

Supplemental figures and tables for:

Acoustic Behavior of Endangered Hawaiian False Killer Whales

Brijonnay C. Madrigal^{1,2}, William T. Gough³, Jens J. Currie^{3,4}, Lars Bejder³, Augusta Hollers³, Robin W. Baird⁵, T. Aran Mooney⁶ and Aude Pacini³

¹Hawai'i Institute of Marine Biology, University of Hawai'i at Mānoa, Honolulu, HI, USA

²Scripps Institution of Oceanography, University of California San Diego, La Jolla, CA USA

³University of Hawai'i at Manoa Hawaii Institute of Marine Biology, Kaneohe, HI, USA

⁴Pacific Whale Foundation, Wailuku, HI, USA

⁵Cascadia Research Collective, Olympia, WA, USA

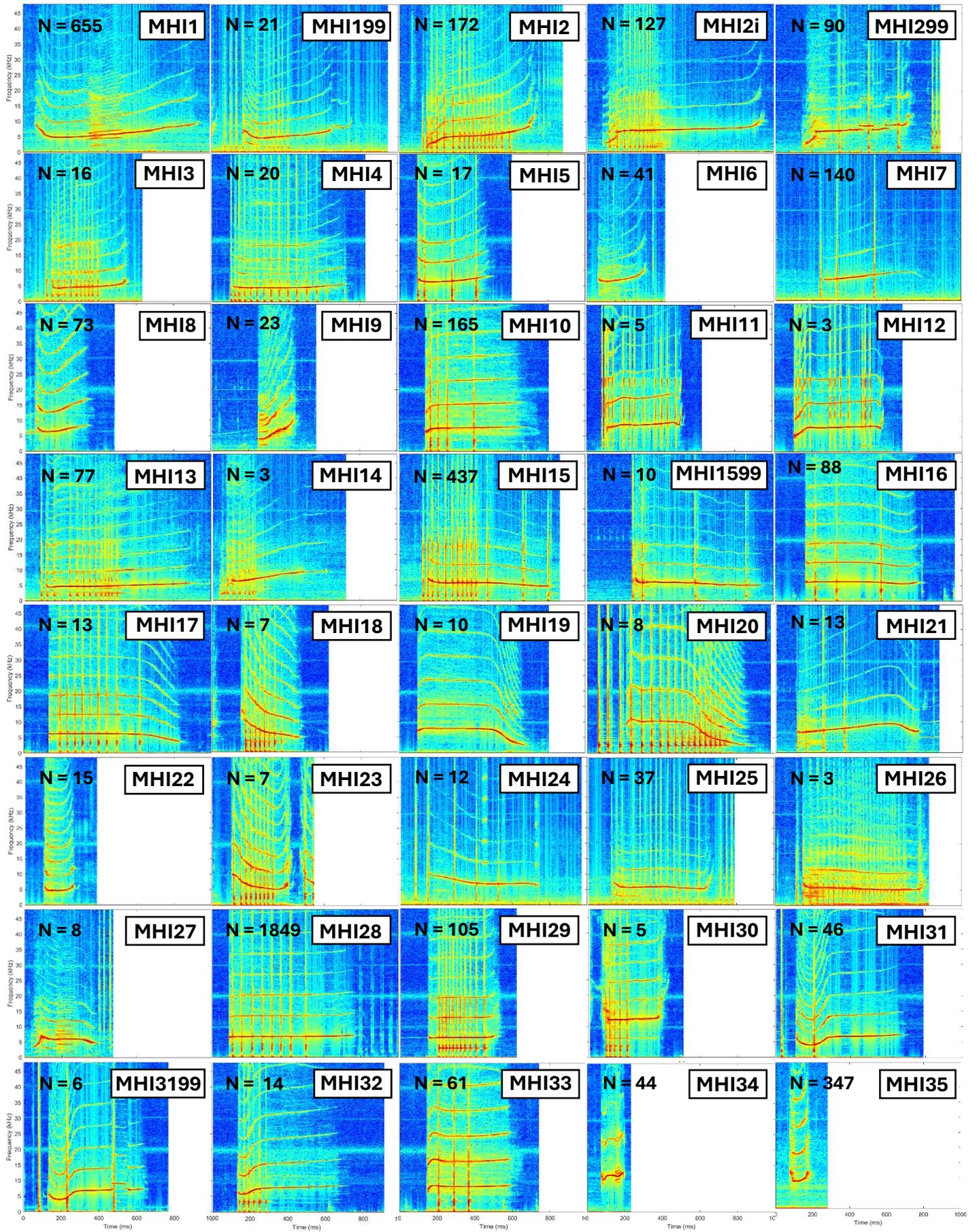
⁶Department of Biology, Woods Hole Oceanographic Institution, Woods Hole, MA, USA

