Changes to Sampling and Estimation Designs, Including Descriptions of Completed and Ongoing MRIP Projects, that Could Impact MRFSS/MRIP Calibration Efforts

March 12, 2012

White paper prepared for MRFSS/MRIP Calibration Workshop in Raleigh, NC

Authors: Rob Andrews, Ron Salz, and Tom Sminkey

NOAA Fisheries, Office of Science & Technology, Fisheries Statistics Division, 1315 East-West Highway, Silver Spring, MD, 20910

Contents

Introduction

Traditionally, marine recreational fishing data for the U.S. Atlantic Coast and the Gulf of Mexico have been collected by NOAA Fisheries through the Marine Recreational Fisheries Statistics Survey (MRFSS). The MRFSS is a complemented surveys approach that includes telephone surveys to estimate fishing effort and an access-point angler intercept survey (APAIS) to estimate catch per angler trip. In a 2006 review of the MRFSS conducted by the National Research Council (NRC) of the National Academies of Science, reviewers made extensive recommendations for improving recreational fisheries data collection and analysis. Specific conclusions and recommendations from the NRC Review include:

- The estimation procedure for information gathered onsite does not use nominal or actual selection probabilities of the sampling design and therefore has the potential to produce biased estimates for both the parameters of interest and their variances;
- The [onsite] sampling process requires greater quality control (less latitude on the part of the samplers) than it has at present;
- The onsite sampling frame for the MRFSS should be redesigned;
- Onsite methods fail to intercept anglers who have private access to fishing waters;
- Offsite sampling methods that rely on telephone interviews are complicated by the increasing use of cellular telephones;
- The existing random digit dialing (RDD) survey suffers in efficiency from the low proportion of fishing households among the general population and may allow bias in estimation from its restriction to coastal counties only;
- An updated, complete [angler] registration list would greatly improve sampling efficiency in terms of time and cost;
- Dual-frame procedures should be used wherever possible to reduce sample bias.

To address these recommendations, MRIP has funded more than 40 projects to develop and test alternative data collection and estimation designs. The majority of these projects have focused on one of four categories; 1) estimation designs, 2) catch survey designs, 3) effort

survey designs, and 4) for-hire data collection. This report summarizes MRIP efforts to develop improved methodologies within these categories by consolidating the executive summaries from four completed or soon-to-be completed MRIP project reports. Each summary describes the objective and outcomes of the project, as well as recommendations for implementing new designs or conducting additional studies. Completed project reports are available for download in their entirety at http://www.countmyfish.noaa.gov/projects/index.html.

Some of the designs described in this document (e.g. revised estimation design for catch per trip) have been peer reviewed, certified as an MRIP method, and implemented. For other designs, feasibility studies have been completed, but the results have not yet been peer reviewed or certified, and subsequently the designs have not been implemented.

In the case of the estimation designs, revised catch and effort estimates have been produced and made publicly available for the period 2004-2011. Subtle changes over the years in the data collection design and the data elements collected during the course of intercept assignments demand additional work to apply the MRIP estimation design for years prior to 2004. We anticipate that revised estimates for 1998-2003 will be available in late 2012 or early 2013, and revised estimates for 1990-1997 will be available in mid to late 2013. More substantial changes to the survey design prevent application of the new estimation design for years prior to 1990.

A pilot study test the feasibility of a revised sampling design for the APAIS was implemented in North Carolina in 2010. We anticipate that the design will be peer reviewed and certified as an MRIP methodology in 2012 and implemented coast-wide beginning with wave 1, 2013.

Several pilot studies, focusing primarily on mail survey designs and address-based sampling (ABS) frames, have been implemented to test alternative designs for fishing effort surveys. Based upon the results of these projects, the effort survey design team has recommended a design for additional testing beginning in late 2012. We anticipate that the design will be

tested in four states beginning with wave 5 (September/October) 2012 and continuing through all waves of 2013. The pilot study will be conducted in parallel with the CHTS, which will provide an opportunity to assess differences between survey estimates. Depending upon the results of the pilot study, a revised effort survey design could be implemented coast-wide beginning with wave 1, 2014.

