Review of the South Atlantic Deepwater Longline Survey

SADLS Workgroup Recommendations

Developed by the SADLS Workgroup

Review of the South Atlantic Deepwater Longline Survey (SADLS).

Workgroup Members:

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Scope of Work

The workgroup members (WG) was tasked with reviewing SADLS and addressing the questions laid out in the Scope of Work:
Review the survey design and sampling methodology.

- *Review methods for site selection (e.g., geographic range, stratification)*
- *Review sampling methodology (e.g., gear, sampling method, hook sizes, bait)*
- *Document differences in year, seasonality, gear, and geographic distribution of the survey and sample collections (i.e., catch and life history data).*
- *Describe strengths and weaknesses of the survey design and data collection*

Develop final report for SSC review that summarizes the workgroup discussions, describes concerns, potential improvements, or recommendations with respect to survey design, data collection, and use in the development of analytical products.

The WG met over 3 webinars (June 29, July 25, and August 16). During the first two webinars Kevin Craig, NOAA Fisheries SADLS lead, presented an overview of the survey design and some preliminary results. The focus of the first webinar was primarily the overall survey design. During the second webinar Kevin included some additional analyses as well as the species composition and biological sampling information. During the second portion of this webinar the WG started discussing the SOW questions. During the third and last webinar the WG continued discussing the SOW, and reviewed recommendations and report timeline.

Key survey aspects (see attached report for details).

- Sampling is based on latitude/longitude (36.5° or NC-VA border to 83° W or southwest of FL Keys) and 2 depth zones (75-145 m and 146-366 m), not on habitat. Sampling strata north of 25 degrees is based on latitude, while south of 25 degrees the strata are based on longitude. There are two depth strata in each latitudinal/longitudinal stratum (see SADL report Figure 1).
- Sampling is done in collaboration with fishing industry partners. Each partner is contracted on an annual basis and contract bids are open for any qualified, interested party. One federal fishery observer is present at all times on the participating vessels while sampling. The observers are responsible for all data collection, including taking biological samples from selected species.
- Allocation of relative effort has been distributed across the survey (see slide 14 from presentation). In 2020 and 2021 there were three sampling station types: random, universe random, and captain's choice. Random are sites chosen randomly by latitude and longitude

within a stratum, universe random are known hard bottom sites that were chosen at random within a stratum, and captains choice were sites chosen by the industry partners. Alternate sites for random and universe random stations were selected by survey staff and utilized at the discretion of the captain. If the captain chose another sampling site, they were required to indicate why a different site was chosen (weather, current or sampling efficiency).

- In 2022 site selection was based on a fully random design, and the sampling in future years is scheduled to be fully random. Excess stations were provided to the industry participants, from which they were to choose the agreed upon number to sample based on funding allocations (i.e. pick 6 out of 10 in each strata for 2022). This provided alternate stations if one could not be sampled due to weather, current or other factors, while maintaining the integrity of the random selection. Fully random design did not noticeably affect the proportion positive in 2022 when comparing among years, but there was a drop in the overall number of key species caught per unit of effort.
- Sampling is done using bottom longline gear consisting of a 3/16 inch main cable (galvanized steel), 3 nm of main line length (2021-2023), but note that the length was 4 nm in 2020. Each line has 150 monofilament gangions (3 ft 300 lb test) with one 12/0 offset Mustad circle hook. The hooks are baited with squid (2x2 inch square). A temperature logger is attached at the end of each mainline. The gear is set "first hook in-last hook out" to maintain contact with the sampling gear. The soak time from first hook in to first hook out is generally 1 hour, but because of the way the lines are set, there is considerable variation in the soaktime for individual hooks.
- There are six priority/focal species (Golden) Tilefish, Blueline Tilefish, and Snowy Grouper, Yellowedge and Warsaw Grouper and Speckled Hind, and 23 targeted "non-priority species" (see SADLS report for details). During the three years of the survey, close to 100 species were collected, but many in very low numbers (<5 fish in the three years).
- Sampling occurs during day-light hours. All fish are identified, enumerated, and length is measured. Biological samples (age structures and reproductive tissues) are taken from priority species. Depending on catch rates, the observer on board may be unable to collect biological samples from all priority fish.
- Biological sampling (age and reproduction):

