Entanglement Scar Acquisition Rates for Bowhead Whales From Interyear Photo-ID Matches

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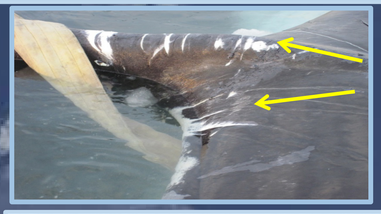
Background and Overview

We used interyear photo-recaptures of the same individuals to estimate the rate at which bowhead whales acquire entanglement scars. Bowhead whales (*Balaena mysticetus*) of the Bering-Chukchi-Beaufort Sea (BCBS) stock overwintering in the Bering Sea overlap spatially with commercial crab/fishing operations. George *et al*., (2017) found 12.2% of the landed whales carry entanglement injuries, mainly on large older animals. An analysis of aerial photos (n = 693) from the 2011 spring survey near Utqiaġvik, Alaska, indicated that 12.6% (n = 87) show evidence of entanglement scarring, closely matching the estimates for harvested whales (12.2%). The entanglement-mortality rate is unknown, but 10 whales have been found dead or severely entangled in pot gear over a 33 year period - 1983 to 2015. Results from this study are largely consistent with entanglement frequencies and age-related scar accumulation rates on harvested whales.

Methods

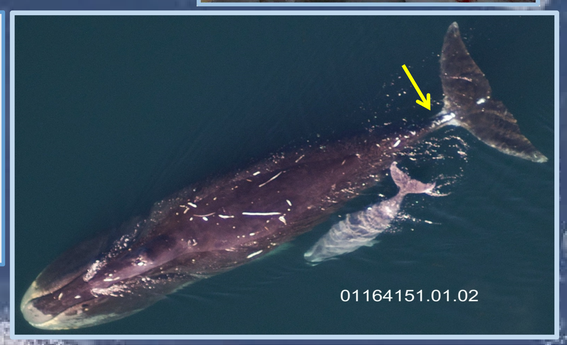
We assessed inter-year matches (n = 117) from a multi-year (1985, 1986, 2003, 2004, 2005, and 2011) mark-recapture study (Givens *et al*., 2017) for adequate photo quality of the caudal peduncle. To determine an entanglement rate, we examined the interyear matches with adequate photo quality (n = 68) and identified whales that had acquired entanglement injuries to the peduncle during the study period, i.e., between the first photo capture and subsequent recapture (photos right).

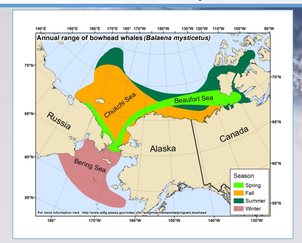
Aerial images of an inter-year match photographed in 1985 without entanglement scarring and observed in 2011 with acquired entanglement injuries.



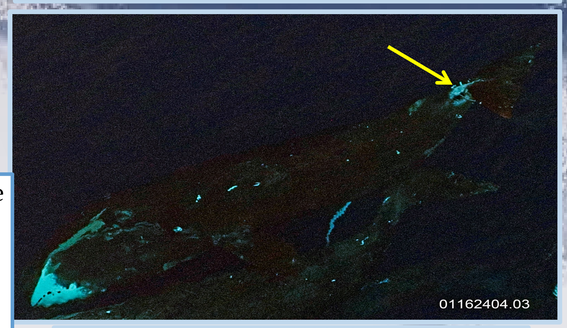
Entanglement Scarring—Harvested Whales: Rope injuries appear as permanent white scars against the bowhead's black skin. Most scars appear on the peduncle and leading edge of the flukes but have occurred on the mouth and pectoral fins.

Entanglement Scarring—Aerial Photos: caudal peduncle scars can be observed in aerial photos. The peduncle must be clearly visible in photos to be included in the scar accumulation analysis.

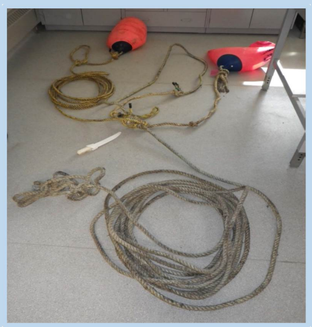




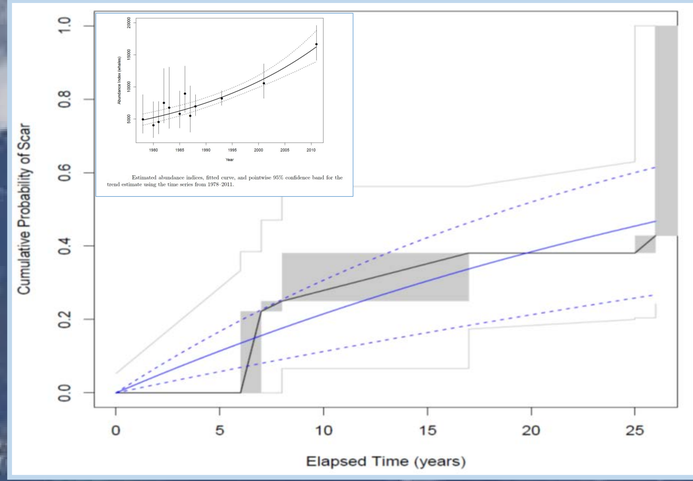
In 2011, two bowheads were photographed dragging gear. The rope is likely commercial crab or fishing gear.



Example of commercial fishing gear found on an entangled bowhead in the Bering Strait Region in 2015.



Severe injuries to the peduncle of a bowhead* harvested on 5 May 2017 at Utqiaġvik (Barrow). Crab line embedded ~10 cm beneath the skin. Peduncle had ~six line-wraps. Whale was in poor body condition.
*whaleID 17B6



(left) Plot of estimated cumulative probability of obtaining an entanglement scar over the elapsed number of years. Black and gray lines are the interval censored survival analysis: black line is estimated curve, faint gray lines are 95% confidence bands, gray shaded boxes are indeterminate regions due to data sampling 'granularity', and blue lines are the estimated curve (solid) and 95% CI (dotted) for the binomial analysis.

Results & Discussion

We estimated the probability of a bowhead acquiring an entanglement injury using two statistical methods: interval censored survival analysis and a simple binomial model. Both methods give similar results suggesting a 2.4% (1.2%, 3.6%) annual probability of acquiring a scar and that about 40% of adult whales will be scarred after ~25 years. These estimates agree with our other analysis where ~50% of large (~17 m) and presumably old, harvested whales carried entanglement scars. Further, we found that about 47% of the whales >50 years carried entanglement scars. The BCBS bowhead population is increasing at a relatively high rate (3.7% annually); however, the findings reported here together with examinations of harvested whales suggest that commercial fishing/crab gear entanglement is a larger concern for BCBS bowheads than previously thought. We recommend continued monitoring of entanglement injures both by aerial survey-photography and careful examinations of harvested whales.

Acknowledgements

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References

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Photo credits: NOAA , Marine Mammal Laboratory, Seattle, WA; LgL Limited, King City, Ontario, Canada; NSB Department of Wildlife Management, Box 69, Utqiagvik, Alaska 99723; Gay Sheffield, Alaska Sea Grant, University of Alaska Fairbanks, Pouch 400, Nome, Alaska 99762

Permits: Aerial surveys: NMFS Permits 782-1719 and 14245 issued to NMML. Examinations of harvested whales: NMFS Permits 814-1899-01,814-1899-02, 17350-00, and 17350-01 issued to North Slope Borough.