Catch statistics for harbour porpoises in West Greenland including correction for unreported catches

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Abstract

This paper summarizes available catch statistics for harbour porpoises (*Phocoena phocoena*) hunted in Greenland from 1900 to 2012. From 1900 – 1990 the catches are reported by year (Ministry of Greenland) however catches in some years are missing from the time series. More complete reporting is available from 1993 – September 2012 (Piniarneq, Government of Greenland,) where catches are reported by month. Most catches were taken in central West Greenland during summer months, however, the town of Maniitsoq and its adjacent settlements were responsible for 40 % of all catches. To validate the reported catches in 2012 a questionnaire survey of 28 hunters was conducted in Maniitsoq, West Greenland, in 2013. From the interviews it was found that 113 (470-357) animals were not reported in 2012, however, the official catch statistics (Piniarneq) for October – December 2012 are not yet compiled (expected 2014). Adjusting the catches for the missing months revealed that the catches reported in the interviews were in agreement with the expected catches for January – December 2012. The interview study furthermore revealed that 15 hunters did not report any of their 2012 catches of harbour porpoises to Piniarneq and this underreporting corresponds to 45 % of the porpoise catches obtained through the interviews. Thus the correction factor for underreporting of harbour porpoise catches in Maniitsoq equals 1.8. Despite the uncertainties it is recommended that this correction factor is applied to catch reports from Piniarneq (after 1993) in order to derive a realistic time series useful for assessment purposes of harbour porpoises in Greenland.

Introduction

Information on catches of harbour porpoises dates back to 1900 and provides a minimum estimate of the history of exploitation and provides the only quantitative information on harbour porpoise population history in Greenland (Teilmann and Dietz 1998). Between 1900 and 1992 catch reporting was based on the Hunters List of Game (Ministry of Greenland) where list keepers in each settlement kept a record of the catches of birds and mammals. Catch statistics after 1992 are based on a reporting system, where everybody who hunt (both full-time and part-time) are required to report their monthly catches once a year (Piniarneq, Government of Greenland).

The recent catch statistics disaggregated by month and settlements of catches also allow for a description for the seasonal and latitudinal occurrence of harbour porpoises in Greenland. The reported catches from 1900 – 1990 were collected from 17 settlements, however, data for some years are missing and some year are presented as the average of several years (Table 1). Since 1993 harbour porpoises have been caught in 65 cities and settlements, but since the reporting began in 1900 Maniitsoq is the city with the highest annual average catch (280).

There are at present no quota regulations for the hunt at harbour porpoises in Greenland but harbour porpoises has historically, and still is, an important source of meat and mattak (skin and blubber) in Greenland in general and especially in Maniitsoq where they represent an important resource both financially and culturally. In this study the catch series from Teilmann and Dietz (1998) was updated through 2012 and recent catches were validated through a questionnaire survey focused on hunters from Maniitsoq.

Materials and Methods

Catch data from 1900 to 2012 are presented in Table 1. Catch data from 1900 to 1990 were obtained from Teilmann and Dietz (1998) that summarized available statistics mainly from the Hunters List of Game reporting system (Ministry of Greenland). Catch data from January 1993 – September 2012, disaggregated by settlement and month, were obtained from the Piniarneq catch reporting system implemented by the Government of Greenland (Table 2). Even though reported catches exist as far back as 1900 some years are missing in the catch series and in other years catches are lumped over several years, and the average was used to represent the annual catches for these periods (Table 1).

