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INTERNATIONAL WHALING COMMISSION

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ABSTRACT

In 2017, 57 bowhead whales (*Balaena mysticetus*) were struck during the Alaskan subsistence hunt resulting in 50 animals landed. The total number of whales landed in 2017 was higher than the average for the previous 10 years (2007-2016: mean of landed =41.7; *SD* =6.7) while the average number struck was similar (2007-2016: mean struck =55.9; SD =10.1). The efficiency (# landed / # struck) of the hunt (88%) was also higher than the average over the past 10 years (mean of efficiency = 75.2%; *SD* =6.5%) and was one of the highest ever recorded. Total mortality was estimated at 55 animals after the fate of the struck and lost whales was considered. Spring hunts are logistically more difficult than autumn hunts because of challenging and dynamic environmental conditions, difficulty in accessing open water, and changing sea ice thickness and dynamics. The hunting efficiency during spring is usually lower than autumn, which was the case in 2017. In 2017, the efficiency of the spring hunt was lower (81%) than the autumn hunt (100%). Of the seven whales struck and lost during the spring, three were lost under the sea ice, a fourth whale sank, and harpoons pulled out of two animals. No whales were struck and lost during the autumn hunt. Of the harvested whales, 28 were females and 22 were males. Based on total length (>13.4 m in length), 13 of the females were presumed mature. Six of the mature females were examined. Of those, two were pregnant, one with a mid- and another with a term fetus, and one female was lactating.

KEYWORDS: ARCTIC; *BALAENA MYSTICETUS*; BOWHEAD WHALE; STATISTICS; WHALING-ABORIGINAL

INTRODUCTION

The subsistence harvest of bowhead whales (*Balaena mysticetus*) provides important nutritional and cultural needs for many Native communities in northern and western Alaska (United States) and eastern Chukotka (Russian Federation). The Alaska Eskimo Whaling Commission (AEWC), comprised of 11 communities, locally manages the Alaskan harvest through an agreement with the U.S. National Oceanic and Atmospheric Administration (NOAA). The level of allowable harvest is determined under a quota system in compliance with the International Whaling Commission (IWC, 1980; Gambell, 1982). The quota is based on the nutritional and cultural needs of Alaskan Natives as well as on estimates of the size and growth of the Bering-Chukchi-Beaufort seas stock of bowhead whales (Donovan, 1982; Braund, 1992). Whales were harvested in 2017 under a six-year block quota that began in 2013 (IWC, 2013).

The subsistence hunt typically occurs during spring and autumn as whales migrate between the Bering and Beaufort seas. Hunters on Saint Lawrence Island, in the northern Bering Sea, may harvest whales during the winter (e.g., December and January) as well. Bowhead harvests are subjected to considerable environmental interference from weather (wind speed and direction, fog, and temperature), stability of

landfast ice, and sea ice concentration, type, and dynamics. The success of each hunt is greatly affected by these factors and shows considerable annual and regional variation.

Since 1981, the North Slope Borough Department of Wildlife Management (NSB DWM) has gathered basic data on landed whales in several communities and assists the AEWC with compilation of statistics on landed and struck and lost whales (Albert, 1988). In 2017, the NSB gathered detailed information and tissue samples on whales landed at Barrow and Cross Island (the hunting location for Nuiqsut hunters) and with the assistance from the Alaska Sea Grant, we also collected detailed information and tissue samples from most of the whales landed at Kaktovik, as well as Gambell and Savoonga on Saint Lawrence Island. The objectives of this paper are to document: (1) the number, location (village), and dates of landed and struck-and-lost bowhead whales during 2017 in Alaska, (2) the estimated fate of struck and lost bowhead whales, (3) basic morphometric data and the sex composition of the harvest, (4) hunting efficiency, and (5) relevant additional environmental observations on hunting conditions. Additional relevant information on bowhead whale health (e.g., unusual findings, found dead whales etc.) will be summarized in the 2017 Bowhead whale health report (see George *et al.*, 2018).

METHODS

Data on sex, standard length, harvest and landed dates, as well as the fate of struck and lost whales for all whaling villages were obtained from the AEWC. Biologists recorded similar information for many of the whales taken at Barrow, Gambell, Kaktovik, Nuiqsut, and Savoonga during 2017. Biologists also collected tissue samples, detailed morphometric data, and documented evidence from scarring of previous non-lethal human interactions (i.e., ship strikes or line entanglements) and killer whale attacks.