As with the effort data collection, several projects have been implemented to test the feasibility of alternative designs for collecting data from the for-hire sector. These projects have been guided by a set of "best practice methods", which were recommended by an MRIP evaluation of for-hire survey methods and are summarized in this report. Specific projects have tested electronic logbook reporting and probability-based designs for conducting dockside interviews and validating catch and effort logbook data. A pilot study to test electronic logbook reporting and validation procedures for a sub-sample of federally-permitted charter vessels in the Gulf of Mexico was conducted in 2010-2011. We anticipate that a final report resulting from the project will be submitted to the MRIP Operations Team in April 2012.

In addition to the projects summarized below, MRIP has funded additional studies to further enhance data collection within the framework of improved sampling and estimation designs. These projects are testing innovative data capture techniques, such as video monitoring; examining the characteristics and behaviors of anglers who are excluded from the APAIS, such as anglers who access fishing opportunities from private-access fishing sites; and testing the scalability of sampling designs to produce estimates at finer levels of geographic resolution.

Estimation Designs

The Marine Recreational Fisheries Statistics Survey (MRFSS) conducted by the National Marine Fisheries Service utilizes complementary surveys: a Coastal Household Telephone Survey (CHTS) and an Access Point Angler Intercept Survey (APAIS). The CHTS is used primarily to access a target population of coastal resident marine recreational anglers, and to collect fishing activity data that can be used to estimate the total recreational effort (in number of angler fishing days) within a given two-month period. The APAIS is used to assess marine recreational angler fishing days and collect data on catch by species that estimates the mean catch per angler fishing day for the same two-month period.

The design of the APAIS is a stratified, multi-stage cluster sample. The target population consists of the set of all angler-trips within a given year, two-month wave, state, and fishing mode. The frame for this target population consists of site-days, constructed by crossing a list of available public access sites to fishing with a list of available days within the wave. The frame is stratified by month and day type (weekday and weekend). The sample within a stratum is selected in multiple stages. In the first stage, a primary sampling unit (PSU) consisting of a specific site-day combination is selected by probability proportional to size without replacement (ppswor). In the subsequent stages of selecting among a cluster of anglers or boats within a site-day or among a cluster of anglers who fished on a selected boat, the secondary (SSU) and/or tertiary (TSU) sampling units are assumed to be selected with equal probability without replacement.

In the traditional MRFSS, estimates from the APAIS rely on unweighted averages that do not reflect the complex sampling design and also contain data that are not obtained through a probability sample. These unweighted estimates are design-biased and have undergone critiques from NRC (2006) and constituents. The purpose of this report is to outline proposed changes to the estimation procedures for the APAIS. These changes will ensure that estimation methods being applied to the APAIS are statistically valid.

The most important change to the APAIS is the development of a design-based, weighted estimation method for estimating catch rate and its variance using the APAIS data. The weights used in the weighted estimation method are obtained as the inverses of the inclusion probabilities for each PSU within a stratum and for each SSU and/or TSU encountered in the multi-stage sampling design. The estimator of catch rate is, to a good approximation, design-unbiased because the method takes the weights of stratum and stages into account.

Future access point intercept surveys will need to eliminate the "alternate mode" and "alternate site" sampling allowed by the current MRFSS APAIS. In the field, samplers have been allowed to obtain samples from alternate fishing modes and alternate fishing access sites under explicit rules for the purposes of increasing productivity and minimizing the costs of the survey. However, looking back into the history of the APAIS, the pattern of alternate mode sampling was inconsistent, making it difficult to compute the inclusion probabilities for such sampled angler fishing days by any means. For this reason, alternate mode samples were excluded from this design-based, weighted estimation approach. The impact on exclusion of the alternate mode data is expected to be minimal because the size of alternate mode samples was usually small.

Although interviewers are asked to follow explicit rules when choosing alternate sites, the traditional field sampling procedures have allowed for considerable flexibility on the part of the samplers. This can make it difficult to calculate the inclusion probabilities for alternate site sampling. Since a large fraction of data (50% or more) has come from alternate sites, it would be a major loss of information if alternate site samples were not included in the estimation. For this reason, an estimated weight for alternate site sampling was developed by exploiting empirical transition rates from primary site to alternate sites in the historical database.

