURS FISHED: Please write the total number of hours spent with gear in the water.

STATE: Please enter the 2 digit state where the trip departed from (FLORIDA=12, TEXAS=48).

COUNTY: Please write the county where the trip departed from.

NUMBER KEPT: Please write the number of each species of fish kept from the fishing trip. Use the OTHER FISH section to write in any species you may have kept that are not already on the form.

RELEASED ALIVE ($\leq$ 60 ft): Please record the number of each species released that were hooked in 60 feet of water or less.

RELEASED ALIVE (> 60 ft): Please record the number of each species released that were hooked in greater than 60 feet of water.

RELEASED DEAD: Please record the number of each species released dead.

PLEASE PRINT AND SIGN YOUR NAME ON THE BACK OF THE FORM.

OMB#: 0648-0016 Expires: 2013-07-31

MRIP LOGBOOK TRIP REPORT

VESSEL NAME: _____ YOUR NAME: _____

USCG DOC#: _____ STATE REG# _____

DEPART DATE: 2 0 1 ☐ Month ☐☐ Day ☐☐ RETURN DATE: 2 0 1 ☐ Month ☐☐ Day ☐☐

No fishing today ☐ No fishing this week ☐ No fishing this month ☐ DEPART TIME: ☐☐☐☐ AM ☐ PM ☐ RETURN TIME: ☐☐☐☐ AM ☐ PM ☐

NUMBER OF PASSENGERS: ☐☐ 1st Target Species _____ HOURS FISHED ☐☐

NUMBER OF ANGLERS: ☐☐ 2nd Target Species _____

NUMBER OF CREW: (incl. captain) ☐ PRIMARY AREA FISHED: (use statistical maps) ☐☐☐.☐ DEPTH FISHED: (feet) ☐☐☐ to ☐☐☐

PERCENT OF TIME FISHED (should equal 100%): >10 Miles from Shore (federal waters) ☐☐☐ ≤10 Miles (state waters) ☐☐☐ Inland ☐☐☐

PRIMARY GEAR: (check one) Hook & Line ☐ Spear fish ☐ Other ☐

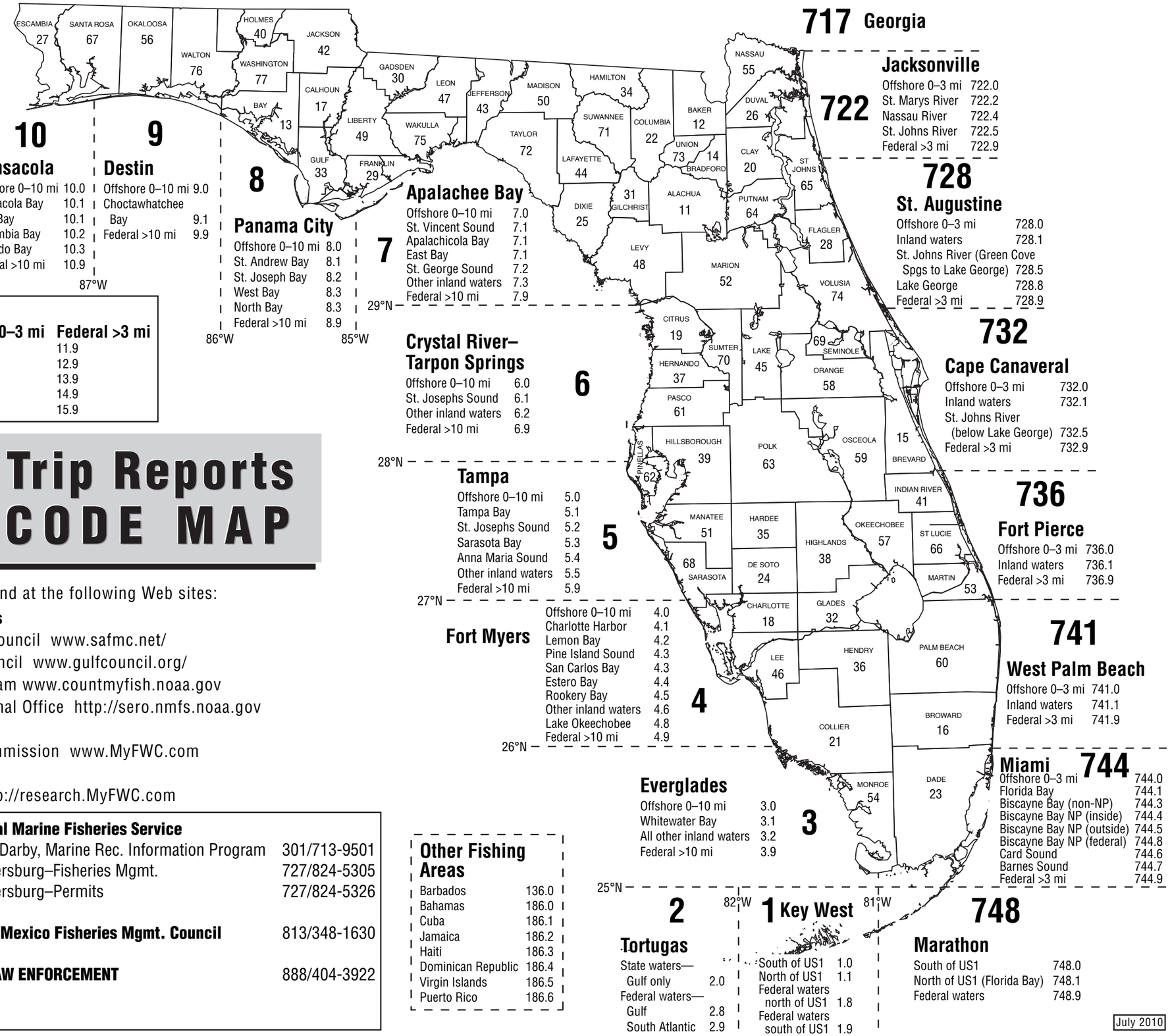
STATE: ☐☐ COUNTY: _____ SIGNATURE: _____

	Fish Species	Number Kept	Released Alive (≤ 120 ft)	Released Alive (> 120 ft)	Released Dead
	GROUPERS				
167759	Gag				
167702	Red Grouper				
167760	Black Grouper				
167763	Scamp				
167698	Speckled Hind				
167705	Snowy Grouper				
167704	Warsaw Grouper				
167696	Rock Hind				
167762	Yellowmouth Grouper				
167700	Red Hind				
167764	Yellowfin Grouper				
167741	Graysby				
167699	Yellowedge Grouper				
167838	Creole-fish				
	SNAPPERS				
168853	Red Snapper				
168909	Vermilion Snapper				
168848	Gray Snapper (Mangrove)				
168860	Lane Snapper				
168852	Blackfin Snapper				
168907	Yellowtail Snapper				
168847	Cubera Snapper				
168849	Mutton Snapper				
168902	Queen Snapper				
	PORGIES				
169207	Red Porgy				
169200	Whitebone Porgy				
169201	Knobbed Porgy				
169192	Spottail Pinfish				
169197	Jolthead Porgy				
169203	Littlehead Porgy				
169196	Grass Porgy				
169187	Pinfish				
	JACKS				
168689	Greater Amberjack				
168691	Almaco Jack				
168612	Blue Runner				
168693	Banded Rudderfish				
168738	Rainbow Runner				
168609	Crevalle Jack				
	TRIGGERFISH				
173138	Gray Triggerfish				
173139	Queen Triggerfish				

	Fish Species	Number Kept	Released Alive (≤ 120 ft)	Released Alive (> 120 ft)	Released Dead
	SEA BASSES				
167687	Black Sea Bass				
167690	Bank Sea Bass				
	BIGEYES & TILEFISH				
168178	Bigeye				
168190	Short Bigeye				
168543	Blueline Tilefish				
	MACKERELS & TUNAS				
172435	King Mackerel				
172436	Spanish Mackerel				
172451	Wahoo				
172402	Little Tunny (Bonita)				
172427	Blackfin Tuna				
172423	Yellowfin Tuna				
	GRUNTS				
169059	White Grunt				
169058	Tomtate				
169077	Pigfish				
	MISCELLANEOUS				
168559	Bluefish				
168566	Cobia				
168791	Dolphin				
161116	Tarpon				
169007	Tripletail				
169290	Red Drum (redfish)				
169283	Atlantic Croaker				
170429	Great Barracuda				
	SHARKS				
160200	Atl. Sharpnose Shark				
160502	Bonnethead				
160289	Sandbar Shark				
160401	Spinner Shark				
160318	Blacktip Shark				
160304	Blacknose Shark				
160275	Bull Shark				
160268	Dusky Shark				
	FLOUNDERS				
172793	Dusky Flounder				
172738	Southern Flounder				
172736	Gulf Flounder				
	HMS (Highly Migratory Species)				
172488	Sailfish				
172482	Swordfish				
172491	Blue Marlin				
172499	White Marlin				
	OTHER FISH				

Florida Fish and Wildlife Conservation Commission

For-Hire Logbook Trip Reports
FISHING AREA CODE MAP



Area 12
from 89°W to 90°W
(MS Sound to MS River mouth)

Area 11
from 88°W to 89°W
(Mobile Bay to MS Sound)

Fishing Area Codes West of Mobile Bay

Longitudes	Area	Offshore 0–3 mi	Federal >3 mi
88°W to 89°W	Mobile Bay–MS Sound	11.0	11.9
89°W to 90°W	MS Sound–MS River	12.0	12.9
90°W to 91°W	MS River–Barataria Bay	13.0	13.9
91°W to 92°W	Terrebonne–Atchafalaya	14.0	14.9
92°W to 93°W	Atchafalaya–Vermilion-Teche River Basin	15.0	15.9

Other Fishing Areas

Barbados	136.0
Bahamas	186.0
Cuba	186.1
Jamaica	186.2
Haiti	186.3
Dominican Republic	186.4
Virgin Islands	186.5
Puerto Rico	186.6

Fishery Management Regulations can be found at the following Web sites:

Federal Waters

South Atlantic Fishery Management Council www.safmc.net/
Gulf of Mexico Fishery Management Council www.gulfcouncil.org/
NOAA Marine Recreational Information Program www.countmyfish.noaa.gov
National Marine Fisheries Service Southeast Regional Office http://sero.nmfs.noaa.gov

State Waters

Florida Fish and Wildlife Conservation Commission www.MyFWC.com

Our Website

Fish and Wildlife Research Institute http://research.MyFWC.com

For-Hire Electronic Reporting Questions	
Claude Peterson, www.BluefinData.com	225/744-0807
Gulf States Marine Fisheries Commission	228/875-5912
FWC For-Hire Logbook Coordinators	
Stephanie McGrath, Regional Coordinator	850/277-0911
Beverly Sauls, State Supervisor	727/896-8626
FWC Division of Marine Fisheries	
Licenses and Permits Section	850/487-3122
Marine Fisheries Management	850/488-6058
Marine Fisheries Services	850/922-4340
National Marine Fisheries Service	
Forbes Darby, Marine Rec. Information Program	301/713-9501
St. Petersburg–Fisheries Mgmt.	727/824-5305
St. Petersburg–Permits	727/824-5326
Gulf of Mexico Fisheries Mgmt. Council	813/348-1630
FWC LAW ENFORCEMENT	888/404-3922

July 2010

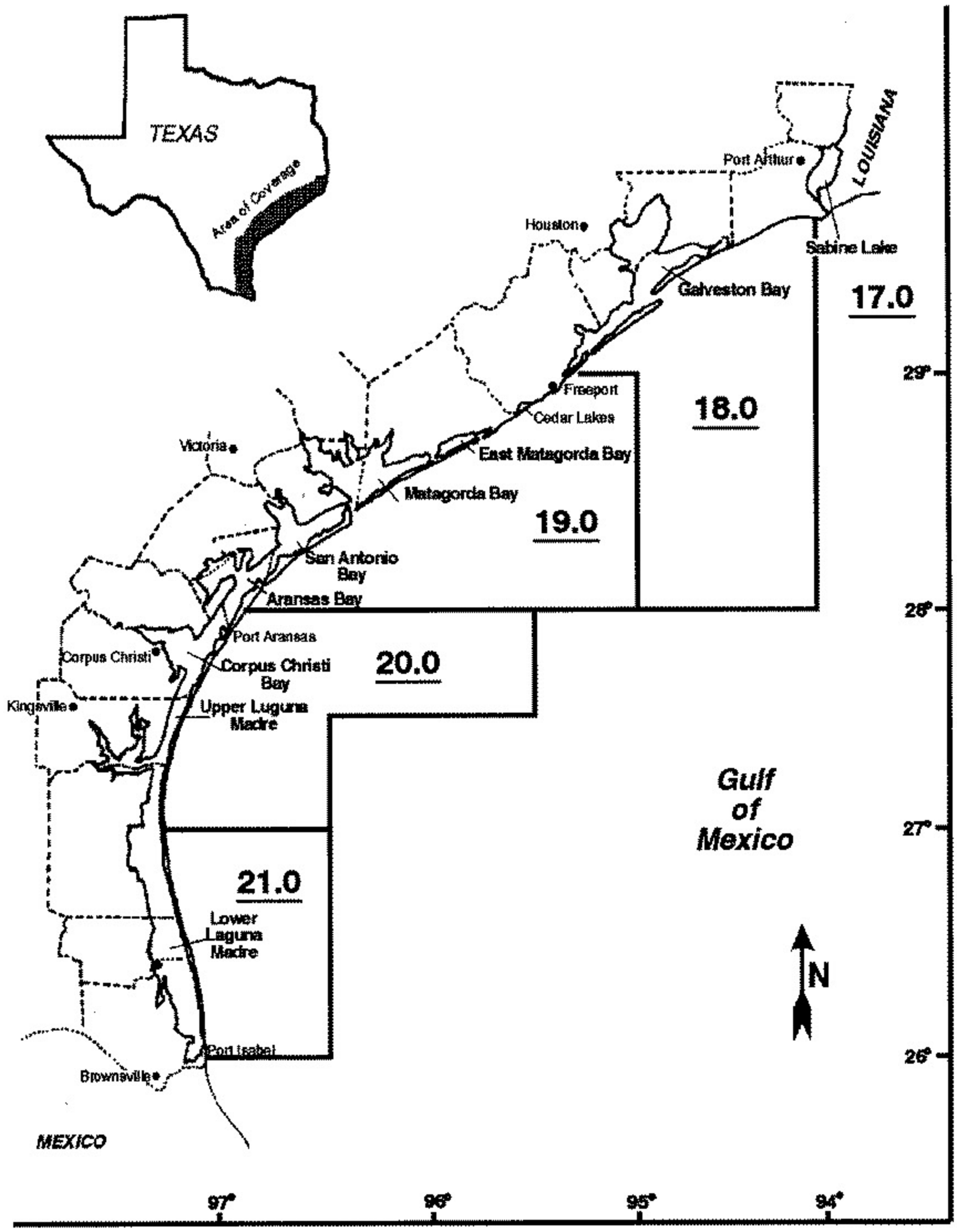


Figure 1. Texas bay systems and Gulf of Mexico grid zone.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701-5305
(727) 824-5305; FAX (727) 824-5308
http://sero.nmfs.noaa.gov

Dear Gulf of Mexico Charter Vessel Permit Holder;

I am writing to remind you of reporting requirements for owners and operators of charter boats in the Gulf of Mexico. As provided for in federal regulations, owners and operators of all charter boats in your area that fish in state and/or federal waters of the Gulf of Mexico have been selected to keep records of catches (see attached excerpt – 50 CFR part 622.4 and part 622.5). Catches from state waters as well as from federal waters must be reported. If you do not operate your charter boat yourself, you should inform the captain(s) of your vessel(s) of these requirements.

The intent of this data request is to develop and test a new reporting system for charter vessels in the Gulf of Mexico. Currently, charter vessel fishing effort is collected in a random telephone survey of vessel operators; however, this methodology provides limited documentation of participation in for-hire fisheries by individual permit holders. In addition, charter vessel catch data are currently collected from for-hire anglers during random intercept surveys; whereas, this new data collection system will collect catch information directly from you, the charter vessel operator. Your participation during the testing phase of this new reporting system will determine the feasibility for moving away from random surveys and expanding this data collection method to other regions in the Gulf of Mexico.

You are receiving this letter because our records indicate that you received a certified letter from National Marine Fisheries Service notifying you of your selection to report. Reporting was required as of September 1, 2010, or upon receipt of your certified letter if it was after September 1, 2010. As of the date of this letter, no official reports have been received for your vessel.

You are reminded that, in accordance with federal regulations at 50 CFR 622.4.(r)(2), renewal of a charter vessel/headboat permit for Gulf coastal migratory pelagic fish or Gulf reef fish is contingent upon the permitted vessel owner and/or captain providing the information required in designated fishing data surveys. Accordingly, if you do not comply with the requested survey, your permit(s) may not be renewed.

If you have any questions about reporting options, how to get started, or the required permits you possess or need to possess in order to participate in certain fisheries, please refer to the Frequently Asked Questions document that is included in this letter, which also contains contact information if you have further questions. Accurate and timely reporting of logbooks in the charter boat sector is a requirement for maintaining and renewing your charter vessel/headboat permits. All proprietary commercial or financial information that you provide will be confidential to the National Marine Fisheries Service as required under applicable federal laws.

Sincerely,

Roy Crabtree, Ph.D.
Regional Administrator

Gulf Logbook Pilot Study Survey for Electronic Reporters

1. Which state is your permitted vessel (or vessels) currently located in?

    a. Florida
    b. Texas

2. Which category best describes your affiliation with the permitted vessel(s) that were reported for in this study?

    a. Vessel Owner
    b. Vessel Owner and Operator
    c. Hired Captain and/or crew
    d. Employee of charter fishing business
    e. Other

3. Who submitted the logbook trip reports for the vessel(s) you are affiliated with?

    a. Yourself
    b. Someone else on your behalf

4. How do you access the Gulf Logbook website the majority of the time? (*circle all that apply*)

    a. Public computer (*such as at a public library*)
    b. A computer with dial-up Internet access
    c. A computer with high-speed Internet access
    d. A computer with wireless access
    e. Smart phone application
    f. Other (*please specify*)

5. How easy was the registration and setup process for Gulf Logbook website?

    a. Very easy
    b. Somewhat easy
    c. Not at all easy
    Comments:

6. How helpful was the Gulf Logbook website support staff?

    a. Very helpful
    b. Somewhat helpful
    c. Not helpful
    d. I did not contact website support staff
    Comments:

(Continued on next page)

7. How easy is it to find the information you are looking for on the Gulf Logbook website?

    a. Very easy
    b. Somewhat easy
    c. Not at all easy

8. Was one or more of your permitted vessels actively charter fishing for at least one month during this pilot study?

    a. Yes
    b. No (*you may skip to Question 12*)

9. How long does it typically take for you to fill out electronic reports for a *single fishing trip*?

    a. Less than 1 minute
    b. 1 to 5 minutes
    c. 5 to 10 minutes
    d. More than 10 minutes
    e. I did not report any fishing trips

10. How easy was it for you to keep an accurate count of released fish for weekly logbook trip reporting?

    a. Very easy
    b. Somewhat easy
    c. Not at all easy
    d. I did not report any fishing trips

11. How did you typically keep track of released fish for weekly trip reporting?

    a. Kept a written account of released fish *while the fishing trip was underway*
    b. Wrote down numbers of released fish sometime *during the day the fishing trip took place*
    c. Wrote down numbers of released fish sometime *during the week the fishing trip took place*
    d. Wrote down numbers of released fish *the following week or later*
    e. I did not report any fishing trips

12. For information on the numbers of fishing trips your vessel takes each week, choose one:

    a. I prefer to report information every week on logbooks
    b. I prefer to **not** report information every week on logbooks
    c. No preference

13. If you selected choice b for Question 12 above, for what reason(s) would you prefer to **not** report information every week on logbooks? (*circle all that apply*)

    a. Takes too much time
    b. Too much confidential information is collected
    c. Information in the logbook is inaccurate
    d. Other (*please specify*)

(Continued on next page)

14. How easy is it to view submitted trip reports and weekly inactivity report in the Gulf Logbook website?

    a. Very easy
    b. Somewhat easy
    c. Not at all easy

    Comments:

15. How easy is it to identify weeks that are missing trip reports or inactivity reports in the Gulf Logbook website?

    a. Very easy
    b. Somewhat easy
    c. Not at all easy

16. How helpful were the weekly emails to remind you of reporting deadlines and notify you when reports were late?

    a. Very helpful
    b. Somewhat helpful
    c. Not necessary
    d. I did not receive any email reminders
    e. I would prefer not to receive email reminders

17. How helpful were the telephone calls at the end of the month notifying you of weeks when reports were not submitted?

    a. Very helpful
    b. Somewhat helpful
    c. Not necessary
    d. I did not receive any phone calls for late reports
    e. I would prefer not to receive phone calls

18. How helpful was staff from the state Agency (FWC or TPWD) during the pilot study?

    a. Very helpful
    b. Somewhat helpful
    c. Not at all helpful
    d. I did not communicate with state staff

    Comments:

(Continued on next page)

19. Based on your experience with this pilot study, would you support using a logbook reporting system to report your vessel activity in the future?

    a. Yes, with no changes
    b. Yes, with minor changes
    c. Yes, with major changes
    d. No

20. What, if anything, would you do to improve this logbook survey?

Gulf Logbook Pilot Study Survey for Paper Reporters

1. Which state is your permitted vessel (or vessels) currently located in?

    a. Florida
    b. Texas

2. Which category best describes your affiliation with the permitted vessel(s) that were reported for in this study?

    a. Vessel Owner
    b. Vessel Owner and Operator
    c. Hired Captain and/or crew
    d. Employee of charter fishing business
    e. Other

3. Who submitted the logbook trip reports for the vessel(s) you are affiliated with?

    a. Yourself
    b. Someone else on your behalf

4. Which reason best describes why you chose paper logs over electronic reporting?

    a. No access to a computer and/or Internet
    b. Do not know how to use a computer and/or Internet
    c. Paper is more convenient
    d. Other (please specify)

5. Did you, at any time during this pilot study, use the electronic reporting method?

    a. No, I used paper logs the entire time
    b. Yes, I started with paper logs and switched to electronic reporting (*Please explain why*)

    c. Yes, I started with electronic reporting and switched to paper logs (*Please explain why*)

6. How important is receiving postage paid envelopes to you?

    a. Very important
    b. Somewhat important
    c. Not important
    d. I don't mind paying postage

(Continued on next page)

7. Was one or more of your permitted vessels actively charter fishing for at least one month during this pilot study?

    a. Yes
    b. No (*Skip to Question 11*)

8. How long does it typically take for you to fill out paper logs for a *single fishing trip*?

    a. Less than 1 minute
    b. 1 to 5 minutes
    c. 5 to 10 minutes
    d. More than 10 minutes

9. How easy was it for you to keep an accurate count of released fish for weekly logbook trip reporting?

    a. Very easy
    b. Somewhat easy
    c. Not at all easy

10. How did you typically keep track of released fish for weekly trip reporting?

    a. Kept a written account of released fish *while the fishing trip was underway*
    b. Wrote down numbers of released fish sometime *during the day the fishing trip took place*
    c. Wrote down numbers of released fish sometime *during the week the fishing trip took place*
    d. Wrote down numbers of released fish *the following week or later*

11. For information on the numbers of fishing trips your vessel takes each week, choose one of the following:

    a. I prefer to report information every week on logbooks (*Skip to Question 13*)
    b. I prefer to **not** report information every week on logbooks
    c. No preference (*Skip to Question 13*)

12. For what reason(s) would you prefer to **not** report information every week on logbooks? (*circle all that apply*)

    a. Takes too much time
    b. Too much confidential information is collected
    c. Information in the logbook is inaccurate
    d. Other (*please specify*)

(Continued on next page)

13. How helpful were the telephone calls at the end of the month notifying you of weeks when reports were not submitted?

    a. Very helpful
    b. Somewhat helpful
    c. Not necessary
    d. I did not receive any phone calls for late reports
    e. I would prefer not to receive phone calls

14. How helpful was staff from the state Agency (FWC or TPWD) during the pilot study?

    a. Very helpful
    b. Somewhat helpful
    c. Not at all helpful
    d. I did not communicate with state staff

    Comments:

15. Based on your experience with this pilot study, would you support using a logbook reporting system to report your vessel activity in the future?

    a. Yes, with no changes
    b. Yes, with minor changes
    c. Yes, with major changes
    d. No

16. What, if anything, would you do to improve this logbook survey? (*Please feel free to add an additional sheet for comments*)

Appendix H

Figure 1. Field data sheets for dockside validation of logbook data, including assignment summary form and dockside interview form.

LOGBOOK ASSIGNMENT SUMMARY FORM

SAMPLER ID: ☐☐☐☐ STATE: ☐☐

SAMPLE DATE: 2 0 1 ☐ - ☐☐ - ☐☐

CONTROL NUMBER: ☐☐☐☐ ARRIVAL TIME: ☐☐☐☐

SITE NAME: ☐ SITE CODE: ☐☐☐☐

VESSEL NAME	ARRIVAL STATUS	EXPECTED RETURN TIME	FINAL STATUS	ACTUAL RETURN TIME

DEPARTURE TIME: ☐☐☐☐

ARRIVAL STATUS:
1=VESSEL IN
2=VESSEL OUT, CHARTER FISHING *(MUST BE VERIFIED)*
3=UNABLE TO VALIDATE *(VESSEL SOLD, MOVED TO UNKNOWN LOCATION, ETC)*
4=VESSEL OUT, NOT CHARTER FISHING *(MUST BE VERIFIED)*
5=VESSEL OUT, FISHING STATUS UNKNOWN *(USE WHEN UNABLE TO VERIFY FISHING STATUS)*

FINAL STATUS:
1=QUESTIONNAIRE COMPLETED
2=REFUSED OBSERVED CATCH
3=MISSED INTERVIEW
4=VESSEL DID NOT RETURN
5=VESSEL DID NOT FISH

Page ____ of ____

2010 LOGBOOK DOCKSIDE VALIDATION FORM **OMB NO. 0648-0052 (EXP. 04/30/11)**

VESSEL NAME: _____ DEPART DATE: 2 0 1 - - DEPART TIME:

VESSEL ID #: INTV. DATE: 2 0 1 - - INTV. TIME:

NUMBER OF PASSENGERS: NUMBER OF ANGLERS: NUMBER OF CREW: AREA FISHED: . HOURS FISHED:

TARG SPP. 1: _____ TARG SPP. 2: _____ DEPTH FISHED: TO feet

% OF TIME FISHING: EEZ STS INL

PRIMARY GEAR: HOOK & LINE: SPEAR: OTHER: COMMENTS:

DATA COLLECTED FROM: CAPTAIN CREW

UNAVAILABLE CATCH (DISCARDED, FILLETED, ETC) SAMPLER ID#: NAME: _____

DISPOSITION CODES

1 Thrown back alive, ≤ 120' of water	3 Eaten/plan to eat	5 Sold/plan to sell	7 Other purpose
2 Thrown back alive, > 120' of water	4 Used for bait/plan to use for bait	6 Thrown back dead/plan to throw away	

	SPECIES CODE	# OF FISH	DISP.
1. _____			
2. _____			
3. _____			
4. _____			
5. _____			
6. _____			
7. _____			
8. _____			

AVAILABLE HARVEST

DISPOSITION CODES

3 Eaten/plan to eat	5 Sold/plan to sell	7 Some other purpose
4 Used for bait/plan to use for bait	6 Thrown back dead/plan to throw away	9 Refused

	SPECIES CODE	# OF FISH	LENGTH (mm)	WEIGHT (kg)	DISP
1. _____				.	
2. _____				.	
3. _____				.	
4. _____				.	
5. _____				.	
6. _____				.	
7. _____				.	
8. _____				.	
9. _____				.	
10. _____				.	
11. _____				.	
12. _____				.	
13. _____				.	
14. _____				.	
15. _____				.	
16. _____				.	
17. _____				.	
18. _____				.	
19. _____				.	
20. _____				.	
21. _____				.	
22. _____				.	
23. _____				.	
24. _____				.	
25. _____				.	

	SPECIES CODE	# OF FISH	LENGTH (mm)	WEIGHT (kg)	DISP
26.				.	
27.				.	
28.				.	
29.				.	
30.				.	
31.				.	
32.				.	
33.				.	
34.				.	
35.				.	
36.				.	
37.				.	
38.				.	
39.				.	
40.				.	
41.				.	
42.				.	
43.				.	
44.				.	
45.				.	
46.				.	
47.				.	
48.				.	
49.				.	
50.				.	
51.					
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Appendix H

Figure 2. Field data sheet used in Texas for at-sea validation of logbook data.

AT SEA OBSERVATION FORM

SAMPLER ID# _____ NAME: _____

VESSEL NAME:_____ VESSEL ID#:_____ DEPART DATE: ___/___/___DEPART TIME: _____ ARRIVAL DATE:___/____/___ ARRIVAL TIME: _____

HOURS FISHED:_____ PERCENT TIME FISHED EEZ (>9MI)_____ STS (< 9MI)_____ INL _____ NUMBER OF PASSENGERS:____ NUMBER OF ANGERS:____ NUMBER OF CREW:___

PRIMARY AREA FISHED: _____

TARG SPP. 1:_____ TARG SPP. 2: _____ DEPTH FISHED_____ TO _____ FEET PRIMARY GEAR: HOOK & LINE:___ SPEAR:____ OTHER:_____

WIND SPEED:_____ WIND DIRECTION:_____ SEAS:_____ FT SEAS: CHOP____ ROLLER____ CALM____

HARVESTED CATCH

DISPOSITION CODES

1 - THROWN BACK ALIVE, ≤ 120 FT OF WATER | 2 - THROWN BACK ALIVE > 120 FT OF WATER | 3 - EATEN/PLAN TO EAT | 4 - USED FOR BAIT/PLAN TO USE FOR BAIT | 5 - SOLD/PLAN TO SELL | 6 - THROWN BACK DEAD/PLAN TO THROW AWAY | 7 – OTHER

START/STOP	DEPTH (FT)	STAT AREA	TTS/EEZ	BAIT	HOOK TYPE	GEAR	SPECIES	SP CODE	DISP	HOOK POS.	T,F,S	LENGTH

START/STOP	DEPTH (FT)	STAT AREA	TTS/EEZ	BAIT	HOOK TYPE	GEAR	SPECIES	SP CODE	DISP	HOOK POS.	T,F,S	LENGTH

Appendix H

Figure 3. Field data sheet for validation of vessel activity.

LOGBOOK VALIDATION FORM

SAMPLER ID: _____ **STATE:** _____ **PAGE____of____**

DATE: _____ **ARRIVAL TIME:** _____

CONTROL: _____ **DEPARTURE TIME:** _____

SITE NAME: _____ **SITE CODE:** _____

VESSEL ID	VESSEL NAME	ARRIVAL STATUS	COMMENTS

ARRIVAL STATUS:

1=VESSEL IN

2=VESSEL OUT, CHARTER FISHING (MUST BE VERIFIED)

3=UNABLE TO VALIDATE (VESSEL SOLD, MOVED TO UNKNOWN LOCATION, ETC)

4=VESSEL OUT, NOT CHARTER FISHING (MUST BE VERIFIED)

5=VESSEL OUT, FISHING STATUS UNKNOWN (USE WHEN UNABLE TO VERIFY FISHING STATUS)

LOGBOOK VALIDATION FORM

Charter-Boat Logbook Reporting Pilot Study

Initial Examination of Data

Mark S. Kaiser

Dept. of Statistics, Iowa State University

Prepared for

Marine Resources Assessment Group Americas

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1 Introduction

This report describes an examination of data collected as part of a pilot study conducted by the Marine Recreational Information Program (MRIP) in portions of the Gulf of Mexico. The primary objective of the pilot study is to determine the feasibility of using a logbook reporting system to monitor activity and catch by the for-hire recreational charter fishery in the Gulf of Mexico. The design of data collection systems used in the pilot study have been described elsewhere. This examination of data collected from September 2010 through May 2011 will make use of data from three sources.

1. Activity Monitoring.

   The intention of activity monitoring data is to determine the level of compliance of charter-boat operators in submitting logbook information for all trips taken. The data collected in this portion of the project are called "Prevalidation" data by MRIP. They consist of recorded status of vessels at times of visitation of docking sites. Status of vessels is recorded as 1 =Vessel In, 2 =Vessel Out Charter Fishing, 3 =Unable to Validate Status, 4 =Vessel Out Not Fishing, and 5 =Vessel Out, Status Unknown. The primary concern is the proportion of days for which it could be verified that vessels were out fishing that the captains filed logbook reports.

2. Dockside Sampling.

   Dockside monitoring data were gathered by samplers when vessels returned from fishing trips and is intended to be compared with information entered by captains in logbook records. The primary concern is how records of the numbers of individuals of various species compare between logbook and dockside sampling data. Numbers of individual species are recorded in dockside sampling data as falling into one of 8 categories, 1 =released alive $<$ 120 ft., 2 =released alive $>$ 120 ft., 3 =plan to eat, 4 =bait, 5 =plan to sell,

6 =discard mortality, 7 =other, 9 =information refused. These are not the same categories used by captains in filling out logbook records, but categories 3, 4, 5 and 7 were combined for comparison with what the logbooks record as harvested. While catch composition and disposition are perhaps the primary concern in validation of logbook data by dockside sampling, there are a number of other common variables that might prove useful in monitoring effort. In particular, both logbook and dockside sampling data record the number of passengers and anglers, primary gear, hours fished, area fished, minimum depth and maximum depth, and percent of time in EEZ waters, State waters, or Inland waters. Dockside sampling also collected some biological data such as length and weights of a few individuals, but these data are not used in this report.

3. Logbook Data.

   Logbook data are submitted by vessel captains and contain overlapping variables with dockside sampling data as described in item 2. The disposition of individuals of various species are recorded in logbook records as harvested, released alive < 120 ft., released alive > 120 ft., and discard mortality.

Many other variables, some related to dates and times of trips, are included in the three data sources listed previously. These variables were used to match records between data sources and to attempt to untangle discrepancies in logbook records for individual trips. These issues will be described more fully in what follows.

The data examination reported on here was focused on two questions related to the overall objective of determining whether logbook data could be used in monitoring effort and catch in the charter fishery.

1. Can logbook data be used as an essential census of trips taken by the charterboat fishery? This question is largely concerned with completeness and accuracy of the logbook data source. To consider logbook data as a census of

the fishery requires, first, verification that logbook records are reported for essentially all trips known to have been taken (within a small measure of reporting error). The comparison to be conducted is the proportion of known fishing trips, as documented in the activity monitoring or prevalidation data, for which logbook records were submitted. Another necessary attribute of logbook data needed to consider this source in a census-like manner is that there be a high level of agreement in trip characteristics (hours fished, number of anglers, etc.) and catch composition (numbers and dispositions of individuals by species) between logbook and dockside sampling data sources.