During two weeks in July 2013, 28 hunters from Maniitsoq were interviewed about their catches of harbour porpoises in 2012 (15 full-time and 13 part-time hunters). The hunters were not informed that their catches would be compared to data from Piniarneq. A total of 11 questions were designed in order to clarify *i.e.* the number of catches, the method used (rifle, shotgun or net), and the time of year they see and hunt porpoises. The questionnaire had the following questions:

1) *What is your year of birth?*
2) *How many years have you been hunting harbour porpoises?*
3) *Are you a full-time hunter?*
4) *Do you land fish to the factory?*
5) *What is your source of income in months where you do not catch harbour porpoises?*
6) *How many harbour porpoises did you catch in 2012?*
7) *In which months do you observe harbour porpoises around Maniitsoq?*
8) *In which months do you catch harbour porpoises?*
9) *Where do you catch harbour porpoises (in which areas?)*

10) *How do you catch harbour porpoise?*
    a. *Rifle - what calibre?*
    b. *Shotgun - what calibre?*
    c. *Net?*
    d. *Bycatch?*
11) *How many harbour porpoises were struck and lost in 2012?*

At the end of the interview the hunter was asked to write the names of other hunters which he believed caught large numbers of harbour porpoises. This was done to ensure that hunters who caught the most porpoises were covered by the survey. Due to logistical issues it was not possible to interview all hunters and it was estimated that 20 hunters were not included in the survey (both full-time and part-time). The hunter was compensated Dkr. 300 for the interview.

Results and discussion

Trends in catches of harbour porpoises. The total reported catches of harbour porpoises in Greenland from 1900 – 2012 was 72,887 and these catches falls in three periods (Fig. 2). During 1900-1950 catches remain below 1000 per year with a weak annual increase. The data from this period probably reflects realistic catch levels although actual catches may be underestimated to an unknown degree. The average annual catches during 1950 to 1990 was significantly larger than the previous period, but did not show an increasing trend but rather a peak around 1970 due to the by-catches in the commercial offshore drift-net Atlantic salmon (*Salmo salar*) fishery. The large scale salmon fishery in Greenland began in the early 1960´s and peaked in the early 1970´s with annual catches of around 2500 tonnes (ICES advice 2013, Book 10). Large numbers of harbour porpoises were by-caught in this fishery, but were never reported in the Hunters List of Game. Lear and Christensen (1975) estimated that 1500 harbour porpoises were taken in 1972, when the salmon fishery was at its highest i.e. 2800 tonnes. During 1965-1969 and 1976-1982 the salmon catch was between 1000 – 2000 tonnes and it is likely that the by-catch was smaller compared to 1972. It is a reasonable assumption that by-catches in years with salmon catches of more than 2000 tonnes (1971 – 1975) resembles the estimate of 1500 porpoises presented in Lear and Christensen (1975) and it can be roughly estimated that 750 (50 %) porpoises were by-caught during years with fisheries with catches between 1000 – 2000 tonnes (1965 – 1970 and 1976 – 1982). These estimated by-catch levels (1500 for 1971-1975 and 750 for 1965-1970 and 1976-1982) should be added to the statistics on direct takes to get the total level of removals.
The last period (the Piniarneq-period) from 1993 until today show a significant increase of almost 100 porpoises per year. From January 1993 – September 2012 a total of 42,779 harbour porpoises were reported to be caught in Greenland in the 16 municipalities present until 2010 (covering 61 towns and settlements, Fig. 1, Table 2).

By far the majority of catches were taken in West Greenland (Table 2). An average of 2139 harbour porpoises were taken annually in West Greenland during 1993 – 2012 and ca. 13 were taken annually in East Greenland.

Distribution of catches in Greenland. According to the hunters from Maniitsoq, harbour porpoises are caught whenever they are encountered thus the catches likely reflects the seasonal occurrence of harbour porpoises, however, it may also be influenced by the availability of other hunted animals. The average monthly catches divided between North, West, South and East Greenland were lowest in December – April and highest in May – November with a peak in July – October (Fig. 3).

