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Report of the Joint NAFO/ICES Working Group on Harp and Hooded Seals (WGHARP)

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The ICES/NAFO Working Group on Harp and Hooded Seals (WGHARP) met during 15-19 August 2011 at the British Sea Mammal Research Unit (SMRU) at the Scottish Oceanographic Institute, University of St. Andrews, Scotland. In attendance were 12 scientists representing Canada, Greenland, Norway, Russia, United Kingdom and United States.

The WG received presentations related to reported catches, abundance, and biological parameters of White Sea/Barents Sea, Greenland Sea and Northwest Atlantic harp (*Pagophilus groenlandicus*) and hooded (*Cystophora cristata*) seal stocks, and provided updated catch options for northeast Atlantic harp and hooded seals in response to a September 2010 request from Norway. The WG also responded to a request from NAFO to consider the impacts of the increasing northwest Atlantic harp seals on the number of seals near Greenland.

Figure 1. Locations of North Atlantic harp and hooded seal stocks. Green spots indicate the whelping areas for the White Sea (East Ice) stock of harp seals, the Greenland Sea (West Ice) stocks of harp and hooded seals, and the northwest Atlantic stocks (Front and Gulf areas) of harp and hooded seals. Dark blue indicates the entire distributional areas.

Greenland Sea hooded seals:

A 2007 survey of hooded seal pup production in the Greenland Sea produced an estimate of 16,140 pups (SE = 2,140). This estimate is not significantly different from the estimate obtained with comparable methodology in the Greenland Sea in 2005, but is considerably lower than the 1997 estimate. The reason for this decline is unknown. The historical data on pregnancy rates that are available are unreliable. Hence, the population was estimated assuming a range of pregnancy rates. A population model, incorporating a reproduction rate of F = 0.9, produced a 2011 abundance estimate of 67,770 1+ animals and 18,040 pups. The total 2011 population of hooded seals in the Greenland Sea therefore is estimated at 85,810 (SE= 13,981).

All model runs indicate a population currently well below N_{lim} of 233,700 (30% of the Nmax estimate of 777,900). Following the Precautionary harvest strategy previously developed by WGHARP (see ICES 2006[a]) and the fact that the population is below N_{lim}, it is recommended that no harvest be allowed for Greenland Sea hooded seals at this time.

Greenland Sea harp seals:

The size of the Greenland Sea harp seal population is estimated as 649,566 (SE = 138,028) animals in 2011, composed of 553,100 (SE=136,030) age 1+ seals, and 96,470 (SE=23,401) young of the year. In 2011, the existing population model was modified to incorporate historical reproductive rate data. This resulted in a smaller population than was reported in 2008. However, this revised estimate still indicates that this is the largest population size to date.

White Sea/Barents Sea harp seals:

The total size of the population was estimated as 1,364,700 (SE=68,503). A recent survey of harp seals of the White Sea/Barents Sea gives an estimate of 163,032 (SE=32,342) pups, which is slightly higher than the estimates obtained from surveys completed between 2005 (122,658; SE=19,625) and 2009 (157,000; SE=16,956). However, the estimate is considerably lower than survey estimates prior to 2004 (~300,000). A number of hypothesis were examined to explain this reduction including poor survey design, unobserved mortality of adults ca. 2004, high mortality of neonates prior to the aerial surveys, or declines in fecundity (i.e. pregnancy rates). The most parsimonious explanation for the continued low count of pups in surveys in both good and bad ice years appears to be a decline in fecundity given the lack of evidence for a significant adult mortality event.

The original population model for the White Sea/Barents Sea harp seal population provides a poor fit to the pup production survey data. Incorporating fecundity data produced a lower estimate and a conservative projected population. Based on current data availability and the criteria agreed to previously (3 surveys within the past 15 years, one survey within the past 5 years, recent data on reproductive rates), the Barents Sea / White Sea harp seal population is considered to be data rich, and above the N70 level.

Northwest Atlantic hooded seals

Catches

Under the Canadian Atlantic Seal Management Strategy, Northwest Atlantic hooded seals are considered to be data poor with the TAC set by considering a PBR approach. Since 2007 the Canadian commercial quota has been set at 8,200. However, catches of hooded seals (1+ only)

have remained extremely low in recent years. Reported catches in 2006, 2007, 2008 and 2009 were only 40, 17, 5 and 10, respectively (Table 1). No hooded seals were reported taken in 2010 and preliminary estimates for 2011 indicate that only 1 hood was been taken. The killing of bluebacks is prohibited in Canada.

Northwest Atlantic hooded seals are caught by hunters along the Greenland west coast and in their moulting area off Southeast Greenland. The reported catch has declined during the last 4 years with data available (2006-2009) from 4744 to 1982 (Table 2). The 2009 catch was the lowest catch since 1962.

Current research

Canada is continuing research on diets, reproductive rates and growth and condition. Canadian and Greenland scientists are continuing a study of the movements and diving behaviour of newly moulted hooded seals that provides data on habitat use. The animals are also acting as oceanographic samplers, collecting data on sea temperature and salinity.

Biological parameters

New information on reproductive rates of Northwest Atlantic hooded seals has been obtained from the analyses of samples collected between 1956 and 2010. For moulting patch samples collected in 1956-60, 1970-72 and 1978, the Mean Age of Primiparity (MAP) was estimated to be 3.9 ± 0.04(CI). Frequency based estimates of MAP based on a cut-off age of 7 years (MAP[7]) ranged from 4.2-4.4 years over the period 1970-1978 and then showed a moderate, but statistically significant, increase to 4.9 years in 1979. MAP [7] remained at this level in 1983-87 and 1989-95, whereas a further increase to 6.1 years was seen for the 1989-95 data, when using a cut-off age of 10 years.

