NEFSC Atlantic Trap-Video Survey Mitigation Plan

I. Purpose of the survey

The Atlantic Trap-Video Survey (ATVS) is proposed as a northward expansion of the Southeast Fisheries Science Center (SEFSC) Southeast Reef Fish Survey (SERFS; see Bacheler et al. 2023 for description). Chevron traps have been employed as the primary monitoring gears in SERFS since 1990 due to the efficiency in catching sufficient numbers and weight of recreationally and commercially important fish in that region (Collins 1990; Smart et al. 2015).

SERFS uses baited fish traps and attached underwater video cameras to produce species-specific time series of occurrence, relative abundance, and geographic distribution, as well as the collection of life history information to support the assessment and management of reef-associated fish species in the U.S. South Atlantic region. The ATVS is an attractive option in the context of survey mitigation as it allows application of established SERFS methodology in a new region (i.e., the continental shelf and shelf break waters of the Mid-Atlantic and New England regions), and the fixed gear sampling methodology is able to sample within and adjacent to wind energy development areas which may not be conducive to other gears (e.g., bottom trawling).

What data is collected?

From traps: species-specific catch rates, lengths, and weights; biological samples including otoliths, reproductive tissues, genetic samples, stomach contents, and other samples, as requested.

From video: species-specific abundance using established MinCount or MeanCount approaches (Schobernd et al. 2014); habitat information; species-specific lengths from stereo-video may be estimated

From Conductivity, Temperature, and Depth (CTD) casts: bottom water temperature, salinity, oxygen, and various other physical characteristics of the water

Station location and other standard operating parameters are also recorded.

Which assessments/science advice pathways currently use this survey?

In the Southeast region, trap and video data have been included in most South Atlantic Southeast Data Assessment and Review (SEDAR) stock assessments over the past 10 years, including red snapper (*Lutjanus campechanus*), red porgy (*Pagrus pagrus*), gag (*Mycteroperca microlepis*), scamp (*Mycteroperca phenax*), greater amberjack (*Seriola dumerili*), vermilion snapper (*Rhomboplites aurorubens*), gray triggerfish (*Balistes capriscus*), red grouper (*Epinephelus morio*), and mutton snapper (*Lutjanus analis*; Kellison et al. 2023; Vecchio et al. 2023; Vecchio et al. 2024). For the ATVS, data would be used in assessments and for supporting management actions for more northern reef-associated fish. This includes a variety of commercially and recreationally important fish covered by the Mid-Atlantic Fishery Management Council (MAFMC), New England Fishery Management Council (NEFMC), and the Atlantic States Marine Fisheries Commission (ASMFC), likely including finfish such as black sea bass (*Centropristis striata*), eels, striped bass (*Morone*

saxatilis), and scup (*Stenotomus chrysops*), bottom-dwelling crustaceans such as lobster, crabs, and whelks as well as other managed species including sharks and skates. Additionally, longfin squid (*Doryteuthis pealeii*) are known to lay eggs on traps, thus the ATVS may provide useful information on recruitment of this stock. At least 5-10 years of survey data would likely be required before abundance indices would be considered for potential use in stock assessments, but life history, oceanographic, and habitat data may be used immediately to supplement existing data streams.

What specific products use this survey?

The ATVS is proposed as a new survey, so it is not currently used in any specific products. However, SERFS is used in stock assessments, so it is anticipated that ATVS data (indices of abundance and life history data) could be used in stock assessments for the species managed by the ASMFC, MAFMC, and NEFMC. These data would also be informative for the Mid-Atlantic- and New England-region State of the Ecosystem reports.

Who are users of the survey generated data?

ATVS data could be used by stock assessment scientists and managers for species managed by the NEFMC, ASMFC, and MAFMC, and Northeast Fisheries Science Center (NEFSC) ecosystem and climate scientists. The data could also be used by GARFO and by academic and non-governmental organization groups.

Are there any formal quality standards (e.g., operational/gear requirements or standard operating procedures) for the survey that need to be considered?

The ATVS will be consistent with methodology used in SERFS, which is compatible with a variety of vessel types. SERFS uses a simple random sampling of known hard bottom areas, which would likely be modified to a random stratified (by depth and latitude) design. Depending on the size of vessel(s) used to perform the survey in non-wind areas, smaller vessels may be required for ATVS sampling within and adjacent to wind energy areas (WEAs).

Are there added values that cannot be met without this survey?