  Following completion of identification, enumeration, and measurement, a subset of catch by species were further processed to obtain biological samples for life history characterization, mainly sagittal otoliths for age estimates and gonads for histological processing. Due to the uncertainty of catch (species and number) on a set-by-set basis and having only one observer assigned to each vessel, it was difficult to develop a strict sampling protocol for life history samples. Instead, a simplified approach was provided that allowed for flexibility in the number of biological samples, while prioritizing specific species, but still being representative of the catch. The priority tilefish and grouper species mentioned above were to have biological samples removed from the first 20 specimens per species, after which, every fifth individual was to be sampled. For named non-priority species, which included a number of tilefish, grouper, snapper, and jack species, more discretion was given to the observer to obtain a representative sample for biological tissues. For named, non-priority species with 3 or less individuals on a given set, all individuals were to be sampled. If there were more than 3 individuals per species every fifth fish per species was to be sampled starting with the first encountered up to a maximum of 5 individuals per species and a maximum of 20 individuals of all non-priority species combined. Additionally, observers were given discretion to sample any species not included in these two categories, provided. Considerations for these species included rarity, other sampling needs were met so that it did not limit the amount of priority and named non-priority specimens that could be sampled, if the species was managed within the snapper-grouper fishery management plan, and if there was time available. For any of the three categories of fish mentioned above, if observers could accurately mark an individual so that it could be identified to a specific set upon completion of the trip, they were given the leeway to work-up the remaining specimens that were not sampled at sea, back on land.

General WG discussions on sampling design and methodology.

- The WG commented on the gap off central NC in 2022. The captain was allowed to choose 6 out of 10 stations and based on sampling efficiency as well as the randomly selected stations in 2022, he chose the 6 southerly stations, leaving no sampling in the northern half of the latitude band. Smaller (½ degree bins) were added into the strata to address this issue. This issue was addressed with survey coordinators and the captain(s). It stresses the need for (continued) instructions (possibly workshops) for new industry participants as well as continued review of allocation decisions and their realized outcomes.
- A northern expansion of sampling in 2023 has been proposed from 36.5 N to 39 N to join the southern limit of the Mid-Atlantic Golden Tilefish survey (adding another 30 stations). This will be done using the same sampling design and methodology with additional funding and will not affect the sampling density in the remainder of the survey area.
- The WG requested a table for geographic area for each of the strata and more detailed maps of each area. The table and maps were provided (and are included in the SADLS Report) and discussed. The availability of the maps was very helpful in understating the overall survey design and coverage.
- In 2020, it was not clear if one captain was fishing 100 or 150 hooks per mile due to confusion from his participation in a previous pilot study in which 100 hooks were utilized per mile. This has been resolved for future sampling. The WG discussed the use of CPUE to make catches comparable.
- The WG discussed how data were affected by the change in line length in 2021. The data collection system does not allow for determining where in the longline a fish was caught (cannot eliminate the last mile for the four-mile sets to make it comparable to the three-mile set). In the end, the WG recommended not using the 2020 data (see below), which eliminates this issue.
- The WG discussed the biological sampling protocols, noting concerns about the potential for biased age sampling when not all priority species could be sampled at-sea. Workarounds have been utilized including taking unsampled fish back to the dock for later otolith extraction, but this was not a possibility for all trips.
- Standardization should be done at the average hook level to address "first hook in-last hook out" deployment and retrieval, as well as changes in the length of the longline.
- It was not clear how the captain chose the Captain's choice sites and that choice likely varied by captain. E.g., were the captains pre-selecting locations to sample, were they looking at their instruments to select sampling sites, or some combination? This may no longer be an issue as there will be no Captain's choice in future sampling.

