



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

JUN 15 2018

MEMORANDUM FOR: The Record

FROM: Cisco Werner, Ph.D., Director, Scientific Programs and Chief
Science Advisor, National Marine Fisheries Service

SUBJECT: Certification of Marine Recreational Information Program (MRIP) Fishing
Survey Method for Mississippi Department of Marine Resources Tails n'
Scales

This memorandum certifies the Mississippi Department of Marine Resources (MDMR) Tails n' Scales survey design described herein as an approved method for derivation of estimates of recreational fishing catch and effort for Gulf of Mexico Red Snapper (*Lutjanus campechanus*). The MRIP certification process is described at <https://www.st.nmfs.noaa.gov/recreational-fisheries/MRIP/making-improvement>. For MDMR Tails n' Scales, specific Terms of Reference were also adopted (see attached).

BACKGROUND

Prior to 2008, the Marine Recreational Fisheries Statistics Survey (MRFSS), initiated in 1979, was the primary source for national recreational fishery statistics in the United States. In response to a growing demand for an improved recreational fishing data collection program, NMFS commissioned the National Research Council (NRC) of the National Academies of Science to conduct a high-level scientific review of the existing survey methods used by NMFS and its partners to monitor catch, effort, and participation in marine recreational fisheries throughout the U.S.

The NRC's Ocean Studies Board formed a 10-member committee of experts in sampling design and statistics to conduct the requested review independent of NMFS. A final report of their findings (*Review of Recreational Fisheries Survey Methods*) was published in April 2006. The committee identified a number of potential problems with the MRFSS sampling and estimation designs, and questioned the adequacy of existing surveys in providing the statistics needed to support stock assessments and the kinds of fishery management decisions required by current law and practice. The report included recommendations to redesign current surveys to improve: their effectiveness, the appropriateness of their sampling procedures, their applicability to various kinds of management decisions, and their usefulness for social and economic analyses.

Section 401(g) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), which was added via the 2006 Magnuson-Stevens Reauthorization Act (MSRA), P.L. 109-479 (Jan. 12, 2007), includes requirements for improving recreational fisheries data collection:

- "Within 24 months after the date of enactment of the [MSRA], the Secretary, in consultation with representatives of the recreational fishing industry and experts in statistics, technology, and other



appropriate fields, shall establish a program to improve the quality and accuracy of information generated by the Marine Recreational Fishery Statistics Survey, with a goal of achieving acceptable accuracy and utility for each individual fishery.” 16 U.S.C. § 1881(g)(3)(A).

- “The program shall take into consideration and, to the extent feasible, implement the recommendations of the National Research Council in its report *Review of Recreational Fishing Survey Methods* (2006), including...redesigning the survey to improve the effectiveness of sampling and estimation procedures, its applicability to various kinds of management decisions, and its usefulness for social and economic analyses...” *Id.* § 1881(g)(3)(B).
- “Unless the Secretary determines that alternative methods will achieve this goal more efficiently and effectively, the program shall, to the extent possible, include...use of surveys that target anglers registered or licensed at the State or Federal level to collect participation and effort data...collection and analysis of vessel trip report data from charter fishing vessels.” *Id.* § 1881(g)(3)(C)(ii)-(iii).

NOAA Fisheries initiated the Marine Recreational Information Program (MRIP) in 2006 to address the findings and recommendations of the NRC report and to carry out the above requirements. MRIP was formally established upon adoption of an Implementation Plan in October, 2008. It is a collaborative effort among NOAA Fisheries, regional fisheries managers and stock assessment scientists, and the recreational fishing community to develop and implement an improved recreational fisheries statistics program. The new program consists of a system of regional surveys, which, after being designed, tested, and peer-reviewed, will provide recreational catch and effort statistics that fulfill the requirements of 50 CFR § 600.315 (National Standard 2 guidelines) and that will be eligible to be considered best scientific information available in the assessment and management of fisheries, taking into consideration other relevant factors.

Decisions to implement new data collection methods are informed by a technically-sound scientific process that includes testing of new or enhanced survey methods, peer reviews of survey methods and project results, reviews by stakeholder groups, and development and execution of transition plans that assure an orderly and scientifically sound process for incorporating the catch and effort estimates derived from new methods into catch history databases as necessary for fisheries stock assessments and management.

In response to the NRC findings and recommendations, and as directed and authorized by § 401(g) of the MSA, MRIP has undertaken a series of actions to establish more suitable sample frames and to develop and test survey methods which will result in more accurate estimates of fishing effort. MRIP follows the requirements of the Information Quality Act (P.L. 106-554 § 515), which ensures the quality, objectivity, utility, and integrity of disseminated information.

Many regional partners have also initiated development of alternative and supplemental survey designs that are intended to provide catch estimates that directly address partner needs that are not fully met by the general MRIP surveys. In order for the data generated by these surveys to be utilized by NMFS, NMFS developed a certification process under which survey designs are pilot tested, the design and pilot results peer reviewed, and NMFS certifies whether the survey and estimation methods are scientifically sound.

In 2014, the Mississippi Department of Marine Resources (MDMR) enacted a regulatory requirement for private and for-hire vessels to report all Red Snapper harvest regardless of waters fished and began development of an alternative survey design to accommodate required reporting of Red Snapper catches.

Goals of the survey design were: to provide Red Snapper catch estimates that were more precise than those currently available through MRIP and to facilitate improved monitoring of Red Snapper catches with respect to annual catch limits. In 2015, MDMR began development of the Tails n' Scales mobile application to facilitate required reporting and effective enforcement of reporting requirements. At MDMR's request, NMFS conducted an initial peer review of the Tails n' Scales survey design in June, 2016. MDMR has responded to the peer review comments and there have been subsequent rounds of review and response, as documented in the attachments.

Description of Certified Method

Tails n' Scales was specifically designed to provide estimates of Red Snapper catch that are unbiased and more precise than estimates available through MRIP. To meet this goal, MDMR introduced a regulation in 2014 that required private boat and for-hire vessel representatives to report all Red Snapper harvested and released. The Tails n' Scales survey design consists of two complimentary components: the Tails n' Scales reporting system and an access point intercept survey. Through a capture-recapture sampling approach, catch and effort information reported by anglers through the Tails n' Scales system is validated and corrected using information from the intercept survey. In using a capture-recapture approach, the assumption is made that access point intercept surveys and Tails n' Scales reporting are conducted independently. Compliance is maintained through strict enforcement of the Red Snapper reporting requirements.

- The Tails n' Scales system is the mechanism whereby required reporting of Red Snapper catch is achieved. One representative from a fishing party must register in the system and is required to prospectively declare the upcoming fishing trip to obtain a unique trip authorization number. A new trip authorization number cannot be obtained until the previous trip information has been reported using the Tails n' Scales system. Three reporting options are available to vessel representatives: Mobile app, Online, and phone.
- The dockside private boat and for hire vessel validation component is a randomized intercept survey conducted at public fishing access points based on Red Snapper fishing pressures at those sites. Sampling assignments are randomly selected by site-day and time block using probability proportional to size (PPS) protocols.

Certification

The MDMR survey design described in the attached documents is certified as a design that has been appropriately developed and peer-reviewed and that is considered scientifically valid. Critical to the validity of the capture-recapture methodology used in the Tails n' Scales survey design is maintenance of reporting compliance levels and the matching of access point intercept survey information with Tails n' Scales trip reports. The assignment of a unique trip authorization number facilitates matching of Tails n' Scales reports to access point intercepts.

The practical effect of this certification is that NMFS may fund use of this survey design and fund and/or provide technical support for other similar surveys proposed or used by partner organizations. It should be noted that any modifications of the documented survey design are not automatically deemed certified, but will require review for consistency with this determination and potential further modification for the survey to remain certified.

NMFS and MDMR's next steps will be to: (1) determine how best to integrate the supplemental survey with the general MRIP surveys; (2) develop a calibration method to adjust historic estimates based solely on the MRIP general surveys to be comparable to estimates derived from the integrated approach; (3) have the new calibration method peer reviewed; (4) apply the calibration method to catch history time series in updated stock assessments. These steps will be undertaken through execution of a Transition Plan pursuant to NMFS Policy Directive 04-114.