Occurrence of harbour porpoises in Maniitsoq. From the interviews it was clear that harbour porpoises where seen and caught mainly between May and November with a peak during June to October however they were also occasionally caught in December and January. The monthly catches listed in Piniarneq (for all of Greenland) from 1993 – 2012 are in agreement with the hunters statements (Fig. 3). In Maniitsoq an average of 68 % (123 porpoises mo^{-1}) of all catches are reported in July – September during the 20-year period (Fig. 4). Second comes October – December (from 1993 – 2011) with 24 % (46 porpoises mo^{-1}) of all catches, and then April – June with 7 % (13 porpoises mo^{-1}). Some hunters added that they have seen harbour porpoises in low numbers all year round, but not every year and this is reflected in Piniarneq with 1 % (2 porpoises mo^{-1}) of the reported harbour porpoises taken in January – March. The winter conditions (including storms and cold temperatures) are part of the reason behind the low catches in January – March, however, a study of harbour porpoise movements also indicates that they move offshore during winter and return the following spring and this may be the ultimative explanation for the low number of catches (and sightings) during winter months (January – May) (Nielsen *et al.* 2013).
The maximum extend of the hunting area utilized by the hunters in Maniitsoq for hunting porpoises spanned over ca. 400 km from Kangaatsiaq to Nuuk (Fig. 1), however, 50 % of the porpoises were caught between Kangaamiut and Atammik and 25 % were caught near Maniitsoq.

Underreporting of catches through Piniarneq. Data from the hunt in 2012 from Piniarneq and the interviews are presented in Table 3. The total catch of 40 hunters (21 full-time and 19 part-time, all from Maniitsoq) reported in Piniarneq was 494 porpoises. The catch of the 28 hunters (15 full-time and 13 part-time) reported in the interviews was 849 porpoises including struck-and-lost animals. According to the interviews a total of 71 porpoises (42 by the full-time hunters and 29 by the part-time hunters) were

reported struck-and-lost or an average of 2 and 3 porpoises per hunter respectively. To validate the reported catches in Piniarneq 13 hunters that both reported to Piniarneq and provided data in the interviews were selected and their information on catches compared. The total number of catches from January – December 2012 from the 13 hunters in the interview was 470 harbour porpoises and the same hunters reported 357 porpoises to Piniarneq for the months January – September 2012. In order to estimate the expected catches reported to Piniarneq in 2012 the proportion of reported catches in the last three months (October – December) relative to the entire year from the past 19 years in Maniitsoq was estimated. This equalled an average of 24 % which were used to correct the incomplete reporting through Piniarneq in 2012. This increased the estimated catches of the 13 hunters included in the interviews to an expected 470 harbour porpoises for all 12 months in 2012 which is the same number as obtained from the interviews of the same hunters. It is therefore assumed that the reported catches through Piniarneq are in good agreement with the actual catches in Maniitsoq.
The number of underreported catches estimated for 2012 relies on the hunter providing the correct catch numbers in the interviews and that the reporting from the 13 hunters can be extrapolated to all hunters. The last catch data for 2012 (October – December) will be reported to Piniarneq in 2014 and will replace the estimate based on historical catches for October–December. When these data are available a more precise assessment of the completeness of Piniarneq can be conducted.

Correction for hunters not reporting to Piniarneq. A total of 15 (54 %) of the 28 interviewed hunters (6 full-time and 9 part-time) did for unknown reasons not report their catches of harbour porpoises through the Piniarneq catch reporting system. Thirteen of these 15 hunters (87 %) did not report any catches of birds or mammals in Maniitsoq in 2012. To check for late reporting of 2012-data it was also found that 10 of the 13 hunters (77 %) did not report any hunting in 2011 either.
The 15 hunters that did not report any harbour porpoise catches through Piniarneq had, according to the interviews, caught a total of 379 harbour porpoises, which constitute a lack of reporting of 45 % (379/849). Catches of harbour porpoises in Maniitsoq constitute the bulk part (23 %) of all catches in Greenland and it is likely that a similar lack of reporting exists in other areas thus it is relevant to apply a rounded correction of 1.8 [1/ (470/849)] to all reported catches of harbour porpoises in Greenland.
Although Maniitsoq holds the largest catches of harbour porpoises in West Greenland application of the estimates of underreporting and lack of reporting to other communities ideally requires a more detailed study including all hunters in Maniitsoq and a representative sample of other settlements. However, recognizing that lack of reporting is a substantial problem and that no corrections lead to underestimates of

catches it seems valid to apply the correction for all catches in Greenland. Although this validation of the catch reporting depends on several assumptions it provides the first attempt to validate catch reporting of harbour porpoises in Maniitsoq and is the first validation of the Piniarneq catch reporting system in general.

