

NOAA Fisheries, Office of Science and Technology/Gulf States Marine Fisheries Commission

Red Snapper Workshop IV Report

New Orleans, LA

September 12-13, 2018

## Background

The workshop represented the fourth in the series with the previous three workshops occurring in a 13-month period between November 2013 and December 2014, which preceded survey design development and testing. Consistent themes in those workshops included: coordination between partners (states, GSMFC, NOAA Office of Science and Technology, Southeast Regional Office and Southeast Science Center); integration of specialized surveys into MRIP and the need to meet management and stock assessment needs. The need to maintain consistency in the recreational catch time series was identified as an objective in the first workshop. The consultant report for the first workshop presented potential options for survey development either as integrated improvements to the general survey or as standalone surveys that specifically target red snapper. For either option, the need to characterize the angling universe that could potentially catch red snapper was identified as a necessary step. Consultants also pointed out the designs had to balance competing needs for more accurate and stable estimates at the annual level and effective in-season catch monitoring. Private access anglers would likely remain a concern for either approach. The second workshop expanded on themes from the consultant report. Points for discussion included: improvement or expansion of MRIP; the potential for using permit and license databases to characterize the “red snapper” angler universe; onsite validation of reported information, model based approaches that use catch from the monitored part of the population to predict total catch. Also considered was the use of a longitudinal panel survey of fishing effort to complement MRIP. The third workshop settled on two basic survey approaches: Self reporting with validation and complemented intercept surveys. To ensure the survey designs developed and tested would meet standards for acceptance in stock assessments and management, a review process to certify survey designs as statistically valid was described. Survey designs would also need to plan for transition to the new survey methods before being implemented. The consultant report from the third workshop acknowledged the challenge of the short red snapper season and also challenges of the two survey approaches examined: For formal probability based onsite/offsite intercept surveys (direct approach) sampling efficiency gains from using permit files to improve sample sizes would need to be evaluated in terms of the additional cost for those improvements. Challenges to effective implementation of capture-recapture approaches which only require probability based sampling for the recapture phase, included matching trips from both phases and the potential for correlation bias. Since the last workshop, states have developed and tested a standalone general survey alternative to the MRIP catch and effort surveys in Louisiana (LA Creel) as well as specialized survey designs that supplement MRIP in AL, MS and FL and the TPWD Creel Survey in Texas. In Florida and Louisiana, the direct approach was used in developing survey designs where in Texas, Alabama, and Mississippi, survey designs were based on capture-recapture methodology. As of December 2018, all survey designs had been certified by NOAA Fisheries as statistically sound.

## Workshop

For the fourth workshop, the focus shifted from testing and development to transition plan coordination: integration and calibration options for survey estimates to meet stock assessment and management needs for stable gulfwide red snapper catch estimates. Over the three to four

years (2014-2018), states conducted pilot studies to refine methodologies and meet certification requirements. At the onset of the meeting, four basic questions were posed that formed the framework for addressing assessment and management needs. Those questions were:

1. How do we make best use of the supplemental and general surveys?
2. How do we maintain a comparable time series of red snapper catch estimates in each state?
3. How do we ensure comparable red snapper catch estimates across states in any given year?
4. How do we work together to develop and implement a Transition Plan?

Given stock assessment and management needs, the variety of survey designs under consideration, as well as differences in the scale and scope of the fishery among the states, there was not an expectation that these questions would be satisfactorily answered in two days. Rather, the expectation was for continued progress toward consensus on how to address any or all of the questions. Each of the questions had integration and calibration related considerations that would require further evaluation.