Attachments:

Red Snapper Certification doc 7.7.17 FINAL.pdf

Review of MS Tails 'n Scales Program.pdf

TOR9_MS_TailsnScales.pdf

Appendix 1. MS Certification Document.pdf

Appendix 2. MS Red Snapper survey consultant report.pdf

MISSISSIPPI DEPARTMENT OF MARINE RESOURCES

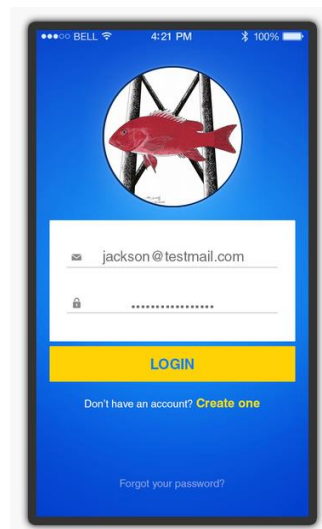
MARINE FISHERIES



ENHANCE ★ PROTECT ★ CONSERVE

MANDATORY RED SNAPPER REPORTING PROGRAM

2015 METHODS AND RESULTS



APRIL 2016

BACKGROUND/PURPOSE

Red Snapper is currently one of the Gulf of Mexico's most important recreationally targeted fishes. Accurate and timely estimation of recreational Red Snapper harvest and angler effort is crucial for the current Gulf-wide management plan. The current management of Red Snapper includes a derby style Federal season with multiple and highly variable state seasons. Accurate estimation of seasonal harvest as well as harvest within season is valuable for fisheries managers to set and adjust fishing restrictions. With the current interest in regional management, estimation of in-season harvest on a timelier basis would be of utmost importance in preventing overages allowing each state and the Gulf as a whole stay within its allocated quota.

METHODS

A. Reporting

On October 21, 2014 the Commission of Marine Resources adopted a regulatory modification to Title 22 Part 9 enacting the reporting and confidentiality of Red Snapper landings in the state of Mississippi. On April 7, 2015 The Mississippi Department of Marine Resources (MDMR) partnered with a software developer to design a mobile application to record all Red Snapper landings in Mississippi. The goal of the mobile App design was to provide an easily accessible and intuitive system to enable Red Snapper private and for-hire anglers to report their Red Snapper landings in real time.

All vessels (private and for-hire) landing Red Snapper in Mississippi were required to use the Tails n' Scales electronic reporting system regardless of harvest area (Federal waters, Mississippi state waters, adjacent states' waters, etc.). There were no exemptions. One angler per vessel was required to possess a trip number from the reporting system when targeting Red Snapper. When approached by law enforcement trip numbers were checked with the reporting system database for that day.

To promote the Tails n' Scales reporting system, MDMR employees posted signs and banners next to boat ramps and in marinas and passed out business cards detailing where and how to download the app, reporting requirements and the toll-free number. Tails n' Scales was also publicized on social media and Mississippi anglers were informed of the reporting requirements

at local fishing meetings (Gulf Fishing Banks, Coastal Conservation Association, and Ocean Springs Fly Fishing Club).

MDMR required one report per trip per vessel. A trip authorization number had to be obtained by a representative of each vessel prior to fishing. Trip authorization numbers were valid for 24 hours only and had to be closed out each time before a new trip number was issued. Trips could only be created up to five days in advance. Registration, obtaining trip authorization numbers, and reporting harvest could be done using one of three methods: through the Tails n' Scales mobile applications, available on both iPhone and Android devices, online at www.tailsnscales.org, and by phone through the toll-free number (1-844-MSSNAPP).

The toll-free number directly connected users to a call center available 24 hours a day, seven days a week. The number could be used to register, create new trips and close out trips. In the event that a user did not have an email account or did not have access to the Tails n' Scales electronic reporting system online or on a mobile device, the toll-free number was always accessible. However, MDMR highly encouraged using the free downloadable app and/or visiting the website for the reporting process. If any users of the Tails n' Scales program had questions or concerns regarding reporting, MDMR created and maintained an email specifically for Red Snapper reporting.

To register in the Tails n' Scales system, users were required to provide first and last name, a valid email, phone number and home address and either the vessel's state registration number or the U.S. Coast Guard vessel documentation number. Vessel type (private or for-hire) had to be indicated and a vessel name provided if applicable. Users were not allowed to complete registration until all required fields were completed. Once registered, users could use more than one method to create and complete trips.

If a trip was created that was rescheduled or cancelled, the user had to abandon that trip and provide a reason code. Anglers could not create new trip numbers until the current trip was abandoned and a reason provided. This allowed administrators to maintain a closed trip universe whereby anglers were forced to report their trip before starting a new one.

All questions pertaining to closing a trip in the system were required to be answered: the amount of time spent fishing to the nearest half hour, the number of people who fished on the vessel, the

number of Red Snapper harvested, and the habitat where the majority of time was spent fishing. Anglers only had access to their own account and trip information and MDMR project managers had administrative access and the ability to update or change any personal or trip information.

The reporting system was housed on a secured server which stores all data. These data were then exported into analyzing software for analyses. The flow of data, data access and user interaction was restricted at each level of the process depending on user group (angler, call center staff, administrator and law enforcement) (Figure 1).

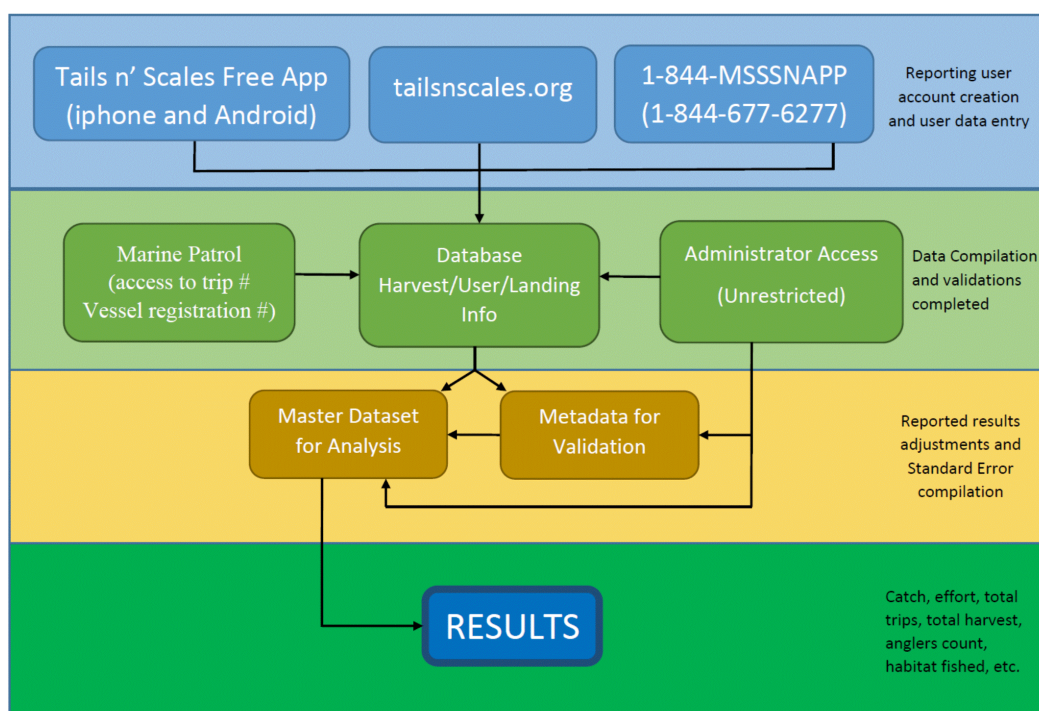


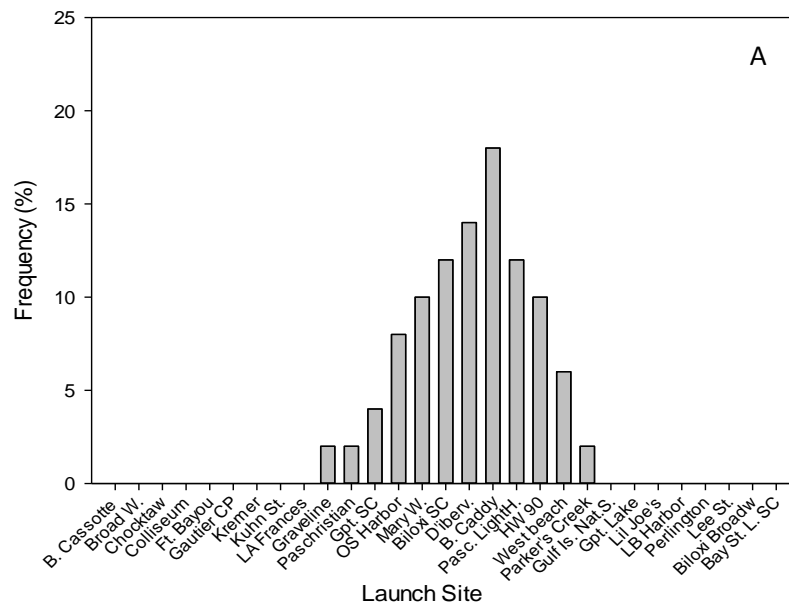
Figure 1: Flow chart illustrating user interaction and data flow through the reporting system.