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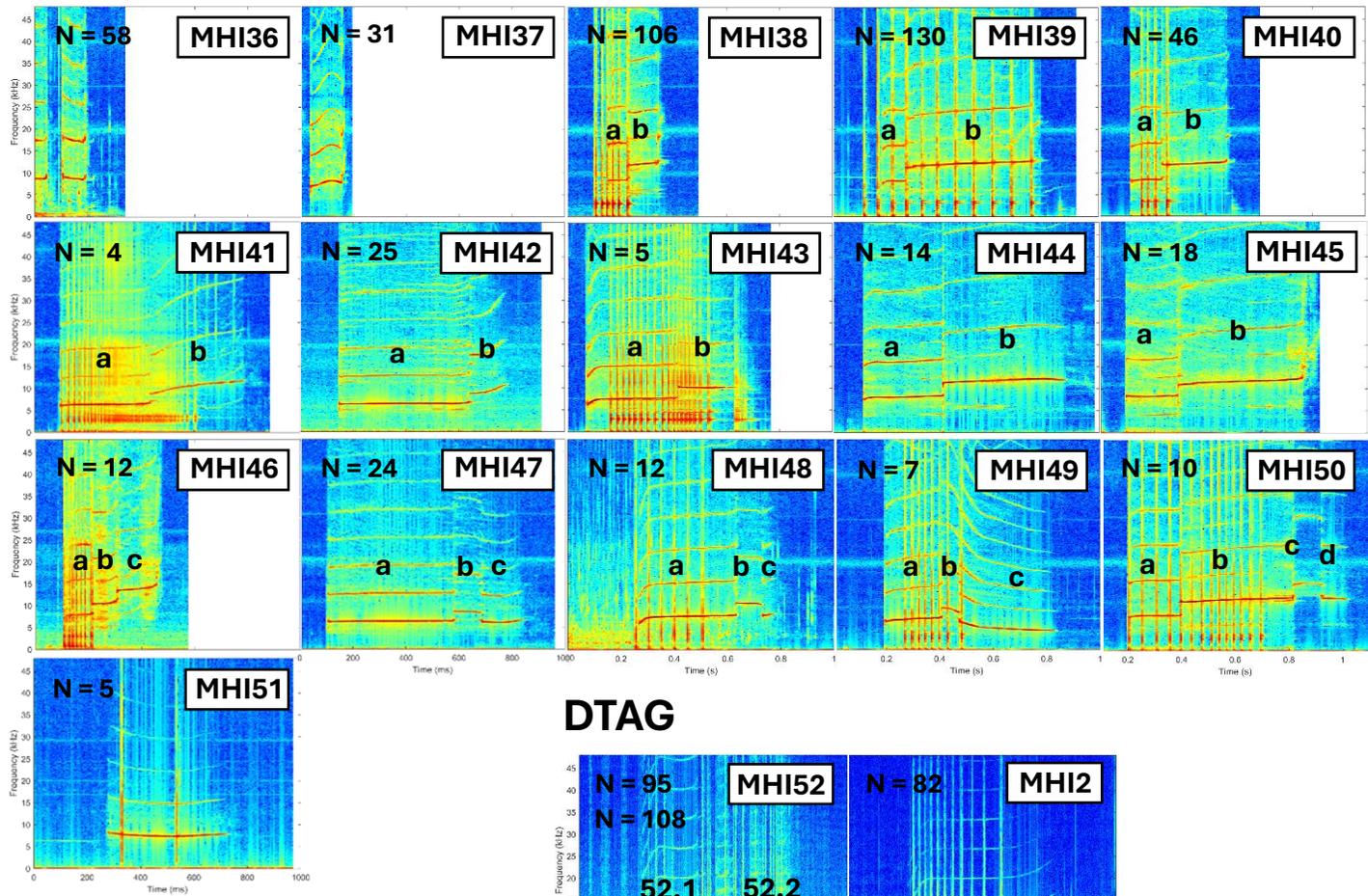
Corresponding author: Brijonnay C. Madrigal

