Biological data from the hunt of bowhead whales in West Greenland 2009 and 2010

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ABSTRACT

Five female and one male bowhead whale were taken for subsistence purposes in Disko Bay, West Greenland, in April-May 2009 and 2010. All the whales were sexually mature with body lengths exceeding 14 m, one female was pregnant with a 3.87 m fetus and two presumably with small fetuses that could not be detected in the field. Another female was resting with a maximum number of corpora albicantia of 7 but no mature follicles. Age determinations of three of the whales revealed that the whales were between 30 and 42 yrs old. Four of the whales had more than half full stomachs and they had been feeding intensively on calanoid copepods in particular on *Calanus hyperboreus*.

INTRODUCTION

Except for 3 catches bowhead whales, *Balaena mysticetus*, have virtually been protected from hunting in West Greenland since around 1915 (Reeves and Heide-Jørgensen 1996). Based on new data on recent abundance (Heide-Jørgensen et al. 2007) removals of 5 bowhead whales per year for 5 yrs was recommended as being sustainable by the IWC Scientific Committee (2008). This was adopted by the IWC Commission but reduced to a strike limit of 2 per year for the years 2008-2012. The strike limit of two per year was not installed in West Greenland until 2009 where the unused quota of two from 2008 was added to give a total strike limit of four whales.

Collection of biological data on bowhead whales is restricted to two skeletons and one foetus from the 19th century that are deposited at the Natural History Museum of Denmark. Ancient (>1000 yrs) vertebrae, skulls and bone fragments from bowhead whales in East, North and West Greenland have also been collected and deposited at museums in Greenland and Denmark (e.g. Bennike 2008). About 500 skin biopsies from bowhead whales have been collected during 2000-2010 in West Greenland (Heide-Jørgensen et al. 2010) but no other biological samples are available from the relative large number of bowhead whales that have been caught in West Greenland since the 1700th century.

The initiation of small scale bowhead whaling in 2009 provided an obvious opportunity for collecting basic biological information on bowhead whales from an area where very little is known. Here we report on some of the biological data collected from 6 bowhead whales that were taken in Disko Bay, West Greenland, in April and May 2009 and 2010.

MATERIAL AND METHODS

The length of the whales was measured in a straight line from the tip of the rostrum to the tail notch. Fluke width was also measured in a straight line. Circumference was measured when feasible either as the full circumference when the whale was still in the water or as half the circumference when it was hauled up on land for flensing. Blubber thickness was measured at four spots; on the back behind the blow hole, at the rear part of the whale about 1 m posterior to the tail, on the belly between the flippers and at the umbilical opening.

Testes and ovaries were collected and measured for length, width, thickness and weight. Ovaries were also examined for corpora lutea and albicantia and diameter of mature follicles was measured.

Samples of baleen, skin, blubber, liver, kidney and muscle were collected and stored as frozen samples for future use.

Eyes were extracted and kept frozen and stored at -20^{o}C immediately after collection. In the laboratory, lenses were dissected out of the eyes and lens layers surrounding the nucleus were removed by slowly rolling the lens on paper. All remaining layers were removed under a stereoscope. Age estimation was facilitated by the asparctic acid racemization technique following methods described in Garde et al. (2007).

Stomach content was sampled from four of the whales. About a liter of the content of the forestomach was fixed in 4%buffered formaldehyde after sieving through 500my mesh sieves. Identification of species in smaller subsamples of the stomach content was conducted under microscope.

RESULTS

Six bowhead whales were taken inside Disko Bay and west off the islands in the opening of the Bay (Fig. 1). The whales were flensed in Qeqertarsuaq, Aasiaat or Ilulissat on cliff or shallow islands. In 2009 the whales were flensed on land but whale IDNO 325 was flensed under difficult conditions in an ice covered bay north of Ilulissat, thus not all samples and measurements were secured from this whale. In 2010 the initial flensing of the mattak (skin) and blubber took place in the water and for those whales it was difficult to collect measurements of the circumference of the whales. Also, the abdominal part of the whales was partly opened at sea in 2010 which rendered collection of the entire reproductive tract and the entire forestomach difficult.

In 2009 two females and one male was taken and in 2010 three females were taken. One female in 2009 had a male fetus of 3.87 m and it was the only whale that was taken from a group of two, the others were solitary whales. Two of the whales had scars from killer whales on the tail (IDNO 323 and 501) or on both flukes and tail (IDNO 501). The largest whales was a female of 16.10 m and it had no scars.

The whales that were sampled in 2009 appeared to have thicker blubber layers and larger circumference than those sampled in 2010.

