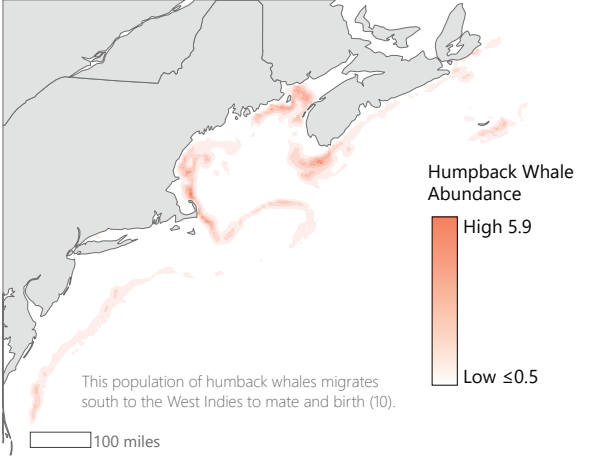
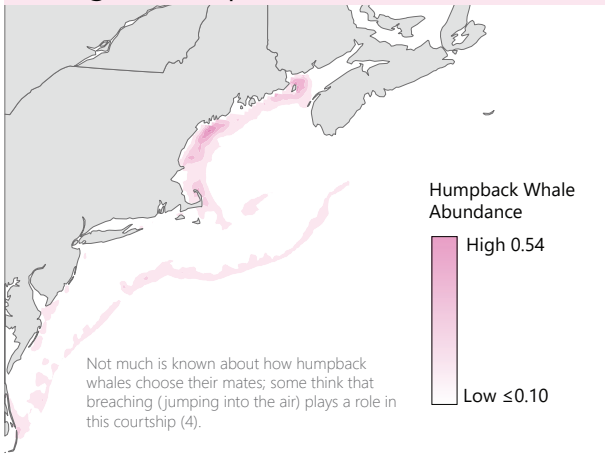


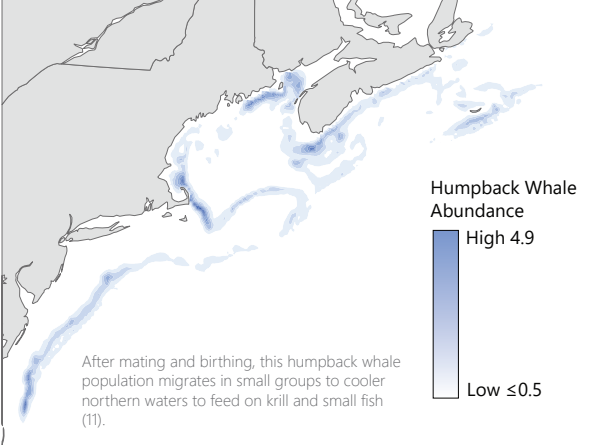
Pre - Mating Season | October - November