Email: brijonnay.madrigal@gmail.com

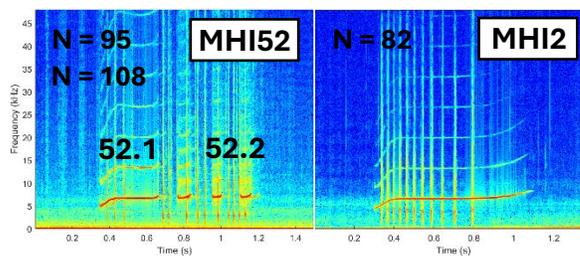
Figure S1



CATS



DTAG



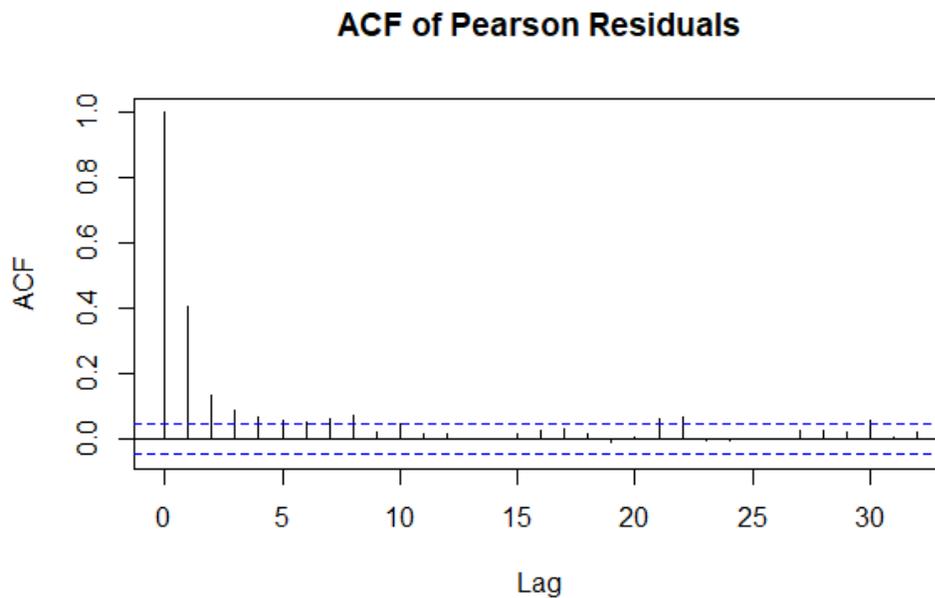
Call Type	<i>N</i>	Start Freq (kHz)	End Freq (kHz)	Min Freq (kHz)	Max Freq (kHz)	Freq Range (kHz)	Duration (s)	Contour
DTAG								
MHI2	82	5.00 ± 0.23	8.23 ± 0.37	4.95 ± 0.21	8.23 ± 0.36	3.27 ± 0.44	0.64 ± 0.06	Ascending
MHI52.1	95	5.29 ± 0.46	7.32 ± 0.48	5.15 ± 0.38	7.32 ± 0.48	2.18 ± 0.48	0.31 ± 0.09	Ascending
MHI52.2	100	7.09 ± 0.32	7.78 ± 0.21	6.71 ± 0.13	7.78 ± 0.21	1.07 ± 0.21	0.07 ± 0.01	Concave
TOTAL	277	5.79 ± 0.34	7.78 ± 0.35	5.60 ± 0.24	7.78 ± 0.35	2.17 ± 0.38	0.34 ± 0.05	
CATS								
MHI1	100	8.21 ± 0.75	8.73 ± 1.02	4.69 ± 0.43	8.89 ± 0.89	4.20 ± 0.75	0.60 ± 0.16	Ascending
MHI2	66	3.46 ± 0.88	9.95 ± 1.57	3.44 ± 0.88	9.94 ± 1.57	6.51 ± 1.93	0.47 ± 0.17	Ascending
MHI2i	100	6.94 ± 0.59	11.35 ± 1.88	6.40 ± 0.42	11.35 ± 1.88	4.94 ± 1.90	0.52 ± 0.15	Ascending
MHI3	16	6.27 ± 1.21	9.52 ± 2.53	5.48 ± 1.03	9.52 ± 2.53	4.04 ± 1.75	0.38 ± 0.13	Ascending
MHI4	20	5.55 ± 0.42	6.43 ± 1.22	4.55 ± 0.10	6.49 ± 1.18	1.94 ± 1.10	0.56 ± 0.09	Ascending
MHI5	17	7.33 ± 0.99	8.28 ± 0.51	6.46 ± 0.94	8.32 ± 0.55	1.86 ± 0.94	0.45 ± 0.07	Ascending
MHI6	41	7.40 ± 0.53	10.93 ± 1.18	6.48 ± 0.38	10.93 ± 1.18	4.45 ± 1.11	0.19 ± 0.04	Ascending
MHI7	95	7.39 ± 0.39	8.57 ± 0.89	6.91 ± 0.27	9.75 ± 0.32	2.84 ± 0.24	0.54 ± 0.06	Ascending
MHI8	73	7.27 ± 0.51	8.49 ± 0.45	6.08 ± 0.43	8.52 ± 0.37	2.44 ± 0.42	0.33 ± 0.09	Ascending
