STUDY TITLE: North Pacific Right Whales in the Southeastern Bering Sea: Distribution, Abundance and Habitat Use.

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INTERAGENCY AGREEMENT (IA) NUMBER: M07RG13267 (AKC 063)

SPONSORING OCS REGION: Alaska

FISCAL YEARS OF PROJECT FUNDING: FY2007 – FY2011

COMPLETION DATE OF REPORT: 5 JUNE 2012

CUMMULATIVE PROJECT COST: $3,950,000.00
FY07: $1,000,000
FY08: $1,200,000
FY09: $1,200,000
FY10: $550,000
FY11: $0

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KEY WORDS: North Pacific right whale, Southeastern Bering Sea

BACKGROUND[1]

The North Pacific right whale (NPRW) was heavily hunted between the 17th and the 20th centuries, when it ceased to be the principal target of commercial hunting. Protection was supposedly afforded by international treaties in the 1930s and 1940s, but the illegal capture of hundreds of individuals by the Soviet Union, primarily in the 1960s drastically impacted the recovery of the species. Currently, only a small remnant of this population (estimated at ~30 individuals) inhabits the southeastern Bering Sea (SEBS). There is an increasing body of evidence suggesting that the middle shelf domain constitutes the primary habitat of NPRWs in the SEBS during the summer. Despite substantial observation effort from various sources in some other areas, the only region in the Bering Sea where NPRWs have been consistently seen is the middle shelf. Occasional sightings and acoustic detections have been observed in other areas (e.g. near the Pribilof Islands), but these occurrences are rare. The reasons why NPRWs concentrate in the SEBS during the summer are not yet well understood and have primarily been related to the availability and likely high biomass of their main prey (calanoid copepods).

This study was intended to investigate distribution, movements and ecology of right whales in the SEBS, particularly with respect to planned oil and gas development activities in the North Aleutian Basin (NAB) area. Results from this study are consistent with the existing information on NPRW occurrence in the SEBS, and underscore the theory that whales spend extended periods of time in the region.

OBJECTIVES:

This work was prompted by the need for better data to assess the potential impact of oil and gas development in the NAB area. The IA study was a multi-year project which featured multi-disciplinary investigations of right whale occurrence, movements and feeding ecology. The overall goal of the IA study was to facilitate any development of future oil and gas-related mitigation by assessing the distribution,

[1]*References and details for information contained in this section can be reviewed in the corresponding Final Report.*

occurrence and habitat use of NPRW in the SEBS (NAB lease sale area and adjacent waters). The general objectives of the study were as follows:

- To assess distribution of NPRWs in the SEBS, with emphasis on the NPRW Critical Habitat and NAB area in the Bering Sea.
- To locate whales for tagging, behavioral observations and habitat studies using ship-based visual surveys and passive acoustic methodology.
- To deploy satellite transmitters to assess movements and distribution on the feeding grounds as well as to determine migratory routes and destinations in the North Pacific Ocean.
- To deploy long-term passive acoustic recorders to assess year-round presence and relative abundance of NPRWs in the SEBS.
- To collect photo-identification data and biopsy samples from individual whales to investigate population structure, improve estimates of abundance, determine sex, pollutant loads, diet and other studies.

DESCRIPTION:

A total of 13,605nm of combined aerial and shipboard effort were surveyed. Several species of large and small cetaceans were documented; humpback whales were the most prevalent species observed. Right, humpback, killer and fin whales were photographed for individual identification purposes. There were 79 sightings of 120 right whales. This number reflects the high resighting rate of individual right whales during the study as only 12 unique individuals were identified. In total, 4 right whales, 21 humpbacks and 5 fin whales (one duplicate) were biopsy sampled. There was a 50:50 ratio of males to females for the four right whale biopsy samples; only one sample was a new individual for the existing genetic catalog.

Four satellite tags were deployed in right whales in the SEBS. Transmitter average duration was 40 days (range = 30-58 days) and provided information on the distribution and movements of NPRWs during the months of July to October. Additionally, ten satellite transmitters were deployed in humpback whales during this study, of which 8 tags transmitted long enough to be considered for further study. Transmitter average duration was 28 days (range = 7-67 days).

From 2007 to 2011, a total of 988 sonobuoys (with an 80% success rate) were deployed from the vessel. Fin whales were the most common species heard, with a 40% detection rate, followed by right whales (32% and 15% detection rates for gunshot and upsweep calls, respectively), humpback whales (13%), and killer whales (6%). From July to August 2009, 54 sonobuoys (with an 87% success rate) were deployed from the aerial survey aircraft during 23 survey flights. Of these, 65% and 26% detected right whale gunshot and upsweep calls, respectively. The majority of both vessel and aerial sonobuoy deployments used DiFAR (Directional Frequency Analysis and Recording) sonobuoys to localize (and direct the ship/aircraft to) the calling right whales. Analysis was completed for 22 long-term passive acoustic recorders: 10 AURALs (Autonomous Underwater Recorder for Acoustic Listening, Multi-Électronique), 3 Haruphones, and 9 EARs (Ecological Acoustic Recorders, Oceanwide Science Institute). Spatial and temporal distribution of right whales and fin whales were determined. Right whale gunshot and upsweep calls were analyzed separately due to differences in frequency bandwidth.