Lastly, a statistical adjustment is being developed to account for the fact that only a fraction of all the anglers during a sampled day are being observed at a selected site. In the traditional APAIS design, the cluster size of a specific PSU (i.e., the number of completed angler fishing days occurring within a site-day) is not observed by a sampler for the entire day because the sampler is encouraged to target only the most active part of day and is not required to stay at

the site for any specified duration. An empirical time slice distribution of completed angler fishing days is obtained from the Coastal Household Telephone Survey (CHTS) and is used to expand the number of completed angler fishing days in the sampled APAIS time slice to the entire day.

The weighted estimation method can be used to estimate the mean catch rate of a given target population of angler fishing days. It can also be used to estimate the proportion of angler fishing days occurring in different water bodies and the proportion of angler fishing days covered by the sampling frame for the CHTS (i.e., anglers living in a coastal residential household that has a landline telephone). To simplify the illustration of the weighted estimation method, this report presents mean striped bass catch rates by New York private/rental boat (PR) fishing mode from 2003 to 2007 as an illustrative example. The two estimates of proportions for the target populations as mentioned above are also presented. While estimates under the new method and the historical method are quite different in many places, the direction and magnitude of differences do not exhibit any obvious patterns.

Catch Survey Designs

Background

The NRC review identified problems in the Access Point Angler Intercept Survey (APAIS) component of the MRFSS that is used primarily to estimate catch rates. The APAIS had been using a stratified, multi-stage cluster sampling design to collect catch data from anglers at fishing access sites, but the survey catch estimates and associated measures of precision were not accounting for the complex design. For this reason, the estimates were potentially biased and the measures of precision were overly optimistic. In addition, the sampling protocols for the APAIS had combined formal randomization with subjective decision-making in ways that further complicated the development of statistically valid, defensible catch estimates and measures of precision. Finally, the spatiotemporal sampling frame used for the survey was incomplete and did not provide adequate coverage of angler fishing days ending either on private property or at night.

The Marine Recreational Information Program (MRIP) of the NOAA Fisheries Service initiated work in 2008 to address these concerns with the help of expert consultants. The first project initiated by the Sampling and Estimation Work Group (SEWG) produced a new weighted estimation method that accounts for the APAIS sampling design. Some components of the sample weights needed for this method could be calculated directly from available data on sample selection probabilities and cluster sizes, but other components had to be approximated using modeling techniques. Although implementation of a design-unbiased estimation method was a very important improvement, changes to the APAIS design were also identified to further improve upon the statistical validity and accuracy of the new MRIP survey estimates. The new weighted estimation method will only provide correct estimates of mean catch rates when the sampling, data collection, and data processing for the APAIS are conducted in accordance with the documented sampling design. Errors could be introduced into the weighted estimator if the data structure is not arranged to accurately reflect the stratified, probability-proportional-to-size (PPS) multistage sampling design, or if the field samplers misinterpret the sampling and

measurement protocols. More formalized sampling protocols with stricter control of sampler behavior are needed to ensure that a probability sample is consistently obtained. Furthermore, it is necessary to know the probability of selection of each unit (landing site, vessel trip, angler, or fish) interviewed or observed. A re-design of the APAIS could (1) make it much less complicated to determine the true sample selection probabilities, (2) eliminate the need for model-based weighting methods, and (3) provide a means for a strictly design-based approach to unbiased estimation. Specific recommendations from the estimation project for improving the design of the APAIS included:

- Focus on maximizing the number of site-days sampled, not the number of angler interviews obtained. The primary sampling unit (PSU) in the multistage APAIS sampling design is the site-day, not the angler trip intercept and the precision of multi-stage survey estimates depends almost exclusively on the number of PSUs.
- Eliminate sampler visits to any sites that are not pre-determined in the probability sampling design.
- Implement a design that will cover completed fishing trips throughout the fishing day, not just during "peak" fishing times, and distribute the interviews obtained within a selected site-day assignment proportionally throughout the assignment time interval.
- Eliminate opportunistic sampling in fishing modes other than the assigned mode due to difficulties of determining appropriate inclusion probabilities for alternate mode intercepts.
- Improve the accuracy of counts of the number of angler fishing trips that are completed within each site-day assignment. The total count of angler trips, including those not intercepted by the interviewer, plays a very important role in calculating the PSU cluster size necessary for estimation weighting.