Population assessment

There are no new data on the abundance of NWA hooded seals.

Northwest Atlantic harp seals

Request for advice

In response to a request from Greenland, the NAFO Scientific Council requested that WGHARP "E*valuate how a projected increase in the total population of Northwest Atlantic harp seals might affect the proportion of animals summering in Greenland"* during their biennial meeting held in August 2011. The response from WGHARP is contained in their report (ICES 2011) and was addressed at the NAFO SC in September 2011.

WGHARP concluded that historically the abundance of seals in Greenland waters was positively associated with increases in the total NWA harp seal population. Since 2000, however, it appears that ecological and hydrographical changes may have changed this relationship, and possibly led to local changes in abundance, particularly in southwest Greenland. Unfortunately, there are insufficient data available at this time to adequately analyze the latter.

Catches

No new data are available on catches of harp seals in the Canadian Arctic. However, catches appear to be relatively low and a recent study indicates that current catches average less than 1,000 per year (Table 3).

Canadian commercial catches have steadily declined since 2006 when 354,867 harp seals were reported (1.06% of the TAC, Table 4). However, the statistics for this year assumed that 2,000 seals were taken in the Canadian Arctic which is double the harvest level usually assumed. In subsequent years, Arctic catches were not included in the reported catches but are thought to be less than 1,000 animals. Canadian commercial catches were significantly reduced in 2007 (224,745, 83% of TAC) due to the lack of ice in the southern Gulf and heavy ice off Newfoundland. Poor ice, offshore distribution and low prices also resulted in lower catches in 2008 with only 79% (217,850) of the TAC taken. Although quotas have been increased since then, catches have been extremely low, falling to 27% and 21% of the quotas in 2009 (280,000) and 2010 (330,000), respectively. A combination of low prices, poor ice conditions, reduced effort and alternate fisheries resulted in a catch of only 38,018 in 2011 which is less than 10% of the 400,000 TAC. The vast majority of harp seals taken in the Canadian commercial hunt were young of the year. Since 2008 they have accounted for over 99% of the reported catch.

Data on catches in Greenland are usually available 1 to 2 years after the harvests. Reported Greenland catches showed a decline from 93,318 to 71,716 during the last 4 years for which data are available (2006-2009, Table 5). The trend in catches has been the opposite in north- and southwest Greenland, with more seals caught in north, but significantly fewer in south. The decline in catches in south may partially reflect reduced hunting effort. However, the number of seals in the area appears to be greatly reduced in recent years although there are no quantitative data to confirm this.

Given the reduced level of recent catches in Canada, the high level of hunting in Greenland (including struck and loss) and the relative ages of seals taken in the two hunts, the current Greenland hunt is likely to be having a greater impact on the population dynamics of Northwest Atlantic harp seals than the hunt in Canada.

Current research

Research on diet, reproductive rates, growth, condition and habitat use are continuing with a focus on the role of harp seals in the northwest Atlantic ecosystem, The impact of climate change on harp seals in the northwest Atlantic are being investigated, particularly with respect to how they cope with poor ice conditions. Changes in biological parameters are being monitored to determine how they may respond to density dependent factors or changes in prey availability.

Harp seals are dependent upon suitable ice for pupping, nursing and resting. As a result, they have been severely impacted by the declining trend in ice availability in the past decade. The total extent of ice suitable for whelping harp seals in the Gulf of St. Lawrence and of the coast of southern Newfoundland conditions during 2010 and 2011 were at, or near, the lowest since 1969. A study of how harp seals responded to these poor conditions found that seals used unsuitable ice, moved to other areas, extending the whelping period and pupping outside of historical areas. There was no evidence to indicate that harp seals whelped on land even in areas where ice was absent. Young seals that did drift to shore had high levels of abandonment and mortality. The specific responses of whelping seals to poor ice conditions were influenced by the amount and timing of ice development in the different whelping areas. It is likely that mortality of young was high in both years, but likely greater in 2010 and 2011.

Biological parameters

Annual estimates of late term pregnancy rates, fecundity and mean age of sexual maturity of Northwest Atlantic harp seals have been collected since 1954. Pregnancy rates among 3 year olds remained low (<10 %) throughout the time period while those of 4 and 5 year olds initially increased during the 1970s, but declined by the mid 1980s to levels similar to, or lower than, those seen in the 1960s. Pregnancy rates of older seals remained high until the mid 1980s, but then declined to their current low levels. Annual fecundity rates are highly variable. Although they remained high (>85%) until the late 1970s, they subsequently declined and remain low. The proportion of mature females that were pregnant was particularly low (<40%) in 2004, which was a survey year. Reproductive rates increased to approximately 70% in 2008, another survey year, which may account for the rapid increase in pup production observed between these two surveys. Preliminary data from 2009 through 2011 indicate that fecundity rates have declined and may be in the order of 30% during the last two years. Late term abortions have been observed among late term reproductive samples. However, these abortions cannot account for all of the variation observed in the annual pregnancy rates.

