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INTERNATIONAL WHALING COMMISSION

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ABSTRACT

In 2019, 36 bowhead whales (*Balaena mysticetus*) were struck during the Alaskan subsistence hunt resulting in 30 animals landed. The total number of whales struck and the number landed in 2019 was lower than the averages for the previous 10 years (2009-2018: mean struck = 57.1, *SD* = 10.3 and mean landed = 43.5, *SD* = 7.1; respectively). The efficiency (# landed / # struck) of the hunt (83%) was higher than the average over the past 10 years (mean of efficiency = 76.7%; *SD* = 7.1%). 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 during 2019. In 2019, the efficiency of the spring hunt (79%) was higher than the previous 10 year average (2009-2018; mean spring efficiency = 68%) but lower than the 2019 autumn hunt (100%). The efficiency of the autumn hunt over the past ten years (2009-2018) was 91% (SD = 9%). Six whales were struck and lost in 2019. Of those six whales, two whales died and sank, two whales were lost because of equipment malfunction (float pulled off whale), one whale was stuck and never seen again, and no explanation was given for why one whale was struck and lost. Of the harvested whales, 19 were females and 11 were males. Based on total length ($\geq$13.7 m in length), nine of the females were presumed mature. Three of the mature females were closely examined. Of those, two were pregnant, one with a term fetus (3.9m long), one with a small fetus (29 cm long), and a third female was secreting colostrum. The other mature females could not be carefully examined because they were mostly butchered in the water.

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), representing 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 2019 under a seven-year block quota that began in 2019 (IWC, 2018).

The subsistence hunts typically occur 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 to February) as well. Bowhead harvests show considerable annual and regional variation, and the success

of each hunt is greatly affected by many factors, including: environmental conditions (e.g., wind speed and direction, wave size, fog, and temperature), stability of shorefast ice, and sea ice concentration, type, and dynamics.

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 2019, the NSB gathered detailed information and tissue samples on whales landed at Utqiaġvik (formerly Barrow) and Nuiqsut, 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, and Gambell. The objectives of this paper are to document: (1) the number, location (village), and dates of landed and struck and lost bowhead whales during 2019 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.

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 most of the whales taken at Utqiaġvik, Gambell, Kaktovik, and Nuiqsut during 2019. 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. Historically, we used several estimates of average length at sexual maturity for females that changed as we collected more data. Initially we used 14.2 m (Tarpley and Hillmann, 1999), then 13.4 m (George *et al*., 2004), and most recently 13.7 m (George et al. 2018). For this paper, we use 13.7 m as the length of sexual maturity for females. 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 the 2019 Alaskan subsistence hunt, of the 36 whales that were struck, 30 were landed. The total harvest for all villages was the lowest, by a small margin, recorded since 1991 when only 28 were landed (Philo et al. 1994). Note that only 31 whales were landed in the 2006 and 2009 seasons (Suydam and George 2018). The 2019 season also had the lowest number of whales struck since 1989 (26 whales struck). In only two other years (2006 and 2009) since 1990 have there been less than 40 whales struck. This is largely because about half the total harvest in recent decades is taken by Utqiaġvik hunters (Suydam and George, 2018). The total number of whales struck and the number landed in 2019 was lower than the averages for the previous 10 years (2009-2018: mean struck = 57.1, *SD* = 10.3 and mean landed = 43.5, *SD* = 7.1; respectively). Twenty-three bowheads were landed and six were struck and lost during the spring (Tables 1 and 2). Seven whales were struck and landed by three villages (Utqiaġvik, Kaktovik, and Nuiqsut) during the autumn and none were struck and lost (Tables 1 and 2).

Spring Hunting Conditions

Hunting conditions during much of spring 2019 were especially challenging in the northern Bering Sea because of another year with an early retreat of sea ice, considerable open water conditions, and prolonged windy conditions. Environmental conditions were better suited for hunting in the Chukchi Sea during the spring season.

At Saint Lawrence Island in the northern Bering Sea, hunters from Gambell landed two whales during April despite the difficult conditions, while no whales were struck at Savoonga also on Saint Lawrence Island. Typically, the combined harvest for both Gambell and Savoonga during 2010-2015 was about 6 to 10 whales (Suydam and George, 2018). Similar to Savoonga, extremely early sea ice retreat in the northern Bering Sea and southern Chukchi Sea in February and March, weather conditions, and logistical constraints prevented hunters from striking a whale at Little Diomede, Wales, and Kivalina.

Farther north in the Chukchi Sea, conditions were more suitable for hunting. Point Hope landed five whales between mid-April and mid-May. Point Lay was able to land one whale and another was struck and lost in late April. Wainwright landed six whales from late April through mid-May.

