Summary Report of the Protected Species Survey Mitigation Plan Peer Review

March 29-30, 2024
Northeast Fisheries Science Center, Woods Hole Massachusetts

Report prepared by Panel Members:
Richard Merrick (Chair), NOAA (retired)
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Executive Summary

In 2022, NOAA Fisheries and the Bureau of Ocean Energy Management (BOEM) developed a Federal Survey Mitigation Strategy (hereafter, "the Strategy") which described the possible impacts of wind energy development on fisheries and protected species surveys (Hare et al. 2022). Such impacts are anticipated where offshore wind energy areas (WEAs) have been developed or are under development (Lipsky et al 2024). The Strategy provided goals, objectives, and actions to guide the development and implementation of a Northeast Survey Mitigation Program to mitigate the impacts on fisheries and protected species surveys over the expected (30+ year) duration of wind energy development in the Northeast U.S. Region (Maine to North Carolina). Action 1.1.1 of the Strategy calls for the development of survey-specific mitigation plans for all NOAA Fisheries surveys impacted by wind energy projects in NOAA's Northeast U.S. Region (see Fig. 1). These plans provide: the purpose of the survey, details of the survey, effects of the four impacts of wind energy development on the survey, and the planned mitigation of the impacts (using the six-component framework outlined in the Strategy and summarized below). Northeast Fisheries Science Center (NEFSC, or "Center") scientists have now developed draft survey mitigation plans for six protected species surveys conducted by the NEFSC.

Objective 3.3 of the Strategy outlines the use of peer-review processes to ensure elements of the Northeast Survey Mitigation Program represent the best science available. To this end, the NEFSC has requested the expertise of the Atlantic Scientific Review Group (ASRG) to peer review the six draft survey mitigation plans. The panel is charged with evaluating each survey mitigation plan following a consistent Terms of Reference (Appendix 1). Foci of the review include evaluation of the relative effectiveness of the proposed survey mitigation to the:

- Four impacts of offshore wind energy development - 1) preclusion, 2) statistical design, 3) changes in habitat, and 4) reduced sampling efficiency.

