Sightings Data for Species of Concern

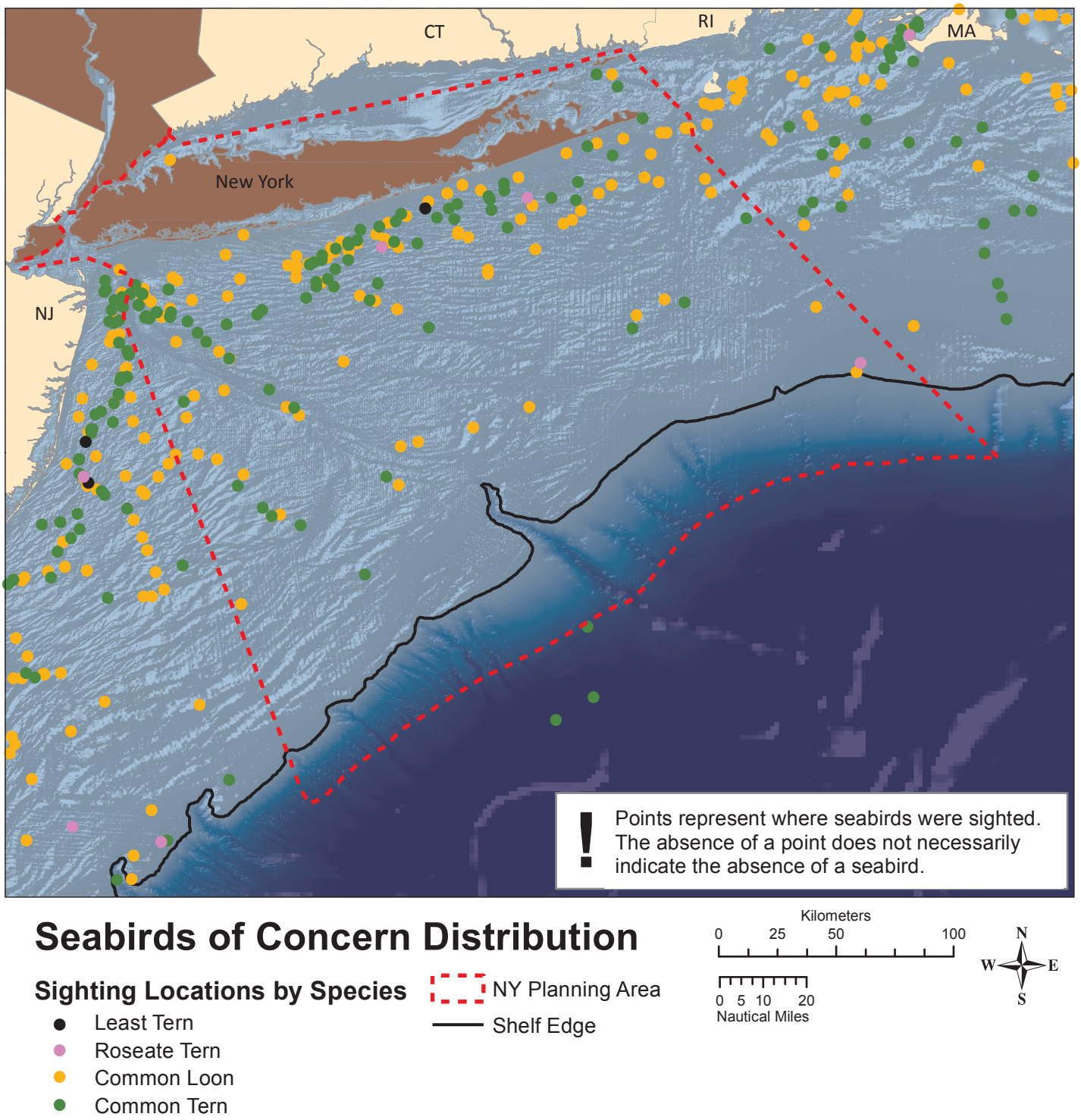

*Figure 6.38. Point map of raw sightings data for species of concern. This map shows the location of sightings in the Manomet dataset for four species of seabirds listed as endangered, threatened or of special concern by New York's Department of Environmental Conservation: the Roseate Tern (*Sterna dougallii dougallii*), Common Tern (*Sterna hirundo*), Least Tern (*Sternula antillarum*), and Common Loon (*Gavia immer*). The Piping Plover (*Charadrius melodus*), listed as endangered by New York, was not in the Manomet dataset and therefore was not mapped.*

6.10. DISCUSSION

The spatial models, data, and associated statistics presented in this chapter provide information on the long-term annual and seasonal spatial distribution of the marine avifauna offshore of NY. Results focus on identifying areas of likely and possible persistent aggregations of seabird species, species groups, and communities (multi-species hotspot/coldspot analyses) in the NY Bight. These maps are expected to be of high utility for marine spatial planning decisions involving seabirds in the NY Bight.

