

How many right whales are missed?  
A field behavioral study of sightability  
to correct survey counts for an endangered species.

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The long term goal of this project is to construct a model predicting individual right whale distribution based on previous movements and intrinsic factors unique to each individual, by using aerial survey data collected in Cape Cod Bay. In order to fulfill this goal, the number of animals missed by aerial surveys needs to be determined, and is likely dependent on season, age class, and sex. To calculate this correction factor, dive times were recorded over the course of the 2016 right whale season, with an effort to sample equally throughout demographic groups. The average time spent at the surface and the average dive time, for each individual, are necessary to determine the sightability of right whales in Cape Cod Bay.

The funding from the American Wildlife Conservation Foundation, and other sources, allowed us to collect data for twelve days during the 2016 Cape Cod Bay right whale season. This time at sea yielded 42 hours of focal follow data for 54 individual right whales. Additionally, photo-identification and sighting data for 64 right whales were collected and submitted to the North Atlantic Right Whale Consortium. Furthermore, photographs of five whales listed as right whales with serious injury were obtained and submitted to the New England Aquarium for further analysis.

To determine the effects of seasonality, age, and sex on right whale sightability an effort was made to sample equally over the course of the season and through demographic groups. We were somewhat successful in this endeavor. Sampling during January and February proved to be difficult for a number of reasons described below, however we were able to successfully sample during seven weeks of the 18 week season, and we have outlined a few ways to potentially fill in the gaps over the temporal scale. In regards to demographics, preliminary photo-identification analysis indicates we collected focal follow data for 14 females, 16 males, and 24 animals of unknown sex, 22 of which were adults, 8 juveniles, 7 calves, and 16 of unknown age class. As the photo-identification process continues many of the animals with unknown sex and unknown age will be assigned a sex and age class.

During focal follows detailed behavioral data and the time of the behaviors were recorded. This data has been input into Jwatcher, which allows for focal sampling, timed event recording, and statistical analyses of these data. As a result, we have determined average surface and dive times for each of the 54 right whales followed this season. Average surface and dive times are an integral part of determining the sightability of right whales.

This project will, for the first time, allow for density and abundance estimates to be made for right whales in Cape Cod Bay, not only going forward, but can also be applied to the previous 18 years of data collected by the Center for Coastal Studies. This project has an extremely high impact on the model we intend to build predicting individual distribution of right whales. A model of this kind has never been attempted before, and will prove beneficial when trying to locate a specific individual right whale for health assessments and disentanglement efforts.

Once all of the analyses from this project are completed these data will be used as a springboard for a number of other projects. A study comparing the sightability of entangled vs. non-entangled right whales would reveal how successful survey teams are at detecting entangled animals. Furthermore, the survey altitude of the plane, in Cape Cod Bay, has changed due to federal permit requirements, as a result of this study we will be able to determine the optimal altitude for spotting right whales in Cape Cod Bay, therefore improving the accuracy of these surveys.

Overall, this field season was a resounding success. During the months of March and April Cape Cod Bay had a high number of right whales that were behaving in a way that easily facilitated focal follows. On a number of days, the whales were close to port, therefore transit times were minimized and more daylight hours could be spent sampling whales. In addition, the weather during these months was cooperative, allowing us to sample on more days than expected. Finally, the partnership with the Center for Coastal Studies (CCS) right whale teams was invaluable for this project and immensely contributed to the success of this study. The right whale teams at CCS were able to share individual identifications of right whales with us in real-time, which helped further our ability to get an almost even ratio of males to females. We were also able to sample every mother/calf pair that visited Cape Cod Bay, also a result of the collaboration with CCS.

As with any field project, not everything went according to plan. Although 2016 was not an overly snowy winter in New England, a large number of days in January and February were too windy for sampling. In addition, January and February had low numbers of whales, that were diving for long periods of time. The low numbers of animals meant that we had to spend hours searching for animals, while burning precious daylight, during short winter days. Furthermore, when we did find animals they were diving for long periods of time, and returning to the surface too far away to verify it was the same individual. Although, the CCS aerial survey team assisted in locating whales for us, often times, likely due to the long diving behavior at this time of year, we were unable to relocate the animals.

We have a two plans in place to deal with the sparsity of data from January and February. First, the Center for Coastal Studies recorded film of right whales in 1985, 1986, and 1987; they have graciously agreed to let us analyze these video tapes for this study. These tapes will also increase our sample size for the months of March – May, as

well. In addition, we were able to obtain further funding for this study for next season. Our plan is to front load the 2017 season, and use as many of the days in January and February that weather will allow to fill our remaining data gap for these months.

Moreover, this August, I attended a week long workshop at St. Andrew's University, Scotland to further my education in topics related to advanced distance modeling, which will aid in my ability to analyze these data. Researchers at St. Andrew's University, holding the workshop, are the leaders in the field for this type of analysis.

Additionally, in order to increase my sample size and fill in gaps in the data over the temporal scale of the season, I plan to continue the analysis of the archived right whale videos at the Center for Coastal Studies.

Finally, this project is subset of the larger project I am working on for my PhD to build a distribution model for individual right whales. Therefore, I anticipate that this project will continue to develop as my dissertation evolves.