## Management

Multiple surveys and sources of data pose a challenge to management of a fishery with state quotas apportioned from one or more stocks. Effective management of Gulf of Mexico red snapper requires balancing the need to estimate Gulf-wide catch using several different surveys with monitoring of state level catch quotas under an Exempted Fishing Permit (EFP). There are competing needs to apportion catch to states based on catch histories from one survey while monitoring current state level catches using different surveys. Until 2014, NOAA Fisheries' Marine Recreational Information Program (and previously Marine Recreational Fisheries Statistics Survey) general catch and effort surveys were used to estimate red snapper catch for Alabama, Florida, Louisiana and Mississippi whereas the Texas Parks and Wildlife Department's creel survey provided estimates of annual catch and continue to do so for Texas. Under the EFP, red snapper catch would be monitored using state led surveys. Louisiana replaced MRIP surveys in 2014 with its own general survey: LA Creel. A different approach was taken in Alabama, Mississippi and Florida in which the states developed surveys not to replace MRIP but to supplement MRIP. Alabama and Mississippi used capture-recapture methodology overlaid onto a census approach using mandatory reporting systems. In Florida, a different approach that used an independent monthly mail based effort survey coupled with a boat based catch survey drawn as additional sample in the MRIP APAIS draw was the model. With all three states supplementing MRIP, at least two estimates would be available (a hybrid estimate potentially a third option for Florida) which could pose a concern if estimates differ greatly from the MRIP standard currently being applied to historical or legacy estimates through calibrations to catch and effort surveys.

How survey data are integrated with MRIP would impact any calibrations required to produce comparable estimates between surveys. There is also the issue that a calibration applied to state surveys to produce a single gulfwide estimate could result in confusion over why state estimates

are so much lower than estimates calibrated to an FES standard. Which calibration approach would provide for the most effective use of the data was a question posed. In calibrating to an FES standard the issue of summing catch among the different surveys may be addressed but there were concerns that translating between survey standards for catch monitoring would present public relations as well as compatibility challenges.

## Stock Assessment

Different surveys methods among states (as opposed to a standard method used for all states) as well as changes to survey methods over time can be expected to yield different estimates. Analyses of trends in catch and effort estimates need to account for those survey differences to provide context for meaningful interpretation of observed trends in catch and effort information. Calibration is a tool that has been used to account for survey changes and differences among surveys in the presentation and interpretation of catch histories. Most recently, MRIP produced calibrated estimates to allow comparisons of annual catch information based on the Coastal Household Telephone Survey and its replacement, the Fishing Effort Survey. The calibration based on the Fay-Herriot (linear mixed) model used routinely in small area estimation applications allowed conversion of estimates between the CHTS and FES “currencies.” The calibration model allows conversion in both directions which means that it can be used to either extend the CHTS time series using FES based estimates or to convert the entire CHTS time series to an equivalent FES based time series. The former facilitates continuation of the “old” time series using calibrated FES based estimates in stock assessment updates; the latter facilitates the inclusion of the entire time series of CHTS based estimates as an FES calibrated equivalent in benchmark assessments. Either option maintains the ability to use the entire time series in the stock assessment process and provides the opportunity for comparisons of stock assessments conducted using either CHTS or FES based estimates. Having recreational catch estimates based on methods that are stable over time and account for survey design level effects increase the likelihood that interpretations of other catch related inputs such as age composition are realistic and that comparisons between commercial and recreational age distributions are meaningful.

Although revisions to the Access Point Angler Intercept Survey (APAIS) did not include a change from one method to another very different method, substantial survey design related changes were introduced in 2013 that resulted in changes to the distribution and weighting of sampling and to sampling protocols including sampler discretion in the conduct of the sample assignments. Estimation methodology also changed to reflect the changes to the survey design. Catch was re-estimated for years 2004-2012 so that estimation accurately reflected the complex sampling design. For years 1981-2003, catch was not re-estimated because information present for 2004-2012 was not available. Unlike the FES calibration which included a three year benchmarking period for which the FES and CHTS were conducted side by side, the option for a benchmark period for the APAIS was considered impractical in terms of cost, survey logistics and respondent burden. A different calibration approach was necessary to achieve a better alignment between survey design and estimation. The approach taken involved reweighting of the raw intercept data to better represent the current sampling distribution (raking or iterative proportional fitting). Advantages of this method are that it is an established analytical tool for survey analyses, allows all the sample data to be used and is favored over independent modeling

when significant interaction effects are present among cross-classification variables and categories in those variables are greater than two.