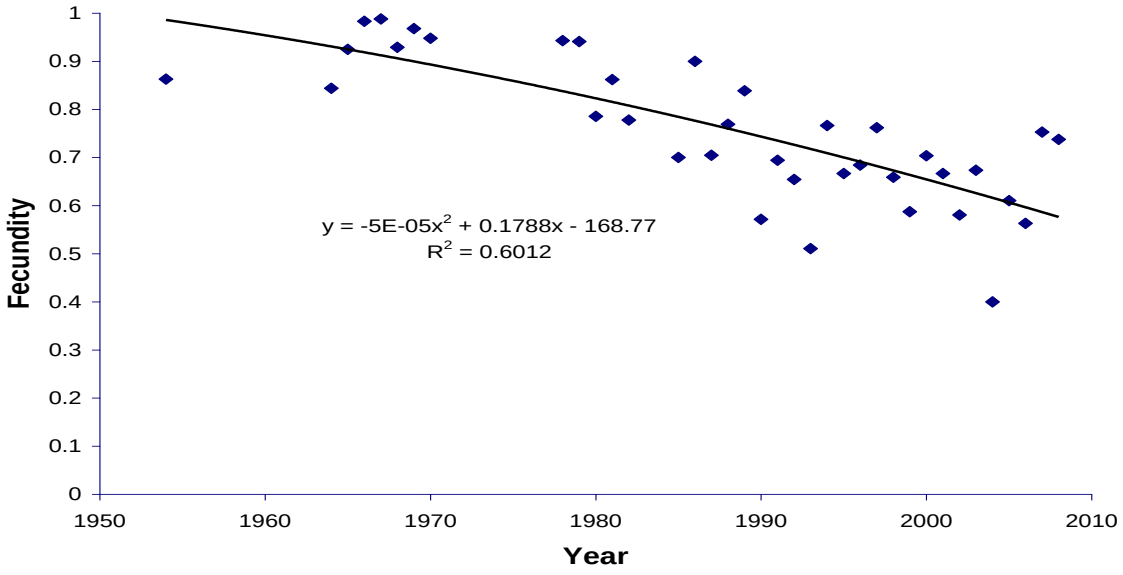

Figure 2. Annual late term fecundity rates of NWA harp seals (1954 – 2008) indicating the proportion of mature females that are pregnant.

Population assessment

Harp seal abundance is estimated using a population model that incorporated annual age specific estimates of human induced removals (reported catches, bycatch and estimates of the number of animals killed but not landed, Table 6)) and pregnancy rates, along with periodic estimates of pup production. The most recent estimate of pup production in the NWA was carried out in 2008. However, the results of these surveys were not available to the WG at the previous meeting.

Surveys of 5 whelping concentrations resulted in estimated pup production of 1,630,300 (SE=110,400, CV=6.8%). This is significantly higher than estimated in 2004 and is inconsistent with previous predictions obtained from the harp seal population model. The methods used in 2008 were very similar to those used previously with the exception that a digital camera system

was used in the most recent surveys. However, a direct comparison of the digital camera system used in 2008 and the film camera system used previously showed that, once corrected for reader errors, the estimates from the two systems yielded similar results.

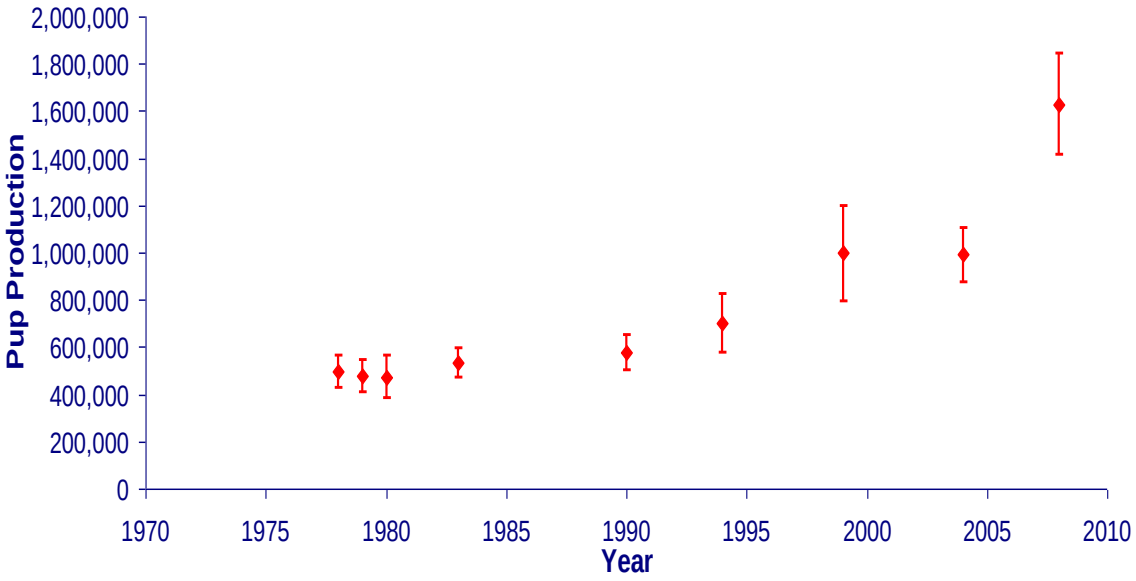

Fig 3. Independent estimates pup production of northwest Atlantic harp seals

The population model was fit to eleven estimates of pup production beginning in 1952. As in previous assessments, the model was initially fit to age specific reproductive rates that were smoothed from the annual estimates. However, this model did not fit the unusually high 2008 pup production estimate very well. This high pup production appears to be due to relatively high reproductive rates observed in the same year. This is in contrast to a general trend towards a decline in reproductive rates, as pup production has increased suggesting that the dynamics of this population are being mediated by density-dependent changes. Incorporating the annual pregnancy rates, whenever possible, improved the model fit. Under the assumption that density-dependent population growth is occurring and the population is nearing carrying capacity (K=12 million), the population in 2008 was 8.1 million (95% CI=7.3-8.9 million animals).