We estimated the approximate animal age and reproductive status based on several published criteria. Females with a total body length greater than 13.4 m were considered to be sexually mature; however, females shorter than that have been pregnant, and females greater in length have been immature (George *et al*., 2004). A new on-going analysis may suggest a slightly different length at sexual maturity for females but that analysis had not been finalized at the time of this summary. Historically, we used 14.2 m as the best estimate of length at sexual maturity for females (Tarpley and Hillmann, 1999). Males with a total body length greater than 13 m are considered to be sexually mature (O'Hara *et al*., 2002).

RESULTS AND DISCUSSION

During 2017, 57 whales were struck, and of those, 50 were landed during the Alaskan subsistence hunt. The total number of whales landed was higher than the average for the previous 10 years (2007-2016: mean of landed =41.7; *SD* =6.7) while the average number struck was similar (2007-2016: mean struck=55.9; SD =10.1).

Winter Hunting

The timing, extent, and quality of sea ice formation and presence in the northern Bering Sea has changed dramatically. Sea ice now forms later in the autumn, there is less sea ice coverage, and it is of thinner, weaker quality. In the late 1990s, Savoonga and Gambell began to more regularly harvest bowheads in December and January (Suydam and George, 2012; Noongwook *et al.*, 2007). In 2017, Savoonga landed a whale on 9 January, in unprecedented ice-free conditions reflecting the presence of open water and accessible whales.

Spring Hunting Success and Conditions

Twenty-nine bowheads were landed during the spring (Table 1). Hunting conditions during much of spring 2017 were challenging in the northern Bering Sea due to a rapid reduction in sea ice coverage, sea ice quality, and windy conditions. Conditions were very good in the southern and central Chukchi Sea, and difficult in the northern Chukchi Sea. Regardless, most of the villages that are typically successful in the spring were able to land whales in 2017.

Gambell and Savoonga, on Saint Lawrence Island in the northern Bering Sea, landed three whales during spring. Gambell landed one whale in late March and another in mid-April while Savoonga landed a whale

in early April. The environmental conditions were atypical primarily because there was less ice. Regardless of the challenges associated with less ice, Gambell and Savoonga were able to land approximately the same number of whales as is typical (i.e., about two whales per year; Suydam and George, 2012). Sea ice, weather conditions, and logistical constraints prevented hunters from striking a whale at Little Diomede, Wales, and Kivalina.

Point Hope had a very successful spring hunting season. They landed 10 whales between 7 April and 11 May. Point Lay landed one whale in late April. Wainwright landed seven whales during the last 10 days of April and first week of May. Hunting conditions for Point Hope, Point Lay, and Wainwright were generally good during the spring.

Wainwright struck and lost a whale on 30 April and that animal initially survived but was caught several days later at Barrow (Utqiaġvik) on 4 May – to our knowledge this has not happened before in the last 40 years. Including this whale, Barrow landed eight whales from 13 April to mid-May. The bowhead landed on 13 April is the earliest landed whale for Barrow that we have recorded (Suydam and George 2012). The ice was more fractured and "jumbled" than is typical, reducing its "trafficability" (Dammann *et al.*, 2017), and it was very difficult for Barrow hunters to access the open water. All of the whales landed during the spring at Barrow were pulled onto the ice and butchered at one location; more typically there are several areas suitable for pulling a whale onto the ice. This highlights how unusual and difficult ice conditions were for the 2017 spring hunt at Barrow and is an indication of how the ice is changing as the Arctic warms. Several crews remained on the ice hunting whales until early to mid-June because of a relatively cool May that contributed to the slow deterioration of the ice.

Autumn Hunting Conditions

Twenty whales were struck and landed by three villages during the autumn (Barrow, Kaktovik, and Nuiqsut; Table 1). Three whales were landed at Kaktovik during the first two weeks of September. Hunting conditions were generally good and whales were present near the village. Nuiqsut landed four whales at Cross Island during the first week of September. There were a large number of bowheads in the central Beaufort Sea at that time. The presence of many whales and good weather conditions allowed Nuiqsut to land whales during a relatively short period of time.

At Barrow, 13 bowheads were landed between 1 and 11 October. The whale hunt opened on 29 September but due to bad weather hunters did not take the first whale until 1 October.

