

LINE ENTANGLEMENTS, PREDATORY ORCAS, AND SHIP STRIKES ON WESTERN ARCTIC BOWHEAD WHALES

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INTRODUCTION

Studies of scarring on whales provide evidence of line entanglement, ship strikes, orca whale attacks, and other injuries. Once injured, the black epidermis [skin] of a bowhead whale (*Balaena mysticetus*) heals with a pure white coloration leaving what appears to be a permanent record of past physical encounters (Rugh et al. 1992).

Working collaboratively for over 30 years with Alaska Native whalers in the Beaufort, Chukchi, and Bering seas, biologists have conducted postmortem examinations on bowhead whales harvested for subsistence.

OBJECTIVES

1) Calculate baseline quantitative estimates of the likelihood of three distinct scar types observed on an examined harvested whale:

- Line entanglement
- Large vessel strike
- Orca predation attempts

2) Provide information on the human gear recovered from all bowhead whale carcasses (harvested and/or strandings).

METHODS

We identified 521 records of subsistence-harvested bowhead whales examined during 1990-2012 for distinct scar patterns. Logistic regression was used to evaluate different combinations of covariates to develop a prediction model for each response variable (Hosmer and Lemeshow 2000) using the “glm” function from the “stats” library in R (Crawley 2007; R Development Core Team 2009). Akaike’s Information Criterion (AIC) was used to rank competing models and to identify the “best” model for prediction (Burnham and Anderson 2002).