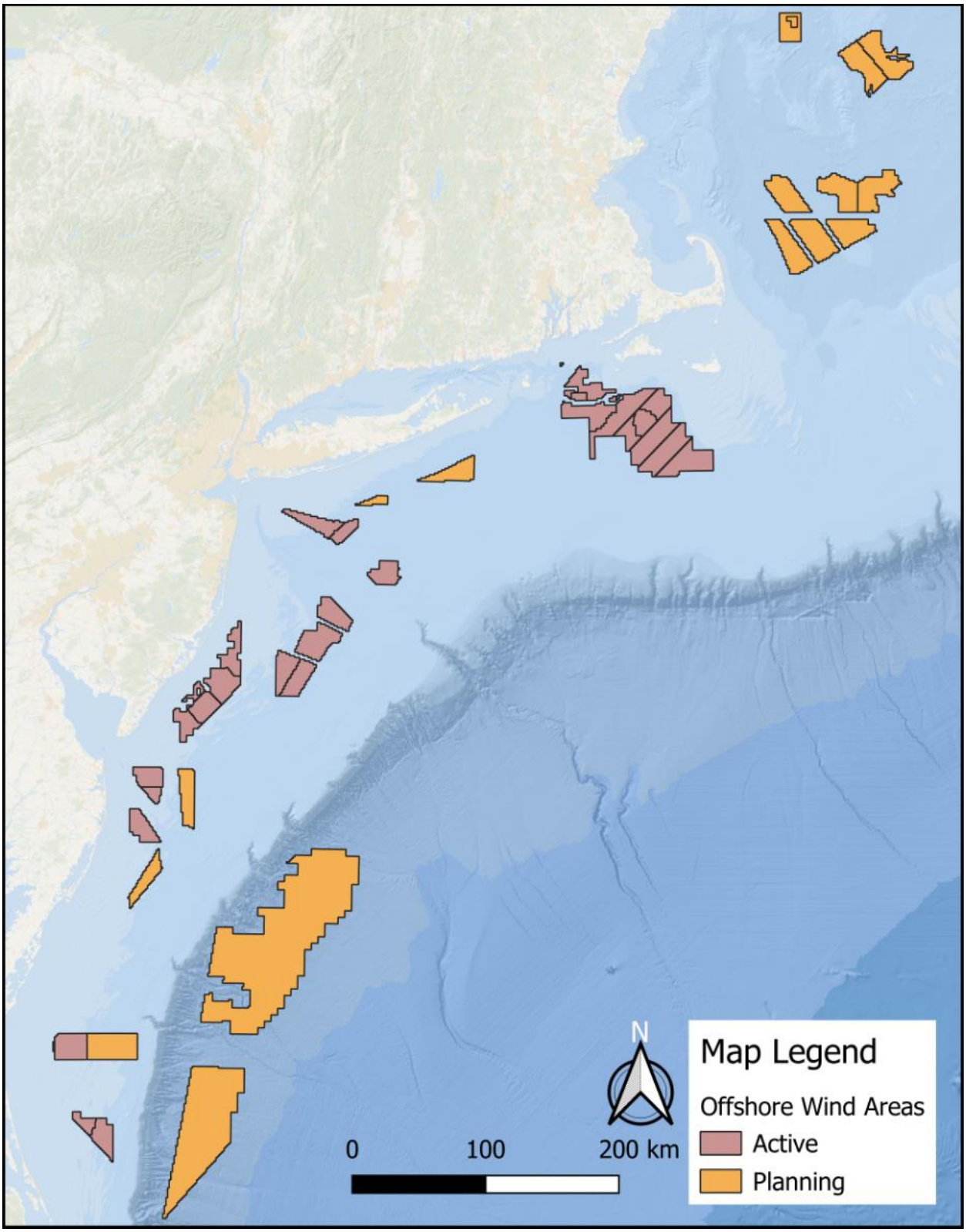

Figure 1. Wind Energy Areas (WEAs) in Federal waters in the Northeast Region.

- Six key elements of survey mitigation - 1) the evaluation of survey designs, 2) innovation in survey methodologies, 3) calibration and integration of new approaches, 4) formulation of interim provisional survey indices, 5) monitoring to fulfill scientific data requirements, and 6) communication needs and establishment of new regional data streams.

The Panel was composed of five scientists representing the ASRG and met on 29-30 May 2024 by videoconference. Agenda for the meeting is provided in Appendix 2 with materials provided for the review listed in Appendix 3. The Panel was assisted by Andrew Lipsky, Chris Meadows, Madison Hall, and Jordan Katz (meeting rapporteur) from the NEFSC's Offshore Wind Ecology Branch. We thank NEFSC's Protected Species Division staff (especially, Debra Palka, Heather Haas, Kimberly Murray, Tim Cole and Sofie Van Parijs) for the work that went into the draft plans and for their thoughtful presentations. We are also grateful for the assistance of Francine Kershaw, Deputy Chair of the ASRG, throughout the review process.

Draft plans were provided to the Panel several weeks in advance of the meeting and are at: https://www.fisheries.noaa.gov/event/peer-review-proposed-nefsc-protected-species-survey-mitigation-plans. Prior to the meeting, members of the Panel met with Andrew Lipsky and other NOAA staff to review and discuss the meeting agenda, reporting requirements, meeting logistics and the overall process.

The meeting opened on the morning of Wednesday, May 29 with welcoming remarks and comments on the agenda by the NEFSC and the Panel chair. The meeting agenda is provided as Appendix 2. Six surveys were reviewed:

- Marine mammal, turtle and seabird aerial surveys
- Marine mammal, turtle and seabird vessel surveys
- Turtle ecology surveys
- Seal aerial surveys
- North Atlantic right whale aerial surveys
- Passive acoustic monitoring (PAM) surveys

The Panel also received a briefing on new digital camera survey methods.