### State Survey Summaries

Over the several years of testing which for states (LA – FL), included the full benchmarking period for the FES (2015-2017) and for MS-FL also involved side by side conduct of the APAIS and state surveys for the same period, a reduced level of APAIS sampling was conducted alongside LA Creel for a single year (2015). LA Creel and GRFS use a complemented survey approach that independently sample catch and effort. In the case of LA Creel, a list based telephone survey is used to obtain trip information while catch information is collected using a dockside intercept survey. GRFS uses a list based monthly mail survey to gather information on fishing effort. Catch and effort sampling components from both survey designs are probability based. MS Tails n’ Scales and AL Snapper Check survey designs are based on capture-recapture methodology in which catch and effort are reported by anglers primarily through specially developed mobile applications in what is termed the capture phase. Ideally, reported trips would be independently sampled in a recapture phase for comparison with information reported by anglers. All of the states reported on progress improving the reliability of catch estimates produced. The focus of those efforts for capture-recapture survey designs has been on improving or maintaining compliance with survey reporting requirements.

### Integration

One of the challenges to using several data sources to estimate catch is how to best incorporate data collected using a variety of different methods so that the estimation process accounts for those differences to provide a reasonable overall estimate. There is the concern that supplemental surveys may not have the coverage MRIP offers and not collect all of the information necessary to generate complete and comparable estimates. The Gulf surveys consist of a general survey that replaces MRIP (as is the case with LA Creel) and surveys that supplement MRIP data collection (MS, AL, FL) to produce alternative estimates. Similar to Louisiana, Texas Parks and Wildlife Department runs a general creel survey. The survey provides annual catch estimates through a methodology that has been relatively consistent over the entire MRIP time series. Survey approaches differ among states and include capture-recapture as well as formal probability based designs that use complemented surveys to produce catch and effort estimates. Capture-recapture methods require probability based sampling only for the recapture phase (validation of reported information). Matching of reports to validations is critical to the effectiveness of the design because of the need to compare reporting rates for sampled and unsampled trips. Sampled trips are assumed independent of reported trips (unless reports that occurred after sampling occurred can be identified. In Tails n’ Scales, unique trip identification numbers issued to anglers prior to making a “red snapper” trip facilitates accurate trip matching between angler reports and trip validations. MS also requires a trip to be “closed out” (reported by the angler) before a new trip identification number can be obtained. This requirement applies regardless of season so that reporting history impacts an angler’s ability to participate in future seasons. For assessment purposes, MRIP estimates both released catch as

well as harvested catch and coverage spans the entire year but this has not necessarily been the case with other surveys. The following table summarizes survey coverage.

Survey	Type	Species	Harvest	Releases	Mode	Coverage	State coverage
MRIP (APAIS/FES)	General	All	Y	Y	PR, PC, SH	12 mths	AL, FL, MS, LA**
LA Creel	General	All	Y	Y	PR, PC, SH	12 mths	LA
GRFS	Supplemental	Reef fish <sup>#</sup>	Y	Y	PR	12 mths	WFL <sup>^</sup>
Snapper Check	Supplemental	Red snapper	Y	Y*	PR, PC	Season	AL
Tails n' Scales	Supplemental	Red snapper	Y	Y*	PR, PC	Season	MS
TPWD	General	All	Y	N	PR, PC	12 mths	TX

\*limited to trips that targeted red snapper

\*\*MRIP coverage in LA was 1981-2013, 2015.

<sup>#</sup> Limited suite of species

<sup>^</sup>Monroe County excluded

How to combine different sources of data on similar parameters is a common statistical problem. For estimation purposes, survey data may need to be combined. Three different approaches used in government surveys were considered in the workshop:

- Composite Estimation (weighted average): USDA, BLS
- Models for small area estimation (Census, USDA)
- Calibration (regional estimates are used to determine “shares” of an independent estimate of total): USDA

Solving the problem of integration prior to calibration may allow a single calibration between a unified (FL-LA) and an FES (FL-LA\*) estimate.