MHI9	23	4.24 ± 1.17	9.68 ± 1.95	4.23 ± 1.18	9.68 ± 1.95	5.45 ± 1.62	0.16 ± 0.07	Ascending
MHI10	98	6.33 ± 0.94	7.52 ± 0.84	6.29 ± 0.90	7.75 ± 0.77	1.46 ± 0.68	0.52 ± 0.11	Ascending
MHI11	5	5.94 ± 1.23	6.56 ± 1.32	5.78 ± 1.23	7.05 ± 1.47	1.27 ± 0.31	0.40 ± 0.03	Ascending
MHI12	3	5.17 ± 0.29	7.76 ± 0.37	5.17 ± 0.29	8.29 ± 0.11	3.12 ± 0.39	0.44 ± 0.02	Ascending
MHI13	77	5.36 ± 1.19	6.63 ± 0.85	4.79 ± 0.81	6.69 ± 0.82	1.90 ± 0.54	0.64 ± 0.11	Ascending
MHI14	3	5.86 ± 0.94	9.81 ± 0.28	5.67 ± 0.79	9.84 ± 0.24	4.17 ± 1.03	0.55 ± 0.04	Ascending
MHI15	100	7.71 ± 0.53	4.96 ± 0.49	4.75 ± 0.31	7.71 ± 0.53	2.96 ± 0.74	0.56 ± 0.14	Descending
MHI16	89	7.39 ± 1.34	6.48 ± 0.69	5.99 ± 0.85	7.50 ± 1.30	1.51 ± 0.66	0.55 ± 0.09	Descending
MHI17	13	5.97 ± 0.77	5.26 ± 0.83	5.12 ± 0.80	6.22 ± 0.65	1.10 ± 0.52	0.62 ± 0.12	Descending
MHI18	7	10.09 ± 0.81	4.59 ± 0.71	4.34 ± 0.44	10.09 ± 0.81	5.75 ± 0.92	0.35 ± 0.06	Descending
MHI19	10	7.08 ± 0.90	2.92 ± 1.90	2.79 ± 1.77	8.00 ± 0.61	5.21 ± 1.55	0.53 ± 0.10	Descending
MHI20	8	10.86 ± 0.52	3.43 ± 0.89	3.35 ± 0.90	11.02 ± 0.25	7.67 ± 1.00	0.58 ± 0.07	Descending
MHI21	13	7.23 ± 0.25	5.74 ± 0.80	5.61 ± 0.76	9.78 ± 0.26	4.16 ± 0.83	0.66 ± 0.05	Descending
MHI22	15	7.45 ± 0.65	7.36 ± 0.44	5.61 ± 0.60	7.65 ± 0.51	2.04 ± 0.89	0.18 ± 0.04	Concave
MHI23	7	9.43 ± 1.25	7.45 ± 1.12	4.98 ± 0.33	9.57 ± 1.19	4.59 ± 1.19	0.30 ± 0.07	Descending
MHI24	12	9.94 ± 0.54	6.54 ± 0.40	6.49 ± 0.33	9.95 ± 0.52	3.46 ± 0.64	0.54 ± 0.06	Descending
MHI25	37	7.63 ± 0.51	6.66 ± 0.78	5.57 ± 0.40	7.68 ± 0.57	2.10 ± 0.57	0.30 ± 0.09	Descending