Additional information on hunting. The major source of income for all full-time hunters in the interviews was landing of fish to the fish factory (93 %). The hunt of harbour porpoises was important to all hunters (both full- and part-time) both for landing to the local market (all full-time hunters), but also essential for providing the family with fresh meat and mattak. One hunter also mentioned that it was an important part of his culture.

All hunters used rifle to kill the harbour porpoises, however some also used shotgun (11 %), by-catch (7 %) and one hunter used nets specifically for porpoises (4 %).

Both groups of hunters informed that fish (n = 12, 43 %), reindeer (n = 12, 43 %), musk ox (n = 10, 36 %), seal (n = 11, 39 %), beluga (n = 5, 18 %) and a variety of species of birds (n = 4, 14 %) were important, both financially and to supply the household with meat. However, the question (# 5) in the questionnaire was designed in a way that did not specifically asked for every species of animal hunted thus many part-time hunters simply replied "work" to this question thus the percentages must be assumed to be a minimum.

Acknowledgement

We would like to thank all the hunters for participating in the study. Svend Heilmann and Bolethe Skifte Egede are specially thanked for acting as interpreters and providing accommodation during the stay. The study is financed by the Arctic Program for Environmental Support (DANCEA) under the Danish Ministry of the Environment and Greenland Institute of Natural Resources.

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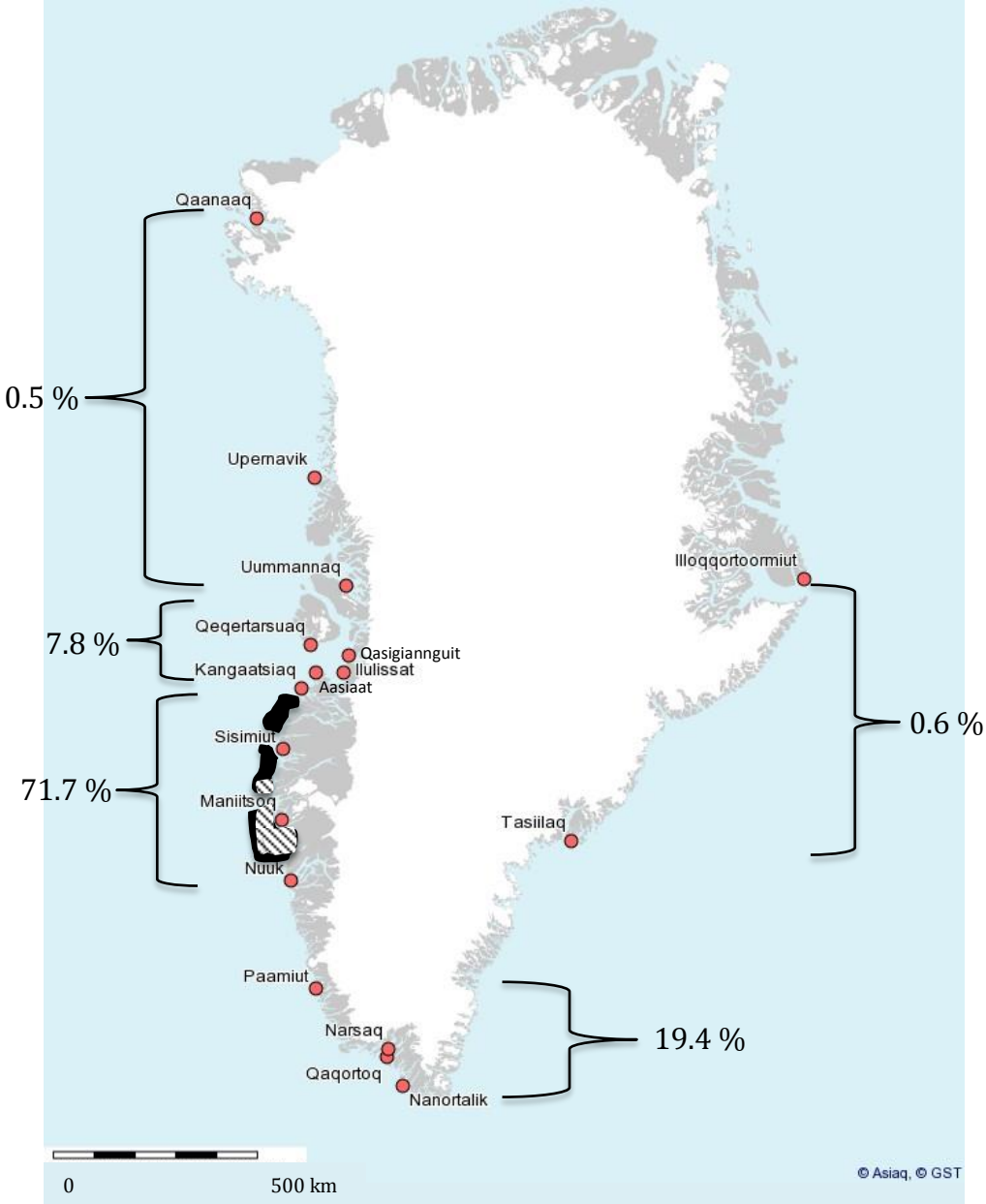