B. Validation

Validations were conducted using three different methods. (1) Access point intercept survey validations, (2) visual effort validations, and (3) phone validations were completed to determine non-reporting, under- and over-reporting as well as to gather bio-sampling data (fish lengths, weights and otoliths). This information provided the inputs for validation and adjustment analyses (correction factors) for all user groups (private and for-hire) and seasons (federal and state) involving Red Snapper.

1) Access Point Intercept Survey Validations

To conduct access point intercept survey validations a site pressure analysis was performed to select assignment times and locations accounting for pressures (high or low vessel traffic) at public boat ramps on the Mississippi coast. Four, six hour time blocks were created for survey time assignments (2 a.m.-8 a.m., 8 a.m.-2 p.m., 2 p.m.-8 p.m., 8 p.m.-2 a.m.). Weekday and weekend assignment locations and times were randomly assigned from a pressure frequency distribution acquired from the created trips in the Tails n' Scales database (Figure 2A&B). Assignment selection was performed for both site locations and time blocks by calculating the cumulative combined pressures and 100. The beginning value for each site's pressure was the product produced for the site and added to the previous site's combined pressure (Table 1A&B). Numbers created using a random number generator in R[®] statistical software (setRNG package) were then used for assignment selection. During the first year of the program (2015), the reported pressure values were created using the distributions of launch locations and ramp arrival times reported from the first weekday and first weekend day of the season. Subsequent years will have a larger data pool of weekday and weekend distributions to assign pressure values for both location and time. If a time block or site was randomly selected twice, it was assumed a high pressure instance and two surveyors were assigned to that particular assignment time.



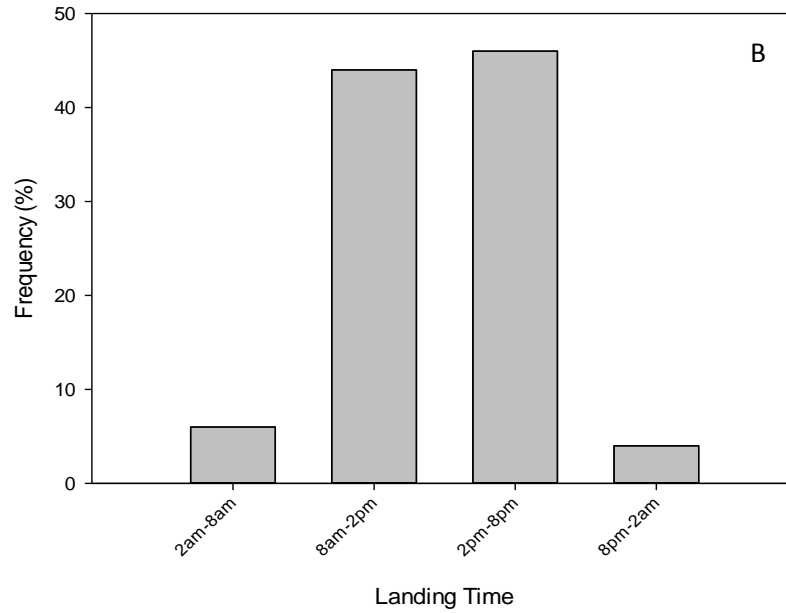


Figure 2: (A) Site pressure values using 2015 weekday reported data. (B) Time pressure values using 2015 weekday reported data. Subsequent years will use all past reported pressure values by mode.

Table 1A: Example of site pressure summary value ranges for the federal Red Snapper season using 2015 weekday reported data.

Mode	Day	Site	Pressure	Cumulative Combined Pressure	Pressure Range
Private	Weekday	B. Caddy	18	18	1-1800
Private	Weekday	B. Cassotte	0	18	
Private	Weekday	Bay St. L. S.C.	0	18	
Private	Weekday	D'iberville	14	32	1801-3200
Private	Weekday	Biloxi BroadW.	0	32	
Private	Weekday	Biloxi S.C.	12	44	3201-4400
Private	Weekday	Gpt. Lake	0	44	
Private	Weekday	Gpt. S.C.	4	48	4401-4800
Private	Weekday	Graveline	2	50	
Private	Weekday	Gulf Is. Nat. S.	0	50	5001-6000
Private	Weekday	H.W. 90	10	60	
Private	Weekday	Kremer	0	60	
Private	Weekday	Lil Joe's	0	60	6001-7000
Private	Weekday	Mary W.	10	70	
Private	Weekday	O.S. Harbor	8	78	
Private	Weekday	Parker's Creek	2	80	7801-8000
Private	Weekday	Pasc. Light H.	12	92	
Private	Weekday	PasChristian	2	94	9201-9400
Private	Weekday	Pearlington	0	94	
Private	Weekday	Lee St.	0	94	9401-10000
Private	Weekday	West Beach	6	100	

Table 1B: Example of time pressure summary value ranges for the federal Red Snapper season using 2015 first day reported data. Subsequent years will use all past reported pressure values by mode.

Mode	Day	Time Block	Pressure	Cumulative Combined Pressure	Pressure Range
Private	Weekday	0200-0800	3	3	1-300
Private	Weekday	0800-1400	22	25	301-2500
Private	Weekday	1400-2000	23	48	2501-4800
Private	Weekday	2000-0200	2	50	4801-5000

MDMR staff interviewers approached all boats landing at the designed site. After initial contact and introduction, the surveyor inquired if anyone on board were anglers and if they had targeted Red Snapper during their trip. Anglers in vessels that had targeted Red Snapper were asked a series of questions for report validation purposes; vessel registration number, habitat type (artificial reef, natural bottom, oil/gas platform), number of anglers, hours fished and trip type (private/for-hire).

During the state season, survey validation was the same as the federal season excluding the location and time assignments. Because of the staffing constraint of multiple projects, the Recreational Information Program's (MRIP) Access Point Angler Intercept Survey (APAIS) was used to assign times and locations (APAIS Methods and Techniques Manual 2014).

2) Visual Effort Validations

Visual validations were conducted to verify vessels offshore targeting Red Snapper. This was exclusively performed during the Federal Red Snapper season because it was assumed that Red Snapper angler effort could only be estimated from vessels present offshore during a derby style season (federal season). During additional seasons (state) the assumptions of targeting Red Snapper cannot be made because of the ability of anglers to target additional species offshore.

Visual observations were completed by two vehicles (aircraft and MDMR vessel) which were used to cover different areas to avoid overlapping vessel counts. For logistical reasons the vessel departed at approximately 0800 hrs. and returned approximately 1700 hrs. The route was subject to change because of weather conditions.

The Civil Air Patrol (CAP), a volunteer organization chartered and funded by Congress with Air Force oversight, was used to fly aircraft reconnaissance missions. This group of professionals was able to meet the MDMR's aerial request on short notice and at a low cost. Observer personnel from the MDMR were onboard the CAP aircraft for each flight. Planes left from Gulfport/Biloxi Regional Airport and maintained an altitude of 1000 feet which allowed MDMR observers to easily record the required information. The flight path covered all of Mississippi's offshore artificial reef sites within the state's territorial waters (Figure 3). The flight sight range was limited to an area no greater than 60 miles past the barrier islands. For areas south of the aircrafts range, vessel counts were completed by a MDMR offshore vessel. Personnel visually inspected off-shore artificial reefs and oil and gas production platforms within the designated area. Staff counted the number of vessels at each location, recorded the GPS coordinates, and verified the state of registration for each vessel encountered as well as the number of anglers aboard each vessel.