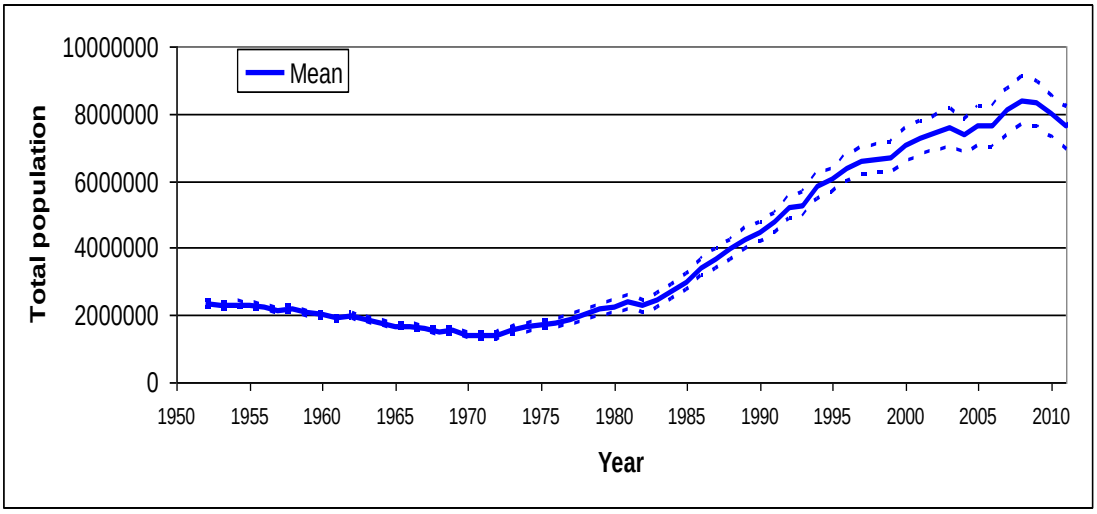

Figure 4. Estimated population size of northwest Atlantic harp seals, 1952-2010.

Harp seals have been commercially exploited since the early 1700s although significant catches did not begin until early in the 19th century. Catch data from historical records and recent harvests were incorporated into a surplus production model (Pella-Tomlinson) to reconstruct the dynamics of this population to the late 18th Century. Model runs estimated an initial population of 10.8 million (SE=196,000) animals.

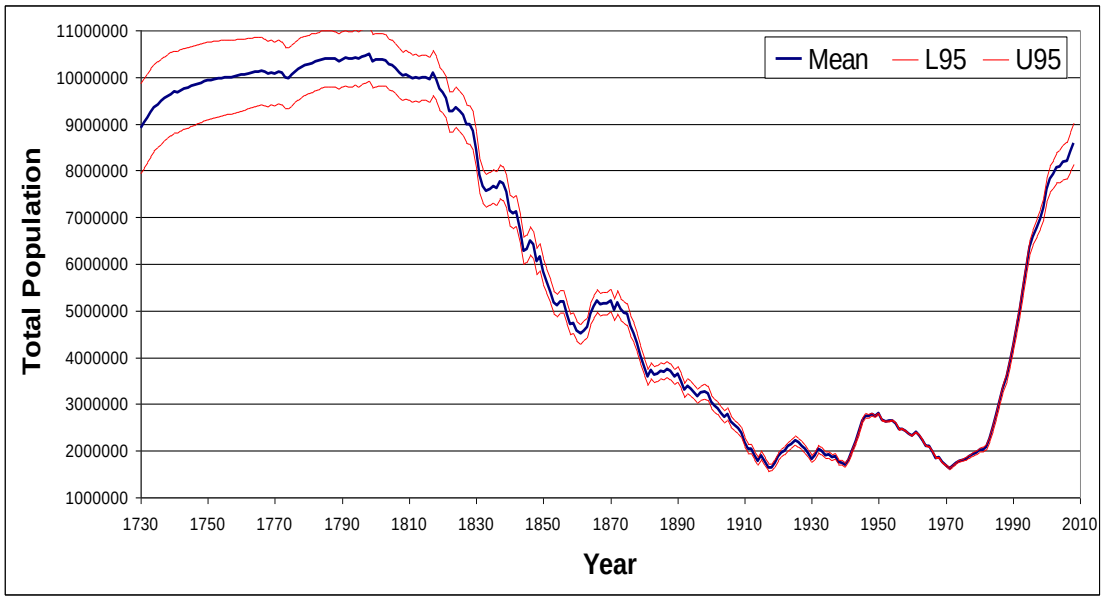

Fig 5. Estimates of historical population size for northwest Atlantic harp seals.

Reference

ICES. 2011 Report of the Working Group on Harp and Hooded Seals (WGHARP). ICES CM 2011/ACOM:22.

Table 1. Canadian catches of hooded seals off Newfoundland and in the Gulf of St. Lawrence, Canada ("Gulf" and "Front"), 1946-2011[a,b]. Catches from 1995 onward includes catches under personal use licences. YOY refers to Young of Year. Catches from 1990-1996 were not assigned to age classes. With the exception of 1996, all were assumed to be 1+.

