Mapping Gray Whale Migration to Evaluate Shipping Lanes and Reduce Whale Ship Strikes

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Introduction

The gray whale (Eschrichtius robustus) makes an annual migration of up to 13,600 miles round trip from their winter breeding grounds off Mexico to their summer feeding grounds off Alaska. This may be the longest migration of any mammal. The North American population is 22,000. Threats to their population include ship strikes (boat collisions), entanglement in fishing gear and climate change. This project looks at gray whale migration, how this intersects with shipping lanes, modeling their migratory behavior, and ways to reduce ship strike.

Objectives

- What are the gray whale migration routes along California, and how do these intersect with shipping lanes?
- Where do gray whale ship strikes occur in California, and are there any regions of special concern?
- Can habitat modeling of whale sightings be used to predict whale occurrences and evaluate shipping lanes to reduce ship strikes?
- What is actual vessel movement like in shipping lanes? Do ships follow suggested lane routes and speeds? Can ships change their behavior to reduce ship strikes?

Methods

- Map whale migration and shipping lanes
- Map available ship strike records for gray whales to identify areas of concern
- Create habitat based model of gray whale densities
- Map vessel movements and characteristics using AIS data, especially around areas of gray whale ship strike concern

Data Sources

Gray whale sightings 1980-2013 (NOAA)
Dominant shipping lanes along California coast (ArcGIS)
Gray whale ship strikes – Marine Mammal Stranding Network
Kelp growth data 2010-2015 - UC Berkeley
Satellite imagery for currents, SST & chlorophyll (NOAA CoastalWatch Aqua MODIS), bathymetry
Automated Identification System (AIS) 2009 data (NOAA)
Ocean Currents Scrypd/UCSD
Bathymetry, NOAA, Modeling Data-Aquamaps.org

Results

- Near the Channel Islands, (7) areas identified as high risk zones.
- Thousands of ships exceed safe limit of 14 knots.
- Physical oceanographic factors make predicting gray whale presence possible but uncertain.

Conclusion

- While high risk areas have been identified, avoiding the area entirely based on whale density and high traffic of ships is not viable option.
- The implementation of an active management system which takes into account whale migration patterns and habits in real time, will be needed to significantly reduce the number of whale strikes near the Channel Islands.
- It is possible to reduce ship strikes to grey whales, but chances of actual policy changing are small.
- Grey whales change their migration path near Channel Islands, though quantifying sampling bias needs more exploration.
- Our model roughly fit other probability models, though we blended our models with theirs using overlay, to compensate for any bias on our part to fit with known models.
- Our model needs to be refined to more accurately project actual populations. We had a myriad of different sample types all with different sampling techniques and potential bias.
- Researchers should be sure to note whether gray whales are going north or south in order to help understand larger patterns.
- Seasonal Distribution patterns offer hope for dynamically managed shipping lanes.

References