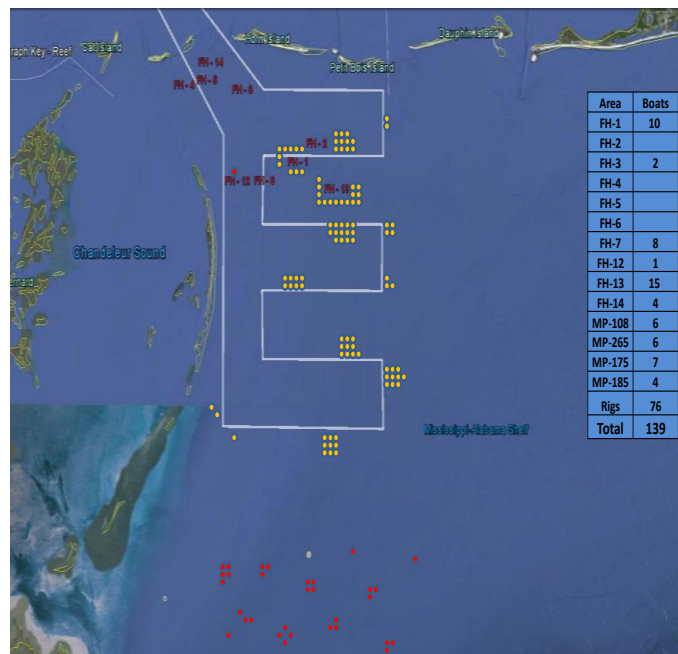


Figure 3: An example of a vessel/flight path during a Red Snapper Federal season visual survey (yellow dots are fishing vessels spotted by the aircraft and red dots are fishing vessels spotted by the MDMR vessel).

3) Phone Validations

Telephone validation interviews were performed MDMR staff. Within the first season (2015), all expired trips were contacted by staff and verified by an MDMR employee closing out the expired trip for the angler. This violates the independence assumption of the capture/recapture method but was done only to show the functionality of the estimator equations. In future seasons, 10% of the reported trips within each user group (private/for-hire/federal season/state season/weekday/weekend) will be randomly selected by using the same random number generator in R[®] statistical software (setRNG package) that was used in the intercept time and location selection. An extended calling list will be created for each user group and staff will be instructed to call the list in order until 10% of the entire group has been contacted and their trips verified. These contact interviews validate the reported data created by the user when the trip is closed out. All questions answered in the reporting system (listed in Section A) will be verified by the staff caller.

C. Biosampling

To acquire biological data, MDMR staff conducting the validation interviews asked permission to measure all Red Snapper landed. Data collected included weights (g) and lengths (SL, FL, TL mm) as well as sagittae otolith collection. These data were used for calculating the mean weights, lengths and ages for landings estimations as well as for future stock assessment inputs. Additional methods can be found in MDMR's biological processors methodology report (NOAA-NMFS-SE Interjurisdictional Fisheries Report 2013-2003494).

D. Angler Population, Trip, and Fish Harvest Estimators

Estimating angler participation, trip number and fish harvest was done through a capture/recapture method because it was assumed that both inputs were independent. This was completed using two different methods from which the first [1] is a simple estimator that takes the reported values and multiplies the sum by the quotient of the intercepted values and the correct intercepted values. The second estimator [2] was similar in structure with the summation of the three validation techniques along with the product of the weighted values for each of the three validations. The ratio estimator (\hat{N}) was defined as the reported values multiplied by the quotient of the validated values and the correct validated values. This was identified as $r_i=1$ if the i^{th} unit being the number of reporting and $r_i = 0$ if not reporting, and $y_i = 1$ for every unit in the

resampled population. Within the validated groups, there were three different validation inputs described in section B (i = intercept, v = vehicle, and p = phone intercept).

$$\hat{N} = \sum_{i=1}^N ri \left(\frac{\sum_{i=1}^{n2} yi}{\sum_{i=1}^{n2} ri} \right) \quad [1]$$

$$\hat{N} = \sum_{i=1}^N ri \left(\frac{\sum_{i=1}^{n2} yi(i)(wi) + \sum_{i=1}^{n2} yi(v)(wv) + \sum_{i=1}^{n2} yi(p)(wp)}{\sum_{i=1}^{n2} ri(ci)(wi) + \sum_{i=1}^{n2} ri(cv)(wv) + \sum_{i=1}^{n2} ri(cp)(wp)} \right) \quad [2]$$

Because the three validation methods were different and independent, a weighting variable was added to each validation. Weighting values for each validation method were determined by using a quantitative value assignment to each requirement of the method (Table 2). This is done similarly to the South East Data Assessment Review (SEDAR) process of assigning p^* values to stock assessment reference points.

Table 2: Weighted value assignments for intercept, phone and visual validation methods. All requirements were assigned a 0.00 or 0.25 value based on each method's ability to validate the requirement.

Requirement (0.25)	Validation Method		
	Intercept (i)	Visual (v)	Phone (p)
Trip Occurrence	0.25	0.25	0.00
Number of Anglers	0.25	0.25	0.00
Number of Fish	0.25	0.00	0.00
Correct Trip Number	0.25	0.00	0.25
Total Weighting Value (w)	1.0	0.50	0.25

This estimator also allows standard error (SE) and an approximate 95% confidence interval for the outputs (\hat{N}) which was conducted using R[®] statistical software (SURVEY package). This equation [3] was exclusively used on the landings to display the uncertainty and window of probable landings. Other management agencies may use Percent Standard Error (PSE) to present the landings and these outputs have the ability to be converted to PSE.

$$\text{Upper/Lower 95\% Confidence Limit} = X \pm \left(\frac{SD}{\sqrt{n}} * 1.96 \right) \quad [3]$$

RESULTS

Table 3: Intercept, vehicle and phone validation totals for federal/state and private/for-hire groups (2015 data only). For visual validations (*v*), during the federal season both vessel and aircraft were used and during state season only the vessel was used.

Type	Season	Tails n' Scales Reported Trips	Intercept (<i>i</i>) Validations/Correct Validations
Private	Federal	323	14/7
Private	State	171	6/4
For-Hire	Federal	85	4/4
For-Hire	State	0	0
TOTAL		579	24/14

Table 4: Reported totals for trips, anglers, fish harvested along with weighted validation totals (estimator 2), and correction factors for federal/state, and private/for-hire groups (2015 data only).

Type	Season	Reported Trips	Reported Anglers	Reported Fish Harvested	Final CF
Private	Federal	619	3,855	5,721	2.000
Private	State	574	1,288	2,954	1.500
For-Hire	Federal	85	747	1,175	1.000
For-Hire	State	0	0	0	NA

Table 5: Mean weights of biological sampling along with estimate totals of trips, anglers, fish harvested, and total landings (estimator 2) (2015 data only).

Type	Season	Total Estimated Trips	Total Estimated Anglers	Total Estimated Fish Harvested	Mean Weight (lbs.)	Total Estimated Landings (lbs.) (SE)
Private	Federal	1238.000	7710.000	11442.000	6.087	69,647.454 ($\pm 15,805.860$)
Private	State	861.000	1,932.000	4431.000	4.661	20,652.891 ($\pm 3,396.24$)
For-Hire	Federal	85.000	747.000	1,175.000	6.087	7,155.750 (± 572.462)
For-Hire	State	0	0	0	NA	NA
TOTAL	(MS 2015)					80,199.444 ($\pm 19,774.562$)

FUTURE ADDITIONS

Discards/Catch Mortality

Future Red Snapper reporting in Mississippi will estimate discards or catch mortality. By adding a few key questions to Tails n' Scales reporting system as well as to access point surveys, we can begin to build a record of fish caught and released. Multiple stock assessments on Red Snapper have quantified survivorship related to hook size and depth fished to allow additional inputs in the models.

Private Docks

It is important to consider the large number of private access sites along the Mississippi coast line. Private docks offer a unique way to collect catch data. Groups or individuals that have access to private docks and boat launches generally own or have access to larger boats: making deeper water and bigger fish more accessible. Tidelands funds within MDMR offer the flexibility to allocate staff, target anglers and gather data from fish landed at these “private access site” locations. The access point survey methodologies for these locations remain the same as it is for public access sites. Interviewers will contact individuals prior to embarking and request permission to intercept anglers at the site upon returning from their trip. All pertinent information and Red Snapper data will be recorded.