	Large Vessel Catches				Landsmen Catches[c]				Total Catches			
Year	YOY	1+	Unk	Total	YOY	1+	Unk	Total	YOY	1+	Unk	Total
1946-50	4029	2221	0	6249	429	184	0	613	4458	2405	0	6863
1951-55	3948	1373	0	5321	494	157	0	651	4442	1530	0	5972
1956-60	3641	2634	0	6275	106	70	0	176	3747	2704	0	6451
1961-65	2567	1756	0	4323	521	199	0	720	3088	1955	0	5043
1966-70	7483	5220	0	12703	613	211	24	848	8096	5431	24	13551
1971	7987	6875	0	14862	54	30	0	84	8041	6905	0	14946
1972	6820	5636	0	12456	108	36	0	144	6928	5672	0	12600
1973	4499	1930	0	6429	103	35	0	138	4602	1965	0	6567
1974	5984	3990	0	9974	7	18	0	25	5991	4008	0	9999
1975	7459	7805	0	15264	187	160	0	347	7646	7965	0	15611
1976	6065	5718	0	11783	475	127	0	602	6540	5845	0	12385
1977	7967	2922	0	10889	1003	201	0	1204	8970	3123	0	12093
1978	7730	2029	0	9759	236	509	0	745	7966	2538	0	10504
1979	11817	2876	0	14693	131	301	0	432	11948	3177	0	15125
1980	9712	1547	0	11259	1441	416	0	1857	11153	1963	0	13116
1981	7372	1897	0	9269	3289	1118	0	4407	10661	3015	0	13676
1982	4899	1987	0	6886	2858	649	0	3507	7757	2636	0	10393
1983	0	0	0	0	0	128	0	128	0	128	0	128
1984	206	187	0	393[d]	0	56	0	56	206	243	0	449
1985	215	220	0	435[d]	5	344	0	349	220	564	0	784
1986	0	0	0	0	21	12	0	33	21	12	0	33
1987	124	4	250	378	1197	280	0	1477	1321	284	250	1855
1988	0	0	0	0	828	80	0	908	828	80	0	908
1989	0	0	0	0	102	260	5	367	102	260	5	367
1990	41	53	0	94[d]	0	0	636[e]	636	41	53	636	730
1991	0	14	0	14[d]	0	0	6411[e]	6411	0	14	6411	6425
1992	35	60	0	95[d]	0	0	119[e]	119	35	60	119	214
1993	0	19	0	19[d]	0	0	19[e]	19	0	19	19	38
1994	19	53	0	72[d]	0	0	149[e]	149	19	53	149	221
1995	0	0	0	0	0	0	857[e]	857	0	0	857[e]	857
1996	0	0	0	0	0	0	25754[e]	25754	0	22,847[f]	2907	25754
1997	0	0	0	0	0	7058	0	7058	0	7058[e]	0	7058
1998	0	0	0	0	0	10148	0	10148	0	10148[e]	0	10148
1999 [e]	0	0	0	0	0	201	0	201	0	201[e]		201
2000 [e]	2	2	0	4[d]	0	10	0	10	2	12[e]	0	14
2001[e]	0	0	0	0	0	140	0	140	0	140[e]	0	140
2002 [e]	0	0	0	0	0	150	0	150	0	150[e]	0	150

	Large Vessel Catches				Landsmen Catches[c]				Total Catches			
Year	YOY	1+	Unk	Total	YOY	1+	Unk	Total	YOY	1+	Unk	Total
2003 [e]	0	0	0	0	0	151	0	151	0	151[e]	0	151
2004 [e]	0	0	0	0	0	389	0	389	0	389[e]	0	389
2005 [e]	0	0	0	0	0	20	0	20	0	20[e]	0	20
2006[e]	0	0	0	0	0	40	0	40	0	40	0	40
2007[e]	0	0	0	0	0	17	0	17	0	17	0	17
2008[e]	0	0	0	0	0	5	0	5	0	5	0	5
2009[e]	0	0	0	0	0	10	0	10	0	10	0	10
2010	0	0	0	0	0	0	0	0	0	0	0	0
2011	0	0	0	0	0	1	0	1	0	1	0	1

[a] For the period 1946–1970 only 5-years averages are given.

[b] All values are from NAFO except where noted.

[c] Landsmen values include catches by small vessels (< 150 gr tons) and aircraft.

[d] Large vessel catches represent research catches in Newfoundland and may differ from NAFO values.

[e] Statistics no longer split by age; commercial catches of bluebacks are not allowed

[f] Number of YOY estimated from reported illegal catches

Table 2. Catches of hooded seals in West and East Greenland 1954–2009.

Year	West Atlantic Population				NE	All Greenland
	West	KGH[b]	Southeast	Total		
1954	1097	-	201	1298	-	1298
1955	972	-	343	1315	1	1316
1956	593	-	261	854	3	857
1957	797	-	410	1207	2	1209
1958	846	-	361	1207	4	1211
1959	780	414	312	1506	8	1514
1960	965	-	327	1292	4	1296
1961	673	803	346	1822	2	1824
1962	545	988	324	1857	2	1859
1963	892	813	314	2019	2	2021
1964	2185	366	550	3101	2	3103
1965	1822	-	308	2130	2	2132
1966	1821	748	304	2873	-	2873
1967	1608	371	357	2336	1	2337
1968	1392	20	640	2052	1	2053
1969	1822	-	410	2232	1	2233
1970	1412	-	704	2116	9	2125
1971	1634	-	744	2378	-	2378
1972	2383	-	1825	4208	2	4210
1973	2654	-	673	3327	4	3331
1974	2801	-	1205	4006	13	4019
1975	3679	-	1027	4706	58a	4764
1976	4230	-	811	5041	22a	5063
1977	3751	-	2226	5977	32a	6009
1978	3635	-	2752	6387	17	6404
1979	3612	-	2289	5901	15	5916
1980	3779	-	2616	6395	21	6416
1981	3745	-	2424	6169	28a	6197
1982	4398	-	2035	6433	16a	6449
1983	4155	-	1321	5476	9a	5485
1984	3364	-	1328	4692	17	4709
1985	3188	-	3689	6877	6	6883
1986	2796a	-	3050a	5846a	-a	5846a
1987	2333a	-	2472a	4805a	3a	4808a
1988–92c						
1993	4983	-	1967	6950	32	6982
1994	5060	-	3048	8108	34	8142
1995	4429		2702	7131	48	7179
1996	6066	-	3801	9867	24	9891