The ATVS is being proposed to provide data on a number of species that are currently sampled by mobile gear surveys. However, because mobile gear surveys are expected to be at least partially precluded in WEAs, the ATVS may provide supplemental sampling in regions inaccessible to traditional survey methods used in the region.

Additionally, the ATVS is anticipated to provide data on structure-oriented and semi-pelagic species that are not well sampled by existing surveys and are likely to aggregate around offshore wind turbines and scour protection features. Species that are highly structure-oriented (e.g., black sea bass and tautog [*Tautoga onitis*]) or semi-pelagic (e.g., bluefish [*Pomatomus saltatrix*] and pollock) may be better captured across their habitats and length range by trap and video gear than other fixed and mobile gear surveys. Furthermore, the changes in habitat created by WEAs will increase the need for data on many species that would be sampled by the ATVS.

How does offshore wind energy impact survey objectives going forward?

A core objective of the ATVS is to enable sampling within and adjacent to WEAs, where other types of sampling may be challenging. As additional WEAs are established and decommissioned, those areas will be incorporated into the ATVS sampling design. These changes in WEAs will necessitate analytical efforts to understand and control for incremental change in the spatial footprint and design of the ATVS.

II. Survey Details

Beginning Year: TBD

Frequency: Annual

Season: Late spring (late April or May) through early fall (September or October)

Geographic Scope: Continental shelf and shelf break waters beyond 3 miles from Cape Hatteras, NC, through the Gulf of Maine

Platform(s): Scientific or chartered commercial vessels

Statistical Design: The survey will likely use a random stratified (by depth and latitude) design, with allocation of effort across strata proportional to area.

Methods: Anticipated methods are described below; efforts will be made to be consistent with the SERFS protocol.

Daily sampling period: ATVS sampling will occur during daylight hours consistent with SERFS protocols.

Site selection: TBD

Gear: The ATVS will employ chevron traps with mounted underwater video cameras. Chevron traps will be shaped like an arrowhead and constructed from 3.4 × 3.4 cm wire mesh, resulting in a size of 1.7 × 1.5 × 0.6 m and volume of 0.91 m^3. Chevron traps will be baited with 24 menhaden (*Brevoortia* spp.), 4 on each of 4 stringers and 8 placed loosely inside the trap (Figure 1).

Figure 1: Baited chevron traps prior to deployment (left) and after deployment (right). Image courtesy of the Southeast Reef Fish Survey (SERFS), reproduced with permission from Smart et al. 2015.

Several camera configurations have been explored over the lifetime of the SERFS (Smart et al. 2015). We expect at least 2 video cameras will be attached to each chevron trap in the

ATVS, one over the trap mouth facing inside the trap (used to count fish and quantify habitat) and one over the trap nose facing away from the trap (to quantify habitat in the opposite direction). An additional camera may be added and operated in parallel to the outward-facing camera for a stereo-video system capable of producing length data from images (Boutros et al. 2015). The camera model anticipated to be used in the ATVS (and currently in use by SERFS) is the GoPro Hero 3+/4.

Seabird CTDs will be used to be consistent with methods in the SERFS and the NEFSC Ecosystem monitoring surveys. Further design discussions will determine the specific Seabird CTD model and parameters (e.g., conductivity, temperature, depth, chlorophyll *a*, dissolved oxygen) and whether this survey can help supplement the plankton and pCO_2 sampling typically done on the NEFSC Ecosystem Monitoring survey.

Gear deployment and retrieval: Each trap will be deployed attached to a line connected to 2 surface buoys. Target soak time is 90 min for each trap, and the minimum distance between traps will be at least 200 m (consistent with SERFS) to provide independence between traps; if 200 m is not sufficient for trap independence in wind areas due to the spatial impacts of the turbine structure or scour protection, we will determine the appropriate distance to ensure trap independence in the context of wind in the pilot phase. Up to 6 trap-video units will be deployed sequentially at previously selected locations, after which a CTD deployment will occur prior to retrieval of the trap-video units in the order in which they were deployed. The vessel does not leave traps unattended, and traps will not be deployed if marine mammals are visually detected in the vicinity of the sampling location. Final methods will be consistent with all necessary environmental compliance and consultation requirements

Trap catch and video data processing: Fish caught in chevron traps will be sorted by species, and individuals of each species will be counted, weighed, measured for fork or total length, and either released or retained for biological sampling (e.g., otolith and gonadal sample).