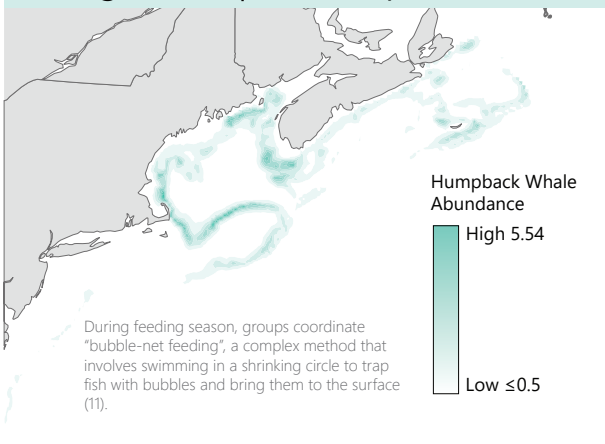
Mating Season | December - March



Pre - Feeding Season | April - May

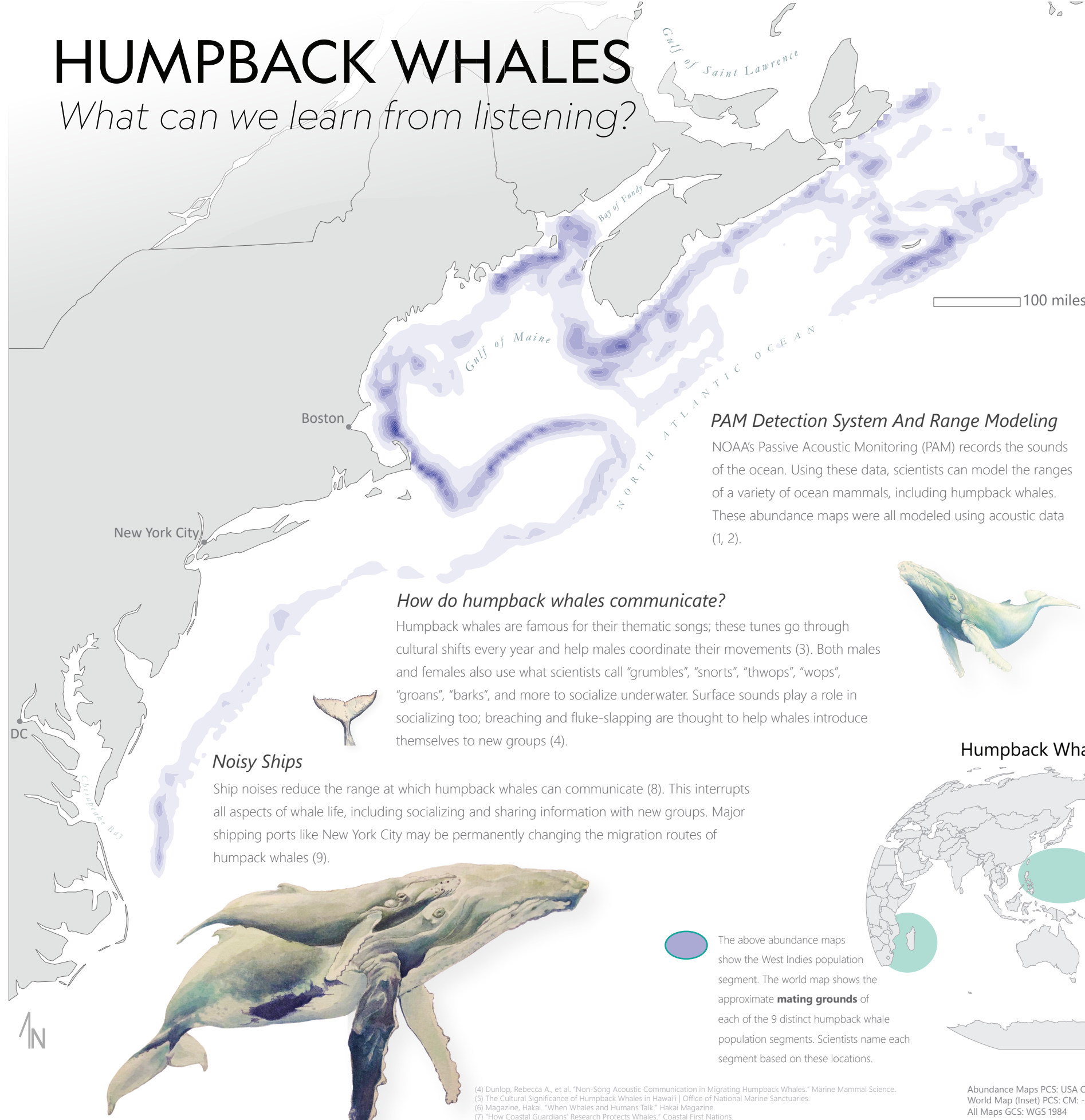


Feeding Season | June - September



# HUMPBACK WHALES

*What can we learn from listening?*



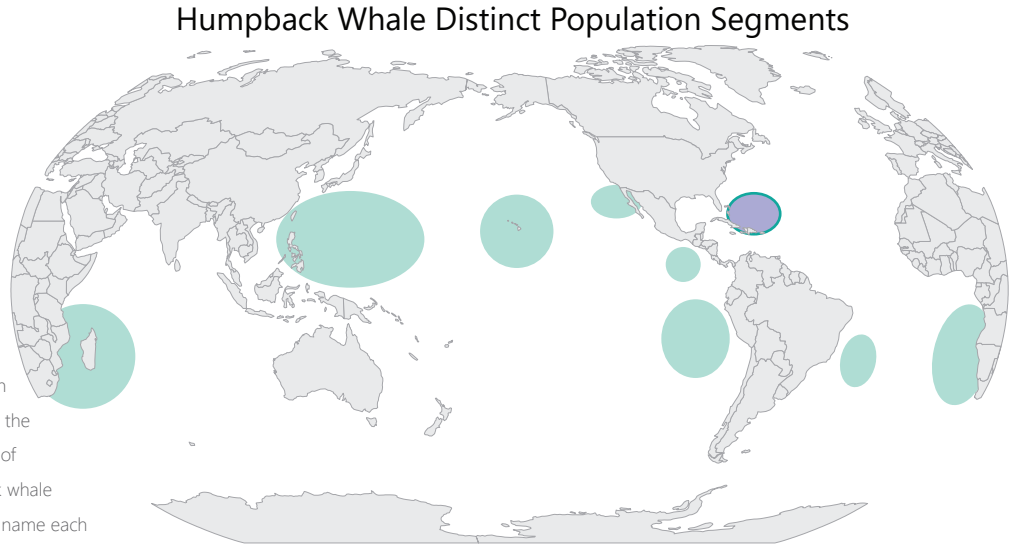
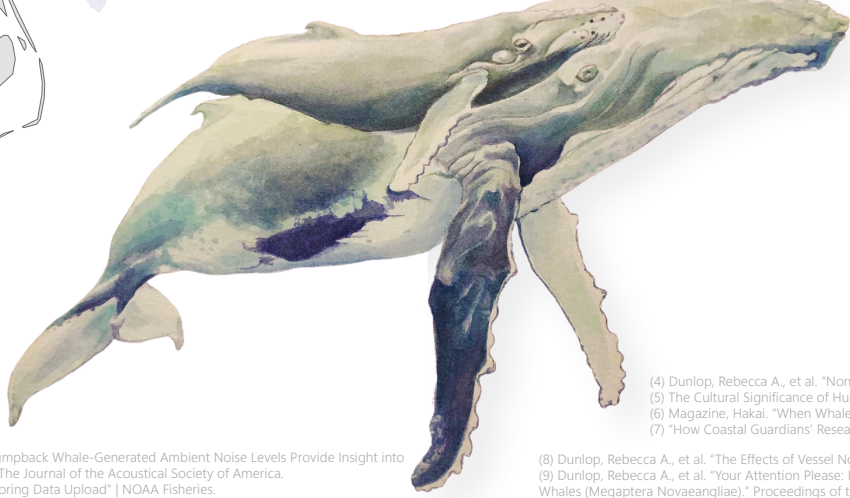
**What is abundance?**  
Abundance is measured as the number of individuals per sample divided by the total group population. These maps show modeled spatial estimates of humpback abundance year round.