- The WG expressed some concern that habitat information might be lost when going to a completely random survey. The "Universe random" sites do include some description of habitat. Perhaps consider recording available habitat information. Given the survey practicalities, using the fish finder equipment would be the available option. The WG concluded that collection of useful data was very difficult as the read-out of the fishfinder equipment is difficult to standardize and interpretation can be subjective. Also, the gear spans a relatively large area and habitat may be patchy (and vary by hook), which complicates habitat designation for a deployment.
- The WG noted the very low catches of three focal species (Warsaw Grouper, Yellowedge Grouper, and Speckled Hind). Survey staff mentioned that low catches are very likely due to low abundance of Warsaw Grouper and Speckled Hind, and the sampled habitat may be on the edge of where Yellowedge Grouper is typically found.
- The WG also noted the relatively low percentage of biological samples for Blueline Tilefish, but that seemed to have been a one-year anomaly in 2020 as a result of "Captain's choice". The expectation was that biological samples of Blueline Tilefish in that year were limited by excessive catches of Blueline Tilefish and not other priority or non-priority species. The fully random design may limit instances such as this due to lower catches per deployment.

WG recommendations for the current survey (addressing the SOW).

- The <u>current sampling design</u> (stratified simple random sampling) is suitable for the survey, including the fully random station selection for each latitudinal/longitudinal-depth strata. Sampling may be optimized using analyses for possible re-stratification (e.g., cluster analysis or random forest analysis). Reallocation could also be considered (see also below) without changes in the basic strata design (depth and latitude) (e.g., Neyman allocation). Any changes in survey stratification or allocation to optimize the value of the data would need additional years of data before they should be considered. The 2023 expansion (additional 30 stations), with effort proportional to the remainder of the sampling area, should be continued in the future. The strengths are the collaboration with the industry (but uncertainty in participation can also be a weakness), region-wide sampling, and the fully random sampling design. The fully random sampling design can reduce catch rates, but future optimization (e.g., re-stratification and/or re-allocation) could improve sampling efficiency.
- The <u>current gear and deployment methods</u> are appropriate for the survey. Although other methods (e.g., hook size or bait) may increase catches for certain species, the focal species (see below) are collected in significant enough numbers. The choice of hook size is intermediate to other sampling gears used for deepwater and bottom dwelling fishes, and thus represents a good compromise for a diversity of species. The WG considered it a survey strength that the initial choices were made with considerable input from industry and during workshops, results of several pilot studies, and review of published information. In the end, the choice of methods was a good compromise that included considerations for safety and gear loss (e.g., line length), targeting a variety of species and lengths (hook size and bait), and available funding and time (biological sampling). Another strength is that, although there are three main focal species, this is a multispecies survey with potential to provide useful information for a range of species. The WG also considered that changes to the gear would likely result in "starting the survey over". A weakness of the survey is the limited habitat information that is collected during the survey. Temperature is the only hydrographic or

habitat variable collected using a temperature logger attached to the bottom line (see also Research Recommendations below).

- The survey focal species should be (Golden) Tilefish, Blueline Tilefish, and Snowy Grouper, with Yellowedge and Warsaw Grouper and Speckled Hind secondary focal species (see also Slide 21 in presentations). An important consideration was the original impetus of the survey. Any considered survey optimizations should be based on the focal species. It was noted that other important shelf species are caught in the survey. Should the need to emphasize some of these species arise, the opportunity for additional sampling could allow expansion of the survey utility to these other species.
- The age and reproductive tissues that are currently taken are appropriate for the survey. However, collecting samples from the focal species should be prioritized as much as practically possible. The WG recommended that the sampling strategy for ages be clarified and made more consistent (transparent). A clear protocol should be documented for biological subsampling (e.g., randomized systematic sampling). A weakness is that no samples to determine fecundity (important for recruitment analyses) are collected. If future funding limits sampling, the WG recommends continuing collecting the samples, but postpone processing these samples until funding becomes available. Furthermore, sampling for age structures should be prioritized (e.g., approach 100% age sampling of all focal species caught) and follow a random design to ensure ages properly represent the catch.
- Based on previous conversations within the SSC and with SEFSC assessment staff, the WG recommends that at least 5 years of survey data should be available before an index of relative abundance should be considered for use in a stock assessment. However, index development and monitoring of a possible index for contrast, variance. etc. can commence earlier. Other information, such as length, age, or reproduction can be used at any time.
- Because of considerable changes to the survey, including sample design, gear modifications and sample size, 2020 data should not be used for index development. If used, data from 2021 should be viewed with caution as samples were not yet collected with a fully random design.

Optimization of survey and index development.

