North Atlantic Right Whale Aerial Survey Mitigation Plan

I. Purpose of the survey

The purpose of these North Atlantic right whale (NARW) aerial surveys is to monitor the population, track injury rates, and identify areas of entanglement and vessel collision risks. The Marine Mammal Protection Act (MMPA) and Endangered Species Act (ESA) mandates the National Marine Fisheries Service (NMFS) to evaluate the status of the NARW population and reduce mortality below the population's Potential Biological Removal (PBR) in order for the species to recover. A major component of the surveys is photo identification of individual right whales to estimate the population and its annual rate of mortality.

Data collection and standard operating procedures

Distance sampling data is collected for all large whale species during systematic aerial surveys of neritic waters of the eastern seaboard of the U.S. Additional aerial surveys are focused in areas of seasonal right whale occurrence. Right whale absolute density (individuals km^2) is calculated from spatial, temporal, and environmental covariates, accounting for detectability differences between observation conditions, and corrected for perception and availability biases, whale dive behavior, group composition, and group size. Seasonal densities are calculated using covariate maps.

When right whales are encountered, the aircraft breaks from the systematic trackline to circle and collect photographs of distinguishing marks on the whales for individual identification handheld digital single-lens reflex camera systems. Estimation of the NARW population is based on a state-space model of the sighting histories of individual whales constructed from the central photo-ID recapture database curated at the New England Aquarium. Most of the population is photographically captured each year. The comprehensive capture effort provides small credibility intervals to the population estimate, which in turn provides relatively precise estimates of annual mortality. High precision estimates of right whale mortality are critical to meet conservation goals. Photographic captures in specific areas over shorter periods can provide estimates of both local abundance and seasonal residency of individuals.

Assessment pathway that use these data

The abundance estimates are reviewed and reported in NMFS Tech Memos and in peer-reviewed journal articles. The Atlantic Scientific Review Group is required to review the right whale population estimates before they are reported in the Atlantic and Gulf of Mexico Marine Mammal Stock Assessment Reports. The status of the stock is assessed by the PBR level, which is the product of minimum population size, one-half the maximum net productivity rate, and a recovery factor for endangered, depleted, or threatened stocks. The recovery factor for right whales is 0.1 because this species is listed as endangered under the ESA. The value of the PBR level is compared to the estimated level of average human-caused mortalities to determine the population status (strategic or non-strategic). The NARW population is a strategic stock because the average annual human-related mortality and serious injury exceeds PBR, and also because the NARW is listed as an endangered species under the ESA.

Strategic status triggers the development of take reduction teams who are tasked with developing mitigation measures to reduce the level of mortality to a sustainable level. These measures generally modify fishery or other human activities with the goal of reducing the levels of mortality while still allowing the fishery or other human activities to be economically viable.

Other scientific advice pathways and data users

The abundance estimates and other analyses resulting from the data collected on these aerial surveys are also used by industries and other government agencies that use the ocean and might interact with right whales. More specifically, the right whale abundance estimate is used in ocean users' Environmental Impact Statements and in other analyses required under the National Environmental Policy Act (NEPA), ESA, and MMPA.

The seasonal right whale density estimates are incorporated into several decision support tools, which overlay fishing gear or vessel traffic densities to assess entanglement or vessel collision risk reduction strategies.

How wind developments will impact the survey objectives

The aerial survey objectives are to collect the data needed to estimate right whale seasonal density, abundance, and residency of individuals. The development of offshore wind energy turbines directly impacts these objectives in several ways. One way is the height of the turbines, which will require the right whale surveys to fly at a higher altitude than the current standard of 1000 feet. NOAA aircraft operations require flights to be at least 500 feet above obstacles. Thus, to continue aerial surveys, the flights will have to be flown at a minimum altitude of 1500 feet. NOAA aircraft operations also require surveys be conducted at least 500 feet below the cloud ceiling. The impacts of flying at higher altitudes are that1) it may become more difficult to detect whales at the surface, particularly whales directly on the trackline due to an increased swath of the ocean's surface not easily covered by observers scanning for whales farther out; and 2) days with good enough conditions will become more restricted if there are cloud ceilings below 2000 feet.

Another type of impact is the presence of the wind turbines and the additional associated traffic which could cause changes in local distribution, abundance, and behavior of right whales. These changes need to be accounted for during the abundance surveys, when analyzing the survey data, and when interpreting the results.

Right whales may be displaced from wind development areas, and wind development may also reduce right whale foraging, which could affect an individual's health, potentially leading to a decline in population-level recruitment and abundance. The displacement (and reduced foraging) could be either temporary or longer term.

Since density estimates are dependent on the correction for availability bias (the relative amount of time an animal spends at the surface and can be detected in an abundance survey versus the amount of time an animal spends below the surface and thus cannot be detected in an abundance survey), changes in foraging behavior may result in the need to adjust future availability bias correction factors.