Reproduction

Reproductive organs were secured from five of the whales and they were all sexually mature which was also indicated by their length (cf. George et al. 2004). The sixth whale (IDNO 325) had a body length of 15.50 m and based on that it was likely also mature. Only one ovary was secured from IDNOs 323 and 501 but both whales had corpus lutei one with a near-term fetus (IDNO 323, ovary weight =2900 g) but for the other (IDNO 501, ovary weight=3820 g) it was not possible in the field to detect the fetus and it must have been small, i.e. <50 cm. The corpus luteum of IDNO 501 was 180x100 mm in diameters, it had 4 corpora albicantia (ca. 50x30 mm) in the same ovary and >15 large follicles of which the largest was 30 mm.

Both ovaries and the entire reproductive tract were secured from IDNO 500 and 502. No fetus, c. luteum or mature follicles were detected in IDNO 500 but there were 3 and 4 c. albicantia (ca. 50x30 mm) in each of the ovaries and the length of the uterine horns were 82 cm and 110 cm with diameters of 12 mm. The length of the uterine body was 65 cm. IDNO 502 had a large c. luteum in one ovary and four c. albicantia in the other ovary but no fetus could be found in the field.

None of the females (IDNO 323, 500-502) were lactating.

Dimensions of one testis from IDNO 322 were 98x38x94 cm (lengthxwidthxcircumference) and 42 kg (weight). Dimensions of the other were 100x40x100 cm.

Age estimation

Estimates of D/L ratios were converted to age estimates by the racemisation rate from George et al. (1999). The whales taken in 2009 were between 30 and 42 yrs old and age has not been yet been determined for the whales from 2010. One fetus was available to estimate an average D_o = 0.02558 for both eyes which augments the sample size of only two fetuses from Alaska (George et al 1999).

Feeding habits

Examination of the forestomach from four of the whales (IDNOs 322, 323, 500, 501) revealed that they were between 50 and 100% full of prey items, however, this assessment was difficult due to the different degree of fermentation of the stomach content in the whales. In all stomachs the prey items were >99% copepods and in one where species determination was possible it was primarily *Calanus hyperboreus* that were found.

DISCUSSION

The sex and size classes of the sampled whales confirm field observations and information from sex determinations of skin biopsies of 271 whales that it is primarily large and sexually mature whales (>14 m) dominated by about 80% females that utilizes Disko Bay in winter and spring (Heide-Jørgensen et al. 2006, Heide-Jørgensen et al. 2010).

There are only two reports of newborn bowhead whales from West Greenland from the commercial whaling period in the 18th and 19th century (Eschricht and Reinhardt 1861) indicating that West Greenland was not used as a calving or nursing ground. In the 20th century there is only one reported observation of a mother and calf in Disko Bay from ca. 1920 (Knudsen 1983). During extensive aerial

surveys and field operations for tagging and biopsy sampling of whales conducted between 1981 and 2010 in West Greenland calves or immature whales have only been detected once on 25 April 2006 about 100 km west of the Greenland coast at 68°08'N 56°02'W (Heide-Jørgensen *et al.* 2002, 2006, 2007, David Boertmann, NERI, dmb@dmu.dk).

The samples from the whales caught in 2009 and 2010 confirm that the females that are found in Disko Bay are either pregnant or resting and not lactating. Two females sampled had large c. lutei but no fetus could be detected under the difficult sampling conditions at sea, but they were likely pregnant with a small fetus from a recent conception. Disko Bay and adjacent offshore areas of West Greenland is probably a mating ground for bowhead whales despite the low proportion of males. Conception in bowhead whales are believed to occur within a window of a month with a mean date around 24 March (Reese et al. 2001). Apparently not all females in Disko Bay are in estrous since some are either pregnant from the year before or resting and this reduces the fraction of females that are available for conception.

The data on reproduction of bowhead whales from West Greenland seem to be in agreement with information on reproduction in bowhead whales in Alaska (George et al. 2004, Reese et al. 2001). Sexual maturity is attained before the whales reach a body length of 14 m and fetuses are near-term or very small in spring (April- May).

The stomach content of the bowhead whales from Disko Bay indicate that they feed almost exclusively on calanoid copepods and that no other prey items contribute to their diet. This is in agreement with observations of diving behavior and area utilization by whales instrumented with time-depth-recorders and satellite transmitters (Laidre et al. 2007).

It seems important to continue sampling the harvested whales to monitor reproductive status and assess changes in body condition.