LINE ENTANGLEMENTS

Bowhead length vs. probability of line entanglement scars by sex

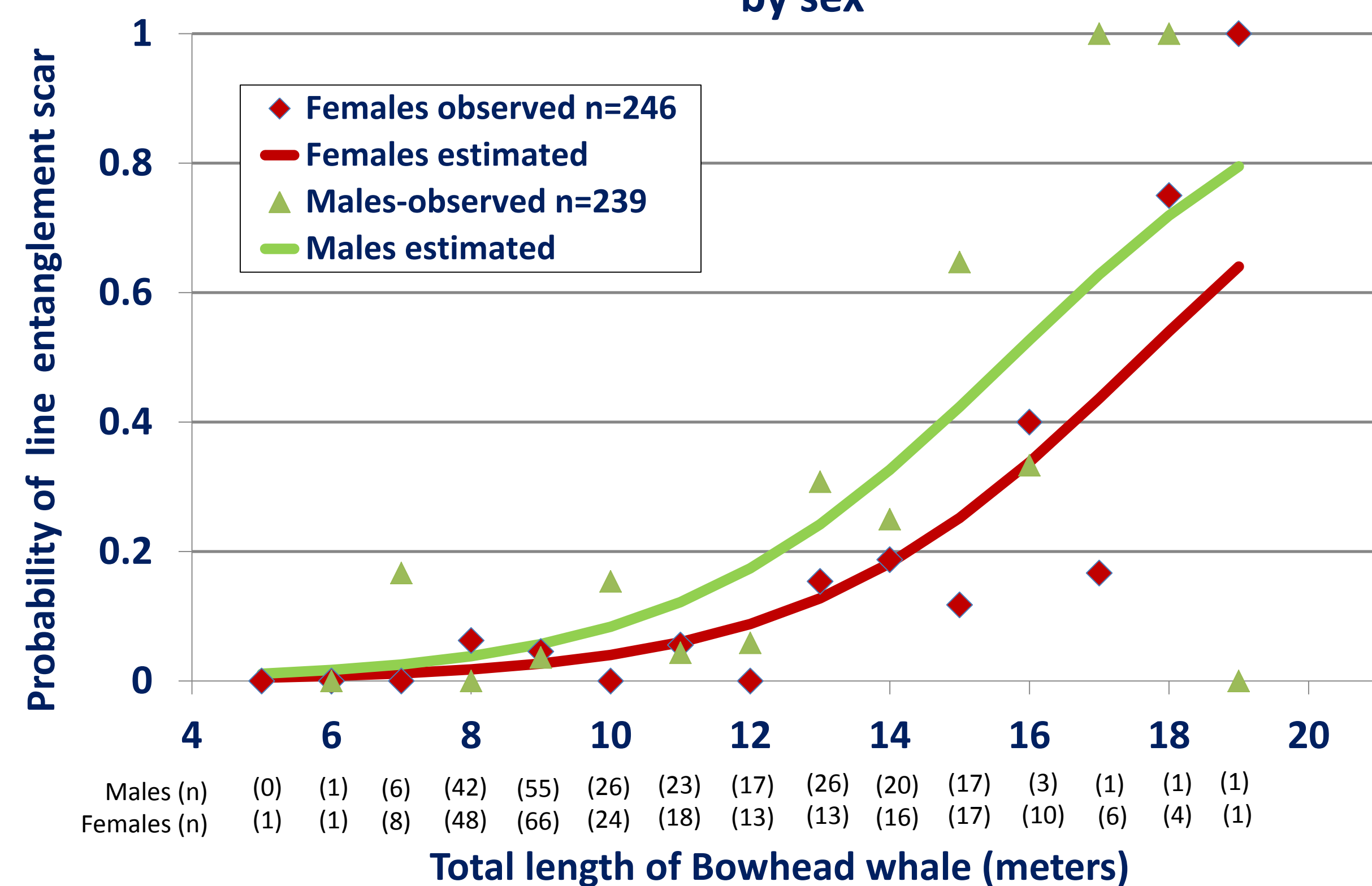


Figure 1. Estimated probabilities of encountering line entanglement scars by length and sex.