Approach

To address some of these issues an MRIP project was initiated in 2009 to develop and test an improved sampling design for access point surveys of marine recreational fishing. A project team consisting of expert consultants and representatives from NOAA Fisheries and three state

agencies was formed to develop appropriate changes in sampling frames, sample selection methods, and on-site sampling protocols that would support a purely design-based estimation approach. A pilot test was conducted from January through December of 2010 in North Carolina to test the feasibility of implementing the new sampling design. The pilot design was run side by side with the traditional MRFSS Intercept Survey design to allow for comparisons for sampling productivity, catch estimates and variances. Methodological changes implemented for the pilot were in response to both specific NRC recommendations mentioned above and to address other potential biases or inefficiencies of the old methodology identified by the project team. Key data collection design changes that were implemented in the pilot include:

1) Sampling from four fixed 6-hour time intervals covering a full 24-hour sampling day.
2) Formalizing a probability-based approach for the selection and order of all sites to visit on a given assignment.
3) Clustering of sites for sampling.
4) Eliminating opportunistic sampling of alternate modes.
5) Attempting to complete all assignments drawn thus reducing possible bias due to non-observation of selected elements in the sample frame.
6) Cancelling assignments that could not be completed rather than re-scheduling which makes it difficult to determine sampling probabilities.
7) Improving methods for accurately obtaining counts of eligible angler trips missed and adding counts of fishing vessels to accurately determine appropriate sampling weights of intercepted trips in the estimation process
8) Expanding eligible trip definition to include anglers under five years old and trips at tournament sites.
9) Disallowing “incomplete trips” in shore mode thus eliminating potential “length of stay” bias and issues associated with expanding partial trip catch to represent the entire trip.
10) Removing the interview per assignment cap which, combined with fixed assignment time intervals, should spread the sampling to appropriately represent a larger temporal slice of fishing.
11) Implementing fish sub-sampling procedures to strike a balance between the objective of selecting an unbiased probability sample of fish with the need for field procedures that are both feasible to implement under a variety of real field conditions and easy to understand by the average sampler.

Preliminary Results[1]

Conducting the pilot study side-by-side with the traditional MRFSS Intercept Survey allowed for the direct comparison of productivity measures. There are many different ways to measure productivity, and which of these are most important will likely depend on the particular survey design. For example, while the MRFSS Intercept design emphasizes the number of angler intercepts obtained as the primary measure of "productivity," for the pilot design the number of site-days or PSUs was a more important measure in terms of estimate precision. Since the number of interviewers available for the pilot was less than the number available for MRFSS sampling, comparisons focused on productivity rates (e.g. intercepts per assignment, sites per assignment) rather than absolute numbers (e.g. total intercepts, total sites visited).

The average number of intercepts per assignment was less for the pilot compared to the MRFSS. This was expected since several MRFSS field procedures were initially designed to maximize the number of intercepts interviewers could obtained. MRFSS procedures that allowed for interviewer discretion in selecting interviewing sites and times that would yield the most intercepts were eliminated in the pilot. The pilot was viewed more as a feasibility study to test the new unbiased estimation and sampling design: maximizing intercept productivity was not a study objective. The final project report will include specific recommendations for increasing intercept productivity while staying within the proposed new survey design.

Pilot sampling effort was distributed across more sites and times of day compared to MRFSS sampling. The pilot survey consistently obtained higher averages for the number site visits per assignment across all modes. Time of intercept was also examined to determine the levels of intercepts obtained through the pilot during times not surveyed by MRFSS. Comparison of the average number of intercepts per two-hour time period (for assignments with intercepts) displayed higher numbers for pre-dawn hours (before 8:00 AM) for private boat and manmade fishing modes for the pilot survey compared to MRFSS. The pilot survey also had higher average intercepts from 6:00 pm through 12:00 midnight for private boat mode. Within

[1] The North Carolina Pilot Study report has not been finalized. Results presented here are considered preliminary and are subject to change when the final report is released.