Day 1 focused on vessel and aerial surveys for a broad suite of protected species taxa. Day 2 was focused on specialized surveys including passive acoustic arrays, right whale photo-id, and seal breeding site and haul out surveys. Each day included periods for public comment and time for Panel discussion.

The draft plans prepared by NEFSC scientists were thorough and of high quality. Their very clear reports and presentations made the Panel's review more efficient and in-depth. The ASRG Chair, Deputy Chair, and rapporteur compiled and edited this Panel Summary Report

with assistance from the Panelists, before submission of the report to the NEFSC.

Overall, the Panel agreed that the two Marine Mammal, Turtle and Seabird survey plans, the North Atlantic Right Whale aerial survey plan, and the Passive Acoustic Monitoring survey plan all directly met the generic Terms of Reference (Appendix 1). The plans for the Turtle Ecology and Seal surveys were appropriate but did not necessarily align well with the TORs.

Several overarching direct and indirect WEA impacts on surveys should be of concern to the NEFSC. One is that WEAs will likely change the survey's detection and perception biases for most species occupying the WEAs. Bias corrections currently used may need to be updated. Secondly, changes to survey cameras, platforms or altitudes should be approached in an experimental manner such that the comparability between methods can be assessed. Finally, these new digital still/video, as well as the greatly expanded passive acoustic, data collections will greatly expand the surveys' needs for IT support, including AI to process the image and acoustic data, data storage/archiving, and staffing.

Fortunately, each of the six "Surveys" potentially can be adapted to the presence of offshore wind energy development without significant impacts on the survey time series. The Marine Mammal, Turtle and Seabird aerial survey plan and the North Atlantic Right Whale aerial survey can fly at higher altitudes and switch from visual human observers to high-resolution digital cameras (or video recorders) without loss of data because of the high resolution of the cameras being used. The Marine Mammal, Turtle and Seabird vessel survey plan can be adjusted so that additional aerial survey transects using digital cameras are flown to cover areas now located within offshore WEAs that NOAA FSV class vessels normally surveyed but are now too large to enter. The Seal survey sites seem to be far enough away from WEAs that surveys can proceed without disturbance. But, like the Turtle Ecology survey, the WEAs may influence the behavior and distribution of their survey taxa leading to changes in availability bias in the WEA. Lastly, the PAM survey would require minimal relocation of instrument deployments as the survey Plan already is designed to survey and is coordinated with the WEAs.

Specific comments and recommendations for each survey plan are provided below. Because all of the Plans met the Terms of Reference, we will focus comments on our recommendations for the plans (rather than provide detailed responses to each TOR).

Evaluation of the Marine Mammal, Turtle and Seabird Aerial Survey mitigation plan

The primary impact of WEA development on this survey are the turbines' rotors which will interfere with the current survey altitude (600' above sea level) in WEAs.

The Panel supports the modification to the existing Plan to fly above the turbine rotors at a safe altitude (approximately 1,500') and use belly-mounted digital camera systems (DCS; we include within this digital video systems) for the entire survey as the primary method to mitigate WEA impacts on this survey. Note that methods for the existing aerial survey are described in Palka (2020).

The Panel considered multiple alternative survey platforms and methods for estimating stock abundance in areas affected by WEA developments and rejected them as follows.

- **Small boat based line transects** – these are suboptimal because of the greatly reduced sighting distance, and the difficulty of supporting multiple sighting stations.
- **Uncrewed aerial platforms with digital camera systems** – this may be the long-term solution for the survey, but there are outstanding technical and logistical issues that prevent its near-term implementation.
- **PAM** – this method is promising but is not yet ready to provide estimates of absolute abundance except possibly in the case of deep-diving cetaceans. Currently, it could be useful for monitoring presence and potentially relative abundance, but absolute abundance estimation is the purpose of current NEFSC surveys.
- **Satellites** – this method has potential to be useful for large whales but is currently unproven in this context. It remains to be developed for small cetaceans and turtles. In general, there are outstanding technical issues related to satellite availability, cloud cover, and cost.
- **eDNA** – this method is still largely in development but may be ultimately useful for monitoring presence and potentially abundance; however, it is currently not usable for these purposes..
- **Not survey** – the NEFSC surveys must continue.