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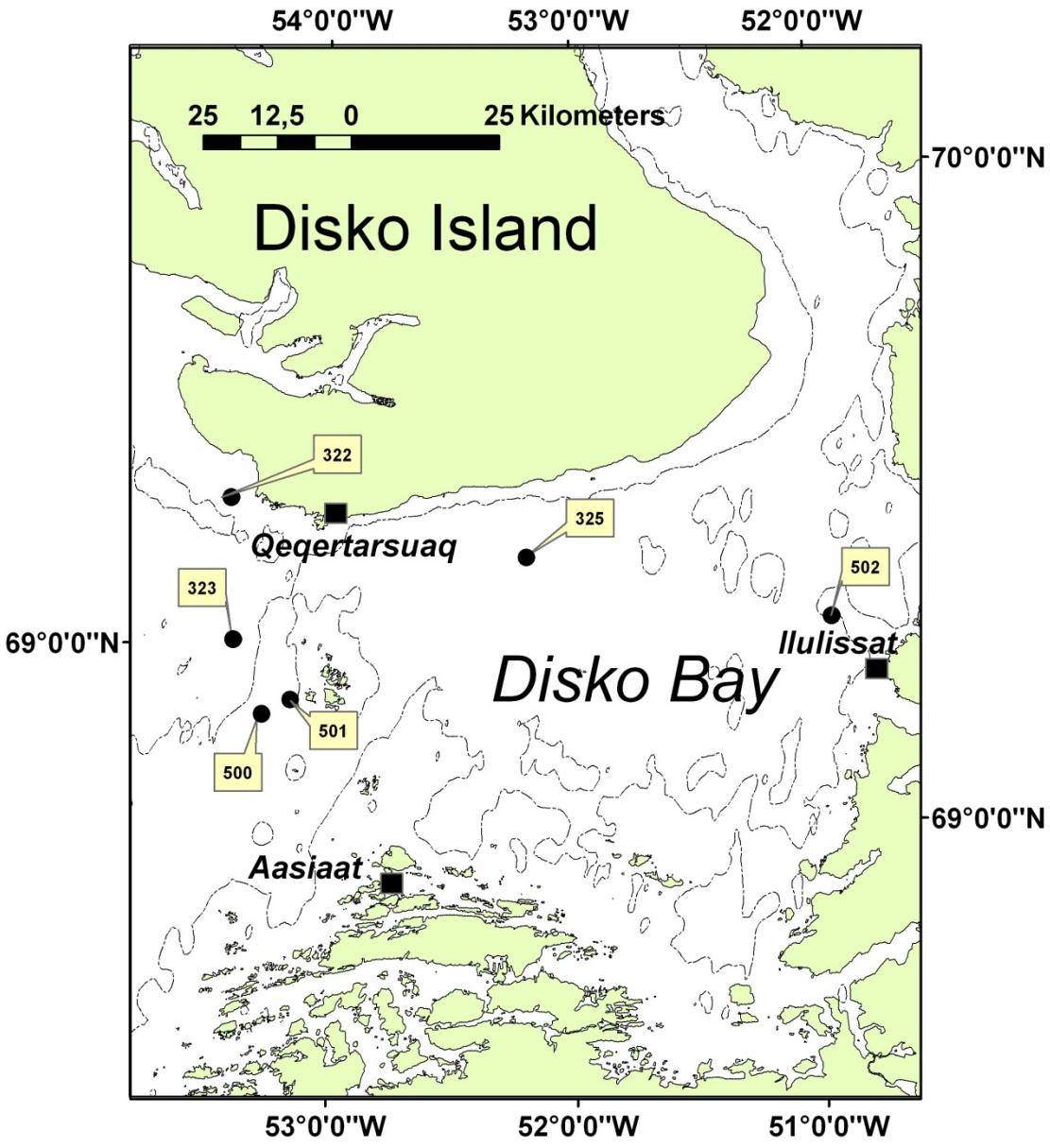

Fig. 1. Positions of bowhead whales caught in Disko Bay in April-May 2009 and 2010 shown with the 200 m depth contour.

Table 1. Biological data from bowhead whales hunted in West Greenland 2009 and 2010. Positions of the catches are given in Fig. 1. AAR= Aspartic Acid Racemisation age, tbd=to be determined.

IDNO	Date	Sex	Length (m)	AAR Age yrs	Fluke width (cm)	Circ.at flippers (cm)	Circ. umbilicus (cm)	Circ. anus (cm)	Circ. peduncle (cm)	Blubber thickness (cm)			
										Behind blowhole	On tail	Between flippers	At umbilical opening
322	300409	M	14.10	35.8	557	850	800	528	170	34	32	25	32
323	80509	F	14.80	30.4	466	1100	1090	335	177	38	28	42	(65.1) ?
324	80509	M	3.87	-1.2	118	na	na	na	na	na	na	na	na
325	100509	F	15.50	41.9	520	na	na	na	na	20	na	na	na
500	90410	F	14.35	tbd	528	790	na	na	200	28	27	18	25
501	90410	F	15.85	tbd	497	na	na	na	175	26.5	na	na	24
502	010510	F	16.10	tbd	520	na	885	na	na	21	36	tbd	24