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Differentiating marine mammal clicks using time-series properties

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2015-2017 ESRF, BIO and MEOPAR



- 2015-2017, replaced in summer 2016.
- Recording cycle: 560 seconds @ 8 ksps, 43 seconds @ 375 ksps, 260 seconds sleep
- Red pins are 250 m or less
- Yellow pins are 2500 m or less
- 20 are funded by ESRF and JASCO.
- 5 are funded by DFO / BIO
- 1 is funded by MEOPAR / Dalhousie University
- 40 TB / year



Hypothesis: each species has a unique center frequency, frequency characteristic and inter-click-interval



- Beaked whales 'long' clicks that increase in frequency
- Dolphins short impulses, generally around 25-30 kHz. ICI helps distinguish types
- Sperm Whales lowest of all frequencies, largest of all odontocetes.
- Porpoise smallest of all odontocetes – highest frequencies (predators such as dolphins and killer whales have a hard time hearing them)



Click Characteristics Used



- Number of zero crossings down to -9 dB → duration
- Median time between zero crossings → center frequency
- Slope of time between zero crossings → frequency characteristic (separates beaked whales from delphinids)



DCL/DE 7 La Jolla 2015

Scotian Shelf P/R/F Scores

- Hilary Murphy-Moors, Clair Evers
- 424 files from Gully Data in 2012 OW, 2013 Summer, 2013 OW

Species	Number of manually analyzed files with detections	Classification Threshold (minimum calls per 2 minute file)	Ρ	R	F
Dolphin	261	2	1	0.3	0.68
NBW	125	21	0.72	0.71	0.72
`Sowerby's'	21	6	0.8	0.8	0.8
Sperm Whale	195	33	0.92	0.70	0.86

DCL/DE Training Data Set Confusion Matrix

Species	BB	Zc	Pm	Gg	Lo	UO	Unk	Clicks Detected
BB	22.3	1.9	0.0	5.9	1.0	2.8	67.1	80,601
Zc	0.8	29.6	0.0	19.4	1.0	5.7	43.5	258,701
Pm	1.5	0.2	25.0	5.9	2.0	8.0	57.3	990,478
Gg	0.7	1.9	0.4	24.8	7.5	22.4	42.3	804,143
Lo	0.7	0.5	0.7	8.3	6.6	39.7	43.7	905,151
UO	0.5	0.9	0.7	16.2	8.8	33.9	40.0	9,676,772

Computationally efficient 3-feature classifier. Very good separation of PRP, BB, Zc, Pm, OO, NBW, WW, NW and delphinids. Distinguishing delphinids more difficult but promising



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