- It may be possible to optimize the data collection for the survey. Optimization of the survey should be investigated after enough data (years) has been collected for sufficient analysis. This optimization analysis should concentrate on the three main focal species (Tilefishes and Snowy Grouper) and possibly consider the secondary focal species as well. An optimization analysis should be considered to improve sampling efficiency and improve the precision of final estimates derived from this survey. The primary data products expected from this survey include indices of abundance, length and age compositions, spatial distributions, and reproductive characteristics. Thus, analyses should be focused on optimizing these important data products. The WG recommended to start looking at this after the 2023 data are available, and then decide if sufficient data exists for recommended changes to stratification and/or sample size allocations. It may turn out that more years of data are needed before a sufficient analysis can be completed with clear recommendations for survey optimization. Any proposed changes to the survey should be carefully considered relative to the survey consistency to avoid a “break” in the resulting index or other time series related estimates.
- The WG discussed the use and implications of two possible index design methods: Model Based (currently used for most SA index development) and Design Based, which would

need, among other things, density estimates, which is complicated for hook-and-line gear. Model based estimates are recommended for this survey, but further detailed discussion of index development was outside the scope of this review.

Research recommendations.

- Analyze the effect of the "first hook in/last hook out" strategy and as well as general effects on catch rates using hook timers and numbering the hooks and their individual catches. This should be done as a separate project, not as part of the ongoing survey as not to impact the survey in terms of effort and funding.
- Collecting whole gonads for fecundity studies where possible during the study.
- Collect more habitat information, including bottom water current and structure. Given the size of the participating vessels, variability in equipment used, and funding, this can be challenging. Possible gear that can be used are fish finder equipment, underwater cameras (though there are limitations with light level at depth), current meters (which were used with little success in SCDNR pilot studies), and doppler current meters.
- Analyses to optimize final data products that will be used for stock assessment and management. This might include reducing index and age composition variability (see also above), but also could be important in managing the survey under variable funding. Given that the focal species tend to be longer lived species, an analysis of the efficacy of concentrating higher (2x) sample sizes into fewer years (e.g., run the survey every other year) should be investigated. Re-stratification and allocation should be analyzed for possible improvements to efficiency and reducing overall variance of final analytical products. Power analysis should also be completed to provide information on how to best manage funding decreases and increases (e.g., changes to annual sample sizes).
- The seasonal timing of the survey may warrant further investigation. It is recognized that a fair amount of work went into pilot and preliminary investigations for the current survey design, but it should be investigated to see if there are alternate, more optimal sampling times within the year. This might need to be done as one-off studies to avoid any interruption to the current sampling design.
- There should be a concerted effort to continue seeking external funding sources to address some of the aforementioned studies that could enhance the survey in the long term. Many of the recommended investigations and enhancements to the survey require funded efforts outside of the normal operations of the current survey design. Barring set-aside funds for such activities, the survey staff should seek these funds through other means.

Some additional considerations for the future of the survey.

- The survey partnering with industry is very positive but can have challenges as well. The WG discussed several of the challenges, but realized that although contingency plans can be made, these may need to be addressed on an individual basis. E.g.: Can the area still be sampled if a partner cannot not be found? Is there a back-up plan if the contracted vessel, captain, or crew is not available?
- The WG asked about the possibility for multi-year contracts, which could increase consistency in sampling, but that may be challenging due to funding and contracting.
- Funding is critical for the future (and therefore utility) of the survey. The Survey is funded based on allocation for Cooperative Research Projects to the SEFSC. This can create

significant uncertainty for the survey's future. In addition, there is some uncertainty in the continued funding for sampling of the northern expansion for 2024 and beyond.

- Although this was outside the WG's SOW, there was some discussion about data governance. There should be a clear path for data governance and means of making the data (publicly) available for it to be of use for assessments and management. Currently the survey data is managed by the NOAA's Observer Program and includes its QA/QC, data storage, and availability procedures. The age and reproductive information are housed at SCDNR.
- This survey design has potential to be extended northward with additional funding. A northward expansion of this survey has great potential to track important movement and species distribution changes over time. Detecting climate change effects relies heavily on baseline data to detect the effects.
- Because the survey captures other important shelf species, investigations into power analysis or other similar analyses could illustrate how much increase in sampling size might allow computation of abundance or age composition for other species.

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