MRFSS, manmade intercepts were collected over the longest duration (17 hours, 7:00 AM through 11:59 PM), followed by beach/bank mode (14 hours, 7:00 AM through 8:59 PM). MRFSS boat mode intercepts (charterboat and private boat) were collected during 12-hour durations; 10:00 AM through 9:59 PM for charter and 9:00 AM through 8:59 PM for private. The Pilot expanded durations to 24 hour coverage for manmade, beach/bank, and private boat modes. Charterboat mode for the pilot was sampled over a 12-hour duration (8:00 AM through 8:00 PM) similar to MRFSS. Pilot expansion of temporal coverage resulted in 3.9% of manmade intercepts and 3.2% of beach/bank intercepts obtained outside of the time periods sampled by MRFSS. The private boat mode exhibited the greatest percentage (6.2%) of pilot intercepts collected outside of times sampled through MRFSS.

Pilot catch estimates were compared to revised (weighted) MRFSS catch estimates for 15 important management species. Overall, no clear trends or systematic differences were found when comparing landings estimates or released alive estimates; i.e. in some cases pilot estimates were higher, in others MRFSS estimates were higher. For example, with all waves and modes combined, pilot landings estimates were higher than MRFSS for 7 out of 15 species, while pilot released estimates were higher than MRFSS for 8 out of 15 species. Ninety-five percent confidence intervals were calculated for pilot and MRFSS estimates to examine overlap and detect statistical significance. Confidence intervals overlapped for 13 out of 15 landings estimates comparisons and also for 13 out of 15 released estimates comparisons. This suggests that, for the large majority of management species, pilot and MRFSS annual catch estimates (with all modes and waves combined) were not statistically different from one another. Comparisons of pilot and MRFSS catch estimates at the mode/wave strata level yielded similar results with 95^{th} percent confidence intervals overlapping in nearly 90% of all cases. The MRFSS estimate exceeded the pilot estimate in about 95% of those cases with non-overlapping confidence intervals at the species/mode/wave level.

While the results suggest that pilot and MRFSS point estimates were reasonably close, and not statistically different in the large majority of cases, there were a few particular species/mode/wave strata where absolute differences were rather large. In some of these

cases the MRFSS estimate was greater than the pilot and in others the pilot estimate was greater than the MRFSS. The particular components of the estimates (e.g., sample sizes, catch rates, estimation weights, and effort multiplier) in these strata were further investigated to determine which estimate component(s) were driving the very large differences found between pilot and MRFSS estimates in a relatively small number of cases. In the cases investigated the large catch estimate differences were due to primarily to 1) large differences in un-weighted catch rates, or 2) very large estimation weights applied to pilot catch rates, or 3) some combination of 1 and 2. It is postulated that the differences found between MRFSS and pilot catch estimates could have been greatly reduced with increased pilot sampling effort (i.e., more interviewers and more issued assignments) combined with more optimal distribution of pilot assignments across time intervals, regions, modes, and waves . PSEs (Proportional Standard Errors) were consistently higher for pilot catch estimates than they were for MRFSS catch estimates. These differences were likely attributed, in part, to differences in the number assignments issued for the pilot (1,080) compared to the MRFSS (2,697). Increased sampling effort and more optimal distribution of assignments will also likely improve the variances associated with pilot catch estimates.

Effort Survey Designs

A primary objective of the Marine Recreational Information Program (MRIP) is to implement improved surveys of recreational fishing effort. To that end, MRIP has funded several pilot studies to develop and test the feasibility of alternative data collection designs with a goal of increasing the efficiency of data collection and the accuracy of survey estimates. A focus of the research program has been to improve coverage of the population while also reducing nonresponse and measurement error. The objective of this report is to synthesize the results of the completed pilot studies, assess differences in the resulting estimates within a framework of survey errors, and provide recommendations for future testing and implementation.

To date, MRIP has considered four data collection designs for collecting recreational shore based and private boat fishing effort data: 1) the Coastal Household Telephone Survey (CHTS), which is the ongoing random-digit-dial (RDD) survey administered by NOAA Fisheries, 2) the Angler Licensed Directory Telephone Survey (ALDS), which samples from lists of licensed or registered saltwater anglers, 3) dual-frame telephone surveys, which integrate CHTS and ALDS sampling in a dual-frame design, and 4) dual-frame mail surveys, which sample from angler license frames and residential address frames. Because the components of the dual-frame surveys are sampled independently, we are also able to consider the effectiveness of single-frame, license surveys (ALDS and license mail survey) and general population surveys (CHTS and ABS).