Utqiaġvik landed nine whales from 20 April to 16 May 2019. During March, a large amount of shorefast ice had broken off between Utqiaġvik and Wainwright (Figure 1 [reprinted from Givens et al. 2020]). Some Utqiaġvik Captains suggested that these ice conditions caused the whales to migrate farther west from Utqiaġvik than typical. Crews saw very few whales from the shorefast ice edge throughout the season. Because of the conditions, all nine whales were harvested using power boats and all were landed to the north of Point Barrow.

Autumn Hunting Conditions
There are three villages that typically hunt bowheads in the Beaufort Sea during the autumn: Kaktovik, Nuiqsut and Utqiaġvik. Conditions in the Beaufort Sea were marked by the extreme northern withdrawal of the sea ice that persisted into late autumn.

At Kaktovik, three whales were landed between late August and mid-September during unusually warm and rainy conditions. Whaling crews experienced an atypical four-day period (7-10 September) where no whales were observed by the ten crews actively hunting. Concurrent with the lack of observed whales were excellent environmental conditions for detecting whales. On 12 September, the first whales detected were observed more than 20 miles offshore. Nuiqsut landed three whales at Cross Island during the last few days of August. Crews from both villages had to travel considerable distances to the north to find whales. At Cross Island, one crew remained on the island hunting bowheads until at least mid-September and saw very few whales (S.E. Leavitt, pers. comm.), suggesting that the whales remained farther to the north than typical.

At Utqiaġvik, only one bowhead was landed during the autumn on 16 November. This is the latest autumn date for a crew to land a whale at Utqiaġvik since at least 1974. From mid-September through mid-November, very few whales were seen in the primary area traditionally used for hunting during the autumn, which is in the western Beaufort Sea within five to ten miles of shore. The whale hunt began on 21 September, but very few whales were seen despite days with favorable conditions for hunting. Aerial Surveys for Arctic Marine Mammals (ASAMM), conducted by the U.S. National Marine Fisheries Service with funding from the U.S. Bureau of Ocean Energy Management, detected whales farther offshore in the Beaufort Sea relative to the previous 18 years (see Stimmelmayr et al. 2020). Observations by both ASAMM and hunters showed that bowheads migrated farther north across the Beaufort Sea than typical. It is unclear why, but whales may have been influenced by warmer than usual water, lower than typical prey densities, the presence of killer whales, anthropogenic sounds, or some other factors.

Struck and Lost and Hunting Efficiency
Of the six whales struck and lost in 2019, all occurred in the spring. Two died, sank and could not be retrieved, two were lost because of equipment malfunction (i.e., float pulled off whale), one was stuck and not seen again, and no explanation was given for the sixth whale. No whales were struck and lost during the autumn hunt. The estimates of survival included: two died, sank and were unretrivable, one had an excellent chance of survival, and no estimates were provided for the other three. Those estimates of survival are primarily based on the assessment of the Captains or their crews (Table 2 and 3).

The overall efficiency (# landed / # struck) of the hunt (83%) was higher than the average for the past 10 years (mean efficiency = 76.7%; *SD* = 7.1%). Since the mid-1970s, efficiency of the hunt increased steadily until the mid-1990s, when it stabilized at about 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 highly variable environmental conditions (George *et al.*, 2003). As such, hunting 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. The efficiency of the 2019 spring hunt (79%) was higher than the previous 10 years (2009-2018; mean spring efficiency = 68%, SD = 12%) and lower than the 2019 autumn hunt (100%). The mean efficiency of the autumn hunt over the past ten years (2009-2018) was 91% (SD = 9%). Autumn hunts typically occur in more open water conditions, at which time sea ice is less of an influence on hunting success. However, high wind speeds with the larger fetch of the open water period during the autumn can generate large waves limiting hunting opportunities, and making conditions 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 typically results in poor hunting conditions and success.

Sex and Maturity
Eleven (37%) of the landed whales were males. The longest male measured 14.4 m and the smallest was 7.7 m. Based on a length of >13 m (O'Hara *et al*., 2002), four males were presumably sexually mature (see Table 1).