Addition of Season and Type

Due to Amendment 39, sector separation will require an additional user group during Federal seasons. Non-Federally permitted for-hire captains landing Red Snapper during the Federal season will be separately accounted.

Marine Patrol Intercept Data

Another addition that will help improve the system will be collaboration with Marine Patrol. MDMR Marine Patrol had 252 intercepts during the federal season and 874 during the state season alone last year. These are data that are being validated on board the angler's vessel by marine patrol officers who will have access to trip numbers recorded in the system each day. Using this catch data and comparing it to reported trips will further our knowledge of how to improve the validation process.

LITERATURE CITED

Procedures Manual: Access Point Angler Intercept Survey. January 2014.

NOAA Fisheries. Pp.12-78.

NOAA-NMFS-SE Interjurisdictional Fisheries Report. November 2013.

NOA Fisheries. Report # 2003494. Pp.144-180.

R Development Core Team. (2005). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria, URL <http://www.R-project.org>.1/17/2015.

Mississippi Red Snapper Reporting Program review
Biloxi, MS
June 29-30, 2016
Consultant Report

Jay Breidt, Virginia Lesser, Jean Opsomer, Lynne Stokes

August 26, 2016

General Comments

The review meeting in Biloxi was informative and efficient, and we appreciate the care taken in putting together the materials and presentations for our review. We are confident that the Tails 'n Scales data collection system, with minor changes, can support a scientifically valid red snapper catch estimation system.

This report summarizes what we see as the strengths of the project plan as it is currently implemented, as well as the parts of the current system we believe could be eliminated or changed. We also present valid estimation methods in more detail, based on capture-recapture methodology.

Strengths of Tails 'n Scales

The Tails 'n Scales system requires that red snapper angling trips be prospectively declared by a member of the angling party. The data collection strategy proposed in Mississippi uses mark-recapture methods to estimate population totals, which are efficient and statistically valid approaches for producing estimates in difficult-to-sample populations. The pre-declaration of the intention to fish provides a well-defined "capture" for each trip that is by definition independent of any subsequent "recapture," since it occurs before the angler is aware of whether or not a recapture will occur. (This is true for estimating the count of trips; the counts of anglers and caught fish are not declared in advance of recapture. This will be discussed later in the estimation section.) We consider this to be a great strength of this implementation of the angler reporting system, since it eliminates a common assumption violation in other capture-recapture estimation systems. Another strength of the Mississippi approach is that the pre-declaration of the trips is mandatory, with significant penalties for violations (e.g., increasing fines for 1st, 2nd, and 3rd offenses resulting in revoking a license after the third offense) *and* actual enforcement on the water. This makes it likely that compliance numbers will be high, ensuring that the Tails 'n Scales database will represent close to a complete census of red snapper trips.

The survey implementation of Tails 'n Scales is well conceived and crafted, including the requirement of the trip declaration. The weather and sea forecasts and the trip log should incentivize users to access the system before and after their trips. There

are few questions and the response categories are easy to figure out . However, we do suggest that the list of landing sites is quite long which may reduce accurate responses. A person might be more likely to click the first sites on the screen rather than scroll to the bottom. We suggest rather than look over a long list of over 50 sites, the program should first list counties (Harrison, Jackson, Hancock). Once the respondent clicks on the county, the list of sites within that county are displayed. There will still be a list to look at but it will be much smaller.

Another strong point of the data collection system is that it may provide an opportunity to collect information to answer a particularly thorny problem in many recreational angler surveys: How do public and private access angling trips differ? In particular, a goal of each state is to examine whether the reporting compliance rate and catch rate differ for public and private access anglers. Two aspects of the Mississippi survey protocols provide opportunities to examine public and private estimates. First, the unique geography of Mississippi and the intense law enforcement presence on the water may provide an opportunity to collect data to discern the difference in reporting rates for the two groups of anglers. Specifically, suppose we can assume that law enforcement data can produce a reasonable estimate of reporting compliance rate of the entire population of red snapper anglers. Then this estimate can be combined with other data already available to estimate the reporting compliance rate of private access anglers. We return to a discussion of how this can be done through a combination of Tails 'n Scales reports, and law enforcement and access point intercepts. This is discussed in the section on auxiliary data collection procedures.

Second, the program of “sampling by appointment” for private access anglers provides a means for allowing validation of reported data on catch (although not on number of anglers) for those private access anglers who do report their trip. While this is not the entire universe of private access anglers, it is still a subgroup whose data are not available in other recreational angler surveys. As it is now implemented, this subgroup is not sampled according to a probability sample, as the sample is restricted to individuals who are specifically chosen by Mississippi staff. While this is a reasonable way to begin the program to test its feasibility, we recommend that it be extended to a randomly selected sample of anglers who have ever reported a private access trip. There will probably be more refusals for this group than previously, but sample analysts are accustomed to dealing with missing data and have tools for adjusting for non-response bias.

Validation data sources

Estimating aspects of angling trips (number, total fish caught or number of anglers participating, or any other feature) via capture-recapture methods requires two sources of data, one of which must be randomly selected (or at least reasonably modeled as randomly selected). In this application and other similar ones using angler reports, one of the two sources is the database of angler initiated reports. These reports do not originate from a random sample of red snapper anglers, so the

other source of data must originate from a random sample. Fortunately, the access point intercept sample does produce a random sample of (public access) trips by design. It is important to note that the design does not need to give each trip an equal chance of selection, but when it does not, weights must be used in estimation to account for the unequal selection. These two sources (Tails 'n Scales reports and access point intercept samples) are all that is needed to estimate features of public access trips.

For example, to estimate the number of public access trips, the reported number of such trips in Tails 'n Scales is adjusted by dividing it by an estimate of their reporting compliance rate. This estimate is calculated from the access point intercept sample. In order to expand such estimates to include the number of private access trips, one must make the (usually unverifiable) assumption that public and private access trips are reported at the same rate. Then the compliance rate estimated from the access point intercept sample can be applied to the whole population of Tails 'n Scales reported trips. Note that if a separate estimate of reporting rate for private access trips were available, it could be used to inflate the number of reported trips in this category separately, and the estimates of total trips for the two domains summed up after separately adjusting them.

To estimate another characteristic over all trips, such as total catch, the form of the estimator is similar. In that case, the Tails 'n Scales reported number of fish caught is adjusted by dividing by an estimate of the ratio of the total reported to total true number of fish caught, where the estimate is made from the access point intercept sample only. This ratio is likely to be less than one when reporting is incomplete, thus producing an estimate that inflates the number of fish reported. However, unlike for the estimate of number of trips, it is possible for the ratio to exceed one—say if reporting were 100% and anglers exaggerated their catch in Tails n' Scales. In that case, the estimated catch would actually be smaller than the reported catch. If this estimated ratio is used to adjust all the reported catch (public and private), the estimate of total catch will only be approximately unbiased when the ratio of reported to true catch is the same for public and private access trips. As noted earlier, the auxiliary data collected in the Mississippi data collection plan may provide a way to assess this assumption.

While the presence of a trip report in Tails 'n Scales is truly independent of its possible access point intercept, the same cannot be said a priori about the trip characteristics. That is because the completion of a Tails 'n Scales trip report, which includes the catch, the number of anglers and the area fished, can occur both before (on the water) and after the intercept. That seems unavoidable given the current approach but it is good to remain aware of this potential source of bias in the estimates.

It is possible to make use of additional sources of information using a methodology known as multiple recapture, in which the data from each of the new sources must also be either randomly selected or reasonably modeled as such. In addition, the

events of capture in the various sources must be independent, and the units observed in each sample must be identifiable across samples. One or several of these conditions are violated for either of the other data collection systems that were described (telephone and on-the-water samples). Only trips present in the Tails 'n Scales list appear in the telephone sample. Thus the probability of selection for the telephone sample depends on membership on the Tails 'n Scales list, violating the independence assumption. It is not possible to match encountered trips from either the airplane or law enforcement samples with the other available samples. Therefore neither of these additional sources of data can be used for estimation under the multiple recapture framework.