This report provides information on the long-term annual and seasonal spatial distribution of seabirds in the NY region, which is one important consideration for design of spatial management strategies. Such long-term average maps, known as "spatial climatologies," are useful for characterizing long-term average patterns of abundance and occurrence of organisms in space (e.g., Santora and Reiss, 2011). However, it is important to emphasize that climatological mapping is only one step towards developing an effective and defensible management and conservation strategy for seabird populations. Consideration of species' differential sensitivity to different offshore activities, and differences in population-level vulnerability to mortality or other demographic changes will also be critical to a comprehensive evaluation of risks posed by offshore management actions (Drewitt and Langston, 2006; Hueppop et al., 2006; Hatch and Brault, 2007; Allison et al., 2008; Watts, 2010). The climatological seabird occurrence and abundance models presented here should be viewed as measures of the potential exposure of different species to the effects of spatial management actions, rather than a direct measure of risk (Crichton, 1999). Although beyond the scope of this report, future work should address the incorporation of "exposure models" using the information generated here into comprehensive risk analyses for specific types of proposed management and/or development activities.

We wish to urge several cautions regarding inference of hotspots and coldspots of abundance from the maps in this report. First, the reader is urged to consult both the certainty class overlays presented on Figures 6.8-6.37 and the diagnostic statistics presented in associated tables. Second, if a particular hot or coldspot is of interest, the reader should consider consulting Appendix 6.C to determine whether that feature occurs in all seasons or only in particular seasons, whether it is directly supported by data points or is merely inferred from environmental conditions, and whether the model cross-validation plots indicate good performance outside the training data set. Third, if an important decision is to be made on the basis of a particular feature seen in model predictions, we would recommend several independent efforts to confirm model findings:

- Examination of original Manomet data to determine whether the hot or coldspot persisted over many years consistently or was only sporadic
- Collection of new survey data to confirm findings
- Consultation with local experts

In particular, hotspots or coldspots based only on extrapolation from environmental conditions, with no nearby data points, should be considered hypotheses to be tested rather than certainties. The data point overlay maps in Appendix 6.C are very useful for distinguishing such features from those that are directly supported by data points.

Similar cautions apply about judging the persistence of a hotspot or coldspot seen in the model predictions presented here. In defining "persistence", the spatial climatological modeling approach we take does not account for how observations are spread over time. Several high observations in a small area can lead to a predicted hotspot, but they may all have occurred in the same year. One way to evaluate whether a hotspot is persistent over time within a year is to compare seasonal maps. However, to assess inter-annual persistence it is necessary to go back to the original data and examine the years in which observations associated with each potential hot or coldspot were made.

Similar cautions should be observed with multi-species abundance, richness, and diversity hotspot maps. Appendix 6.D gives a detailed account of the performance of these models in a leave-50%-out cross-validation test, and should be used as a guide to interpreting multi-species hotspot model results. In particular, it is important to note that while the hotspot maps do a good job at predicting the relative values of abundance,

richness, and diversity, the predicted values tend to be systematically higher than what is actually observed in any single 15-minute survey. This issue is discussed in Appendix 6.D and correction factors are presented, based on cross-validation, which could be applied if the absolute values of summed abundance, richness, or diversity are important.

Consideration of temporal changes and population, community, and ecosystem dynamics will also be critical to any long-term management strategy. Many dynamic aspects of seabird ecology are not directly captured by the maps presented here. Seabirds interact with a highly dynamic environment where the location of food resources, competition and threats are constantly moving. Consequently, seabird habitats are variable in distribution, time, and extent with changing human activities and environmental biophysical parameters of the marine ecosystem. The age of the data used to develop the models presented here means that the patterns can only strictly be viewed as representative of the 1980's. Generalization to the present day requires an assumption that the human and natural environment has not changed. This assumption is likely to be more valid for some species than others, and in some areas than others (see Section 6.9.1., Species Notes). Similarly, our results assume that the climatological patterns of ocean conditions (including sea surface temperature, stratification, chlorophyll, turbidity, and zooplankton) have not undergone substantial shifts over the period from 1980-present. In reality, ocean climate is known to vary in ways that influence seabird distribution (e.g., Zipkin et al., 2010), further underscoring the need for collection and analysis of more up-to-date comprehensive regional seabird surveys.

