

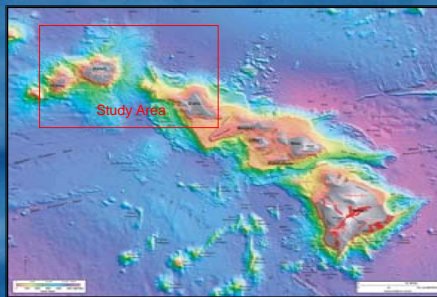
Hear Me, See Me: An Acoustic and Visual Survey of Deep-water Cetaceans in Hawaiian Waters

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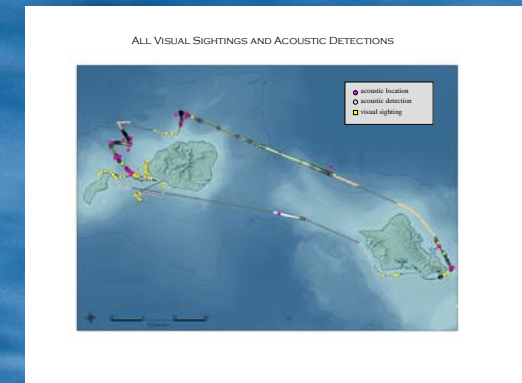
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Main Objective
A pilot study to conduct visual/acoustic surveys of cetaceans occurring in deep-waters (> 500 m) off Hawaii during winter/spring.

Secondary Objectives

- Look and listen for “cryptic” species (e.g. minke, beaked, pygmy & dwarf sperm whales).
- Develop and test a passive acoustic detection and location system for surveying cetaceans.
- Integrate acoustic and visual techniques for behavioral work and line-transect surveys.
- Explore the capabilities of a large motor-sailing vessel (87 ft. *Dariabar*) as a survey platform.



Survey Platform
(Motor-Sailing Research Vessel *Dariabar*)

- 87ft capable of birthing a team of 12
- Custom outfitted with spotter platforms for cetacean surveys
- Acoustically & electronically quiet.
- Acoustics / Science Lab.
- Great food with a view!!

Passive Acoustic Equipment

- Towed hydrophone arrays : 5 element low-to-mid (15 Hz-35 kHz) range
2 element mid-frequency range.
- Large-capacity battery bank for generator-free/clean power (e.g. while under sail).
- Dry acoustics lab with signal conditioning and processing hardware.

Target Species

Deep-diving whales	Mysticetes
• sperm whales	• minke fin & blue whales
• pilot whales	• offshore humpback whales
“Cryptic” odontocetes	Other odontocetes
• beaked whales	• “blackfish”
• pygmy/dwarf sperm whales	• pelagic dolphins

Results

Acoustic Highlights:

- Over 200 detections of calls resulting in 150 acoustic bearings to sources. Resulting in localizations of :
 - 6 minke whale acoustic localizations.
 - 6 humpback whales (4 in deep water).

Visual Highlights

- 1st documented minke whale sighting within 50km of the main Hawaiian islands.
- Beaked whale encounter (same location as minke whale sighting – see map below).
- Numerous deep water sightings of humpback whales.

Overall Results

- Surveyed deep water region much of which in relatively poor sea-conditions
- Passive acoustics allowed many more animals to be detected than otherwise possible



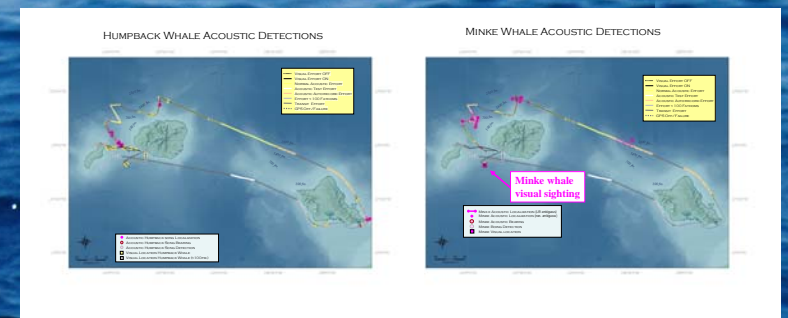
Methods

Passive Acoustics

- Dual towed-hydrophone arrays used to passively monitor, locate and record vocal cetaceans.
- Multi-channel (5 to 7) acoustic data acquired via NI DAQ card to a laptop computer.
- Acoustic localization and plotting accomplished via ISHMAEL and Whaltrak software.

Visual Observations

- One to three experienced marine mammal observers stationed at spotting platforms.
- Data recorded using WINCRUZ (NOAA/SWFSC) computer-based data-logging software.
- Standard line-transect protocols (Buckland et al. 1993) were used to collect visual data.
(Note: density estimates were not calculated due to limited numbers of observations.)



Future Research Plans

- Further develop passive acoustic tracking system
 - 3-D localization and tracking (after Thode et al. 2005)
 - Incorporate high-frequency (up to 100 kHz) monitoring capability
 - Increase towed array deployment depths (~100m)
 - Incorporate sensors (pressure, tilt, heading) into array.
- Survey deep-water seamounts and slopes
- Focus on deep-diving and “cryptic” cetaceans (beaked, kogia sp. minke whales)
- Improve oceanographic data-collection capabilities for use in habitat studies

What Did We Learn?

Combined visual/acoustic techniques are effective for surveying many deep-water species.

- Passive Acoustics allows surveys during night-time and poor-conditions.
- Visual observations are useful to confirm species ID and count animals.

Minke whales were relatively numerous in HI waters in Feb (even if only rarely seen).

- The sighting and visual detections demonstrates that minke whales were very vocal and relatively common in winter/spring near the Hawaiian Islands (but only in deep-waters).

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