# SPATIAL PATTERNS OF THE HUMPBACK WHALE (*MEGAPTERA NOVAEANGLIAE*) AND ITS SUMMER HABITAT IN THE NORTH ATLANTIC OCEAN

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## Abstract

The humpback whale (*Megaptera novaeangliae*) is found in all oceans of the world, migrating between low-latitude breeding grounds in the winter and high-latitude feeding grounds in the summer. In addition to these broad-scale spatial patterns, individuals in the North Atlantic Ocean exhibit fine-scale site fidelity, with median re-sighting distances of less than 40 km in consecutive years. Because they occur close to coasts and demonstrate a predictable distribution, humpback whales are particularly susceptible to disturbance from human activities. A clear understanding of the geographic pattern of summer sightings, along with the environmental features that characterize areas of concentrated distribution, could further management objectives. I analyzed the spatial pattern of summer humpback whale sightings and survey effort in three feeding grounds of the North Atlantic Ocean. Controlling for the spatial pattern of effort, sightings were clustered, with peaks at radial distances of 300 km, 600 km, and 1500 km. Fine-scale clustering at distances of 300 km and 600 km is compatible with the current hypothesis of multiple populations consisting of the Gulf of Maine, eastern Canada, western Greenland, and Iceland. Broad-scale clustering at distances of 1500 km may represent divisions between the western and eastern North Atlantic. I also conducted a broad-scale study of the environmental factors that influenced the summer distributions of humpback whales in the North Atlantic Ocean over the past several decades. Sightings in the Gulf of Maine, eastern Canada, and Iceland were modeled with static and ephemeral landscape features to develop logistic regression models of habitat. The global model including month; year; depth; slope; sea surface temperature (SST); SST gradient; and distances to shore, the 100-m isobath, and the 200-m isobath explained the greatest amount of variability in

distribution at both the ocean-basin- and feeding-ground-scales. The variability explained by the ocean-basin-scale model was 17% as compared to the regional models that explained 33% to 38% of the variation in whale sightings. The spatial scale of the feeding ground, therefore, represents a crucial geographic extent for managing humpback whale activity. I suggest priority research and management activities given our present state of knowledge.