There may be other uses for the data from these sources that make them worthwhile to continue to collect. The telephone sample may be used for quality control/verification of the access point intercept samplers, as is currently done in MRIP (to determine whether the interview actually took place and whether all the questions were answered). If this is the goal, then only anglers intercepted during the access point survey need to be included in the telephone sample. Currently, calls are also made to anglers who declared a trip in Tails 'n Scales and were not intercepted. However, data collected in the telephone interview of registered anglers on any trips not included in the access point intercept sample cannot be used for adjusting the compliance rate, since that by definition concerns anglers who did not register trips.

As mentioned before, making telephone contact with a random sample of anglers who report trips returning to private access points for the purpose of requesting permission for access to their private property could be useful. The data for assumption checking will not come from the calls themselves, but from the subsequent private access point encounters.

The data from the law enforcement sample might be useful for assessing the validity of the assumption of equal reporting compliance rate for public and private access. It is less clear to us that the data from the airplane sample provides any real value for either the estimation program or assessment of assumptions, since it is difficult to match individual boats with the Tails'n Scales trip numbers and that the sampling is non-random (only clear days can be flown, only a subset of the fishing sites can be reached).

Auxiliary data collection procedures

As noted earlier, only the Tails 'n Scales reporting database and the access point intercepts are needed for producing the catch estimates, though some of the auxiliary data sources could be useful for checking additional characteristics of the red snapper fishery, formally or informally. In particular, we return briefly to the "by appointment" private site intercepts and the on-the-water enforcement intercepts.

If data about catch are to be obtained from the private access point trips, these trips should have a probability of selection that can be calculated. The current method of selecting anglers who are most likely to be willing to participate makes this difficult, since it is not a probability sample of anglers. A probability sample of private access trips could, however, be obtained by first selecting a probability sample of reporting private access anglers, then by selecting trips within anglers, with non-zero selection probabilities for each such trip. Either the angler sample or the trip within angler sample may have unequal probabilities, provided they are known and non-zero. The resulting sample of trips may have unequal probabilities across trips, and weights should be constructed to reflect this unequal probability design.

We had substantial discussion at the meeting about what data would be needed from law enforcement in order to be useful, and whether it would be possible to obtain it. The latter question is beyond our expertise. However, for the former, we believe that information only about the presence or absence of a trip number (reporting compliance information) for all red snapper anglers is enough to be useful. This can be shown by noting that the overall reporting compliance rate R can be expressed as the number of trips reported (n_1) divided by the total number of trips taken (N), or

$$R = \frac{n_1}{N} = \frac{n_{1,pub} + n_{1,pr}}{N_{pub} + N_{pr}},$$

which can be rearranged as

$$N_{pr} = \frac{n_{1,pub} + n_{1,pr}}{R} - N_{pub},$$

where $n_{1,pub}$ is the number of trips reported by public access anglers and $n_{1,pr}$ is the number of trips reported by private access anglers, and N_{pub} and N_{pr} are the total number of trips taken by public and private access anglers. Suppose we can make an estimate of R , denoted as \hat{R} , from the law enforcement data. We can also validly estimate N_{pub} from Tails 'n Scales and the access point sample as $\hat{N}_{pub} = \frac{n_{1,pub}}{\hat{R}_{pub}}$

where \hat{R}_{pub} is the estimated public access reporting rate. Plugging the estimates \hat{R} and \hat{N}_{pub} and the number of trips reported, $n_{1,pub} + n_{1,pr}$, into the equation above, we then have

$$\hat{N}_{pr} = \frac{n_{1,pub} + n_{1,pr}}{\hat{R}} - \hat{N}_{pub} = \frac{n_{1,pub} + n_{1,pr}}{\hat{R}} - \frac{n_{1,pub}}{\hat{R}_{pub}}.$$

An estimate of private access reporting rate $R_{pr} = n_{1,pr}/N_{pr}$ is then obtained as

$$\hat{R}_{pr} = \frac{n_{1,pr}}{\hat{N}_{pr}} = \frac{n_{1,pr}}{\frac{n_{1,pub} + n_{1,pr}}{\hat{R}} - \frac{n_{1,pub}}{\hat{R}_{pub}}}.$$

Estimation under capture-recapture methodology using a complex validation sample

Before introducing the proposed estimator, we review the usual capture-recapture estimator of population size:

$$\hat{N} = \frac{n_1 n_2}{m},$$

where n_1 and n_2 are the sizes of the capture and recapture samples and m is the number of units in the recaptured sample that were previously captured. This estimator can be thought of as a ratio estimator. To see this, define $y_i = 1$ for every unit in the population so that the parameter of interest is the population total

$$t_y = \sum_{i=1}^N y_i = N.$$

Next, define $r_i = 1$ if the i^{th} unit in the population is in the captured (or reporting) sample and $r_i = 0$ otherwise. With this notation, $n_1 = \sum_{i=1}^N r_i$, $n_2 = \sum_{i=1}^{n_2} y_i$ and $m = \sum_{i=1}^{n_2} r_i$. Thus, under equal-probability sampling, we can write the usual capture-recapture estimator of population size, \hat{N} , as a ratio estimator with auxiliary variable r :

$$\hat{N} = \sum_{i=1}^N r_i \frac{\sum_{i=1}^{n_2} y_i}{\sum_{i=1}^{n_2} r_i}.$$

This provides the framework for how to accommodate complex sample designs that include unequal weighting and clustering, and how to compute standard errors for \hat{N} and confidence intervals for N . This is done by replacing the unweighted sample ratio in \hat{N} by a ratio of survey-weighted estimators, with the weights determined by the sampling design of the access point intercept survey. This properly weighted version of \hat{N} is readily implemented in commercial or open-source survey software (SAS, R), which can also produce estimates of its variance and associated confidence intervals.

The estimator we propose for estimating number of fish removed is similar to the estimator of population size. First, define y_i to be the number of red snapper removed (by catch or discard) on trip i ; and define the auxiliary variable $x_i = r_i y_i^*$, where y_i^* is the number of removals reported on the i^{th} trip. If no electronic report was made for trip i , then $x_i = 0$. The total number of fish removed can be estimated consistently as a standard ratio estimator by

$$\hat{t}_y = \sum_{i=1}^N r_i y_i^* \frac{\sum_{i=1}^{n_2} y_i}{\sum_{i=1}^{n_2} r_i y_i^*}. \quad (1)$$

If the sample design is complex, weights need to be included in the sample sum to accommodate the design, and standard software can be used to compute the estimate and its standard error. We have developed two other estimators that are variations of this one that have better properties when reporting rates are low. Because they are more complicated and the reporting rate in Tails 'n Scales is expected to be high, we do not discuss these alternative estimators further here.

The estimator \hat{t}_y (and its variants) are consistent estimators of the total number of fish removed as long as the validation sample is a probability sample and identification of reported trips is accurate. Note that there is no requirement that the original reporters (in Tails 'n Scales) constitute a representative sample or report accurately for this estimator to be statistically valid, since $r_i y_i^*$ is used only as auxiliary data to support estimation of t_y . However, a larger fraction of reporters in Tails 'n Scales and/or greater accuracy of their reports reduce the variability of \hat{t}_y .

The current sampling design of the access point intercept survey is PPS (probability proportional to size), with the size variable taken to be the observed fishing pressure in the previous year. Pressures are computed separately for 4 time intervals across all sites and for the sites-days, with weekend and weekday treated separately. The assignments are chosen by selecting PPS samples of time intervals and of site-days, which are then combined into specific site-days and times. The idea of using PPS sampling to allocate the sample proportionally to fishing activity is certainly valid, increasing the sampling "yield" in terms of number of interviews and improving the precision of survey estimators. This is also the motivation for using PPS in the Access Point Angler Intercept Survey (APAIS).

However, using observed pressures from the prior year is likely not the best way to implement PPS, for a number of reasons. First, because the pressure is based on a single year of data, it is likely that it represents a "noisy" version of the true long-term fishing pressure at those sites, so that strict proportionality to it does not actually achieve the goal of PPS with respect to the current year's fishing effort. Second, it results in a non-trivial fraction of sites being given zero pressure (and hence zero probability of being selected), which leads to an invalid design if the goal is to represent the full fishery. Third, while PPS is a good design for efficiency reasons, it can lead to sampling weights that are very different between low and high pressure site-days, which can result in estimators that are highly variable. For example, suppose a very low-pressure site-day happens to be sampled and contains an unusually high observation. This can have a large effect on the final estimate due to the very large associated sampling weight. For these reasons, we recommend implementing a PPS design that adjusts the pressures to ensure all sites with potential fishing activity are available for selection, and also sets the pressures in such a way that very extreme differences in weights are avoided. This continues to result in a fully statistically valid design, even if the resulting pressures differ from the historically observed ones.

