



NOAA Technical Memorandum NMFS-NE-325

Northeast North Atlantic Right Whale Aerial Coordination Workshop Report

**US DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Fisheries Science Center
Woods Hole, Massachusetts
December 2024**



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Northeast Fisheries Science Center

NOAA Fisheries, 166 Water Street, Woods Hole, MA 02543

**US DEPARTMENT OF COMMERCE
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Editorial Notes

Information Quality Act Compliance: In accordance with section 515 of Public Law 106-554, the Northeast Fisheries Science Center (NEFSC) completed both technical and policy reviews for this report. These pre-dissemination reviews are on file at the NEFSC Editorial Office.

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TABLE OF CONTENTS

Introduction.....	2
Welcome and Opening Remarks	3
Panels	3
Photo Identification and Mark-Recapture Led by Philip Hamilton (New England Aquarium) 3	
Photo-Identification and Mark-Recapture Discussion	4
Data Management Led by Hansen Johnson (NEAq)	5
Data Management Discussion	5
Modeling Led by Jason Roberts (Duke University).....	6
Modeling Discussion	6
State Management Led by Erin Burke (MA DMF).....	7
State Management Discussion.....	8
General Discussion	9
Key Messages.....	9
Next Steps/Future Discussions.....	9
Regional Coordination Meetings.....	9
Acknowledgements.....	9
Figures.....	10
References Cited	12
Appendix A: List of Acronyms.....	13
Appendix B: Workshop Agenda.....	14
Appendix C: Participants	16
Appendix D: Feedback Survey Results	20

INTRODUCTION

Systematic aerial surveys designed to collect image and sightings data of North Atlantic right whales (*Eubalaena glacialis*; NARWs) have been vital to NOAA's mission of fulfilling conservation initiatives mandated under the Marine Mammal Protection Act (MMPA) and Endangered Species Act (ESA) and informing management decisions. With the growing number of aerial teams and survey effort in the Mid-Atlantic and Northeast regions, there is a need to provide a forum for collaborators and stakeholders to discuss strategy, refine daily survey coordination, and establish frameworks for communication and data sharing.

The National Marine Fisheries Service (NMFS) is developing a Monitoring Framework for North Atlantic right whales with the objective of identifying the benefit of annual workshops by platform/region to inform planning, collaboration, and data sharing within and outside of the NARW research community. The purpose of this workshop sought to maximize the benefit, safety, and collaboration of NARW aerial surveys in the Mid-Atlantic (MIDA) and Northeast United States (NEUS). This workshop was conducted to receive input from the NARW community, to identify areas where more support is needed, and to highlight current and future obstacles that require consideration.

This 1-day workshop took place on February 1, 2024, and was hosted by the Northeast Fisheries Science Center (NEFSC). It was organized into a series of structured panels to focus on 4 major facets of NARW research: photo-identification and mark-recapture, data management, distribution and density modeling, and state management. Over 70 participants from governmental agencies, non-governmental organizations (NGOs), international partners, and academic institutions involved with the planning, execution, analysis, and interpretation of NARW aerial survey data attended in person or remotely.

The objectives of the workshop were to:

1. summarize available resources and data;
2. review 2024 and future aerial survey plans;
3. provide a forum for survey team leads and state and federal managers to coordinate; and
4. identify data needs, coverage gaps, and logistical challenges associated with survey execution.

The panel discussions focused on aerial surveys' contribution to conservation and management efforts, data and logistical limitations, present and future aerial survey methods, and coordination. These productive conversations highlighted the importance of future annual workshops to address knowledge and coverage gaps, skilled personnel and platform availability, cross-training opportunities, the implications of wind energy development and the resulting wind energy areas (WEA) for study design and analysis, and the maintenance of collaborative partnerships. Key elements of the meeting are summarized in the report below.

Following the workshop, presentations were shared with participants, and feedback regarding future workshop needs was solicited through an online survey.

This workshop was initially proposed for the annual North Atlantic Right Whale Consortium (NARWC) meeting in October 2023. Instead, a pre-recorded presentation was made available to participants, and discussion was promoted to identify topics for the in-person workshop described in this report.

A draft of workshop attendees and dates were selected in December 2023. Invitations were sent to participants in December 2023, and nearly all individuals attended the workshop in person or virtually.

The workshop format is detailed below. There was at least 1 rapporteur for each panel and subsequent question and discussion session.

Host: NOAA/Northeast Fisheries Science Center

When: February 1, 2024, 8:30 a.m. to 5:30 p.m. Eastern Time

Where: Northeast Fisheries Science Center (Woods Hole, MA) and virtual (Google Meet)

Invitees: Approximately 75 researchers and governmental managers involved in NARW aerial survey efforts

Format: 1 day of panel-based presentations and discussions

Panel Topics: Photo-Identification and Mark-Recapture, Data Management, Modeling, and State Management

WELCOME AND OPENING REMARKS

Tim Cole (NEFSC Protected Species Division) welcomed participants and provided an overview of the workshop's agenda. Cole highlighted that the primary objectives of this meeting were to: 1) maximize efficiency when coordinating North Atlantic right whale aerial surveys off the Northeast United States and 2) facilitate collaboration between state and federal managers, researchers, and contractors.

Cole provided an overview of NARW ecology, distribution, population status, and threats. He discussed the basic methods, benefits, obstacles, and limitations of aerial surveys in observing and monitoring the species. He summarized the current dedicated aerial survey effort along the east coast of the United States and Canada, and highlighted the gaps where more coverage is needed throughout the year (Figure 1).

Cole concluded his opening remarks by stressing the importance and challenges of using aerial surveys as a tool in detecting right whales and understanding right whale occurrence. He noted that involvement from the states is vital and emphasized how the coordination and collaboration among teams maximizes safety and efficiency for all.

PANELS

Photo Identification and Mark-Recapture | Led by Philip Hamilton (New England Aquarium)

Philip Hamilton was the first presenter for the photo-identification panel. His presentation described the how, what, and why of right whale photo identification, explaining the nuances of NARW identification through photographic data and how those details are coded for, and queried in, custom software (DIGITS). He summarized the North Atlantic right whale image database (i.e., the catalog) content, which is managed by NEAq for NMFS and NARWC and consists of over 95,000 sightings. Philip emphasized the importance of all sightings of NARWs given the uncertainty of distribution, changes of habitat use, and variable sighting history intervals of individuals. Lastly, Philip spoke to the importance of photographing NARWs and the life history

knowledge gained from these data, such as calculations of abundance, estimations of population size, tracking of calving intervals, and detection and monitoring of anthropogenic injuries.