### Composite Estimation

This methodology allows for the generation of a single “composite” estimate by combining estimation inputs from two or more sources. There are a variety of ways in which data can be combined. Generally, inputs are weighted based on precision levels and coverage considerations. With respect to state survey estimates it may be necessary to combine released catch estimates from one survey with harvest estimates from another to address coverage gaps. In any event, the resultant estimates are based on all available information (MRIP and supplemental surveys) and may produce an improvement in overall precision because of increased sample sizes that result from combining data sources. However, as alluded to in the workshop, consultants wanted to examine the behavior of composite estimation under different conditions. An analysis that included both MRIP and state survey estimates may provide a range of conditions under which the method could be evaluated. The analysis might also reveal the potential of automating a process to produce composite catch estimates annually. However, consultants were cautious about the possibility of being able to do so, given the diversity and relationships of survey components and designs being evaluated.

### Small Area Estimation models

Small area or small domain estimation is often referenced as a way to provide reliable estimates for a domain with a small sample size. As small sample sizes may preclude the direct generation of estimates considered statistically reliable, “strength” is borrowed from adjacent cells. The relationship (linking/sampling models) between domains may be informed with administrative or

other auxiliary sources of data to produce an indirect estimate. This approach was used to produce a calibration for Fishing Effort Survey (Fay Herriot model). Preferably, survey design would attempt to accommodate where practicable direct estimation through stratification, optimal sample allocation or integration of surveys. This can be a more sophisticated approach and take longer than composite estimation to evaluate.

### Calibration

It is a reasonable expectation that surveys designed differently will produce different estimates for the same parameter. Calibration allows differences in survey design and implementation to be taken into consideration in comparisons of estimates for a given set of parameters. From a fisheries management perspective, calibration addresses both short and long term needs for comparable estimates. In the short term, comparable estimates are needed for evaluation of annual catch limits (ACLs) developed using a different methodology. Although assessment models can be modified to handle a less than perfectly calibrated time series, the underlying assumption is that catch has been calibrated without bias. Interpretation of long term catch trends may be compromised, resulting in stock status determinations that are less likely to be consistent with true trends if bias resulting from substantive changes to survey methods are not considered.

As an example, the change from the Coastal Household Telephone Survey (CHTS) to the mail based Fishing Effort Survey (FES) marked a major methodological shift. In the past decade in particular, the CHTS' reliance on landlines to reach saltwater anglers resulted in a steady decline in survey response rates. There has been for a number of years, a growing concern that the demographic still using landlines no longer represents the angling public and indications are that landline use has shifted to an older less representative demographic, more unlikely to conduct saltwater fishing trips. Increases in cell phone only households and in voicemail screening of landline calls only served to heighten that concern. After a number of MRIP pilot studies it was clear that a mail survey based on the USPS address system database provided the best overall coverage of anglers in terms of the completeness of the database and the quality of contact information. Moreover, the design allowed angler license information provided by the states to be used to identify licensed anglers in the USPS samples and improve sampling efficiency.

### FES

In the three year side by side benchmarking period from 2015-2017, effort estimates for the Fishing Effort Survey (FES) were found to be substantially higher than those produced by the Coastal Household Telephone Survey (CHTS). The third year of the benchmarking period (2017) was the final year for the conduct of the CHTS, which meant it would be inappropriate to monitor and assess 2018 ACLs set using the 2017 CHTS effort estimates without calibration. Based on well-established small area estimation (Fay-Herriot model) methods consultants from Colorado State University developed a flexible calibration model that accounts for survey mode and trend effects as well as uncertainty due to sampling error. Cell phone use was incorporated into the model from 2000 onward. The model allows reconciliation of estimates in either direction: FES based estimates can be calibrated to CHTS and vice versa. For comparison of 2018 ACLs, FES based estimates can be calibrated to a CHTS equivalent to extend the CHTS time series. Likewise, CHTS based estimates can be calibrated to an FES based equivalent to

build an FES time series. An independent review of the model conducted in 2017 was extremely positive.