Nineteen (63%) of the landed whales were females. The longest female measured 18.7 m; however, this is an estimated length and may be an overestimate. The shortest female measured 8.2 m. Based on a length ≥13.7 m (George *et al*., 2018), nine of the females were sexually mature. Three of those were closely examined for pregnancy. Two were pregnant, one with a term fetus (female, 3.9 m long) and one with a small fetus (male, 29 cm long). The uterus and ovaries of the third female were not examined because the whale could not be pulled onto the ice. That female was secreting colostrum, which suggests she was about to give birth or had recently done so. At the 2018 bowhead Implementation Review, we reported an updated pregnancy rate for 1976-2016 to be 32% (95% CI: 21% to 55%) with the possibility of an increasing trend (George et al., 2018). We are limited in what we can report about pregnancy rates based on the examination of only three mature females; however, the observation that all three sexually mature females were pregnant or had recently given birth suggests that 2019 was a good year for reproduction for bowheads.

Although high variation in annual bowhead calf production is well documented (Koski *et al.,* 2008; Clarke *et al.,* 2014), we observed high pregnancy rates in harvested bowheads in 2015 (Suydam *et al.,* 2016), 2016 (Suydam *et al.,* 2017), and again in 2017 (Suydam et al. 2018). Corroborating evidence about bowhead calf production comes from aerial surveys in the summer and autumn (ASAMM) in the Alaskan Beaufort Sea. In 2016, a total of 104 bowhead calves were observed and in 2017 a record high of 155 calves were observed (J. Clarke, *personal communication*). 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). Based on data from harvested whales and aerial surveys, the BCB bowheads had a very strong period of reproduction from 2015 to 2019.

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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 2019 subsistence hunt.

Village	Whale ID#	Date Landed	Length (m)	Sex
Utqiaġvik (formerly Barrow)	19B1	20 Apr	8.2	F
	19B2	21 Apr	8.8	F
	19B3	25 Apr	9.1	M
	19B4	1 May	8.3	F
	19B5	4 May	8.5	F
	19B6	13 May[1]	16.8	F[2]
	19B7	13 May[1]	15.7	F[3]
	19B8	15 May	13.6	F
	19B9	16 May	16.5[4]	F[5]
	19B10	16 Nov	7.7	M
Gambell	19G1	13 Apr	17.6[4]	F
	19G2	26 Apr	18.7[4]	F
Kaktovik	19KK1	30 Aug	10.3	F
	19KK2	4 Sep	8.6	M
	19KK3	14 Sep	10.5	M
Nuiqsut	19N1	29 Aug	7.8	M
	19N2	30 Aug	8.6	F
	19N3	30 Aug	11.2	F
Point Hope	19H1	9 Apr	13.7	F
	19H2	12 Apr	13.3	M
	19H3	24 Apr	13.3	M
	19H4	3 May	?	F
	19H5	12 May	18.0	F
Point Lay	19PL1	30 Apr	17.4	F
Wainwright	19WW1	25 Apr	8.5	M
	19WW2	26 Apr	8.6	M
	19WW3	28 Apr	8.8	F
	19WW4	28 Apr	14.4	M
	19WW5	4 May	14.2	M
	19WW6	12 May	15.1	F

[1] Struck on 12 May and landed on 13 May.
[2] Pregnant with a 29 cm long male fetus,
[3] Likely pregnant, leaking colostrum.
[4] Approximate length.
[5] Pregnant with 3.9 m long female fetus.

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 2019. Data provided by the Alaska Eskimo Whaling Commission.

Village	Date	Season	Estimated Survival
Point Hope	21 Apr	Spring	Unknown
	23 Apr	Spring	Unknown
Point Lay	25 Apr	Spring	Died
Wainwright	30 Apr	Spring	Excellent
	30 Apr	Spring	Unknown
	20 May	Spring	Died

Table 3. Summary of the number of landed bowhead whales and the Captains' estimate of survival for whales struck and lost during 2019. Data provided by the Alaska Eskimo Whaling Commission.

Village	Landed	Struck & Lost	Total Struck	Estimated Survival[1]
Utqiaġvik	10	-	10	-
Gambell	2	-	2	-
Kaktovik	3	-	3	-
Nuiqsut	3	-	3	-
Point Hope	5	2	7	2U
Point Lay	1	1	2	1D
Savoonga	-	-	-	
Wainwright	6	3	9	1E; 1D; 1U
Totals	30	6	36	1E; 2D; 3U

[1] E=excellent, F=fair, P=poor, D=died, U=unknown.

Figure 1: From Givens et al. 2020— Satellite images of the region near Pt. Barrow on 13 May, 2011 (left) and 2019 (right). In 2019, hunters reported that bowheads tended to migrate through the open water far from the shore-fast ice edge (and the perch). The 2019 perch location is shown with the red dot in the right image. Some local whale hunters believe the shorefast ice configuration explained much of the differences in whale distribution in 2019, and why bowheads swam further offshore in 2019.