SIGNIFICANT CONCLUSIONS:

- Twelve individual right whales were documented and photographed. Four were biopsied.
- The first abundance estimates for the NPRW were calculated using prior biopsy-based genotype results and current photo-ID mark-recapture data (Wade *et al.*, 2011). The current population estimate is approximately 30 animals; the eastern NPRW is considered the most critically endangered large whale population in the world for which an abundance estimate exists.
- Satellite transmitters were deployed in 4 individual right whales. This study provides the first description of fine-scale movements of NPRWs in their feeding grounds in the Bering Sea and indicates that movements were restricted to a relatively small region between 56°-58°N and 163°-167°W (= area of ~26,400 km^2).
- These data indicate that right whales do not venture into the inner shelf in the SEBS (waters shallower than 50m). It is still unclear why there is a marked preference for the middle shelf domain, but

[1] *References and details for information contained in this section can be reviewed in the corresponding Final Report.*

preliminary results suggest that this can be related to the presence of oceanographic features of importance to the right whale's prey.

- Although *Pseudocalanus* spp. was a dominant copepod in this area in both years, its small size likely made it secondary as a right whale prey item relative to the larger *Calanus marshallae* and *Calanus glacialis*. No diel vertical migration was observed for these larger copepods; instead, copepods tended to aggregate day or night at the bottom, in the pycnocline, or in the upper mixed layer.
- Focal follows conducted during the 2008-2010 field season of the PRIEST survey have confirmed that Bering Sea right whales make gunshot calls. Data from the long-term recorders have shown that this call type occurs more frequently than the upsweep call, which has been the call type used in past analyses.).
- Recorders deployed in 2009 detected a pulse of right whale calls in Umnak Pass and a consistent but low number of detections in Unimak Pass. If the assumption is made that right whales winter south of the Aleutians, the pulse may be indicative of right whales entering the Bering Sea via Umnak Pass in July, and that Unimak may be an additional pass used by right whales entering and leaving the Bering Sea. Further analysis on a larger sample size would be needed for confirmation; however, in 1964 a Soviet whaling scout vessel recorded 4 right whales transiting Unimak pass in the month of January.
- Analysis of sonobuoy recordings from the 2008-2011 summer field surveys revealed high site fidelity in the northeastern portion of the Critical Habitat. Long-term recorders have confirmed this fidelity and have extended the known seasonal presence of NPRWfrom July to January in the RWCH near the M2 mooring site.
- In all years, there was a decrease in both the percentage of time intervals with gunshot calls and a decrease in the correlation between gunshot and upsweep calling trends from south to north; this was observed on all long-term recorders. It seems likely that this may be due to an influx of bowhead whales into the areas surrounding M8 and M5 in the winter. Although bowhead and right whales have similar calls in their repertoires, this gunshot/upsweep correlation combined with the context of the calls and correlation with ice coverage maps might be used to discriminate between these two species.
- The timing of peak calling on the various long-term recorders may provide some insight into right whale movements in the Bering Sea. For example, 2010 data show a possible movement of the whale(s) from EA3 south to M2; a westward shift from EA1 to EA2 can be seen on the 2008 recorder data.
- This study demonstrated that 1) a small number of NPRWs can produce thousands of calls over tens of hours (~36,000 calls in 67 hours), 2) call rates vary by call type, 3) individual callers produce bouts of calls, and 4) patterns in individual calling behavior may facilitate inferences about call function.
- Current analyses have revealed multiple instances of repetitive stereotyped call patterning of the gunshot call by NPRW. This is the first documented examples of call patterning in the NPRW.
- Results demonstrate that incorporating acoustic sampling into aerial visual surveys provides an effective strategy for increasing detections of this critically endangered species.
- The first high- to low-latitude match of a NPRW between Hawaii and the Bering Sea was discovered during the creation of the NMML NPRW catalog. While this is not definitive proof of a yearly migration, it does show that at least some of the population undertakes longer migrations during some years.
- Eight humpback whales were tagged with PTT-only satellite transmitters near Unalaska Bay (~53°55'N, 166°32'W). This study provides evidence that while humpback whales aggregate in areas of predictable prey abundance (*e.g.* to the north of Unalaska/Unimak Islands), some individuals perform relatively long trips (including, in one case, to Russia), presumably to explore other potential feeding grounds.
- From analysis of the long-term passive acoustic recorders it is clear that fin whales spend substantial periods of time calling in the Bering Sea, especially in and around the RWCH, along the 50m isobaths, and through Unimak Pass. However, although there are these areas with higher call concentrations, comparison of the duration and timing of fin whale calling peaks among years suggests that fin whale movements within the Bering Sea are highly variable.

STUDY RESULTS:

Detailed results from this study are presented in the final report submitted to BOEM for this project.

STUDY PRODUCTS:

To date, over 30 oral and poster presentations on these results have been presented as part of scientific, government, international, co-management, and community information meetings. The full list of presentations is listed in the Final Report.

The following peer reviewed publications have resulted, in part or whole, from this work:

Ivashchenko, Y.V. and Clapham, P.J. 2012. Soviet catches of bowhead (*Balaena mysticetus*) and right whales (*Eubalaena japonica)* in the North Pacific and Okhotsk Sea. Endangered Species Research, *in press)*.

Kennedy, A. S., Salden, D. R. and Clapham, P. J. 2011. First high- to low-latitude match of an eastern North Pacific right whale (*Eubalaena japonica*). Marine Mammal Science. doi: 10.1111/j.1748-7692.2011.00539.x

Rone, B. K., Berchok, C. L, Crance, J. L., Clapham, P. J. 2012. Using air-deployed passive sonobuoys to detect and locate critically endangered North Pacific right whales. Marine Mammal Science, *in press*.

Wade, P., Kennedy A., LeDuc R., Barlow J., Carretta J., Shelden K., Perryman W., Pittman R., Robertson K., Rone B., Salinas J.C., Zerbini A., Brownell Jr R.L. and Clapham P.. 2011. The world's smallest whale population? *Biology Letters* 7: 83-85.