Dr. Daniel Linden (NEFSC) described the various approaches to estimating population abundance and further detailed the use of capture-recapture models for NARW population estimates. Dan emphasized the importance of individual identification in capture-recapture and how calculating sighting probabilities from recapture events have been integrated into population size estimates. These probabilities allow additional parameters to be estimated, such as annual abundance and mortality.

Allison Henry (NEFSC) presented on using photo identification of NARWs in mortality, serious injury, and unusual mortality event (UME) determinations.

The final presenter of the first panel was Alison Ogilvie (NEFSC), who described aerial photography methods. Alison summarized good photographic practices in various scenarios, with examples to illustrate points. She advised reviewing images, when there is time, to confirm settings are appropriate for the conditions and to check for injuries. Alison asserted the importance of communication in the aircraft between the photographer and other people on board, including pilots and other researchers.

Photo-Identification and Mark-Recapture Discussion

Media types and file sizes were discussed following this panel, specifically if digital video would be integrated into the identification database and how. Video can capture behaviors particularly well; however, storage constraints are a concern and can provide inferior data based on platform (i.e., aircraft) and quality. The DIGITS software is being modified to incorporate video files, and technological advances may address the aerial challenges of speed and vibration.

Participants considered how different survey designs influence sightings data. Surveys that prioritize mark-recapture will revisit aggregations, while those that focus on distance sampling often fly line transects of a survey region that are ideally chosen at random. The former is integral to the best population estimate calculations, while the latter is important for the density surface model. The credible intervals of the annual population estimates are relatively narrow due to mark-recapture efforts. The reasoning behind why mark-recapture should be maximized, or to what point, was discussed. With limitations on aerial survey effort due to funding and platform availability, there is a need to balance the allocation of survey hours for various data demands. Mark-recapture is critical for estimating residency; identifying injuries and entanglements events and narrowing down timeframes of occurrences; quantifying cryptic mortality; studying reproductive success and calving intervals; and identifying population trends. Additionally, the precise population estimate allows the effects of management actions to be assessed. Acoustic monitoring was suggested as a supplemental means to detect animals in lieu of visual surveys; this would allow for determination of presence/absence but not abundance or density/distribution. Creating an individual simulation model to assess how much effort is required to answer questions robustly was proposed, but there was concern about the accuracy due to excess knowledge gaps. It was noted that one of the motives for the workshop was to provide a forum for those conversations and to discuss management and data needs of state managers and researchers and how to support these groups. It was also noted that when observers record more than large whales (e.g., small delphinids, pinnipeds, fishing gear, vessels), the effective strip width and the likelihood of detecting a North Atlantic right whale at a distance may be significantly reduced due to observers focusing attention close to the survey track. This may especially impact detections of NARWs in areas where their density is low. One solution that was proposed was to incorporate

belly cameras to capture sightings on and close to the survey track while observers focus their attention farther out.

The utility of digital aerial surveys was raised since they are being conducted by some wind developers. There was a question of where the data from these surveys go and how they would be integrated into the NARWC databases. NARWs are rarely detected during digital aerial surveys since these surveys are often unmanned, at high altitude, and do not circle or target whales, but when individuals are captured, they are submitted to the NARWC catalog. Photo identification of NARWs captured during digital surveys can be difficult due to low image resolution of identifying features and can generally only confirm species.

Lastly, the sighting threshold to trigger a slow zone¹ was raised. Visual detection of 3 or more NARWs within a certain proximity is required to implement a Dynamic Management Area (DMA). A single confirmed acoustic detection is required to trigger an Acoustic Slow Zone.

Data Management | Led by Hansen Johnson (NEAq)

Dr. Hansen Johnson described the background and functionality of WhaleMap² and the goal for it to serve as an efficient interface to view survey sightings and effort. The genesis of WhaleMap was brought about during the 2017 right whale UME³, where the increase of survey effort and sightings required an efficient platform for viewing survey results in lieu of email threads. The system became more automated over time with raw data added to a shared repository and WhaleMap server, effort and sightings extracted, and this information displayed on interactive and summary maps. It has a user-friendly dashboard where data can be filtered by multiple parameters.

Dr. Robert Kenney (URI) discussed the NARWC Sightings and Survey Database, which is housed at University of Rhode Island. Bob explained what types of data are, and are not, archived, the relationship to the image database, and common misconceptions about the effort and sightings records.

Monica Zani (NEAq) was the final speaker of this panel and presented on the NARWC image database⁴. Monica summarized the range of contributors and submissions, shared the submission guide, and outlined what a submission should include. She emphasized the amount and importance of opportunistic sightings to the dataset.

Data Management Discussion

Protocols for submitting opportunistic sightings and special interest cases to the sightings and identification databases were explained. Opportunistic sightings are submitted to URI (NARWC sightings database) and NEAq (NARWC image database). There is an established communication network that includes federal officials, NARWC curators, and field teams for sharing sightings of new or known injuries in near real-time. These animals are assessed and closely monitored.

The functionality, technical details, and upcoming modifications of WhaleMap were reviewed among panelists and workshop participants. The website is intended to be used for research and management purposes, and a disclaimer about the use of the data and interpretation of displayed sightings is conspicuous for users. WhaleMap's interactive map display can be

¹ <https://www.fisheries.noaa.gov/feature-story/help-endangered-whales-slow-down-slow-zones>

² <https://whalemap.org/>

³ <https://www.fisheries.noaa.gov/national/marine-life-distress/2017-2024-north-atlantic-right-whale-unusual-mortality-event>

⁴ <https://rwcatalog.neaq.org>

filtered to view sightings and effort data, but to access these data for analysis, a data access request must be provided to the NARWC. DMAs are visible on WhaleMap via a connection to the ArcGIS Rest Service site housed at the NEFSC. Integration of archived data was requested, but this is unlikely to occur on the public-facing side of WhaleMap for a few reasons: first, inclusion would require increased server storage and slow website speed or crash it altogether; and second, historical data without the context of survey effort may be misleading since distributions have shifted over time and changes in survey effort protocols would not be conveyed. The WhaleMap team, composed of NEAq and state and federal curators, is developing solutions. The display restriction can currently be bypassed by using the password “54321survey!” in the option “Show unverified data” in the lower left sidebar.

