Hawaiian Spinner Dolphins: Vulnerability to Climate Change and Exposure to Anthropogenic Sound

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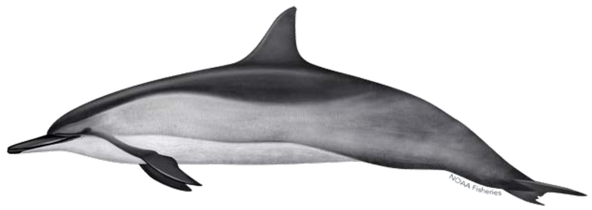
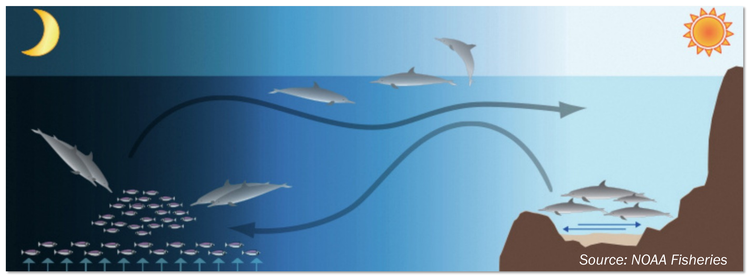
Objectives

- Evaluate and compare the climate vulnerability of the Pelagic and Insular Hawaiian spinner dolphin stocks
- Determine the life history and ecological traits affecting their climate vulnerability
- Assess their current exposure to anthropogenic sound

Introduction

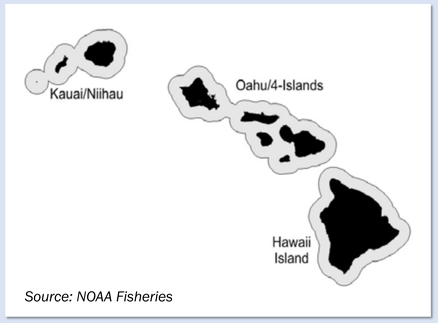


- The Hawaiian spinner dolphin (*Stenella longirostris*) uses the high frequency channel (kHz) to communicate, find prey, and avoid predators
- While vessels produce lower frequency sounds (<400Hz) detected at longer distances, it is still an effective proxy for sound propagation because higher frequency sounds are detected at shorter distances
- This creates the potential for human interference of key dolphin characteristics:
  - Spinning to communicate
  - Diurnal resting in areas close to drop-offs of very deep water
  - Nocturnal offshore feeding within the scattering layer



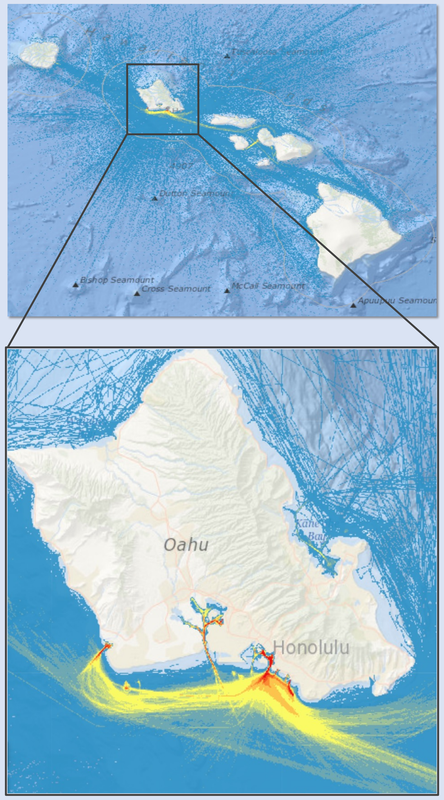
Methods

- NOAA's stock assessment reports were used to define clear stock boundaries between the pelagic and insular stocks
- Life history attributes of each stock relevant to climate change and anthropogenic sound were identified
- A systematic methodology developed as part of NOAA Fisheries' Marine Mammal Climate Vulnerability Assessment (MMCVA) project assessed their climate change vulnerability
- A defined scoring rubric was created to quantify potential shipping exposure by comparing the proportion of Marine Cadastre's 2019 AIS Vessel Transit Counts data layer overlapping each stock boundary



Potential Shipping Exposure (ships per year)

- Very Low (1-50)
- Low (51-75)
- Moderately Low (76-100)
- Moderate (101-250)
- Moderately High (251-500)
- High (501-1500)
- Very High (1501+)



Results

- While both stocks had a high climate vulnerability, the Insular stock had a higher climate vulnerability because of the greater number of cumulate non-climate stressors and proximity to human activity

	INSULAR	PELAGIC
Habitat specificity	High	High
Site Fidelity	High	High
Migration	None	None
Cumulative stressors	5+	4

Key adaptative capacity attributes apparent to both stocks that explain high vulnerability

- The Insular stock also had a higher exposure to sound than the pelagic stock
- The life history attributes scored for climate change that had the most influence from sound were site fidelity, home range, and diet specificity.

Discussion

- Sound exposure may intensify the climate vulnerability of marine species if ocean acidification alters the ocean soundscape.
- Honolulu is one of the busiest ports globally, with the abundance of large ships steadily increasing
- The combination of these effects threatens the survival and livelihood of marine species
- These findings can improve management strategies of Hawaiian cetacean stocks by providing more protection from human interference