In summary, to mitigate the effects of the wind energy developments on the right whale aerial surveys that collect data to estimate whale distribution, abundance, and residency, we will need to conduct abundance surveys that have modified data collection and analysis methods and collect additional dive pattern data inside and outside of wind development areas. These monitoring tools will need to result in accurate and precise estimates of

absolute distribution and abundance at the small scale (within and near wind development areas) and at the large scale (at the population level, at least within U.S. waters).

II. Survey Details

Beginning Year: 2001

Frequency: Year round

Season: Year round

Geographic Scope: All neritic waters east of Long Island

Platform(s): NOAA Twin Otter; charter planes

Statistical Design: Varied

Methods: Aerial surveys flown at 750' to 1000'

III. Effect of Four Impacts

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

   While turbines are projected to be nearly 1000 feet tall, the current standard operating procedure is to fly right whale surveys at 1000 feet above sea level. This flight altitude was chosen to maximize animal detection rates. We would not be able to continue with the current standard operating procedure, at least in wind development areas.

   If in future surveys we simply ignored wind development areas where planes could not safely enter, the effect would most likely be a decrease in the number of animal groups detected in wind development areas, even if there are more individual animals detected within the development areas. This could likely result in lower density estimates and higher estimate variability. Either of these results could then lead us to a false conclusion that there is a declining trend in abundance, and thus the status of the stocks are declining. The true effect of not surveying in wind development areas is not known, as it depends on how whales react to the turbines and the physical and biological local environment surrounding the turbines.

   Under all of the possible effects of wind developments on right whales, including no effect, the preclusion of the survey planes in the vicinity of the developments will result in NMFS having to change the data collection and analysis methods used to estimate the density of whales in the region.

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 preclusion of flights in wind development areas would violate the underlying assumption of the line transect methodology that states the areas surveyed are random representations of the habitats that animals inhabit. With the exclusion of large regions where the planes cannot enter due to wind developments, the remaining areas that can be surveyed by planes may not be representative of the excluded wind development areas. Thus, it is essential to conduct surveys inside and outside of the development areas to estimate right whale density and to determine if the estimates of distribution and abundance change in wind development areas.

A priori, the type and magnitude of the effect of the developments on the estimates of the distribution and abundance of right whales will be species-specific and could be positive, negative, or have no effect. Given these uncertainties, the most obvious effect of violating this basic underlying assumption will be less precise (more uncertain) estimates of the distribution, abundance, and trends of right whales, where under different scenarios, right whale density estimates could be biased positively, negatively, or not all.

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.

   Alteration of benthic and pelagic physical and biological habitats due to factors such as pile driving or the presence of turbines may influence the redistribution of animals at all trophic levels and would thus need to be documented to ensure future abilities to measure trends in potential changes in distribution and abundance of right whales. Any influence the turbines have on oceanic and atmospheric circulations could change the distribution of planktonic species and consequently also change the distribution of right whales. The wind energy areas (WEAs) could lead to localized increases in prey resources or lead to their disappearance. Given these uncertainties, the most obvious effect will be less precise (more uncertain) estimates of the distribution, abundance, and trends of right whales. These effects could result in unnecessary regulations to develop mitigation strategies to reduce human interactions with the whales.

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

   If around wind development areas we would need to either avoid the areas or fly higher over these areas, there would be a reduction in the sampling productivity (ability to confidently detect animal groups). If flights were flown higher above the wind turbines, the probability of detecting animals would be reduced because of an increase in the size of the swath directly below the plane not routinely scanned by observers focusing out at 1.5 nautical miles, which is the prescribed scan distance for increasing whale detection probability. The reduction of the number of detected whales will result in lower density estimates that are more uncertain. Increased flight altitude will also result in fewer survey days, as there will be an increase in days in which cloud cover precludes flying in those areas. Reduced survey effort will result in greater uncertainty in density estimates. These effects could result in unnecessary regulations to develop mitigation strategies to reduce human interactions with the whales.

IV. Mitigation Planned, as per Six Elements

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

   Annual and seasonal variation in right whale distribution have included extended periods of right whale residency within WEAs. Preclusion of NOAA and partners' aerial surveys from WEAs would affect the ability to monitor right whales. Evaluation of impacts to monitoring include power and sample size estimation for right whale population, density, residency, and displacement measurements. Potential impacts to management include an inability to estimate whale density, residency, displacement, and risk levels within WEAs, and the formulation of appropriate management actions.

   Impacts on the design of aerial surveys include a requirement to fly at higher altitudes than the current 1000 feet. Federal Aviation Regulation 91.119 calls for 500 feet of clearance both vertically and laterally from any obstacle in a non-congested area. If turbines are 1000 feet above sea level, aerial surveys will need to be conducted at 1500 feet, at least in the vicinity of turbines. Increased altitude may affect right whale detection rates for density estimates and the collection of images for injury and scaring rates. Increased altitude is not likely to affect the collection of photo identification images of individuals for monitoring the population. A required increase in survey altitude may also reduce survey effort on days that cloud ceilings are close to turbine altitude. Evaluation of the effects of survey altitude include additional flights and image collection at higher altitudes for a comparative analysis of images for photo identification and scarring rates, a review of detection probabilities at higher altitudes, and an analysis of cloud height data to assess potential preclusion from WEAs due to weather.