Modeling | Led by Jason Roberts (Duke University)

Dr. Jason Roberts spoke first during the modeling panel. His talk gave a detailed overview of density surface modeling and how these models inform management decisions such as NOAA’s proposed seasonal speed rules and the Decision Support Tool (DST; Solinger et al. 2024). Jason discussed the NARW density model in detail. NARWs are too scarce to be solely modeled by data from broadscale aerial surveys, and the detectability is important. Effort is not homogeneously distributed, which is a requirement of traditional abundance estimates from distance sampling. The density surface model relaxes the effort requirement by using effective covariates and also incorporating perception and availability biases. Data from different survey types can be used in the density surface model as long as the data fields are encoded. Jason demonstrated how data collected by aerial survey teams are analyzed and suggested best practices for teams to maximize the usefulness of their data for use in the model. This included avoiding track lines parallel to shore or an environmental gradient, recording resights on adjacent tracks, surveying an area once a month, and not spatiotemporally biasing effort based on whale presence. He also discussed upcoming developments to the NARW density model that will include near real-time data and modeling.

Dr. Burton Shank (NEFSC) discussed the DST, a model used to predict entanglement risk to NARWs. Burton explained that the model provides estimates of co-occurrence and risk using NARW distribution, distribution of vertical and horizontal lines in the water column, and the lethality of the gear should a whale become entangled. He mentioned that the model is still limited and would be improved with the addition of whale behavior, whether it was feeding or transiting, how the whale used the water column, and how much time it spent at the surface.

Modeling Discussion

The effects of adopting the ideal survey design parameters for the density surface model were discussed. It was pointed out that if all species are recorded, then there could be fewer large whale detections. The question then arose about how less data in the model would affect the results and influence estimation of detection functions and effective strip widths. Multispecies aerial surveys that record all species tend to have smaller effective strip widths, but there is variability depending on the declination ceiling for scanning. The number of sightings is not directly correlated with the density estimates as long as there is no bias. One idea considered was building a tool to assess the effort required for a hybrid approach. Another was to reach out to experienced colleagues about the tradeoffs between multispecies surveys and NARW management needs. A solution to accommodate multispecies and large whale data collection was to incorporate belly-mounted camera systems to capture animals on the track and develop AI for automated detection. Preliminary results of this approach have been promising with close abundance estimates between

visual observer and belly-mounted camera sightings. Increasing altitude and adding more lines were proposed as a means of accommodating the smaller field of view of camera systems, but ultimately, further discussion on the topic was deferred until a detailed proposal could be devised.

The subject of survey altitude was raised on multiple occasions. One calibration study to compare NARW sightings at 1000 feet versus 1500 feet had similar abundance estimates. Increasing survey altitude to 1500 feet will likely be standard due to the prevalence of wind energy and turbine heights in the future. This will not necessarily be problematic for the NARW density surface model; however, data from different altitudes cannot be pooled, and new detection functions will need to be calculated. Integrating resources to reach a balance was noted as critical for management needs. Another question was posed about whether new aerial survey efforts should be conducted at 1000 or 1500 feet; the discussion on this topic was also postponed to explore on a later date.

State Management | Led by Erin Burke (MA DMF)

Erin Burke outlined the Massachusetts NARW aerial surveillance program. She highlighted the importance of Massachusetts as a seasonal NARW feeding habitat and the high density of NARWs documented in the area each winter and spring. Erin discussed the longstanding partnership between the Massachusetts Division of Marine Fisheries (MA DMF) and the Center for Coastal Studies (CCS), who they have contracted to fly NARW surveys in Cape Cod Bay and adjacent waters since 1998. She drew attention to Cape Cod Bay and how the number of whales using that habitat has changed over time. Notable challenges for the aerial surveillance program were funding, weather, and balancing data needs. She also discussed how MA DMF uses sightings data to manage closures and speed restricted areas in state waters to protect NARWs from ship strikes and entanglements in near-real time.

Erin Summers (Maine Department of Marine Resources [ME DMR]) detailed a new NARW surveillance program being started by the Division of Marine Mammal Research through the Maine Department of Marine Resources. Although NARWs have been sighted inconsistently in Maine, the state has the highest concentration of fixed-gear fishing effort and potential entanglement risk on the U.S. east coast, highlighting the need for increased survey effort. The new NARW surveillance program will include broadscale aerial surveys, vessel surveys, and passive acoustic monitoring (PAM). Broadscale surveys that overlap with fisheries are a priority for the state of Maine. Objectives include creating new analytical tools that will incorporate various data streams and potentially forecast changes in NARW distribution, support existing models by filling key data gaps of fishing effort and NARW detection effort, and develop management tools to implement risk reduction measures, like an alternative gear testing program and dynamic management regulations.

Meghan Rickard (New York Department of Environmental Conservation [NY DEC]) outlined New York state's Whale Monitoring Program, designed to gain information on large whale species while balancing the needs of the shipping, fishing, and wind energy industries. The program, which operates for 3 years at a time every 5 years, includes monthly aerial surveys and a PAM program. The goal is to identify areas of sustained or recurrent large whale activity and to reduce the threat of vessel strike or entanglement in fishing gear to large whales. Meghan emphasized that the New York Bight has historically been under-surveyed and was previously thought to serve only as a migration corridor for large whales between feeding and breeding locations. The surveys have demonstrated that large whales, including NARWs, are now using the area to feed and are being sighted consistently during some months of the year. The sightings data

have since been used in density models, management decisions, methodological comparison, and model ground truthing. Funding, a limiting factor, is from the state budget and the fiscal year 2023 omnibus through the Atlantic States Marine Fisheries Commission (ASMFC). The NY DEC has aspirations to establish a New York state whale monitoring program that can enhance collaboration with surrounding states and other entities.

State Management Discussion

Much of the discussion following this panel focused on identifying areas where increased survey effort is needed. Workshop participants noted the value and need for more broadscale survey effort, recognizing that it is important to understand where NARWs are not found, as well as where they are found. With respect to the NEFSC survey design, it was noted that ~75% of the effort is currently conducted as broadscale surveys, while ~25% is directed to known NARW aggregations. It was also noted that this balance of survey priorities has been providing good data for the population estimate, facilitating estimates with precise credible intervals, while also contributing data to density modeling and other efforts. It was suggested that states could establish more systematic survey effort and that the NEFSC effort could be directed to get further coverage in those areas when NARW aggregations are found. It was noted increased survey effort could also help narrow down where injuries are occurring. In the past, it has been possible to determine which habitat an injury likely occurred in based on photo-ID recaptures of individuals and documentation of the injury.

With respect to the Mid-Atlantic Bight, several workshop participants noted the need for increased survey effort off the Chesapeake Bay entrance. Since ship strike risk is high in the area, increased survey effort is additionally valuable as it would also increase the likelihood of detecting any mortalities. Furthermore, a new wind lease area is proposed in the region, but there are few baseline data available to determine use of the area by NARWs.