DCS flown at a higher altitude thus seem to be the best approach (as an alternative to human observers) at the present for mitigating impacts to surveys in the WEAs. We further **recommend** that this survey protocol with DCS be adopted for the entire aerial survey to facilitate the comparison of results between areas within vs. outside of WEAs.

However, we recognize that the change in altitude and imagery represent a significant shift in survey protocol and agree (as proposed in the Plan) that these changes be implemented in a stepwise and deliberative manner. The relatively slow pace of construction of offshore wind turbines within lease areas suggests there is time available for the NEFSC to implement and evaluate these changes in a robust manner.

The adoption of the new high resolution camera systems developed by NOAA or in Europe may be an improvement in the aerial surveys, as they minimize detection bias (compared to human observers) and provide improved capabilities for observing and identifying small animals (like some marine turtles). The method is already in use in some European aerial surveys and at NOAA Alaska Fishery Science Center, with good results, so there is no proof of concept needed.

The two extant systems use different frame rates – one is essentially still imagery while the other is video. The Panel **recommends** the NEFSC evaluate both approaches. The video imagery requires more storage, but, in discussing the issue with Center staff, the Panel did not believe this

to be a significant problem in the long run. NOAA, in general, can benefit from European experience using video imagery for surveys.

Comparability between the current method (2 human observer teams flying at 600') to the new method (DCS surveys flown at 1,500') is an issue the NEFSC needs to assess. One concern is that moving to DCS would mean a switch from a line transect to a strip transect approach, with the latter having a smaller strip width. If more survey lines are not run, the result would be a loss of precision in the abundance estimate. The Panel **recommends** the potential change in precision be determined in advance and appropriate changes to the survey protocol (more lines and/or a wider survey strip) be made to mitigate it.

The panel also **recommends** that the Center investigate the different factors that can influence the detection rate, and how this varies by altitude. For example, turbidity could be a factor. There are several approaches to estimating how bias related to turbidity may be changed by the switch in altitudes and the NEFSC must consider estimating the effect of DCS as they switch from human observers. A related issue is that availability bias changes when one switches from human observers (where the field of view includes an area in front of the observation platform) to a DCS (which typically captures only animals below the platform); hence estimates of availability bias will need to be re-derived.

Switching from human observers to DCS would increase the number of observers on board the aircraft. This has the advantage of reducing the cost of the surveys and increasing the endurance of the survey. Moving to unmanned systems also has these advantages plus it increases the safety of the survey effort.

One final issue, which the NEFSC is aware of but needs calling out, is that DCS will generate an enormous amount of imagery which needs to be processed. An automated neural network, as presented in the meeting, is the only reasonable way to make DCS useful. The Panel **recommends** that NOAA writ large continue to support the development of AI for processing digital imagery, and that this be a national effort.

Evaluation of the Marine Mammal, Turtle and Seabird Vessel Survey mitigation plan

With this survey, the primary impact of WEA development is confined to the two central Atlantic Ocean offshore WEAs. In those two areas, the turbine towers are too closely spaced to allow safe transit of NOAA's larger FSVs (e.g. the FSV *Henry Bigelow*).

As with the aerial survey, the Panel discussed several alternative approaches to collecting abundance data (i.e., uncrewed aerial/surface/subsurface vessels, small boats, and crewed aerial). The Panel supports the modification to the existing Plan to extend the existing aerial survey transects (Palka 2020) into these two areas, with the aircraft to fly above the turbine rotors at a safe altitude (1,500') and use digital camera systems (DCS). This will mitigate the impacts on the abundance survey but not the loss of the habitat information typically collected by the vessels. This drawback could be addressed through adjustments to the NEFSC's existing Ecosystem Monitoring (EcoMon) survey.