2. If sizable discrepancies between logbook and validation data sources exist, are those discrepancies consistent enough across time and regions (Florida versus Texas) that quantitative adjustments could be made to logbook data? For example, if the proportions of known fishing trips (based on activity monitoring data) for which logbook records are submitted are nearly constant across months, then even if those proportions are not exactly (or essentially) 1.0, a correction would be available to estimate the total number of trips taken based on logbook data. The same issue exists for variables related to fishing effort and catch composition.

2 Data Characteristics and Issues

This section reports a number of summaries that describe the amount of data available from the three data sources for Florida and Texas across months of the study, and describes a number of issues encountered in initial data processing, primarily with regard to the logbook data source. This this section, and the remainder of the report, "month of study" will be taken as $1, 2, \ldots, 9$ with 1 corresponding to September 2010, and 9 corresponding to May 2011. Thus, month of study in the tables and graphs to follow is not calendar month.

2.1 Fishing Activity

The activity monitoring or prevalidation data recorded the numbers of vessels and their status as presented in Table 1. Recall that status 1 =In, status 2 =Out

		Month of Study								
Region	Status	1	2	3	4	5	6	7	8	9
Florida	1	662	587	617	203	651	610	713	645	513
	2	24	55	16	0	7	3	64	121	95
	3	66	32	43	8	49	94	111	87	54
	4	11	29	17	10	66	93	85	66	26
	5	56	67	54	19	51	57	92	124	61
	Tot	819	770	747	240	824	857	1065	1043	749
Texas	1	424	638	497	347	412	320	342	142	482
	2	33	18	3	1	1	4	5	1	29
	3	77	87	69	33	98	284	444	204	621
	4	0	14	19	13	17	25	62	21	59
	5	4	24	16	4	1	5	6	3	4
	Tot	538	781	604	398	529	638	859	371	1195

Table 1: Numbers of vessels recorded by activity monitoring by region, status, and month of study.

Fishing, and status 3 =Unable to Verify. Also note, as mentioned previously, that month of study is not calendar month; month of study 4 is December 2010. The status monitoring in the first 9 months of this project resulted in a large number of vessel/days on which charter trips could not be verified. This will lead to substantial uncertainty in estimating the proportion of trips known to have been taken for which logbooks were filed. Apparently, it is difficult to verify the activity of vessels that are not in at the time of observation, and this seems especially the case for Texas.

If there is a good deal of movement of vessels, either into and out of the fishery or among docking sites, observation of vessel status at those sites may be an inefficient way to determine how much fishing activity is occurring. This is not necessary for our current purposes, but it may make the status monitoring procedure used in this study somewhat ineffectual for an alternative use as a method to determine the level of fishing activity.

The number of logbook reports filed over time appears to reflect a sharp decrease in fishing activity in the months of December, January, and February. The number of logbook reports filed over months of the study is presented in Table 2. The values of Table 2 suggest that the Texas fishery is tremendously smaller than

	Month of Study								
Region	1	2	3	4	5	6	7	8	9
Florida	465	1149	342	57	22	62	622	1036	1153
Texas	57	42	11	5	2	2	26	10	37

Table 2: Numbers of logbook reports submitted by region and month of study.

the Florida fishery, more so that do the values of Table 1 (which were, of course, influenced by sampling effort as well as size of fleet). Examining the data from logbooks and status monitoring (prevalidation) shows that there were 217 unique vessel identification numbers in the Florida logbook data but only 21 in the Texas logbook data. Concomitantly, there were 231 unique vessel numbers reported in the status monitoring data for Florida and 62 in Texas. Thus, assuming that all vessels represented in the logbook data were included in status monitoring at some time (or that the vessels included in status monitoring are the entire collection of vessels in existence in a region) about 94% of vessels in Florida filed a logbook report at least once, while only 34% of the vessels in Texas did so. While the premise of this calculation might not be strictly true, the discrepancy between Florida and Texas in this aspect of the data is quite striking.

Assuming nothing about characteristics of the charter fisheries in Florida and Texas, the information from Table 1, Table 2 and the immediately preceding observation would seem to suggest a picture in which the charter fishery in Texas is smaller, possibly more mobile, and either less cooperative or harder to identify than is the fishery in Florida. If this is the case, sampling in Texas or regions with similar characteristics, be it for verification of a self-reporting logbook system or to provide data for direct estimation, may be more difficult and costly than for Florida.

2.2 Trip Characteristics and Catch

The number of trips for which dockside samples were obtained is presented in Table 3 by region and month of study. These sampled trips come from a total of 112 different vessels in Florida and 13 different vessels in Texas.

	Month of Study									
Region	1	2	3	4	5	6	7	8	9	Total
Florida	54	108	36	1	1	7	17	71	105	400
Texas	4	9	2	2	0	1	3	2	15	38

Table 3: Number of trips having dockside samples by region and month of study.

It is clear from the values of Table 3 that an insufficient number of dockside samples were obtained in a number of months to compare catch variables with corresponding logbook records on a month-by-month basis. This conclusion could have already been reached for Texas based on the number of logbook reports available as reported in Table 2, but the same is true for Florida at least over the stretch of months from December 2010 (month of study 4) to March 2011 (month of study 7). The decision was made to compare logbook and dockside sampling data for month of study 1, 2, 3, 4-7, 8, and 9 in Florida, and only aggregated over all months in Texas.

A large number of individual species were reported in both dockside sampling data and logbook reports, as demonstrated in Table 4.

Region	Logbook	Dockside Samples
Florida	154	78
Texas	47	32

Table 4: Number of unique species recorded in logbook and dockside sampling data sources.

Based on these values it might appear that the fishery in Florida is more diverse than the fishery in Texas, but this suggestion must be tempered by the fact that so few trips in Texas had either logbook or dockside sampling records. Note that the values in Table 4 are not cross-classified. That is, the logbook records from which the number of unique species identities were calculated includes all logbook reports (rightmost column of Table 2), not only trips also included in the dockside samples.

2.3 Data Issues

A number of data issues were identified during the process of data organization and summarization, most notably with logbook data files. The more substantive of these are summarized in the following points.

1. Vessel identification numbers were only unique to an individual region, here Florida or Texas. If a logbook reporting system is developed for Gulf-wide application this will become much more than the minor issue it was in the current analysis.

2. The variables TRIPSPERDAY and TRIPREPORTNUM in the data file Trips.txt both proved unreliable. TRIPSPERDAY is apparently supposed to be the number of trips taken on a given day for which a logbook report has been

filed. TRIPREPORTNUM is supposed to be a unique identifier for each trip (maybe unique at least on the given day). As a simple example of what was a widespread problem with TRIPSPERDAY, the values of TRIPSPERDAY ranged from 1 to 11 in the data file. But, looking at the records that have 11 for that variable produces records for 3 different trips taken in May by 3 different vessels (vessel ids 6, 108, and 38). So this is confusing.

3. Without reliable variables that directly indicate single or multiple trips in one day, the process of determining when a given vessel may have taken more than one trip on a given day was not well defined. Some logbook records that indicate there was more than one trip in a day seem correct. For example, vessel 21 in Florida lists 2 trips on 9/17/2010 with different report numbers. The first departed at 6:00, lists 3 hours fished, and return at 10:00. The second lists depart at 13:00, 3 hours fished, and return at 17:00. The same number of party and anglers was on both trips, but there was a difference in maximum depth fished between the two sets. So this looks like the same party that went out two times on that day.

   More frequently, logbook records that indicate more than one trip in a day do not seem correct. For example, vessel 3 in Florida lists 2 trips on 9/17/2010. Both are listed as departing at 5:30, 12 hours fished, and return at 17:30, and both have the same report number. This must have been only one trip. On other records there appears to have been more than one trip based on departure and arrival times for the same date, but all have the same trip report number. On other records, several trips are listed for the same day, but in which all of the other variables, such as departure time and arrival time, are identical for all trips. This would seem to be impossible for one vessel to accomplish.

   The most reliable variables for determination of days that may have had more than one trip by a given vessel seemed to be matching departure and arrival

times for the same date. If non-overlapping sets of departure and arrival times that seemed consistent with number of hours fished (i.e., defined time intervals about 0.5 to 2 hours greater than number of hours fished) then multiple trips were taken for that vessel on that day. This process could be automated, but left about a dozen cases with remaining conflicts. Determination of whether these cases corresponded to logbook reports having more than one trip in a day, or mistakenly reporting more than one trip in a given day, or simply having data entry errors, was painstaking and less than exact. That is, judgment calls were required in a number of cases, and decisions required individual examination of the values of all of the reported variables in a case-by-case examination. A separate summary of situations in which this occurred will be provided to data managers at MRIP.

After data cleaning there were logbook records for $4,908$ trips in Florida and 192 trips in Texas (see row totals for Table 2). In Texas, all vessels reported only one trip on any given day. In Florida, there were 242 records given as the second trip of a day, and one record given as the third trip.

4. There are implications of data discrepancies for taking a logbook reporting program to a Gulf-wide basis. Any time data are recorded by a relatively large number of individuals (here captains) one expects there to be a certain level of inconsistency in the manner that variables are recorded. There may also be a maddeningly large array of specific data entry errors that are then difficult to categorize and run checks for in an automated manner. While the number of such occurrences in these data was actually fairly small (based on my experiences with other situations), the need for individual consideration of cases involving one or more conflicts can be prohibitively time consuming even in data bases with only moderate numbers of records. As a rough guess, I would say that identification and resolution of conflicting data records in the fairly small amount of data I dealt with in this project (small by most

data-base standards) took about 10 to 15 minutes per case. This was caused by the fact that there was not a single or even small number of well-defined variables that could be used to resolve conflicts. The rate of cases in need of individual consideration was about 3 per 1000 or somewhere approaching one third of one percent of the total data records. When other relatively minor discrepancies are included (e.g., data records for month 1 in 2010, which clearly should have been 2011 given the time span of this study), the time commitment needed for data cleaning and editing is not inconsequential. If one supposes that a Gulf-wide program would expand the volume of data by about five-to-tenfold, increase the number of individuals (captains) recording data and hence also the number of unique errors committed, and also increase the complexity of geographic considerations as well, I would hazard a guess that such a program would require about three to four weeks of time from one talented data manager to be devoted solely to data cleaning. Note here that this comment concerns data files as provided to me that I presume had already been worked with to some degree by data management personnel at MRIP, so my caution concerns additional effort beyond that already devoted to data considerations in the pilot study by MRIP.

5. A better system for matching dockside sampling reports with logbook entries would be beneficial. In the Florida data there were 400 trips having dockside samples taken (see Table 3). Each of these contained a unique report number in the dockside sampling data file. Of these 400 trips, 23 were from sampling two trips by the same vessel on the same day. The only way to match these against logbook reports was by time of departure in both logbook and dockside sampling data files. Given that logbook entries are usually made some time after a trip has been completed, it is a reasonable assumption that the reliability of variables in logbook reports decreases across the sequence of departure year, month, day, hour, and minute. In fact, some logbook records that were

matched to dockside sampling reports did differ in departure time (dhr and dmin) but these could usually be resolved through individual inspection. For example, dockside sampling report 59 in Florida was for vessid id 102 on 5 September 2010. In the dockside report departure hour was 15 and departure minute 30 (i.e., 15:30). Logbook reports record two trips for vessel 102 on this day, one departing at hour 7 minute 0 (7:00) and the other departing at hour 15 minute 0 (15:00). While this discrepancy is not difficult to correct by hand, automating the matching of dockside sampling reports and logbook reports is again made difficult. If one uses too "crude" or too "fine" a level of matching, one may either eliminate sampled trips or replicate the same trip several times. This reinforces the point of the previous item.

6. The coding system for species may be too detailed for the use of logbooks as a data source. There are many instances of records in logbook and dockside sampling data sources that list different species codes that are most likely the same species and should not be taken as discrepant. For example, a trip by Florida vessel 29 on 2 September 2010, lists four different species caught in both logbook and dockside sampling data sources. The following are records of the species codes and dispositions given in the dockside sampling report (number 29) and corresponding logbook record.

Data Source	Species Code	Harvest	Released < 120	Released > 120	Mortalities
Dockside	168566	1	1	0	0
	168693	1	0	0	0
	168853	0	4	0	0
	169207	5	0	0	0
Logbook	168566	1	0	0	0
	168853	0	4	0	0
	169180	5	0	0	0
	172435	2	0	0	0

In these records, species 168566 agree in harvest but differ in number released at less than 120 feet. Species 168853 agrees exactly. The other two species codes differ between dockside sampling and logbook data sources. Dockside sampling records give species code 169207 (Red Porgy) with 5 individuals harvested, while logbook records give species code 169180 (Porgy Family) with 5 individuals harvested. These would seem to be referring to the same fish, but would register as a discrepancy between dockside and logbook data sources in any computer algorithm constructed with the given species codes. Dockside sampling also lists species code 168693 (Banded Rudderfish) with 1 individual harvested while logbook records list species code 172435 (King Mackerel) with 2 individuals harvested. This would appear to be a true discrepancy between data sources. The point is that it is not possible without individual inspection of corresponding dockside sampling and logbook records to determine which differences in species codes represent slight differences in identification, and which represent more meaningful discrepancies. This appears to be a difficulty with the majority, if not all, pairs of logbook and dockside sampling records.

3 Assessing Number of Trips

This section concerns an assessment of the reliability of logbook data records in determination of the total number of trips taken by the for-hire recreational fishery in the study areas under consideration. The basic concern is comparison of the number of verified trips with logbook records. For logbook records to be useful as a census of the trips taken there should be a corresponding logbook entry for each of the trips verified as taken by status monitoring, subject to a small level of reporting error. If not all, or not nearly all, of the verified trips have corresponding logbook records, a question is whether trips taken that do not have logbook records were reported as inactive for the week the trip occurred, or whether there was a

lack of compliance by the captain in filing either a logbook or inactive report. In addition, there is some information in these data that may be used to examine the effectiveness of the status monitoring procedure as employed in this study.

3.1 Basic Evaluation

The comparison to be made is straightforward. Taking the activity monitoring data (prevalidation data sets) with status 2 (see Table 1) as reflecting combinations of days and vessels for which it is known fishing trips were taken, the proportion of those trips for which a corresponding logbook record is available is computed. As previously indicated in Section 2.2, this comparison is conducted for Florida with 6 time blocks consisting of individual months 1, 2, 3, 8 and 9 of the study (September 2010, October 2010, November 2010, April 2011 and May 2011, respectively), and the aggregate of study months $4, 5, 6$, and 7 (December 2010 through March 2011). A cross-classification of known trips in Florida by these time periods and whether or not a corresponding logbook record existed is presented in Table 5.

	Logbook Record		
Study Months	Yes	No	Proportion Yes
1	13	11	0.54
2	36	19	0.65
3	12	4	0.75
4-7	47	27	0.64
8	83	38	0.68
9	70	25	0.74

Table 5: Numbers and proportion of known trips with logbook records for Florida by time period.

A Chi-squared test of independence between time period and logbook record or,

(assuming that the number of trips in each time period is fixed at the row marginal total) a test of equality for proportion of trips with logbook entries, gives a test statistic value of $T = 4.726$ which, with 5 degrees of freedom, results in an approximate (i.e., asymptotic) $p-$value of $p = 0.4503$. Thus, we would appropriately conclude that the data do not contain sufficient evidence to reject a hypothesis that the proportion of trips with logbook records differs across time periods considered. While this is not, of course, the same as accepting a hypothesis that the proportions are the same over time periods, it provides some motivation for making that assumption in further analysis.

Collapsing Table 5 across time periods gives a total of 385 known trips of which 261 had corresponding logbook records. Assuming no effect of time (motivated by the previous Chi-squared test result), we would then estimate the proportion of trips taken in the Florida charter-boat fishery for which logbook records will be available as $\hat{p} = 0.678$. Based on a sample size of $n = 385$ the estimated variance of $\hat{p}$ is $\hat{V}(\hat{p}) = \hat{p}(1-\hat{p})/n = 0.000567$ and an approximate (i.e., asymptotic) 95% interval estimate of the proportion of compliance would be

$$\hat{p} \pm 1.96\,[\hat{V}(\hat{p})]^{1.2} = (0.631,\ 0.724). \tag{1}$$

Of the $385 - 261 = 124$ verified trips lacking logbook records, 28 had corresponding inactive reports filed for the week of the trip, and 96 had neither logbook nor inactive reports; there were no trips having both logbook and inactive reports because this had already been looked at by MRIP prior to the time data was made available for this examination. If "compliance" with the program is defined as having filed either a logbook or inactive report, of the 385 Florida trips verified by status monitoring to have been taken, $261 + 28 = 289$ or 75% were in compliance. Another way to summarize this is that, of the 124 trips known to have been taken and for which no logbook report was submitted, 96 or 77% were due to captains failing to submit a report of any type. The low level (about 68%) of trips for which logbook records are submitted is caused by captains failing to submit a report of any kind,

not by the submission of an inactive report instead of a logbook report.

To examine whether the low level of compliance (about 75%) might have been depressed due to confusion and unfamiliarity with the reporting requirements of the program when it was intially started, similar calculations were made using only data from 2011 (months $5 - 9$ of the project). Here, there were 290 confirmed trips in Florida, 200 of which had corresponding logbook reports, 19 of which had no logbook but an inactive report, and 71 of which had neither logbook nor inactive reports, for a compliance of $219/290 = 0.76$ or 76%. Thus, the overall level of compliance computed over 9 months of data was not depressed due to low compliance early in the project.

The proportion of known trips with corresponding logbook reports in Florida does not support use of logbook reports as a true census. There is some evidence that the proportion of trips for which logbook reports are filed may be consistent enough across time that an adjustment could be made to logbooks as a estimation procedure, at least for the purpose of estimating the number of trips taken.

In Texas, there is no possibility of assessing the consistency of logbook reporting over time due to the small numbers of both verified trips and logbook reports (Tables 1 and 2). Across all months, there were 95 confirmed trips and 64 of these had corresponding logbook reports. Assuming that the proportion of trips that file logbook reports is constant over time, that proportion is then estimated as $\hat{p} = 0.674$ with a 95% interval of (0.579, 0.768) which are in quite good agreement with values for Florida. The interval estimate is a bit wider due to smaller sample size.

Of the $95 - 64 = 31$ trips with no logbook report, 24 did file inactive reports for the corresponding week, while 7 submitted neither logbook nor inactive reports. Among trips verified to have been taken we would then estimate reporting compliance as $88/95 = 93\%$, substantially greater than for Florida, although computed from a much smaller sample. While the value of 93% would seem to indicate a high level of compliance in Texas, this must be assessed relative to the definition

of compliance (which is, according to information provided for this exercise, filing a report, regardless of its accuracy). Of the total of 95 verified trips in Texas, about 67% had corresponding logbook reports, similar to Florida. But of the 31 verified trips without logbook reports in Texas, 24 or 77% either falsely or mistakenly filed an inactive report, compared to 22% (28 of 124 trips) in Florida. Conversely, of the verified trips without logbook reports, 7/31 = 22% filed no report in Texas, compared to 77/124 = 77% in Florida.

There is little discrepancy between Florida and Texas in the number of verified trips for which logbook reports were submitted (about 67% in both regions). There is a discrepancy in terms of the number of trips that failed to file logbook reports that would also be flagged as out of compliance with reporting requirements (77% in Florida and 22% in Texas). A conjecture might be that in Florida there seems to be little concern that one might be identified as not complying with reporting requirements, while in Texas there seems to be an attempt to remain technically in compliance even if fishing trips that were taken were not reported in the logbook system. This discrepancy may have implications for designing attempts to increase participation in a mandatory logbook reporting system, should one be implemented on a Gulf-wide basis.

3.2 Effectiveness of Sampling Protocol

As a check on the efficacy of status monitoring as conducted in this study for the potential alternative purpose of determining the level of fishing activity, the proportions of vessel/days recorded in other status categories (other than charter fishing) can be examined. Values for Florida in status categories 1 =Vessel In, 3 =Unable to Verify, 4 =Out, but not fishing, and 5 =Out, fishing status unknown are presented in Table 6. In Table 6, columns labeled n are sample sizes (same as values from Table 1) and columns labeled $\hat{p}$ are the proportion having logbook entries.

The values of Table 6 are encouraging relative to the effectiveness of the sta-

	Status 1		Status 3		Status 4		Status 5	
Study Month	n	$\hat{p}$	n	$\hat{p}$	n	$\hat{p}$	n	$\hat{p}$
1	662	0.03	66	0.03	11	0.00	56	0.12
2	587	0.01	32	0.00	29	0.00	67	0.28
3	617	0.01	43	0.00	17	0.00	54	0.31
4	203	0.00	8	0.00	10	0.00	19	0.05
5	651	0.00	49	0.00	66	0.00	51	0.00
6	610	0.00	94	0.01	93	0.00	57	0.05
7	713	0.05	111	0.06	85	0.00	92	0.26
8	645	0.06	87	0.08	66	0.04	124	0.32
9	513	0.06	54	0.07	26	0.04	61	0.29

Table 6: Proportions of logbook records in Florida for vessels/days with status other than fishing.

tus monitoring procedure employed in the study. The proportion of vessels/days recorded as being In (Status 1) that filed logbook reports is generally less than 5%, never greater than 6%, and positive values occur during some of the busier fishing months in the data (September 2010, March, April, and May 2011). Some trips are expected for vessels recorded as being In because the sampler cannot be present for an entire 24 hour period. But the reasonably low level of these occurrences supports a conclusion that the timing of visits by samplers was quite effective in determining vessel activities for the day. Similarly, values for vessels listed as Out, But Not Fishing (Status 4) indicate that these assessments were largely accurate, with only slight discrepancies again occurring during more active fishing periods. Perhaps somewhat surprisingly, the proportion of vessels that could not be verified (Status 3) that filed logbook reports was also reasonably low, although approaching levels that might cause some concern in the months of April and May 2011 (study months

8 and 9). It appears that, at least in Florida, the inability of samplers to verify vessel status was more indicative of vessel inactivity than other possible causes. The proportions of vessels/days listed by status monitoring as Out, But Fishing Activity Unknown that filed logbook reports is both greater and more variable than the other categories, which would seem indicative of good adherence to protocol by samplers. According to my understanding, samlplers were instructed to not list a vessel as Status 3 (Out Fishing) unless that status could be certified with high confidence. This would then suggest that any number of vessels that were out fishing would be classified as Out, but Fishing Unknown (Status 5), and that the number of such instances might fluctuate over time depending on how easy it was for samplers to obtain verification of fishing activity.

3.3 Tentative Conclusions Regarding Fishing Activity

The following tentative conclusions are supported by the examination of the data reported in this Section.

1. Logbook records cannot be considered a complete census of the number of fishing trips taken in the for-hire recreational fishery.

2. The proportion of verified trips taken for which logbook reports were filed is reasonably consistent over time periods, at least in Florida (data were insufficient for a similar determination in Texas). This holds out the possibility that logbook reports might provide a useful source of data when viewed as a sampling, rather than census, mechanism. Overall, it appears that about 68% of trips taken result in logbook reports for both Florida and Texas, with a range of uncertainty being about 63% to 72% in Florida and 58% to 77% in Texas.

3. The procedures used for status monitoring (resulting in prevalidation data) in the pilot study were effective in meeting the objectives of the study. That the

proportion of trips classified as "Unable to Verify" for which logbook reports were filed was consistently low suggests that, although the occurrence of this category was higher than that of verified fishing, it did not vitiate the sampling effort. The implication of this conclusion is that, if logbook reports were to be considered a source of sample data, periodic assessment of the necessary adjustment to arrive at an estimate of the total number of trips taken could reasonably be obtained through the same procedure of status monitoring used in this pilot study.

4. The reporting requirement used in this project is ineffectual for either producing a high level of participation, or for tracking "true compliance", defined as filing a logbook report for fishing trips that were taken. In particular, requiring reports of inactivity for a week appears to yield no useful information whatsoever in the absence of a separate activity monitoring program. In Florida that requirement is largely ignored, while in Texas it may be used as a way to avoid filing logbook reports while still remaining in technical compliance in terms of reporting.

4 Assessing Trip Characteristics

This section presents a comparison of variables connected with the physical characteristics of trips recorded in logbook and dockside sampling data. Such variables include number of anglers, hours fished, primary gear, and areas fished. The presentation will first consider data aggregated over all months of the study, and then divisions of data into time periods for Florida, consisting of months of study 1, 2, 3, 8, 9, and 4-7; see Table 3 and following discussion.

4.1 Aggregated Data

Of the 400 trips with dockside samples in Florida (see Table 3) 263 had corresponding logbook reports. Taking these together (i.e., aggregating over all months of the study) Table 7 presents the number of trips (out of 263) for which variables connected with trip characteristics matched exactly between dockside sampling and logbook reports. As might be expected, the proportion of exact matches was generally higher

Variable	Matches	Mismatches	Proportion Matching
Anglers	202	61	0.77
Gear	261	2	0.99
Hours Fished	136	127	0.52
Min Depth	114	149	0.43
Max Depth	113	150	0.43
Area Fished	166	97	0.63
EEZ %	211	52	0.80
State %	196	67	0.74
Inland %	245	18	0.93

Table 7: Exact matches between 263 dockside sampling and corresponding logbook reports in Florida over all study months.

for variables with fewer distinct values in the data (gear had only 3 distinct values) and lower for variables with more distinct values (maximum depth had 77 distinct values). The one exception to this is area fished, which had 11 distinct values (and 63% agreement), the same as percent of time fishing in inland waters (11 values and 93% agreement).

The same information for Texas is presented in Table 8. Of the 38 trips with dockside samples (see Table 3) 24 had corresponding logbook reports. Although the number of matched logbook and dockside samples is much smaller for Texas than

for Florida, the values of Table 8 are comparable to, and reflect largely the same patterns, as those of Table 7.

Variable	Matches	Mismatches	Proportion Matching
Anglers	19	5	0.79
Gear	24	0	1.00
Hours Fished	7	17	0.29
Min Depth	10	14	0.42
Max Depth	8	16	0.33
Area Fished	15	9	0.62
EEZ %	22	2	0.92
State %	19	5	0.79
Inland %	21	3	0.88

Table 8: Exact matches between 24 dockside sampling and corresponding logbook reports in Texas over all study months.

As demonstrated by the values of Tables 7 and 8, logbook reports cannot be taken as one-to-one substitutes for what would have resulted from dockside sampling. It has already been stated in Section 3.3 that logbook records cannot be considered a complete census of the number of fishing trips taken, and Table 7 indicates that neither can logbook records be taken as exact replacements for the results of dockside sampling as regards trip characteristics. But it was also suggested in Section 3.3 that logbook records might be reasonably adjusted (subject to periodic re-assessment) as an estimator of the total number of trips taken. Similarly, we might question whether logbook records, taken as a data source for estimation of effort related variables, could provide estimates that are largely in concert with what might result from dockside sampling. For example, total effort in the fishery might be estimated as a product of estimated number of trips and estimated effort per trip. With this in mind, a composite effort variable was constructed as the product

of number of anglers and hours fished for each trip for both dockside sampling data and corresponding logbook data. Three variables, number of anglers, hours fished, and the constructed variable of effort, were then examined for differences between dockside sampling and logbook sources of data. Comparison involved four measures of discrepancy, two at the individual level, and two at an aggregate level. Let D_i; $i = 1, \ldots, n$ denote any of the three variables of interest for dockside sampling of trip i and, similarly, let L_i; $i = 1, \ldots, n$ denote the same variable for logbook data from trip i. Quantities used to summarize the level of discrepancy between variables for individual trips (then averaged over all trips) were mean absolute error (mae) and root mean squared error (rmse). These are defined as,

$$\begin{aligned} mae &= \frac{1}{n}\sum_{i=1}^{n} |D_i - L_i| \,, \\ rsme &= \left[\frac{1}{n}\sum_{i=1}^{n}(D_i - L_i)^2\right]^{1/2} . \end{aligned} \tag{2}$$

Mean absolute error represents the absolute difference in a variable that would be expected on any given trip between logbook records and dockside sampling. Root mean squared error is a measure associated with squared error loss in estimation theory (the quantity that is often minimized to select among several possible estimators). If estimation of average anglers, hours fished, or effort per trip were to be based on either dockside samples or logbook records, estimates would most likely be formed as sample means, and uncertainty in estimation quantified as sample variances or standard deviations. The difference that would be realized between estimation from the two data sources may then be summarized by looking at differences between sample means and standard deviations,

$$\begin{aligned} M_d &= \bar{D} - \bar{L} \\ R_d &= \frac{s_D}{s_L} \end{aligned} \tag{3}$$

where $\bar{D}$ and s_D^2 are the usual sample mean and variance of data from dockside samples $\{D_i : i = 1, \ldots, n\}$ and similarly for $\bar{L}$ and s_L^2.

The four measures of discrepancy, mae, $rmse$, M_d and R_d were computed for the variables of number of anglers, hours fished, and effort, resulting in the values presented in Table 9, which also includes the values of the sample means and standard deviations $\bar{D}$, $\bar{L}$, s_D and s_L. The values of Table 9 indicate that we would

Region	Variable	mae	$rmse$	$\bar{D}$	$\bar{L}$	M_d	s_D	s_L	R_d
Florida	Anglers	0.450	1.220	6.290	6.397	−0.107	2.988	2.810	1.063
	Hrs Fished	0.676	1.286	3.991	3.893	0.098	1.611	1.527	1.055
	Effort	5.603	11.298	25.918	25.261	0.657	18.416	15.260	1.207
Texas	Anglers	0.458	1.061	3.958	4.417	−0.458	1.517	1.442	1.052
	Hrs Fished	1.531	2.237	6.917	6.406	0.510	2.068	1.408	1.468
	Effort	10.167	14.948	28.896	28.688	0.208	16.864	12.113	1.392

Table 9: Discrepancy measures for variables connected with fishing effort.

expect the difference between the logbook record for a trip and what would have been recorded if that trip had been subject to dockside sampling to be slightly less than 0.50 anglers in both Florida and Texas, somewhat over 0.50 hours fished in Florida and three times that in Texas, and about 6 person-hours of fishing effort in Florida but 10 hours of effort in Texas. That mean absolute errors are substantially greater for effort than the product of absolute error for anglers and hours fished indicates that discrepancies in anglers and hours fished are positively related (i.e., tend to be either both greater or both less for one data source than the other). Thus, discrepancies in effort tend to be greater than those in anglers or hours fished individually. If differences are of a constant direction (i.e., always greater for logbook records) these differences would cause concern in using logbook values as expansion factors for estimation in the entire fishery. That this is not the case (expect perhaps for anglers in Texas) is shown by the values of $\bar{D}$, $\bar{L}$, and M_d in Table 9. In particular, the average values of effort show much less discrepancy than do the average

absolute discrepancies for effort in both Florida and Texas. Thus, while individual trip records differ, they do not appear to do so in a systematic manner in either region. Variability in values is consistently greater for dockside sampling than it is for logbook records (i.e., all values of R_d in Table 9 are greater than 1.0) although not tremendously so. Variances for Texas are likely not terribly precise given the small number of paired logbook and dockside samples available (only 38 in Texas compared to 262 in Florida).

4.2 Data by Time Period

There is insufficient data from Texas to examine trip characteristics between logbook records and dockside samples by time, but this may be accomplished for Florida if the months from December 2010 through March 2011 are aggregated, as previously described in Section 3.1. Here, time period 1 will correspond to September 2010, time period 2 to October 2010, period 3 to November 2010, period 4 to December 2010 through March 2011, period 5 to April 2011, and period 6 to May 2011. The number of paired logbook records and dockside samples were 30, 75, 28, 14, 43, and 72 for time periods 1 through 6, respectively.

Because the previous subsection has indicated that individual logbook records cannot be considered equivalent to individual dockside samples over the entire study period, there is no need to examine this question by time period. Also, because the previous subsection has indicated that considerable discrepancies exist between the two data sources as an average discrepancy over trips, there is little need to examine the measures of mse and $rmse$ for individual time periods. The results of the previous subsection did suggest that the averages of number of anglers, hours fished, and effort were comparable between the two data sources for the entire study period. Figure 1 presents the averages of number of anglers for logbook data and dockside samples considered by time period. Similarly, Figure 2 presents the averages of hours fished, and Figure 3 the averages of effort.

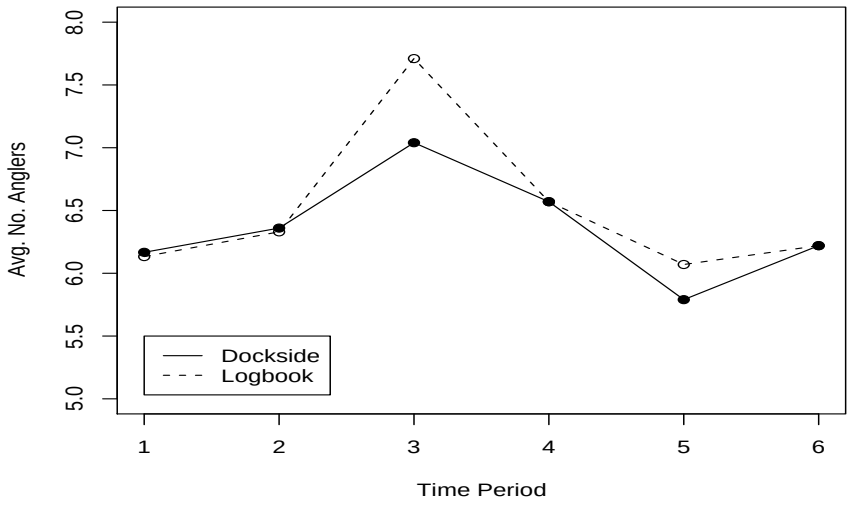

Figure 1: Average number of anglers for trips over time period from logbook and dockside data sources.