Figure 1. Map of Greenland with the names of the 16 municipalities listed in Table 1. The black area outlines the maximum extend of the harbour porpoise hunting ground of the 28 hunters from Maniitsoq (Kangaatsiaq – Nuuk). The hatched area represents the area where the majority of the hunters from Maniitsoq travelled (Kangaamiut – Atammik). The percentage catches for the 5 areas listed in Table 2 (1993 – 2012) are shown next to the curly brackets.

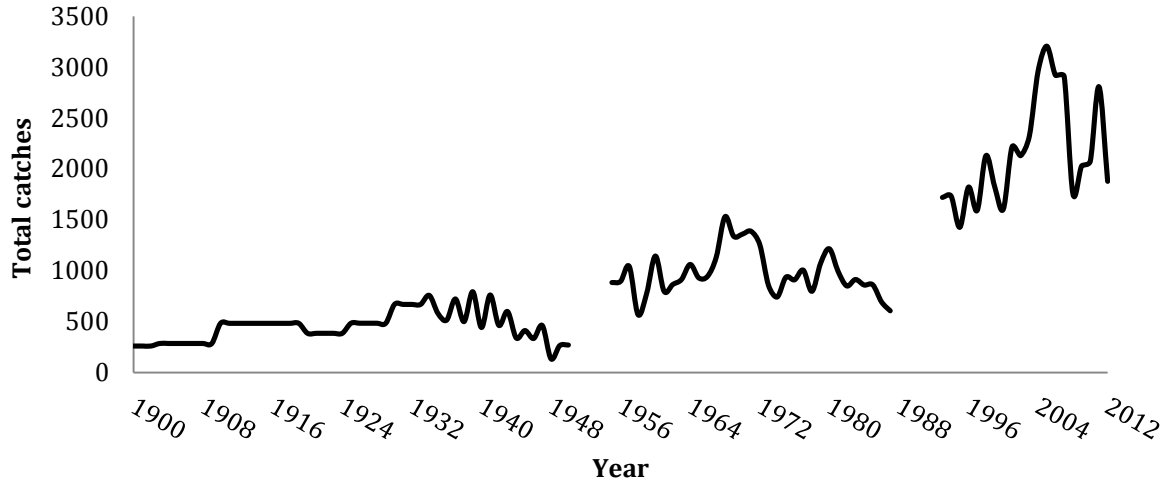

Figure 2. The total annual catches of harbour porpoises in Greenland 1900 – 2012 presented in Table 1.