Using the modified aerial survey to collect the abundance data previously collected by the vessel generally follows the logic presented for the aerial survey writ large. However, given that this would be the only aerial survey of deeper, off the shelf, waters, the Panel **recommends** that the Center consider stratifying this area into separate aerial and vessel strata for abundance estimation.

One question that arises with this restratification is the layout of the survey lines. For the newly-created aerial stratum, an obvious approach would be to extend the current inshore aerial survey lines to cover the new area. For the reduced vessel stratum, one concern could be that it is now necessary to transit in off-effort mode between truncated zig-zag vessel survey lines - but given the size of the stratum re-adjustment this was not considered to be a major problem and hence no change in vessel survey design layout was deemed necessary. The possibility of a complete redesign of the stratum using generalized random tessellation stratification (GRTS) was raised but is not thought by the Panel to be necessary.

One potential concern is that this new aerial survey stratum may contain different, shelf-associated, species that are not typically encountered in the shallower waters that are typically surveyed by aerial transects. Hence the Panel **recommends** that the NEFSC consider methods for estimation of availability bias from DCS for these species, so that results for this new aerial stratum give absolute abundance and hence are comparable with results from the previous shipboard surveys in this area.

With respect to collection of habitat data, the most reasonable alternative at this time would be an expansion of the NEFSC's EcoMon survey into these areas, though it would be unnecessary to follow survey track lines so long as there were sufficient sampling stations within the WEA to model the habitat there.

Evaluation of the Vessel Based Sea Turtle Ecology Survey mitigation plan

With this survey, the primary impact of offshore wind energy development is how the turbines impact turtle habitat in those areas (and thus the availability of turtles to the survey). For example, if the wind wakes generated by operating turbines lead to local hydrodynamic or oceanographic changes in or close to the WEAs, the turtles' buoyancy may be affected and, as such, their time at the surface and availability to be surveyed. Line transect estimates of turtle abundance would then be biased, if they used correction factors developed under the previous ocean state in the WEA. This potential issue would be further exacerbated by significant changes in ocean conditions throughout the continental shelf domain (from the Gulf of Maine through the Mid-Atlantic Bight) resulting from climate change.

The Panel considered changes in availability to be a significant concern for survey-based estimates of abundance in the WEAs, though it is likely an issue throughout the region and not just in the WEAs. It is also likely an issue for other marine mammal and seabird taxa. For sea turtles, the Panel **recommends** development of revised factors to adjust for availability bias using contemporary dive data drawn from a combination of satellite tags and suction cup TDRs.

The Panel further **recommends** that this research be focused on leatherback and loggerhead sea turtles, to maximize sample sizes under the current resource constraints.

The Plan should consider the following in developing revised corrections for availability:

- The number of survey geographic strata requiring unique corrections (at present the survey includes 4 strata but there appears to be only 1 availability bias correction factor in the model).
- The need for consideration of WEAs as a separate stratum.
- The need for species-specific factors (can loggerheads be used as a proxy for other species, for example).
- Given that there are only two WEAs currently under construction, current deployments should focus on obtaining baseline estimates that have resulted from ocean changes that have occurred since the last set of adjustment factors were developed.

These considerations should help focus sampling for instrument deployments.

Finally, the cost of this exercise will be high. Given the cost of satellite tags compared to suction cup tags, we suggest that the Center carefully consider whether it might be more efficient to only use suction cup tags to provide the data especially for spatially explicit adjustment factors (e.g., within a WEA).

Evaluation of the Seal Survey mitigation plan

This survey's plan suggests the primary impact of WEA development in southern New England and the Gulf of Maine would be interference by the WEA turbine rotors with the survey aircraft as it transits between seal breeding sites and haul outs in coastal areas.

However, now that the WEAs in both areas are relatively well defined, and with the understanding that NOAA aircraft can transit to within 2 nm of the towers and rotors (or 1,500' above), the Panel does not foresee no direct interference with seal surveys at the Monomoy, Muskeget, No Man's Land and coastal Maine grey breeding sites and harbor seal haul outs.