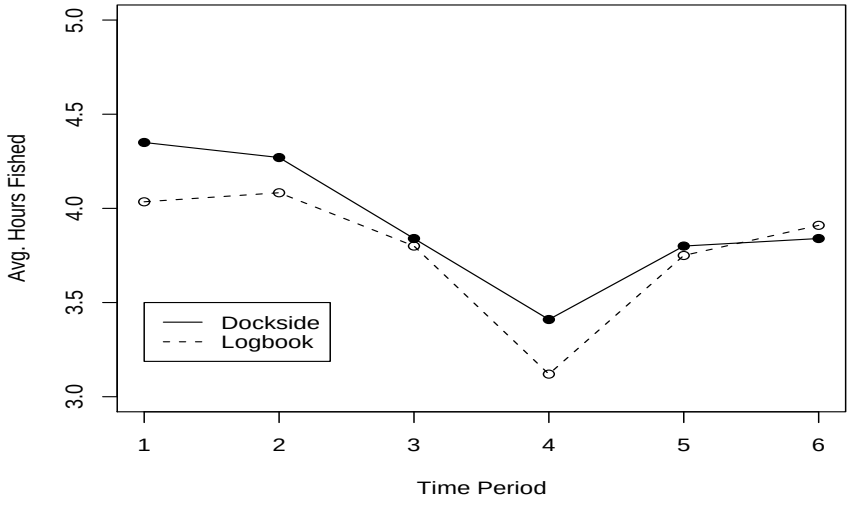

Figure 2: Average hours fished for trips over time period from logbook and dockside data sources.

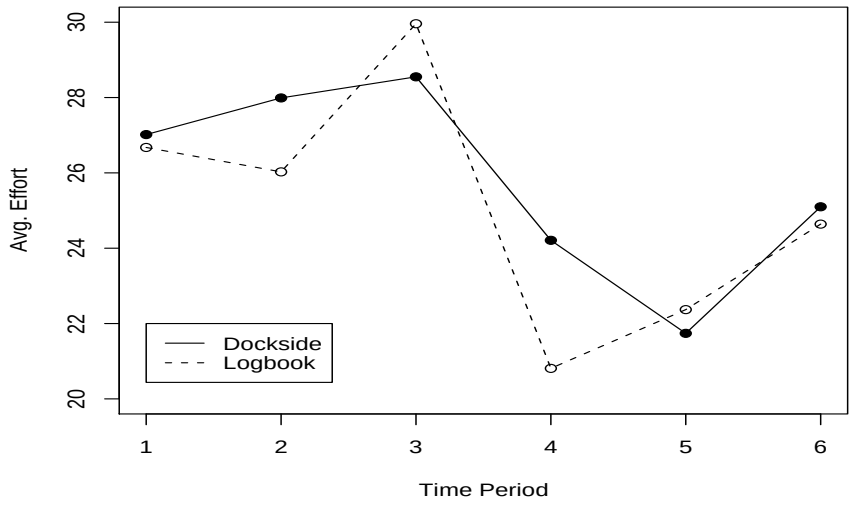

Figure 3: Average effort for trips over time period from logbook and dockside data sources.

Overall, Figures 1-3 show good agreement between logbook and dockside sampling data sources in the averages of the three quantities considered, for all of the time periods. In particular, the directions of changes in these quantities over time appear to agree for the most part. The difference in effort between time periods 4 and 5 provides the most notable exception, but that appears to be due primarily to a low value for logbook data at time period 4; recall that time period 4 contained only 14 pairs of data records, by far the fewest of any time period.

4.3 Tentative Conclusions Regarding Trip Characteristics

The following tentative conclusions are warranted from the examination of data reported in this section.

1. Logbook records cannot be considered as one-for-one replacements of what would have been obtained from dockside sampling, in terms of variables con-

nected with characteristics of trips.

2. As a source of data for estimation of the expected values of variables connected with fishing effort (including a constructed effort variable) logbook records would provide similar estimates as dockside samples. The level of uncertainty in estimates of effort would be (estimated as) smaller for logbook data than for dockside sampling data, but perhaps only moderately so. If the variability of dockside sampling data is taken to be "correct", then the use of logbook data to estimate average effort would lead to an moderate underestimate of the actual uncertainty we should have.

3. The conclusions in items 1 and 2 appear to apply with a reasonable level of uniformity to all time periods considered.

5 Assessing Catch Composition

Assessing the level of discrepancy between dockside sampling and logbook data sources in terms of variables connected with catch was made difficult by the problem of species identification as noted in item 6 of section 2.3. This difficulty might be at least partially mitigated by forming species groups, but that was not possible given the time available for the current data examination. The degree of discrepancy in catch composition between dockside sampling and logbook data sources was assessed in two ways. A number of characteristics that avoid matching individual species identifications were considered, as described in what follows. In addition, matching of species identifications was conducted for several species that were (1) among the most common in the dockside sampling records, and (2) may be among those for which individual management plans exist. For the species-independent comparison, paired dockside samples and logbook records were examined to determine the degree of discrepancy in

1. The number of species caught (number of distinct species codes).

2. The total number of individuals harvested (regardless of species code).

3. The total number of individuals released < 120 ft.

4. The total number of individuals released > 120 ft.

5. The total number of mortalities.

For examples of species-specific comparison, the number of individuals harvested, released, and mortalities were matched for the particular species codes of 168853 (Red Snapper) and 172435 (King Mackerel).

5.1 Species-Independent Comparison

In Florida, the 263 trips with paired dockside samples and logbook records (see Section 4.1) yielded the following exact matches for the variables listed previously. Not surprisingly, the proportions of exact matches between dockside samples and

Variable	Matches	Mismatches	Proportion Matching
No. Species	88	175	0.33
Harvest	50	213	0.19
Rel < 120	98	165	0.37
Rel > 120	183	80	0.70
Mortalities	202	61	0.77

Table 10: Exact matches between 263 dockside sampling and corresponding logbook reports in Florida over all study months.

logbook records is lower for these variables related to catch than they were for variables related to physical characteristics of trips (c.f., Table 7). The proportion of exact matches was only 19% for number of harvested individuals. The higher

agreement for number of individuals released > 120 ft. and mortalities is caused primarily by the fact that a large number of 0 entries occur for these variables in both logbook records and dockside samples. The same information contained in Table 10 for Florida is presented for the 24 paired logbook records and dockside samples from Texas in Table 11. Again, the proportion of exact matches is generally lower

Variable	Matches	Mismatches	Proportion Matching
No. Species	10	14	0.42
Harvest	8	16	0.33
Rel < 120	12	12	0.50
Rel > 120	14	10	0.58
Mortalities	23	1	0.96

Table 11: Exact matches between 24 dockside sampling and corresponding logbook reports in Texas over all study months.

than it was for trip characteristics. The values of Tables 10 and 11 reinforce the conclusion that logbook records cannot be considered as one-to-one replacements for dockside samples. In terms of trip characteristics, however, logbook entries might be considered a legitimate data source for estimation of average effort in the population, as evidenced by the comparison of Table 9. The same quantities used to summarize discrepancies in trip characteristics in Section 4.1 were applied to the summary variables of catch considered here. The results are presented in Table 12. The values of Table 12 tend to paint the same picture as those of Table 9 did relative to physical trip characteristics. Average measures of discrepancy (mae and $rmse$) again indicate substantial differences between data sources for individual trips (averaged over trips). But measures of discrepancy among average measures (M_d and R_d) indicate reasonable agreement of the data sources in terms of what they indicate about the mean values of number of species, harvest, releases, and mortalities in the population of trips.

Region	Variable	mae	$rmse$	$\bar{D}$	$\bar{L}$	M_d	s_D	s_L	R_d
Florida	No. Species	1.445	2.215	5.068	3.935	1.133	2.428	2.267	1.071
	Harvest	8.992	19.601	32.103	30.304	1.798	33.979	36.277	0.937
	Rel $<$ 120	9.578	20.354	17.441	17.316	0.125	27.501	31.355	0.877
	Rel $>$ 120	9.000	11.727	7.129	5.719	1.411	15.886	13.716	1.158
	Mortalities	1.053	3.963	0.817	1.065	-0.247	4.354	4.245	1.026
Texas	No. Species	0.875	1.242	3.792	3.167	0.625	2.000	1.711	1.169
	Harvest	3.167	5.809	9.792	10.375	-0.583	8.782	9.559	0.919
	Rel $<$ 120	3.917	7.200	3.833	1.167	2.667	6.274	3.319	1.890
	Rel $>$ 120	0.000	7.853	5.250	3.917	1.333	10.900	8.787	1.240
	Mortalities	0.125	0.612	0.000	0.125	-0.125	0.000	0.612	0.000

Table 12: Discrepancy measures for variables connected with catch composition.

5.2 Red Snapper

Red snapper (species code 168853) was recorded as caught on 282 trips in Florida by dockside sampling. Of these, there were 157 trips with corresponding logbook records. For these 157 trips, the number of exact matches between dockside samples and logbook records is presented in Table 13. Although the proportion of exact

Variable	Matches	Mismatches	Proportion Matching
Harvest	133	24	0.85
Rel $<$ 120	77	80	0.49
Rel $>$ 120	103	54	0.66
Mortalities	120	37	0.76

Table 13: Exact matches between 157 dockside samples and corresponding logbook reports for Red Snapper in Florida.

matches between dockside samples and logbook reports is greater for harvested Red Snapper than it is across all species (see Table 10) the overall picture represented by the values of Table 13 is similar to that for values across all species. Logbook records cannot be considered one-to-one replacements of what would result from dockside sampling of trips in terms of Red Snapper.

In Texas, there were 22 dockside samples that recorded catch of Red Snapper. Of these, 11 had corresponding logbook records. The numbers of exact matches between dockside samples and logbook records are presented in Table 14. Even

Variable	Matches	Mismatches	Proportion Matching
Harvest	9	2	0.82
Rel < 120	6	5	0.54
Rel > 120	6	5	0.54
Mortalities	11	0	1.00

Table 14: Exact matches between 11 dockside samples and corresponding logbook reports for Red Snapper in Texas.

though the number of paired dockside samples and logbook records for trips that dockside sampling recorded as having caught Red Snapper was small (i.e., 11) the values of Table 14 are consistent with previous results for Red Snapper in Florida and for all species in both Florida and Texas. Note that all 11 trips represented in the paired data records of Table 14 recorded mortalities as 0, both dockside samples and logbook records.

Discrepancy measures for the paired data records for which dockside samples indicated Red Snapper had been caught are presented for both Florida and Texas in Table 15. The values of Table 15 for Red Snapper largely mirror the patterns exhibited by the same quantities computed from records across all species (Table 12). Data for individual trips from dockside samples and logbook records can be expected to differ. For example, the average discrepancy in the number of fish

Region	Variable	mae	$rmse$	$\bar{D}$	$\bar{L}$	M_d	s_D	s_L	R_d
Florida	Harvest	0.599	2.223	5.911	5.924	-0.013	7.657	7.629	1.004
	Rel < 120	4.962	9.710	11.809	12.439	-0.631	20.057	20.137	0.996
	Rel > 120	4.229	9.377	6.299	5.854	0.446	12.469	10.505	1.187
	Mortalities	0.949	3.293	0.879	1.255	-0.376	4.757	4.696	1.013
Texas	Harvest	0.818	1.931	4.818	5.636	-0.818	4.996	4.884	1.023
	Rel < 120	2.909	5.576	1.545	1.364	0.182	3.012	4.523	0.666
	Rel > 120	1.545	2.541	4.818	5.455	-0.636	7.884	8.116	0.971
	Mortalities	0.000	0.000	0.000	0.000	0.000	0.000	0.000	—

Table 15: Discrepancy measures for variables connected catch of Red Snapper.

released less than 120 ft. can be expected to differ by about 5 for trips in Florida, and 3 for trips in Texas (although this figure for Texas is computed from such a small sample size as to be suspect). Despite this, the mean values over all trips for which both dockside samples and logbook records existed were quite similar for all of the variables considered in both Florida and Texas, and variability was not dramatically different between the two data sources.

5.3 King Mackerel

King Mackerel (species code 172435) was recorded as caught on 110 trips by dockside sampling in Florida. Of these, there were 50 trips with corresponding logbook records. For these 50 trips, the number of exact matches between dockside samples and logbook records is presented in Table 16. Note that all records for both data sources recorded the number of individuals released > 120 ft. as 0, and all records were 0 for mortalities except one dockside sample which recorded 1 mortality. In addition, there were only 5 non-zero records for releases < 120 ft. in the dockside samples, only two of these were non-zero in the logbook records, and only one was

Variable	Matches	Mismatches	Proportion Matching
Harvest	34	16	0.68
Rel < 120	46	4	0.92
Rel > 120	50	0	1.00
Mortalities	49	1	0.98

Table 16: Exact matches between 50 dockside samples and corresponding logbook reports for King Mackerel in Florida.

an exact match to the corresponding dockside sample. Thus, the values for all variables other than harvest in Table 16 are largely without force. In particular, if one considers the proportion of trips on which King Mackerel were released (from any depth), dockside samples would give $5/50 = 0.10$ while logbook records would result in $2/50 = 0.04$. If these proportions are used as "expansion factors" for the total number of trips that logbook records indicate catch of King Mackerel, which was 1013, one would obtain 101 trips releasing King Mackerel based on dockside sampling but only 40 trips based on logbook records. If one then further takes into account that roughly 68% of Florida trips resulted in a logbook record (see Section 3.1) one obtains estimates of 148 trips releasing King Mackerel based on dockside samples, and 59 trips based on logbook records. Thus, even though the proportions of exact matches for Rel < 120, Rel > 120, and Mortalities in Table 16 appear high, this is caused by the prepoderance of 0 values. There are substantial differences that would result from using dockside samples and logbook records as data sources in estimaton of the number of trips releasing or having mortalities of King Mackerel.

In Texas, the number of trips having catch of King Mackerel in both dockside samples and logbook records was only 8, and this was deemed too few to give any indication of matches or discrepancy measures for this species in Texas. Thus, a comparison of data sources for King Mackerel in Texas was not considered. Similarly, the few trips on which King Mackerel was recorded as released (either alive or

dead) in both dockside samples and logbook records in Florida precluded meaningful comparison of quantitative discrepancy measures in that region. For harvest in Florida, the following quantities were computed: $mae = 0.58$, $rmse = 1.27$, $\bar{D} = 3.92$, $\bar{L} = 4.02$, $M_d = -0.10$, $s_D = 4.08$, $s_L = 4.09$, $R_d = 1.00$. These values are roughly consistent with the patterns observed for all species combined and also for Red Snapper. In terms of number of harvested individuals, dockside samples and logbook records would result in similar values for the average over trips.

5.4 Tentative Conclusions Regarding Catch Composition

The examination of data on catch composition reported in this section supports the following tentative conclusions.

1. As for trip characteristics, logbook records cannot be considered as one-for-one replacements of what would have been obtained from dockside sampling in terms of variables connected with catch and catch composition.

2. As a source of data for estimation of the average number of species caught, total harvest, total number of releases (either < 120 ft. or > 120 ft.) and total number of mortalities, logbook data may provide a reasonable alternative to dockside sampling.

3. The conclusion of the previous item appears to hold for commonly caught individual species at least in terms of the number of individuals categorized as "harvested". Whether this is also true for number of individuals released alive or dead is less certain. As the frequency of releases and/or mortalities becomes smaller, the magnification of discrepancies by expansion of estimates to the population level becomes a greater percentage of the overall value. Whether this is of import to management of the Gulf fisheries should be considered.

6 Overall Conclusions

Tentative conclusions have been offered with respect to the assessment of number of trips (Section 3.3), trip characteristics (Section 4.3) and catch composition (Section 5.4). This section offers some (tentative) overall conclusions that result from combining these sections with considerations of data issues (Section 2.3).

1. Logbook records cannot be considered an accurate census of the for-hire recreational fishing trips taken in the Gulf of Mexico. Logbook records appear to be available for roughly 67% to 68% of the total number of trips taken, at least in the regions considered in this study, and this appears to be fairly stable over time. A reasonable assessment of uncertainty in this value results in an interval of about 63% to 72% (somewhat wider in Texas for which less data were available).

2. Logbook records cannot be considered as substitutes for what would have resulted from dockside sampling for individual trips, either in terms of trip characteristics (such as number of anglers, hours fished, and areas fished) or in terms of catch (number of species, numbers of harvested individuals, etc.). This then also applies to variables that might be constructed from the observed quantities, such as fishing effort.

3. The use of logbook records as a data source would require an increased level of data examination, assessment, and cleaning on the part of the National Marine Fisheries Service or state agencies. This stems largely from the number of different individuals that would be recording data. It can be anticipated that the greater the number of variables requested in logbook records, the greater the resources that would need to be devoted to data verification and assessment.

4. If a mandatory logbook reporting program is instituted, the definition of com-

pliance with reporting requirements needs additional consideration. In particular, filing a report of nonactivity while continuing to make active fishing trips should not be considered to be in compliance with a reporting program. The question of whether reports of no activity have value should be considered. If it is determined that reports of no activity are of value, having reporting requirements that differ in temporal frequency for active fishing and nonactivity certainly increases the complexity of a reporting system and can only increase, not decrease, confusion for vessel operators. A system in which one report is filed for each day, even if that was simply a report of no fishing activity, would promote regular reporting behavior and decrease excuses (either legitimate or contrived) for lapses in reporting. The suggestion offered here is that a reporting requirement consist of either (1) one logbook entry for each trip taken and nothing else, or (2) one report for each day containing logbook entries for each trip taken or an indication of no fishing.

5. Logbook records do appear to be a potentially useful source of information for estimation of average effort, number of species caught, total number of individuals harvested and released, and total mortalities. Logbook data and dockside sampling data appear to provide similar estimates of population averages of these quantities. Uncertainty may be slightly to moderately underestimated using data from logbook records.

6. The previous conclusion seems to apply to particular species in terms of number of individuals harvested, but may be somewhat more suspect relative to number of individuals released (alive or dead), particularly for species that are not frequently encountered. This is entirely in concert with the observation that logbook records do not correspond individually to dockside samples, but do in aggregate. The fewer individual records incorporated into an aggregate value, the more the influence of individual discrepancies and the less certain

agreement at the aggregate level.

7. It is not certain that values for numbers of mortalities (or discards) are accurate for either logbook or dockside sampling data sources. Both of these data collection schemes make use of information provided by captains or crew after a trip has returned to a dock site. If these values are reliable, it appears that the number of mortalities in the for-hire recreational fishery is low. Apparently some data were collected from at-sea observation, but these data are small in number and were not considered in the examination reported on here.

7 Potential Uses of a Logbook Reporting System

A consistent conclusion across each aspect of logbook data examination has been that logbook records cannot be considered a complete census of the for-hire recreational fishery. There have also been consistent indications, however, that logbook records could provide a reliable source of data for estimation. Specifically, the proportion of trips documented by activity monitoring (resulting in the "prevalidation" data set) for which logbook records are available appears reasonably constant over time. Average values of quantities connected with trip characteristics agree reasonably well when computed using data from dockside sampling and logbook records. As noted, this may also be true for at least some individual species, although a broad conclusion about species-specific values in general is not warranted at this time. The question arises, then, how logbook data might be used in an estimation procedure. Two possible estimation strategies are briefly sketched here. Some of the details of these procedures would require additional analysis of existing data, and this is not meant to provide a complete outline for analysis. Also, although these strategies seem fairly basic, they should not be taken as exhaustive of the possibilities.

7.1 Estimation Based on Effort

Many estimators in fisheries science have the form of effort multiplied by catch-per-unit-effort (cpue). Such a strategy could be employed in the for-hire recreational fishery of the Gulf, in the following way. Assume that the quantity to be estimated is a population total τ, such as the total number of individuals of a given species in a given region and time span that are harvested, and let N denote the total number of trips taken. Let κ denote the average effort (in fishing hours) across all trips, and let ψ denote the cpue (in number per fishing hour). Then

$$\tau = N\,\kappa\,\psi. \tag{4}$$

An estimated version of τ results from (4) by replacing N, κ and ψ with estimators $\hat{N}$, $\hat{\kappa}$ and $\hat{\psi}$. Deriving the standard error of an overall estimator $\hat{\tau}$ formed as such a product is difficult, and is typically approached in survey sampling theory through the use of a Taylor expansion and asymptotic results. A straightforward alternative is the use of a Bayesian strategy, in which a posterior distribution for τ is produced through simulation, automatically quantifying uncertainty.

For estimation of N, the fundamental idea would be to divide the number of logbook records available by the proportion of trips that have logbook records, as estimated from the data in this project. Let θ denote that proportion. Suppose θ has been assigned a prior distribution $\pi(\theta)$, most likely a beta distribution with fixed parameters α_0 and β_0. Given a total of m trips verified by activity monitoring of which z had corresponding logbook records, an appropriate data model for z is binomial with parameter θ. The posterior of θ in this well-known formulation is then a beta distribution with parameters $\alpha_0 + z$ and $\beta_0 + m - z$. Importantly, a posterior distribution for the number of trips results from simulating values from the posterior of θ and dividing the number of logbook records by these simulated values.

For estimation of κ, we might assign a parametric distribution to effort, defined

as number of anglers multiplied by hours fished. Preliminary examination of these values suggests that the distribution of effort has an extremely long and thin right tail. Distributions such as (one type of) generalized gamma or extreme value might be useful in modeling effort. Alternatively, one could assign distributions to both number of anglers and hours fished. In either case, prior distributions would again be assigned to the parameters of these distributions, and data from logbook records used to update those priors as posterior distributions. It is likely that for either effort or its component quantities (anglers and hours fished) posterior distributions will not be able to be derived analytically. Posterior distributions would thus most likely be produced through the use of Markov Chain Monte Carlo (MCMC) methods. Along with basic estimation as summary quantities of posterior distributions, an objective here would be to simulate from the posterior distribution of κ (which may well be a function of other model parameters) and possibly the posterior predictive distribution of effort, which could be easily accomplished as part of an overall MCMC procedure.

Estimation of ψ would require a model for either number of individuals (in the appropriate category) or the constructed variable of cpue. This may well present the greatest modeling challenge, in part because cpue may be highly skew or spread out, and in part because it may be difficult to define a general model that applies to many different species. But, given that an appropriate model can be arrived at, the procedure would parallel that for κ as sketched in the previous paragraph. If ψ is the expected value of cpue it will be a parameter in the distribution chosen for modeling, or a function of parameters in that distribution. The objective would again be to derive or simulate the posterior distribution of ψ based on available data. A major issue in dealing with cpue is whether logbook data could be deemed reliable for individual species. If so, then the entire estimation procedure could be conducted with logbook data alone (and prior knowledge about the proportion of trips submitting logbook reports gained from this project). If not, then there would

be a need for data from a direct observation program such as the dockside samples obtained in this project.

The overall strategy, then, would be to simulate values from the posterior distributions of N, κ, and ψ, from which values from the posterior distribution of τ are available by construction. This would provide a point estimate as the mean (or perhaps mode) of the simulated values, and automatically give credible intervals as the central portion of the empirical distribution of simulated values. This procedure assumes that the number of trips taken N, expected or average effort κ, and catch-per-unit effort ψ may be considered independent. If an examination of data fails to support such an assumption, joint distributions for several of these quantities might be required (most likely effort and cpue) which would complicate some of the details involved but not change the overall structure of the procedure.

7.2 Estimation Based on Probabilities of Events

An alternative form for an estimator arises from a different representation of the total number of individuals contained in a given category (e.g., harvest). Continuing to let N represent the total number of trips, let y_i now denote the number of individuals of interest for trip i. Then the total τ is,

$$\tau = \sum_{i=1}^{N} y_i. \tag{5}$$

Now, let the trips that caught the given species be represented as the set $\mathcal{C}$, and the subset of $\mathcal{C}$ for which the disposition was as specified be represented as $\mathcal{D}$ (note that $\mathcal{D} \subset \mathcal{C}$). Let $|\mathcal{C}|$ and $|\mathcal{D}|$ denote the sizes of these sets. Then (5) may be written as,

$$\tau = \sum_{i=1}^{N} y_i = \sum_{i \in \mathcal{D}} y_i = N \frac{|\mathcal{C}|}{N} \frac{|\mathcal{D}|}{|\mathcal{C}|} \frac{1}{|\mathcal{D}|} \sum_{i \in \mathcal{D}} y_i. \tag{6}$$

Expression (6) simply says that the sum over all trips of the number of individuals in a given disposition category is equal to the sum over non-zero values, and this is not changed if it is multiplied by 1. But (6) also provides the key for estimation in

pieces. As before, N is the total number of trips in the fishery. The factor $|\mathcal{C}|/N$ is the proportion of trips on which the species of interest is caught, and $|\mathcal{D}|/|\mathcal{C}|$ is the proportion of those trips on which individuals were included in the given disposition category. Finally, $1/|\mathcal{D}| \sum_{i \in \mathcal{D}} y_i$ is the average number of individuals per trip in the disposition category, given that at least some individuals were. To write (6) in a form suitable for estimation based on a sample of trips, let $\{Y_i : i \in \mathcal{D}\}$ be random variables connected with the number of individuals of a given species that fall into a given disposition category when any individuals of that species fall into that category. Note that the possible values of Y_i are $y_i \in \{1, 2, \ldots\}$ (that is, Y_i cannot be 0). Also, let C denote the event the species is caught and D the event the species occurs in the disposition category of interest. Then a version of (6) written in terms of probabilities and expected values is,

$$\tau = N \, Pr(C) \, Pr(D|C) \, E(Y_i). \tag{7}$$

An estimator of τ may then be developed by substituting estimators of N, $Pr(C)$, $Pr(D|C)$, and $E(Y_i)$ into (7), and such estimators may be developed from a sample of trips. In particular, N may be estimated in the same manner as outlined in the previous section. The probabilities $Pr(C)$ and $Pr(D|C)$ may be estimated from binomial data models in a manner quite similar to N. These are all situations for which few modeling decisions are needed, the obvious choices of data models being binomial with conjugate beta priors. Estimation of $E(Y_i)$ requires modeling according to some parametric distribution in the same manner that was outlined for estimation of κ and ψ in the previous section. Given simulated values from the posteriors of N, $Pr(C)$, $Pr(D|C)$, and $E(Y_i)$, values from a posterior for τ are available by construction, again providing both point estimates and quantification of uncertainty directly.

One final aspect of the estimation strategy outlined in this section is that it may be quite straightforward to extend this structure to simultaneous estimation of all disposition categories for a given species. This would be accomplished by extending

the event D to the vector of events (D_1, D_2, D_3, D_4), where D_1 is harvest, D_2 is released < 120 ft., D_3 is released > 120 ft. and D_4 is mortality. The binomial data model for one of these component events, as in (7), would be replaced by a multinomial data model, and the beta prior would be replaced with a Dirichlet prior.

The main question in terms of data sources for this type of estimator is the same as for the estimator of the previous section with regard to ψ – could logbook records provide the needed information for estimation of $E(Y_i)$? Only two specific species were examined in this report. Those species were chosen because of frequency of occurrence in the data and because they may be species of particular interest. More individual species or species groups could be examined, but the difficulty of species identification described in Section 2.3 would need to be resolved first.

8 Additional Work

8.1 Logbook Verification in Practice

If logbook data are to be used in practice, it is natural to consider the design of some type of additional sampling program to provide a check on the representativeness of logbook data over time. If logbook records could be considered one-to-one equivalents of what would result from dockside sampling, a small monitoring program consisting of intercepts of trips as they return from fishing trips would be a potentially effective strategy. But it is clear from the examination of data sources considered in this report that logbook records cannot be considered one-to-one equivalents of dockside sampling. Logbook data appear to give similar aggregate values as do data from dockside sampling, but a small number of dockside samples should not be expected to agree with a small number of corresponding logbook reports. This implies that any external program with the objective of verifying the representativeness of logbook data should be conducted only on a larger scale, which may then imply it be conducted only on occasion, rather than continuously.

The data available from this project could be used to examine the agreement or disagreement of aggregate values from logbooks and dockside samples under various levels of sampling effort. This would most likely take the form of a Monte Carlo assessment in which a large number of M (e.g., $M = 10,000$) samples of various sizes are selected at random from the dockside and logbook data sources. The average values of quantities such as those used in Sections 4 and 5 of this report (averages over the M Monte Carlo repetitions) are then approximations to the expected values of those quantities. Comparison of these quantities for different potential sample sizes would then hopefully provide guidance about the level of sampling effort that would be required in a verification effort at a future point in time. Similarly, data from activity monitoring in this project could be used in a simulation-based assessment of how large a sample would be needed to verify that the "correction factor" used to estimate the total number of trips is still relevant.

8.2 Data From June-August 2011

It is anticipated that additional data of the same types as those examined in this report will be available for the period of June through August 2011. Initial conversations between individuals involved with MRIP and MRAG supposed that those data could be subjected to a similar examination as reported on here. While this is certainly still possible, it may not be entirely necessary. It is unlikely that these three additional months of data will change the conclusion that not all trips taken (or even essentially all) result in logbook reports. Unless the behavior of captains in filling out logbooks (or that of dockside samplers) changes markedly in these three months from the fairly consistent patterns identified in this report, it is unlikely that conclusions regarding the potential use of logbook data will be altered dramatically. If MRIP determines that it would like to pursue estimation from the logbook data source along the lines of the potential estimators briefly described in Section 7, a more efficient use of the additional data might be to implement one of these

estimation strategies using logbook data on the one hand, and data from activity monitoring (for estimation of the number of trips N) and dockside sampling (for estimation of other necessary quantities) on the other. A comparison of estimates produced using these different data sources would verify (or cast doubt upon) the tentative conclusions reached in this report.

Charter-Boat Logbook Reporting Pilot Study
Addendum on Analysis of Red Snapper

Mark S. Kaiser

Dept. of Statistics, Iowa State University

Prepared for

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1 Introduction

Subsequent to an initial report from Marine Resources Assessment Group Americas (MRAG-Americas) on the examination of data from the Marine Recreational Information Program (MRIP) pilot study on the use of charter logbook reporting systems in the Gulf of Mexico, it was determined that MRIP desired additional examination for the species Red Snapper when additional data became available. The initial data examination had included only data from September 2010 through May 2011. This addendum to that initial report repeats the examination of data for Red Snapper using data from September 2010 through August 2011.

The previous examination had resulted in conclusions that logbook reports could not be considered as one-to-one replacements for dockside or intercept sampling but that, in aggregate, logbook data provided similar indications of the total number of individuals in various catch categories (harvest, released < 120 feet, released > 120 feet, and mortalities). The essential purpose of examining the full data record here is to determine if these conclusions remain valid when data from the period of highest fishing pressure on this species is included in the available information.

2 Data and Data Concerns

A data file was provided by MRIP that consisted of "matched" records from logbook and dockside sampling data sources. These data should contain one record for each trip for which (1) a dockside sample was conducted and (2) a corresponding logbook record was available. The data contained records for all species included in the study. In addition, the data file contained additional records for a study apparently conducted by Texas A&M University, the objectives and protocol of which are unknown to MRAG. All data records corresponding to the study by Texas A&M University were deleted from the data to be included in this examination to avoid contamination of data from the logbook pilot study conducted by MRIP by a study

that may have involved different sampling and data recording procedures. The use of the word "contamination" does not necessarily imply that the study by Texas A&M University was poorly conducted or of inferior quality, only that the sampling and recording protocols used in that study may differ to some degree from that used in the MRIP study. One could also consider that the MRIP data would "contaminate" data from the Texas A&M study relative to the objectives and procedures of that study.

The data file provided by MRIP contained 4065 records corresponding to 761 unique indicator variables for matched trips. In these data records, the species code could be missing for either the logbook data source or the dockside sampling data source. For example, of the 4065 records in the original data file, 1142 contained missing values for species code from the logbook data source, and 366 contained missing values for species code from the dockside sampling data source. No records contained missing species codes from both data sources, by construction.

A data file corresponding to records of Red Snapper catch was created from the original data file provided. This data set contained a total of 600 records, but only 588 unique "matched" trips. Closer examination of the data showed that there were several "matched trips" that actually included what appeared to be different trips (e.g., taken on different dates), and at least one record of all missing values. Separate documentation of these discrepancies and the resolution that was enacted for this analysis have been provided to MRIP. A "cleaned" data file contained 598 records of matched logbook and dockside sampling data for 598 distinct trips. These were the data used in the analysis reported on here.

3 Matching Records

Results analogous to those reported in Section 5.2 of a previous MRAG report "Charter-Boat Logbook Reporting Pilot Study, Initial Examination of Data" (Au-

gust 2011) are included in this section of the current addendum. The number of trips on which values for the four variables of (1) harvest, (2) released less than 120, (3) released over 120, and (4) mortalities, matched exactly between dockside samples and the corresponding logbook data are reported in Table 1 for the combined data, in Table 2 for data from Florida, and in Table 3 for data from Texas.

Variable	Matches	Mismatches	Proportion Matching
Harvest	494	104	0.83
Rel < 120	276	322	0.46
Rel > 120	426	172	0.71
Mortalities	498	100	0.83

Table 1: Exact matches between 598 dockside samples and corresponding logbook reports for Red Snapper in the Gulf of Mexico (Florida and Texas combined).

Variable	Matches	Mismatches	Proportion Matching
Harvest	462	85	0.84
Rel < 120	242	305	0.44
Rel > 120	402	145	0.73
Mortalities	447	100	0.82

Table 2: Exact matches between 547 dockside samples and corresponding logbook reports for Red Snapper in Florida.

For ease of comparison, the proportion matching from Table 2 and Table 3, along with the corresponding values from the previous report (data from September 2010 through May 2011) are presented in Table 4.

Values for Florida appear quite similar between the first portion of data examined and the full data record. Values for Texas are less stable, but this may be due primarily to small sample sizes in Texas (only 11 trips were available from the first 9

Variable	Matches	Mismatches	Proportion Matching
Harvest	32	19	0.63
Rel < 120	34	17	0.67
Rel > 120	24	27	0.47
Mortalities	51	0	1.00

Table 3: Exact matches between 51 dockside samples and corresponding logbook reports for Red Snapper in Texas.

	Proportion Matching			
Variable	Florida 9	Florida 12	Texas 9	Texas 12
Harvest	0.85	0.84	0.82	0.63
Rel < 120	0.49	0.44	0.54	0.67
Rel > 120	0.66	0.73	0.54	0.47
Mortalities	0.76	0.82	1.00	1.00

Table 4: Proportion of exact matches between dockside samples and corresponding logbook reports over first 9 months of study (columns labeled Florida 9 and Texas 9) and all 12 months of study (columns labeled Florida 12 and Texas 12).

months of the study). Values for all variables, but especially Rel < 120, Rel > 120, and Mortalities, are elevated by trips for which both logbook and dockside sampling produced values of 0. For example, no mortalities were ever reported by either data source in Texas, producing perfect agreement. If we consider only trips for which at least one data source reports a positive value for a variable, the proportion of exact matches decreases, as demonstrated by the values in Table 5 for the combined data (both Florida and Texas). Comparing these values to those of Table 1, the proportion of exact matches decreases substantially for all variables, particularly for variables other than Harvest.

Variable	Matches	Mismatches	Proportion Matching
Harvest	229	104	0.69
Rel < 120	112	322	0.26
Rel > 120	31	172	0.15
Mortalities	12	100	0.11

Table 5: Exact matches between dockside samples and logbook reports excluding trips in which a variable was reported as 0 by both data sources.