In order to better control the distribution of the assignments over the population being surveyed, PPS is often combined with stratification. In the case of the red snapper fishery, it might make sense to stratify the site-days by weekend and weekday in addition to assigning them different pressures, and also to stratify by time intervals, to ensure a spread over both the busy and less busy times. This reduces the variance of the estimators and can also help in scheduling of interview assignments.

Regardless of whether the pressures are adjusted based on the above discussion, a sampling design that is used to select access point intercept assignments is a complex sampling design, so that the associated sampling weights need to be used in estimation to ensure statistically valid estimates. In addition, because the intercepted trips are clustered within assignments, the variance estimates need to account for that aspect of the design as well. Both of these aspects are readily handled by standard survey software including the survey-specific routines in R and SAS.

Review of MS Tails 'n Scales Program Proposed for MRIP Certification

**Jay Breidt (Colorado State University), Mike Brick (Westat), Ginny Lesser (Oregon State University),
Jean Opsomer (Colorado State University), Lynne Stokes (Southern Methodist University)**

January 9, 2017

We received the following documents describing the MS Tails 'n Scales Program:

1. Red Snapper Certification doc 7.7.17 FINAL.docx
2. MDMR Certification Bullet Points Document_Final.docx

Our review will be based on these materials and refer to them as needed. Below, we address each of the terms of reference.

1. *Does the survey design follow a formal probability sampling protocol with known inclusion probabilities at all stages and/or phases of sampling?*

The data collection consists of two components: the Tails 'n Scales trip reporting system, and the dockside intercept survey. The first consists of a required "pre-authorization" by one angler per trip, followed by reporting of trip and catch characteristics after trip completion. The reporting is greatly enhanced by enforcement mechanisms, both on-the-water interception by law enforcement and the inability to sign up for a trip unless the previous trips is closed out or canceled. From a compliance perspective, this is one of the better programs we have seen among the several self-reporting systems for recreational fisheries we have reviewed.

The second component of Tails 'n Scales consists of a validation survey, conducted through a random sample of on-site intercepts of returning trips during the relevant fishing seasons. Data from this survey are used to construct capture-recapture type estimators for the total number of trips targeting red snapper and their associated total catch. Considered in combination, these two data collection mechanisms are a valid approach to collect statistical data in this fishery.

Both Tails 'n Scales self-reporting and the intercept survey are well documented, and the latter has randomization protocols that appear appropriate. However, as the PPS sampling procedure is not described in full detail in the documentation, we are not able to fully assess it at this point. Specifically, it is not clear to us how the PPS sampling is performed across both sites and time slots (i.e. how are the site and time pressures combined) to select individual assignments. This should be clarified further to ensure that the weighting and variance estimation procedure correctly reflect the sampling design.

The PPS design as currently implemented appears statistically valid, but the very large range of pressures shown in Table 3A of (1) might lead to estimates that are highly variable. One approach to reduce this problem is to first stratify the sites into pressure categories, and then select samples using PPS within these categories. The allocation to the strata does not have to be proportional to the number of sites in a stratum nor to their total pressure, but the latter is

certainly a good place to start in considering sample allocation for this program. Depending on the sampling intensity and budget, it is also possible to have a small number of “certainty sites” for the highest-pressure ones.

2. *Do the estimation methods appropriately weight the sample data to account for the sampling design and produce design-unbiased point estimates and variance estimates?*

Following up on the previous comment, we are not able to tell from the provided documentation how the PPS design was implemented across sites and time blocks, and hence how the weights were obtained. Information on how to improve the design through stratification would be obtained from an examination of the pressures and weight distribution. We have no reason to believe it is not done correctly, but it would still be useful for documentation purposes to more fully describe it.

On a similar topic, the documentation mentions that if a specific site/time is selected more than once, two samplers are sent to account for the expected large number of returning trips. This is certainly appropriate, but how is this assignment handled in weighting? Specifically, is it also given a double weight?

Assuming there are no weight construction issues, the capture-recapture estimator described in the documentation is indeed appropriate. Particular strengths of the Tails ‘n Scales program are the high compliance rate and the fact that the issue of matching of self-reported trips and intercepted trips is mostly avoided, since it can be done based on the trip permit number. Other estimators are possible for combined self-reporting and survey intercept estimation of effort and catch, as have been recently explored in a pilot project for the charter fishery in South Carolina. In that project, an additive adjustment was found to be a better option than the capture-recapture one implemented so far for Tails ‘n Scales, so it might be worthwhile to evaluate it here as well. However, given the high quality of the record matching and the high compliance rate in Tails ‘n Scales compared to those encountered in South Carolina, we expect these different estimators may lead to similar estimates. It would be of interest to conduct this comparison in order to examine the usefulness of the additive adjustment with this design.

On p.14 of (1), an adjustment for sites with zero intercepts is mentioned but not fully described. If the number of sites with zero intercepts is small, no adjustment is likely to be needed in the general estimation procedure. If this occurs at a non-trivial number of sites, then an adjustment might indeed be warranted and using some type of larger-area average is reasonable. It might again be worthwhile to document this in more detail, so that it can be more fully assessed.

3. *Are appropriate methods in place to measure and/or correct for potential biases due to undercoverage, nonresponse, or response errors?*

By construction, the combination of mandatory self-reporting and randomized intercepts is designed to correct for undercoverage and self-reporting errors. Especially with high participation in the self-reporting component, this should lead to high quality estimates for the MS recreational red snapper fishery. Other issues, such as angler nonresponse in the intercept survey, possible differences between private and public sites, are present in most other MRIP surveys, so acknowledging them is sufficient at this stage.

As noted in the documentation, there are a number of additional auxiliary data sources that are unique to MS and, while not necessary as part of the basic estimation procedure, can provide further insights in some of the sources of non-sampling errors. These include the home visits to a random sample of anglers returning to private sites, the on-the-water law enforcement intercepts, and the flight counts of angler vessels.

4. *How sensitive is the accuracy of the survey to assumptions made about segments of the target population that are not covered by the survey frame? What can be done to reduce or limit that sensitivity?*

The undercoverage due to vessels returning to private sites is inherent in this intercept survey, as it is in the APAIS, even though at an estimated 30% of the trips, it might represent a larger fraction in MS than in many other states. If these trips are different in either their catch characteristics or in their compliance behavior, then this might indeed lead to bias. However, the combination of mandatory pre-approval for trips and on-the-water enforcement makes it likely that the latter factor will have at most a minor impact. Regarding possible differential catch reporting, the home visits mentioned above will provide some information on this issue even if it is unlikely to allow for estimation of the magnitude of biasing effects.

5. *How sensitive is the accuracy of the survey to other potential sources of nonsampling error? What can be done to reduce or limit that sensitivity?*

Because trip matching will be done based on individually issued authorization numbers, matching errors, often a major source of non-sampling errors, is not present in MS. Requiring that these numbers be issued prior to going on a trip also greatly reduces the potential dependence between the “capture” (self-reporting) and the “recapture” (intercept) events. Overall, the Tails ‘n Scales program appears to be a very good way to avoid several of the key complications present in implementing survey-based capture-recapture surveys.

6. *How sensitive is the survey design to potential errors in implementation? What can be done to evaluate, reduce or limit that sensitivity?*

In most survey programs, careful and accurate implementation of the stated procedures is an essential underpinning of the quality of the resulting estimates and associated measures of precision. Because this program includes two separate components that require matching at the individual trip level, this is certainly the case here. But the mandatory pre-authorization, the high level of enforcement and issuing of penalties, the public relations campaigns are all aspects of the program that greatly improve its overall quality. As already noted, trip matching by authorization numbers bypasses one of the major hurdles in implementing capture-recapture surveys. In addition, the high level of compliance ensures that the resulting estimators are expected to be efficient.