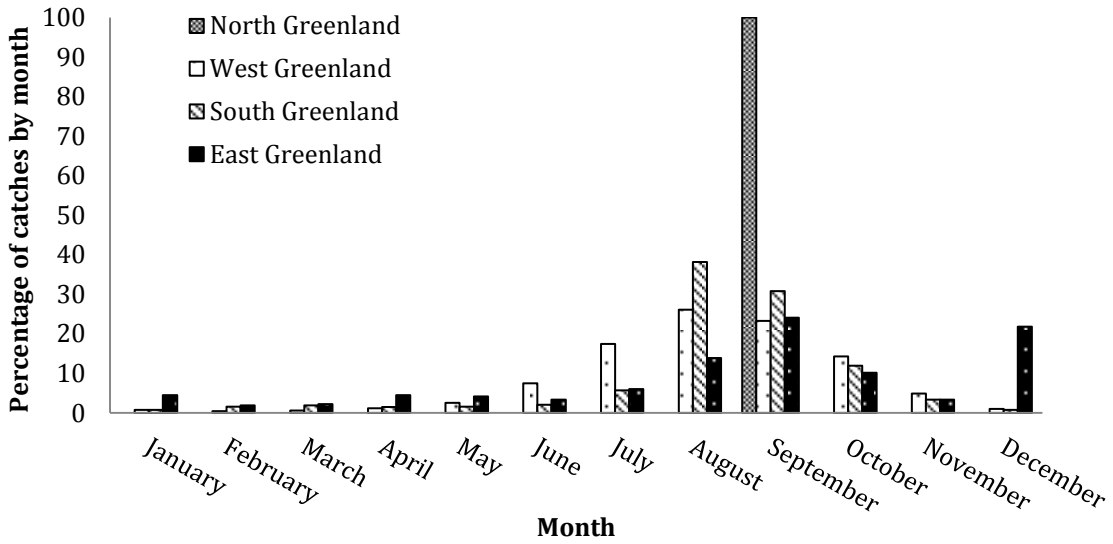

Figure 3. The monthly distribution of the total number of harbour porpoises caught in all of Greenland 1993 – September 2012 (Piniarneq).

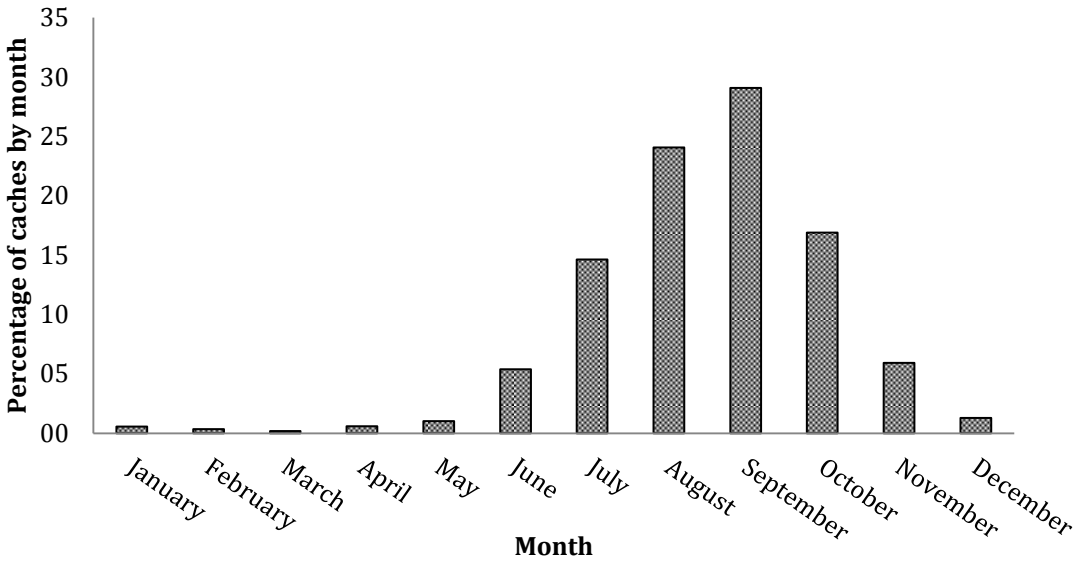

Figure 4. The monthly distribution of harbour porpoises caught in Maniitsoq 1993 – September 2012 (Piniarneq).