Overall, the occurrence of exact matches between dockside samples and the corresponding logbook reports reinforces the tentative conclusion made on the basis of the first 9 months of data. Logbook records for Red Snapper cannot be considered as one-to-one replacements of what would result from dockside sampling of trips.

4 Discrepancies Between Data Sources

Following the analysis presented in the previous report, discrepancy measures for the paired data records for which dockside samples indicated Red Snapper had been caught are presented for both Florida and Texas in Table 6. Definition of the measures used may be found in Section 4.1 of the previous report. As for values of exact matches in the previous section, the value of Table 6 largely reinforce the results found using only the first 9 months of data. Some values of mean absolute error (e.g., Rel < 120 and Rel > 120) show substantial differences between data sources, approaching or exceeding the average values over all trips. For example, based on these values we would expect the difference between logbook and dockside data sources in the number of Red Snapper recorded as released over 120 ft. in Texas to be 2.9, while the average number over all trips is roughly 2.7 (computed from $0.5(3.627 + 1.863)$). Similarly, for Florida we would expect a difference of 3.26 while the average is roughly 3.58. The previous tentative conclusion that logbook records

Region	Variable	mae	$rmse$	$\bar{D}$	$\bar{L}$	M_d	R_d
Florida	Harvest	0.664	2.343	6.848	6.982	−0.133	1.006
	Rel < 120	5.733	13.085	9.205	8.598	0.607	1.091
	Rel > 120	3.256	8.959	4.002	3.159	0.843	1.304
	Mortalities	0.644	2.694	0.413	0.618	−0.205	1.017
Texas	Harvest	1.392	2.960	5.686	5.784	−0.098	1.029
	Rel < 120	1.706	3.933	1.137	0.647	0.490	1.078
	Rel > 120	2.863	5.763	3.627	1.863	1.765	1.330
	Mortalities	0.000	0.000	0.000	0.000	0.000	——

Table 6: Discrepancy measures for variables connected catch of Red Snapper.

cannot be considered as one-to-one replacements for data from dockside sampling is again reinforced.

But, also similar to the results of the examination of data from the first 9 months of the study, aggregate values over all trips ($\bar{D}$ and $\bar{L}$ with difference M_d) are remarkable similar for the two data sources, as are estimates of the variability among trips (R_d). Note that, once again similar to the previous analysis (Table 15 in the previous report), the row for Mortalities in Texas is no meaningful as all values were 0 for both logbook records and dockside samples.

5 Conclusions

This additional examination of data for Red Snapper, accomplished by adding data from June 2011 through August 2011 to the previous data from September 2010 through May 2011 reinforces the tentative conclusions reach on the basis of examining data from only the first nine months of the study. Specifically, individual logbook records should not be viewed as giving values for what would have resulted

from dockside sampling of the same trip (i.e., logbook records cannot be considered as one-to-one replacements for data from dockside sampling). Despite this, data on variables related to catch disposition (Harvest, Rel < 120, Rel > 120, Mortalities) when aggregated over the entire fishery (or geographic region) are quite similar for logbook and dockside sampling sources. Thus, logbook data hold potential for use in estimation of catch related quantities for the entire fishery (at least for Red Snapper).

Charter-Boat Logbook Reporting Pilot Study
Verification Sampling

Mark S. Kaiser

Dept. of Statistics, Iowa State University

Prepared for

Marine Resources Assessment Group Americas

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1 Introduction

A previous examination of data from the first 9 months of a pilot study on the use of a logbook reporting system conducted by the Marine Recreational Information Program (MRIP) in portions of the Gulf of Mexico concluded that logbook records might serve as a source of data for estimation of average effort, number of species caught, and disposition of individuals (harvested, released alive, mortalities). This conclusion is contained in a previous MRAG report titled "Charter-Boat Logbook Reporting Pilot Study: Initial Examination of Data", dated August 2011. Subsequent examination of data for the particular species of Red Snapper using all 12 months of data from the project reinforced this conclusion, as described in a previous MRAG report titled "Charter-Boat Logbook Reporting Pilot Study: Addendum on Analysis of Red Snapper", dated November 2011. The initial report of August 2011 also contained a recommendation that the use of logbook data in practice involve a regular verification sampling program (Section 8.1 of that report), and a caveat (item 6 in Section 6 of that report) that agreement between logbook records and dockside interviews does not provide absolute verification of accuracy, particularly for the number of mortalities.

This report contains results from an exercise conducted with existing data with the objective of determining the level of effort that would be required in a sampling program for verification of logbook data as part of an operational program. The conclusion that logbook records might serve as a source of data for estimation in the for-hire recreational fishery was based on the agreement of aggregate values for quantities computed from large sets of logbook and dockside data, not agreement between these data sources for individual trips. That is, logbook records and dockside samples seem to be in reasonable concert at the population level, but not the individual trip level. The level of aggregation at which logbook and dockside sampling data sources may be considered roughly equivalent has important implications for the design of a verification sampling program. In particular, one should not

expect that dockside sampling a small number of trips in a particular time frame will result in agreement with logbook records from those same trips. For example, a strategy in which 3 to 5 trips are selected for dockside sampling each month will almost certainly fail to indicate agreement with the logbook records for those same trips in each month. Continued for a sufficiently long time span, however, average values over the entire time period might produce agreement. Thus, a verification program should be designed for comparison of aggregate values rather than small sets of values.

The obvious question that arises from the considerations of the previous paragraph is how many dockside samples are needed to provide reliable comparison between aggregate values from logbook and dockside sampling data sources. Assessment of this question was approached through the use of a Monte Carlo study in which samples of varying size were selected from the set of trips with matched logbook reports and dockside samples. Data from the two sources were then compared using a number of summary quantities. The question is how accurately and precisely samples of varying size reflect the differences that exist in the entire collection of data. That is, for this exercise, the set of all trips in the MRIP pilot study having both logbook and dockside data were considered a "population" and differences between quantities computed from logbook records and dockside samples were taken to represent "true" differences. Given a large number of Monte Carlo samples of size n taken from this population of size N, the questions of interest center on how accurate (agreement between population and average sample means) and precise (variability among sample means) are the values as sample size changes. Note that the true population differences in this exercise are small, which was the basis for the conclusion that logbook and dockside data sources might be considered equivalent at an aggregate level.

2 Simulation Design

This section describes in detail the design of the Monte Carlo simulation study conducted and presents formal definitions for the quantities computed and criteria used for comparison. This simulation design was used for a species-independent comparison and again for a comparison involving only Red Snapper. In the species-independent comparison quantities assessed were number of species caught, total harvest, total release < 120, total release > 120 and total mortalities. In the comparison involving only Red Snapper the number of species caught was, of course, not meaningful. All simulations were conducted separately for Florida and Texas.

2.1 Sampling Strategy

In any Monte Carlo procedure in which samples are to taken from a larger group the method by which samples are to be selected must be determined. Ideally, the logistics involved in actual sampling provide a set of constraints that help determine sample selection (e.g., stratifications, etc.). Here, there is little to guide the decision of how samples should be selected. Aside from the pilot study there is no regular program for dockside sampling of charter boats. Effective dockside samplers are valuable and generally have participated in extensive training regimens. The ability to execute a dockside sampling program then depends on the availability of qualified personnel and their levels of commitment to other programs that may be in operation at any given time. Because a more definitive sampling strategy was not available, then, samples were selected using simple random sampling without blocking or stratification by time periods or other factors. As previously noted, however, separate simulation studies were conducted for Florida and Texas.

2.2 Basic Quantities Used in Comparison

The simulations reported on in what follows focused on five quantities for the species-independent comparisons and four for the comparisons specific to Red Snapper. These were the number of species recorded as having been caught on the trip, the number of individuals harvested, released < 120, released > 120, and mortalities; the number of species caught was not included in assessments using only Red Snapper. Let $Y_{i,j}$ denote random variables connected with any of these quantities (e.g., number of individuals harvested) on trip j from data source i, $i = 1, 2$ for dockside and logbook data sources, respectively, and $j = 1, \ldots, n$ in a sample. Given a sample of size n from the population of all trips having both logbook and dockside sample information available, quantities used to compare the two sources of data included *mean absolute error* (mae), *root mean squared error* ($rmse$), *difference in means* (M_d), and *ratio of standard deviations* (R_d). These are the same quantities used in the original examination of data from the first 9 months of the pilot study, but their definitions are included here for completeness. Let the difference in values between dockside samples and logbook records be denoted as

$$D_j = Y_{1,j} - Y_{2,j}, \tag{1}$$

where the index $i = 1$ (e.g., $Y_{1,j}$) denotes dockside sample and $i = 2$ (e.g., $Y_{2,j}$) denotes logbook. The mean absolute deviation, root mean squared error, mean difference, and ratio of standard deviations are then defined as,

$$\begin{aligned}
mae &= \frac{1}{n}\sum_{j=1}^{n} |D_j|, \\
rmse &= \frac{1}{n}\sum_{j=1}^{n} D_j^2, \\
M_d &= \frac{1}{n}\sum_{j=1}^{n} D_j = \bar{Y}_1 - \bar{Y}_2 = \frac{1}{n}\sum_{j=1}^{n} Y_{1,j} - \frac{1}{n}\sum_{j=1}^{n} Y_{2,j}, \\
R_d &= \frac{s_1}{s_2},
\end{aligned} \tag{2}$$

where

$$s_i = \left[\frac{1}{n-1} \sum_{j=1}^{n} (Y_{i,j} - \bar{Y}_i)^2 \right]^{1/2}.$$

2.3 Testing Equivalence

An additional criterion used in the comparison of logbook and dockside sampling data was based on the knowledge that in actual application there will be available one set of trips for which both logbook records and dockside samples will be available. Based on this set of trips a decision will be required as to whether logbook data continue to be a reasonable source of information for estimation in the fishery or whether it appears there has been some change and logbook data should no longer be considered a reliable source of information for the purposes of estimation. A procedure that recommends itself for this purpose is often called "equivalence testing" in statistics (e.g., Wllek, S. (2010), *Testing Statistical Hypotheses of Equivalence and Noninferiority*, CRC Press). This simple procedure recognizes that failure to reject a null hypothesis in a classical test is not the same as accepting the null hypothesis, and may be described in the context of comparing logbook and dockside data sources as follows.

Using the same notation as in the previous section, a $(1-\alpha)100\%$ interval estimate or confidence interval for the difference in expected values $\mu_1 = E(Y_{1,j})$ and $\mu_2 = E(Y_{2,j})$ may be computed as

$$\bar{Y}_1 - \bar{Y}_2 \pm z_{1-\alpha/2} \left(\frac{s_1^2}{n} + \frac{s_2^2}{n} \right)^{1/2}, \tag{3}$$

where $\bar{Y}_i$ are the sample means and s_i^2 the sample variances for dockside ($i = 1$) and logbook ($i = 2$) data, as in the previous section. Testing equivalence requires that a value be available based on scientific knowledge δ, say, such that if $-\delta < \mu_1 - \mu_2 < \delta$ then the difference in expected values is not important for the problem. The interval $(-\delta, \delta)$ is sometimes called the "zone of indifference". Now, let L denote the lower endpoint of the interval in (3) and U the upper endpoint. Then the two data sources

may be considered equivalent (in mean) at the $1 - \alpha$ level if

$$-\delta < (L, U) < \delta, \tag{4}$$

that is, if the entire confidence interval is contained within the zone of indifference. Such a procedure would seem to be a likely candidate for use in a verification sampling program. Although the precise meaning of how much evidence has been offered in favor of equivalence (the hypothesis that $\mu_1 = \mu_2$) can become convoluted, equivalence testing procedures are undeniably superior to asserting that failure to reject $\mu_1 = \mu_2$ provides evidence in favor of equivalence.

In the Monte Carlo exercises reported on here, a test for equivalence in the expected number of harvested individuals was included for each sample, and an additional assessment criterion was then defined as the proportion of samples for which equivalence was declared. This criterion may be interpreted as an indication of the probability that a conclusion of equivalence between logbook and dockside data sources will be declared for the given sample size (and given the actual difference that exists in the simulation "population", which is small).

2.4 Selection of Monte Carlo Sample Size

Under simple random sampling, averages of quantities computed from Monte Carlo samples are numerical approximations to the expected values of those quantities that, by the ordinary law of large numbers, converge to those expected values as Monte Carlo sample size grows without bound. Under an assumption of independence, a central limit theorem also applies, implying that an interval approximation to an expected value may be constructed in the usual way for independent and identically distributed random variables. Note that we are willing to ignore the finite size of the population being sampled in these simulation studies because the number of possible samples is large and this also justifies the use of results for independent samples. For example, in Florida there are 4.8×10^{21} possible samples of size 10 and

2.5×10^{121} possible samples of size 100.

Let Q_m denote the random version of a quantity to be computed on the basis of a Monte Carlo sample of size n, such that $m = 1, \ldots, M$ indexes Monte Carlo samples. Let q_m; $m = 1, \ldots, m$ denote the realized values of the quantity in the Monte Carlo samples. Then a Monte Carlo approximation to the expected value $E(Q_m)$ is,

$$E_M(Q_m) = \frac{1}{M} \sum_{m=1}^{M} q_m. \tag{5}$$

Assuming independence among Monte Carlo samples, the precision of such an approximation is quantified as

$$s_M^2 = \frac{1}{M} \sum_{m=1}^{M} (q_m - E_M(Q_m))^2, \tag{6}$$

and the central limit theorem indicates that an interval approximation may be formed as,

$$E_M(Q_m) \pm z_{1-\alpha/2} \left[s_M^2/M\right]^{1/2}. \tag{7}$$

To select a value for the number of Monte Carlo samples to use in the assessments that follow, Monte Carlo approximations (5) and (7) were computed using Q_m as the mean absolute difference of harvested individuals recorded by sets of 10 logbook and dockside sampling data sources in Florida. That is, for a given Monte Carlo sample m, Q_m in this section was taken to be mae from (2) when Y_{1j} and $Y_{2,j}$ were the number of harvested individuals in dockside samples and logbooks, respectively, and $j = 1, \ldots, 10$.

A plot of the point Monte Carlo approximation (5) along with upper and lower limits from the interval (7) as Monte Carlo sample size increases is presented in Figure 1. Figure 1 demonstrates stabilization of the MC approximation as Monte Carlo sample size increases, as well as a "rate of diminishing returns" in the improvement in precision, both of which are typical for Monte Carlo exercises. By the time $25,000$ Monte Carlo samples had been selected, the width of interval approximations had been less than 0.15 for over $1,000$ iterations. While arbitrary, this seemed more

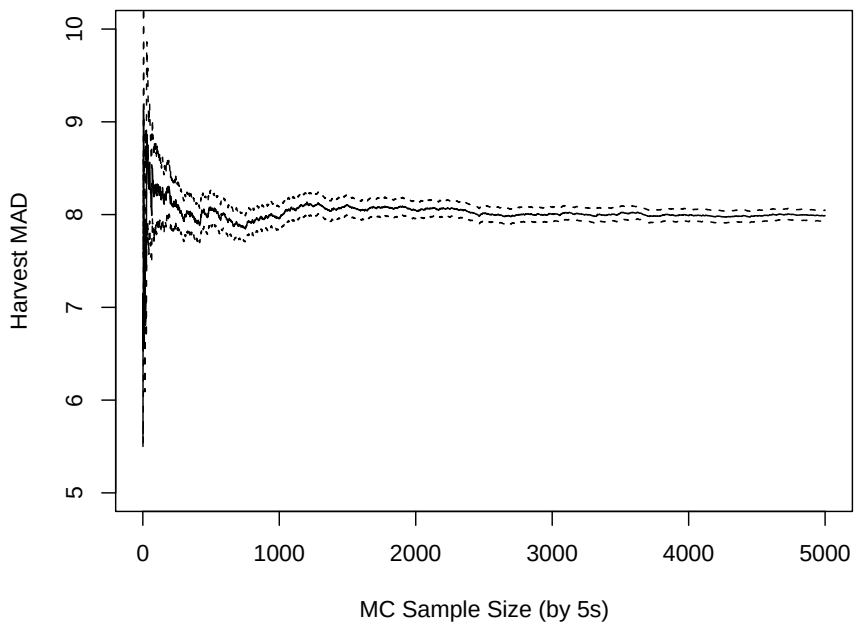

Figure 1: Plot of Monte Carlo approximations to *mae* for number of harvested individuals in Florida based on samples of size $n = 10$ as Monte Carlo sample size increases. Note that values on the horizontal axis should be multiplied by 5 to determine Monte Carlo sample size.

than a sufficient level of precision for the purposes of this study, and Monte Carlo sample size was taken as $M = 25,000$ in all simulations conducted.

2.5 Outline of Overall Procedure

Putting together the pieces discussed in the previous four subsections, the overall process used in Monte Carlo simulation studies in this project may be outlined in algorithmic form as follows.

1. Fix $M = 25,000$ and choose n to be one of the values $10, 20, 50, 100, 200, 300, 400, 500$.

2. Generate M samples of size n from the entire set of trips having both logbook records and dockside samples for either Florida or Texas.

3. For each sample $m = 1, \ldots, M$, compute the four basic comparison quantities mae, $rmse$, M_d, and R_d for each of the characteristics of number of species caught, number of individuals harvested, number of individuals released < 120, number of individuals released > 120, and number of mortalities.

4. Also for each sample, compute a test for equivalence for the expected number of harvested individuals, as described in Section 2.3, and using $\delta = 5$. For Monte Carlo sample m, set an indicator of declared equivalence equal to 1 if equivalence would be the appropriate conclusion, and equal to 0 otherwise.

5. Produce Monte Carlo approximations for the expected values of the basic comparison quantities and the indicator of equivalence. Note that, in the case of this indicator, the average over Monte Carlo samples is an approximation to the probability that equivalence would be declared.

The above procedure was repeated for each of the sample sizes $n = 10, 20, 50, 100, 200, 300, 400, 500$ and conducted separately for data from Florida and Texas, and also separately for a species independent comparison (using all species combined) and a comparison specific to Red Snapper. Recall that the objective is to determine a value for n in a regular program of dockside sampling for verification of logbook data.

3 Results for Florida

Results of simulations using data from Florida are reported on in this section. Separate subsections report on the species independent and Red Snapper specific comparisons, but we begin with a summary of the basic quantities of Section 2.3 for the simulation "population", consisting of all trips with both logbook and dockside data sources from Florida.

3.1 Population Values

3.1.1 Species Independent Comparison

The population size for Florida was $N = 672$ for this comparison of logbook and dockside data sources. The values of the four basic comparison quantities for the species independent comparison, computed from the entire population, are given in Table 1. Note that these results are quite similar to those reported for Florida using

Quantity	*mae*	*rmse*	M_d	R_d
No. Species	1.315	2.032	1.036	1.062
Harvested	7.990	17.136	1.624	1.023
Rel. < 120	8.652	17.010	1.304	1.084
Rel. > 120	4.228	11.883	1.019	1.162
Mortalities	0.686	2.756	-0.210	0.967

Table 1: Population values for Florida in the species independent comparison.

only the first nine months of data from the pilot study (see Table 12 in the August 2011 report "Charter-Boat Logbook Reporting Pilot Study: Initial Examination of Data"). As for those previous values, the *mae* for disposition categories (harvest, etc.) are somewhat large while values of M_d are considerably reduced; this again reinforces the need for comparison between data sources at an aggregate level, rather than expecting them to be in concert for individual trips. Also similarly to the previous examination of data, there were a large number of trips for which either logbook records, dockside sample values, or (usually) both were 0 for the disposition categories. This is demonstrated by the values of Table 2. In the previous examination, this frequency of 0 values inflated the proportion of exact matches between logbook records and dockside samples, although that is no longer a concern here since the failure of logbook records to serve as a one-to-one replacement for dockside samples has already been established.

Disposition	Logbook Records	Dockside Samples
Harvested	7	10
Rel. < 120	240	228
Rel. > 120	517	507
Mortalities	560	595

Table 2: Number of trips in the simulation population from Florida reporting values of 0 for different catch disposition categories.

3.1.2 Red Snapper

For Red Snapper, the Florida population size was $N = 547$. For all of these trips both logbook and dockside sampling values for number of mortalities were 0, so that variable was not used in the comparison. Population level values of the basic quantities used in comparison are presented in Table 3. The values of Table 3 are

Quantity	mae	$rmse$	M_d	R_d
Harvested	0.664	2.343	-0.133	1.006
Rel. < 120	5.733	13.085	0.607	1.091
Rel. > 120	3.256	8.959	0.843	1.304
Mortalities	0.644	2.694	-0.205	1.017

Table 3: Population values for Florida in the comparison specific to Red Snapper.

again quite similar to those from examination of the first nine months of data (see Table 12 in the August 2011 report "Charter-Boat Logbook Reporting Pilot Study: Initial Examination of Data" and Table 6 in the November 2011 report "Charter-Boat Logbook Reporting Pilot Study: Addendum on Analysis of Red Snapper"). Also similar to previous examinations, including the species independent values of Table 1, there was a high frequency of 0 values reported for release (especially > 120) and mortality in both logbook and dockside sampling data, as demonstrated

by the values of Table 4. In particular, 91% of trips had no mortalities according to dockside sampling records (84% according to logbook records).

Disposition	Logbook Records	Dockside Samples
Harvested	0	0
Rel. < 120	229	197
Rel. > 120	428	413
Mortalities	459	498

Table 4: Number of trips in the Red Snapper simulation population from Florida reporting values of 0 for different catch disposition categories.

3.2 Species Independent Simulations

Using the species independent population of $N = 672$ trips from Florida, Monte Carlo approximations in the form of expression (5) are presented in Table 5 for the four basic comparison quantities of Section 2.2. Aside from the inability to compute R_d for all quantities with smaller sample sizes, the values of Table 5 appear nearly identical for all sample sizes n, and are quite similar to the population values of Table 1. This is a direct consequence of simple random sampling and should not be taken as having any other meaning for design of a program for verification of logbook records. The entire extent of Table 5 is presented solely to emphasize this point. Thus, the question of accuracy in a verification program is a moot point if sample selection is truly random. Any program with actual random sampling will provide accurate values for comparison of logbook and dockside sampling data sources, regardless of sample size. The question of central concern is precision.

Sample Size	Quantity	No. Spp.	Harvest	Rel. < 120	Rel. > 120	Mortalities
$n = 10$	mae	1.319	8.053	8.659	4.217	0.686
	$rmse$	1.926	14.408	14.987	9.358	1.697
	M_d	1.037	1.631	1.327	1.032	−0.215
	R_d	1.097	1.127	—	—	—
$n = 20$	mae	1.314	8.009	8.595	4.204	0.688
	$rmse$	1.973	15.503	15.827	10.403	2.031
	M_d	1.034	1.635	1.271	1.023	−0.208
	R_d	1.078	1.087	1.144	—	—
$n = 50$	mae	1.316	7.998	8.651	4.220	0.686
	$rmse$	2.011	16.404	16.563	11.227	2.375
	M_d	1.036	1.623	1.309	1.007	−0.213
	R_d	1.067	1.055	1.112	1.279	—
$n = 100$	mae	1.316	7.993	8.645	4.241	0.686
	$rmse$	2.022	16.779	16.793	11.587	2.565
	M_d	1.037	1.638	1.306	1.014	−0.207
	R_d	1.064	1.040	1.100	1.220	0.976

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Sample Size	Quantity	No. Spp.	Harvest	Rel. < 120	Rel. > 120	Mortalities
$n = 200$	mae	1.315	7.981	8.652	4.226	0.686
	$rmse$	2.028	16.965	16.934	11.745	2.676
	M_d	1.036	1.625	1.313	1.020	−0.211
	R_d	1.063	1.030	1.092	1.190	0.953
$n = 300$	mae	1.316	7.984	8.651	4.227	0.685
	$rmse$	2.031	17.027	16.959	11.802	2.711
	M_d	1.036	1.634	1.297	1.017	−0.210
	R_d	1.062	1.027	1.088	1.177	0.957
$n = 400$	mae	1.316	7.990	8.653	4.228	0.686
	$rmse$	2.031	17.086	16.987	11.846	2.735
	M_d	1.036	1.626	1.298	1.023	−0.210
	R_d	1.062	1.025	1.086	1.173	0.960
$n = 500$	mae	1.316	7.992	8.653	4.230	0.685
	$rmse$	2.032	17.115	16.997	11.865	2.741
	M_d	1.036	1.628	1.301	1.021	−0.210
	R_d	1.062	1.024	1.085	1.167	0.963

Table 5: Monte Carlo approximations to the basic quantities used for comparison of logbook and dockside sampling data sources in the species independent simulations for Florida. Monte Carlo sample size was $M = 25,000$ for each sample size n in the table.

Histograms of the difference in means (M_d) for number of harvested individuals (over all species) are presented in Figures 2 and 3 for varying sample sizes. Figure 2 contains sample sizes $n = 10$, $n = 20$, $n = 50$ and $n = 100$, while Figure 3 has sample sizes $n = 200$, $n = 300$, $n = 400$, and $n = 500$.

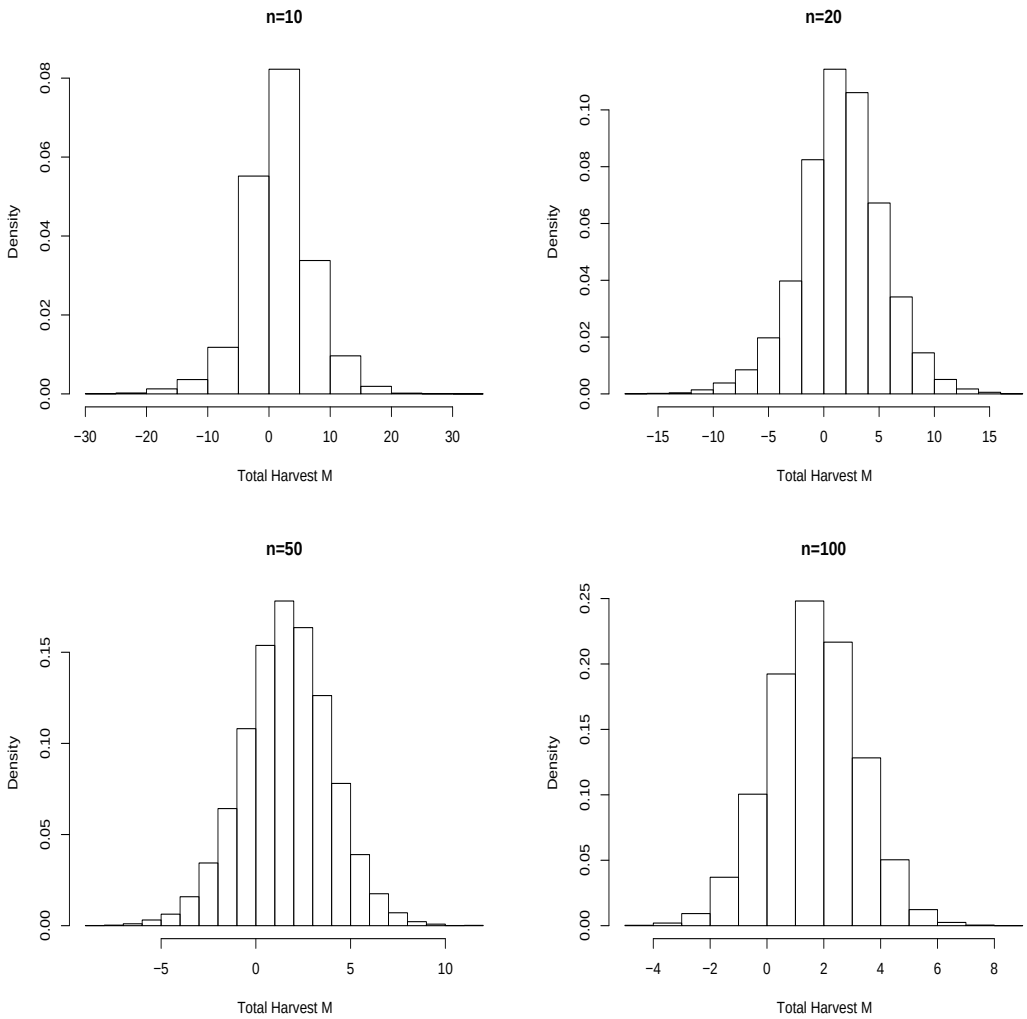

Figure 2: Histograms of M_d for harvest for sample sizes 10, 20, 50 and 100.

The most meaningful feature of these histograms is the range of values on the horizontal axis, which decreases as sample size increases. Thus, the precision of this quantity computed from a sample of trips is greatly increased for larger samples.

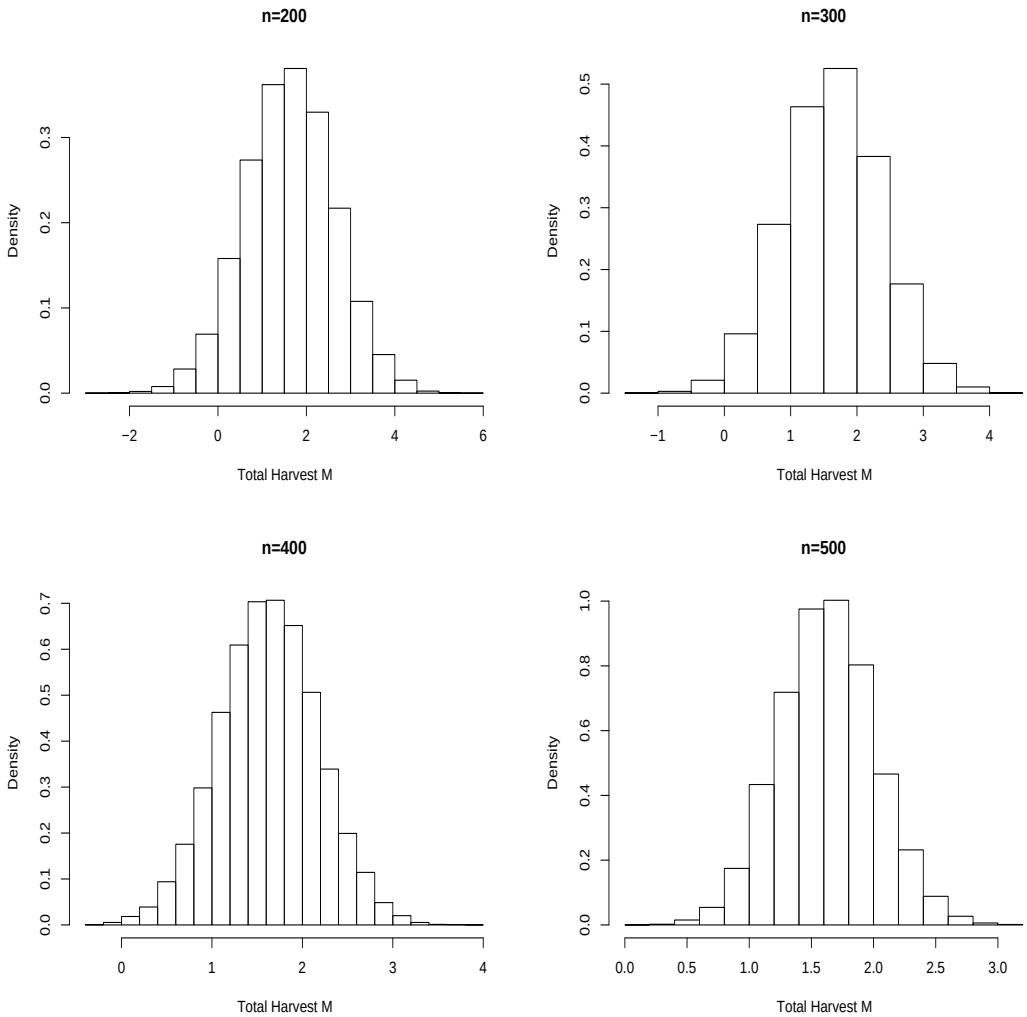

Figure 3: Histograms of M_d for harvest for sample sizes 200, 300, 400 and 500.

Similar results occur for all of the 20 quantities represented in Table 5. The histograms of Figures 2 and 3 are on different scales so that each graph fills available plotting space. To emphasize the greater spread and lower modal density value for smaller sample sizes, smoothed (Epinechnikov kernel) versions of the histograms for $n = 20$, $n = 50$ and $n = 200$ are presented on the same scale in Figure 4. Here it is easy to visualize the differences among the Monte Carlo distributions for varying sample sizes and the smoothing also makes clear the near symmetry of the distribu-

tions for M_d with harvest. This was true in general for differences in means (values of M_d) as might be anticipated. Distributions for *mae*, on the other hand, tended to be skew right, often considerably so. But, since the conclusion has already been reached that logbook and dockside data sources need comparison at an aggregate rather than individual level, the approximate sampling distributions of M_d for catch variables is of greater interest than are those for *mae* values.

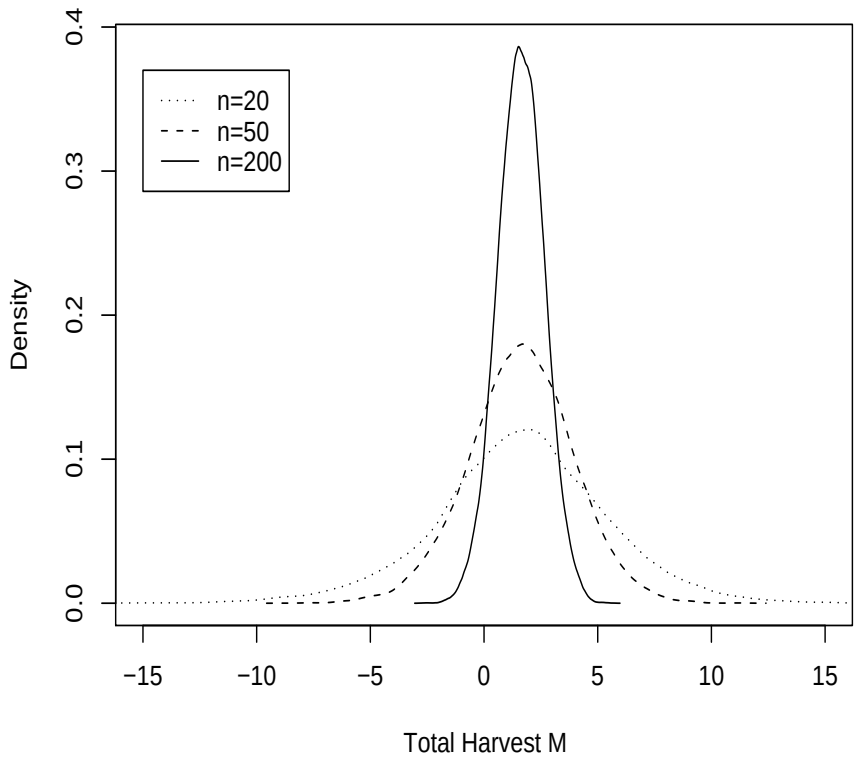

Figure 4: Smoothed histograms for $n = 20$, $n = 50$ and $n = 200$ overlaid.