**Traditional Ecological Knowledge**  
Indigenous nations in the Arctic and Hawai'i have long understood that whales have complex methods of communication (5, 6). Western scientists are only beginning to catch up. The Gitga'at Nation is partnering with scientists on the Pacific coast to identify individual humpback whales and to install a hydrophone network for acoustic monitoring in key coastal areas (7).

**PAM Detection System And Range Modeling**  
NOAA's Passive Acoustic Monitoring (PAM) records the sounds of the ocean. Using these data, scientists can model the ranges of a variety of ocean mammals, including humpback whales. These abundance maps were all modeled using acoustic data (1, 2).

**How do humpback whales communicate?**  
Humpback whales are famous for their thematic songs; these tunes go through cultural shifts every year and help males coordinate their movements (3). Both males and females also use what scientists call "grumbles", "snorts", "thwops", "wops", "groans", "barks", and more to socialize underwater. Surface sounds play a role in socializing too; breaching and fluke-slapping are thought to help whales introduce themselves to new groups (4).

**Noisy Ships**  
Ship noises reduce the range at which humpback whales can communicate (8). This interrupts all aspects of whale life, including socializing and sharing information with new groups. Major shipping ports like New York City may be permanently changing the migration routes of humpback whales (9).



The above abundance maps show the West Indies population segment. The world map shows the approximate **mating grounds** of each of the 9 distinct humpback whale population segments. Scientists name each segment based on these locations.

(1) Seger, Kerri D., et al. "Humpback Whale-Generated Ambient Noise Levels Provide Insight into Singers' Spatial Densities." *The Journal of the Acoustical Society of America*.  
 (2) "Passive Acoustic Monitoring Data Upload" | NOAA Fisheries.  
 (3) Helweg, David A., et al. "Cultural Change in the Songs of Humpback Whales from Tonga." *Behaviour*.

(4) Dunlop, Rebecca A., et al. "Non-Song Acoustic Communication in Migrating Humpback Whales." *Marine Mammal Science*.  
 (5) The Cultural Significance of Humpback Whales in Hawai'i | Office of National Marine Sanctuaries.  
 (6) Magazine, Hakai. "When Whales and Humans Talk." *Hakai Magazine*.  
 (7) "How Coastal Guardians' Research Protects Whales." *Coastal First Nations*.  
 (8) Dunlop, Rebecca A., et al. "The Effects of Vessel Noise on the Communication Network of Humpback Whales." *Royal Society Open Science*.  
 (9) Dunlop, Rebecca A., et al. "Your Attention Please: Increasing Ambient Noise Levels Elicits a Change in Communication Behaviour in Humpback Whales (Megaptera Novaeangliae)." *Proceedings of the Royal Society B: Biological Sciences*.  
 (10) Fisheries, NOAA. "Humpback Whale | NOAA Fisheries." NOAA.  
 (11) Bubble-Net Feeding: Humpback Whales Feeding in Kenai Fjords National Park.

Abundance Maps PCS: USA Contiguous Albers Equal Area Conic | CM: -66.18 | SP1: 28.3 N | SP2: 46.4 N  
 World Map (Inset) PCS: CM: -159 | False Easting: 0 | False Northing: 0  
 All Maps GCS: WGS 1984

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 Data Source for Abundance Models: NOAA  
 Data Source for Countries: Natural Earth Project