### APAIS

Although changes to Access Point Angler Intercept Survey methodology did not include a change in survey mode, survey design changes implemented in 2013 and improvements incorporated since led to substantial changes in the sampling distribution largely due to improved temporal coverage and incorporation of strict sampling protocols that removed sampler decision/discretion from the process. In this case a benchmarking period was not practical so a different approach was taken where reconciliation was achieved by iterative proportional fitting or raking to adjust sample weights and apply pseudo-weights to unweighted data. The method allows all of the data to be used and as such preserves the integrity of the original datasets. This method also received a favorable review by independent reviewers. The final calibrated catch estimates were based on both APAIS and FES calibrations.

### LA Creel

In collaboration with NOAA Fisheries Office of Science and Technology, LDWF developed ratio calibrations based on a single year of overlap for APAIS and the LA Creel catch component and three years of side by side conduct of the FES and LA Creel effort surveys. Federal as well as state needs were evaluated by LDWF in the development of calibrations. For federal assessments which have relied on the historical time series, LA Creel would be calibrated to the current federal standard – the FES whereas a CHTS calibration would accommodate state assessment and management needs. LDWF opted for direct calibrations (LA Creel to FES: 2013 forward; CHTS to LA Creel: 1981-2012, 2015). LA MRIP estimates through 2012 are currently included FES calibrated MRIP estimates. APAIS and FES estimates are also available for 2015, the year in which APAIS/FES and LA Creel were conducted side by side in the state. APAIS was conducted at a reduced level in 2015 in LA which translated into reduced sample sizes for the APAIS, which impacted the (domain?) level at which calibrations could be reliably applied. Basin level estimates at the wave level were not considered feasible but data were considered adequate for a state level annual calibration. In the development of annual calibrations, FES estimates available for 2015-2017, were combined with APAIS estimates for 2015. Other more sophisticated options may be considered in the future but ratio based FES and CHTS calibrations for the FES and CHTS represent a viable option at least in the short term. In the case of LA, small area estimation techniques that use composite estimation may offer an option for improving the reliability of higher resolution calibrations but would be based on limited benchmarking alongside MRIP which could not be updated without additional benchmarking at a later time. Calibrations would essentially be static, maintaining the same ratios/proportions for selected estimation domains.

### Discussion of problem and possible solutions

#### Next Steps

- Consultant analysis of composite estimation. States will provide catch and effort estimates for evaluation of composite estimation. As noted in the workshop, the behavior



of the estimates under certain weighting scenarios may result in composite estimates that are lower than estimates from either of the contributing surveys. Consultants will look at the potential for composite estimation to be an automated process.

- Consider reconvening in a conference call and/or a follow up meeting to discuss the results of the analysis. The results of the analysis will inform decisions on how best to integrate survey data and the choice of calibration method pursued.
- Decisions on long-term calibration approaches would be made in a follow-up workshop. Two options being considered are: (1) Simple Ratio based calibrations ratios and; (2) More sophisticated option for calibration. As ratio based approach may be adequate for development of calibrations, more sophisticated approaches may not be necessary but should be evaluated (particularly as more side by side data become available).
- NOAA Fisheries OST would support states on calibration work through the provision of statistical expertise.
- Review of transition plans (integration and calibration) for state surveys.

## Addendum to Workshop report

### Integration: Feb 2019 Follow-Up Call Summary

Consultants agreed that more research is needed to determine the feasibility of composite estimation. As of now (Feb 2019), an automated process for the generation of a Gulfwide (composite) estimate does not appear to be feasible. Differences between survey designs and implementation, temporal and spatial coverage and associated adjustments, as well as catch components are challenges to integration.

Consultants recommended that we should proceed with calibrations based on the workshop discussions. A simple ratio based calibration could be made available quickly to meet the deadlines for the 2020 Gulf red Snapper Stock Assessment. More sophisticated calibrations (which may not be necessary would take longer to produce). The consultants recommended concentrating on calibrations while continuing to work on potential solutions for integration.

