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Recoveries in Greenland, 1949–94, of Tagged or Branded Harp and Hooded Seals

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Abstract

More than 92 000 harp seal (*Phoca groenlandica*) pups have been tagged or branded at the whelping patches by Canadian, Norwegian or Russian researchers since 1949. Most of these were tagged in the Newfoundland region, either in the Gulf of St. Lawrence or at the "Front" off Newfoundland/Labrador (total about 56 000 – with the most intense tagging effort in the years 1978 to 1993: 34 700). About 17 400 harp seals have been tagged around Jan Mayen, the Greenland Sea, where the major effort was put into experiments in 1983–91 (total 15 800). In the White Sea 20 900 harp seals have been tagged, most of them in the years 1989 to 1994 (18 100). A significant number of tagged harp seals have been recovered in the tagging area in the same or a following year, or in other areas. In Greenland, 1 037 harp seals tagged at Newfoundland have been reported, 44 from Jan Mayen, and 3 from the White Sea. The distribution of these recoveries is reviewed in this paper.

About 9 500 hooded seals (*Cystophora cristata*) have been tagged or branded by Canada, Norway and Russia since 1951: 4 800 in the Gulf and Front areas of Newfoundland, 1 500 at the Davis Strait whelping patch, 101 at the Denmark Strait moulting field, and 3 200 in the Jan Mayen whelping area. A number of these seals have been recaptured in the tagging areas in the same or a following year, or in other regions. In Greenland, 62 tagged or branded hooded seals have been reported to date: 50 from the Newfoundland areas (almost equal numbers from Gulf and Front), 8 from the Davis Strait, 3 from the Denmark Strait, and one from Jan Mayen. By far most of the recaptures of hooded seals were reported from Ammassalik district, Southeast Greenland (n = 35, 56%), followed by South Greenland (n = 14, 24%). The remaining 20% of the recoveries were spread along the coast of West Greenland.

The Greenland recoveries contribute to the knowledge on the general distribution of harp and hooded seals and the routes and timing of the annual migrations, but cannot be used for assessment of stock size (mark-recapture analyses) because reporting efficiency is variable or unknown.

Key words: Greenland, harp seals, hooded seals, migration, tag recoveries

Introduction

Tagging of harp (*Phoca groenlandica*) and hooded seals (*Cystophora cristata*) at the whelping patches in the Gulf of St. Lawrence, off Newfoundland–Labrador (the "Front"), and in the Greenland Sea around Jan Mayen was initiated by Canadian and Norwegian researchers around 1950 (Rasmussen and Øritsland, 1964; Sergeant, 1965), about ten years later also by Russian researchers, mainly at the harp seal whelping patches in the White Sea (Popov, 1970). In 1971 Norway tagged some hooded seals at the moulting patches in the Denmark Strait, and in 1984 a Canadian expedition tagged about 1 500 hooded seal pups at the Davis Strait whelping patch.

Most of the tagging was carried out on newborn pups, but a few adult seals were also tagged at the whelping patches, and the Denmark Strait tagging in 1971 was directed at subadult hooded seals.

The purpose of the tagging experiments was primarily to obtain evidence on the movements and migrations of harp and hooded seals, and on possible exchange of animals between the various whelping stocks. Further, some of the large scale tagging experiments in the early-1960s, the late-1970s and early-1980s in the Newfoundland area, and the years 1977–91 in the Jan Mayen area were intended to and have been used for estimation of pup production by mark-recapture analyses (Bowen and Sergeant, 1983; Sergeant 1975, 1991; Øien and Øritsland, MS 1991, MS 1992, 1995). In addition, teeth from recaptured harp seals have provided material for evaluation of the method of age determination used in this species (Bowen *et al.*, 1983).

Reviews of recaptures of tagged harp and hooded seals were included in the published papers on the early tagging experiments (Rasmussen and Øritsland, 1964; Sergeant, 1965; Popov, 1970), and to some extent in more recent literature (Bowen and Sergeant, 1983; Sergeant, 1973, 1975, 1991; Øien and Øritsland, 1995). Additional information can be found in a number of meeting documents (Sergeant, 1971, MS 1978; Sergeant and Hoek, 1974; Øien and Øritsland, MS 1987, MS 1991, MS 1992). Recoveries from Greenland, in particular, were previously summarized in papers presented at NAFO or ICES meetings (Kapel, MS 1982, MS 1989, MS 1993, MS 1994; Larsen and Kapel, MS 1979; Larsen, MS 1985). The purpose of the present paper is to give a complete survey of all recoveries in Greenland of tagged harp and hooded seals, and examine whether any change in the pattern of recapture reporting has occurred.