Struck and Lost and Hunting Efficiency

Of the seven whales struck and lost in 2017, two whales had a fair chance of survival, two had a poor chance of survival, and three died. The estimates of survival are primarily based on the Captain's assessment and our assessment of the Captain's description of the circumstances of the struck and lost whale (Table 2 and 3). Based on the number of landed whales and the assessment of survival, the total hunting mortality for 2017 was 55 whales (i.e., 50 landed, plus five whales that were struck and lost, which died [n=3] or had a poor [n=2] chance of survival; see criteria in Suydam *et al.*, 1995).

The overall efficiency of the hunt (#landed/#struck) in 2017 was 88%, which is higher than the average efficiency over the past 10 years (2007-2016: mean of efficiency = 75.2%; *SD* =6.5%). Since the mid-1970s, the efficiency of the harvest increased steadily until about the mid-1990s when it stabilized around 75 to 80%. That increase was due to many factors, including enhanced communication (i.e., improved marine radio capabilities) among hunting crews, education/training of younger hunters, and improved weaponry (Suydam and George, 2012). However, efficiency can vary substantially from year to year, primarily due to environmental conditions. For example, 2010 had a relatively low efficiency of 63% (Suydam *et al.*, 2011) while 1999 had a high efficiency of 89% (George *et al.*, 2000).

The success of the spring hunt is quite sensitive to variable environmental conditions (George *et al.*, 2003). As such, efficiency varies between seasons and among years. The efficiency of the spring harvest is on average lower than the autumn harvest due to more demanding ice and weather conditions. Additionally, during spring whaling, some struck whales were able to escape pursuit by swimming under the sea ice. That was the case in 2017. The efficiency of the spring hunt was 81% and the autumn hunt was 100%. Of

the seven struck and lost whales during the spring, three were lost under the sea ice, a fourth whale sank, and the harpoon pulled out for another three animals.

No whales were struck and lost during the autumn hunt. Autumn hunts typically occur in more open water conditions, thus sea ice is less of an influence on success. However, high wind speeds with the larger fetch of the open water period in the autumn can make hunting opportunities extremely difficult (George *et al.*, 2003). As climate change causes a larger and longer open water period, the corresponding increased fetch contributes to larger swells that persist even after strong winds abate. The overall hunting period has increased in recent years due to sea ice reduction and retreat, which possibly offsets inclement weather that results in poor hunting conditions and success. Hunters at Barrow in particular have responded to the changing hunting conditions by purchasing larger boats (~8-9 m long) capable of handling larger seas.

Sex and Maturity
Twenty-two (44%) of the landed whales were males. The longest male was 15.9 m and the shortest was 8.4 m. Based on a length of >13 m (O'Hara *et al*., 2002), five males were presumably sexually mature, and one other was near maturity (12.7 m; see Table 1).

Twenty-eight (56%) of the landed whales were females. The longest female was 17.6 m and the shortest was 8.0 m. Based on a length >13.4 m (George *et al*., 2004), 13 of the females were sexually mature. Six of those were examined for pregnancy. Two were pregnant, one with a mid- and another with a term fetus (2.1 to 3.0 m long), and one female was lactating. The percent pregnant during 2017 was similar to the long-term average of 33% (George *et al.*, 2004; George *et al.*, 2011).

The point estimate we use for the length of maturity for females is 13.4 m; however, we know some animals have become mature at shorter or longer lengths. For example, a 12.6 m female landed at Barrow in spring 2016 was pregnant and the longest immature female that we have examined was 14.4 m (George *et al.*, 2004; NSB unpublished data).

High variation in annual bowhead calf production is well established (Koski *et al.*, 2008; Clarke *et al.*, 2014). However, bowheads had high pregnancy rates in 2015 (Suydam *et al.*, 2016), 2016 (Suydam *et al.*, 2017) and again in 2017 (this paper). Aerial surveys in the summer and autumn (Aerial Surveys for Arctic Marine Mammals, conducted by the U.S. National Marine Fisheries Service with funding from the U.S. Bureau of Ocean Energy Management) in the Alaskan Beaufort Sea provide information about calf production. During 2016, the surveys documented 104 bowhead calves (J. Clarke, personal communication) and during 2017, 155 bowhead calves were observed, a record high number. These numbers were not corrected for bowhead habitat not surveyed, thus there were likely many more calves present but not observed (Clarke *et al.*, 2018). We do not have a recent estimate of pregnancy rate for the entire population but based on data from harvested whales and aerial surveys, BCB bowheads had a very strong period of reproduction from 2015 to 2017.