SHIP STRIKES



Bowhead length vs. probability of ship strike scars

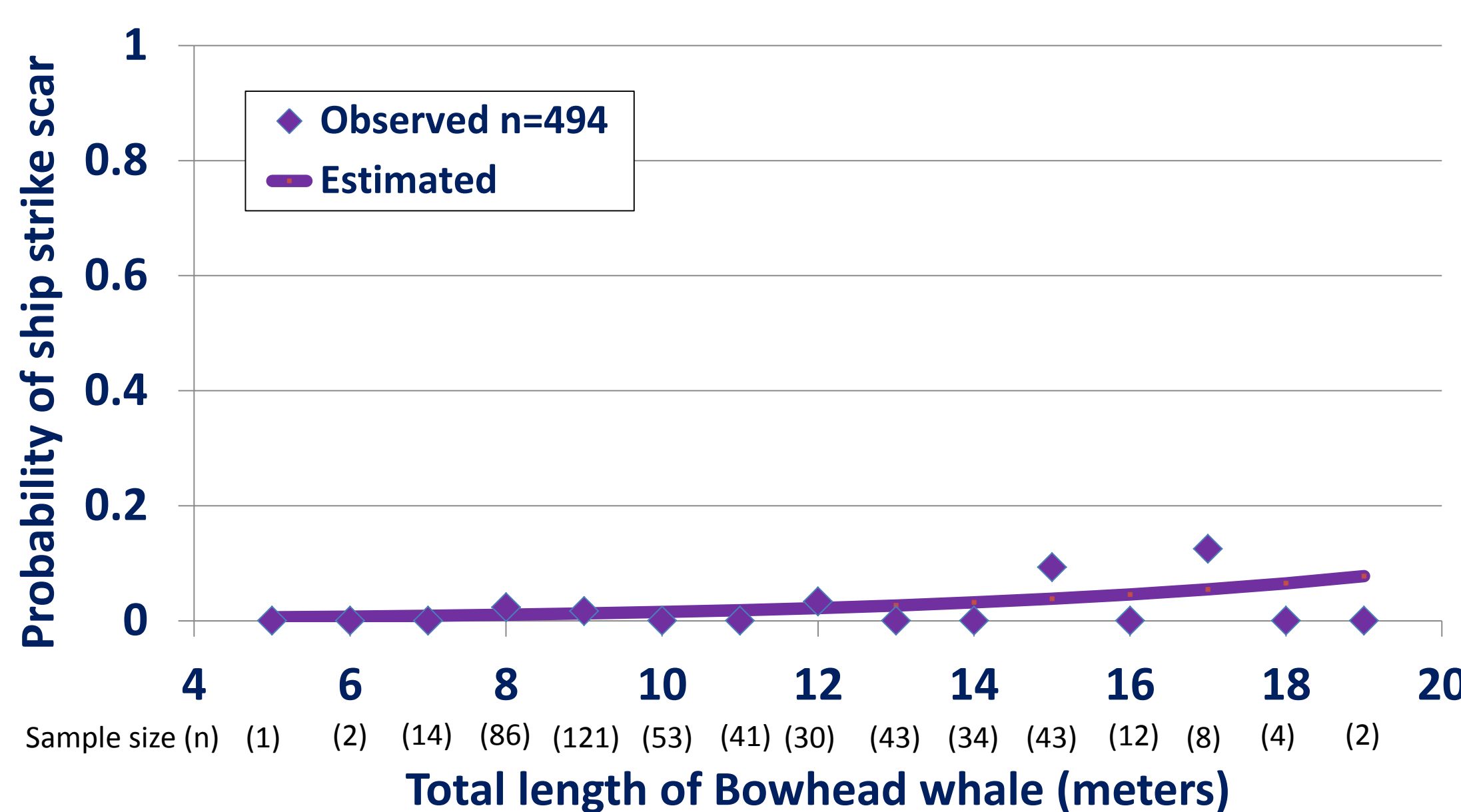


Figure 2. Estimated probabilities of encountering ship strikes scars by length.