In discussion about survey effort being supported by other states, state managers noted the development of both aerial and PAM plans for the waters off New Jersey. Questions were raised about survey funding, and it was noted that several states have been able to take advantage of both state and federal funding to develop monitoring plans.

The workshop participants discussed the tradeoffs between visual and PAM, particularly with respect to the Mid-Atlantic Bight, noting the choice of monitoring platforms is related to the survey needs and goals. In this region, where PAM data have already demonstrated use of the habitat, it was noted that data on which individuals are using that area, as well their behavior and stay duration, are critical to understanding the potential impacts of human activities. Workshop participants discussed how NARWs have been observed foraging in this region, indicating that this area is not just a migratory corridor. Several workshop participants suggested it would be a good strategy to focus more intensive survey effort over a shorter period of time if resources were limited.

Finally, the workshop participants reflected on the survey effort being conducted in Canada. Canadian participants suggested that they could consider areas of survey need identified by the habitat-based density/distribution modelers. It was also recognized that there is good collaboration between the U.S. and Canadian research teams and that the strength of the surveys and coverage comes from the established partnerships and ability for agencies and teams to coordinate with one another.

GENERAL DISCUSSION

Time at the end of the workshop was reserved for general discussion. Some workshop participants reiterated the importance of broadscale effort, regardless of known whale presence, to identify areas that are not being used. Strengthening the balance between targeting known aggregations for mark-recapture and expanding effort would address goals of managers and stakeholders. Partnerships are key to meet these needs, including dynamic management support, through coordinated systematic surveys. A scenario proposed was for state and nonprofit research teams to conduct broadscale surveys in their regions as needed, while sightings of aggregations could be communicated to the NEFSC for directed effort.

Participants were encouraged to reach out to the experts who participated in the workshop. Additional workshops are planned to help coordinate on specific topics, such as changes in survey altitude. The workshop committee plans to also involve Virginia, Maryland, and Delaware managers in future survey planning discussions.

Key Messages

Topics requiring further discussions included quantifying change, survey altitude and species considerations, and resource pooling.

Next Steps/Future Discussions

Regional Coordination Meetings

Interim meetings are planned with states about combining efforts and resources, with researchers and modelers about effects of changing survey altitude to data, and with the U.S. Navy about broader coordination efforts in MIDA.

ACKNOWLEDGEMENTS

The workshop planning committee was composed of Tim Cole, Danielle Cholewiak, Alison Ogilvie, and Brigid McKenna. We thank the NEFSC Facilities and ITD staff for assistance and support in on-site implementation. The committee sincerely thanks all those who participated in the workshop and contributed their thoughts and ideas at the event and in preparation of this report. In particular, the committee members extend their appreciation to the panelists, who shared their expertise and stimulated productive discussions, and the workshop rapporteurs for their comprehensive notes and summaries.

FIGURES



Figure 1. Map of primary current/forthcoming systematic aerial survey effort areas in the Mid-Atlantic Bight and Northeast U.S. Note that actual effort within these regions varies, and all surveyed areas are not necessarily displayed.



Figure 2. Aerial image of wind turbines above the cloud base.

REFERENCES CITED

Solinger L, Miller A, Asaro M, Duffing Romero M, Shank B, Franco C, Trego M, Huamani A. 2024. A decision support tool to assess risk of entanglement mortality to large whales from commercial fixed-gear fisheries in the Northwest Atlantic. US Dept Commer Northeast Fish Sci Cent Tech Memo 312. 102 p. Accessible at: <https://doi.org/10.25923/m4zy-f952>

APPENDIX A: LIST OF ACRONYMS

AI Artificial Intelligence
ASMFC Atlantic States Marine Fisheries Commission
CCS Center for Coastal Studies
DIGITS Digital Image Gathering and Information Tracking System
DMA Dynamic Management Area
DST Decision Support Tool
ESA Endangered Species Act
MA DMF Massachusetts Division of Marine Fisheries
ME DMR Maine Department of Marine Resources
MIDA Mid-Atlantic
MMPA Marine Mammal Protection Act
NARW North Atlantic right whale
NARWC North Atlantic Right Whale Consortium
NEAq New England Aquarium
NEIT Northeast Implementation Team
NEFSC Northeast Fisheries Science Center
NEUS Northeast United States
NGO Non-Governmental Organization
NMFS National Marine Fisheries Service
NOAA National Oceanic and Atmospheric Administration
NY DEC New York Department of Environmental Conservation
PAM Passive Acoustic Monitoring
PSD Protected Species Division
UME Unusual Mortality Event
URI University of Rhode Island
WEA Wind Energy Area

APPENDIX B: WORKSHOP AGENDA

Northeast NARW Aerial Coordination Workshop

Thursday 01 February 2024

Clark Conference Room
Northeast Fisheries Science Center - Aquarium Building
166 Water Street
Woods Hole, MA 02543

Meeting link: <https://meet.google.com/zbm-qepg-mwf>

Format and Agenda

Purpose:

The goal of this workshop is to coordinate North Atlantic right whale aerial surveys in the Northeast Region (VA to ME) to maximize their efficiency and safety. To do this, we want to facilitate collaboration between managers, scientists, and potential contractors. This workshop is a venue to foster partnership, and we encourage participants to make connections and tap on experts with questions.

Participation:

Attendees, remote and in-person, will have the opportunities to ask questions and participate in discussions. There is time allocated at the end of each panel for these dialogues, and we ask that questions and comments be reserved until then. We will construct a queue based on the order of raised hands (virtual and physical), and acknowledge who is next to speak. Please state name and affiliation when speaking.

0830-0900 Opening Remarks
Tim Cole, NEFSC

0900-1030 Panel 1: Photo-ID and Mark-Recapture
The How, What, and Why of Right Whale Photo-Identification
Philip Hamilton, Anderson Cabot Center at the New England Aquarium

Capture-recapture of right whales
Dan Linden, NEFSC

How Photo-ID informs M/SI & UME determinations
Allison Henry, NEFSC

Tips and Tricks for Taking Right Whale Photos from a Plane
Alison Ogilvie, NEFSC

- 1030-1045 Break**
- 1045-1200 Panel 2: Data Management**
WhaleMap: A system for collating and displaying whale survey results in near real-time
Hansen Johnson, Anderson Cabot Center at the New England Aquarium
- The NARWC Sightings and Survey Database
Bob Kenney, URI Graduate School of Oceanography
- Submission to the NARWC Photographic Identification Catalog
Monica Zani, Anderson Cabot Center at the New England Aquarium
- 1200-1300 Lunch**
- 1300-1430 Panel 3: Density Modeling**
Density Surface Models for North Atlantic Right Whales
Jason Roberts, Duke University
- Risk Management and Decision Support Tool
Burton Shank, NEFSC
- 1430-1445 Break**
- 1445-1545 Panel 4: State Management**
Massachusetts; an Existing Model for State Right Whale Protection
Erin Burke, Massachusetts Division of Marine Fisheries
- Developing Fishery Management Tools by Increasing Right Whale Detection Capabilities in the Gulf of Maine
Erin Summers, Maine Department of Marine Resources
- New York Bight Whale Monitoring Program
Meghan Rickard, New York State Department of Environmental Conservation
- 1545-1645 Future Coordination and General Discussion**
- 1645-1700 Closing Remarks**