The main aspect we were not able to fully evaluate is whether the PPS design and its associated weighting procedures are properly implemented, because the documentation was incomplete in this area.

7. *How does the survey design compare to the survey design it would replace or supplement? Is it more statistically sound and efficient, or is it at least comparable in its statistical validity and efficiency? What design features are most important in supporting this assessment?*

The Tails 'n Scales Program is intended to provide more data on red snapper catch and to do so in a more timely manner than the general-purpose APAIS and CHTS (or FES). All indications are that this program can indeed achieve these purposes. The statistical methodology underlying the combined estimators is not in doubt, because it can be explained using standard design-based theory. It might be useful to evaluate alternative forms of the combined estimator, but this can be done at a later time and does not change the data collection and survey design aspects of this program.

8. *How does the survey design compare with other survey designs previously certified by MRIP for estimating fishing effort and/or catch for the same fishing mode(s)? Is it more statistically sound and efficient, or is it at least comparable in its statistical validity and efficiency? What design features are most important in supporting this assessment?*

The intercept component of the Tails 'n Scales is very similar to the APAIS, which has been used as the standard MRIP catch data collection approach. The self-reporting component is not yet part of any certified programs, although a similar program in AL is currently undergoing review. Matching and estimation procedures have been pilot-tested in South Carolina and are also being implemented in AL. We recommend that these various programs coordinate future efforts in implementation of their statistical methods and try to harmonize their approaches, to facilitate data integration and comparisons across states and regions.

9. *Is the survey collecting data and producing information products that will meet the needs of the primary customers (stock assessment scientists and fishery managers)? [To be addressed by NMFS staff.]*

Response to the Consultants' MS Tails n' Scales Program Review

MDMR Staff

January 23, 2018

The following document was received by staff on January 16, 2018:

Review of MS Tails n' Scales Program.pdf

This response will broadly discuss the answers provided by the consultants to the terms of reference and then focus on specific questions that they posed in the document.

First, MDMR staff would like to thank the consultants for taking time to review the Tails n' Scales program (TNS). Suggestions made during the review process have allowed us to greatly improve our reporting system and explore new options in terms of harvest estimation. We also would like to thank the consultants for their support of the program throughout these past reviews and appreciate the numerous compliments given to the TNS system. This cooperation between state agencies, NOAA, and academia is exactly what is needed to help manage and sustain this fishery for the foreseeable future. When responding to specific questions in the document, we will first respond to the secondary questions then finish with a more detailed explanation of how the site/time selection process was conducted.

At the end of the first term of reference, the consultants mention that stratifying sites into categories may be of interest since we have variation in ramp pressures. In response, we have gone back into our site pressure data and split sites into four pressure categories based on cumulative pressure (low pressure, medium pressure, high pressure, and certainty sites). We are certain this alteration will allow us to cover more sites every wave to ensure adequate coverage of our sampling universe.

In the second term of reference, consultants list concerns with weighting issues if two samplers are selected for the same site and time. While it would be an extreme circumstance and certainly merit a double-weight, this issue has not occurred within the TNS program and we do not anticipate this becoming an issue. Further, we feel that with limited staff and time constraints – it has not been an issue and will not likely become an issue in the future. While some sites certainly may have high pressures on weekend days, we would not allow two members of staff to sample the same site and time and would redraw the second survey to ensure adequate coverage of the intercept sites.

Also in the second term of reference, the consultants mentioned examining the use of an additive adjustment to see if it would be more beneficial for the program. While we see the use in using multiple methods to estimate harvest and will likely look into the additive adjustment in the future, we don't feel as though this should be pursued currently as the consultants were satisfied with the current estimator that is used. In consulting with NOAA, it was recommended to review other states' programs to compare methodologies to ensure the most appropriate estimators are used and complement our program design.

The last question in the second term of reference refers to the use of an adjustment for sites with zero intercepts. To explain further, there were a non-trivial number of sites with zero intercepts within each wave. For waves with intercepts, a wave specific average adjustment was used. For waves one and two (which had no intercepts), an overall average adjustment was used for every ramp with reported catch.

In the first two terms of reference, the consultants discussed further clarification on our probability proportional to sample size (PPS) procedure, particularly questioning how site/time pressures were derived/combined. In order to assign pressure values to sites and times, the same process was applied separately to both assignments of site pressures and time pressures. Once final pressure values were calculated for each, site selections and time selections were chosen separately then combined to create a schedule of intercept surveys. Surveys were scheduled randomly each month for weekdays and weekends. Weekdays included Monday through Thursday and weekends consisted of Fridays through Sundays. The 2016 Red Snapper season included both weekday and weekend days so site and time selections were calculated accordingly. Because of the 2017 federal extension allowing for fishing only on weekend days, site and time selections were adjusted to reflect the increased weekend pressure by gathering trip values from 2016 and 2017 on Fridays, Saturdays and Sundays only. A more detailed description of site and time selections follows below:

PPS Sampling Procedure

For each year the total number of trips per site were tallied to inform us of how often each site was used to fish for Red Snapper and therefore gain a better understanding of each site's pressure. The first year's data (2015) was used for 2016, then all years were compiled after that to get a cumulative value of total trips for each site. For sites with no trips recorded, but still having the potential for Red Snapper landings, an initial pressure value of 0.5 was given. Site pressure values were added to get one overall pressure value. A percent abundance for each site was then calculated by dividing each site's pressure value by the summed total of all site pressure values and multiplying by 100. The percent abundance value for each site was multiplied by 100; this value, starting from the site with the least pressure (all ramps assigned a value of 0.5) was added to the next site's value to get cumulative values that increased in value from low pressure sites to high pressure sites (Table 3A and B, pages 10 and 11, see certification document).

A random number generator was created using a formula in Excel to be used for assignment selection. Random numbers were generated from 50 to 10,000 for the site pressure range. For each randomly generated site selection value, the closet cumulative site pressure calculated from above was used to determine the site selected.

Reported pressure values were created using the distributions of launch locations and ramp arrival times reported from weekday and weekend days of each season. The combination of values from all years' data provided a larger data pool of weekday and weekend distributions to assign pressure values for both location and time. Combining pressure values over multiple years will create larger data pools for both weekday and weekend distributions. As TNS builds more years in its data set, this will account for any changes in the fishery that might occur.

To conduct access point intercept survey validations, a site pressure analysis was performed to select assignment times and locations accounting for pressures (high or low vessel traffic) at public boat ramps along the Mississippi coast. All sites with the potential to have boats launch that may fish for Red Snapper were included in the site list. Similar to MRIP, four, six-hour time blocks were created for survey time assignments (2 a.m. to 8 a.m., 8 a.m. to 2 p.m., 2 p.m. to 8 p.m., and 8 p.m. to 2 a.m.). Weekday and weekend assignment times were chosen using the same method for site selection as detailed above. Reported trip times were assigned to the six-hour time block they fell within to get an overall time pressure value for that time block based on the total number of trips reported as completed during

that window. As above, a percent abundance for each time block was then calculated by dividing each time pressure value by the summed total of all time pressure values and multiplying by 100. The percent abundance value for each time block was multiplied by 100; this value, starting from the time block with the least pressure was added to the next time block's value to get cumulative values that increased in value from low pressure time blocks to high pressure time blocks (Figure 2A and B, page 9, see certification document). After sites were scheduled for the month, a time block would then be randomly chosen for each site selected using the random number generator. Random numbers were generated in a range from 50 to 5,000 for the time pressure range. For each randomly generated time selection value, the closet cumulative time pressure calculated from above was used to determine the time block selected.

Should the consultants recommend site and time pressures be combined, we can certainly consider evaluating and implementing alternate methods in the future as required. If data analyses indicate a need for a more efficient method of assigning intercept surveys based on a combination of the two, we can modify our methodology. However, we feel that the current PPS procedure used, along with implementation of ramp selection stratified into categories by site pressure will allow for adequate coverage of ramps and also accurate harvest estimation.

Again, we want to thank the consultants and NOAA for taking time to edit and give input and recommendations to improve the TNS program. The TNS program continues to improve each year and with the help of NOAA and the consultants, we hope that it will become the primary source for Red Snapper recreational harvest data in Mississippi. We look forward to the final certification of the TNS program. If the consultants and NOAA have any additional questions or concerns, please advise.

Kind Regards,

MDMR Finfish Staff