The importance of different environmental predictors varied from species to species and often among seasons for a given species (Figure 6.5). Different predictors were sometimes important for Stage I (presence/absence) models when compared to Stage II (abundance-when-present) models. Overall, dynamic ocean climate variables like surface chlorophyll, surface turbidity, zooplankton, sea surface temperature, and stratification were often important, but for certain species static predictors like distance from shore and bathymetry were of equal or greater importance. Species that are more strongly correlated with dynamic oceanographic variables are more likely to be affected by long-term trends in ocean climate; thus, Figure 6.5 could be used to identify species more likely to be affected by ocean climate shifts.

Ideally, the information in this report would serve as an initial guide to be followed up by more current, detailed studies or syntheses of more recent data for selected areas of interest. Information presented here could be supplemented with a meta-analysis including other seabird survey datasets, non-quantitative observations, unpublished reports, and reports from the primary scientific literature. Section 6.7. identifies several existing datasets that would be useful in a meta-analysis. Additional data as well as additional modeling could supplement and improve our understanding of any particular species and area. New modeling technologies are constantly emerging; machine learning techniques such as TreeNet, RandomForest and others are likely to outperform GLM-based approaches for modeling trend surfaces and should be explored in the future (Oppel et al., 2012).

Several additional caveats should be considered when exploring the results presented in this report. The following is a non-exhaustive list (other, more technical caveats are discussed in Section 6.A.14.):

- Data used in seabird assessments are biased towards species which are larger, commonly seen, conspicuous, abundant and/or attracted to ships. Birds that are small, rare, nocturnal or avoid ships were likely undercounted (see Tasker, 1984 for species/group detection information).
- Predictions quantify the expected long-term average relative abundance of a species or species group, when averaged over time. A prediction of high abundance does not mean many individuals will be sighted there all the time; the hotspot may only occur periodically, and many individual observations may still be zero even if the long-term average abundance is high.
- Predictions made in Long Island Sound, nearshore (<5 km from land) and off the shelf slope (waters deeper than 2,000 m) can be highly uncertain, because little survey effort occurred in these areas.
- Sightings per unit effort are a relative index of abundance and should not be confused with an absolute population estimate.

Implications of the first point about detectability and attraction are particularly important to consider. Estimates of detectability require frequent, replicated repeat surveys over the same area, and therefore are not possible with the Manomet dataset. However, future targeted survey efforts may be able to estimate differences in detectability for different species with methods similar to the Manomet methods. In that case, the model estimates presented here could be updated to reflect differences in detectability. Biases due to attraction are more difficult to correct. Certain species are more likely to be affected by detectability and attraction issues than others. For example, as noted in Section 6.9.1., Northern Gannets are attracted to fishing trawlers, and the presence of large factory trawlers near the shelf break in the 1980's may have influenced some of the apparent hotspots for this species. Conversely, most terns are smaller and harder to detect or identify to species-level, and their abundance is probably underestimated. Diving birds like cormorants and dovekies also have lower detectability because they are sometimes underwater. These issues underscore the importance of treating the measures of relative abundance presented here as proxies for the real underlying patterns, and considering them in the light of other datasets, the life history of each species, and independent local expert opinion.

Notwithstanding these caveats and the inevitable uncertainties associated with modeling a complex, dynamic community from scattered data, the maps presented here represent the first high-resolution depiction of spatial patterns in the marine avifauna of New York, and as such, represent an important step towards design of effective spatial conservation, management, and sustainable use strategies for New York's offshore waters.

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Chapter 6: Online Supplements

Online Supplements can be found by going to http://oceanservice.noaa.gov/programs/nccos/welcome.html and searching on the keywords: *New York Spatial Plan*

Online Supplement 6.1: Predictor variable transformation details

This document provides additional detail on the statistical preparation of potential predictor variables for analysis.

Online Supplement 6.2: Species and group seasonal models, full diagnostic reports

This Online Supplement is presented in the form of an HTML document providing links to full diagnostic reports from each of the seasonal species/group predictive models.

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