### NOAA Fisheries White Paper

In July 2019, the NOAA Fisheries OST, SEFSC and SERO released a “white paper” that summarized options for inclusion of Gulf of Mexico recreational fisheries survey data in stock assessments and provided recommendations based on stock assessment needs to maintain the recreational catch time series for the Gulf of Mexico, ACL monitoring needs under the Gulf exempted Fishing Permit (EFP) pilot study and the status of development of calibrations for the various surveys. Of the options presented, option 1 (and its various scenarios) was considered practicable with option 1a (use of the already calibrated MRIP time series) currently possible and option 1b preferred use of “common currency” estimates for stock assessments and state estimates for management purposes. Option 1c which involves combining supplemental and general survey information to produce a Gulfwide estimate presents a challenge for reasons already specified.

The various options from the NOAA paper described in detail

**Option 1:** *Use a time series of catch estimates fully calibrated to ensure comparability across years and among states.*

*Option 1a: Use the current fully calibrated MRIP time series (1981-2017) of catch estimates for MS, AL, and FL for charter boat fishing and private boat fishing. This approach employs the peer-reviewed FES mail survey for effort estimates and adjusts past Coastal Household Telephone Survey (CHTS) estimates to account for temporal changes in telephone usage. Convert LA Creel estimates to the MRIP currency using simple ratio calibrations based on side-by-side comparisons of LA Creel and MRIP surveys in 2015-2017. Use these for assessment and management purposes.*

*Option 1b: Use the common currency in Option 1a for assessment purposes, but for management purposes convert assessment-based annual catch limits (ACLs) into the currencies used by the alternative general survey (LA Creel in LA) and supplemental surveys (Tails n’ Scales in MS, Snapper Check in AL, or Gulf Reef Fish Survey in FL). An ACL set for a particular stock such as Gulf red snapper could be partitioned among states in support of regional management. This*

*approach will not be available until early 2020, when peer-reviewed calibration methods are expected to be available for each state.*

*Option 1c: Integrate the supplemental and general surveys in MS, AL, and FL to produce one set of estimates for species covered by both. Use this series for assessment purposes. For management, either use the integrated series, or convert the assessment-based ACLs into the currencies used by the alternative general survey (LA Creel in LA) and supplemental surveys (Tails n' Scales in MS, Snapper Check in AL, or Gulf Reef Fish Survey in FL). This approach will not be possible until final decisions are made on integrated estimation methods (in 2021) and calibrations are approved for use in MS, AL, and FL.*

**Option 2:** *Rescale MRIP time series estimates (1981-2018) to better match estimates based solely on LA Creel and the new supplemental surveys in MS, AL, and FL. This approach would assume estimates produced by the general MRIP surveys are known to be biased and all of the other new surveys are known to be unbiased. It would also be based on an assumption that all of the new survey designs in LA, MS, AL, and FL would produce similar estimates if conducted side-by-side in the same state. As there is no clear evidence that any of these assumptions are valid, this approach would be very difficult to defend on statistical grounds. For example, it is quite possible that the LA Creel surveys would produce different estimates of private boat reef fish catches than those produced by the Gulf Reef Fish Survey if they were conducted side-by-side in FL. It is also quite possible that the methods used for the MS Tails n' Scales surveys would produce estimates of red snapper landings in AL that are different from those produced by the Snapper Check surveys.*

**Option 3:** *Use LA Creel catch estimates for all species in LA, Gulf Reef Fish Survey catch estimates for reef fish species in FL, supplemental survey landings estimates for red snapper in MS and AL, and the general MRIP survey estimates of catch for all state, mode, species, and catch type domains not covered by the supplemental surveys. This approach would assume that all survey approaches produce unbiased estimates and would produce similar estimates if conducted side-by-side. However, recent side-by-side comparisons have demonstrated that the different survey designs do not produce comparable estimates for private boat fishing, and there is no evidence that any of the current surveys are immune to nonsampling errors. Accordingly, this approach would also be very difficult to defend on statistical grounds.*