PREDATORY ORCAS



Bowhead length vs. probability of orca scars during 1990-2001 and 2002-2012

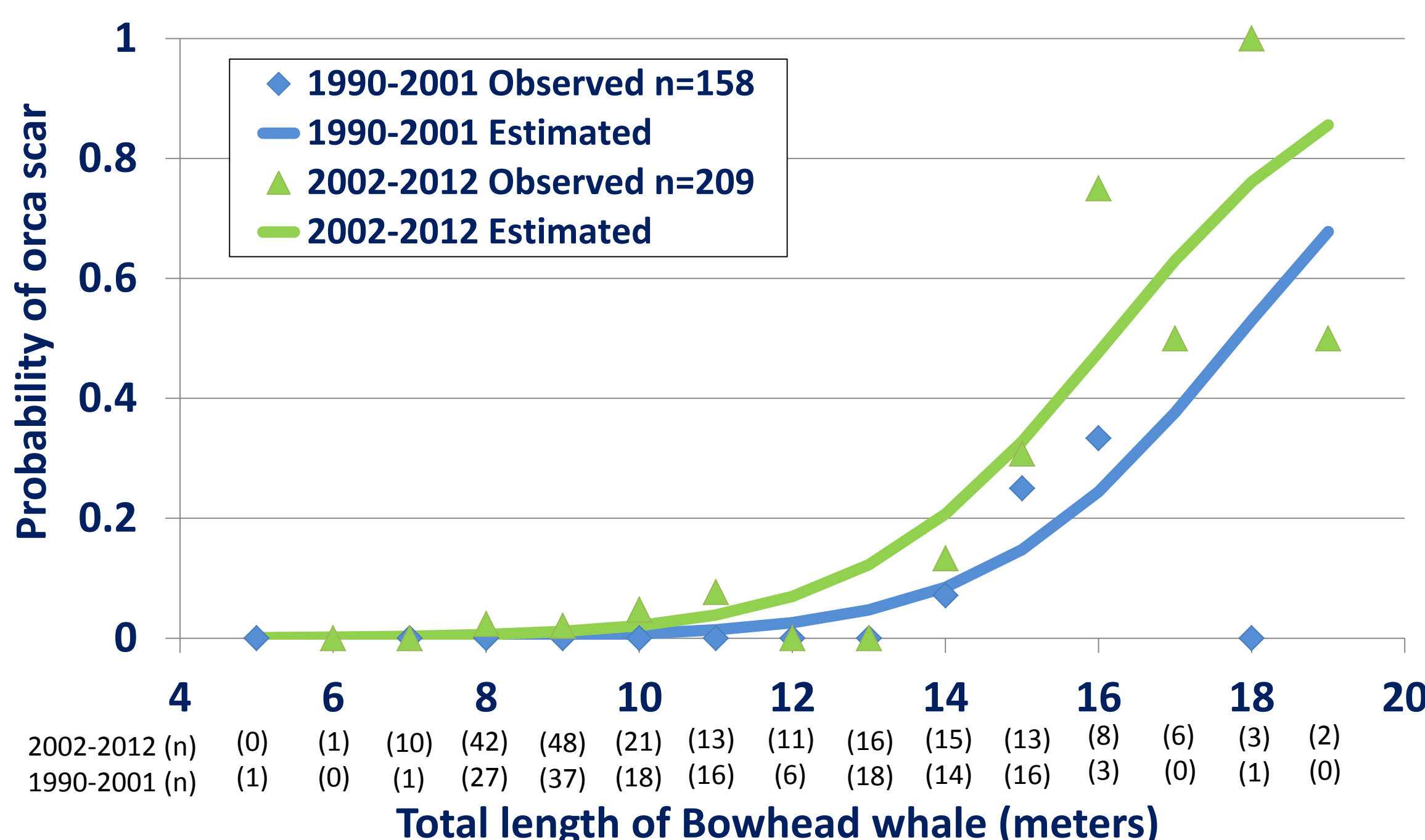


Figure 3. Estimated probabilities of encountering predatory orca scars by length during 1990-2001 and 2002-2012.

RESULTS

LINE ENTANGLEMENT

- At ~17m, 50% of landed whales show entanglement scars. Gender and size explained most of variation in the occurrence of line entanglement scars (Figure 1), with such scars rare on small whales.
- Males have higher rates of line entanglement scars.

SHIP STRIKES

- Occurrence of ship strike scars is low for bowhead whales (figure 2). Size may explain some of the difference in injury rate.

PREDATORY ORCAS

- Most bowheads over 17m show evidence of orca predation attempts, particularly in the last decade. Time period and size explained the observed variation in the occurrence of predatory orca scars (Figure 3).
- There was a higher probability of observing orca scars during 2002-2012 than in the previous decade. Reasons for this may include: better reporting, sampling bias, higher predation rates or some combination of these factors.

GEAR TYPE

- Of the 11 whales reported with line attached, 6 were stranded dead, 3 were seen swimming, and 2 were harvested for subsistence (Table 1). At least three events included confirmed commercial pot gear.

Table 1. Opportunistic data from live sightings, dead strandings, and harvested bowhead whales with information regarding types of line / gear in which they were entangled.

LOCATION	YEAR	TYPE	COMMENTS
Kaktovik	1983	Live	Whale swimming dragging a line (Reeves et al., 1983)
Wales	1987	Stranded - dead	Two lines attached to tail (Philo et al., 1993)
Gambell	1989	Stranded - dead	Rope wrapped around head and in mouth (Philo et al., 1992)
Barrow	1990	Harvested	Two ropes: one exiting mouth and one recovered in water (Philo et al., 1992)
Barrow	1993	Stranded - dead	Confirmed commercial pot line wrapped around flukes (NSB-DWM)
Red Dog Mine	1998	Stranded - dead	Line on whale (at NMFS). Note: a second entangled bowhead reported same area and year; verifying record
Barrow	1999	Harvested	Confirmed commercial pot line wrapped in mouth, flipper and tail (NSB-DWM)
Barrow	2001	Live	Whale dragging a substantial green line (Brower and Williams Jr. pers. comm)
Cinder River	2003	Stranded - dead	8 ropes (1/2-3/4" diameter) of different colors attached to tail (Public report)
Chukchi Sea	2010	Stranded - dead	Confirmed commercial pot gear recovered from mouth and tail (Sheffield 2010)
Chukchi Sea	2012	Live	Whale dragging a substantial yellow line (Mocklin pers. comm)

FUTURE WORK

Future work will concentrate on refining existing data records, statistics, and data gathering methodology. Educational materials on identifying and reporting scar types on bowhead whales will be distributed to whaling communities and biologists. We anticipate working with commercial fishing industry on awareness and potential solutions to the problem.

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