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Table 1. Village, whale identification number, dates landed, standard length (meters) and sex of bowhead whales landed by Alaskan Eskimos during the 2017 subsistence hunt.

Village	Whale ID#	Date Landed	Length (m)	Sex
Barrow	17B1	13 Apr	14.0[1]	M
	17B2	27 Apr	8.4	F
	17B3	29 Apr	9.0	M
	17B4	30 Apr[2]	12.7[1]	M
	17B5[3]	4 May	13.6	F
	17B6	5 May	11.1	M
	17B7	11 May	8.1	F
	17B8[4]	15 May	13.7[1]	F
	17B9	1 Oct	9.4	M
	17B10	5 Oct	9.0	M
	17B11	5 Oct	10.8	M
	17B12	5 Oct	8.4	M
	17B13	8 Oct	10.1	M
	17B14	8 Oct	10.1	M
	17B15	8 Oct	9.0	M
	17B16	9 Oct	9.1	F
	17B17	9 Oct	9.3	F
	17B18	9 Oct	10.3	M
	17B19	11 Oct	9.9	F
	17B20	11 Oct	10.8	M
	17B21	11 Oct	11.7	F
Gambell	17G1	28 Mar	13.9	F
	17G2	17 Apr	17.6	F
Kaktovik	17KK1	3 Sep	15.3	F[5]
	17KK2	9 Sep	9.4	F
	17KK3	13 Sep	9.4	F
Nuiqsut	17N1	1 Sep	14.6	M
	17N2	3 Sep	10.7	F
	17N3	3 Sep	10.8	F
	17N4	5 Sep	9.6	M
Point Hope	17H1	7 Apr	9.2	F
	17H2	7 Apr	8.7	M
	17H3	22 Apr	9.4	F
	17H4	28 Apr	15.1	F
	17H5	29 Apr	15.3	F[6]
	17H6	4 May	8.0	F
	17H7	7 May	16.4	F
	17H8	9 May	14.8	M
	17H9	10 May	16.6	F
	17H10	11 May	16.8	F
Point Lay	17PL1	29 Apr	>12.2[1]	M
Savoonga	17S1	9 Jan	16.1	F[7]
	17S2	3 Apr	8.5	F
Wainwright[8]	17WW1	20 Apr	14.5	F
	17WW2	22 Apr	12.2	M
	17WW3	25 Apr	13.3	M
	17WW4	29 Apr	9.6	M
	17WW6	1 May	14.6	F
	17WW7	5 May	8.2	F
	17WW8	7 May	15.9	M

[1]Estimated length.

[2]Struck on 29 April but landed on 30 April.
[3]Initially struck in Wainwright on 30 April (17WW5)
[4]Whale entangled in crab pot gear.
[5] Lactating
[6] Pregnant; sex of fetus was not determined, ~2.1 m long.
[7] Struck on 8 January but landed on 9 January. Pregnant; male fetus, ~3m long.
[8]17WW5 was struck and lost on 30 April at Wainwright but landed at Barrow on 4 May (17B3).

Table 2. Locations, dates, season, and Captains' estimate of survival or our assessment based on the Captain's description, for whales struck and lost during 2017. Data provided by the Alaska Eskimo Whaling Commission.

Village	Date	Season	Estimated Survival
Barrow	24 Apr	Spring	Died
	27 Apr	Spring	Died
	29 Apr	Spring	Fair
	1 May	Spring	Poor
	15 May	Spring	Died
Point Lay	22 Apr	Spring	Fair
Wainwright	23 Apr	Spring	Poor

Table 3. Summary of the number of landed bowhead whales and the Captains' estimate of survival (or our assessment based on the Captain's description) for whales struck and lost during 2017. Data provided by the Alaska Eskimo Whaling Commission.

Village	Landed	Struck & Lost	Total Struck	Estimated Survival[1]
Barrow	21	5	26	1F; 1P; 3D
Gambell	2		2	-
Kaktovik	3		3	-
Nuiqsut	4		4	-
Point Hope	10		10	-
Point Lay	1	1	2	F
Savoonga	2		2	-
Wainwright	7	1	8	P
				-
Totals	50	7	57	2F; 2P; 3D

[1] F=fair, P=poor; D=died.