**Option 4:** *Use general MRIP survey estimates of private boat and shore catches based on the CHTS-APAIS design, rather than those based on the new FES-APAIS design. This approach presupposes that CHTS estimates of effort are less prone to potential bias than FES estimates. However, this supposition is known to be invalid, especially for the years since 2000 when the coverage of the CHTS declined dramatically with the increasing use of wireless phones (the CHTS only contacted households with landline phones). The segment of the recreational fishing population reached by the CHTS in recent years is a much smaller proportion of the total reached in years prior to 2000 and is demographically very different (generally older) from that covered by the FES. The FES has also collected data showing that the average fishing effort of households with a landline phone is now significantly lower than that of households using only a wireless phone. The FES has a much lower nonresponse rate (~60%) than the CHTS (~92%), indicating it is much less susceptible to potential nonresponse error, and a non-respondent follow-up study showed that there was no evidence of a significant nonresponse error in the*

*FES. Hence, the CHTS-based estimates since 2000 are not comparable to CHTS-based estimates prior to 2000, and have become increasingly less so with time. For this reason, MRIP has discontinued the CHTS and any attempt to convert FES-based estimates for 2018 and later years into estimates comparable to CHTS-based estimates prior to 2000 will be difficult to accomplish with any reasonable degree of certainty. Therefore, Option 4 is indefensible on statistical grounds, and use of CHTS-based estimates will not be feasible moving forward.*

***Recommendations:*** *NOAA Fisheries has determined that Option 1—using a time series of catch estimates fully calibrated to ensure comparability across years and among states—is the best approach to use for stock assessments at this time. Option 1a is preferred until Options 1b or 1c are possible. Options 2 and 3 would be very difficult to defend without a considerable amount of further study. Options 1a and 4 are the only possibilities for the South Atlantic region, as there are no competing state surveys, but Option 4 is statistically indefensible. Having catch estimates that are comparable both across states and throughout the historical time series should be the top priority.*

*As we learn more about the possible causes of differences in estimates produced by the different survey designs, we will further improve the sampling and estimation methods of the surveys and reduce the potential for biases due to non-sampling errors. As these improvements are made, we may need to develop and apply new calibrations to produce a more accurate comparable time series of catch estimates for use in stock assessments and management decision-making.*

## Appendix

### Participant List

Kevin Anson – Alabama Department of Conservation and Natural Resources (ADCNR)  
Luiz Barbieri – Florida Fish and Wildlife Conservation Commission (FWC)/  
Gulf of Mexico Fisheries Management Council (GMFMC) SSC - *Chair*  
Harry Blanchet – Louisiana Department of Wildlife and Fisheries (LDWF)  
Leann Bosarge – Gulf of Mexico Fishery Management Council (GMFMC)  
Gregg Bray – Gulf States Marine Fisheries Commission (GSMFC)  
Richard Cody – NOAA Fisheries Office of Science and Technology (OST - Affil.)  
Roy Crabtree – NOAA Fisheries Southeast Regional Office (SERO)  
Tiffany Cross – FWC  
Thomas Derbes – ADCNR  
David Detlor – NOAA Fisheries Office of Science and Technology (OST)  
Dave Donaldson – GSMFC  
Mike Drexler – Ocean Conservancy  
Mark Fisher – Texas Parks and Wildlife Department (TPWD)  
John Foster – NOAA Fisheries OST  
Jason Froeba – LDWF  
John Froeschke – GMFMC  
David Gloeckner - NOAA Fisheries Southeast Fisheries Science Center (SEFSC)  
Sepp Haukebo - Environmental Defense Fund  
Mike Larkin – NOAA Fisheries SERO  
Virginia Lesser – Oregon State University  
Vivian Matter – NOAA Fisheries SEFSC  
Paul Mickle – Mississippi Department of Marine Resources (MDMR)  
Trevor Moncrief – MDMR  
Jean Opsomer – Westat Inc.  
Andrew Peterson – Bluefin Data Inc.  
Karen Pianka – NOAA Fisheries (OST Affil.)  
Ashford Rosenberg – Gulf Shareholders Alliance  
Beverly Sauls – FWC  
Joey Shepard – LDWF  
Tom Sminkey – NOAA Fisheries OST  
Carly Somerset – MDMR  
Lynne Stokes – Southern Methodist University  
Greg Stunz – Harte Research Institute, Texas A&M University  
Tom Wheatley – Pew Charitable Trust  
Geoff White – Atlantic Coastal Cooperative Statistics Program (ACCSP)