Age at First Calving of Female Humpback Whales in Southeastern Alaska

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Abstract. Female humpback whales in southeastern Alaska have never been observed with their first calf at ages 5 to 7 years, the documented age at first reproduction in the Gulf of Maine humpback whale population. Long-term sighting histories of 10 individually identified females of known age in southeastern Alaska were used to address this issue. These females were sighted with their first calf at ages 8-16 (mean 11.8) years, significantly older than observed in the Gulf of Maine where 5.91 years is the mean age at first calving. We summarize potential sources of bias and other factors that likely contributed to the difference in age at first calving. Despite their limitations, these are the only available data to assess the age at first calving in North Pacific humpback whales.

Introduction

In the Gulf of Maine, the long-term sighting histories of individually identified female humpback whales first observed as calves and documented every year afterward have been used to determine an age at first calving of 5 to 7 years (Clapham, 1992). The Gulf of Maine results corroborated findings made by whaling biologists who examined the reproductive tracts of whales killed commercially off Australia in the mid-20th century (Chittleborough, 1958). Age 5 has been generally accepted as the average age at first calving for all humpback whale populations although ambiguity in the age determination method used in the Australian studies has cast some doubt on the reliability of that estimate (Best, 2006). Using Clapham's (1992) results from the Gulf of Maine as a basis of comparison, we investigated whether female humpback whales in southeastern Alaska show a similar reproductive pattern.

The annual National Park Service humpback whale population monitoring efforts in Glacier Bay are uniquely suited for documenting the life history parameters of this endangered population because the intensive sampling effort results in unbroken annual sighting histories of many individual whales. Thus, the data described here are the only data suitable for determining the age at first reproduction for humpback whale mothers in the North Pacific Ocean.

Methods

National Park Service biologists have documented the humpback whale population during daily summer surveys of the Glacier Bay—Icy Strait area since 1985. Each whale's flukes have a distinct, stable black and white pigment pattern that allows for individual identification (Jurasz and Palmer, 1981). We used photographs of flukes (fig. 1) to track the life histories of individual whales.

Figure 1. Stable markings on the ventral tail flukes of humpback whales, like this one photographed in Glacier Bay, Alaska, allow individuals to be identified over many years.

We identified each mother by her close, consistent affiliation with a much smaller whale that was presumed to be her calf. Along with their small size, calves have other diagnostic features, like the mottled gray appearance of their dorsal fin area and the grayish fluke coloration. Using sighting histories of females first sighted as a calf and seen nearly every year afterward we determined the age at which females had their first calf. A collaborative catalog of humpback whale fluke photographs (Straley and Gabriele, 1997) allowed us to combine the Glacier Bay sightings with sighting data resulting from studies elsewhere in southeastern Alaska.

Results

A total of 20 females of known age were observed with a calf in southeastern Alaska. Ten of these females had sighting histories that were sufficiently complete to allow some degree of certainty about their age at first calving (table 1). The remaining ten known-age mothers had sighting histories that were too intermittent to include them in the current analysis. The age distribution of mothers observed with their first calf in

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Table 1. Sighting histories of known-age females observed with a calf during the study.

[Cells coded with C indicate sightings of the female as a calf in her first year of life, J indicates juvenile less than 5 years of age, A denotes an adult greater than 5 years old, M indicates that the female was a mother accompanied by a calf. An M in bold type indicates the first observed calving for that female. Blank boxes indicate that the female was not sighted during that year. The observed age at first calving is the age at which the female was first seen as a mother. The minimum age at first calving assumes that the female had a calf in the earliest year in which there is a gap in her sighting history after age 5]