All of these survey designs have been administered to collect data for a common time period (November-December, 2010) in common states (Louisiana and North Carolina), which provides an opportunity to make direct comparisons of survey estimates. Our goal was to examine, both qualitatively and quantitatively, the potential sources of survey error for each of the designs and explain, to the extent possible, observed differences in estimates within the context of these errors. The largest observed differences were between estimates generated from the CHTS and ABS general population samples. Subsequently, much of the assessment focused on explaining differences between these two survey designs. Comparisons between the license

frame survey estimates (ALDS and license mail survey) revealed less substantial differences, but provided insight into the observed differences between mail and telephone survey designs.

In general, the mail survey designs produce larger estimates of fishing effort than the corresponding telephone survey designs, particularly for estimates of shore-based fishing effort generated from the general population samples. The larger estimates of effort are driven by differences in the estimated number of anglers rather than the estimated mean trips per angler.

Nonresponse, incomplete coverage, and measurement error were examined to evaluate the observed differences in survey estimates. Evidence of nonresponse bias was found for both the ABS and CHTS designs, as avid anglers are more likely to respond to the surveys than non-anglers. While nonresponse bias is a concern, it is unlikely to contribute significantly to the observed differences between the ABS and CHTS estimates of effort. Similarly, both mail and telephone survey designs are susceptible to bias resulting from noncoverage, with a greater potential for bias in the CHTS due to the exclusion of non-landline households and households in noncoastal counties. As with nonresponse, noncoverage is a concern but does not appear to be responsible for large differences between the CHTS and ABS.

We concluded that differential biases due to measurement errors were likely to be the largest source of differences between the CHTS and ABS estimates. Specifically, we hypothesize that inaccurate responses to the telephone survey screening questions are producing biases in the estimates largely due to recall/salience effects. This error has a greater impact on estimates of shore fishing effort than boat fishing effort because boat fishing trips are more salient than shore fishing trips. The mechanism for this bias appears to be related to the tasks imposed on the telephone survey respondent. Specifically, telephone survey respondents, answering a "cold" telephone request, are asked to recall recreational fishing activity for all members of the household with minimal time to consider the request. Because the CHTS screening questions are administered to whomever answers the phone, it is very possible that the respondent did not personally participate in any or all the recreational fishing trips taken by the members of the household, and he or she may not recall or be aware of the fishing activities of other

household members. This would result in an underestimate of fishing incidence and subsequently the estimated number of anglers who fished in the wave. In contrast, respondents to the mail survey have more time to consider the survey request, and the mail instrument provides a visual cue in the form of a calendar to aid in recall. In addition, we believe the mail questionnaire is more likely to end up in the hands of someone within the household who fishes or is likely to know about the fishing activities of other household members. Because the surveys were not administered in a controlled, experimental setting, we cannot confirm this hypothesis with existing data. However, comparisons among the survey results consistently support this hypothesis.

While we do not have external data sources to confirm that one approach has less bias than another, our investigations and hypotheses lead us to believe that the mail survey estimates are subject to less bias across all sources of error than the telephone survey estimates. Since the dual-frame approach is efficient in terms of identifying anglers, the dual-frame mail survey design is a reasonable alternative to the CHTS. However, we recommend testing a single-phase, stratified alternative to the dual-frame design that changes how the license frames are used, as well as the mailing procedures. Rather than using the license databases directly for sampling, we propose to use them to stratify ABS samples. Stratifying ABS sample into matched and unmatched strata will allow us to sample at different rates, effectively maintaining the efficiency of sampling directly from the license frame while avoiding some of the potential biases and complexities associated with the dual-frame design.

Conclusions/Recommendations

The review of survey methods and results has led us to the following conclusions and recommendations:

- While both general population surveys are susceptible to bias resulting from noncoverage, the potential for bias is greater in the CHTS due to the exclusion of non-landline households and non-coastal county households. We did not find evidence to suggest noncoverage bias accounted for differences in the survey estimates, but

noncoverage from excluding non-landline households is likely to continue to increase and this could lead to larger noncoverage biases in the CHTS in the future.

