

Aerial sonobuoys: A tool for increasing detectability of the endangered North Pacific right whale (*Eubalaena japonica*) in the southeastern Bering Sea

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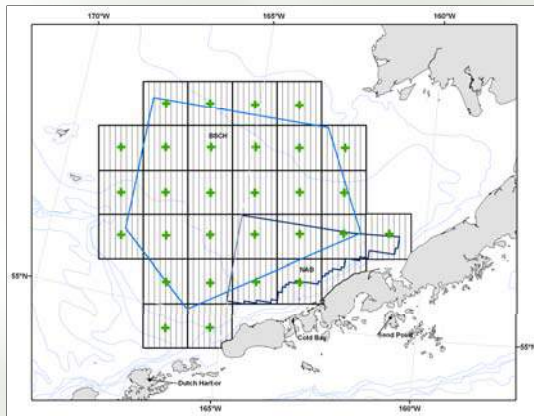
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The North Pacific right whale (*Eubalaena japonica*) was once abundant and widely distributed throughout the North Pacific Ocean. Recent estimates of abundance suggest the population is in the ten's. Little is known about the distribution, movements, migrations or habitat use of this population, but the limited existing data suggest that it now occupies a reduced range compared to historical times. In 2007, the National Marine Mammal Laboratory funded by the Minerals Management Service initiated a multi-year study of right whales and their habitat to facilitate development of future oil and gas-related mitigation in the North Aleutian Basin lease sales area and adjacent waters. In 2008, passive acoustic monitoring using sonobuoys deployed from the shipboard survey proved essential to right whale detections. After considering limitations encountered during the aerial survey that year (i.e. limited visibility and high sea states combined with minimal numbers of right whales), we incorporated sonobuoys into the survey design in 2009 providing a strategy that would maximize visual and acoustic coverage. From 14 July – 25 August, 2009, a total of 56 sonobuoys

(7 failures) were deployed from an Aero Commander 690A in conjunction with and in place of visual operations. Right whale gunshot and upsweep calls detected during in-flight observations of the sonobuoy deployments provided real-time information to both aerial and shipboard operations. Sonobuoy tracking software allowed for accurate localizations of vocalizing animals and led to visual confirmation on six out of nine days animals were sighted. On two of these days, animals were located in sea conditions greater than Beaufort 7, conditions typically impossible for visual detections of rare and elusive animals. Results from the 2009 survey demonstrated that the implementation of sonobuoys increased detections with decreased search effort. Increasing the amount of time both research platforms could dedicate to photo-identification, biopsy, and satellite tagging demonstrates the effectiveness of sonobuoys as a tool for species-directed flights. Other species acoustically detected during this study period were fin whales (*Balaenoptera physalus*) on a majority of deployments and the occasional humpback (*Megaptera novaeangliae*) call.

Survey Design



Light blue = Bering Sea Critical Habitat (BSCH), Dark blue= Lease Area (NAB), Green cross = sonobuoy deployment sites, Tracklines = black lines (5 nm spacing)



Sonobuoy deployment out the belly port. Photo credit: Jeff Foster



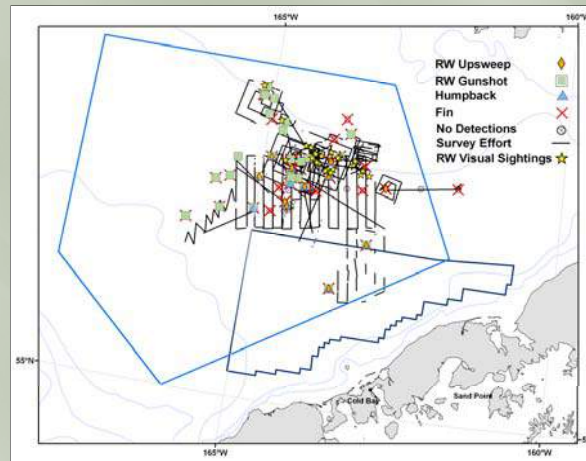
Sonobuoy exiting the aircraft. Photo credit: Any Kennedy