Construction and operation of the WEAs could lead to a change in the availability bias during the surveys. The Panel suggests that the construction and operation of fixed and floating wind platforms relatively near to areas where seals aggregate could affect behavior (e.g., time ashore) and abundance on shore. This could first be as a deterrent to hauling out (during construction) and then as an attractant to the WEAs (during operation the facilities may serve as a fish aggregating device). The NEFSC would be wise to consider evaluating any previously developed correction factors for percentage of time ashore which are used to expand survey counts to population estimates.

Surveys of southern New England grey seal breeding sites frequently share platforms (a NOAA Twin Otter) in the same or subsequent days. This could lead to some issues with respect to the belly mounted digital camera, if it is difficult to reset the altitude from one survey's protocol to another. This is difficult to comment on as it is unclear to the Panel what set of belly mounted cameras will be used in the joint surveys (e.g., seal vs right whale or seal vs AMAPPS). While this is not strictly a WEA issue (both the other surveys fly higher and use different cameras than the grey seal surveys), it is an issue that was discussed and the Panel **recommends** that the NEFSC coordinate cameras and platforms and **recommends** that vertical photography replace oblique photography wherever possible.

The Panel understands that a joint survey of the Muskeget grey seal breeding site was flown previously with results suggesting that the high resolution drone imagery produced significantly higher counts than the handheld oblique photography from the NOAA Twin Otters. As such, it is important that these surveys continue to evaluate the difference in detectability between oblique imagery from the Twin Otter and from the drone, with results used to update earlier abundance estimates obtained from Twin Otter surveys. This undercounting is likely relevant to all the grey and harbor seal surveys flown with the Twin Otter.

Evaluation of the Right Whale Transect and Photo-ID Survey mitigation plan

The primary impact of WEA development on this survey is that the turbine's rotors will interfere with the current survey altitude (1,000' above sea level) in WEAs.

The Panel supports the modification to the existing Plan to fly transects above the turbine rotors at a safe altitude (1,500'), and to use the combination of human observers (for sightings) and hand-held digital camera systems (for photo-identification) for the entire survey as the primary method to mitigate the impact of WEA structures on this survey. Outside of the WEAs it would be appropriate to descend to lower altitudes for photogrammetry, and particularly to document entangled or injured whales. The Panel was concerned that not being able to descend to lower altitude within the WEA might compromise responses to injured animals within the WEA.

Should conditions require (low ceilings preventing flights at 1,500') it would also be appropriate to survey at lower altitudes outside of the WEAs. This may affect a small number of flights, particularly in winter.

The Panel is aware that the New England Aquarium and contractors to the NEFSC are moving to the 1,500' survey altitude. This change for the NOAA aircraft would bring all the major North Atlantic Right Whale (NARW) surveys in the Northeast into conformity.

The Panel notes that the shift in altitude will influence the detection function as required for the surface density models for NARW. When altitude was changed in 2017 from 750' to 1,000', detectability seemed lower, as there were fewer sightings, which then affects calibration of the surface density model. Detectability as a function of distance from the transect line is accounted for by the line transect protocol – but this does not account for changes in detectability at zero distance ("g0"). The Panel **recommends** using either an observer at the rear window or imagery

from the belly mounted camera system as a "second observer" to enable estimation of g0 as part of intermittent calibration experiments.

Evaluation of the Passive Acoustic Survey mitigation plan

The survey plan indicates that the only direct impact of WEA development on the Passive Acoustic survey would be small shifts in the specific locations for instrument deployment.

The Panel agrees this the WEAs will have minimal impact on the deployment and operation of the Passive Acoustic Monitoring (PAM) network. There remains, however, some uncertainty as to whether floating wind platforms and their anchoring, either in the Gulf of Maine or the offshore central Atlantic regions, may interfere with PAM deployment, or recovery, or whether it will affect detection ranges.