APPENDIX C: PARTICIPANTS

Name	Affiliation	Attendance
Adele Labbe	DFO	Remote
Alicia Miller	NEFSC	In person
Alison Ogilvie	Integrated Statistics/ NEFSC	In person
Allison Henry	NEFSC	In person
Amy James	Center for Coastal Studies	Remote
Amy Knowlton	New England Aquarium	Remote
Amy Whitt	Azura Consulting	Remote
Annie Bartlett	Center for Coastal Studies	In person
Ashley Millan Ambert	Center for Coastal Studies	In person
Audrey Ostroski	Delaware Natural Resources	Remote
Becky Gwynn	VA DWR	In person
Bob Glenn	MA DMF	In person
Brigid McKenna	Integrated Statistics/ NEFSC	In person
Burton Shank	NEFSC	In person
Caitlin McGarigal	NJ DEP	Remote
Casey Nolan	MD DNR	Remote
Chris Orphanides	NEFSC	Remote
Cindy Driscoll	MD DNR	Remote
Colleen Bouffard	CT DEEP	Remote
Corinne Truesdale	RI DEM	In person
Dan Engelhaupt	HDR Inc.	Remote
Daniel Linden	NEFSC	Remote
Daniel Pendleton	Integrated Statistics/ NEFSC	Remote

Name	Affiliation	Attendance
Danielle Cholewiak	NEFSC	In person
Debbie Brill	NWSC	Remote
Debra Palka	NEFSC AMAPPS	Remote
Diane Borggaard	GARFO	In person
Doug Sigourney	NEFSC	In person
Elizabeth Thompson	DFO	Remote
Erin Burke	MA DMF	In person
Erin Summers	ME DMR	In person
Hansen Johnson	New England Aquarium	In person
Heather Genievich	NJ DEP	Remote
Heather Foley	NEFSC	Remote
Heather Pettis	New England Aquarium	In person
Jacqueline Bort	NAVFAC Atlantic (U.S. Navy)	Remote
Jason Roberts	Duke	In person
Jen Jakush	FWC	Remote
Jennifer Goebel	GARFO	In person
Jessica Ozog	HDR Inc.	Remote
Jessica Aschettino	HDR Inc.	Remote
Jessica Thompson	GaDNR	Remote
Joel Bell	NAVFAC Atlantic (U.S. Navy)	Remote
Julia Stepanuk	Biodiversity Research Institute	Remote
Kara Mahoney Robinson	New England Aquarium	Remote
Kara Shervanick	NOAA	Remote
Katherine McKenna	New England Aquarium	In person

Name	Affiliation	Attendance
Katie Jackson	FWC	Remote
Kyle Baker	BOEM	Remote
Lance Garrison	SEFSC	Remote
Laura Solinger	NEFSC	Remote
Lisa Conger	NEFSC	Remote
Mark Dodd	GaDNR	Remote
Mark Baumgartner	WHOI	In person
Maureen Spiessl	Savannah State University	Remote
Meghan Rickard	NY DEC	In person
Mike Asaro	NEFSC	In person
Monica Zani	New England Aquarium	In person
Nathan Willse	ME DMR	In person
Nick Sisson	GARFO	In person
Orla O'Brien	New England Aquarium	In person
Philip Hamilton	New England Aquarium	In person
Renee Zobel	NH Fish & Game	Remote
Robert Kenney	University of Rhode Island	Remote
Robert Atwood	NH Fish & Game	Remote
Robert DiGiovanni	Atlantic Marine Conservation Society	In person
Ruth Boettcher	VA DWR	Remote
Ryan Schosberg	Center for Coastal Studies	In person
Sarah Leiter	ME DMR	In person
Scott Newlin	Delaware Natural Resources	Remote
Sharon Hsu	New England Aquarium	In person

Name	Affiliation	Attendance
Stephanie Ratelle	DFO	Remote
Susan Barco	VA DWR	Remote
Tim Cole	NEFSC	In person
Tim White	BOEM	Remote
Trip Kolkmeier	GaDNR	Remote

