Inter- and intra-analyst agreement in real-time passive acoustic monitoring: development and evaluation of analysis protocol for monitoring from autonomous platforms

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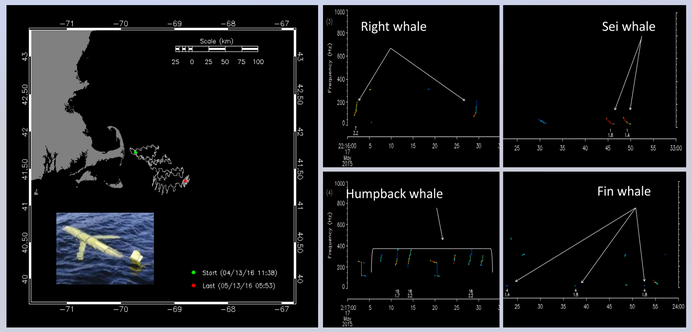
Introduction

- Objective: to use near real-time passive acoustic data from an autonomous glider to evaluate inter- and intra-analyst performance with a standardized protocol
- Slocum glider equipped with a Digital Acoustic Monitoring Instrument (DMON) and Low Frequency Detection and Classification System (LFDCS) was deployed in the Gulf of Maine during spring 2016.
- 4 target species: fin, sei, humpback, and North Atlantic right whales
- One expert and two novice analysts used the same protocol to determine when target species could be confidently assigned as “detected”, “possibly detected”, or “not detected”.

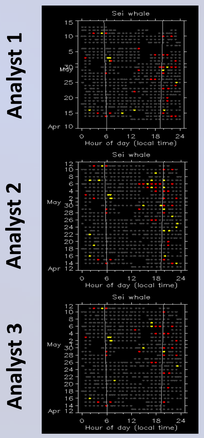
Methods

Step 1: Slocum glider equipped with DMON and deployed in the Great South Channel **;** pitch-track data relayed to shoreside analysts via Iridium satellite link.



Step 2: Novice (N=2) and experienced (N=1) analysts score data 2x each according to defined protocol

	Number of calls required for:		Context & pattern
	Detected	Possibly detected	
Right	3+, 1+ must be classified	1-2 classified or 3+ unclassified	If humpbacks present, assess for off-rhythm and/or different amplitude
Humpback	Many (5+)	Few (1-4)	DETECTED: Often many calls grouped together that are repeated POSSIBLY DETECTED: Some calls in repetition or no pattern
Sei	3+ classified singles 1+ classified within doublet/triplet	1-2 classified singles	If humpbacks present, exercise caution Doublet/triplet pattern
Fin	4+ calls in pattern (2+ must be classified as fin)	3 in pattern (2+ must be classified as fin)	Repeated with constant 7-14 s interval (do not count missing calls as part of pattern)



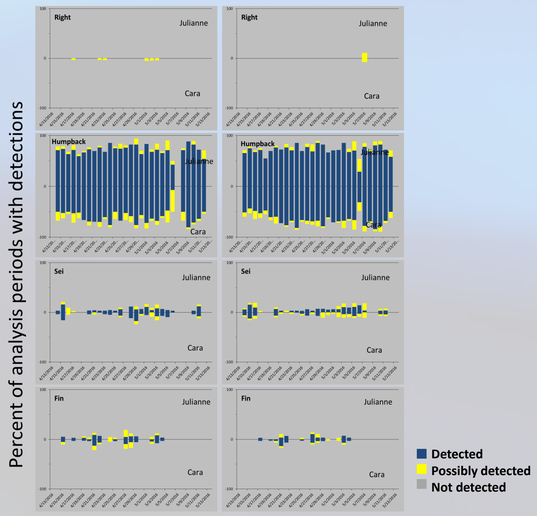
Step 3: Compare analyst-determined presence and absence of target species between and within analysts to determine agreement and disagreement.

- Not all analysts completed all time periods – only periods analyzed by BOTH analysts in a test were compared.
- Agreement = both analysts selected the same detection category; Disagreement meant the analysts selected opposite categories (Detected or Not Detected)

Results

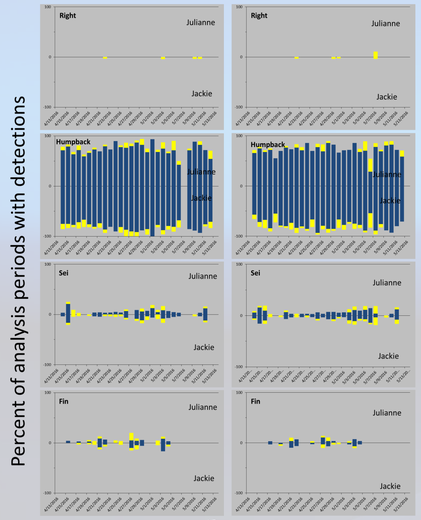
- Excellent agreement (<97%) for 3 species for inter- and intra- analyst comparisons
- Good agreement (< 80%) for humpbacks

Inter-analyst – Julianne & Cara



Julianne - Cara		1st Analysis		2nd Analysis	
		Agree	Disagree	Agree	Disagree
Julianne	**Right**	99.2	0.0	99.9	0.0
	Humpback	82.9	3.7	89.1	3.6
	Sei	97.7	1.4	95.8	1.0
	Fin	97.9	0.4	98.4	0.4

Inter-analyst – Julianne & Jackie



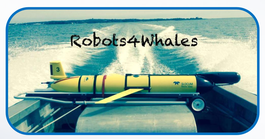
Julianne - Jackie		1st Analysis		2nd Analysis	
		Agree	Disagree	Agree	Disagree
Julianne	**Right**	99.4	0.0	99.4	0.0
	Humpback	84.0	5.8	85.2	4.0
	Sei	97.5	0.4	97.2	0.6
	Fin	97.9	0.6	98.3	0.2

Intra-analyst

Intra- analyst		Cara		Jackie		Julianne***	
		Agree	Disagree	Agree	Disagree	Agree	Disagree
Self	**Right**	99.1	0.0	99.2	0.0	100.0	0.0
	Humpback	87.1	1.4	90.6	1.5	93.6	0.5
	Sei	96.5	0.8	98.2	0.1	98.6	0.3
	Fin	98.4	0.1	97.8	0.1	98.4	0.3

Conclusions

- Use of analysis protocol by 2 novice and 1 expert analysts resulted in high agreement within and between observers
- Classification of humpback whale vocalizations is more subjective due to the variability of calls within and between years; however, agreement is still high within and between analysts
- Archival acoustic data can be incorporated after platform recovery to evaluate analyst performance against “truth” as observed in recorded audio
- Near real-time passive acoustic monitoring from autonomous platforms using the LFDCS and the analysis protocol combination is likely to result in accurate species presence estimates over daily time scales using even novice analysts



More Information

To view more data from this and related projects, please visit:
Robots 4 Whales (dcs.who.edu)
Navy Marine Species Monitoring Portal (http://www.navymarinespeciesmonitoring.us/)

US Navy MARINE SPECIES MONITORING

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