Determination of what constitutes an "acceptable" level of precision can be problematic. Testing for equivalence, as described in Section 2.3, perhaps provides some guidance. The proportion of samples (out of $25,000$ in each case) for which equiva-

lence would be declared between expected values of total harvest for logbook records and dockside samples is reported in Table 6. These tests employed a zone of indifference from -5 to 5, that is, $\delta = 5$ in (4).

Sample Size	Proportion	Sample Size	Proportion
10	0.0104	200	0.6195
20	0.0124	300	0.8737
50	0.0590	400	0.9850
100	0.2505	500	0.9998

Table 6: Proportion of samples for which equivalence would be declared between expected values for harvest.

It may be seen from the values of Table 6 that the probability equivalence would be declared using a sample of $n = 10$ trips is just over 1%, but becomes essentially 100% by the time sample size reaches $n = 500$. The results of Table 6 are not particularly encouraging, indicating that (by the rule used) declaring equivalence with greater probability than a coin flip does not occur until sample size has reached somewhere around 200. The relation of the probability of (declaring) equivalence to sample size is depicted in Figure 5 which would be nicely described by a logistic curve. The linear portion of the curve appears to occur between about $n = 100$ and $n = 300$ in which the slope is about 0.003, indicating that, within this range of sample sizes, increasing sample size by 10 results in an increase of about 3% in declaring equivalence. The values of Table 6 (and Figure 5) are, of course, influenced by how wide the zone of indifference is set in the procedure to test for equivalence. They could be increased by using a wider zone and decreased by using a more narrow zone.

Overall, these results reinforce the conclusion that it is only at aggregate levels that data from logbook records and dockside samples can be considered to provide the same information about catch and its disposition. The level of aggregation

necessary is perhaps greater than one would wish, certainly with respect to designing a practical program for verification of logbook data.

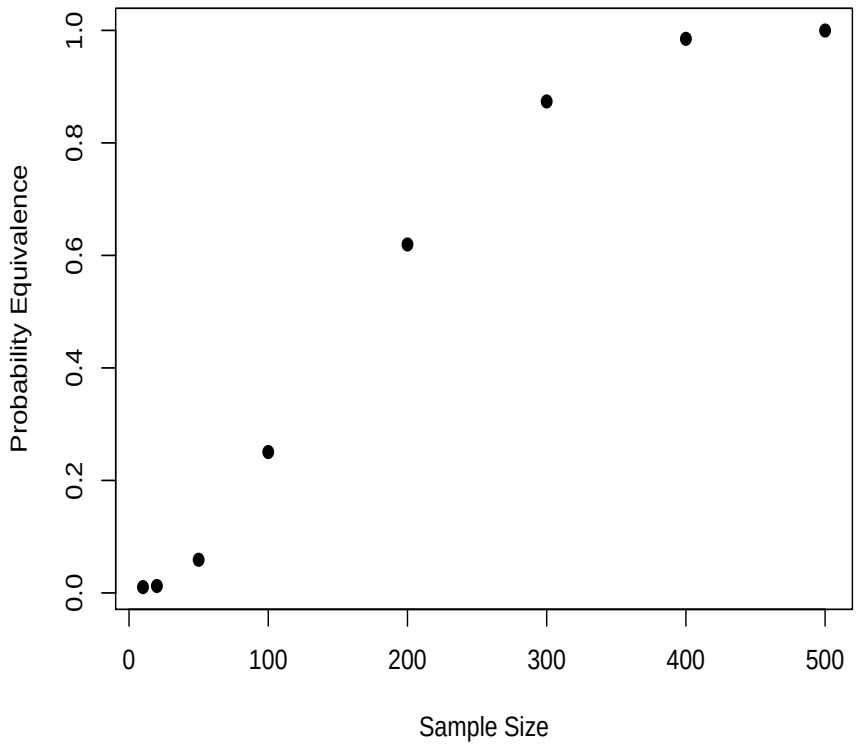

Figure 5: Probability of declaring equivalence as a function of sample size.

3.3 Simulations for Red Snapper

The same simulation study described in the previous subsection was conducted using only data for Red Snapper. The "population" was defined as the total set of trips for which at least one of the data sources of logbook records or dockside samples contained a record for Red Snapper. This population comprised $N = 547$ trips. As for the species independent simulation study, Mont Carlo approximations to

the expected values of all quantities (mae, $rmse$, M_d and R_d for each of harvest, released < 120, released > 120 and mortalities) were essentially all the same as the population values of Table 3. Values for the smallest sample size, $n = 10$, and the largest, $n = 500$, are presented in Table 7. Also similar to the species independent setting, precision improved for larger sample sizes. Histograms of M_d for number of harvested individuals are presented for $n = 10$ and $n = 500$ in Figure 6. Note again the dramatic difference in amount of spread in these histograms.

Sample Size	Quantity	Harvest	Rel. < 120	Rel. > 120	Mortalities
$n = 10$	mae	0.674	5.730	3.253	0.638
	$rmse$	1.676	10.011	7.082	1.615
	M_d	−0.144	0.593	0.827	−0.202
	R_d	—	—	—	—
$n = 500$	mae	0.663	5.732	3.254	0.643
	$rmse$	2.341	13.044	8.948	2.690
	M_d	−0.133	0.608	0.842	−0.205
	R_d	1.006	1.091	1.304	1.018

Table 7: Monte Carlo approximations to the basic quantities used for comparison of logbook and dockside sampling data sources in the Red Snapper simulations for Florida. Monte Carlo sample size was $M = 25,000$ for each sample size n in the table.

Values for the proportion of Monte Carlo simulations on which equivalence would be declared for the expected values of Red Snapper harvest between logbook and dockside data sources are presented in Table 8. Because the number of Red Snapper harvested was, on average, considerably less than the total harvest for all species (6.84 for Red Snapper versus 32.63 for all species in Florida dockside samples) the width of the zone of indifference for equivalence testing was reduced from 5 as used previously to 1 for Red Snapper (about 1/6 of the average harvest in each case).

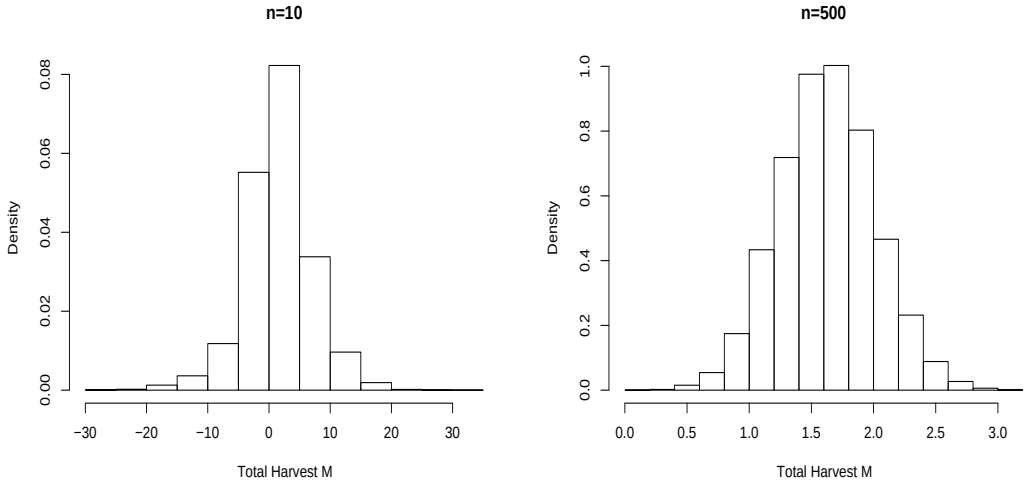

Figure 6: Histograms of M_d for harvest for sample sizes of 10, and 500 in the Red Snapper simulation study.

The results of Table 8 are in striking contrast to those of Table 6. In the case of Red Snapper, there is a very sharp transition of the probability of declaring equivalence (for this population) as sample size increases. This is demonstrated visually in Figure 7, which should be compared to Figure 5 from the species independent simulations.

Sample Size	Proportion	Sample Size	Proportion
10	0.0000	200	0.8316
20	0.0000	300	0.9983
50	0.0000	400	1.0000
100	0.0535	500	1.0000

Table 8: Proportion of samples for which equivalence would be declared between expected values for harvest.

The results of Table 8 and Figure 7 would provide stronger guidance for design of a verification program if the only species of concern were Red Snapper. In this case,

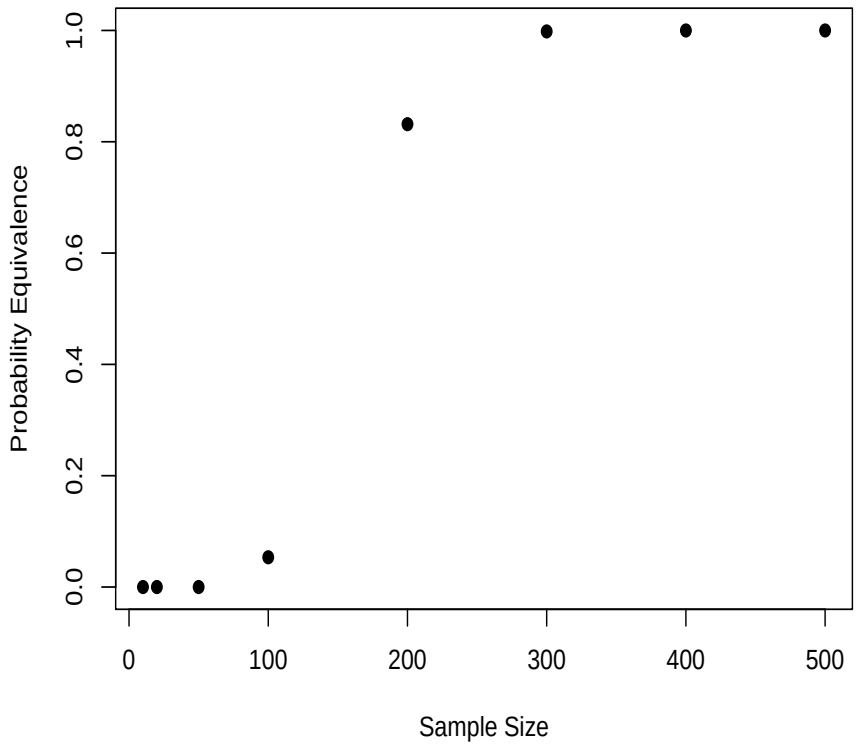

Figure 7: Probability of declaring equivalence as a function of sample size in the Red Snapper simulations.

intermediate sample sizes (between 100 and 200 or between 200 and 300) could be utilized to "fill in" the curve that is easily envisioned for Figure 7. The sharpness of the probability transition in Table 8 and Figure 7 does, in fact, suggest a practical procedure based on a sequential framework, which will be outlined in Section 6 of this report.

4 Results for Texas

Results of simulations using data from Texas are reported on in this section. Separate subsections report on the species independent and Red Snapper specific comparisons, but we begin with a summary of the basic quantities of Section 2.3 for the simulation "population", consisting of all trips with both logbook and dockside data sources from Texas.

4.1 Population Values

4.1.1 Species Independent Comparison

The population size for Texas was $N = 89$ for this comparison of logbook and dockside data sources. The values of the four basic comparison quantities for the species independent comparison, computed from the entire population, are given in Table 9.

Quantity	mae	$rmse$	M_d	R_d
No. Species	1.079	1.469	0.899	1.216
Harvested	3.315	6.123	0.034	1.057
Rel. < 120	1.933	4.740	0.944	1.528
Rel. > 120	2.573	6.309	1.742	1.450
Mortalities	0.045	0.335	-0.045	—

Table 9: Population values for Texas in the species independent comparison.

These results are reasonably similar to those reported for Texas using only the first nine months of data from the pilot study (see Table 12 in the August 2011 report "Charter-Boat Logbook Reporting Pilot Study: Initial Examination of Data"). The number of trips for which logbook records and dockside samples resulted in values of 0 for various catch disposition categories are presented in Table 10. Here, the

Disposition	Logbook Records	Dockside Samples
Harvested	1	3
Rel. < 120	71	60
Rel. > 120	71	58
Mortalities	87	89

Table 10: Number of trips in the simulation population from Texas reporting values of 0 for different catch disposition categories.

preponderance of 0 values becomes a serious concern. Given a total of 89 trips, all of which had 0 mortalities according to dockside data and all but 2 of which did based on logbook information, it is not meaningful to worry about agreement or disagreement of mortalities between data sources. Logbook data also reported a large proportion of trips with no releases (either < 120 and > 120) for which 71 out of 89 trips (80%) had 0 values. The number of trips with recorded releases from dockside sample data was somwhat greater, with 67% and 65% having no releases according to dockside samples.

4.1.2 Red Snapper

For Red Snapper, the Texas population size was $N = 51$. For all of these trips both logbook and dockside sampling values for number of mortalities were 0, so that variable was not used in the comparison. Population level values of the basic quantities used in comparison are presented in Table 11. There was again a high frequency of 0 values recorded for release (in this case for both < 120 and > 120) which is reported in Table 12. And, similarly to the species independent comparison, the number of trips recorded as having 0 releases was greater based on logbook records than on dockside samples. In fact, even harvest was recorded as 0 a great number of times (39% of the time in both logbook and dockside data). Since the

Quantity	mae	$rmse$	M_d	R_d
Harvested	1.392	2.960	-0.098	1.029
Rel. < 120	1.706	3.933	0.490	1.078
Rel. > 120	2.863	5.763	1.765	1.330

Table 11: Population values for Texas in the comparison specific to Red Snapper.

construction of the simulation population included only trips that contained a record for Red Snapper with a non-zero entry for at least one of the disposition categories, this means that at least 20 trips reported no harvested Red Snapper but did report released Red Snapper (since no trips reported any mortalities). There is a greater dispartiy between logbook and dockside samples in the number of trips that report 0 values for release in Texas than in Florida. For example, using numbers from Table 12, the number of trips having 0 for released < 120 is 8 greater for logbook records than dockside samples in Texas, or 16% of the total population size of $N = 51$. The corresponding values from Table 4 for Florida are 32 more logbook 0s than dockside sampling which is only 6% of the population of $N = 547$.

Disposition	Logbook Records	Dockside Samples
Harvested	20	20
Rel. < 120	46	38
Rel. > 120	40	26

Table 12: Number of trips in the Red Snapper simulation population from Texas reporting values of 0 for different catch disposition categories.

4.2 Species Independent Simulations

The small simulation population size in Texas $N = 89$ precludes simulations with larger sample sizes because of the fewer such samples available. Thus, simulations

were conducted only with sample sizes of $n = 10$, $n = 20$ and $n = 50$. Monte Carlo approximations to expected values are presented in Table 13.

Sample Size	Quantity	Harvest	Rel. < 120	Rel. > 120	Mortalities
$n = 10$	mae	1.078	3.314	1.950	2.5676
	$rmse$	1.429	5.519	4.129	5.178
	M_d	0.899	0.025	0.954	1.731
	R_d	1.253	1.128	—	—
$n = 50$	mae	1.079	3.314	1.931	2.573
	$rmse$	1.465	6.061	4.679	6.149
	M_d	0.899	0.036	0.942	1.743
	R_d	1.219	1.064	1.727	1.605

Table 13: Monte Carlo approximations to the basic quantities used for comparison of logbook and dockside sampling data sources in the species independent simulations for Texas. Monte Carlo sample size was $M = 25,000$ for each sample size n in the table.

Precision, as expected, was greater for samples of size $n = 50$ than $n = 10$, as demonstrated by the histograms of Figure 8 (again, focus on the range of the horizontal axis). The mean harvest for the population (based on dockside samples) was 13.101 so in the test for equivalence the zone of indifference was set using $\delta = 2$ to maintain consistency with previous simulation for Florida. Given this, the proportions of samples for with equivalence was declared for harvest were 0.0083 for $n = 10$, 0.0145 for $n = 20$ and 0.1592 for $n = 50$. It is difficult to verity equivalence between logbook records and dockside samples in Texas using any sample substantially smaller than the population. Thus, it may be the case that in Texas a verification program requires about the same level of effort and coverage as was attained in the pilot study.

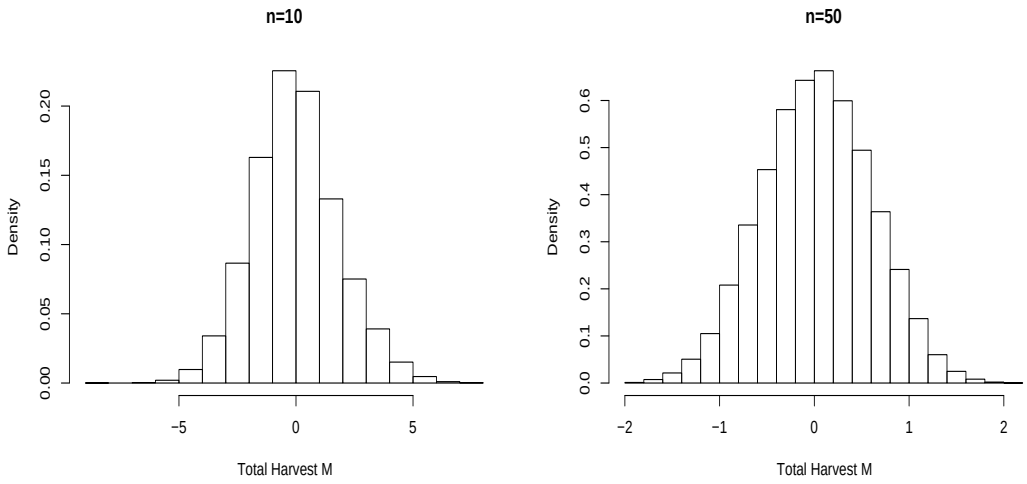

Figure 8: Histograms of M_d for harvest for sample sizes of 10, and 50 in the species independent simulation for Texas.

4.3 Simulations for Red Snapper

Problems caused by small simulation population size, which were evident in the species independent simulations for Texas, are made even more acute if attention is restricted to Red Snapper for which the population size was only $N = 51$. Using all of these 51 records, the mean number of Red Snapper harvested was 5.686 according to dockside samples and 5.784 according to logbook records. This gives a value of $M_d = -0.098$ (see also Table 11), but a test for equivalence was unable to declare equivalence for a zone of indifference $(-1, 1)$, i.e., $\delta = 1$ in the procedure, using all of the data. This zone of indifference comes from using roughly 1/6 the population mean harvest, as was done in all previous simulations. There is no true need, then, to consider this question for samples of less than the population size. Note that a zone of indifference of using $\delta = 2$ in the procedure does produce a declaration of equivalence and, in fact, this would be true for any $\delta > 1.1$. Although one can play various "games" of this type using all available data on Red Snapper from Texas, it

is questionable whether anything of value would result from attempting to conduct a Monte Carlo simulation using as a population a set of only 51 values.

5 Conclusions from the Simulations

The Monte Carlo simulations presented in this report, combined with previous examinations of the available data, lead to the following conclusions relative to the design of a program for verification of logbook records as a source of data for estimation of catch in the Gulf of Mexico charter boat industry.

1. The simulations reinforce previous conclusions that logbooks cannot be considered exact substitutes for what would result from dockside sampling on a trip-by-trip basis. Despite this, values estimated from logbook records appear quite similar to those estimated from dockside samples for large enough aggregates of trips. This phenomenon carries over into data sets that might result from a program instituted for verification of logbooks as a source of data.

2. The information available from Texas as a result of the pilot study is limited. Most of the conclusions and recommendations offered stem from the analysis of data from Florida. The assumption that conclusions based on information from Florida also apply to Texas does not seem directly contradicted by the data that are available from Texas, but there may remain some aspects of the Texas fishery that are not similar to Florida, and this should serve as a bit of a caution in extending results from one portion of the Gulf to others. It appears that to be effective in Texas, a monitoring or verification program for logbook data would need to be of about the same scope as the pilot study.

3. The statistical procedure generally called "equivalence testing" provides a potential tool for assessment of logbook versus dockside sampling in any verification program implemented. If this tool is adopted for use, additional

consideration should be given by MRIP or other fisheries managers of how to best define "zones of indifference" for the procedure. In the simulation studies reported here a crude and arbitrary level of plus or minus roughly 1/6 the overall mean harvest was used to provide some consistency among simulations, but no scientific basis for this decision is claimed.

4. Even in Florida, to reach a level of near certainty that expected harvest based on logbook and dockside data would be declared equivalent (for the underlying population defined by all available matched data from the pilot study) required sample sizes in the hundreds (see Table 6).

Consideration of these conclusions leads to (at least) two possible strategies in design of a verification program. These are described in the next section.

6 Potential Designs for a Logbook Verification Program

Logistical constraints and considerations will likely drive the actual design of any practical program for verification of logbook catch data. The primary use of this report is to help indicate whether a program of a given size could reasonably be expected to declare logbook records and dockside sampling data equivalent in aggregate behavior. Allowing a certain amount of speculation about the availability of personnel for conducting dockside sampling, two structures are presented in this section as possible starting points for design of a practical verification program.

6.1 Static Design

One possible framework for design of a verification program would be to consider a large effort similar or only somewhat reduced in scope from the pilot study. Due to cost, such a program might be conducted on an infrequent basis, once every x

number of years, for example. If cost and available effort are not concerns, then the frequency could be increased. The important point for this design is that, when sampling is conducted, it is of sufficient magnitude to result in a high probability of declaring logbook and dockside sampling equivalent if they are, in fact, as similar as the results of this pilot study indicate they may be. Sampling should be conducted to attempt to approximate a random sample of all trips, either simple random or stratified random.

This framework for a verification program is essentially that of attempting to conduct a large sampling effort in one season or year. Indications are that about 300 to 400 trips should be sampled in Florida (e.g., Table 6 and Figure 5) and as large as possible in Texas.

6.2 Sequential Design

An alternative framework for design of a verification program would be to consider a sequential setting in which a modest number of dockside samples are taken in a more-or-less continuous manner over time. The basic assumption needed for this concept to prove useful is that the relation between logbook and dockside data sources remains fairly stable over a period of years. One might, for example, set a target of $50 - 200$ trips in Florida each year, and conduct assessments such as tests for equivalence on a growing set of data as time proceeds. Given sufficient time for data to accumulate (to the level of about one static design study), a moving window of trips could then be used to assess agreement between data sources from that point on.

There are a number of possible modifications to the sequential framework that could be considered. For example, one could make use of a low-effort sequential framework punctuated by a larger static sampling effort once every so often (such as once every 10 or 15 years). One could use a sequential framework within a shorter period of 1 to 2 years and increase or decrease sampling effort within that

time period as indicated by results that are updated every week or month.

This framework for a verification program is essentially that of attempting to rely on small sampling effort conducted every season or year, with a required willingness to treat data over multiple years as coming from similar populations of trips. Modifications are possible that amount to "bet-hedging" strategies in terms of this assumption.

Charter-Boat Logbook Reporting Pilot Study
Vessel Status Verification Sampling

Mark S. Kaiser

Dept. of Statistics, Iowa State University

Prepared for

Marine Resources Assessment Group Americas

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1 Introduction

This report is a companion to a previous report titled "Charter-Boat Logbook Reporting Pilot Study Verification Sampling" dated January 2012. That report considered sampling for verification of logbook records as a data source for estimation of catch in the charter fishery of the Gulf of Mexico. This report considers a similar question for sampling to verify vessel status and, in particular, sampling to determine the proportion of fishing trips taken for which logbook reports are filed. In the report "Charter-Boat Logbook Reporting Pilot Study Initial Examination of Data", dated August 2011, somewhat less than 70% of all verified trips taken in the first nine months of the pilot study had corresponding logbook records, that this was due primarily to the failure of captains to file any type of report (either logbook or inactive), and that this was reasonably consistent across the enire 9 month period (i.e., not due to low initial compliance only). Confidence intervals for the proportion of confirmed trips for which logbook records were submitted were (0.631, 0.724) for Florida and (0.579, 0.768) in Texas. These findings raised the possibility that logbook records could be taken as representing about 67% to 68% of trips and an adjustment factor of 1.47 to 1.49 could be applied to estimated catch if based on a logbook data source.

If logbook data were to be used in such a manner, it would be desirable for a periodic verification program to determine whether the proportion of verified trips having logbook reports has remained relatively stable or has changed, the latter presumably prompting a change in the adjustment factor used to determine total catch. The purpose of this report is to examine the question of how extensive such a sampling program would need to be in order to determine, with various levels of confidence, whether the proportion of trips having logbook records has changed or not. It is assumed that a sampling program would utilize essentially the same protocol as what in the pilot study was called by the Marine Recreational Information Program (MRIP) "pre-validation" sampling, and in the previous Marine Resources Assess-

ment Group (MRAG) was called "activity monitoring". The question of primary interest cannot be entirely divorced from the manner in which the proportion of trips with logbook reports P is estimated. In much of this report it is assumed that a maximum likelihood estimator of P as a binomial parameter will be used, which is simply the observed proportion, but a Bayesian approach will also be considered.

1.1 Note on Texas

In preparation of this report it was discovered that data files for Texas used here (having the entire pilot study) did not always match those used for the analysis using the first nine months of the study. This was traced to a possible difficulty caused by the addition of records from something called the "Texas A & M study". Records flagged as being attributable to that study were removed from the data files used here, but apparently this also included some records that had been present in the previous data files used in the report on examination of the first nine months of data. This was not an issue for data from Florida. What were given by MRIP as complete data files for the entire study were used in preparation of this report, after deletion of any records flagged as having come from the Texas A & M study.

2 Monte Carlo Simulation Study

2.1 Logistical Considerations

From a statistical viewpoint it is tempting to recommend some approach to this problem based on the methodologies of process control (or quality control). Under this type of approach a 'control chart' is constructed for use through time to detect times at which the proportion of verifiable trips having logbook reports deviates in a meaningful way from a baseline (e.g., 70%). Somewhat similar would be an approach based on sequential likelihood ratio tests for which control is possible over

both Type I and Type II testing errors. While pleasing from the perspective of what is desired in terms of analysis, such approaches would also require some (at least moderate) level of monitoring activity on a continual basis. It is surmised that, given the expenses, availability of personnel, and other logistics connected with sampling vessel activity, these are most likely not a viable options.

The effect of logistics on potential stratifications and other possible restrictions on sampling are largely unknown at this time, similar to the situation for assessing the level of dockside sampling in a verification program (see the report "Charter-Boat Logbook Reporting Pilot Study Verification Sampling", January 2012). In the case of vessel activity, however, something is known about the distribution of status categories (e.g., In, Out Fishing, Unable to Verify) among status monitoring records (see, e.g., Table 1 in the report of January 2012). The distribution of sampling effort over time in the pilot study is quite distinct from the distribution of numbers of verified fishing trips. This is emphasized in the histograms of Figure 1 and Figure 2, which show the distribution of sample records (upper panels) and distribution of number of verified fishing trips (lower panels) for Florida and Texas, respectively. While an effort was made to distribute sampling effort in a fairly even manner over time in the pilot study, fishing effort shows its expected pattern with the greatest frequency of verifiable trips occurring in June-July, followed by May and August, and much lower frequencies in the other months, especially December-February. Because of the uneven distribution of fishing activity over months and our desire to determine the proportion of verifiable trips for which logbook reports are available, in the Monte Carlo assessment of sampling effort to follow, a stratified random sampling strategy was employed in which samples were allocated across months according to a rough summary of how the proportions of verified trips were distributed over months. First, it was determined that sampling in November through February would simply not be cost effective, and these months were not given further consideration. Each of the remaining months was taken to represent its own stratum, resulting in eight

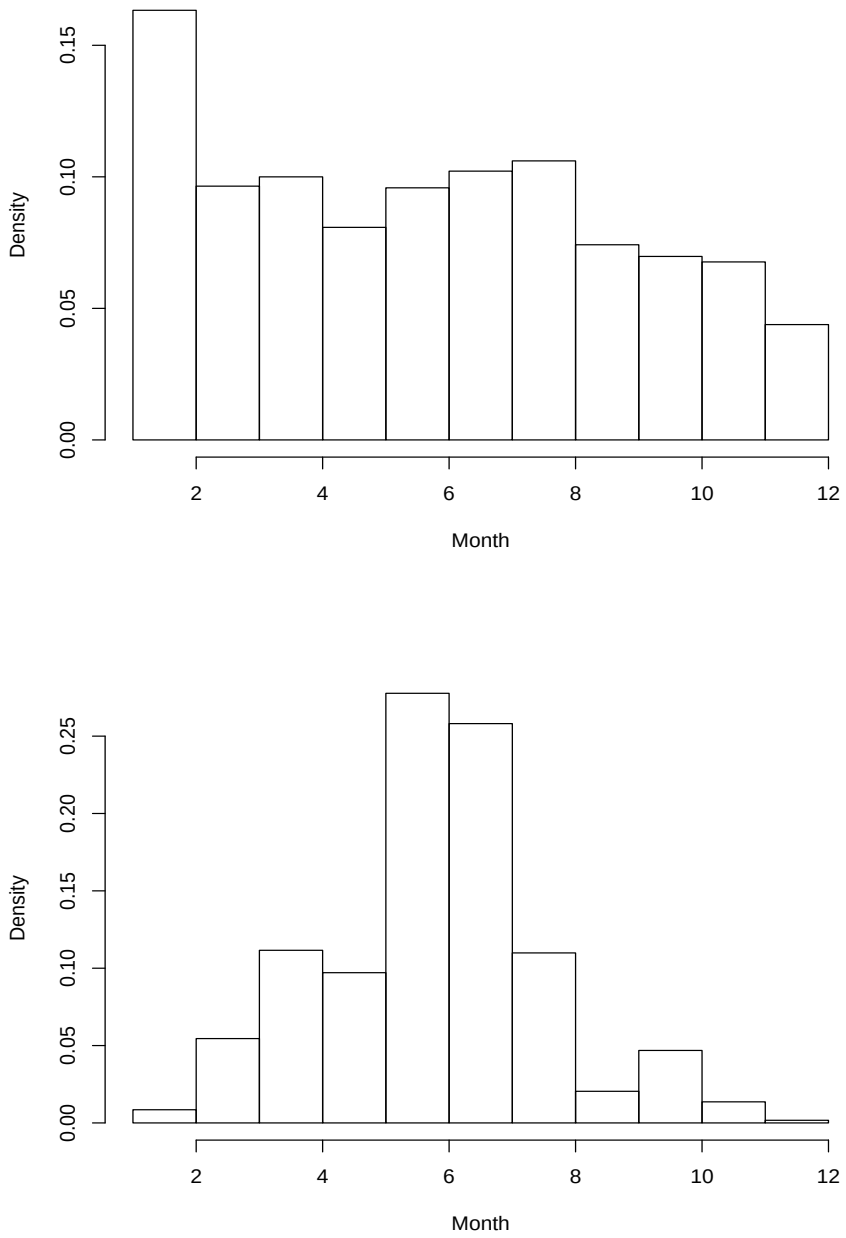

Figure 1: Distributions of the number of monitoring records (upper) and number of verified fishing trips (lower) in Florida.

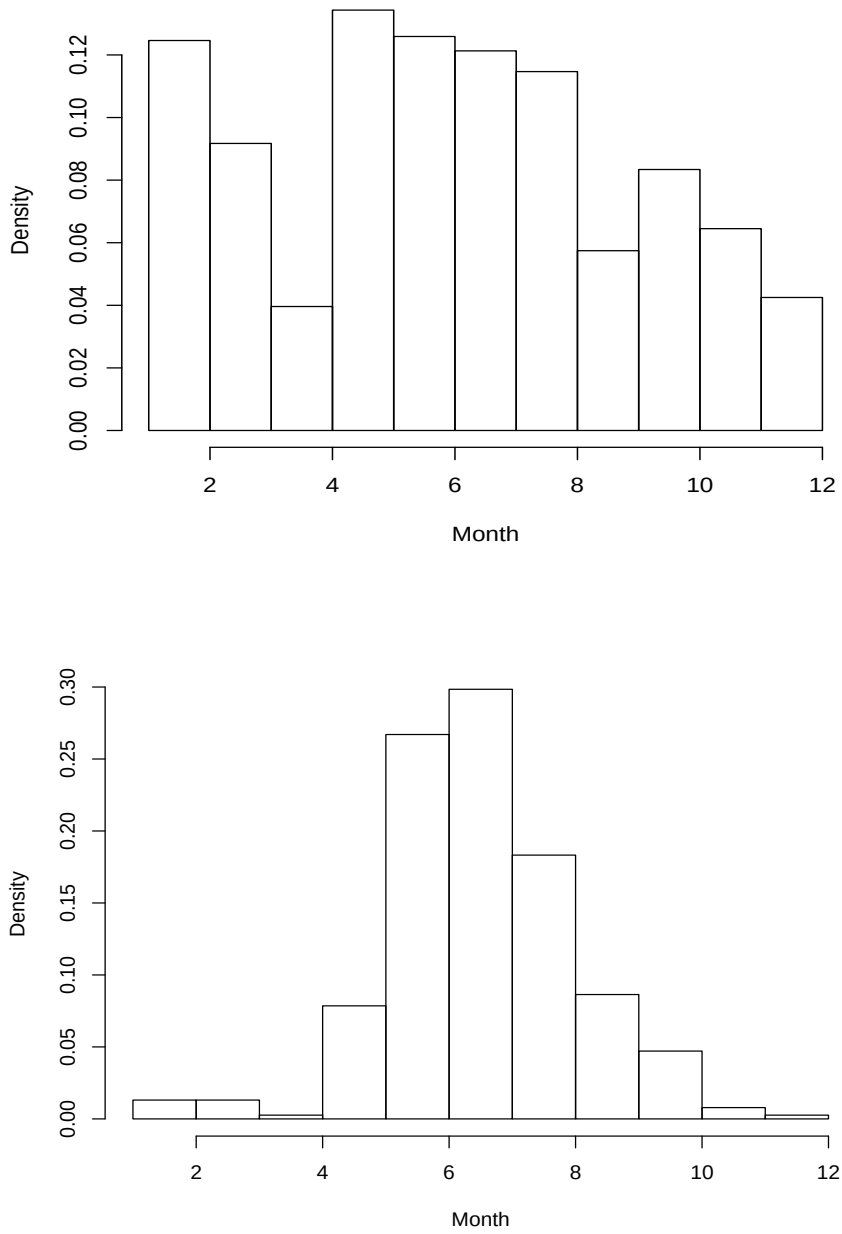

Figure 2: Distributions of the number of monitoring records (upper) and number of verified fishing trips (lower) in Texas.

strata for the purposes of sampling. Note here that stratified sampling was **not** used in an effort to increase precision (its typically role in a statistical sampling problem). Stratification was used as a device to increase the number of verified trips while at the same time maintaining a reasonable temporal coverage (it would likely not be desirable for the industry to know that sampling only occurs in June, for example). It is assume that the proportion of verifiable trips having logbook reports remains reasonably stable over time, as suggested in a previous report. Thus, estimation of proportions and computation of intervals was accomplished using standard formulas developed for simple random samples.