Videos will be read beginning 10 minutes after the trap lands on the bottom, to allow time for fish to acclimate to the presence of the trap, and ending 30 minutes after the trap lands on the bottom. Within that 20-minute window, 1-second intervals will be examined every 30 seconds, for a total of 41 1-second intervals. The maximum number of individuals of a particular species in a single frame will be recorded for each interval. The overall MinCount or MeanCount for each video will be calculated as the minimum and mean number of individuals of each species observed in annotated intervals, respectively. The MinCount and MeanCount approaches have been demonstrated to be linearly related to true abundance (Schobernd et al. 2014) and are consistent with the SERFS protocol (Smart et al. 2015).

III. Effect of Four Impacts

1. **Preclusion** of NOAA Fisheries sampling platforms from the wind development area because of operational and safety limitations.

   There is no current preclusion of this survey, as it is new in the Northeast and Mid-Atlantic regions. Barring unexpected access restrictions, the ATVS sampling should be possible inside fixed-foundation WEAs when considering the size of required vessels

and deployed gear. Areas of preclusion will likely exist close to turbines, junctions, anchors/moorings, and cables. Preclusions could be greater in floating wind areas or for jacket versus monopile foundations, leading to areas with little sampling data.

2. **Impacts on the statistical design of surveys** (including random-stratified, fixed station, transect, opportunistic, and other designs), which are the basis for scientific assessments, advice, and analyses.

   The survey will be stratified by depth and latitude with allocation of effort proportional to strata area. As additional WEAs are established and decommissioned, those areas will be incorporated into the ATVS sampling design. The related changes in wind areas will necessitate analytical efforts to understand and control for design impacts on ATVS-generated data products.

3. **Alteration of benthic and pelagic habitats and airspace** in and around the wind energy development, requiring new designs and methods to sample new habitats.

   Installation of fixed or floating wind turbines will alter hydrographic conditions and change the characteristics of the benthic environment in their vicinity, creating new structured habitats and potentially altering the local distribution of species and the ability of the sites to be sampled. These changes could necessitate additional studies regarding the selectivity and catchability of fixed gear. Sufficient ATVS sampling outside of active WEAs may help in developing baseline data, which are important for fully understanding the impacts of wind development but are overlooked in current wind-related monitoring plans (Methratta et al 2023).

4. **Reduced sampling productivity** caused by navigation impacts of wind energy infrastructure on aerial and vessel surveys.

   Currently, there is no expected limitation on ATVS transiting through WEAs, pending developer approvals. Poor weather conditions, in which the survey platform is unable to safely transit through or operate within wind areas, may reduce sampling productivity.

IV. Mitigation Planned, as per Six Elements

1. ***Evaluation of survey designs***

   The ATVS is a new survey that is intended to ensure continued data flow from areas where traditional mobile gear surveys will be precluded, as well as to address data gaps for species associated with complex habitats. This survey will help stock and ecosystem assessments continue to provide scientific advice despite reduced data inputs from long-term surveys that may be unable to operate within WEAs. This survey would also provide data to support stock assessments for structure-oriented species that are poorly sampled by traditional survey approaches.

2. ***Identification and development of new survey approaches***

   The final methodology for this survey will be developed in consultation with data end users (e.g., the NEFSC Population Dynamics Branch) and with input from industry

partners. Some key survey design elements that need to be determined include: 1) survey stratification; 2) impact of WEA expansion and decommissioning on the survey design; 3) appropriate station density and overall target sample size; 4) sampling of multiple habitat types vs. only hard bottom; 5) extent of stereo video needed for accurate length measurements; 6) identification of low-visibility areas of the sampling frame where video will not be useful; 7) optimal video reading approach (e.g. MinCount vs. MeanCount); and 8) the extent of intercalibration with other NEFSC surveys. Other operational considerations, including the need for paired oceanographic and ichthyoplankton sampling, also need to be resolved.

The development of the survey design will require cooperative planning between survey leads and stakeholders, as well as analytical studies. Further study is required to determine the specific modifications to survey design to allow for implementation of the SERFS design in the Northeast and Mid-Atlantic. Specifically, it will be necessary to determine the stratification, sampling schemes and sizes, and station allocations required to mitigate the impacts of WEA preclusion of existing surveys and meet the data needs of NEFSC stock and ecosystem assessments. Another important early step in this process is a stakeholder workshop with representation from experts in survey design and operation, stock assessments, ecosystem assessments, engineering and advanced technology, and fisheries management. Additionally, a pilot study will need to be completed to trial sampling protocols across depth and latitudinal ranges and to inform sample size targets; we expect this pilot study to require approximately 1 year for completion. Once the design is finalized, a draft of the ATVS design and protocols will be provided to management partners (MAFMC, MAFMC Scientific and Statistical Committee [SSC], NEFMC, NEFMC SSC, ASMFC) for comment. The SEFSC and NEFSC will also need to streamline and standardize biological sampling protocols, which will likely require an in-person meeting.