Table 1. Catch statistics of harbour porpoises from 1900 – 2012 divided in West Greenland and East Greenland. The catch statistics for West Greenland 1900 – 1990 is from the following 15 municipalities and settlements: Nanortalik, Qaqortoq, Narsaq, Paamiut, Nuuk, Maniitsoq, Sisimiut, Kangaatsiaq, Aasiaat, Qasigianguit, Ilulissat, Vaigat, Qeqertarsuaq, Uummannaq and Upernavik (Teilmann and Dietz 1998). Catch statistics for 1993 – 2012 are from the cities and settlements listed in Table 2. East Greenland is represented by Ammassalik (Tasiilaq) and Illoqqortoormiut. Some years are missing and years with * represent the average of several years.

Year	Total catches for West Greenland	Total catches for East Greenland
1900*	260	na
1901*	260	na
1902*	260	na
1903*	285	na
1904*	285	na
1905*	285	na
1906*	285	na
1907*	285	na
1908*	285	na
1909*	285	na
1910*	483	na
1911*	483	na
1912*	483	na
1913*	483	na
1914*	483	na
1915*	483	na
1916*	483	na
1917*	483	na
1918*	483	na
1919*	483	na
1920*	385	na
1921*	385	na
1922*	385	na
1923*	385	na
1924*	385	na
1925*	484	na
1926*	484	na
1927*	484	na
1928*	484	na
1929*	484	na
1930*	669	na
1931*	669	na
1932*	669	na
1933*	669	na
1934*	758	na
1935	580	na
1936	515	na
1937	723	na
1938	500	na

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Year	Total catches for West Greenland	Total catches for East Greenland
1939	794	na
1940	442	na
1941	762	na
1942	463	na
1943	599	na
1944	339	na
1945	412	na
1946	334	na
1947	461	na
1948	134	na
1949	264	na
1950	270	na
1951	na	na
1952	na	na
1953	na	na
1954	na	na
1955	884	na
1956	896	na
1957	1041	na
1958	569	na
1959	779	na
1960	1145	na
1961	798	na
1962	865	na
1963	914	na
1964	1062	na
1965	929	na
1966	946	na
1967	1135	na
1968	1531	na
1969	1339	na
1970	1360	na
1971	1388	na
1972	1257	na
1973	857	na
1974	742	na
1975	936	na
1976	911	na
1977	1006	na

Year	Total catches for West Greenland	Total catches for East Greenland
1978	798	na
1979	1075	na
1980	1216	na
1981	995	na
1982	851	na
1983	914	na
1984	859	1
1985	861	na
1986	694	na
1987	605	1
1988	na	na
1989	na	na
1990	500	1
1991	na	na
1992	na	na
1993	1638	83
1994	1663	71
1995	1427	0
1996	1822	0
1997	1592	1
1998	2131	0
1999	1830	0
2000	1605	0
2001	2213	3
2002	2130	2
2003	2287	38
2004	2944	18
2005	3194	14
2006	2920	1
2007	2910	0
2008	1758	1
2009	2029	0
2010	2067	10
2011	2801	8
2012†	1863	16
TOTAL	98,457	269
Average catch yr-1	937.7	4.9

† The sum of catches from Jan. – Sept. only.

Table 2. Total catch of harbour porpoises in 65 cities and settlements in Greenland. Data are from Jan. 1993 - Sept. 2012, however some months are missing. For locations of major cities see Fig. 1.