Successful sonobuoy deployment. Photo credit: Jeff Foster

Results

Acoustic and Visual Survey Effort for the 2009 Aerial Survey

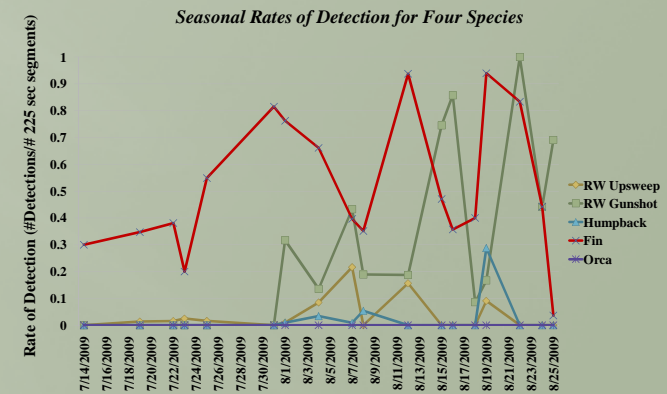


Survey Effort Comparisons Between 2008 and 2009

Year	Trackline Mileage (nm)	Survey Hours	Right Whale Sightings (Individuals)	Individual ID's	# of Days with Right Whales
2008	5821	148	10(12)	6	3
2009	2590	121	23(28)	7	9

Please see Rone et al. aerial survey poster for more information.

- ❖ In 2009, there was a reduction in search effort with an increase in time spent working NPRW's.



Summary of Right Whale Detections

Date	Deployment	Right Whale Acoustic Detection (%Gunshots Only)	Weather	Right Whale Visual Detection
7/31/2009	No	-	Beaufort 4; excellent visibility	Yes
8/1/2009	Yes	Yes	Beaufort 4; excellent visibility	Yes
8/4/2009	Yes	Yes	Beaufort 6; patchy fog	No
8/7/2009	Yes	Yes	Beaufort 7; patchy fog	Yes
8/8/2009	Yes	Yes	Beaufort 5; patchy fog	No
8/12/2009	Yes	Yes	Beaufort 7; patchy fog	No
8/14/2009	No	-	Beaufort 2-3; patchy fog	Yes
8/15/2009	Yes	Yes	Beaufort 1; excellent visibility	Yes
8/16/2009	Yes	Yes	Beaufort 6; patchy fog	No
8/18/2009	Yes	Yes	Beaufort 4-5; excellent visibility	No
8/19/2009	Yes	Yes	Beaufort 4-5; patchy fog	No
8/22/2009	Yes	Yes	Beaufort 5-6; patchy fog	Yes
8/23/2009	Yes	No	Beaufort 4-5; patchy fog	Yes
8/24/2009	Yes	Yes	Beaufort 2-3; excellent visibility	Yes
8/25/2009	Yes	Yes	Beaufort 7; patchy fog	Yes

* Only gunshots were used to localize on vocalizing animals.

- ❖ Right whales were visually detected without acoustic operations on 2 out of a total of 23 survey days.
- ❖ Right whale gunshots were detected on 12 survey days.
- ❖ Of the 12 survey days, 6 days resulted in visual detections.

Acknowledgements

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Acoustic Operations

- ❖ Sparton 53E and 77C with DiFAR (Directional Fixing and Ranging) to provide cross bearings of call locations.
- ❖ Deployments were conducted out the belly port at an altitude range of 600-1000ft at a speed of 110 knots.
- ❖ The aircraft conducted a survey to clear the area of marine mammals and ship traffic prior to deployment.



To maximize the limited space, two WINRADIO (Oakleigh, Australia) receivers, sound card, batteries, and the antennae splitter were secured onto a board designed to fit on the back of the starboard observer's seat.



The receivers and sound card were connected to the acoustic computer located on the desk directly behind the equipment. Sonobuoys were securely stowed behind the port observer's seat. (Photo credit: Jeff Foster)