



Differences in melon-headed whale (*Peponocephala electra*) call characteristics between Hawaiian populations

Maxwell B. Kaplan¹, T. Aran Mooney¹, Robin W. Baird², Aliza J. Millette-Winfree^{3,4}

¹Woods Hole Oceanographic Institution, mkaplan@whoi.edu;
²Cascadia Research Collective;
³Marine Mammal Research Program, Hawai'i Institute of Marine Biology; ⁴Department of Psychology, University of Hawai'i



Poster Presentation at the 20th Biennial Conference on the Biology of Marine Mammals 2013

Abstract
 Here we report the first broadband recordings of melon-headed whale calls using digital acoustic recording tags (DTAG3).

Call categorizations indicate no overlapping call types between or within sympatric populations.

Both visual categorization of spectrograms and analysis of call parameters provide evidence for stereotyped call production.

Introduction
 Melon-headed whales (*Peponocephala electra*; MHW) are found throughout the tropics and may be sensitive to sound, with one near-mass stranding event in Hawaiian waters associated with a naval exercise (Southall et al. 2006). Two sympatric populations are found off Hawaii – the Kohala resident population (KRP) and the Hawaiian Islands population (HIP). We used DTAG3s to record MHW acoustic behavior from 3 individuals (KRP – 2; HIP – 1; Fig. 1).

Methods

- A total of 1425 calls were identified from a total recording time of 120 minutes spread over 3 tags.
- Calls were individually analyzed in Matlab. Only calls with a signal-to-noise ratio of ≥ 6 dB and with no strong overlapping signals were retained for analysis (Table 1).
- Temporal and spectral call characteristics were either derived interactively from the spectrogram or were automatically calculated (Table 2).
- Categorizations were determined independently by 3 untrained volunteers using printed anonymized spectrograms (Fig. 2).
- A group was defined when a minimum of 5 calls were unanimously put together (Table 3).



Table 1. Tag deployment durations and number of calls identified on each recording.

Date	Population	Tag ID	Duration (min)	Total Calls	Analyzed Calls
19-Oct-11	KRP	pe292b	34:37.0	109	77
13-May-12	HIP	pe134a	42:56.0	329	35
24-Aug-12	KRP	pe237a	57:39.0	987	345

Table 2. Spectral and temporal characteristics of the calls included in groups A, J, D, and B, as well as of all uncategorized calls pooled among tags. Start, minimum, maximum, and end frequency were only calculated for calls that were judged to be primarily tonal. Values: mean \pm SD.

Parameter	Group				
	A	J	D	B	UC
Call duration (s)	0.52 \pm 0.1	0.48 \pm 0.1	0.87 \pm 0.1	1.23 \pm 0.2	0.62 \pm 0.4
Peak Frequency (Hz)	10660 \pm 1770	9370 \pm 2280	4350 \pm 360	6230 \pm 2730	7520 \pm 2900
Centroid Frequency (Hz)	10150 \pm 1700	9840 \pm 1320	5810 \pm 550	7420 \pm 1560	9830 \pm 5760
RL _{-95%EPD} (dB re 1 μ Pa ² s)	131.1 \pm 3.6	130.6 \pm 2.6	136.1 \pm 1.16	118.5 \pm 7.7	125.2 \pm 8.9
Start Frequency (Hz)	-	-	3090 \pm 140	-	5590 \pm 4490
Minimum Frequency (Hz)	-	-	2290 \pm 190	-	3770 \pm 1890
Maximum Frequency (Hz)	-	-	6310 \pm 290	-	13910 \pm 6250
End Frequency (Hz)	-	-	3750 \pm 160	-	11150 \pm 6270

Results

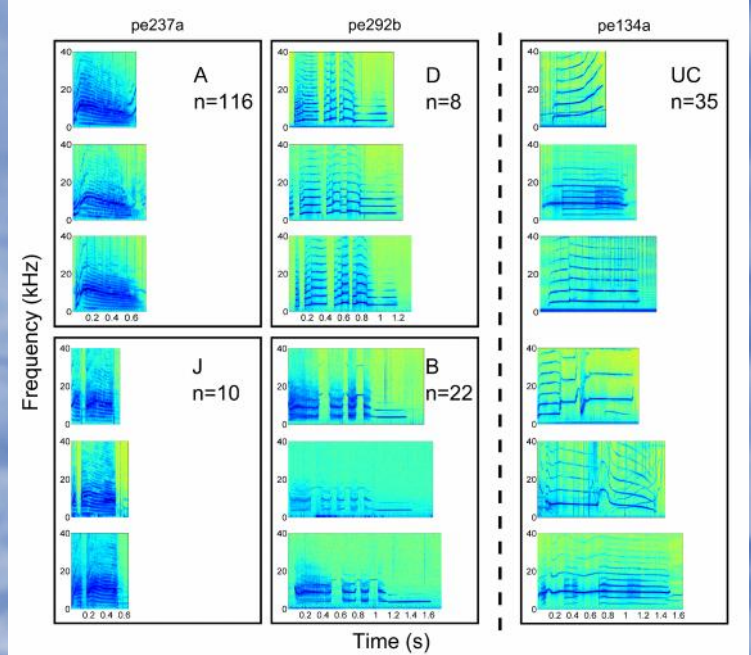


Fig. 2. Call spectrograms (sampling rate 240 kHz, Hamming window 1024 samples, FFT size 1024 samples, 50% overlap). Four groupings of unique call types are displayed with three exemplars each and the total number of calls in that category. Groups A, J, B, and D contain calls exclusively found on a given tag (A and J – pe237a; D and B – pe292b; both animals were members of the KRP). UC represents a random subset of uncategorized calls found on the only tagged member of the HIP. No groups emerged from this tag.

Table 3. All call categories resulting from visual classifications. Highlighted groups are those featured in Fig. 2 and Table 1.

Tag	Group											UC					
	A	B	C	D	E	F	G	H	I	J	K		L	M	N	O	P
pe134a	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35
pe237a	116	0	0	0	5	6	5	9	0	10	6	6	0	56	67	5	54
pe292b	0	22	10	8	0	0	0	0	5	0	0	0	7	0	0	0	25

Discussion

Categories of like calls were only identified in the KRP, and no category contained calls from more than one tag. Spectral and temporal characteristics of the calls varied between groups and the uncategorized calls showed greater variability in call parameters than did the calls in any given group. These results suggest the potential for population- or individual-specific calling behavior, which has implications for automatic detection and classification of this species because individual recordings may be biased towards the calling behavior of one animal.

Acknowledgements

Funding: ONR, WHOI Marine Mammal Center, & the Sawyer and Penzance Endowed Funds. Frants Jensen, Laela Sayigh, Daniel L. Webster, Deb Robbins, Andrea Schlunk, Tammy Silva. The employees of Cascadia Research Collective and a number of assistants in the field. Tagging and photos (taken by T. Aran Mooney) under NMFS permit # 15530 to CRC.

References

Southall et al. 2006. NMFS-OPR-31.

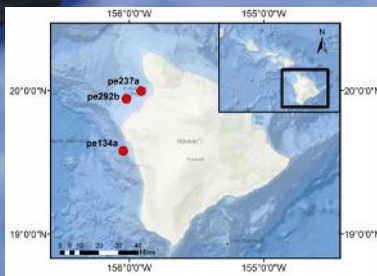


Fig. 1. Map of Hawaii and 3 tagging locations (pe292b - Oct '11; pe134a - May '12; pe237a - Aug '13).