APPENDIX D: FEEDBACK SURVEY RESULTS

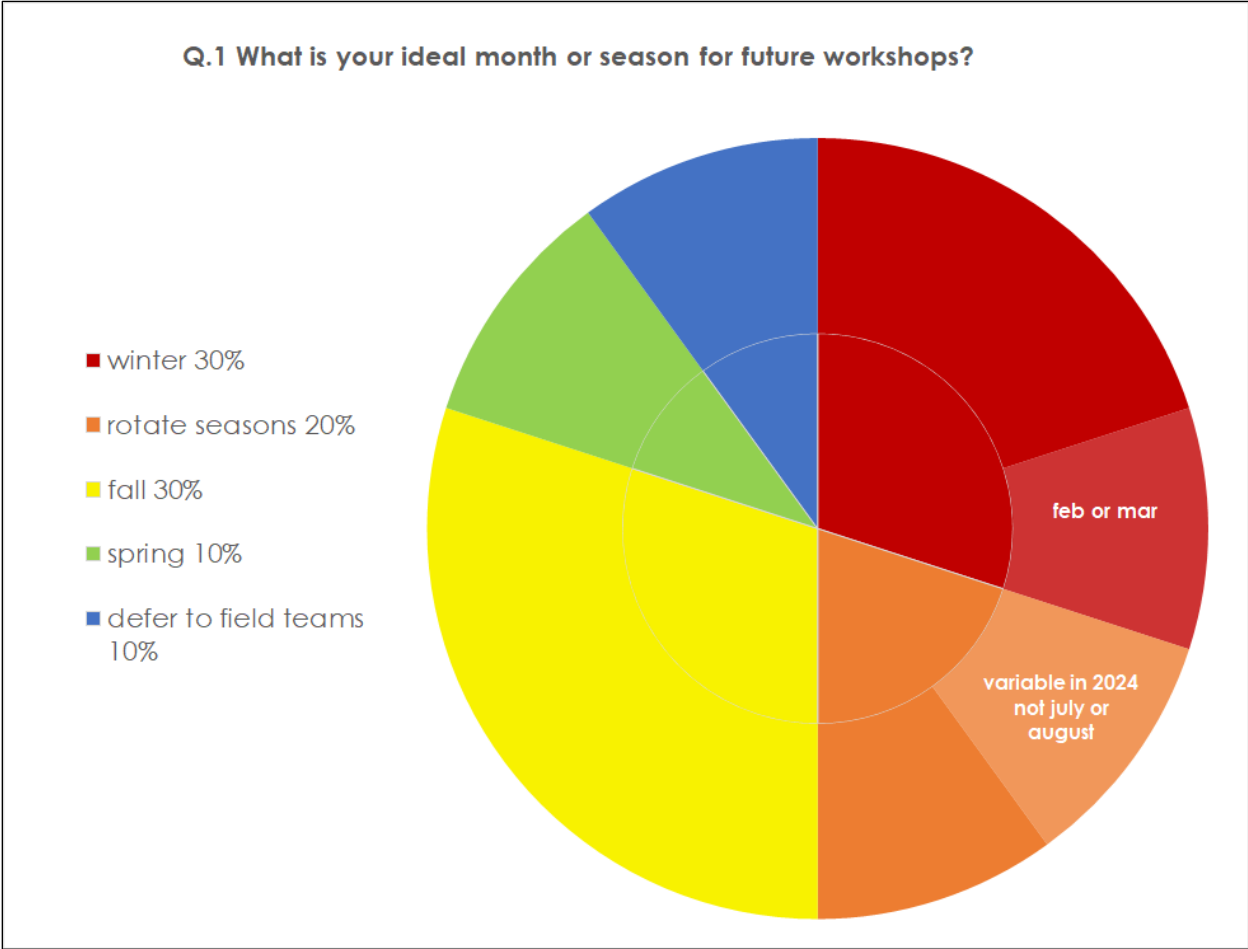


Figure A1. Participant responses to survey question 1.

Q.2 What topics would you like discussed in future workshops?

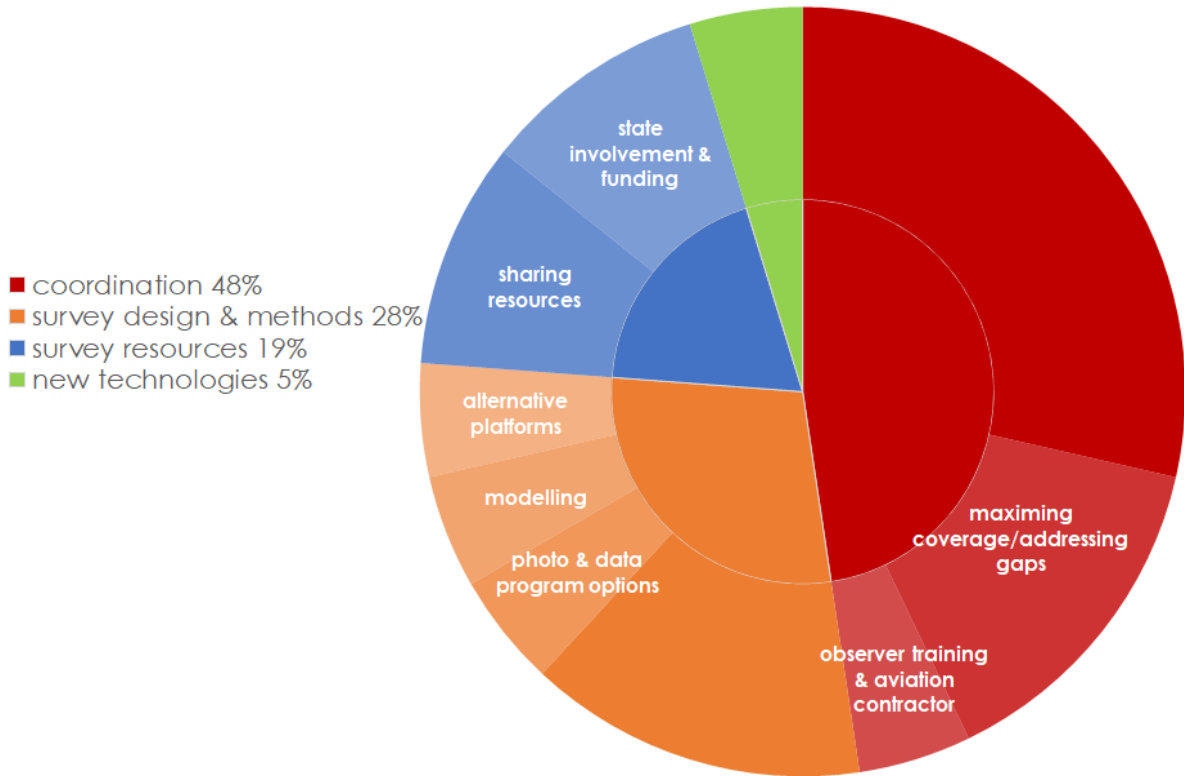


Figure A2. Participant responses to survey question 2.

Q.3 Are you in favor of the panel-based structure of the workshop with questions and discussion at the end of each section, or an alternate format?