- In the states we studied, angler license frames are very incomplete and not suitable to be used exclusively as sample frames for recreational fishing surveys at this time. Undercoverage rates of license frames ranged from 40-50% in North Carolina and from 5-70% in Louisiana.
- Nonresponse error due to avidity bias is a concern in both the ABS and CHTS. Nonresponse adjustment methods, such as those used in the ABS, should be used to reduce avidity bias. Our analysis did not find that differential nonresponse bias contributed significantly to the observed differences between ABS and CHTS estimates.
- The large differences between CHTS and ABS estimates appear to be due primarily to measurement errors. The respondent tasks are very different for telephone and mail surveys, which is likely to result in differential bias due to differences in recall ability and the salience of different types of fishing activity.
- While we do not have external data sources to confirm that one approach has less bias than another, our investigations and hypotheses lead us to believe that the mail survey estimates are subject to less bias across all sources of error than the telephone surveys.
- Frame matching errors in the dual-frame designs are likely to result in a small overestimate of fishing effort for the dual frame mail survey. Since the dual-frame approach is efficient in terms of identifying anglers, the dual frame method is a reasonable alternative design to the CHTS.
- We recommend testing a single-phase, stratified alternative to the dual-frame design that changes how the license frames are used and the mailing procedures. Rather than using the license databases directly for sampling, we propose to use them to stratify ABS samples. Stratifying ABS sample into matched and unmatched strata will allow us to sample at different rates, maintaining the efficiency of sampling directly from the license frame while avoiding some of the potential biases and complexities associated with the dual-frame design.

For-Hire Data Collection

The MRIP initiated an independent review of for-hire data collection programs in 2008. The primary goal of this review was to provide recommended actions to ensure that the future systems of collecting for-hire data provide accurate (precise and unbiased) data that is most useful for management needs (which specifically includes catch estimation needs and stock assessment needs). This review solicited recommendations for specific survey designs, by region, by analyzing the strengths and deficiencies of existing surveys. The specific survey design recommendations could retain current designs, improve current designs, or discard current designs and provide entirely new (and complete) survey designs. The Review Panel was assembled by NOAA Fisheries, Office of Science and Technology, Division of Fisheries Statistics staff based on recommendations by some of the NRC reviewers. Experts were selected to serve on the Panel based on their experience with survey design, sampling statistics and/or fishery survey conduct. The Panel conducted a thorough examination of the appropriateness of current for-hire recreational fisheries data collections methods used for providing timely, accurate catch and effort statistics, and recommended best practices for a data collection program that will meet the needs of fishery managers. Acceptance by stakeholders, minimization to the extent practicable of reporting burden, and minimization to the extent practicable of overlap/redundancy was also taken into account.

The MRIP For-Hire Workgroup provided the Panel with detailed documentation of current existing data collection programs. The For-Hire Workgroup met with the Panel for a two-day workshop during 2008 and presented a series of concise presentations of the various programs followed by informal question and answer period to introduce and clarify the existing survey types. During each presentation, the Panel was given the opportunity ask questions at any time. At the end of each presentation, additional time was allotted for questions and discussion. On the second day the panel met to begin the evaluation and review process while the assembled presenters were available for any additional information needs. A draft summary report was submitted to the For-Hire Workgroup for review and the workgroup was allowed to request clarifications or additional information. The final results of the review were

presented to the Workgroup in December, 2008, and the final report was delivered to the workgroup in March, 2009. The following Best Practice Methods were among those recommended by the Panel in the final report:

- Maintain and periodically update a complete list of for-hire vessels in each fishery and of landing sites used by for-hire vessels.
- Universal use of logbooks by the for-hire survey including the following features: 1) at least weekly reporting frequency, 2) electronic web-based reporting option, 3) telephone followup of all non-responding vessels, 4) procedures to quickly scan and identify missing and inconsistent data with telephone followup of these cases, 5) Initial estimates (effort and catch) developed based on logbook data with final estimates adjusted based on the intercept data and at-sea observation data
- Probability sampling should be used to select a sample of terminating for-hire vessel trips at each selected PSU (site and time period).
- Procedures for nonresponse adjustment and missing data imputation should be developed and implemented.
- Logbook data and intercept data should complement each other and be used together in estimation.
- Procedures recommended specifically for headboat sampling including: 1) create smaller, more well defined primary and secondary sampling frames for only headboats, 2) selection of PPS sample based on angler capacity of each headboat on the frame, 3) develop standard procedures for subsampling of anglers, and 4) develop procedures for at-sea (ride-on) sampling that differ from dockside procedures.