Acoustically observing false killer whales in the Hawaii-based tuna longline fishery

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Research Recommendations from the Take-Reduction Plan

- Distinguish false killer whale calls from other species- HIGH
- Evaluating where FKW are caught within a set and why- MEDIUM
- Recording acoustic profile during setting, soaking, and hauling to assess potential cues to FKW- MEDIUM
- Record individual sound profile of longline vessels- LOW

Why?

How FKWs find and interact with gear are not known. This information is crucial for developing effective bycatch reduction strategies.

Acoustic cues have been implicated in attraction of cetaceans to longline gear in other regions

Identifying false killer whales acoustically

- False killer whale whistles and echolocation (foraging) clicks are generally identifiable based on the their frequency content, duration, and other spectral properties

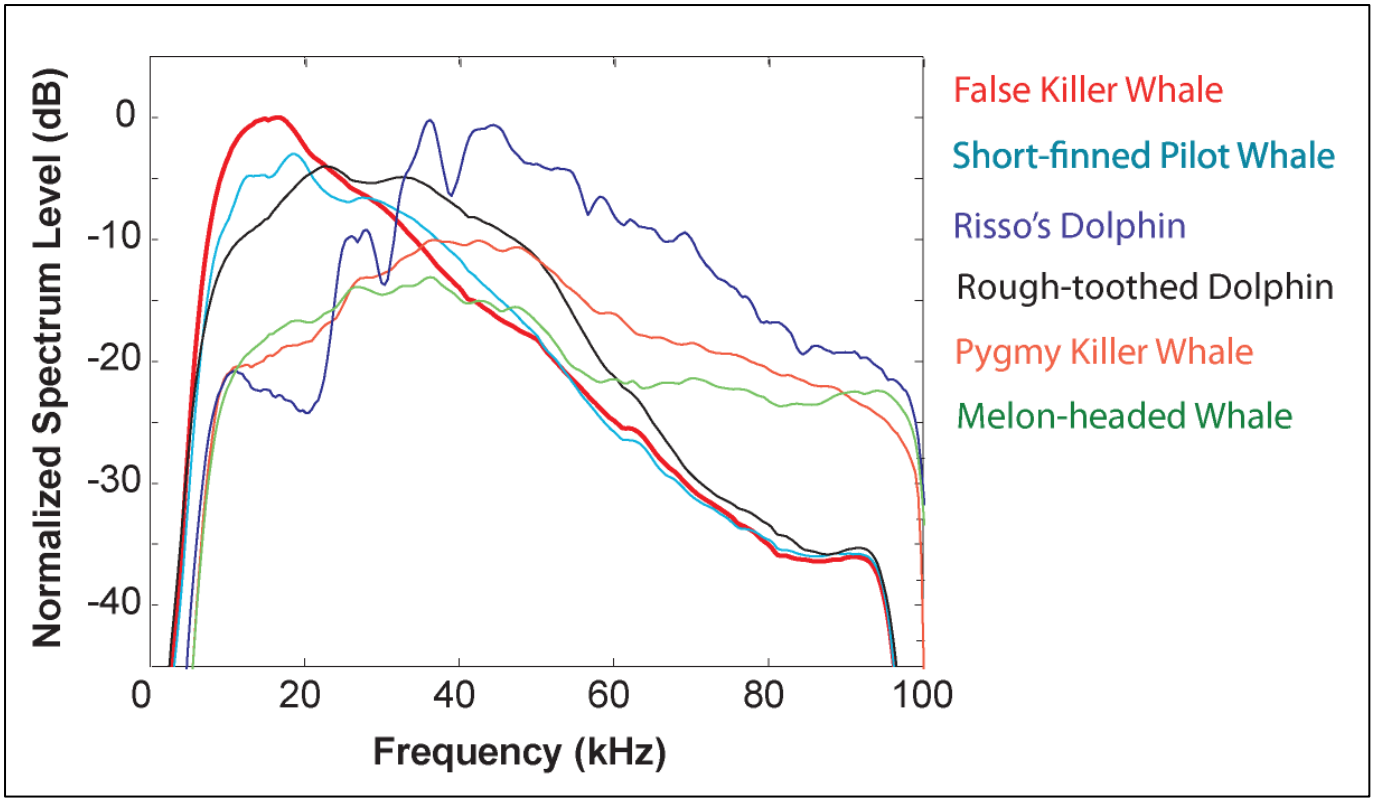
Table 5. Results of 66 terminal node classification tree grown using seven variables (beginning frequency, end frequency, minimum and maximum frequency, duration, number of inflection points, number of steps). Overall correct classification = 53.1%, n = 908. Bold-face numbers are percent correct classification scores; others are percentages of whistles classified incorrectly. Numbers in parentheses are Chi-square P-values testing whether correct classification is greater than expected by chance.

