

## National Research Council Review of MRFSS

- Marine fisheries management goals, objectives, and context have changed since MRFSS was begun in 1979. Stock assessment models now make greater use of data from recreational fisheries.
- Both the telephone and access components of the current approach have serious flaws in design or implementation and use inadequate analysis methods that need to be addressed immediately.
- Many of the independent surveys conducted by the states, as well as state-run surveys that are components of the MRFSS are different from each other, and from the central MRFSS, in important ways including sampling, data collection, and preparation of estimators.
- The committee concludes that users' concerns about the use of the MRFSS in fishery management are justified by the weaknesses.
- The MRFSS (as well as many of its component or companion surveys conducted either indirectly or independently) should be completely redesigned to improve its effectiveness and appropriateness of sampling and estimation procedures, its applicability to various kinds of management decisions, and its usefulness for social and economic analysis.
- The committee concludes that the current methods used in the MRFSS for sampling the universe of anglers and for determining their catch and effort are inadequate. Both onsite and offsite methods suffer from weaknesses that may lead to biases in catch and effort estimation. The estimation procedure for information gathered onsite does not use the nominal or actual selection probabilities of the sample design and therefore has the potential to produce biased estimates for both the parameters of interest and their variances.
- Various physical, financial, and operational constraints often lead to spatial or temporal biases in onsite sampling coverage that are not adequately accounted for in the estimation equations.
- Offsite sampling methods that rely on telephone interviews are complicated by the increasing use of cellular telephones, especially in surveys of residents of coastal counties.
- The correct identification of fish species, especially in places with diverse fish faunas, is a difficult challenge, both for many anglers and for those conducting surveys. Incorrect identification obviously has the potential to lead to incorrect conclusions from survey data.
- The onsite sampling frame should be redesigned. The estimation procedure critically depends on the assumption that catch rate does not vary according to the nature of the access point.
- The designs, sampling strategies, and collection methods of recreational fishing surveys do not provide adequate data for management and policy decisions. Unknown biases in the estimators from these surveys arise from reliance on unverified assumptions. Unless these assumptions are tested and the degree and direction of bias reliably estimated, the extent to which the biases affect final estimates will remain unknown.

- The current estimators of error associated with various survey products are likely to be biased and too low. It is necessary, at a minimum, to determine how those differences affect survey results that use differing methods.
- Current analysis procedures do not exploit the current knowledge of finite population sampling theory. A research group of statisticians should design new analyses based on current developments in sampling theory.
- The qualities of social, economic, and other human dimensions data have been compromised for many of the same reason that the biological data have been compromised. The human dimensions data have been further compromised by simply being added onto the biological data collection efforts that have different sampling requirements and survey design needs.
- A large number of complex technical issues associated with surveys of marine recreational fishing remain unsolved, and a significant investment in intellectual and technical expertise is needed.
- Numerous adjustments and extrapolations arise because the sample frames on which the surveys are based are incomplete or unrepresentative of the entire population
- The sample frames for both catch rate estimation and for effort estimation are incomplete, contain errors, or both
- Fidelity to sampling protocols used in both effort estimation interviews and access-point intercept surveys is not monitored adequately.
- Assumptions of unknown validity are used in the expansion of estimates over the non-sampled segments of the angler population
- Recreational fishing data are now required for use in stock assessments, sometimes as the sole data concerning stock status.
- The expertise and personnel needed to evaluate and improve the survey design and execution continually are lacking, and methods used to collect and analyze recreational fisheries data have not incorporated evolving statistical methodology or new innovations and technologies that would improve statistical efficiency and reduce costs.
- Variation in an estimate among years is a source of major debate for recreational fishing surveys, especially where fluctuations in estimates result in equivalent fluctuations in regulations for subsequent years. It may be the case that these fluctuations are real, but they also may be artificial. They may result from low precision in the estimate so that the estimate may be unbiased but may vary from the true parameter value in any given period because of expected variation. It is currently difficult to assess if this is the problem because standard errors may be estimated incorrectly.
- There are specific issues associated with the dockside interview for headboats. Each angler's data are likely to be highly correlated. This results in both the bias and the standard error calculation for the final estimates. These cluster effects also should be expected for non-guided boat anglers. In addition, biological sampling of these catches should account for cluster effects, and stock assessment analysts using these data also must be aware of these potential effect.
- Care should be taken to not count anglers twice. Once in contacting them individually and once through the for hire survey.