Materials and Methods

Marking of harp seals

More than 92 000 harp seal pups have been marked at the whelping patches. Most of these were tagged or branded in the Newfoundland region (total about 56 000), either in the Gulf of St. Lawrence or at the "Front" off Newfoundland/ Labrador (29 200 and 26 700, respectively). The most intense tagging effort was done in the years 1964 to 1970, 1977 to 1980 and 1983 (Table 1). The Canadian tagging was primarily carried out by personnel from the Department of Fisheries and Oceans, Arctic Biological Station and Northwest Atlantic Fisheries Centre, and until 1976 the Norwegian Institute of Marine Research participated in the tagging at the Front. In the Greenland Sea, around Jan Mayen, about 17 400 harp seal pups have been tagged by the Institute of Marine Research, the majority during experiments in 1983–84, 1987, and 1989–91 (Table 2). In the White Sea, a total of about 20 900 harp seals have been tagged by the Northern Branch of the Institute for Polar Fisheries and Oceanography (SevPINRO, Archangelsk) in cooperation with the Norwegian Institute for Marine Research. In this area, the most intensive tagging was carried out in the years 1989 to 1994 (Table 2).

Marking of hooded seals

The number of hooded seals that has been marked is significant lower than for harp seals, altogether about 9 500. Of these 4 788 were tagged or branded in the Gulf and Front areas, 1 465 at the Davis Strait whelping patch, 101 at the Denmark Strait moulting field, and 3 172 in the Jan Mayen whelping area (Table 3).

Marking techniques

In the early tagging experiments a number of different tag types were used, applied either in the seals' tail or hind flipper (Rasmussen and Øritsland, 1964; Sergeant, 1965; Popov, 1970). Later, various branding techniques were employed (Homestead *et al.*, 1972; Sergeant and Hoek, MS 1974) but since the early-1970s most harp and hooded seals were tagged with Dalton rototags in one or both hind flippers. Different colours have been used for the Canadian tagging experiments, but all rototags applied by Norwegian and Russian researchers were yellow. A serial number was printed on one part of the tag, whereas the other part contained the mailing address of the tagging institution (with few unfortunate exceptions).

Recovery reporting

A number of recaptures were in the tagging areas in the same season or a following year. These recoveries are not treated further here, and recoveries outside the tagging areas in regions other than Greenland are only mentioned in present paper to the extent that they put the Greenland recaptures into perspective.

When a Greenland hunter catches a marked seal, he is supposed to deliver the tag, or the part of skin with a brand mark, to the local trade department, or the municipality authorities, with information about date, place etc. of the recapture. This agency will lay out the reward to the hunter (at present DKR 75), and ship the tag (mark) with the available information to the Greenland Fisheries Research Institute (GFRI, now Greenland Institute for Natural Resources). GFRI would check the tag, send a letter of thanks with tagging information to the hunter (and a copy to the relevant agency in Greenland), and forward the recapture data to the tagging institute. A file of all tagging and recovery information was kept at the institute. Sometimes the tag was accompanied with the lower jaw of the seal, which offered an opportunity of checking our skill in the method of age determination from cross-sections of the canine teeth. A sample of about 250 of such teeth of "known age" is now available at GFRI, and in a number of instances the duplicate tooth was sent to the tagging institute.

The reporting efficiency in Greenland is not known with great precision. Apparently, the hunters most often deliver the tag shortly after the recapture, but in several cases a tag recovery was only reported several months, or years, after recapture, and it is quite possible that a number of tags were kept by the hunter, or dropped, and never reported. We have the impression that reporting is

TABLE 1. Summary of number of recoveries in Greenland of harp seals tagged or branded (br) at Newfoundland (Gulf – GU and Front – FR).

Year	Area	Nation	Pups tagged	Surviving* tags	Recaptures in Greenland (age group in years) Total	0	1	2–4	>5
1949	FR	NOR	95		1	1	–	–	–
1950	GU	CAN	125		3	3	–	–	–
	FR	CAN	59		–	–	–	–	–
1951	FR	CAN	178		–	–	–	–	–
	FR	NOR	29	23	–	–	–	–	–
1952	GU	CAN	203		–	–	–	–	–
	FR	CAN	371		9	4	4	1	–
	FR	NOR	68	62	–	–	–	–	–
1953	FR	CAN	304		9	7	2	–	–
1954	GU	CAN	116		1	–	1	–	–
1963	FR	SOV	79	77	2	2	–	–	–
1964	GU	CAN	2 971	1 313	–	–	–	–	–
1966	GU	CAN	1 350	1 345	31	31	–	–	–
	FR	CAN	3 581	1 919	4	4	–	–	–
1968	GU	CAN	2 219	1 164	12	8	4	–	–
1969	GU	CAN	1 556		12	3	7	2	–
	FR	NOR	12		1	1	–	–	–
1970	GU	CAN	1 966	420	1	1	–	–	–
	FR	NOR	47		4	1	–	1	2
1971	GU	CAN	60 br		–	–	–	–	–
	FR	NOR	68		5	–	2	1	2
1972	GU	CAN	550 br		9	5	2	2	–
	FR	NOR	61		4	1	–	3	–
1973	GU	CAN	70 br		3	2	–	–	1
	FR	CAN	934		9	6	2	–	1
1974	GU	CAN	391 br		4	2	–	1	1
1975	GU	CAN	918 br		22	9	2	5	5
	FR	NOR	38		–	–	–	–	–
1976	GU	CAN	363		12	4	2	3	3
	FR	CAN	99		3	2	1	–	–
	FR	NOR	301		16	6	4	–	6
1977	GU	CAN	1 297		31	12	5	8	6
1978	GU	CAN	4 378	4 170	81	11	22	17	31
	FR	CAN	5 000	4 984	176	45	38	38	55
1979	GU	CAN	2 680	2 574	72	22	16	14	20
	FR	CAN	2 884	2 365	78	27	14	14	23
1980	GU	CAN	3 632	3 601	73	11	15	15	32
	FR	CAN	3 615	2 645	66	12	15	21	17
1981	GU	CAN	69		–	–	–	–	–
	FR	CAN	346		4	1	–	–	3
1982	GU?	CAN	103		5	3	1	1	–
1983	GU	CAN	3 862	3 679	87	21	10	28	28
	FR	CAN	8 401	8 217	175	36	31	55	53
1984	FR	CAN	148		2	2	–	–	–
1989	?	CAN	?		1	1	–	–	–
1990	GU	CAN	112		1	1	–	–	–
??	?	CAN	?		8	–	–	–	–
SUM	**GU**		**29 194+**		**460**	**149**	**87**	**96**	**127**
	FR		**26 718+**		**568**	**158**	**113**	**134**	**162**
	?				**9**	**1**	**–**	**–**	**–**
TOTAL			**55 912+**		**1 037**	**308**	**200**	**230**	**289**