A part of the discussion of the use of PAM data relevant to the plan and WEAs was the issue of PAM deployment off the continental shelf to listen for deep diving whales. The Panel **recommends** that the deep water WEAs more heavily sampled with devices listening at appropriately high frequencies to receive clicks of deep divers – beaked whales and sperm whales.

Overarching Panel Recommendations

Several direct and indirect WEA impacts on surveys should be of concern to the NEFSC.

One is that WEAs will likely change the survey's detection and perception biases for most species occupying the WEAs. We have pointed out here that, especially in the case of sea turtles, changes in ocean temperature, induced by climate change and potentially further contributed to by turbine induced upwelling, could affect sea turtle time at the surface. Other taxa availability at the surface could also be impacted by these changes, or for other reasons. The transition from visual aerial surveys (where observers have some degree of forward view) to DCS (where the cameras point downwards) will certainly affect availability bias. Given all this, the Center should reevaluate currently used availability bias corrections.

Secondly, changes to survey cameras, platforms or altitudes should be approached in an experimental manner such that the comparability between methods can be assessed. Strictly speaking, moving from one altitude to a higher altitude for the aerial surveys should have minimal impact on surveys using high resolution digital imagery; however, the proposed change in cameras and altitude should be approached cautiously, with time provided to measure the difference between survey protocols, before full implementation range-wide. A dual aircraft survey would be one approach to evaluating these differences.

One particular concern is the possible decrease in encounter rate associated with the switch from visual to camera surveys. The potential effect on precision needs to be quantified and mitigated where possible.

This new digital still/video imagery, as well as the greatly expanded passive acoustic data collections will greatly expand the surveys' needs for IT support, including AI to process the imagery and audio files, data storage/archiving, and staffing. The Panel heard that the NEFSC's PAM datasets already approached 2 petabytes. Digital imagery, whether still or video, will further contribute to the need for storage. Both types of data require significant processing to extract information; there has been major progress in the analysis of the acoustic data but the visual imagery processing lags. The NEFSC's continued support of an automated neural net for processing of these data is crucial. Given this is an issue in both fish and protected species, and at all the Fishery Science Centers, it is crucial that NOAA continue to support this work.

Finally, though the total scope of wind farm development within the US Atlantic Ocean EEZ is extensive, actual development is just beginning and will take decades to reach completion. The NEFSC has time to take a measured approach to implementation of new survey methodologies and has sufficient time to complete relevant calibration studies between new and old approaches to the assessing the abundance of marine mammals and turtles but should start this process without delay.

Appendix 1 - Terms of Reference for ASRG Panel Review of the NEFSC Protected Species Survey Mitigation Plans

1. Existing survey - Does the plan describe the existing survey design, methods, and uses of the data generated from the survey with a level of detail sufficient to assess proposed mitigation solutions for offshore wind impacts? If not, please describe what additional detail is needed.

2. Impacts on the survey - Does the plan adequately describe how the survey may be affected by the 4 impacts of wind energy development?
    a. Are there additional offshore wind related impacts the plan should consider?
    b. Are key areas of uncertainty in the impacts from offshore wind identified and addressed?

3. Mitigation of impacts - Will the proposed approach mitigate the identified survey impacts to ensure time series continuity and the same or better data quality compared to current survey methodologies?
    a. Does the plan effectively describe approaches, both specific and general, for addressing each of the 6 elements of survey mitigation (Hare et al. 2022)?
    b. What additional mitigation plan elements or mitigation strategies should be considered?
    c. Are key assumptions made about actions to mitigate impacts reasonably justified?
    d. Are key areas of uncertainty in the effectiveness of the survey mitigation sufficiently described and addressed in the plan elements?

4. Communication - Does the plan effectively describe steps for communicating important changes in plan implementation? How can communication plans be improved?