MHI26	3	7.60 ± 0.33	6.54 ± 0.89	4.98 ± 0.05	7.63 ± 0.29	2.65 ± 0.30	0.75 ± 0.18	Descending
MHI27	8	5.77 ± 1.73	4.59 ± 0.69	4.22 ± 0.82	7.04 ± 0.16	2.83 ± 0.94	0.31 ± 0.08	Descending
MHI28	100	6.30 ± 0.45	6.51 ± 0.56	6.20 ± 0.44	6.61 ± 0.52	0.41 ± 0.15	0.55 ± 0.07	Tonal
MHI29	105	6.41 ± 0.41	6.98 ± 0.47	6.16 ± 0.38	7.00 ± 0.46	0.84 ± 0.32	0.34 ± 0.09	Tonal
MHI30	5	12.43 ± 0.45	12.84 ± 1.38	11.65 ± 0.92	13.10 ± 0.80	1.46 ± 0.17	0.27 ± 0.05	Tonal
MHI31	46	7.09 ± 0.63	6.91 ± 0.54	4.88 ± 0.62	7.44 ± 0.46	2.56 ± 0.82	0.56 ± 0.08	Concave/Tonal
MHI32	14	6.38 ± 0.84	8.24 ± 1.10	5.93 ± 0.75	8.28 ± 1.05	2.35 ± 0.80	0.48 ± 0.08	Ascending
MHI33	61	7.94 ± 0.74	8.67 ± 0.51	7.86 ± 0.65	8.81 ± 0.59	0.95 ± 0.35	0.52 ± 0.07	Ascending
MHI34	44	10.67 ± 0.91	12.99 ± 1.08	10.53 ± 0.75	13.05 ± 1.04	2.51 ± 1.14	0.10 ± 0.02	Sequence
MHI35	100	9.61 ± 1.33	11.25 ± 1.45	8.27 ± 1.20	11.26 ± 1.45	2.98 ± 1.21	0.07 ± 0.02	Sequence
MHI36	65	9.41 ± 2.64	8.83 ± 2.32	8.39 ± 2.48	9.52 ± 2.53	1.12 ± 0.50	0.10 ± 0.04	Sequence
MHI37	31	7.23 ± 0.43	7.85 ± 0.21	7.21 ± 0.39	8.18 ± 0.24	0.97 ± 0.44	0.09 ± 0.01	Sequence
MHI38a	100	7.79 ± 0.51	8.52 ± 0.28	7.72 ± 0.43	8.54 ± 0.28	0.82 ± 0.42	0.09 ± 0.03	Frequency jump
MHI38b	98	11.65 ± 0.56	12.35 ± 0.38	11.35 ± 0.46	12.37 ± 0.37	1.01 ± 0.52	0.10 ± 0.04	Frequency jump
MHI39a	100	7.64 ± 0.28	8.41 ± 0.19	7.63 ± 0.27	8.43 ± 0.18	0.80 ± 0.31	0.09 ± 0.03	Frequency jump
MHI39b	100	11.39 ± 0.30	12.40 ± 0.20	11.26 ± 0.28	12.44 ± 0.17	1.18 ± 0.26	0.41 ± 0.08	Frequency jump