Year	West Atlantic Population				NE	All Greenland
	West	KGH[b]	Southeast	Total		
1997	5250		2175	7425	67	7492
1998	5051		1270	6321	14	6335
1999	4852	-	2587	7439	16	7455
2000	3769	-	2046	5815	29	5844
2001	5010	-	1496	6506	8	6514
2002	3606	-	1189	4795	11	4806
2003	4351	-	1992	6343	10	6353
2004	4133	-	1690	5823	20	5843
2005	3092	-	1022	4114	14	4128
2006	4194	-	550	4744	3	4747
2007	2575	-	712	3287	7	3294
2008	2085	-	519	2604	2	2606
2009	1624	-	358	1982	1	1983

[a] Provisional figures: do not include estimates for non-reported catches as for the previous years.
[b] Royal Greenland Trade Department special vessel catch expeditions in the Denmark Strait 1959–68.
[c] For 1988 to 1992 catch statistics are not available.

Table 3. Reported catches of harp seals in the northwest Atlantic for 1952-2011. Estimated catches are indicated by shading. Catches in West Greenland catches and 1/2 of the SE Greenland are considered to be from this population.

Year	Front & Gulf	Canadian Arctic	Greenland	NW Atlantic Total
1952	307,108	1,784	16,400	325,292
1953	272,886	1,784	16,400	291,070
1954	264,416	1,784	19,150	285,350
1955	333,369	1,784	15,534	350,687
1956	389,410	1,784	10,973	402,167
1957	245,480	1,784	12,884	260,148
1958	297,786	1,784	16,885	316,455
1959	320,134	1,784	8,928	330,846
1960	277,350	1,784	16,154	295,288
1961	187,866	1,784	11,996	201,646
1962	319,989	1,784	8,500	330,273
1963	342,042	1,784	10,111	353,937
1964	341,663	1,784	9,203	352,650
1965	234,253	1,784	9,289	245,326
1966	323,139	1,784	7,057	331,980
1967	334,356	1,784	4,242	340,382
1968	192,696	1,784	7,116	201,596
1969	288,812	1,784	6,438	297,034
1970	257,495	1,784	6,269	265,548
1971	230,966	1,784	5,572	238,322
1972	129,883	1,784	5,994	137,661
1973	123,832	1,784	9,212	134,828
1974	147,635	1,784	7,145	156,564
1975	174,363	1,784	6,752	182,899
1976	165,002	1,784	11,956	178,742
1977	155,143	1,784	12,866	169,793
1978	161,723	2,129	16,638	180,490
1979	160,541	3,620	17,545	181,706
1980	169,526	6,350	15,255	191,131
1981	202,169	4,672	22,974	229,815
1982	166,739	4,881	26,927	198,547
1983	57,889	4,881	24,785	87,555
1984	31,544	4,881	25,829	62,254
1985	19,035	4,881	20,785	44,701
1986	25,934	4,881	26,099	56,914
1987	46,796	4,881	37,859	89,536
1988	94,046	4,881	40,415	139,342
1989	65,304	4,881	42,971	113,156
1990	60,162	4,881	45,526	110,569
1991	52,588	4,881	48,082	105,551
1992	68,668	4,881	50,638	124,187
1993	27,003	4,881	56,319	88,203
1994	61,379	4,881	59,684	125,944
1995	65,767	4,881	66,298	136,946
1996	242,906	4,881	73,947	321,734

Year	Front & Gulf	Canadian Arctic	Greenland	NW Atlantic Total
1997	264,210	2,500[a]	68,816	335,526
1998	282,624	1,000[a]	81,272	364,896
1999	244,552	500[a]	93,117	338,169
2000	92,055	400[a]	98,459	190,914
2001	226,493	600[a]	85,428	312,521
2002	312,367	1,000	66,735	380,102
2003	289,512	1,000	66,149	356,661
2004	365,971	1,000	70,586	437,557
2005	323,826	1,000	91,696	416,522
2006	354,867	1,000	92,210	448,077
2007	224,745	1,000	82,836	308,581
2008	217,850	1,000	80,556	299,406
2009	76,668	1,000	71,046	148,714
2010	69,101	1,000	83,669[b]	153,770
2011	38,018	1,000	83,669[b]	122,687

[a] Rounded
[b] Average of catches 2005-2009

Table 4. Harp seal catches off Newfoundland and in the Gulf of St. Lawrence, Canada ("Gulf" and "Front"), 1946–2011[a,b]. Catches from 1995 onward include catches under the personal use licences.