3. ***Calibration and integration of new survey approaches***

Due to the uncertainty as to whether mobile gear sampling will be possible inside WEAs, fixed gear sampling like the ATVS is an important tool for survey mitigation. The ATVS could help address data gaps from other NEFSC surveys if surveys are intercalibrated. Without calibration, major concerns about the bias of this gear in terms of selectivity and catchability will go unaddressed, and a longer time series will be necessary before this data stream becomes useful. Survey calibration is also valuable to consider between the ATVS and other new or expanded NEFSC surveys (i.e., the passive acoustic monitoring survey, the cooperative hook and line survey, and the eDNA survey) which are being discussed as important survey mitigation solutions due to their ability to sample inside WEAs where other gears (e.g., long-lining, bottom trawling) are more heavily precluded. A combination of methods may be necessary in order to achieve data collection goals inside WEAs; in situations where data products from multiple surveys need to be combined, calibrating the relative estimates for catchability and selectivity should be performed by ensuring sufficient spatiotemporal overlap across sampling efforts of the various surveys (ICES 2023). This will facilitate blending NEFSC survey datasets to support species assessments, maximize the utility of the survey data, and broaden the scientific impacts of these surveys.

The ATVS will be a newly implemented survey generating new data streams in the Northeast and Mid-Atlantic regions. The extent of calibration to existing surveys

necessary is dependent upon the ATVS's intended utility. The time required to integrate ATVS data into assessments would be reduced if it is calibrated to other long-term surveys, such as the Bottom Trawl Survey (BTS). At least 5-10 years of data would be required before the time series is sufficient for producing indices of abundance that may be used in stock assessments and fisheries management. The oceanographic and habitat data, however, would be appropriate for near-term applications.

If this survey is best used for developing a separate index of species abundance inside wind areas, then calibration to current surveys would not be necessary; however, the establishment of a separate index would require several (5-10) years of data collection to build an independent time series which may be useful for stock assessments.

If this survey will be best used in mitigating the impacts of wind development on other NEFSC surveys, then some amount of calibration to those surveys is necessary; this would entail sampling across multiple habitat types (i.e., not just hard bottom) and ensuring spatial and temporal overlap of sampling efforts for the ATVS and the existing surveys for which it is intended to mitigate impacts. This spatial and temporal overlap would allow for model-based calibration of measures of catchability and selectivity for each gear.

4. ***Development of interim provisional survey indices***

The ATVS will be a newly implemented survey generating new data streams, and thus no interim provisional indices will be required. Exploration of alternative approaches for index development will commence once at least 3 years of survey data are available for analysis. Use of survey-generated indices is not anticipated until at least 5-10 years of survey data are available.

5. ***Wind energy monitoring to fill regional scientific survey data needs***

Wind developers are not currently conducting long-term standardized sampling in the manner proposed here. The ATVS design will enable assessment and comparison of species-specific abundance and other population metrics within, adjacent to, and independent of WEAs, allowing data-driven inferences to be made about the local- and regional-scale effects of wind energy development areas on abundance, biomass, and other metrics of species effectively sampled by the survey.

6. ***Development and communication of new regional data streams***

Describe who needs to be involved. What key constituents need to be communicated with? What review and input processes exist to move proposed changes forward? Are there new processes?

A stakeholder workshop with representation from experts in survey design and operations, stock assessments, ecosystem assessments, engineering and advanced technology, and fisheries management will be held to identify recommended survey design and methodologies. A pilot study to determine the specific survey protocols and necessary sample size will be completed over the course of approximately 1 year. Once completed, a description of the draft ATVS design and protocols will be provided to

management partners (MAFMC, MAFMC SSC, NEFMC, NEFMC SSC, ASMFC) for comment.

Describe data management needs. Do existing data acquisition, management, and dissemination systems meet survey mitigation needs? If not, what is needed?

Data collection tools and databases will need to be developed for the survey. Some existing tools and systems may be adapted (e.g., Fisheries Scientific Computing System 2, SEFSC SERFS database), but significant scoping in consultation with NEFSC Information Technology Division (ITD) staff will be necessary to evaluate compatibility. New data systems will be built with consistency with existing data systems in mind (i.e., consistent with other NEFSC survey data) as much as possible. Electronic data collection tools (e.g., scales, fishboards) will be acquired and linked to data collection systems. Data quality control and auditing standard operating procedures will be developed. The data will be integrated into existing NEFSC survey database structures and available to end users through existing workflows.