MHI40a	46	7.94 ± 0.37	8.47 ± 0.20	7.88 ± 0.33	8.48 ± 0.19	0.61 ± 0.36	0.09 ± 0.03	Frequency jump
MHI40b	46	11.42 ± 0.47	12.84 ± 0.29	11.26 ± 0.38	12.84 ± 0.28	1.58 ± 0.43	0.27 ± 0.08	Frequency jump
MHI41a	4	6.43 ± 0.22	6.94 ± 0.23	6.17 ± 0.00	6.96 ± 0.19	0.79 ± 0.19	0.33 ± 0.05	Frequency jump
MHI41b	4	8.88 ± 0.13	11.94 ± 0.38	8.86 ± 0.12	11.94 ± 0.38	3.08 ± 0.48	0.35 ± 0.08	Frequency jump
MHI42a	25	6.90 ± 0.71	7.35 ± 0.76	6.63 ± 0.75	7.38 ± 0.74	0.75 ± 0.30	0.30 ± 0.10	Frequency jump
MHI42b	24	9.28 ± 1.19	9.76 ± 1.19	9.09 ± 0.97	9.83 ± 1.26	0.74 ± 0.57	0.09 ± 0.06	Frequency jump
MHI43a	5	6.85 ± 1.13	8.19 ± 1.01	6.85 ± 1.13	8.22 ± 0.96	1.36 ± 0.41	0.30 ± 0.10	Frequency jump
MHI43b	5	11.24 ± 1.44	11.09 ± 1.63	10.78 ± 1.41	11.26 ± 1.46	0.49 ± 0.08	0.08 ± 0.06	Frequency jump
MHI44a	14	7.48 ± 0.46	8.34 ± 0.24	7.44 ± 0.44	8.36 ± 0.20	0.92 ± 0.45	0.24 ± 0.06	Frequency jump
MHI44b	14	11.02 ± 0.39	12.47 ± 1.58	10.87 ± 0.36	12.57 ± 1.54	1.70 ± 1.47	0.36 ± 0.13	Frequency jump
MHI45a	18	7.42 ± 0.83	8.26 ± 0.58	7.29 ± 0.79	8.29 ± 0.56	1.00 ± 0.59	0.20 ± 0.06	Frequency jump
MHI45b	17	10.74 ± 0.83	12.59 ± 1.21	10.53 ± 0.78	12.62 ± 1.11	2.08 ± 0.74	0.40 ± 0.21	Frequency jump
MHI46a	11	7.55 ± 0.76	8.11 ± 0.75	7.31 ± 0.81	8.15 ± 0.72	0.84 ± 0.36	0.13 ± 0.04	Frequency jump
MHI46b	11	10.26 ± 0.87	11.21 ± 1.34	10.14 ± 0.82	11.21 ± 1.34	1.07 ± 0.61	0.15 ± 0.08	Frequency jump
MHI46c	11	13.61 ± 2.38	15.04 ± 2.28	13.58 ± 2.34	15.04 ± 2.28	1.46 ± 1.11	0.09 ± 0.05	Frequency jump
MHI47a	24	6.43 ± 0.71	7.02 ± 0.65	6.36 ± 0.72	7.04 ± 0.64	0.69 ± 0.40	0.29 ± 0.12	Frequency jump
MHI47b	23	9.00 ± 1.00	8.70 ± 0.95	8.63 ± 0.91	9.08 ± 1.00	0.45 ± 0.27	0.10 ± 0.09	Frequency jump
MHI47c	24	6.90 ± 0.65	6.69 ± 0.64	6.48 ± 0.64	7.04 ± 0.65	0.56 ± 0.26	0.14 ± 0.07	Frequency jump
MHI48a	12	5.56 ± 0.59	7.11 ± 0.32	5.56 ± 0.59	7.13 ± 0.30	1.57 ± 0.59	0.35 ± 0.09	Frequency jump
MHI48b	12	9.09 ± 0.60	8.98 ± 0.57	8.76 ± 0.56	9.22 ± 0.57	0.46 ± 0.24	0.12 ± 0.07	Frequency jump
MHI48c	12	7.09 ± 0.28	6.83 ± 0.60	6.68 ± 0.38	7.27 ± 0.43	0.59 ± 0.23	0.12 ± 0.08	Frequency jump
MHI49a	7	7.65 ± 1.77	7.70 ± 1.35	7.25 ± 1.43	7.97 ± 1.61	0.72 ± 0.36	0.20 ± 0.06	Frequency jump
MHI49b	7	9.77 ± 1.50	8.83 ± 1.14	8.79 ± 1.14	9.81 ± 1.47	1.03 ± 0.46	0.14 ± 0.08	Frequency jump
MHI49c	7	6.94 ± 1.32	5.62 ± 1.05	5.51 ± 0.94	7.06 ± 1.25	1.55 ± 1.07	0.15 ± 0.10	Frequency jump
MHI50a	10	7.69 ± 0.30	8.43 ± 0.23	7.66 ± 0.23	8.45 ± 0.22	0.79 ± 0.38	0.12 ± 0.04	Frequency jump
MHI50b	10	11.48 ± 0.26	12.29 ± 0.29	11.25 ± 0.20	12.29 ± 0.29	1.04 ± 0.43	0.24 ± 0.10	Frequency jump
MHI50c	10	15.39 ± 0.72	14.86 ± 0.52	14.82 ± 0.52	15.52 ± 0.68	0.70 ± 0.45	0.11 ± 0.07	Frequency jump
MHI50d	10	12.35 ± 0.29	12.43 ± 0.31	12.19 ± 0.17	12.57 ± 0.29	0.38 ± 0.21	0.11 ± 0.04	Frequency jump
MHI51	5	7.65 ± 0.41	7.22 ± 0.48	6.79 ± 0.29	7.65 ± 0.41	0.86 ± 0.17	0.42 ± 0.03	Descending
TOTAL	2456	8.15 ± 0.77	8.60 ± 0.86	7.22 ± 0.68	9.28 ± 0.80	2.06 ± 0.66	0.32 ± 0.07	