Based on proportions of verified trips that occurred in various months in the pilot study, a "baseline sample" of $n = 26$ days was determined for use in the Monte Carlo assessment procedure. The sample sizes for this baseline setting are presented in Table 1. In the Monte Carlo assessment procedure this baseline sample was increased by factors of 2 and 3 for samples of $n = 52$ and $n = 78$ days. Note that by taking a sampling unit to be a day, the number of verified trips (the denominator of the proportion of verified trips with logbook reports) is random, not fixed. This is also what would happen in practice, because there is not a list (or "sampling frame") of verified trips from which to choose.

Month	Allocation	Month	Allocation	Month	Allocation
Jan	0	May	3	Sept	2
Feb	0	June	6	Oct	2
March	2	July	6	Nov	0
April	2	Aug	3	Dec	0

Table 1: Sample allocation across months for the baseline sample size used in the Monte Carlo procedure of this report.

2.2 Basic Simulation Study Design

In a manner similar to the assessment of necessary effort in a verification sampling program for catch (see "Charter-Boat Logbook Reporting Pilot Study Verification Sampling, January 2012), the total number of prevalidation or activity monitoring records were taken as a "population" of such records, from which repeated samples were selected by sampling days according to a stratified random design as multiples of the baseline sample sizes of Table 1. Over all 12 months the true proportion of verified trips with logbook reports in the Florida population is 0.713 and in the Texas population is 0.493. These values for only the 8 months used in the Monte Carlo assessment to follow were 0.72 for Florida, and 0.494 for Texas. The values for Texas are decreased substantially from that computed using data from only the first nine months of the study, but that for Florida was similar to the previous value at about 70% (see the note of Section 1.1 on data from Texas).

Monte Carlo sample size was determined using a procedure similar to that described in Section 2.4 of the report "Charter-Boat Logbook Reporting Pilot Study Verification Sampling", January 2012. A plot analogous to Figure 1 of that previous report is presented in Figure 3. With a Monte Carlo sample size of $M = 2500$, the Monte Carlo approximation to $E(\hat{P})$ for a sample size of $n = 26$ in Florida was 0.747, having a 95% interval approximation of (0.746, 0.748) which was judged at provide sufficient precision in the assessment study. Note that this approximation is slightly different than the known "population value" of 0.71 because, while stratified sampling was used, Monte Carlo approximations were computed assuming a simple random sample. This is appropriate here because stratified sampling was used *not* as a blocking mechanism (to isolate sub-populations with distinct behaviors) but rather as a simple expedient to avoid sampling many days with no verifiable trips in months with low fishing activity. That is, stratified sampling was used to reflect logistical constraints in a realistic program, not as a device to improve statistical precision. Each subsequent Monte Carlo simulation conducted then used a Monte

Carlo sample size of $M = 2500$ (i.e., simulations at each of the various sample sizes considered).

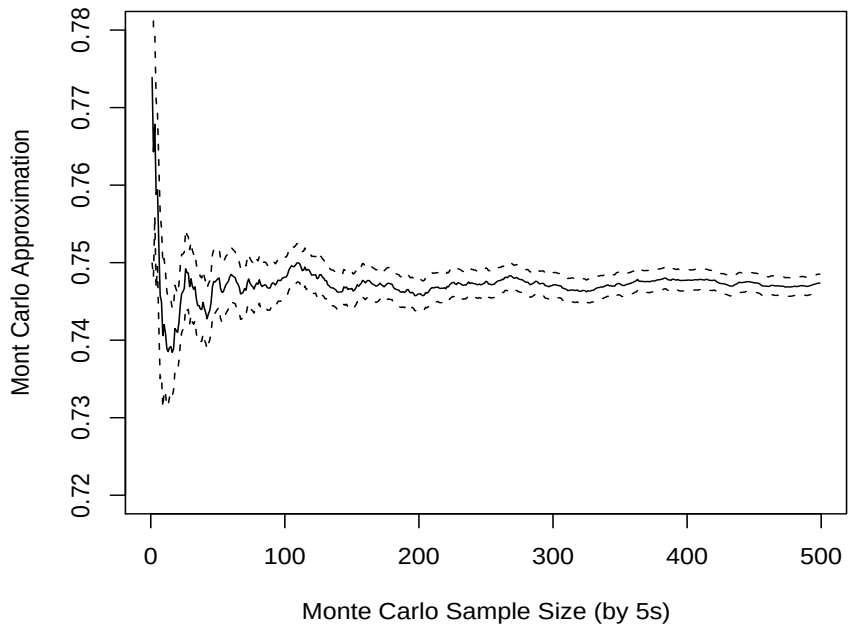

Figure 3: Monte Carlo approximations for proportion of verified trips with logbook reports as Monte Carlo sample size increases, using sample size $n = 26$.

2.3 Assessment Criteria and Practical Decision Processes

In the Monte Carlo assessment, repeated samples will be taken from the "population", the proportion of verified trips in those samples with corresponding logbook reports computed, and interval estimates for the "true" proportion calculated based on typical large-sample normal theory approximations suitable for random samples. How should these samples be assessed, particularly in terms of the question of whether the sample size used was "large enough"? The approach taken here is that the criteria used for assessing the performance of the procedure in Monte Carlo

investigation should reflect basic aspects of the type of decision process that would be used in practice. A number of decision problems can be formulated and, lacking definitive guidance from MRIP, several of the more readily identifiable choices are suggested here.

1. A decision problem could be formulated as the need to choose between two actions, retaining use of a previously acceptable value P_0 for the proportion, or implementing the use of a new value based either on the current sample or the initiation of a more extensive sampling program (from which to determine a new value).

   This framework suggests a test of hypotheses $H_0 : P = P_0$ versus $H_1 : P \neq P_0$, but with the difference from the usual testing situation that the "working hypothesis" is H_0 rather than H_1. It would, under this circumstance, be foolish to base the decision on failure to reject H_0 unless power were carefully controlled. Aside from sequential procedures (which have been dismissed from a standpoint of the amount of effort required, see the beginning of Section 2.1) there are two possibilities that are apparent.

   (a) One way to avoid rewarding low precision in a decision to "accept" a null hypothesis, is to apply the notion of equivalence testing used for assessment of verification sampling for catch quantities and disposition (see Section 2.3 of the report "Charter-Boat Logbook Reporting Pilot Study Verification Sampling", January 2012). Here, values are needed to define a "zone of indifference" (δ_1, δ_2) such that, given the "target value" P_0 and an estimated value $\hat{P}$, we are willing to judge the target as verified by the sample if an interval estimate for P lies entirely within the interval (δ_1, δ_2). The choice of δ_1 and δ_2 is arbitrary and should be based on the degree to which departure from the target will affect the results of estimation. At this time it is not known how MRIP might make use of

logbook data in estimation or making inferences about catch in the for-hire recreational fishery. Thus, it is not possible to quantify the effect of misspecified adjustment factors based on the assumed proportion of trips represented by logbook reports. To allow progress, values of $\delta_1 = P_0 - 0.05$ and $\delta_2 = P_0 + 0.05$ were set for the Monte Carlo study. Specifically, a sample was judged as having verified use of an adjustment value based on the assumption that the proportion of trips represented in the logbook database is P_0 if the interval estimate of P was entirely contained in the interval $(P_0 - 0.05,\ P_0 + 0.05)$.

(b) An approach that is less stringent than that of equivalence, but can still help protect against accepting a hypothesized value due only to low precision, would be to base a decision rule on whether the previously acceptable value P_0 falls in the interior of an interval estimate based on the current sample (accept P_0 if it is in the interior of an interval estimate and reject P_0 if it is not), but only if the width of the interval meets a pre-determined specification. In the Monte Carlo study this width was taken to be 0.10. While this approach does seem practical, it does suffer two deficiencies. First, the theoretical properties of this procedure are not readily available so that is has an *ad hoc* flavor. This is not desirable, but could be mitigated to a large extent through simulation. More importantly, this approach is not a definitive decision procedure in that intervals that fail to meet the specified width criterion (here, 0.10) do not provide guidance about what decision should be made. The obvious remedy is to determine that such an instance should prompt additional sampling until interval width is within the acceptable limits. But this would require analysis early enough in the year to allow additional sampling if needed, and brings the entire procedure closer to the type of sequential evaluation earlier rejected as most likely unfeasible from a logistical standpoint.

2. A different viewpoint would be to simply approach determination of P as an entirely new estimation problem each time activity monitoring samples are taken. In application, this approach avoids the need to worry about Type II errors in testing or precision in interval estimation, but it does not really alleviate the problem, it simply ignores it. That is, this option admits that the resources may not be available to properly solve the problem and takes objective to be one of "doing the best we can". The primary danger with this approach is that it may lead to unstable estimates of the proportion of trips represented by logbook reports over time. If that proportion is in truth relatively stable over time, then the use of this approach could produce wild (and false) fluctuations in estimated catch from year to year (or season to season if that is the time frame used). On the other hand, if that proportion does in fact fluctuate substantially over time, then this approach would be more responsive to those fluctuations than either of those described under item 1. Indications at this time, from previous examination of the pilot study data, seem to support the notion that the proportion of trips reflected in the number of logbook reports filed is reasonably stable over seasons. But note that the entire pilot study encompassed only one year.

Based on the considerations just discussed, three criteria were selected for assessment in the Monte Carlo procedure conducted. For each Monte Carlo sample, two decision criteria were computed for each of two "hypothesized" values. One criterion was that of equivalence with the hypothesized value as an indicator of whether equivalence was declared (value 1) or not (value 0). The zone of indifference was defined as $(P_0 - 0.05,\ P_0 + 0.05)$ as described in the previous item $1a$. The average of these indicators over the 2500 Monte Carlo samples then approximates the probability that equivalence would be declared under this rule. If equivalence is declared, then the hypothesized value P_0 is used. If equivalence is not declared, then a new estimate is produced. The other decision criterion used was whether

the hypothesized value was contained in an interval estimate of width no greater than 0.10. Here, there are three possible outcomes. If the value is contained in a sufficiently precise interval the hypothesized value is accepted for continued use. If the value is not contained in a sufficiently precise interval the hypothesized value is rejected for use, and a new estimate is produced. If the interval is not narrow enough, no decision is reached. In addition to these two decision-based criteria, the distribution of estimated values $\hat{P}$ was considered over the Monte Carlo data sets. In particular, The 0.025, 0.05, 0.950 and 0.975 quantiles of these distributions were computed.

3 Results for Florida

Results of simulations using data from Florida are reported on in this section. Table 2 presents summary values over all $M = 2500$ Monte Carlo samples for each of sample sizes $n = 26$, $n = 52$ and $n = 78$. In particular, the values of Table 2 are all Monte Carlo approximations to expected values, the expected number of verifiable trips n_v, the expected estimate $\hat{P}$, and expected endpoints of 90% and 95% interval estimates of P (the column labeled $E(L_{90})$ is the expected lower endpoint of a 90% interval and so forth).

	Monte Carlo Approximation					
Sample Size	$E(n_v)$	$E(\hat{P})$	$E(L_{90})$	$E(U_{90})$	$E(L_{95})$	$E(U_{95})$
$n = 26$	186.1	0.747	0.695	0.799	0.686	0.809
$n = 52$	370.8	0.747	0.711	0.783	0.704	0.790
$n = 78$	558.4	0.747	0.718	0.777	0.712	0.782

Table 2: Monte Carlo approximations based on various sample sizes for the Florida data.

The values of Table 2 indicate a small bias (of slightly less than 3%) introduced by

the use of stratified sampling but estimation under an assumption of simple random sampling for this "constructed" population (for which the true value is $P = 0.72$). Lower interval endpoints increase and upper endpoints decrease as sample size goes up (as would be expected) but not at a fast pace. The increase in lower enpoints (or decrease in upper endpoints) as sample size increases from $n = 26$ to $n = 78$ days is only about 2/3 of the bias. Despite this, a change in both endpoints of 0.023 to 0.025 is still about 40% to 50% of the specified zone of indifference of 0.10 and we would anticipate an effect in terms of the equivalence criterion.

Monte Carlo approximations to the probabilities that a decision is made to retain use of hypothesized values of 0.70 (from the original population including all months) or 0.72 (from the population actually used in the Monte Carlo study) are presented in Table 3 for the equivalence-based decision procedure outlined in item 1a of Section 2.3.

		Confidence 90%		Confidence 95%	
Sample Size	H_0 Value	Use P_0	New $\hat{P}$	Use P_0	New $\hat{P}$
$n = 26$	$P_0 = 0.70$	0.006	0.994	0.000	1.000
$n = 52$	$P_0 = 0.70$	0.025	0.975	0.005	0.995
$n = 78$	$P_0 = 0.70$	0.060	0.940	0.006	0.994
$n = 26$	$P_0 = 0.72$	0.025	0.965	0.001	0.999
$n = 52$	$P_0 = 0.72$	0.219	0.781	0.089	0.911
$n = 78$	$P_0 = 0.72$	0.270	0.730	0.127	0.873

Table 3: Monte Carlo approximations to probabilities that P_0 is accepted for continued use under the decision procedure based on equivalence testing.

The values of Table 3 are not encouraging relative to the possibility that the equivalence-based decision rule could be effectively used in practice. The probability of accepting the value of P_0 for continued use is low across all sample sizes, and even

for the adjusted value of $P_0 = 0.72$. This is due to the seemingly small bias shown in Table 2 for estimation of P from the sampling procedure employed in the Monte Carlo assessment. As will be seen in what follows, the probability that an interval estimate has width less than 0.10 is extremely high for sample sizes of $n = 52$ and $n = 78$ days. The failure of these intervals to lie entirely within a zone of indifference defined as $(P_0 - 0.05,\ P_0 + 0.05)$ is caused by the departure of estimated values $\hat{P}$ from the target P_0.

Results analogous to those of Table 3 related to the second decision procedure as described in item 1*b* of Section 2.3 are presented in Table 4. The column labeled "ND" in Table 4 corresponds to No Decision

		Confidence 90%			Confidence 95%		
Sample Size	H_0 Value	Use P_0	New $\hat{P}$	ND	Use P_0	New $\hat{P}$	ND
$n = 26$	$P_0 = 0.70$	0.184	0.252	0.564	0.010	0.019	0.971
$n = 52$	$P_0 = 0.70$	0.292	0.707	0.001	0.393	0.582	0.025
$n = 78$	$P_0 = 0.70$	0.060	0.940	0.000	0.146	0.854	0.000
$n = 26$	$P_0 = 0.72$	0.299	0.137	0.564	0.019	0.010	0.971
$n = 52$	$P_0 = 0.72$	0.684	0.315	0.001	0.775	0.200	0.025
$n = 78$	$P_0 = 0.72$	0.568	0.432	0.000	0.748	0.252	0.000

Table 4: Monte Carlo approximations to probabilities that P_0 is accepted for continued use under the second decision procedure based on interval width and coverage.

As previously mentioned, this second decision criterion is less stringent than the one based on equivalence testing, and that is reflected in the increase in decisions that correspond to continued use of P_0 relative to Table 3. Nevertheless, the probabilities for continued use of P_0 are small to only moderate until sample size reaches $n = 78$ days and somewhere between 26 and 52 days are needed before the probability of this procedure resulting in no decision falls below 50%. The effect of what had

previously seemed an almost inconsequential bias is again evident in the values of Table 4. For example, the drop in the probability to continue use of P_0 between $n = 52$ and $n = 78$ for $P_0 = 0.70$, desipte the fact that interval widths are always less than the specified value of 0.10 can only be due to a shift in interval location caused by the fact that the expected value of $\hat{P}$ under this sampling scheme is 0.74 (by Monte Carlo approximation) while the hypothesized values are smaller than that. When the hypothesized value is $P_0 = 0.72$ this drop is less pronounced. Essentially, what is happening is that as sample size increases interval widths are decreasing (as they should), but the center of those intervals differs from the hypothesized values so that those values are often not included in the interval.

Overall, some consideration could be given to this procedure. If it would be possible to sample at least more than 26 (a guess would put the lower limit at $30 - 35$) days, some stability might result in values used as the proportion of trips having logbook reports. On the other hand, given that this procedure does not have easily discernible properties it might be open to criticism and also appears likely to require new estimation of P at least 25% of the time even if sample size is $n = 78$ days.

If the procedure of item 2.3 were adopted, the question becomes how much additional uncertainty is introduced into estimation of catch due to variability in frequent re-estimation of P. Figure 4 presents empirical distributions (in the form of histograms) of values of $\hat{P}$ from the Monte Carlo simulations with different sample sizes. Each histogram is constructed from 2500 estimates. The horizontal and vertical scales of these plots are the same so that the effect of increasing sample size on distribution is visually evident. These histograms represent the sampling distributions of $\hat{P}$ under the Monte Carlo simulation design, and the quantiles of those distributions provides information as to how much variation one might expect from repeated estimation. The 0.025, 0.05, 0.95, and 0.975 quantiles of the three distributions of Figure 4 are given in Table 5.

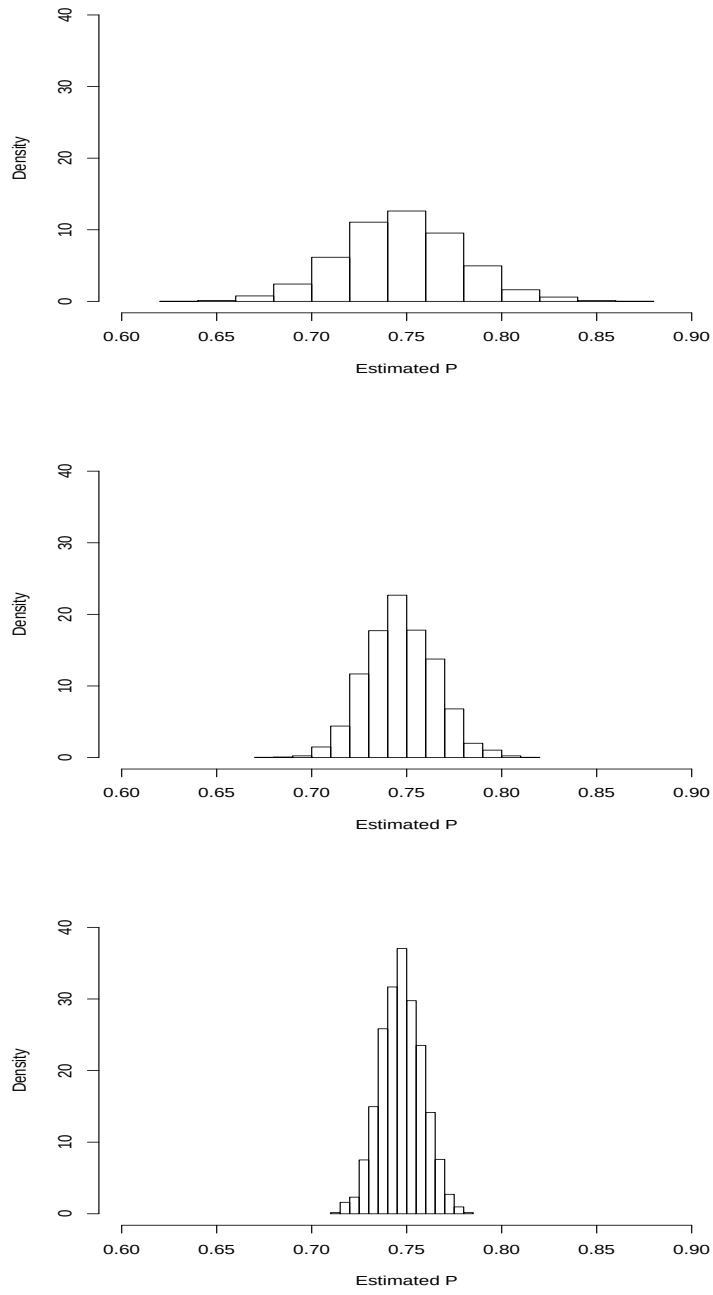

Figure 4: Histograms of Monte Carlo values of $\hat{P}$ for sample sizes of $n = 26$ days (upper panel), $n = 52$ days (middle panel) and $n = 78$ days (lower panel) using data from Florida.

Sample Size	$q_{0.025}$	$q_{0.050}$	$q_{0.950}$	$q_{0.975}$
$n = 26$	0.690	0.698	0.800	0.811
$n = 52$	0.712	0.717	0.776	0.782
$n = 78$	0.726	0.729	0.766	0.769

Table 5: Quantiles of the MC sampling distributions of $\hat{P}$ for three sample sizes.

The difference between $q_{0.950}$ and $q_{0.050}$ in Table 5 is slightly less than that between expected endpoints of 90% interval estimates from Table 2, and similarly for the difference between $q_{0.975}$ and $q_{0.025}$ relative to the expected endpoints of 95% intervals. This suggests that the instability in a correction factor for logbook catch data based on frequent estimates of P as under the strategy of item 2 in Section 2.3 may not be prohibitively large relative to the other strategies (especially when one considers how often they require re-estimation of P anyway). The deficiency of this exercise as a way to determine how variable individual estimates (say yearly or even semi-annually) of P will be is that the "population" used in the Monte Carlo exercise was fixed. Given that logbook reports are filed for only some fraction of trips (which might be thought of as a "sample" in its own right), in actual practice a program would be sampling a different "sample"each year, even if the true underlying population was static (and this is of course not true either). Thus, the variability suggested by the quantiles of Table 5 are most certainly under-estimates of the actual variability that would result.

Taken as a whole, these results using data from Florida suggest that neither of the strategies that one would hope would lend some stability to estimation of the proportion of trips that end up having logbook reports are likely to function in that manner unless the level of effort that can be devoted to an ongoing sampling program is a substantial fraction of that used in the pilot study. That is, neither of the procedures in item 1 of Section 2.3 appear to offer enough benefit to outweigh

their cost in complicating the overall process of using logbook data in estimation of catch (and effort). We are, thus, back at the original problem of attempting to lend some stability to estimates of P produced repeatedly (e.g., yearly) from small to moderate samples. The next section offers a possible solution.

4 Bayesian Estimation with Informative Prior Information

It is not known how MRIP or NMFS intends to estimate the total catch of various species in the for-hire recreational portion of the Gulf fishery. The suggestion for estimating P described in this section should combine well with an overall Bayesian approach for estimation (meaning that uncertainty in estimation of P could be readily combined with other uncertainties to arrive at an quantification of uncertainty in estimation of the final quantities desired). Other, more *ad hoc*, approaches to the overall estimation problem using different sources of data might rely on either Taylor expansion for estimating variances (with which Bayesian estimation of P might be difficult to combine) or some type of a bootstrap procedure (with which Bayesian estimation of P might be more possible to combine with other uncertainty estimates, although how this would be accomplished is not obvious). Although such considerations are important (and cannot be determined at this time) the approach described in this section can be motivated for estimation of P based solely on the desire to make sample sizes as small as possible while also not introducing too much instability in the estimation process.

Consider a scenario in which the proportion of trips filing logbook reports P is reasonably stable over time, although it will almost certainly fluctuate somewhat. Consider attempting to estimate a sequence of such values $\{P_t : t = 1, \ldots, T\}$ based on fairly small sample sizes which also fluctuate over time $\{n_t : t = 1, \ldots, T\}$. We would like to estimate each value P_t, but in such a way as to protect from dramatic

over- or under-estimation because of the small sample sizes. At the same time, it is also desired to detect major changes in P_t with time as rapidly as possible. This setting essentially describes the problem faced here, as nearly as can be determined by the author of this report. To introduce an approach that provides the potential to achieve much of what is desired, we first briefly describe basic Bayesian estimation of a proportion with a flexible class of prior distributions.

4.1 Bayesian Estimation of P

Suppose that Y is a random variable with a binomial distribution having parameters P and m, that is, the probability mass function of Y is, for $0P < 1$,

$$f(y|P,m) = \frac{m!}{y!\,(m-y)!}\,P^y\,(1-P)^{m-y}; \quad y = 0, 1, \ldots, m. \tag{1}$$

This is exactly the same as what has been assumed about sampling for activity in the previous sections of this report, so nothing has changed yet. For a given time period (e.g., year) in our problem, m is the number of verifiable trips from a sample of n days, Y is the number of those with a corresponding logbook report, and P is the proportion to be estimated. For a Bayesian analysis we assume P is a fixed "true" unknown quantity, just as in any other statistical analysis.

Now consider quantifying what we believe about the value of P in the form a a probability distribution called a *prior distribution*. This is the same type of distribution one might apply to one's belief that it will rain tomorrow, or one's belief that Florida State will win its next football game against Florida. Because $0 < P < 1$ must be true, a convenient distribution to represent the distribution of our beliefs about the possible values of P is a beta probability density function,

$$\pi(P|\alpha,\beta) = \frac{\Gamma(\alpha+\beta)}{\Gamma(\alpha)\,\Gamma(\beta)}\,P^{\alpha-1}\,(1-P)^{\beta-1}; \quad 0 < P < 1, \tag{2}$$

where $\alpha > 0$ and $\beta > 0$ are specified parameter values (not unknown values to be estimated).

We would like to combine our prior beliefs about possible values of P with the evidence gained from observation of Y in the data. This is accomplished through derivation of the *posterior distribution* which, based on the rules of probability is

$$p(P|y, \alpha, \beta, m) = \frac{f(y|P, m)\, \pi(P|\alpha, \beta)}{\int f(y|P, m)\, \pi(P|\alpha, \beta)\, dP}. \tag{3}$$

Standard probability results can be used to show that $p(P|y, m, \alpha, \beta)$ is again a beta distribution with parameters

$$\alpha + y \qquad \text{and} \qquad \beta + m - y. \tag{4}$$

That is, $p(P|y, \alpha, \beta, m)$ has the same functional form as (2) with α replaced by $\alpha + y$ and β replaced by $\beta + m - y$. A Bayes estimate of P is then given by the expected value of the posterior distribution which will be

$$E(P|y) = \frac{\alpha + y}{\alpha + \beta + m}. \tag{5}$$

Now, it may be the case that we wish our posterior beliefs to be influenced only by the observed data so that prior "opinion" has no influence. For example, if m is reasonably large and we truly have no prior beliefs based on previous data, this can be logically justified. In practice this is often accomplished by taking $\alpha = 1$ and $\beta = 1$ in (2) which results in π being a uniform distribution on the interval (0, 1) which is, at least on the scale of observation, non-informative about where P may lie between 0 and 1. But there are other cases, which I will argue is true of our current problem, in which we will not have a large m and we do have solid prior beliefs that are based on previous data, not just personal opinion. In these cases, we would like to choose α and β in a manner that allows the prior to have some (maybe even substantial) effect as well as the current data y.

To make the case for use of an informative prior in context of this problem, consider a situation in which, based on previous observations, we have a solid degree of confidence that $0.60 < P < 0.80$; say we are willing to place 90% of our belief

about P in this interval. The notation for this example follows what has been developed to this point in the report, but the problem could be generic, such as the probability a given species is caught in a research cruise tow from a particular zone or habitat type. In a current time period (e.g., year) we obtain a small amount of data that yield $m = 20$ and $y = 10$. Now, the usual non-Bayesian estimate of P would be $\hat{P} = 10/20 = 0.50$. While this estimate is purely data-driven and must certainly be considered "objective" from that viewpoint, it would seem biologically implausible. We would (correctly) attribute this occurrence to variability in observed data and a sample size that is "too small", rather than to such a dramatic shift in the actual value of P. A Bayes estimate with a uniform prior ($\alpha = \beta = 1$) would be $\hat{P} = 11/22 = 0.50$. Now, using this prior would have been a rather silly thing to do, because a uniform prior places only probability 0.20 on the interval $0.60 < P < 0.80$, while we have already stated that our prior probability for this interval is 0.90. An alternative prior would be to take $\alpha = 2.10$ and $\beta = 0.90$ which has prior expected value $\alpha/(\alpha + \beta) = 0.70$, which is more in line with our actual prior beliefs than the uniform prior. With this prior, our Bayes estimate would be $\hat{P} = 12.1/23 = 0.53$, which seems hardly any improvement over the uniform prior. But the probability this prior places on the interval (0.60, 0.80) is still only 0.27, far shy of our prior level of confidence. Another prior could take $\alpha = 44.3$ and $\beta = 19.0$, which has prior expectation 0.70 and places probability 0.90 on the interval (0.60, 0.80). Now, a Bayes estimate is $\hat{P} = 54.3/83.3 = 0.65$. We certainly would still view this as a small value (which is indicated by the data we have available), but no longer as biologically implausible.

The point of the preceding contrived example is that one can produce "biological stability" in estimation even from fairly small data sets by making use of informative priors. If an informative prior is based on previous data, then it cannot be dismissed as "subjective" or "made up", and I will claim that, given the setting of our example, most fisheries scientists would be more comfortable believing that the current value

of P is close to 0.65 than believing that the current value of P is close to 0.50 (which would most likely be a record low if we had sufficient reason to place prior probability 0.90 between 0.60 and 0.80).

The question in making use of informative priors is "how strong" that prior information should be. How do we produce stability in estimation without allowing insensitivity to real changes that may be reflected by even small data sets. In the previous example, if the next year (or time period) of data also had an observed proportion that was small (say 0.57) we now have quite a bit more evidence for a dramatic drop in the value of P from where it must have been for us to form our opinion about the interval (0.60, 0.80). In addition, we would also like to avoid having "too much" prior influence in situations for which data size is not "too small", but is perhaps not overwhelmingly large, either. There is a need to produce some degree of balance between prior strength, current sample size, and responsiveness to data shifts. The basic elements for accomplishing this are described in the next section, although there remain details to be worked out.

4.2 Formulating Informative Priors

There are two basic tools that can provide guidance in selecting values of α and β for use in (2) as a prior for data model (1) such that the prior has the desired amount of strength (or influence on the posterior expectation). The first of these has been illustrated in the example of the previous subsection and is to locate parameter values that match certain values with quantiles of the prior distribution. The calculations needed to accomplish such matching are not difficult but do require numerical integration and the ability to execute one-dimensional search algorithms such as bisection. A potential difficulty with this device is if one desires control over probabilities on two distinct intervals. There may not exist parameter values that can produce the desired probabilities for distinct intervals in the same beta distribution.

Another fundamental tool in selection of prior parameter values is to consider the number of current observations one wishes prior information to be "worth" in determining the posterior. Consider here the forms of prior and posterior expected values

$$E(P) = \frac{\alpha}{\alpha + \beta} \quad \text{and} \quad E(P|y) = \frac{\alpha + y}{\alpha + \beta + m}. \tag{6}$$

Examination of the forms given in (6) reveals that α is analogous to the number of "successes" (i.e. y) out of $\alpha+\beta$ "trials" (i.e., m) in a previous binomial observation. Thus, in the example at the end of Section 4.1, the uniform prior of $\alpha = \beta = 1$ implies that our prior information is "worth" a binomial having 1 success out of 2 trials (for a prior expectation of 0.50). The stronger prior of $\alpha = 44.3$ and $\beta = 19$ implies that we believe our prior information is worth about 44 successes in 63 trials. In this case, our prior provided more information to the posterior than did the data which had $y = 10$ successes out of $m = 20$ trials.

A general strategy for choosing prior parameters is to select a prior expectation (prior best guess) and an interval about that expectation that contains a given proportion of our beliefs (e.g., 75%, 90% or 95% depending on how confident we are in our prior knowledge). This is sufficient to identify prior parameter values α and β that at least roughly match the specified probability for use in (2). As a check on these values, the relation between prior and current "'sample size" as displayed in (6) is considered to determine if our initial assignment of probability to an interval is reasonable. For example, we might select a prior expected value of 0.70, and an interval (0.65, 0.75) to covers 95% of our prior beliefs. This leads to values $\alpha = 233.33$ and $\beta = 100$. These values correspond to a situation in which we would put the "worth" of our prior information at about 233 "successes" out of 333 "trials". If we are anticipating a sampling program of 26 days, our expected number of "trials" (verified trips) is about 186 (see Table 2) so that we are giving our prior information about 1.8 times the weight that our data will have. We may judge this as allowing the prior too much influence on the eventual estimate of P. This could

then lead to one of two adjustments. We may believe it to be worth the expense and effort to increase the sample to 52 days (for example) which would increase the expected number of verified trips to 370 so that now our prior will have about 90% as much weight as the data to be collected. Alternatively, we could revise our prior opinion by decreasing the amount of prior probability we wish to assign to the interval (0.65, 0.75) or by increasing the width of the interval to which we wish to assign 95% prior probability, perhaps to (0.60, 0.80). We could then re-calculate prior parameter values and repeat the assessment of prior strength. This process could be iterated until a set of prior parameters are determined that balance our prior assignment of probability and our wish for relative influence of prior and data on estimation of P in the current time period.

4.3 An Example

To examine how this Bayesian procedure would compare with the strategies examined previously, an additional Monte Carlo simulation study was conducted. The primary comparison to be made is with the procedure of item 2 in Section 2.3, in which a new value of P is estimated for each sample taken. An additional 2500 Monte Carlo samples were taken for each of sample sizes $n = 26$ $n = 52$, and $n = 78$. For each sample the Bayes estimate of P was produced from (5) using prior parameters $\alpha = 44.3$ and $\beta = 19$. Histograms of the resulting Bayes estimates are presented in Figure 5. Note that these are not posterior distributions, they are Monte Carlo sampling distributions of Bayes estimates. Comparing the histograms of Figure 5 to those of Figure 4 is using a frequentist property to assess a Bayesian procedure, but that does seem meaningful in this case, even though there is no reason in general to expect Bayesian methods to have good frequentist properties. Visually, the histograms look quite similar. The same quantiles as given in Table 5 are presented in Table 6 for the Bayes estimates of $\hat{P}$.