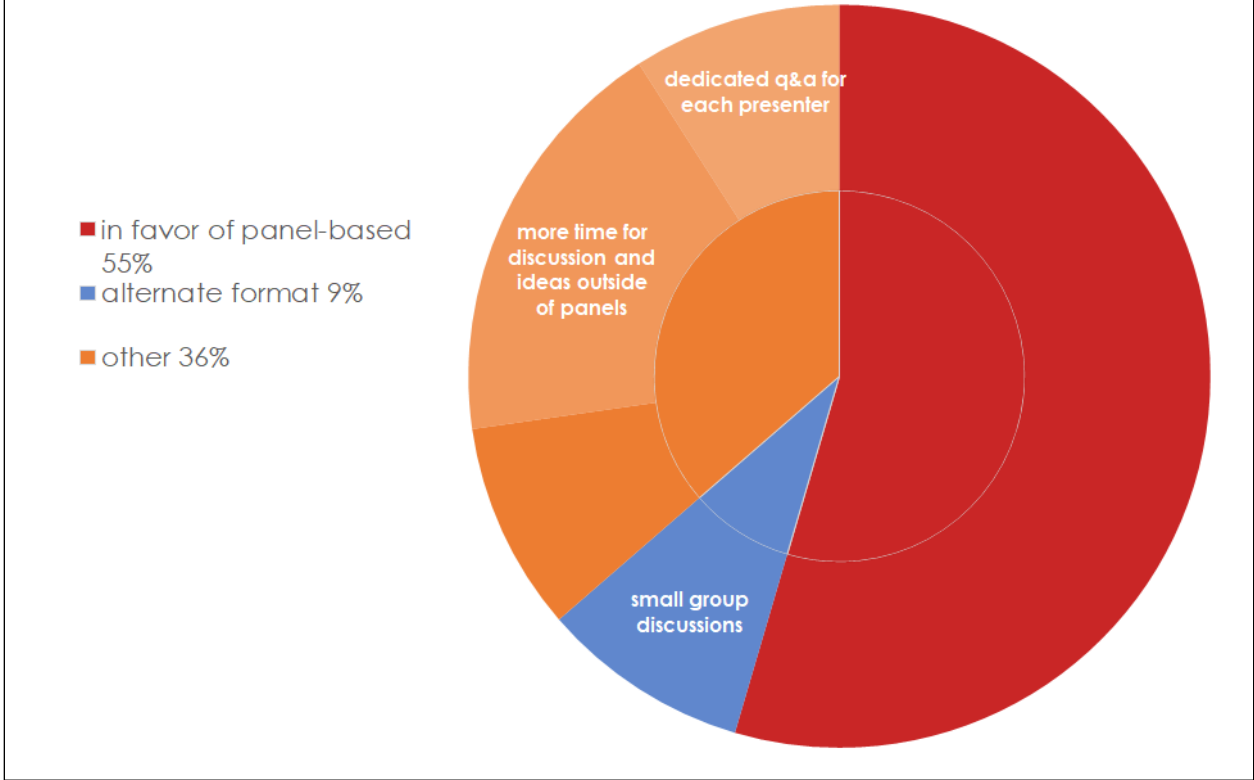


Figure A3. Participant responses to survey question 3.

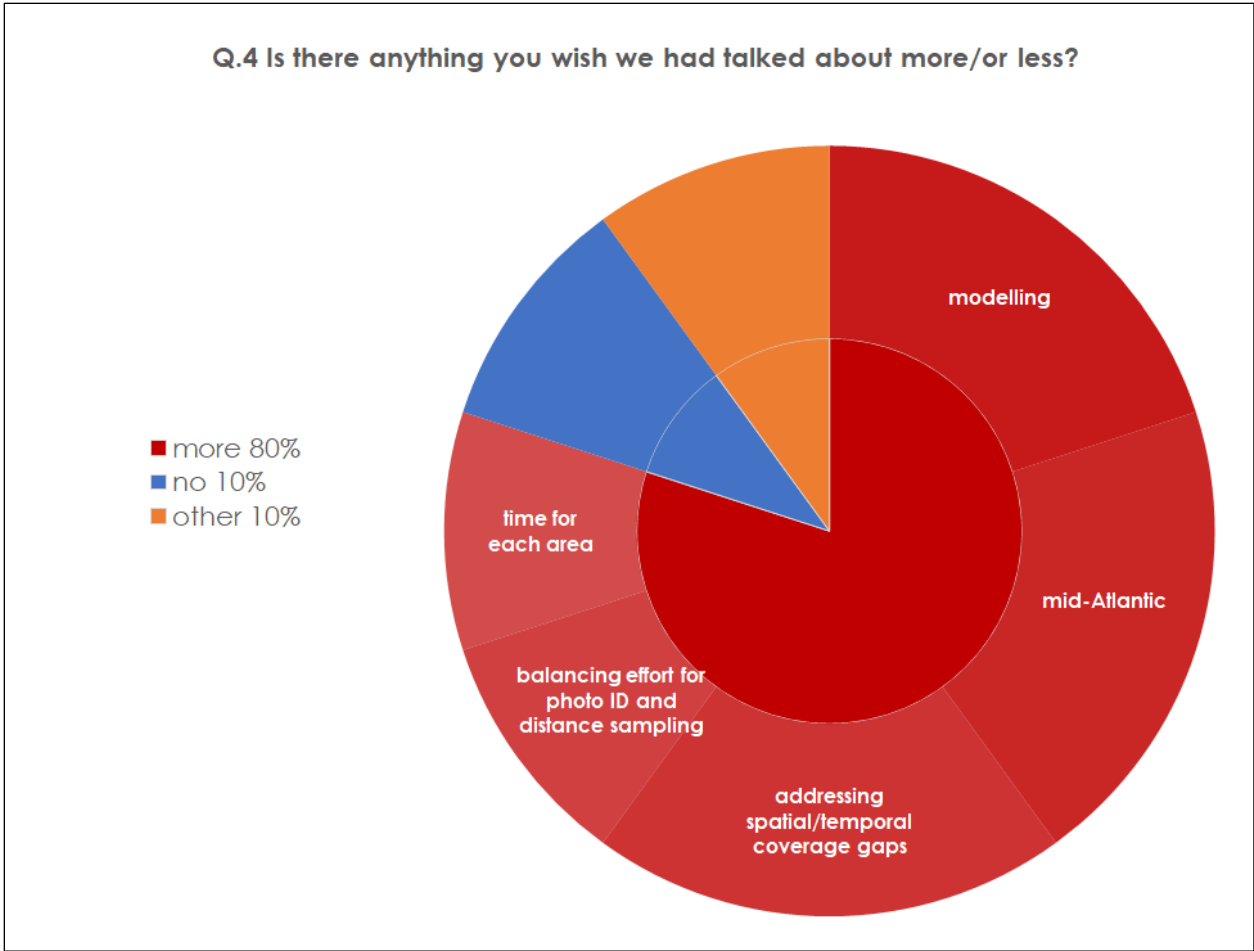


Figure A4. Participant responses to survey question 4.