Whale	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Obs. Age at First Calving	Min. Age at First Calving
353	C			J	J	A	A	A	**M**	A	M	A	A	M	A	A	A	M		A	M	8	8
1042				C			J	J	A		A	A	A	A	A	A	**M**	A	A	M	A	13	6
1046				C			J			A	A		A	A	A	A	A	A	A	**M**	A	16	5
1019					C					A	A	A	A	A		A	A	A	**M**	A	A	14	10
1031					C			J		A		A	A	A	**M**	A	A	A	M	A	A	10	6
1014						C		J	J	J	A	A	A	A	A	A	A	**M**	A	A	M	12	12
1298									C					A	A	A	A	A	A	A	**M**	12	12
1302									C		J	J	J		A	A	A	A	A		**M**	12	5
1304									C	J	J	J	J	A		A	A	A	A	A	**M**	12	6
1079										C		J	J	J	A	A	A	A	**M**	A	M	9	9

southeastern Alaska was 8 to 16 years, as compared to 5 to 7 years for the 12 females in the Gulf of Maine study (Clapham, 1992). The mean age for first time mothers was 11.8 years in southeastern Alaska and 5.9 years in the Gulf of Maine. Using a Welch's ANOVA because the variances of the samples are unequal, we determined that the difference in age is statistically significant (F=57.3, df=11, p=0.0001). Due to the small sample sizes in both studies, the coefficients of variation (CV) of the mean age at first calving range from 0.28 to 0.32.

Because six of the southeastern Alaska females were missing in one or two years during which they were older than age 5 (table 1), they presumably could have had a calf in those years. To address this weakness in the data, we assumed that these females had a calf in their earliest missing year and termed it the 'minimum age at first calving'. Repeating the statistical comparison, we determined that the statistical significance remained, (F=5.6, df=11, p=0.04) although the mean 'minimum' age at first calving for southeastern Alaska was reduced to age 8.0 years.

However, we believe that the 'minimum' age at first calving is not the true calving age, based on the deviation of these females' presumed calving intervals from what has been documented in humpback whales in Alaska. Mature female humpbacks in Alaska typically give birth every 2 to 3 years, with a documented range of 1 to 6 years (Baker and others, 1987; Straley and others, 2001), whereas the acceptance of the 'minimum age at first calving' results in a predominance of 6, 7, and 8 year calving intervals for the six females, a significantly different distribution (F=27.4, df=1, p=0.003). Based on this difference, and the lack of evidence that young females would have longer birth intervals, we reject the assumption that most or all six females with incomplete sighting histories (table 1) had a calf in their missing year. Therefore we believe that the age at first calving estimated from the entire sample is likely to be the most accurate. We identified and assessed several potential sources of bias, all of which would cause us to over-estimate the age at first calving and concluded that it is unlikely that they substantially affected the estimated age at first calving.

Discussion and Conclusions

Based on the observed ages at first calving and our assessment of potential sources of bias, we conclude that first-time humpback whale mothers in southeastern Alaska are 11.8 years old on average, twice the average age of first time mothers in the Gulf of Maine. We believe that our findings would apply to southeastern Alaska as a whole because the observed calving ages of ten additional known-age mothers mainly from outside the Glacier Bay study area

with non-continuous sighting histories (that were therefore not included in the present analysis) were consistent with our findings in Glacier Bay and Icy Strait. We suggest four main factors that may account for the differences between the age at first calving in the southeastern Alaska and Gulf of Maine humpback whale populations: (1) the length of each study, (2) prey availability, (3) migration length, and (4) whaling history. Weighing the influence of each of these factors is essential but beyond the scope of this paper. Additional observations of known-age mothers will provide a needed increase in sample size and help solidify the current findings.

Management Implications

Knowledge of the reproductive parameters of endangered populations is essential for predicting population dynamics and recovery (Brandao and others, 2000) and for determining allowable levels of incidental take in commercial fisheries (Angliss and Lodge, 2004). Accurate prediction of population trajectories is especially important for endangered populations because inaccuracies could mislead managers into incorrect assessments regarding population recovery. This study highlights the importance of basing management actions on current life history information about the population that is being assessed, despite the rarity of data on large whale life history traits. While we can only guess at the forces that generated the 11.8 year mean age at first calving and cause it to persist, documenting the variability in this parameter is an important first step.

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Frontal boundary between fresh, silt-laden glacial waters (gray, background) and more saline inlet waters (green, foreground) in front of Lamplugh Glacier. (Photograph by Marc Romano, U.S. Geological Survey.)