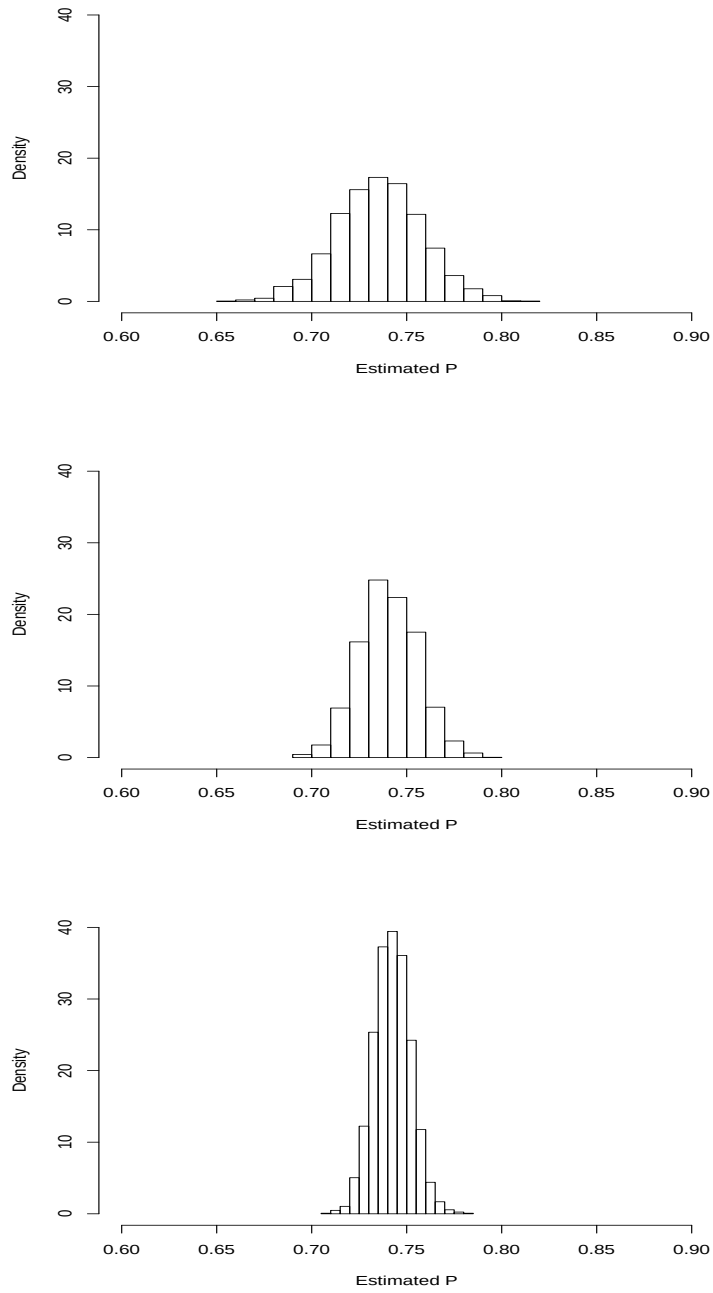

Figure 5: Histograms of Monte Carlo values of Bayes estimates $\hat{P}$ for sample sizes of $n = 26$ days (upper panel), $n = 52$ days (middle panel) and $n = 78$ days (lower panel) using data from Florida.

Sample Size	$q_{0.025}$	$q_{0.050}$	$q_{0.950}$	$q_{0.975}$
$n = 26$	0.690	0.698	0.772	0.780
$n = 52$	0.711	0.716	0.766	0.771
$n = 78$	0.724	0.727	0.758	0.762

Table 6: Quantiles of the MC sampling distributions of Bayes estimates $\hat{P}$ for three sample sizes.

Relative to the values of Table 5, the distributions for Bayes estimates are slightly more concentrated than those for the frequentist estimates, but this is more true for the small sample size than for the larger sample sizes. In particular, the difference between the 0.975 and 0.025 quantiles with $n = 26$ is 0.121 from Table 5 but 0.090 from Table 6, meaning the central 95% of the distribution of Bayes estimates occurs in a range that is only 74% of that for the frequentist estimates. At sample size $n = 52$ the central 95% of the distribution of Bayes estimates is 86% as wide as the frequentist estimates, and at $n = 78$ this value is 88%. What is happening can be understood as follows. In frequentist estimation there is no prior, and the width of the MC sampling distributions represents the amount of variability we would anticipate under this approach to estimation with the given sample sizes. For Bayesian estimation, the estimate is a weighted average of what would result from the prior alone and what would result from the data alone (which is the frequentist estimate). Given the prior chosen for this example, the prior has considerable, although not overwhelming, influence at the smallest sample size of $n = 26$ days. The prior is "worth" about 63 observations (verifiable trips) and the expected number of observations for $n = 26$ is about 186 so the prior is allowed roughly 35 as much influence as the data. If we think of the "total influence" of the data and prior as 100%, the prior accounts for 25% of the influence and the data 75% of the influence. The prior influence makes the replicate estimates more similar than they would

otherwise be, and thus the distribution of Bayes estimates less variable than that of the frequentist estimates. For $n = 52$ days, more weight is being given to the data. The expected number of verifiable trips is now about 370 (see Table 2) so that the prior is allowed about 17% as much influence as the data, or 15% of the total influence while the data account for 85% of the total influence. Because less weight is being given to the prior, the distributions of frequentist and Bayes estimates are more similar, although the prior is still making that distribution somewhat more narrow for the Bayesian than the frequentist estimates. For $n = 78$ days, the data are having considerably more influence than the prior and now the prior accounts for just 10% of the total influence, the data 90%, and the widths of the distributions of frequentist and Bayes estimates is even more similar.

The point of this exercise has been to demonstrate that a judiciously chosen prior can increase the precision of estimates of the proportion of verifiable trips that have logbook reports, without "ignoring" the data. In fact, at all of the sample sizes used the data accounted for at least 3/4 of the influence on estimated values. The use of informative priors can also protect against large fluctuations over time that could occur with small sample sizes. Clearly, it is important how prior parameters are chosen, and this example is not intended to provide a recipe for uninformed use at no risk. The example was intended to illustrate the type of behavior that is possible using this approach.

5 Conclusions

The following conclusions may be drawn on the basis of the work described in this report.

1. The results of the Monte Carlo simulation study largely reflect theoretical properties of sampling from binomial distributions. The precision of estimates in this situation depends on the binomial sample size (here, the number of

verifiable trips) and not the population size (the actual number of trips taken). This is the same phenomenon that allows, for example, political poll results to be given as "plus or minus" 3 or 4 percentage points regardless of whether the poll is local or national. Larger samples are not needed at the national level than at the local level. The one aspect of the simulations that is notable is the effect of the small departure from true random sampling (when using estimators derived to be optimal for random sampling). The small bias that resulted had a substantial effect on procedures based on testing methodologies.

2. Procedures based on equivalence testing or *ad hoc* modifications of the underlying ideas are not recommended for use, partly because of the observed lack of robustness of these procedures to imperfect random sampling and partly because they follow standard binomial theory pretty closely in terms of necessary sample size.

3. Simulations were not conducted with data from Texas, partly because of the confusion with data that is noted in section 1.1, and partly because of the indication that results would follow standard binomial theory. That is, in terms of sample size, the results from Florida should apply directly to Texas. The only question is whether the proportion of verifiable trips filing logbook reports in Texas is similar to that in Florida. Examination of the first nine months of data suggested that this was likely to be the case. That seems to have changed with the current data sets, but the question with data integrity for Texas makes this an uncertain conclusion.

4. The recommended strategy is for a reasonably small monitoring program having about 15 to 25 days of sampling, and estimation using a Bayesian approach with a moderately informative prior to produce a new estimate of P at each sampling period (e.g., year). As is almost always the case, the more sampling that can be conducted the better, but use of a judiciously chosen prior can lend

some stability to the process and avoid the wild swings that might occur (due to small sample sizes and chance) if estimation is by simple raw proportion.

5. Regardless of how the proportion of trips having logbook reports P is estimated, the effect of uncertainty in this value is likely to have a substantial impact on uncertainty in estimation of total catch in the fishery (especially for individual species). Ignoring uncertainty in P in estimation of total catch should not be allowed, and how quantification of uncertainties in various components (e.g., catch per unit effort and number of trips) are combined needs careful attention.

Appendix M. Participant Survey responses for the electronic survey.

Category	Electronic	FL	Percent	TX	Percent
Permit State	Response Rate	79	25%	14	25%
Affiliation with Vessel	Vessel Owner	7	14%	5	36%
	Vessel Owner and Operator	38	75%	7	50%
	Hired Captain and/or crew	2	4%	2	14%
	Employee of charter fishing business	4	8%	0	0%
	Other (please specify)	0	0%	0	0%
	Total	**51**	**100%**	**14**	**100%**
Submission of Trip Reports	Yourself	48	94%	12	24%
	Someone else on your behalf	3	6%	2	4%
	Total	**106**	**100%**	**28**	**27%**
Website Access (Mark All That Apply)	Public computer (such as at a public library)	0	0%	1	6%
	A computer with dial-up Internet access	1	2%	0	0%
	A computer with high-speed Internet access	25	46%	9	56%
	A computer with wireless access	21	39%	3	19%
	Smart phone application	5	9%	3	19%
	Other (please specify)	2	4%	0	0%
	Total	**54**	**100%**	**16**	**100%**
Gulf Logbook Website Support Staff	Very helpful	33	65%	11	79%
	Somewhat helpful	6	12%	2	14%
	Not helpful	2	4%	0	0%
	I did not contact website support staff	8	16%	1	7%
	No Answer	2	4%	0	0%
	Total	**51**	**100%**	**14**	**100%**
Permitted Vessel Actively Charter Fishing >=1 month	Yes	41	80%	10	71%
	No	10	20%	4	29%
	Total	**51**	**100%**	**14**	**100%**

Category	Electronic	FL #	Percent	TX #	Percent
Time Per Report	Less than 1 minute	3	6%	2	14%
	1 to 5 minutes	19	37%	3	21%
	5 to 10 minutes	11	22%	2	14%
	More than 10 minutes	8	16%	3	21%
	No Answer	10	20%	4	29%
	Total	**51**	**100%**	**14**	**100%**
Tracking Released Fish	Kept a written account of released fish while the fishing trip was underway.	18	35%	5	36%
	Wrote down numbers of released fish sometime during the day the fishing trip took place.	15	29%	2	14%
	Wrote down numbers of released fish sometime during the week the fishing trip took place.	5	10%	2	14%
	Wrote down numbers of released fish the following week or later.	2	4%	0	0%
	No Answer	11	22%	5	36%
	Total	**51**	**100%**	**14**	**100%**
Frequency of Reports	I prefer to report information every week on logbooks	12	24%	6	43%
	I prefer to not report information every week on logbooks	17	33%	1	7%
	No preference	12	24%	3	21%
	No Answer	10	20%	4	29%
	Total	**51**	**100%**	**14**	**100%**
Reasons for Preference Not to Submit Weekly Report(Check All That Apply)	Takes too much time	9	17%	1	7%
	Too much confidential information is collected	1	2%	0	0%
	Information in the logbook is inaccurate	1	2%	0	0%
	Other (please specify)	4	7%	0	0%
	No Answer	39	72%	13	93%
	Total	**54**	**100%**	**14**	**100%**
Weekly Email Notification for Late Reports	Very helpful	33	65%	7	50%
	Somewhat helpful	9	18%	3	21%
	Not necessary	6	12%	1	7%
	I did not receive any email reminders	0	0%	1	7%
	I would prefer not to receive email reminders	2	4%	0	0%
	No Answer	1	2%	2	14%
	Total	**51**	**100%**	**14**	**100%**

Category	Electronic	FL #	Percent	TX #	Percent
Monthly Telephone Notification for Late Reports	Very helpful	13	25%	6	43%
	Somewhat helpful	5	10%	1	7%
	Not necessary	11	22%	2	14%
	I did not receive any phone calls for late reports	15	29%	3	21%
	I would prefer not to receive phone calls	6	12%	0	0%
	No Answer	1	2%	2	14%
	Total	**51**	**100%**	**14**	**100%**
State Agency Staff	Very helpful	27	53%	11	79%
	Somewhat helpful	9	18%	0	0%
	Not at all helpful	1	2%	0	0%
	I did not communicate with state staff	13	25%	1	7%
	No Answer	1	2%	2	14%
	Total	**51**	**100%**	**14**	**100%**
Logbook Reporting Support	Yes, with no changes	16	31%	4	29%
	Yes, with minor changes	13	25%	6	43%
	Yes, with major changes	4	8%	0	0%
	No	15	29%	2	14%
	No Answer	3	6%	2	14%
	Total	**51**	**100%**	**14**	**100.00%**

Category	Paper	Number	Percent
Affiliation with Vessel	Vessel Owner	5	17%
	Vessel Owner and Operator	19	66%
	Hired Captain and/or crew	3	10%
	Employee of charter fishing business	1	3%
	No Answer	1	3%
	Total	**29**	
Submission of Trip Reports	Yourself	21	72%
	Someone else on your behalf	6	21%
	No one	1	3%
	No Answer	1	3%
	Total	**29**	
Did you report electronically at any time?	No, used paper logs the entire time	21	72%
	Yes, started with paper then switched to electronic	3	10%
	Yes, started electronic then switched to paper	4	14%
	No Answer	1	3%
	Total	**29**	
Reason for paper reporting (select all that apply)	No access to computer and/or internet	10	34%
	Do not know how to use computer/internet	9	31%
	Paper is more convenient	8	28%
	Other (please specify)	1	3%
	No Answer	1	3%
	Total	**29**	
Vessel Activity	Yes, vessel charter fished	22	76%
	No, vessel was not active as a charter	6	21%
	No Answer	1	3%
	Total	**29**	
Time Per Report	Less than 1 minute	1	3%
	1 to 5 minutes	13	45%
	5 to 10 minutes	6	21%
	More than 10 minutes	3	10%
	No Answer	6	21%
	Total	**29**	
Tracking Released Fish	Kept a written account of released fish while the fishing trip was underway.	11	38%
	Wrote down numbers of released fish sometime during the day the fishing trip took place.	5	17%
	Wrote down numbers of released fish sometime during the week the fishing trip took place.	3	10%
	Wrote down numbers of released fish the following week or later.	2	7%
	No Answer	8	28%
	Total	**29**	

Category	Paper	Number	Percent
Frequency of Reports	I prefer to report information every week on logbooks	7	24%
	I prefer to not report information every week on logbooks	10	34%
	No preference	11	38%
	No Answer	1	3%
	Total	**29**	
Reasons for Preference Not to Submit Weekly Report (All That Apply)	Takes too much time	5	17%
	Too much confidential information is collected	3	10%
	Information in the logbook is inaccurate	0	0%
	Other (please specify)	6	20%
	No Answer	16	53%
	Total	**30**	
Importance of Postage-Paid Envelopes	Very important	17	59%
	Somewhat important	6	21%
	Not important	4	14%
	I don't mind paying postage	1	3%
	No Answer	1	3%
	Total	**29**	
Monthly Telephone Notification for Late Reports	Very helpful	12	41%
	Somewhat helpful	7	24%
	Not necessary	3	10%
	I did not receive any phone calls for late reports	4	14%
	I would prefer not to receive phone calls	2	7%
	No Answer	1	3%
	Total	**29**	
State Agency Staff	Very helpful	23	79%
	Somewhat helpful	3	10%
	Not at all helpful	1	3%
	I did not communicate with state staff	1	3%
	No Answer	1	3%
	Total	**29**	
Logbook Reporting Support	Yes, with no changes	6	21%
	Yes, with minor changes	7	24%
	Yes, with major changes	0	0%
	No	15	52%
	No Answer	1	3%
	Total	**29**	

Response to OT comments provided by Pres Pate to the For-Hire Working Group for the Gulf of Mexico Logbook pilot study on September 5, 2012

I think the authors did an excellent job with this report and their recommendations are thorough and well thought out. I have two questions:

1. Did you have to pay captains to place an observer on their charterboat?

   Response: Yes, we paid a $100 passenger fare for each trip. This was required by state agencies so that staff conducting observer work on the vessels would be covered by the liability insurance purchased by the business owners.

2. Was any attempt made to compare the results of the vessel pre-validations with validations routinely conducted as part of the For-Hire Survey? It may be interesting to compare the accuracy of effort reports between the electronic logbook pilot and the FHS phone survey.

   Response: This pilot study included both active and inactive charter vessels with federal permits only; the For-Hire Survey includes only active charter vessels operating within a state, regardless of whether or not the vessel is federally permitted. A direct comparison of the two methods is not feasible.

I have completed my review of the report for the MRIP Project, "For-Hire Electronic Logbook Pilot Study in the Gulf of Mexico". Generally, I agree with the conclusions and recommendations documented in the report - clearly logbooks cannot provide a census of for-hire catch and effort using the design that was tested, and efforts to achieve a census through additional monitoring and enforcement are likely to be cost prohibitive. However, logbooks may have utility as a means to estimate for-hire catch and effort.

Assuming that an estimation design using logbook and validation data will be successfully developed (to be described in a forthcoming report), the big question is, which is "better", a logbook approach to estimation or the current sampling approach (i.e. for-hire survey)? Several factors must be considered in this assessment, including data quality, accuracy of estimates and cost. The report makes several very useful recommendations for designing and implementing a logbook program. These recommendations should also be considered when comparing logbook and sampling designs to ensure that comparisons are based upon recommended approaches (i.e. not necessarily the approach that was tested here or the current for-hire survey sampling design).

Specific recommendations include: 1) Recommend that electronic reporting tools include a feature that requires an entry of either inactivity or activity for each day in the reporting period. 2) Recommend a weekly reporting frequency combined with a daily reporting requirement for a logbook reporting design as the most feasible method, both in terms of cost and the benefits for minimizing recall bias and tracking compliance. 3) Methods currently in place to estimate catch and effort for for-hire fisheries in the Gulf of Mexico and Texas should be evaluated to determine whether sample sizes are sufficient for precise and accurate estimates. 4) Recommend that a regional logbook reporting program exclude non-federally permitted vessels unless each state has authority to require reporting and a mechanism to enforce timely reporting (cost of continued sampling for non-permitted vessels, where applicable, must be considered in cost

comparisons).

I have a few questions/comments about some of the recommendations and conclusions. Specifically:

1. Pg 4. " Regardless of whether or not real-time reporting is required of participants in a fishery, electronic reporting options that offer users the ability to record and store logbook data at-sea during reported fishing trips (example, smart-phone applications, tablets, etc.) are highly recommended to facilitate record keeping and accurate recall of logbook information." Was the accuracy of different reporting mechanisms (e.g. PC-based vs. smart phone app) tested or is this recommendation based upon an assumption that there would be less recall error with at-sea applications?

> Response: The recommendation is based on data and analyses described in the final report and in the Consultant reports attached as appendices to the final report, which found significant differences between what individual vessel operators recalled on the day of the trip (during dockside interviews) versus what was subsequently recorded on submitted logbook trip reports, particularly for released catch. Although at-sea validation sample sizes were low, there were also large discrepancies in the number of reported species released and number of individuals released for a given species between direct at-sea validations and submitted logbook trip reports. Based on these findings, we recommended methodologies that facilitate accurate recording of catch information while fishing is in progress to reduce recall bias, particularly for released catch.

2. Pg 6. "In this study, neither logbook trip reports nor dockside validations provided accurate estimates for released catch; therefore, it is highly recommended that some form of at-sea validation methodology be incorporated into logbook validations." What comparisons were made between dockside validations and at-sea validations?

> Response: The pilot study was not initially designed to make direct comparisons between dockside validations and at-sea validations (which would require side-by-side at-sea observations and dockside interviews). Dockside validations for released catch were intended to measure differences in the recall of vessel operators on the day of the trip versus their recall on the day they reported information on logbooks. We found larger differences between dockside validations and logbook trip reports for released catch compared to harvested catch, which indicates that released fish are more difficult to recall. At-sea validations were intended to directly validate the accuracy of species and numbers of fish reported on logbooks. The recommendation to utilize at-sea validations over dockside validations for released catch was based on a combination of findings from this study, including the fact that dockside validation is not a direct validation (dependent on recall on day of trip), the issue of recall tended to be higher for released catch compared to harvested catch, and at-sea validations (though low in sample size) indicated that logbook reporting for released catch is inaccurate, both in terms of numbers of species reported and numbers of individuals reported for given species.

3. Pg 23. Appendices appear to be identical, with the exception of some edits and comments in Appendix L.

> Response: Appendix K was replaced with the correct document.

4. Pg 26 (Figure 5). What was the average weekly reporting time (on average, how many days

after the reporting week did vessels report for the week)? What percentage of vessels, overall and weekly, reported weekly activity by the weekly due date (Sunday following the week)?

> Response: Simple averages for reporting timeliness were not provided in the report because reporting consistently improved over the course of the pilot study as procedures were adapted. Reporting timeliness improved as more participants became registered in the electronic reporting system and became accustomed to the reporting methods. Data presented in Figure 6 were available for each week of the study and were used during the course of the year-long pilot study to adapt methods and improve reporting. Multiple attempts were made in the early months to reach participants that were not registered to report electronically or via paper either in person or through warning letters to improve overall reporting. Timeliness also improved with the development of procedures to remind participants about reporting deadlines and to inform participants about missing reports, and after procedures were developed to actively enforce compliance. Figure 6 graphically illustrates the percent of vessels with outstanding reports by week for the last week that logbook reporting was required, which reflects reporting timeliness at the conclusion of the study. Data for each previous week in the year-long study were not presented in the final report because of the incremental method changes over the course of the pilot.

5. Pg 44. "Red snapper are subject to a bag limit of two red snapper per angler during the open harvest season, which requires that vessel operators pay close attention to the numbers of fish harvested." Would you expect less accurate reporting for species with larger bag limits and greater variation among numbers of fish landed? Will results for other species be included in the follow-up report? Are logbooks feasible as a multi-species monitoring tool?

> Response: The consultant's report (Appendix I) evaluated numbers of fish (independent of species) and numbers of species harvested that were reported on logbooks versus observed during dockside validations. Those results are summarized on pages 46-47 in the final report. In the consultant's follow-up report (in preparation), both red snapper and vermilion snapper (20 fish per person bag limit in federal waters) will be used to compare independent catch estimates for harvested and released fish from logbook trip data and dockside validation data.

6. Pg 52. In Florida, annual costs to run a logbook reporting program could be offset if the program replaced the current For-Hire Telephone Survey and Access Point Intercept Survey for for-hire mode. This may not be true if sampling approach still necessary for boats that don't have Federal permit.

> Response: The comment was noted. No changes were made to the document in response to this comment.

My comments are more organizational/clarity in nature…I will let other folks do the heavy lifting stats-wise. I do think that clarity issues are very important however if managers are to be able to use the results to make management decisions (like whether or not to increase the use of logbooks).

The mix of paragraphs and bullets in the Executive summary was difficult to digest. There are recommendations in both. I would prefer to see one bullet point followed by a relevant discussion under each point. It could also be useful to have one section of bullets for key

findings and then a following section of bullets for related recommendations, each with a little paragraph of supporting text. Also, within the points some start with "recommend that" which is unnecessary and then begs the question are the other points recommendations or something different. I would suggest using direct phrasing like "Participants SHOULD be involved" and "elec. tools need to include…" throughout.

> Response: It was important to organize key findings into major categories that are of interest and direct consequence to fishery managers, managers of data collection programs, and/or fishermen affected by the results and conclusions of this study. Recommendations listed under each major category pertain specifically to the category it is listed under so that they are easily located in the Executive Summary. All of the indentions listed under the sub-headings "Recommendations" were re-worded to clearly identify that they are all recommendations.

There is a rec in the compliance and timeliness section that states "due to resources…logbooks are not recommended…" This will read like a general recommendation, maybe even "THE" recommendation rather than something in a compliance and timeliness section. This also apparently conflicts with the rec in the feasibility for regional implementation that "we do no rule out logbook reporting as a feasible method…" I think the first one just might need a qualifier but to many readers this will be confusing…Or maybe they should be combined into one general recommendation…"Without draconian enforcement logbooks will not provide a census and getting near a census consumes tremendous resources. However, in some regions logbooks may, when combined with sufficient validation and related adjustments to estimates, be a feasible strategy for for-hire data collection."

> Response:
> The Enforcement section was moved up so that it precedes the discussion of compliance and timeliness. A new recommendation was added to the Enforcement section: "*Recommend that follow-up procedures to track reporting compliance are designed to facilitate timely enforcement (see recommendations below under "Reporting Compliance and Timeliness").*"
>
> Recommendations under the Compliance and Timeliness section were clarified, and reorganized.
>
> > The first recommendation now reads: "*While we do not rule out logbook reporting as a feasible method for the collection of catch and effort statistics from the for-hire sector, logbooks are not recommended if a complete census is necessary due to the significant additional resources in manpower and funding required for a logbook reporting method to achieve a complete census.*"
> >
> > The remaining recommendations were combined and re-worded to emphasize the importance of up-front efforts and long-term maintenance requirements for achieving maximum reporting compliance and timeliness.

Some of the key findings in the results section are hard to dig out and warrant highlighting. Like on page 36 it could be helpful to readers to summarize the main point "<u>Logbooks were found to underreport trips by about 30% despite intensive outreach and general cooperation by most of the industry.</u>" Dividing the sections by the main points and then supporting those points with all the details would facilitate integration of the findings by managers. These points could

also be used in the Exec Summary…like the above point might be nice to include in the Field Validation findings/recommendation section. There were a variety of statements buried in paragraphs e.g. “these results indicate…” or “given these results…” that I think are the main points but may get lost…

> Response: Much of the information provided in the results section was necessary to document sample sizes achieved and distribution of samples, and does not necessarily fit into the same categories presented in the Executive Summary. The project team agrees that a large amount of information is presented in this report and it was difficult to summarize in the Executive Summary all of the findings that are provided in the results section. The key findings highlighted in the Executive Summary represent the major results that we felt were most important to the target audience for this document. In response to the peer-review, the results section has been divided into 6 numbered sub-sections, and each sub-section is further categorized with italicized sub-titles to assist reader in the organization of information that is presented.

The project team did an excellent job presenting the findings of there report. In general, there needs to be more distinction in the text and the Executive Summary between the points dealing with the results not supporting a census and the ones relative to a survey. There is some possible confusion between these two recommendations.

> Response: this comment has been addressed in the response to other comments received by the Operations Team and peer reviewers.

Peer Review Report for

"For-Hire Electronic Logbook Pilot Study in the Gulf of Mexico: Final Report"

Reviewed by
Dr. Alicia Carriquiry, Iowa State University
Dr. Sarah Nusser, Iowa State University
Dr. Stephanie Eckman, Institute for Employment Research, Nuremberg, Germany

Introduction

This document combines the comments provided by three different peer reviewers of the MRIP Project Report entitled "For-Hire Electronic Logbook Pilot Study in the Gulf of Mexico". The document provides verbatim reviewer comments without identifying the source of each comment.

Reviewer #1:

The authors of this report have conducted a large pilot study to investigate the feasibility of a weekly reporting mechanism to capture data from for-hire fishing boats in the Gulf coast of Florida and Texas. I am impressed with the thorough work they have undertaken and their forthrightness in discussing both the successes and the shortcomings of the methodology.

I believe the report could be improved by incorporating more big-picture background in the introduction and streamlining the presentation in the body of the report, in particular by removing superfluous figures and tables. It could also be more statistically sophisticated. The authors should be mindful that the report may be read by those with no little background in fishing.

My comments below are in two sections. First I discuss general or larger comments, and then I discuss smaller specific comments about the report.

General Comments:

I strongly recommend that the report include a section in the introduction on the importance of collecting good data on catches and releases from for-hire boats. While it is obvious to the authors why this data is needed, it is not necessarily obvious to readers and the report will be stronger if it (briefly) makes a case that this data is crucial to government and industry. (There is a mention of "fisheries management" on page 10, but more detail should be included, and earlier.) The point about a similar data collection effort in British Columbia, mentioned in the conclusion, is very interesting and deserves mention in the introduction as well. It seems that there is a bit of reluctance on the part of boat operators in FL to comply with this data collection, and thus for political reasons it is probably a good idea for the report to argue why

such data is needed. The report does do a good job summarizing other work on how to collect good data about fisheries, in the background section on page 8.

> Response: A new section titled "About This Document" was added before the Executive Summary discussing why the pilot study was conducted. This new section also describes who the target audience is for the report and provides a basic overview of where readers may go to find additional information not contained in this report.

The report contains a few mentions on the Deep Water Horizon oil spill. I recommend a short section in the introduction discussing the time line of the spill in relation to the timeline of the pilot study and how the spill affected the pilot study.

> Response: Additional language was added to the methods section to explain the impact of this event on the start-up of the project.

Similarly, the results section mentions "low activity months" – the introduction should inform the reader what months these are.

> Response: Reference to "low activity month's" of fishing is not made until the Method's section of the report. Text was clarified to indicate that low activity month's of fishing were from September to March.

I believe that the largest for-hire boats in TX and FL were not included in the pilot study, because they are already captured in another survey project. Is that correct? Very little mention of this exclusion is made in the report. If a logbook data collection program were rolled out in the future, would such large boats be included? Do we think that the smaller boats included in the pilot are likely to be more or less difficult to survey? Were the large boats included in the workshops at the beginning of the project? How has data collection with the large boats in the other survey program gone? I am worried about generalizing from a small-boat-only pilot to a population of large and small boats – the authors should address this point.

> Response: The SE Headboat survey is a logbook data collection program of approximately 75-80 vessels. Headboats were excluded from the study as discussed in the Methods section. The program includes mandatory logbook reporting and dockside effort and landing validation (see Background section). These vessels would not likely be included in a logbook program for charter vessels, if implemented, as the methodology, sampling, and reporting from headboats is already well established and reporting compliance is high. Additional clarifying text was added to the Background and Methods section of the document.

The results section makes too much of the TX/FL breakdown, even when the two states behave similarly. I suggest breaking down figures and tables by the states only when there is something important to be learned from presenting the results separately.

> Response: Results are presented separately for Texas and Florida given the differences in sampling, reporting, and fishing activity between these two areas. It was also

important to contrast the results between a small and large geographic area. No changes were made to the document in response to this comment.

When you do feel the need to present tables and figures separately for TX and FL, please clearly label the tables and figures with which one is which. For example, Figure 7 is labeled only in the caption.

Response: Captions were added to Figures to distinguish data from each state.

There are a few undefined acronyms, especially in the beginning of the report. Perhaps the authors could include an appendix which defines all acronyms. Ex: "IFQ" and "cpue" on page 5.

Response: Definitions were added next to each acronym within the document.

I don't like the term "pre-validation"– I had a hard time figuring out what was meant. I suggest the authors say that there were three validation steps and give them sensible names ("dockside" is a useful name, think of something like that to replace "pre-validation")

Response: The term "pre-validation" was replaced with "vessel activity validation" throughout the document.

The authors state repeatedly that this project failed to obtain a census due to underreporting by the boats. But this pilot study was based on a sample of boats in the selected areas, so it would never have resulted in a census. A census is a study in which responses are obtained from the entire population and no sample is drawn. Please replace discussions about a failure to obtain a census with mentions of trip-level and unit (boat)-level nonresponse.

Response: The study was based on selection of all vessels within two selected geographic areas of the Gulf of Mexico. Although the study design did not incorporate all federally permitted for-hire vessels in the Gulf of Mexico, it did attempt to census all vessels in the Panhandle of Florida and Corpus Christi area of Texas. These vessels were required to complete mandatory logbooks as part of the pilot study requirements. All vessels within both geographic areas were selected to report and no samples were drawn because the entire population of vessels within each geographic area was intended to be surveyed. The report accurately states that logbook reporting failed to obtain a census of all vessels required to report. Some clarifying text was added to the document pertaining to why the project failed to achieve a census.

Please use a different font or font size for the table and figure titles. It is often quite hard to tell which pieces of text are the body of the report and which are table or figure titles. See the caption to Figure 2, which spans 2 pages. Similarly, please avoid leaving just a few lines of text at the bottom of a page underneath a figure or title – these bits of stranded text are easy to overlook and thus the reader can loss his or her place (see pages 40 and 42 for examples).

Response: Each figure and table caption is bolded. All captions throughout the document were formatted to ensure they did not span multiple pages and text at the bottom of pages was shifted to the next page, where applicable. Text in the body of the

> document was reformated to a true-type 12 point font to improve clarity in the conversion to pdf format.

I very much like the use of a smartphone app and its use of pictures for different species of fish. Great idea.

I had a lot of trouble understanding the "Validation Productivity and Sample Coverage" section. It needs an introduction explaining clearly what is meant by "productivity" and "sample coverage." I suggest the term "validation rate" rather than coverage. In surveys, coverage and coverage rate are defined very differently than you have used them here, which contributed to my confusion in this section.

> Response: An introduction was added to this section describing what is meant by "productivity" and "sample coverage." The term sample coverage was replaced with the term validation coverage rate per the reviewer's suggestion. Throughout the section, text was modified to refer to validation rates rather than coverage.

The other big problem I had with this section is that the previous section discusses the NUMBER of reports submitted by the selected boats. This analysis leads very naturally into a desire to learn how ACCURATE those reports were. But instead of presenting accuracy results, the report interrupts the flow and detours into a discussion of what percent of all trips were validated. This entire section should move into the methods section, or into an appendix, so that the flow of the results section, from the number of trips reported to the accuracy of the trips reported, is not compromised.

If the authors do not move this section, it should open with an introductory paragraph and that paragraph should acknowledge the interruption: "Before discussing the accuracy of these submitted reports, we first give details about the coverage of the validation procedures" (though, again, my strong preference would be to move this section).

> Response: We disagree with the reviewer's suggested comments and believe the flow of results is appropriate and that discussion of the number of reports submitted by vessels is logically followed by discussion of the percent trips validated and the accuracy and completeness of logbooks submitted. An introductory paragraph was added to the beginning of the "Validation Productivity and Percent of Trips Validated" section per the reviewer's suggestion above.

The validation section also contains too many figures and tables. Think about what your reader really needs to know to understand the validation work and include only what is necessary.

> Response: The tables and figures included in this section are intended to highlight the frequency and quantity of validations occurring during the study relative to the total number of trips reported. All figures and tables reported in this section are important to the results of this study. Figures or tables from this section were not removed.

The report contains no standard errors. Why are there no significance tests on the differences reported in Table 13 (for example)? The reader needs to know if these are big differences or

not. Please provide standard errors or explain why you cannot. Your measure of "difference of means" in the results section is bias in the reports, right? This term may be clearer for your readers (certainly it would be for this reader).

> Response: Tables where means and mean differences are reported now include in the Table heading a reference to the appropriate Appendix to refer to for more detailed statistics. Root mean square error was reported in tables for mean absolute differences. Means were bracketed with 95% confidence intervals in all tables.

Use section numbers for the highest level divisions.

> Response: Section numbers were added to the document.