Appendix 2 – Agenda for ASRG Panel Review of the NEFSC Protected Species Survey Mitigation Plans

Wednesday 29 May

10:00 Opening comments – Kathryn Ford, Andy Lipsky, Brad Blythe

- Introduction of Panel
- Presentation on the need for the Survey Mitigation Plans
- Expectations for this peer review (including review of ToRs)
- Agenda Review

10:30 Marine mammal and sea turtle aerial survey mitigation plan (1.5 hrs) – Debra Palka

- Presentation on the plan
- Discussion
- Public questions/comments

12:00 Break

1:00 Marine mammal, sea turtle, and seabird ship-based survey mitigation plan (1.5 hrs) – Debra Palka

- Presentation on the plan
- Discussion
- Public questions/comments

2:30 Break

2:45 Vessel-based Sea Turtle Ecology Survey (1 hr) – Heather Haas

- Presentation on the plan
- Discussion
- Public questions/comments

3:45 Break

4:00 Panel Review of Day's Findings

5:00 Adjourn for Day

Thursday, 30 May

10:00 Recap of Day 1

10:30 Seal survey mitigation plan (1 hr) – Kimberly Murray

- Presentation on the plan
- Discussion
- Public questions/comments

12:00 Break

1:00 Overview and discussion of digital aerial survey techniques (0.5 hrs) – Debra Palka

- Presentation to recap information sent to peer reviewers
- Clarifying questions/discussion

1:30 Right whale transect and photo-ID survey mitigation plan (1.5 hrs) – Tim Cole

- Presentation on the plan
- Discussion
- Public questions/comments

3:00 Break

3:15 Passive acoustic survey mitigation plan (1.5 hrs) – Sofie Van Parijs

- Presentation on the plan
- Discussion
- Public questions/comments

4:15 Panel Review of Day's Findings

5:00 End Review

Appendix 3 - Materials provided or referenced during the ASRG Panel Review of the NEFSC Protected Species Survey Mitigation Plans

Hare JA, Blyth BJ, Ford KH, Hooker BR, Jensen BM, Lipsky A, Nachman C, Pfiieffer L, Rasser M, and Renshaw K. 2022. NOAA Fisheries and BOEM Federal Survey Mitigation Implementation Strategy - Northeast U.S. Region. NOAA Technical Memorandum 292. Woods Hole, MA. 33 pp.

Lipsky A, Silva A, Gilmour F, Arjona Y, Hogan F, Lloret J, Bolser D, Haase S, Oesterwind D, ten Brink T, Roach M, and Ford F. 2024. Fisheries independent surveys in a new era of offshore wind energy development. ICES Journal of Marine Science 0:1-15. https://doi.org/10.1093/icesjms/fsae060

Palka D. 2020. Cetacean abundance in the US Northwestern Atlantic Ocean Summer 2016. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 20-05; 60 p. Available from: https://www.fisheries.noaa.gov/new-england-mid-atlantic/northeast-center-reference-document-series

Appendix 4 – Partial List of Meeting attendees at the ASRG Panel Review of the NEFSC Protected Species Survey Mitigation Plans

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Panel
Richard Merrick (Chair), NOAA (retired)
Francine Kershaw (CoChair), Natural Resource Defense Council
Kathryn Ono, University of New England (retired)
Ana Širović, Norwegian University of Science & Technology
Len Thomas, University of St. Andrews
Lesley Thorne, State University of New York

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NOAA Presenters
Tim Cole
Heather Haas
Kimberly Murray
Debra Palka
Sofie Van Parijs

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BOEM
Brad Blythe
Ursula Howson

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NOAA
Kathryn Ford
Madison Hall
Sean Hayes
Libby Jewett
Jordan Katz (Rapporteur)
Andrew Lipsky
Chris Meadows
Chris Orphanides

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Public
Sue Barco, Virginia Aquarium and Marine Science Center
Alex Brown, Sea Mammal Research Unit
Kelly MacLeod, Hi Def Aerial Surveying Ltd.
Matthew Manberg, Boston University and Total Energies (intern)
Jason Roberts, Duke University
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