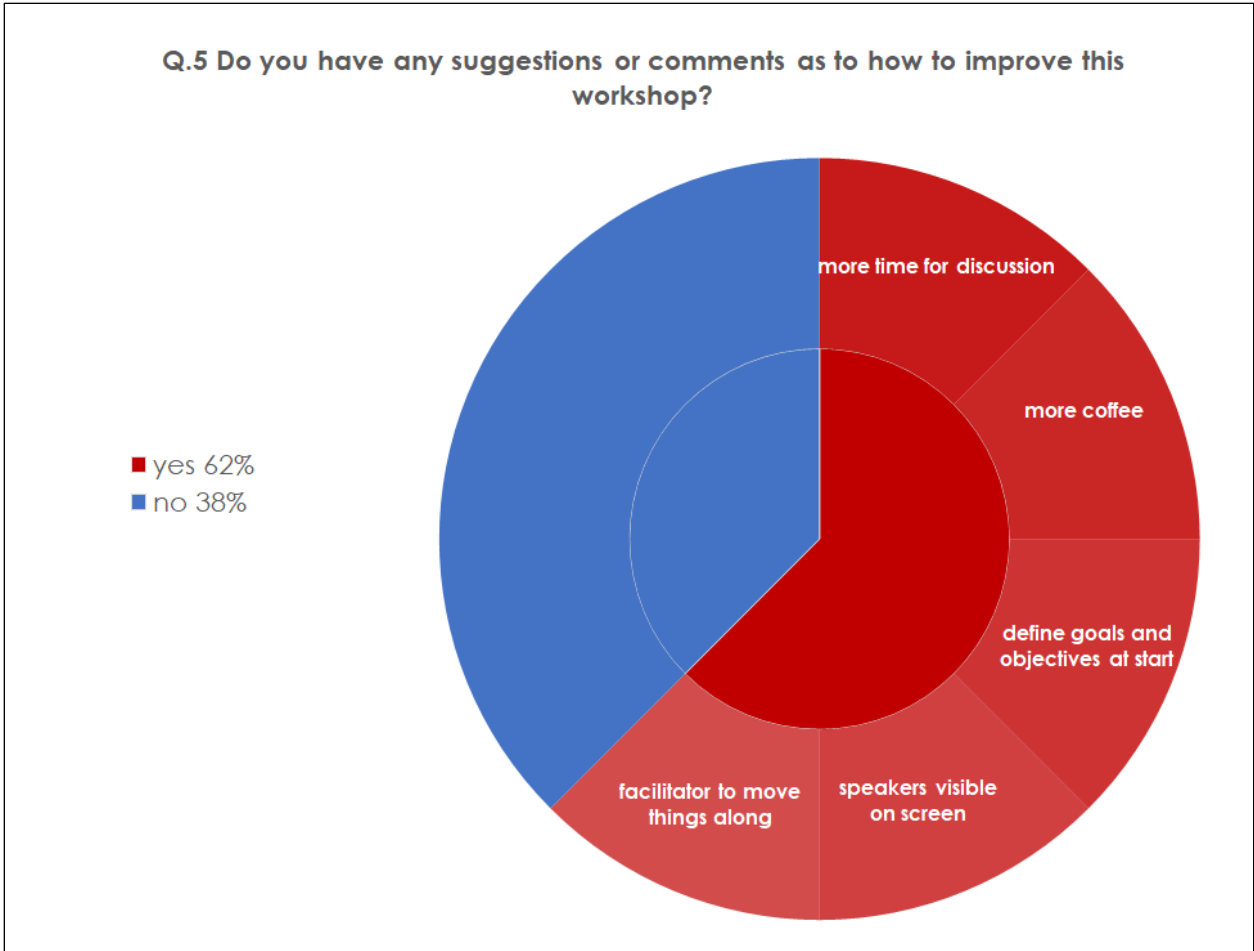


Figure A5. Participant responses to survey question 5.

Q.6 For online participants, how was your experience?

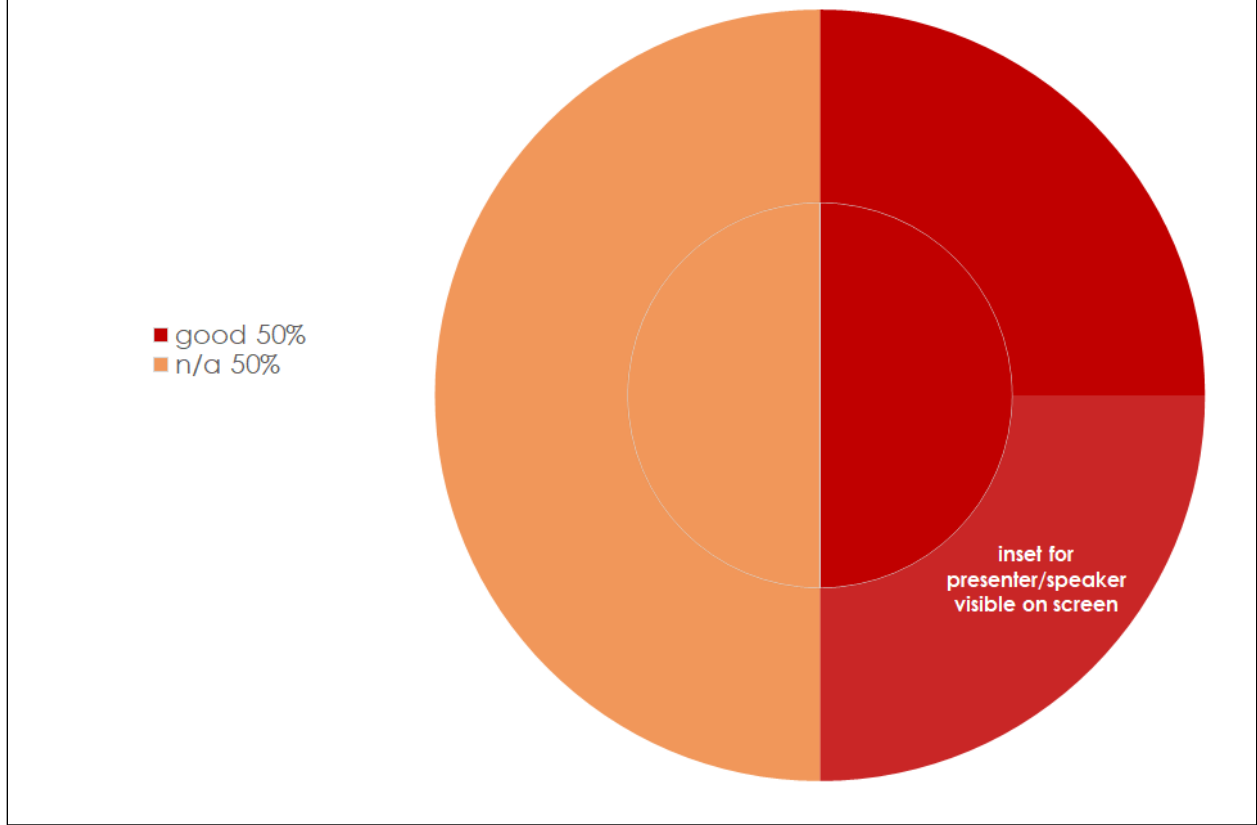


Figure A6. Participant responses to survey question 6.

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