Year	Large Vessel Catch				Landsmen Catch				Total Catches			
	Pups	1+	Unk	Total	Pups	1+	Unk	Total	Pups	1+	Unk	Total
1946-50	108256	53763	0	162019	44724	11232	0	55956	152980	64995	0	217975
1951-55	184857	87576	0	272433	43542	10697	0	54239	228399	98273	0	326672
1956-50	175351	89617	0	264968	33227	7848	0	41075	208578	97466	0	306044
1961-65	171643	52776	0	224419	47450	13293	0	60743	219093	66069	0	285162
1966-70	194819	40444	0	235263	32524	11633	0	44157	227343	52077	0	279420
1971	169426	14343	0	183769	41153	6044	0	47197	210579	20387	0	230966
1972	104109	1646	0	105755	12701	11427	0	24128	116810	13073	0	129883
1973	63369	15081	0	78450	34966	10416	0	45382	98335	25497	0	123832
1974	85387	21828	0	107215	29438	10982	0	40420	114825	32810	0	147635
1975	109832	10992	0	120824	30806	22733	0	53539	140638	33725	0	174363
1976	93939	4576	0	98515	38146	28341	0	66487	132085	32917	0	165002
1977	92904	2048	0	94952	34078	26113	0	60191	126982	28161	0	155143
1978	63669	3523	0	67192	52521	42010	0	94531	116190	45533	0	161723
1979	96926	449	0	97375	35532	27634	0	63166	132458	28083	0	160541
1980	91577	1563	0	93140	40844	35542	0	76386	132421	37105	0	169526
1981[d]	89049	1211	0	90260	89345	22564	0	111909	178394	23775	0	202169
1982	100568	1655	0	102223	44706	19810	0	64516	145274	21465	0	166739
1983	9529	1021	0	10550	40529	6810	0	47339	50058	7831	0	57889
1984	95	549	0	644[e]	23827	7073	0	30900	23922	7622	0	31544
1985	0	1	0	1[e]	13334	5700	0	19034	13334	5701	0	19035
1986	0	0	0	0	21888	4046	0	25934	21888	4046	0	25934
1987	2671	90	0	2761	33657	10356	22	44035	36350	10446	0	46796
1988	0	0	0	0	66972	13493	13581	94046	66972	27074	0	94046
1989	1	231	0	232[e]	56345	5691	3036	65072	56346	8958	0	65304
1990	48	74	0	122[e]	34354	23725	1961	60040	34402	25760	0	60162
1991	3	20	0	23[e]	42379	5746	4440	52565	42382	10206	0	52588
1992	99	846	0	945[e]	43767	21520	2436	67723	43866	24802	0	68668
1993	8	111	0	119[e]	16393	9714	777	26884	16401	10602	0	27003
1994	43	152	0	195[e]	25180	34939	1065	61184	25223	36156	0	61379
1995	21	355	0	376[e]	33615	31306	470	65391	34106	31661	0	65767
1996	3	186	0	189[e]	184853	57864	0	242717	184856	58050	0	242906
1997	0	6	0	6[e]	220476	43728	0	264204	220476	43734	0	264210
1998	7	547	0	554[e]	0	0	282070	282070	7	547	282070	282624
1999	26	25	0	51[e]	221001	6769	16782	244552	221027	6794	16782	244603
2000	16	450	0	466[e]	85035	6567	0	91602	85485	6583	0	92068
2001	0	0	0	0	214754	11739	0	226493	214754	11739	0	226493
2002	0	0	0	0	297764	14603	0	312367	297764	14603	0	312367
2003	0	0	0	0	280174	9338	0	289512	280174	9338	0	289512
2004	0	0	0	0	353553	12418	0	365971	353553	12418	0	365971
2005[f]	0	0	0	0	319127	4699	0	323820	319127	4699	0	323820
2006	0	0	0	0	346426	8441	0	354867	346426	811	0	354867
2007	0	0	0	0	221488	3257	0	224745	221488	3257	0	224745
2008	0	0	0	0	217565	285	0	217850	217565	285	0	217850
2009	0	0	0	0	76668	0	0	76668	76668	0	0	76668
2010	0	0	0	0	68654	487	0	69101	68654	487	0	69101
2011	0	0	0	0	37886	132	0	38018	37886	132	0	38018

[a] For the period 1946-1970 only 5-years averages are given; [b] All values are from NAFO except where noted; [c] landsmen values include catches by small vessels (< 150 gr tons) and aircraft; [d] NAFO values revised to include complete Quebec catch (Bowen, W.D. 1982); [e] Large vessel catches represent research catches in Newfoundland and may differ from NAFO values

Table 5. Catches of harp seals in Greenland, 1954–1987 (List-of-Game), and 1993–2009 (Piniarneq), and % adults[a] according to the hunters' reports.