I have some concerns about the write-up on the simulation studies that reconsider the validation sample sizes. This section would be stronger if rewritten in terms of the statistical power to detect differences between the logbook and the dockside reports. The section also needs an introduction explaining the background – what is the question you are trying to answer with these two simulation studies? Not all of the detail from the Appendices needs to be in the main report, but a little more detail would be comforting. At the very least, the reader should be directed to where in the Appendices more information is available – there are 2 appendices on the simulation studies (K and L) but only 1 is referenced in the text.

> Response: Due to the complexity of the methods and statistics used for this analysis, details were removed from this section of the document and the reader is directed to the appropriate appendices for a full, detailed description of methods, statistics, and results.

Specific Comments:

Page 9 – I'm not entirely sure what you mean by double sampling methods. Do you mean 2-phase sampling? Or 2-stage sampling? The first you did implement in the pilot, the second you did not.

> Response: The recommendation provided in the text is directly from a detailed review of for-hire data collection methods conducted by Chromy et al. (2009). Double sampling in this instance refers to adjustments in logbook estimates based on more accurate data obtained from dockside samplers.

Page 15 – here you are talking about 2 different kinds of nonresponse, boat level and weekly level. I think the writing could be improved by using these terms, if they are also known to the report's audience.

> Response: This recommended change was not made. Procedures for tracking compliance distinguish between vessels not reporting any logbooks and vessels reporting late based on weekly compliance checks.

Page 20 – the section on pre-validation should start with the big picture first. What is pre-validation and how is it different than validation mentioned above? I had a hard time with this section, but once I understood what it was, I could see that this is an important and logical QC step. Please help your reader along a bit more. As mentioned above, I don't like the term pre-validation, and it contributed to my confusion here. I suggest moving the pre-validation section into a larger section on the 3 different types of validation.

> Response: Additional introductory sentences were added to this section explaining the importance of validating vessel activity. Also, the term "pre-validation" was replaced with the term "vessel activity validation."

Page 24 – please include in Table 3 the total number of boats selected

> Response: The total vessels selected to report were added to the Table 3 caption.

Table 4 – are the last two lines in this table the number of missing values in the number of fish released? I think so, given the table title, but please improve the labels used in the table. It looks like 7 vessels reported 7 fish released or harvested.

> Response: The table labels were clarified to indicate the number of trips missing hours fished data, released and harvested fish data, and minimum depth data.

Page 25 – the use of calendar week numbers seems overly complex. I suggest using the numbers 1 to 52 for the 52 weeks in your study.

> Response: This recommended change was not made to the report. The study spanned two calendar years (Sept 2010-August 2011) and weekly reporting was tracked based on weeks within a calendar year rather than consecutively from the beginning of the study.

Page 26 -- Figure 5 – here is an instance in which I don't think the TX/FL distinction is important. In fact, it is confusing because the TX numbers are shown on top of the FL numbers, making it impossible to read the TX nonresponse numbers separately, if that is what the reader wanted to do. Please label the vertical axis "Number of vessels not responding".

> Response: Recommended changes were not made to this section. The figure provides importation information regarding the absolute magnitude of vessels not responding by week. It also clearly shows that a majority of the non-responses were associated with Florida vessels. Figure 6 immediately follows Figure 5 and presents the same results as a percent of non-responses. The description of x and y-axis labels were clarified in figure descriptions for both Figures 5 and 6.

I was hoping to see something telling me how many reports in each week were received on time, versus those that were received late.

> Response: Figures 5 and 6 provide a snapshot of the number and percent of vessels that were missing reports for last reporting week, and shows visually how many reports from previous reporting weeks remained outstanding as of that date. We presented this

information for the last reporting week because reporting timeliness improved over the course of the study as vessel operators entered into the study (which varied due to many vessels that were difficult to reach during the ongoing BP oil spill recovery, and other vessels entered late after compliance action). Reporting this information for every reporting week of the study would confuse the reader and would dilute the main point we wanted to convey, which was the maximum timeliness that was achieved at the conclusion of the pilot study.

Page 27 – There is a surprising amount of non-fishing among the selected boats. 100 out of 358 in FL never went out on a for-hire fishing trip, is that right? So it seems that the behavior you're trying to monitor with this pilot study is not very common among your population. I found it surprising to learn this on page 27. This fact deserves mention in the introduction. Did it also surprise the authors? Does it suggest a different sample design?

Response: Inactivity reports are discussed in the Executive Summary as an impediment to achieving a full census. Additional text was also added to the Executive Summary highlighting the high number of vessels submitting inactivity reports.

The following text is now included in the results section, "A large proportion of permitted vessels selected to report in this study were inactive in the charter fishery. This is largely due to the fact that federal permits are under moratorium, which means that if an owner transfers or gives up a permit, they can not reaquire those permits unless another permit holder transferred a permit to them. Consequently, many permit holders continue to renew permits, even during years when they are not using the vessel to charter fish. In the Texas study area, 43 vessels that were required to report vessel activity or inactivity for any duration of time over the course of the pilot study reported inactivity for every week, compared to 27 vessels that reported at least one trip during the study. In the Florida study area, 100 vessels reported inactivity for every week and 234 vessels submitted at least one trip report over the duration of the study."

Page 28 –Figure 7. Very large figure with not a lot of information. Do the black and grey lines in one figure always sum to the same number? Perhaps this figure could be condensed into one reporting the % of all reports that reported inactivity (then 100 – that number would be the percent reporting one or more trips). Here again, consider whether the TX/FL distinction is really important to your reader.

Response: Suggested modifications to Figure 7 were not made as it is important to show differences in TX vs. FL activity patterns. The inactive reports and trip reports in Figure 7 sum to the same number of vessels for each month.

Page 29 – Table 5 can be cut.

Response: Table 5 was included in the document as it shows the amount of sample days spent validating vessel activity throughout the study period.

Table 6 -- Label the statuses in the table. Report column percents. This data may be better presented in a graph.

Response: The table was removed and replaced with new figure 8.

Page 31 – Help the reader understand Table 8. "The first column gives …. The second column states…The number 1,121 in the text is not in Table 8, yet Table 8 is given as a reference for this number.

Response: Additional text was added discussing Table 8. A total of 1,121 vessel trips were intercepted during 441 dockside assignments. Interviews were completed for 150 trips in Texas and 945 trips in Florida. A total of 24 trips (1 in Texas, 23 in Florida) refused to be interviewed.

Page 32 – the discussion of this table mentions interviews per assignment. If that is an important measure, it should be in the table.

Response: Interviews per assignment are an important measure of sampling productivity and are included in Figure 9, rather than Table 8.

You don't need both Table 8 and Figure 9. Cut Figure 9.

Response: Table 8 and Figure 9 convey different information. Table 8 provides information on the total quantity of assignments and interviews, while Figure 9 summarizes sampling productivity (i.e., interviews per assignment). No changes to the document were made in response to this comment.

Page 36 – 13% in text, but 14% in Figure 11.

Response: The text was corrected to indicate that 14% of Florida vessels reported no trip for day/time.

Page 37 -- Please do not use pie charts, especially 3-D pie charts. Find another way to represent this data. And standardize the legends so that the same colors mean the same thing on the two charts. This figure could be just 1 bar chart (perhaps with different bars for TX/ FL, if that distinction really is necessary for the reader's comprehension). Here again, it is not clear (except in the caption) which figure is for which state.

Response: Pie charts were replaced with bar charts.

Page 38 – the figure and table report the same numbers, right? Include only 1.

Response: Additional information is included in Table 11 that is not included in Figure 12. No changes to the document were made in response to this comment.

Page 42 – clarify what you mean by the "expected amount." This sentence is unclear: "The mean absolute difference is the expected amount (absolute value) by which we would expect a logbook report and corresponding dockside sample (for the same trip) to disagree."

"A large negative value for the difference of means would indicate values were consistently over reported on logbooks, whereas a large positive value would indicate variables were

consistently under reported. The difference of means for numbers of anglers per trip was -0.125 anglers in Texas and -0.191 anglers in Florida, which indicates that vessel operators did not consistently over report or under report this value (Table 13)." I don't understand – since both bias measures are negative, the number of anglers was overreported in both states (is that a correct understanding?). But isn't that consistent overreporting? Why do you argue it is not consistent? Or do you mean that the bias is not "large" enough to allow for this type of conclusion? If so, then you are making an argument about a standard error, but not presenting that standard error. What do you mean by "large" in the first sentence quoted above?

> Response: Text in the document was clarified to address the reviewer's comments. The mean absolute difference is the expected amount (absolute value) by which we would expect a single logbook report and corresponding dockside sample (for the same trip) to disagree. The mean absolute difference can only be positive. The more a value differs from zero, the greater the difference in expected logbook reports and dockside samples. The difference of means is the difference between the average value for all dockside validation responses aggregated (mean dockside) and the average value for all logbook reports (mean logbook) aggregated. A large negative value for the difference of means would indicate values were consistently over reported on logbooks, whereas a large positive value would indicate variables were consistently under reported. Text was clarified to indicate that vessel operators slightly over reported the number of anglers per trip.

Table 13 – please include the word "Exactly" in your "Proportion Matched" columns in this table and all similar tables.

> Response: The term "exactly" was added to Table s13, 14, 15, and 7.

Page 43 -- first paragraph – the order of discussion of the table does not match the order of the table itself.

> Response: The order of data in Table 13 was modified to match the discussion in the text.

Table 13, 14 and 15 should all be combined. Maybe 17 too.

> Response: This comment was not addressed. Although information contained in each of these tables could be combined, it would require extensive reformatting of the document to convey the same information.

Page 45 – this recommendation about how to ask about species is a good one and should be repeated in a separate recommendation section so that it is not overlooked by future researchers.

> Response: The Key Findings and Recommendations section of the report addresses the reviewer's comment by stating: "Recommend that participants in the fishery be involved in the design of electronic logbooks to improve data reporting accuracy and efficiency, and to ensure data entry fields are clearly described."

Page 46 – Table 16, the monthly breakdown here is not needed, just report the overall numbers.

> Response: To maintain consistency with Table 12, a monthly breakdown of trip validations is provided.

Page 47 – In other tables, you've had columns for "Percent Reported," so the switch here to Unreported is odd.

> Response: Values in Table 17 were changed to percent reported and modifications were made to the corresponding text.

Page 48 –Table 19, again, I'd really like to see standard errors on these numbers.

> Response: already addressed from previous comment.

Here again is a recommendation that should be repeated in a special recommendation section.

> Response: The Key Findings and Recommendations section of the report addresses the reviewer's comment by stating: "Released catch represents a major portion of total catch and contributes significantly to total fishing mortality for many managed fisheries in the Gulf of Mexico. In this study, neither logbook trip reports nor dockside validations provided accurate estimates for released catch; therefore, it is highly recommended that some form of at-sea validation methodology be incorporated into logbook validations. For harvested catch, data from dockside validations and logbook trip reports were similar in aggregate; therefore a combination of dockside and at-sea validation methods may be employed. "

Page 49 – this is a nice figure, well labeled. Here the TX/FL distinction is important and interesting. I do suggest you make the vertical axes the same, however, so that it is clear how much over the numbers are in TX than in FL. Readers will likely miss that detail if they just glance quickly.

> Response: No adjustments were made to the vertical axes in the figures, but a note was added to the caption identifying the different scales used.

Page 50 – this section on validation sample sizes needs an introduction explaining the bigger picture behind this work. I guess you are trying to answer the question—given what we know now, what sample sizes should we have used for the validation work? But behind that question is a sense of error tolerance, what you call the "zone of indifference" – I'd rather see this discussion in terms of standard errors.

> Response: Additional clarifying text was added to the introductory paragraph for this section. The purpose of the analysis was to examine how extensive a validation program would need to be in order to determine, with various levels of confidence, whether the proportion of trips having logbook records has changed or not over time.

Additional reference was also made to Appendix L, which explains the intent of the analysis and statistics in much greater detail.

P=0.173 – does this number come from a table in the results section? If so, mention where. If not, where does it come from?

Response: This was a typographical error, the number should have been 0.713. A reference to Appendix L was added to the end of this sentence.

What is the population sample size?

Response: A reference to Figure 8 has been added, which shows the population sample sizes.

Where do the sample sizes 26, 52, and 78 come from?

Response: How sample sizes were determined is discussed in Appendix L. Based on proportions of verified trips that occurred in various months in the pilot study, a "baseline sample" of n = 26 days was determined for use in the MonteCarlo assessment procedure. In the Monte Carlo assessment procedure, this baseline sample was increased by factors of 2 and 3 for samples of n = 52 and n = 78 days.

0.747 (0.746, 0.748) – here is something that looks like a confidence interval (though it is not labeled as such, or at all). Where does that standard error come from? It's strange to see a CI this late in the report.

Response: In response to the comment below, this section has been removed from the document, and the reader is directed to Appendix L.

"For this population, it was known that the proportion of trips with corresponding logbook reports was P=0.173. Sample sizes of n=26, n=52 and n=78 days were taken from the population (over 2,500 Monte Carlo iterations) to compare estimated values with the known value of P. The Monte Carlo estimated value of P for n=26 was 0.747 (0.746, 0.748). … if the Monte Carlo results were used to test the hypothesis that the predicted value of P is equal to the true value of P, the hypothesis would be accepted at the smallest sample size (n=26) due to low precision." – I don't understand this. The CI for n=26 does NOT include the true P=0.173, so why would the (null) hypothesis be accepted (not rejected) at the smallest sample size (n=26)?

Response: This was a typographical error and P should have been reported as 0.713. The details of this analysis are complex and difficult to convey in this report, which was intended to be a summary of results. This paragraph has been removed from the report and the reader is directed to Appendix L for a more detailed discussion of this analysis. A detailed discussion of why the hypothesis was accepted is provided in Appendix L.

At the end of this paragraph "p" should be capitalized.

Response: "P" was capitalized at the end of the paragraph.

Page 51 – it is not clear to me why the “probability of equivalence” is the quantity of interest. If dockside and logbook really do collect different data, then we want validation to pick that up, not to call them equivalent. Wouldn’t a larger sample size detect MORE discrepancies? But in your figure, larger sample sizes are more likely to find equivalence.

> Response: Logbook reporting can provide a much higher quantity of samples then dockside sampling. Equivalency was evaluated to determine sample sizes necessary to produce similar results between dockside and logbook sampling. The primary objective was to determine whether, in aggregate, logbook reports can be considered equivalent to what would result from dockside sampling. To determine this, equivalence testing was used. A “zone of indifference" was specified, and if an interval estimate of the difference in a quantity between logbook and dockside data sources was contained entirely within the zone of indifference, then the two data sources were declared equivalent.

The text says that costs are divided into 2 categories, and the table has two data columns, but the columns do not correspond to the two categories of costs. What are the two columns in the table? Why does your reader want to see fixed broken down in this way? (Perhaps s/he does not.)

> Response: Text was clarified in the Introduction to the “Project Cost” section. Costs were divided into two categories: start up expenses and logbook reporting/validation expenses. Table 20 summarizes start up expenses while Table 21 summarizes logbook reporting/validation expenses. Costs were broken down by agency, program, and region to track where costs originated and how expenses differed by agency, program, and region.

Page 53 – mention that you’re now talking about the post-pilot participant survey.

What was the response rate to this survey?

Was it via mail or online or both?

> Response: A sub-section was added to the methods section which explains that the participation survey was completed after the pilot-project. Methods for reporting were also added to this section. The response rate for this survey could not be reported because the survey was web-based and open to anyone with access to the Gulf Logbook Website; therefore, it was unknown if more than one person from the same vessel responded to the survey. An explanation of this has been added to the Results section.

You mention repeatedly that some respondents would prefer a different frequency of reporting to the logbook study – do they want more frequent or less frequent? If you don’t know, then mention this.

> Response: Participants were not specifically asked whether they would prefer to report more or less frequently than weekly. However, given that a majority indicated reporting

took too much time, it is surmised that they would prefer to report less rather than more often.

Page 54 – do you have any data on satisfaction with the smartphone app?

Response: The iSnapper phone application was made available to participants in June 2011. A limited number of fishermen (n=10) were recruited to pilot test the iSnapper application for the logbook pilot project. These participants were not directly surveyed to determine satisfaction with the iSnapper application, but anecdotal information received from for-hire charter captains at Gulf Council meetings indicates captains are generally very satisfied with the phone application.

Figure 17 – rather than reporting TX/FL differences I'd be more interested in paper/elec, even if that would mean reporting only FL data.

Response: This section includes a discussion of differences/similarities between responses from paper reporters versus electronic reporters. Responses to the survey by paper reporters was added to Appendix M. The figure was not changed since questions pertaining to ease of electronic reporting cannot be compared with paper reporting.

Page 55 – "compliance leveled off to a gradual rate of increase" – this cannot be what you mean, please rephrase.

Response: Text was corrected in the document as follows: "Compliance gradually increased throughout the duration of the study as vessel permits for persistent refusals became due for renewal."

"would MOST LIKELY have continued to improve if the study had continued"

"a well-thought OUT plan"

Response: The reviewer's suggested wording was added to the text in the Conclusions section.

Do you recommend going to daily reporting, or not?

Response: No change to the document was made. In the Key Findings and Recommendation section the following is recommended: "Recommend a weekly reporting frequency combined with a daily reporting requirement for a logbook reporting design as the most feasible method, both in terms of cost and the benefits for minimizing recall bias and tracking compliance. Daily reporting frequency is only recommended if adequate resources can be dedicated to compliance tracking and timely follow up, and only if daily or individual vessel monitoring is necessary for fisheries management.

Page 56 – the section talking about the BC study is really interesting, and as mentioned above, I suggest mentioning this in the introduction as well. But the rest of this paragraph is unclear.

The text skips from one sentence to the next between talking about the Gulf pilot study and the BC study – please clean up.

> Response: A few sentences in the paragraph were moved to make the paragraph flow better.

Second paragraph – clarify here what is meant by coverage. Or find another word that is clearer.

> Response: The term 'low coverage' was replaced with 'low levels of sampling.'

Reviewer #2:

I appreciated the opportunity to review this report. The report is clearly written, very comprehensive and engaging. I do have some specific comments about content and presentation (see below) but overall, I found the report to be scientifically sound and well-reasoned. The conclusions listed toward the end of the report are well justified and do correspond to the quantitative analysis presented in the body of the report. Thus, the conclusions and recommendations do correspond to the data collected in the course of the study.

I may have missed something, but one major issue I did not see discussed is the determination of the sample size (number of vessels) for participation in the pilot study or the actual mechanism by which specific vessels were selected. There is also little description about the "population" of vessels from which the sample was drawn in each region. As someone who knows little about fishing boats for hire, I kept wondering whether there is a lot of variability with regards to type of boat, size of boat, etc. and whether that variability was adequately represented in the sample.

> Response: The number of vessels participating in the pilot study is described in the Results section of the report. All vessels within the selected study regions were selected to report. A description of general passenger capacities for participating vessels was added to the Method section of the report.

Two general comments have to do with the choice of statistics reported throughout and with what I believe is a lack of reporting of uncertainties around point estimates. In terms of choice of statistics, the difference between mean absolute difference and difference of means may be obvious to a statistician, but is probably not so clear to others. I would encourage the report writers to spend a paragraph before those two statistics are introduced explaining (in intuitive terms) the difference between the two concepts and why both are important to understand the results of the study.

> Response: Per the reviewer's suggestion, additional text was added to the document explaining the difference between mean absolute difference and difference of means. A similar comment was also provided by Reviewer #1.

Related to those statistics, I kept asking myself about the "significance" of the entries on Table 13 and other similar tables. Consider, as an example, Table 13. Is a mean absolute difference equal to 0.488 large or small? What about the difference of means equal to -0.125? All of these estimates are given with no indication of uncertainty, so it is difficult for the reader to decide whether any of these figures are noteworthy or negligibly small. If possible, I strongly suggest that some indication of estimation error or uncertainty be provided, so that the reader has a "metric" against which to assess the significance of the estimates.

> Response: Estimation errors are provided in Appendix I. The results presented in the appendix were preliminary and figures and tables presented in the full report have been updated with additional data from the consultants. Root mean square errors were calculated for updated mean absolute differences provided in the report, and updated means were bracketed with 95% confidence intervals in the report.

Specific comments

While it would be naïve to expect perfect compliance and error-free reporting (regardless of system), some comments in the report were surprising to a non-expert such as myself. Some of these include:

- Page 4, middle paragraph: vessels that are leaving port and yet report inactivity should be identifiable, since presumably ports have a record of when ships leave and return. Wouldn't it be possible to incorporate this type of information to complement log book reporting?
- It was mentioned in several portions of the report that while vessels which have not submitted their weekly reports are not allowed to renew permits, they can do so as long as they submit the entire set of missing weekly reports before renewal. Clearly, these reports cannot possibly be as precise as desirable. It might be useful to think of a method to encourage more timely reporting. For example, it could be useful to deny renewal to boat operators who are delinquent on a certain proportion of weekly reports for over a pre-specified amount of time. Under this approach, operators would be unable to lift the registration hold by simply submitting made-up reports all at the same time.

  > Response: Ports do not necessarily have a record of when vessels leave and return and such information is not reported to fishery data collectors. We agree with the reviewer's second comment that submitting entire sets of weekly reports to meet renewable requirements is not desirable and less precise. In the Key Findings and Recommendations section the following is recommended: "As with any mandatory reporting program, timely reporting by participants should be required for logbooks. It is recommended that authority for enforcing reporting requirements be modified to enhance the timeliness of reporting. Recommended authority should include permit suspension, permit termination and civil penalties to facilitate enforcement of timely reporting."

Page 5, middle paragraph: It is not clear what the term "coverage" means in this context. In the survey literature, coverage refers to the completeness of the sampling frame – is the entire population from which the sample is drawn exhaustively enumerated? I am not sure that the definition of coverage on page 5 is the same.

> Response: Validation coverage rate refers to the percent of total trips reported on logbook trip reports that were also verified during validation efforts.

Page 6, top paragraph: As I was reading this section of the report, I was asking myself whether the objective of the electronic log-books is to help authorities to identify violators or to produce population estimates of effort, harvest, etc. The two objectives are quite different with regards to data requirements and interpretation of results. It is difficult to make any type of inference at the level of a single vessel with any reliability. However, vessel-level errors can cancel each other out and still produce reliable estimates at the level of the population. I felt like this distinction was not clearly made in the report.

> Response: The term coverage was eliminated and replaced with validation. Text was also modified to clarify that the study did not achieve a complete census. However, logbook reports in the study were submitted for a large portion of the total effort (approximately 70% overall), which was verified through field validations of vessel status

Pages 11 and 12: It is not clear the time period for which estimates are desired. How was seasonal variability taken into account? Is it important to obtain estimates of effort, harvest, etc., by season or does an averaged annual estimate enough? Wouldn't seasonality interact with region?

> Response: Estimates are currently reported every two months by charter vessels; however, there is a need to have more timely reporting for many key species (e.g., red snapper). It is also important to estimate effort and harvest on a seasonal basis and by region to account for differences in fishing effort and catch throughout the year and by area.

Page 19, top paragraph: The description of the validation procedures is clear in general. But for example, it is not explicitly said whether number of species, length and weight of fish, number of fish caught, etc. are actual measures of estimates. If the latter, how is the estimation carried out?

> Response: We are unable to respond to this comment. No estimates were generated for this report. Validation data were used for direct comparison with self-reported logbook data. A separate report by Mark Kaiser (currently in peer-review) addresses estimators from logbook data.

The term "robust number" is used more than once. For example, it is used on page 22, toward the end of the fourth paragraph. I think that I understand what a "robust number" means, but it would be useful to define it somewhere, given that it is not a commonly used statistical term.

> Response: This has been clarified in the text.

Reviewer #3:

Overview

The report being reviewed describes the goals, methodology, results and conclusions from a pilot study designed to evaluate electronic logbooks for obtaining census information on recreational fishing trip activity, catch statistics (number of anglers, fishing location, number of fish caught by species, etc.), and release statistics (release location, depth, number of fish released species and live/dead status, etc.). The goal of this review is to evaluate the methodology, results and conclusions described in the report.

General assessment

Overall, the report is well--written, clear, thorough and thoughtful. The conclusions are very reasonable given the evidence gathered. Comments are offered in the following sections, and they represent reasonably minor adjustments to the current report and alternative perspectives to consider in moving forward.

The most significant question raised about the conclusions is whether the authors should recommend research into adjustment methods for coverage bias associated with the vessels that did not respond to the census effort.

> Response: As discussed in the Executive Summary, a separate analysis was completed using data collected during this pilot study to explore the feasibility of combining self-reported logbook data with independent validation data to generate statistically valid estimates for catch and effort. That report provides a methodology for estimating the number of fishing trips taking into account non-reporting by vessels. The report is currently undergoing peer-review and was not able to be incorporated into this report.

The primary alternative perspective offered raises a question about why a census of all trips is being pursued. This is an issue that lies beyond the scope of the project as originally designed. This question is particularly pertinent if the approach will be implemented in larger regions. If a census is not mandated, then an alternative approach would be to place less burden on vessels by randomly selecting a subset of vessels to participate in the logbook activity, and/or by sampling a portion of the year's weeks or months for each vessel using a randomization scheme to distribute effort across vessels and time periods. Design research would be needed to work out the most cost effective way to implement such a design, but data available from the pilot study would support these investigations. It would be also fairly straightforward to incorporate further subsampling for the field verification studies that provide quality evaluation information (and possibly data for adjustment factors).

> Response: The NRC review recognized that in regions such as Alaska and the Gulf of Mexico, the magnitude of the for-hire sector and the potential scale for fishery removals warrants the use of mandatory logbooks as the source of catch and effort data for the

for-hire sector. It was recommended that reporting be mandatory. Census-style reporting is expected to minimize the need for adjustments in catch and effort statistics associated with sample-based data collection designs and therefore provide more timely data to managers and scientists. We agree with the reviewer that random selection of vessels is less burdensome.

Methodology

The pilot study was conducted by a collaborative team with input from stakeholders and consultants. Although it can be challenging to assemble design prior to studying a new method, the goals of the study are clear and the design serves pilot goals of evaluating the feasibility of using electronic log books and of assessing data quality with smaller sampling studies conducted dockside and at sea. The development of the survey system appears to have been successful, which was critical to the project's success. The team also was responsive to unplanned occurrences, such as lack of compliance by many vessels in the beginning of the study and the need for better editing control in the electronic logging system as data errors were uncovered. It can be difficult to adjust to such events, and the team's monitoring efforts paid off in that regard.

Two suggestions are offered. First, the design of the study is necessarily complex, and is a bit difficult to track as a fresh reader. It might be easier to understand the course of the study if a brief overview of each study component's purpose and key metrics were provided, possibly with a flow diagram showing how data are collected for a vessel's trip.

Response: A flow diagram summarizing reporting requirements and compliance checks for the Gulf Logbook reporting system is provided in Figure 2. Introductory paragraphs were added to the Vessel Trip Reporting Procedures section and the Validation Procedures section within the Methods section.

The statistical approach at the end is rather scant. This is a common issue in documentation for environmental studies, but is still an important input to evaluating study conclusions. Without this information, it is difficult to understand what estimates are of interest and why, and how estimates were generated. While I suspect the analyses are reasonable from reviewing appendices, I will give some examples of where this might be a problem. The dockside and at--sea verification samples are probability samples, which may require different estimators from classical statistical estimators for observational or experimental studies. It appears as if the verification samples used an "equal probability" design, which would allow for classical statistical estimators, but this is not clearly stated. Also, data are nested in that repeated observations are made on vessels and vessels may be nested in sites, which can induce correlation in raw observations (e.g., vessel reporting errors are likely correlated over time). Because variables and methods are not specified, it's not clear whether that has been accounted for by summarization or some other method.

Response: This report was intended to summarize results of the pilot for a general

audience that includes affected fishermen and resource managers. Full documentation of the statistical approach is provided in the appendices, and appendices are referenced throughout the document. The subsection titled "Validation Procedures" in the Methods section provides a clear description of how vessels and sites were selected for validation samples. Validation data were only used to make direct comparisons with self-reported logbook trip reports, and no estimates of catch or effort were generated for this report.

Results

Results are well specified, and supported with tables and text. Some suggestions are noted below.

Additional contextual information would be helpful in a couple of areas. For example, in the at--sea data evaluation, it would be beneficial to present estimated mean fish counts or depths for each reporting method so that the error measures could be interpreted in the context of the magnitude of the original measurements. In addition, it might be useful to see a relative frequency histogram of these distributions to understand how errors are distributed across reporting units (e.g., distribution of total fish counts from the log and from the dockside data).

Response: Tables were updated to include root mean square error and means are bracketed with 95% confidence intervals.

Units for the depth variables (ft, m?) are missing from Table 13, and should be included.

Response: Units (ft) were added to Table 13.

The verification studies are conducted on samples, and it would be useful to report approximate confidence intervals for parameters being estimated as a measure of uncertainty for the estimates.

Response: This recommended change was made to tables throughout the report.

Finally, I suggest replacing pie charts with histograms. The pie chart grey--scale shades are difficult to interpret, and the category ordering in the chart doesn't always group similar categories together (e.g., into valid response, erroneous response, unknown/not applicable). A histogram can be used to convey compositional data, and can be labeled in a way that facilitates interpretation.

Response: Pie charts were replaced with bar graphs.

Conclusions

The conclusions are well done and thorough. Many are entirely consistent with

recommendations for conducting sample surveys, which are subject to similar problems in different contexts. Comments noted below are organized by the Executive Summary's Key Findings and Recommendations.

Reporting tools

I agree with all of these recommendations. A well--designed system will facilitate compliant and accurate recording to the degree possible, and requiring daily reports even when inactive is critical to minimizing missing and misreported data.

Additional years of experience will yield ideas for further modifications to the system. The project should seek to evolve the system each year in response to these findings, which will improve compliance and data quality and reduce manual data review and manipulation. If this is done effectively, one might expect manual efforts to decline.

> Response: No modifications to the report were needed to address these comments.

Reporting compliance

That logbooks cannot be used to obtain a census is a reasonable conclusion. Even the decennial census of the US, which requires compliance by law, does not achieve full response of census forms. This opens the question of whether a census should even be attempted for future studies as they are scaled to a larger region. While it may be beyond the scope of the report, it is not clear why a census is required. The current approach leaves the sponsors with data from a non--random sample of vessels, which as discussed later in this review, may yield biased estimates.

> Response: See response above to Reviewer 3's early comment about why a census was being attempted. We agree that the current approach is non-random, which may bias results if reporting vessels are not representative of all vessels required to report (both those that reported and those that did not).

A sample--based approach may be more appropriate in collecting data via log books. Under a census model, a limited amount of effort can be expended per unit to obtain data, and thus data tend to be of lower quality. Early survey sampling research demonstrated that for a given cost, better estimates of population parameters can be obtained by selecting a random sample and spending substantial effort to obtain complete and accurate data on a smaller number of sampled units. In a sample--based approach, bias is reduced to such a degree that the mean square error is smaller than for the census approach (i.e., the sampling variance plus the remaining bias squared for the sample--based approach is less than the bias squared for the census approach).

> Response: Currently, sample based approaches are used to estimate charter landings in the Gulf of Mexico. Many constituents believe logbook reporting would provide a more

accurate and timely way of collecting catch and effort data. Consistent with the NRC's recommendations, we tested whether or not a census could be achieved through logbook reporting. An additional analysis is currently under review to explore the feasibility of combining self-reported logbook data with independent validation data to generate statistically valid estimates for catch and effort.

As with earlier sections, the remaining recommendations are important strategies in conducting sample surveys and censuses to motivate respondents towards compliance and quality report. Real-time monitoring and data recover is critical to maintaining data quality in a study.

Reporting frequency

This section also offers reasonable conclusions that are consistent with survey practice. It is not clear from the report what is feasible to expecting in reporting frequency, but the sooner that data can be reported after trips, the better. If it is reasonable to expect individuals to report real--time on a daily basis, that should be encouraged to reduce the likelihood of obtaining poorer quality recall data.

Response: No modifications to the report were needed to address this comment.

Sampling coverage and estimation

I question whether 70% coverage should be labeled as "good" or sufficient for estimating catch and other parameters of interest. Very likely, the 30% of vessels (or trips) that provide no information are different in some way from the vessels that provide compliant reports. This is called informative sampling in that bias is induced through the "sampling" process that occurs through noncompliance. Because data from the missing vessels is likely to follow a different distribution from that of the compliant vessels, the missing data are considered non--ignorable. That is, absence of data from noncompliant vessels potential induces bias in the estimates.

If not already underway, a project to develop adjustments for potential bias should be considered using methods that model the differences in the missing and completed data. To support models that adjust for potential bias, data are acquired on attributes of the vessels to compare how vessels that comply differ from those that do not comply. A number of different adjustment approaches can be followed that are common in survey and other statistical literature. These methods would provide a better estimate of population parameters, and would explicitly take into account undercoverage. (Note that if a random sample rather than a census approach is taken, a sample size is set to meet precision goals for catch and other estimates, and further inflated for the anticipated attrition due to nonresponse/noncompliance.)

Response: The term "good" was removed. The report now indicates "… a large portion of the total effort (approximately 70% overall) was verified through field validations of vessel status." We agree that the lack of data from missing vessels in any survey or

census approach may bias results if reporting vessels are not representative of vessels not reporting. Additional research is needed into adjustment methods for coverage bias associated with the vessels that did not respond to the census effort. This recommendation was added to the Key Findings and Recommendations Section.

Field validation

These recommendations underscore the importance of collecting verification information on self reports in electronic log books. Self-reported data are generally subject to measurement error, and verification data can be used to adjust for measurement error and nonresponse in the self--reported data. In addition, having an on--going validation program encourages vessels to adhere to protocols.

Evaluation of appropriate sample sizes and design structures is needed as part of the design of these studies. There are many options, and a well--integrated multi--phase design can support both estimation and quality evaluation goals, as suggested in the report/appendices.

A concern arises for the at--sea validation study in that only cooperative operators allow this type of data collection. Thus, future studies should consider bias adjustment techniques such as those discussed for undercoverage in the log book study.

Response: We agree with the reviewer's conclusions and evaluation of our findings.

Enforcement

These recommendations are also important. Timeliness has a large impact on data quality. It is well understood that data that are lagging are of poorer quality. Responsive enforcement authorities will provide tools to improve timeliness. Because enforcement will never yield perfect outcomes, the monitoring efforts already designed into the study are necessary.

Response: No modifications to the report were needed to address this comment.

Regional implementation

I have no substantive comments for this section other than to say that once a system and its protocols have been developed for a region, it will be far less costly to adapt the system and protocols for implementation in other regions.

Response: No modifications to the report were needed to address this comment.