Table S2. Mean ± standard deviation for acoustic parameters extracted in ROCCA from all call types produced by MHI false killer whales. *N* includes number of calls traced.

Supplementary Table S3. Summary of results of negative binomial regression of predicting call rate related to average swim speed and dive state. Estimates are on the log scale; Incidence Rate Ratio (IRRs) are interpreted on the original scale. Significant effects ($p < 0.05$) are bolded for emphasis.

Predictor	Estimate	Std. Error	z value	p-value	IRR (95% CI)
(Intercept)	2.811	0.149	18.82	< 0.001	16.63 (12.40–22.30)
Speed average	-0.209	0.064	-3.26	0.001	0.81 (0.71–0.93)
DiveStates bin	0.062	0.034	1.83	0.067	1.06 (0.99–1.14)



Supplementary Figure S4. Autocorrelation function (ACF) plot of Pearson residuals from the fitted GLMM model predicted calling behavior as a function of dive state and time of day.

Supplementary Table S5. Summary of generalized linear mixed model (GLMM) results from the best model for effects of dive state on probability of calling. Individual animal is considered the smooth random effect variable. Estimates are on the logit scale. Predicted probabilities and 95% confidence intervals (CIs) were calculated from the model estimates.

Predictor	Estimate	SE	z-value	p-value	Odds Ratio (OR)	95% CI for OR
(Intercept)	0.4693	0.2854	1.644	0.1001	1.60	0.92 – 2.78
Evening	-3.7337	0.2686	-13.90	<0.001	0.024	0.014 – 0.042
Night	-6.4694	0.4007	-16.15	<0.001	0.0016	0.0007 – 0.0034
Dive State 1	0.8089	0.2917	2.773	0.0056	2.24	1.28 – 3.91
Dive State 2	0.7775	0.2599	2.991	0.0028	2.18	1.32 – 3.61
Dive State 3	1.4570	0.3449	4.225	<0.001	4.29	2.17 – 8.47
Dive State 5	1.1376	0.3546	3.208	0.0013	3.12	1.57 – 6.20