Anticipated IT Resource Needs:

- Developer and database architecture and data management support to adapt FSCS2 data collection system and back-end database
- Assistance in developing data storage plan
    - Numeric/text and images (possibly video)
    - Live storage for immediate use; as the survey progresses, cold storage will need to be discussed
    - Data retention
- Developer support to maintain data collection system and database needs, ongoing data management support
- Long-term data infrastructure support provided by ITD and funded through indirect/overhead
- Stereo-video processing for photogrammetry and morphometric estimation

V. Proposed Schedule for Implementation

The implementation schedule for the ATVS will be dependent on whether there is support (including funding) for designing, implementing, and annual operation of the survey. A proposed first step for 2024 is to convene a stakeholder workshop, as described above, to identify recommended survey design and methodologies.

VI. Links to Other Surveys

The ATVS is anticipated to be a northward extension to the SEFSC SERFS. Close coordination between relevant NEFSC and SEFSC personnel will be critical to ensuring sufficient consistency between the 2 survey efforts that the data can be integrated across surveys (e.g., to make inferences about the degree to which species distributions may be changing in continental shelf and shelf break waters along the U.S. Atlantic coast). This expansion provides an excellent opportunity for cross-center collaboration and basin-scale data collection.

Other NEFSC surveys generating optical data (e.g., the integrated benthic/sea scallop survey) will have strong links to this survey, particularly in terms of data management and automated annotation through machine-learning techniques. However, the advantages of trap/video sampling for inside WEAs allows the ATVS to potentially link to many other NEFSC surveys which will be precluded by wind. The wide range of target species and condition of the catch provides many opportunities to leverage this new survey to contribute to collaborative tagging studies, including but not limited to tagging for highly migratory species, groundfish, and other commercially valuable species. Such tagging studies have been identified as a critical data need by NEFSC assessment scientists in early conversations about understanding the impacts of wind on federally managed species.

While dedicated staffing, oversight, and logistical coordination will be required for the ATVS, cross-seeding of personnel from and with other survey groups (including personnel assigned to other NEFSC surveys and SEFSC personnel) is recommended to ensure standard procedures to maximize potential for data integration. NEFSC and SEFSC coordination will also benefit the optimization of species identifications, analytical best practices, and data management and archiving.

VII. Adaptive Management Considerations/ Opportunities

This survey mitigation plan, and the ATVS itself, will be adaptive in nature. Modifications to the survey design (e.g., strata used), approach to effort allocation, amount of effort, and sampling methodology may be recommended based on pilot survey outcomes, increased impacts on other NEFSC surveys, and/or future wind development in the region.

Data processing for photo/video surveys is a massive undertaking; investments in developing and implementing use of Artificial Intelligence/Machine Learning approaches to automate video processing would likely result in substantial cost savings over the long term (Norouzzadeh et al. 2018) while broadening the impacts of this research.

If water visibility is a hindrance to the utility of video sampling in portions of the survey domain, investments in developing and implementing fisheries sonar and acoustic cameras (see Sibley et al. 2023) may enable increased survey utility over the long term.

VIII. Statement of Peer-Review Plans

A description of the draft ATVS design and methodologies will be provided to management partners (MAFMC, MAFMC SSC, NEFMC, NEFMC SSC, ASMFC) for comment. We expect this review process and subsequent refinements to the survey design and methodologies to take approximately 1 year. We will seek MAFMC and NEFMC SSC feedback on the survey design and methodologies prior to implementation. Additionally, a full survey review will be conducted after the ATVS has occurred for several years and resulting data are available for analysis. A technical memo on the survey's operational design will be developed and evaluated through peer review.

IX. Performance Metrics

ATVS performance will be based on the:

- ability to execute the survey with sufficient sampling density and catch volume to supplement gaps in existing data streams and to develop indices of abundance that are informative to assessments and resources managers;
- provision of calibrated survey data for species potentially impacted by the decrease in spatial coverage of the NEFSC BTS and species not well represented in existing BTS data, potentially serving as a source for supplemental sampling data for the BTS;
- ability to safely operate the ATVS within offshore wind development areas;
- development of survey documentation; and
- adaption of FSCS2 for electronic data collection and development of a data management plan.

X. References

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