Oswald et al 2003

	Classified as								
Actual species	Bottlenose dolphin	Short-beaked common dolphin	False killer whale	Pantropical spotted dolphin	Long-beaked common dolphin	Short-finned pilot whale	Rough-toothed dolphin	Striped dolphin	Spinner dolphin
Bottlenose dolphin	**60.3** (<0.05)	7.7	0.6	7.1	7.1	0.6	1.3	11.5	3.8
Short-beaked common dolphin	12.5	**28.4** (<0.05)	5.7	5.7	10.2	2.3	8.0	15.9	11.4
False killer whale	0.0	1.4	**88.4** (<0.05)	0.0	0.0	4.3	2.9	1.4	1.4
Pantropical spotted dolphin	10.3	9.3	0.0	**48.5** (<0.05)	12.4	0.0	2.1	12.4	5.2
Long-beaked common dolphin	5.5	5.5	4.1	19.2	**24.7** (<0.2)*	0.0	9.6	20.5	11.0
Short-finned pilot whale	2.0	2.6	11.8	1.3	0.7	**68.0** (<0.05)	7.2	3.3	3.3
Rough-toothed dolphin	2.9	5.9	16.2	0.0	7.4	11.8	**45.6** (<0.05)	4.4	5.9

Identifying false killer whales acoustically

- False killer whale clicks can be distinguished form other tropical odontocetes
- Requires full acoustic waveform, not just automatic click measurements



Acoustic Monitoring of the Fishery

- Project started with seed funds from Marine Mammal Commission to purchase recorders (2010)
- Currently funded by NMFS Bycatch Reduction Engineering Program (in response to identified need by TRT)

In collaboration with:

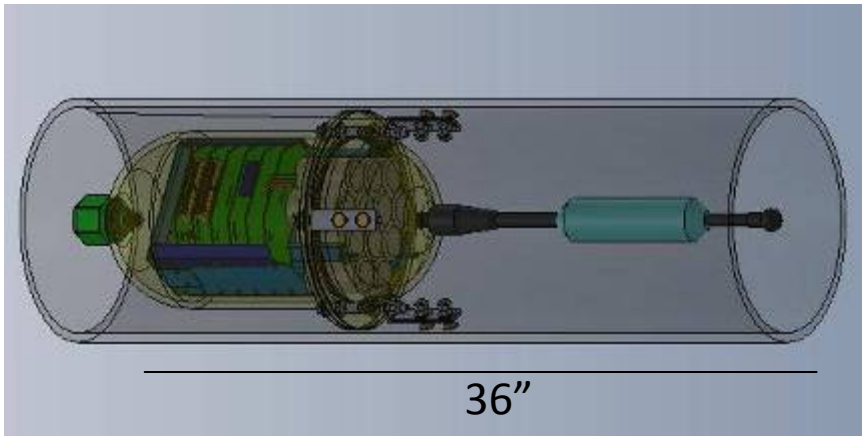
- University of Hawaii (Ali Bayless & Paul Nachtigall)
- Hawaii Longline Association

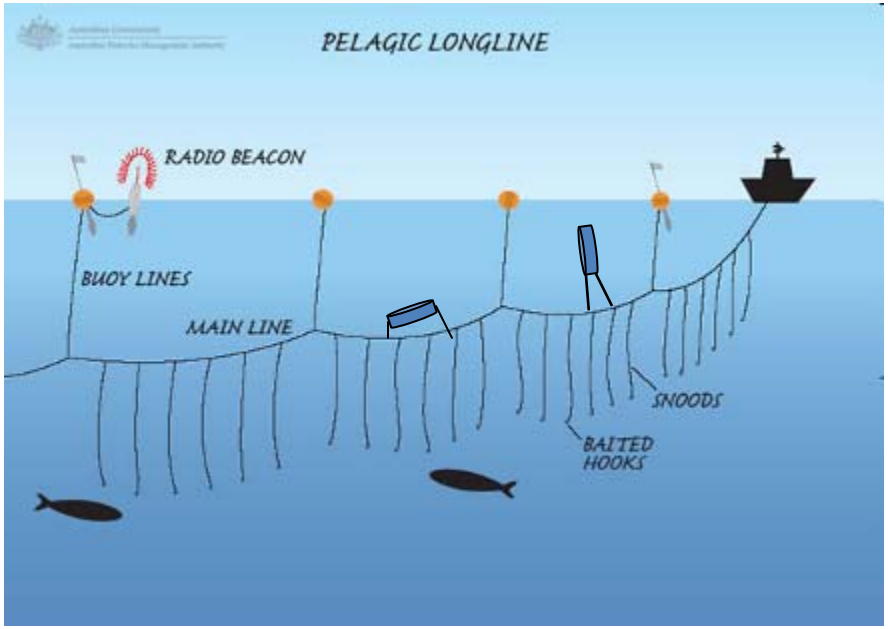
Goal- Deploy acoustic recorders on longline gear to assess:

1. False killer whale behavior around the gear
2. Vessel and gear sounds
3. False killer whale occurrence throughout fishing grounds
4. Identify potential acoustic cues

Longline acoustic monitors

- Specific design considerations:
  - Capable of continuous broadband (>100kHz) sampling
  - Storage for > 15 days @ 15 hours/day
  - Small & robust
  - Saltwater switch, no field programming
  - Vibration isolation
  - Flexible deployment options
    - Can float above or hang below mainline
    - Can attach horizontally or vertically
    - Uses standard fishing gear for attachment





Acoustic monitoring of the fishery

Currently: Awaiting delivery of prototype recorder

Next: Test deploy with HLA

Recordings will commence in 2 stages:

1. Dense array along 40 nmi set to assess how gear is "discovered" and understand whale movement along the gear (beginning in fall-winter 2011)
2. Deployment across the fleet via the PIRO Observer Program to characterize vessel noise & setting/soaking/hauling sounds for evaluation of potential acoustic cues (beginning spring 2012)

Future expansion: Deployment with hook timers to evaluate depredation behavior (bait v. catch, etc.)