Year	West Greenland		South East Greenland		North East Greenland		All Greenland
	Catch numbers	% adults	Catch numbers	% adults	Catch numbers	% adults	Catch numbers
1954	18,912		475		32		19,419
1955	15,445		178		45		15,668
1956	10,883		180		5		11,068
1957	12,817		133		40		12,990
1958	16,705		360		30		17,095
1959	8,844		168		7		9,019
1960	15,979		350		16		16,345
1961	11,886		219		13		12,118
1962	8,394		211		10		8,615
1963	10,003	21	215	28	20	50	10,238
1964	9,140	26	125	40	7	86	9,272
1965	9,251	25	76	65	2	100	9,329
1966	7,029	29	55	55	6		7,090
1967	4,215	38	54	35	10		4,279
1968	7,026	30	180	47	4		7,210
1969	6,383	21	110	62	9		6,502
1970	6,178	26	182	70	15	100	6,375
1971	5,540	24	63	48	5		5,608
1972	5,952	16	84	48	6	100	6,042
1973	9,162	19	100	20	38	79	9,300
1974	7,073	21	144	29	27	95	7,244
1975	5,953	13	125	20	68	72	6,146
1976	7,787	12	260	48	27	55	8,074
1977	9,938	15	72	16	21	81	10,031
1978	10,540	16	408	14	30	36	10,978
1979	12,774	20	171	19	18	25	12,963
1980	12,270	17	308	14	45		12,623
1981	13,605	21	427	15	49		14,081
1982	17,244	16	267	20	50	60	17,561
1983	18,739	19	357	56	57	30	19,153
1984	17,667	16	525	19	61		18,253
1985	18,445	2	534	0	56	52	19,035
1986	13,932[b]	10	533[b]	18	37[b]	65	14,502[b]
1987	16,053[b]	21	1060[b]	24	15[b]	60	17,128[b]
1988-	For 1988 to 1992 comparable catch statistics are not available.						
1993	55,792	50	1,054	30	40	93	56,886
1994	56,941	50	864	30	88	65	57,893
1995	62,296	53	906	36	61	52	63,263
1996	73,287	52	1,320	35	69	59	74,676
1997	68,241	49	1,149	28	201	58	69,591
1998	80,437	51	1,670	30	110	73	82,217
1999	91,321	50	3,592	12	104	65	95,017
2000	97,229	44	2,459	15	113	76	99,801
2001	84,165	42	2,525	18	73	68	86,763
2002	65,810	46	1,849	19	66	86	67,725
2003	64,735	44	2,828	24	44	77	67,607
2004	69,273	41	2,625	27	207	29	72,105
2005	90,308	35	2,775	18	38	58	93,121
2006	91,191	33	2,038	16	89	78	93,318

Year	West Greenland		South East Greenland		North East Greenland		All Greenland
	Catch numbers	% adults	Catch numbers	% adults	Catch numbers	% adults	Catch numbers
2007	81,485	32	2,702	21	85	53	84,272
2008	78,747	32	3,617	15	50	90	82,414
2009	70,411	33	1,269	9	36	44	71,716

[a] Seals exhibiting some form of a harp.

[b] These provisional figures do not include estimates for non-reported catches as for the previous years.

Table 6. Estimated total removals of harp seals in the northwest Atlantic for 1952-2011.

Year	Reported	Bycatch	Struck and Lost	Total
1952	325,292	0	129,230	454,522
1953	291,070	0	95,095	386,165
1954	285,350	0	112,084	397,434
1955	350,687	0	100,938	451,625
1956	402,167	0	64,218	466,385
1957	260,148	0	96,381	356,529
1958	316,455	0	176,883	493,338
1959	330,846	0	94,426	425,272
1960	295,288	0	140,697	435,985
1961	201,646	0	34,532	236,178
1962	330,273	0	125,277	455,550
1963	353,937	0	86,250	440,187
1964	352,650	0	88,959	441,609
1965	245,326	0	64,414	309,740
1966	331,980	0	83,382	415,362
1967	340,382	0	65,438	405,820
1968	201,596	0	46,718	248,314
1969	297,034	0	66,051	363,085
1970	265,548	68	50,313	315,929
1971	238,322	490	29,870	268,682
1972	137,661	621	22,031	160,313
1973	134,828	465	37,486	172,779
1974	156,564	182	42,899	199,645
1975	182,899	285	43,681	226,865
1976	178,742	1,092	47,991	227,825
1977	169,793	1,577	44,094	215,464
1978	180,490	2,919	65,474	248,883
1979	181,706	3,310	50,585	235,601
1980	191,131	2,717	60,048	253,896
1981	229,815	3,921	53,222	286,958
1982	198,547	3,785	54,740	257,071
1983	87,555	4,962	40,131	132,648
1984	62,254	4,108	39,591	105,952
1985	44,701	4,857	32,069	81,627
1986	56,914	8,178	36,178	101,269
1987	89,536	13,096	55,099	157,731
1988	139,342	8,545	75,895	223,781
1989	113,156	10,256	59,775	183,187
1990	110,569	3,621	77,978	192,168
1991	105,551	9,689	65,400	180,640
1992	124,187	25,476	82,629	232,292
1993	88,203	26,472	72,665	187,340
1994	125,944	47,255	102,049	275,248
1995	136,946	20,395	104,635	261,975
1996	321,734	29,201	146,607	497,542
1997	335,526	18,869	126,654	481,048
1998	364,896	4,641	126,725	496,262
1999	338,169	16,111	113,033	467,313

Year	Reported	Bycatch	Struck and Lost	Total
2000	190,914	11,347	110,354	312,615
2001	312,521	19,475	109,069	441,065
2002	380,102	9,329	98,009	487,440
2003	356,661	5,367	91,233	453,261
2004	437,557	12,330[a]	102,612	552,498
2005	416,522	12,330[a]	114,191	543,043
2006	448,077	12,330[a]	112,254	572,661
2007	308,581	12,330[a]	98,750	419,661
2008	299,406	12,330[a]	93,292	405,028
2009	148,714	12330[a]	76,081	237,125
2010	153,770	12,330[a]	88,769	254,869
2011	122,687	12,330[a]	86,795	221,812

[a]Average bycatch 1999-2003 in Canadian and US fisheries