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

   Preclusion of NOAA and partners' aerial surveys from the WEA would require increased aerial monitoring in peripheral regions to bolster photo identification of individuals for population estimates, assessment of displacement, and monitoring of injury and scarring rates. Vessel-based monitoring in WEAs may offset the absence of aerial surveys.

   Increased survey altitudes would not require new protocols. New camera systems may overcome any negative effects of increased altitude on image collection for monitoring injury and scarring rates.

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

   Similar to marine mammal and sea turtle aerial abundance surveys, we propose to continue to use line transect methods that explicitly incorporate estimation of species-specific detection functions, perception, and availability biases. We propose to account for the platform-specific biases in independent analyses of each type of data to result in absolute right whale density estimates for the study area. Then, we theoretically do not need to develop calibration factors between collection methods; we can simply add the different platform-derived abundance estimates from within a single survey time period together. This then results in a time series of comparable abundance estimates. To investigate if the turbines affect the availability bias correction factors, which depend on the animals' dive patterns, we will need to collect dive pattern data from tagged animals.

   The resolution of images collected for individual right whale identification at higher altitudes will be evaluated for necessary detail for matching whales to individuals

contained in the North Atlantic Right Whale Catalog. Images will also be evaluated for comparable detection of apparent injuries to right whales. New camera equipment may be incorporated to improve image results.

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

   Not needed.

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

   To achieve a long-term monitoring program, we need to conduct routine right whale aerial surveys inside and outside of WEAs for the entire U.S. Atlantic coast using the newly developed statistical designs, data collection methods, and analysis methods, and the newly collected tag data to correct for location-based availability bias. We also need to continue developing safe survey protocols to collect data within and outside of WEAs and to collect dive pattern data from tagged animals.

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

   The new survey approach of increased survey altitudes would not require new regional data streams, and current data collection, analysis, management, dissemination, and reporting systems would likely require only moderate modification. New camera systems to overcome any negative effects of increased altitude on image collection for monitoring injury and scarring rates may require some changes to data collection and storage.

V. Proposed Schedule for Implementation

FY24

1. ***Element 1 (survey design)***
   a. Collaborate with other researchers to investigate using other platforms (like vessels) that could potentially be used to collect data to estimate right whale density and collect images for photo identification and injury rate documentation. Evaluate if the methods are viable and when they could be used. Then, develop future field techniques and analytical methods.
   b. Collaborate with researchers with existing or planned future right whale dive profile data to estimate availability bias as it changes by season, latitude, water temperature, and so on. Then, develop future work needs.
   c. Investigate the most effective and statistically correct ways to use survey data collected by industries within their wind energy development areas.

2. ***Element 2 (develop analyses and protocols):***
   a. Develop new detection functions for whales at the new survey altitude to calculate right whale density, and evaluate resulting confidence intervals for estimates.
   b. Compare injury documentation using existing images collected by NMFS in 2022/2023 and new images from summer 2024 at the new survey altitude.
   c. Collaborate with the Alaska Fishery Science Center (AFSC) and other science centers on the development of camera systems to improve injury documentation at the new survey altitude.

FY25

1. ***Element 1 (survey design):***
    a. Continue collaborations on developing other platforms to collect data in WEAs.
    b. Continue collaborations with tagging programs to improve estimation of availability bias and the factors that influence the dive patterns.

2. ***Element 2 (develop analyses and protocols):***
    a. Continue improving camera systems to improve injury documentation.

Beyond FY25

1. ***Element 1 (survey design):***
    a. Continue collaborations on developing other platforms to collect data in WEAs.
    b. Continue collaborations with tagging programs to improve estimation of availability bias and the factors that influence the dive patterns.

2. ***Element 2 (develop analyses and protocols):***
    a. Consider evaluating modifications to the survey design, including the effect of the distance between track lines when conducting digital surveys from an altitude of 1500 feet versus 2000 feet.
    b. Develop relationships between right whale abundance and distribution and physical and biological oceanographic covariates.

VI. Links to Other Surveys

Other mitigation plans that we should collaborate with include the mitigation plans for marine mammal and sea turtle aerial surveys, EcoMon surveys, and passive acoustic monitoring.

VII. Adaptive Management Considerations/ Opportunities

The strategy of this mitigation plan is to develop within the next two years the most promising survey methods and platforms that are currently available.

VIII. Statement of Peer-Review Plans

Standard peer-review practices will be followed. That is, progress reports on field activities and papers with right whale density estimates and other analyses are reviewed by the Atlantic Scientific Review Group. In addition, papers with density estimates and other analyses are reviewed by journals.

IX. Performance Metrics

Our performance metrics can be evaluated by our ability to estimate accurate and precise right whale density estimates. Another performance metric is how accurately we measure impacts of WEA activities (if any) to right whale distributions. This will require sufficient data sampling within the area in order to be able to draw inference that is robust.