Towns and settlements		Total catch (1993 – Sept. 2012)
East Greenland		
East Greenland	**Ittoqqortoormiit**	**88**
	Ittoqqortoormiit	87
	Uunarteq	1
	Tasiilaq	**178**
	Sermiligaaq	1
	Tasiilaq	26
	Kuummiut	64
	Isortoq	30
	Kulusuk	43
	Tiniteqilaaq	14
	Sum East Greenland	**266**
West Greenland		
North Greenland	**Qaanaaq**	**10**
	Siorapaluk	5
	Qaanaaq	3
	Savissivik	2
	Upernavik	**124**
	Innaarsuit	64
	Kangersuatsiaq	14
	Naajaat	2
	Tasiusaq Upernavimmi	3
	Upernavik	30
	Upernavik Kujalleq	11
	Uummannaq	**85**
	Ikerasak	5
	Illorsuit	8
	Nuugaatsiaq	4
	Qaarsut	5
	Saattut	31
	Ukkusissat	14
	Uummannaq	18
	Sum	**219**

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Towns and settlements		Total catch (1993 – Sept. 2012)
Disko Bay	**Qeqertarsuaq**	**883**
	Kangerluk	162
	Qeqertarsuaq	721
	Ilulissat	**293**
	Ilulissat	255
	Ilimanaq	14
	Saqqaq	20
	Oqaatsut	2
	Qeqertaq	2
	Aasiaat	**1601**
	Akunnaaq	73
	Attu	302
	Iginniarfik	32
	Ikamiut	54
	Ikerasaarsuk	213
	Kitsissuarsuit	132
	Niaqornaarsuk	379
	Aasiaat	416
	Kangaatsiaq	**341**
	Qasigiannguit	**220**
	Sum	**3338**
Midwest Greenland	**Sisimiut**	**13269**
	Itilleq	325
	Sarfaannguaq	75
	Sisimiut	2987
	Kapisillit	39
	Nuuk	4766
	Nuussuaq	1073
	Qeqertarsuatsiaat	4004
	Maniitsoq	**17607**
	Maniitsoq	10836
	Napasoq	918
	Atammik	2458
	Kangaamiut	3395
	Sum	**30876**

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Towns and settlements		Total catch (1993 – Sept. 2012)
South Greenland	**Paamiut**	**6000**
	Arsuk	327
	Paamiut	5673
	Qaqortoq	**1647**
	Ammassivik	7
	Eqalugaarsuit	162
	Qaqortoq	1252
	Qassimiut	122
	Saarloq	104
	Narsaq	**183**
	Nanortalik	**516**
	Narsaq Kujalleq	7
	Aappilattoq Nanortalimmi	17
	Alluitsup Paa	279
	Nanortalik	213
	Sum	**8346**
Sum West Greenland		**42779**
Years		20
Catch yr^{-1}		2139

Table 3. The estimated catches of harbour porpoises by hunters in Maniitsoq 2012.

2012	**Hunters in interview**		
	Full-time	Part-time	Total
No. of hunters	15	13	28
No. of catches reported in interviews (Jan. - Dec.) **(A)**	693	156	849
Average no. of catches per hunter (Jan. - Dec.)	46	12	30
	Hunters reporting to both Piniarneq and interview		
	Full-time	Part-time	Total
No. of hunters	9	4	13
No. of reported catches in Piniarneq (Jan. - Sept.) **(R)**	310	47	357
No. of reported catches in interview (Jan. - Dec.) **(I)**	406	64	470
Average no. of catches per hunter (Jan. - Dec.)	45	16	36
Expected catches Oct. - Dec. **(W = R/(1-0.241)-R)** *	98	15	113
No. of expected catches in Piniarneq (Jan. - Dec.) **(C = W + R)**	408	62	470
Fraction of underreporting **(P = C/I)**	1.0	1.0	1.0
	Hunters not reporting in Piniarneq		
	Full-time	Part-time	Total
No. of hunters	6	9	15
No. of unreported catches (Jan. - Dec.)	287	92	379
Average no. of catches per hunter (Jan. - Dec.)	48	10	25
Fraction of unreported catches (Jan. - Dec.) **(B = I/A)**	0.6	0.4	0.6
	Hunters reporting to Piniarneq		
	Full-time	Part-time	Total
No. of hunters	21	19	40
No. of reported catches to Piniarneq (Jan. - Sept.)	387	107	494
Average no. of catches per hunter (Jan. - Sept.)	18	6	12

* The average catches of Oct. – Dec. 1993 – 2011 (24.1 %).