- Assumptions of unknown validity are used in the expansion of estimates over the non-sampled segments of the angler population.
- The designs, sampling strategies, and collection methods of recreational fishing surveys do not provide adequate data for management and policy decisions. Unknown biases in the estimators from these surveys arise from reliance on unverified assumptions. Unless these assumptions are tested and the degree and direction of bias reliably estimated, the extent to which the biases affect final estimates will remain unknown. The statistical properties associated with data collected through different survey techniques differ and often are unknown. The current estimators of error associated with various survey products are likely to be biased and too low. It is necessary at a minimum to determine how those differences affect survey results that use differing methods.
- Design issues associated with the for hire survey still exist. The estimation of CPUE still relies on intercept sampling at points of landing; therefore they are still subject to the problems about interviewer choice. In fact, intercept issues for this sector may be an even bigger problem since cluster effects arise from multiple anglers participating in the same fishing experience. These effects can be significant and must be accounted for in the estimation for this fishing mode. Operations range from very small to very large, with some being transient.
- In addition to identifying reliable data sources, data quality must be assessed and accounted for appropriately. Modern statistical population assessment models are capable of dealing with data characterized by different variance structures, or even unknown variance. Not surprisingly what goes into the model influences what comes out, and the accuracy of population estimates is influenced by the accuracy of the data used. Statistical fitting procedures used in these models often assume variance structure for data inputs that are not likely to be met by most recreational fisheries sampling programs. Assessment models can be modified to accommodate such data characteristics, but these characteristics first must be identified and quantified at the source level of the surveys.
- Inconsistencies in how dockside samples are collected can be particularly aggravating when conducting population assessments. For example, the lack of a common knowledge base among anglers, data collectors, and data users with regard to taxonomic identification will bias mortality estimates for all species concerned. Population assessment scientists must have confidence that species designations are accurate and applied consistently in the sampling process. Therefore, biological data obtained from intercept surveys must be consistent with categories used in assessments.
- Two additional issues complicate the usefulness of recreational fisheries data for population assessment. 1) interpreting catch and effort data 2) how catch and release influences the accuracy of total removals
- Many stock assessments convert numbers caught to weight caught. Weight conversions are based on the length and weight information obtained from the type A catch; the size compositions of the type B1 and B2 catch are assumed to be similar to the Type A catch- a potentially strongly biased approach given that one of the main reasons for releasing fish is that they are below the size limit.

- Documentation of the source of the effort available as to whether it falls into the category of target effort, catch effort, or directed effort, would go a long way in helping population scientists use this data in an appropriate manner.
- The difficulties facing fishery management agencies are as often socio-cultural and economic as they are biological, and failure to incorporate them into fishery management increases the likelihood of management failure
- Because of the diversity of angler motivations, the product of recreational fishing is not necessarily the number or size of fish caught but rather anglers' satisfaction level with recreational fishing overall or on the particular day they were intercepted. If NMFS seeks to maximize angler satisfaction as a management goal, they must know something about the importance of various motivations to anglers and the extent to which they are achieved in their fishing experience. Understanding angler preferences for various management measures prior to implementation is important to understanding compliance probabilities.
- Currently a great number of biases exist and assumptions are made because the sampling methodology is often inadequate to allow for accurate data analysis. Therefore research is needed to determine how best to reduce biases and assumptions. Since data collection is not supervised by an overarching group, research also needs to be done to improve the accuracy of data collection
- Ensuring that stock assessment scientists, fisheries managers, and other decision makers are aware of the limitations and inherent biases of marine recreational fisheries statistics related to survey design and approach. Issues that assessment scientists and decision makers should be aware of include the lack of continuity in intercept samplers, differences in sampling methods applied to different modes of fishing (e.g. independent anglers, guides anglers, shore based anglers) lack of incorporation of design elements in the estimation process (e.g. weighting of spatial or temporal sampling strata), differences in frequency and distribution of fishing trips due to local topography and climate, and the lack of consistency or accuracy in species designation among fishing or sampling modes. Scientists using marine recreational fisheries data may assume that their statistical properties are known and estimable when in fact they may not be. Resolution of this difficulty can occur only through a detailed outreach process between data collectors and data analysts.