? indicate that information on the tagging agency, year or number of seals tagged is not available.
* surviving tags is the number of tags left in the cohort when the number of pups recaptured in the tagging area the same year has been subtracted (see text page 4).

TABLE 2. Summary of number of recoveries in Greenland of harp seals.

Year	Pups tagged	Surviving tags	Recaptures in Greenland (age group in years)				
			Total	0	1	2–4	>5
A. Tagged at Jan Mayen (the Greenland Sea)							
1951	50		–	–	–	–	–
1952	33		–	–	–	–	–
1953	159		–	–	–	–	–
1954	17		–	–	–	–	–
1955	99		–	–	–	–	–
1957	2		–	–	–	–	–
1958	18		–	–	–	–	–
1959	1		–	–	–	–	–
1960	2		–	–	–	–	–
1961	9		–	–	–	–	–
1963	5		–	–	–	–	–
1967	1		–	–	–	–	–
1968	17		–	–	–	–	–
1970	11		–	–	–	–	–
1971	6		–	–	–	–	–
1972	35		–	–	–	–	–
1974	7		–	–	–	–	–
1977	481	480	1	1	–	–	–
1978	498	488	4	2	1	–	1
1979	1		–	–	–	–	–
1980	14		–	–	–	–	–
1983	1 310	1 301	3	1	–	1	1
1984	1 334	1 328	7	1	1	4	1
1985	615	612	2	1	1	–	–
1986	4		–	–	–	–	–
1987	2 138	2 073	9	2	3	2	2
1988	316	316	1	–	1	–	–
1989	3 798	3 792	6	3	1	2	–
1990	3 006	3 004	3	–	2	1	–
1991	3 328	3 327	8	3	2	3	
1992	3		–	–	–		
1993	?						
1994	15		–	–			
TOTAL	**17 331**		**44**	**14**	**12**	**13**	**5**
B. Tagged in the White Sea							
1963–71	2 791		–	–	–	–	–
1987	27		–	–	–	–	–
1989	1 626		–	–	–	–	–
1990	3 352		–	–	–	–	–
1991	4 161		–	–	–	–	–
1992	2 314		3	3	–	–	–
1993	1 800		–	–	–	–	–
1994	4 871		–	–	–	–	–
TOTAL	**20 942**		**3**	**3**	**–**	**–**	**–**

more efficient from settlements, where field work has recently occurred, and good personal contacts have been established. A dedicated effort to trace non-reported recaptures locally has not been made, but through prompt feed-back to reporting hunters and occasional general information on the tagging-recovery scheme it is hoped that increased awareness and cooperation is achieved.

TABLE 3. Marking of hooded seals and recoveries in Greenland.

Year	Tagged or branded at Newfoundland Gulf	Newfoundland Front	Davis Strait	Denmark Strait	Recovered in Greenland Gulf	Front	Davis	Denmark	Tagged at Jan Mayen	Recovered in Greenland
1951	–	1	–	–	–	1	–	–	18	–
1952	–	–	–	–	–	–	–	–	13	–
1953	–	–	–	–	–	–	–	–	8	–
1954	–	–	–	–	–	–	–	–	–	–
1955	–	–	–	–	–	–	–	–	4	–
1956	–	–	–	–	–	–	–	–	16	–
1957	–	–	–	–	–	–	–	–	–	–
1958	–	–	–	–	–	–	–	–	9	–
1959	–	–	–	–	–	–	–	–	21	–
1960	–	–	–	–	–	–	–	–	18	–
1961	–	–	–	–	–	–	–	–	26	–
1962	–	–	–	–	–	–	–	–	11	–
1963	–	–	–	–	–	–	–	–	43	–
1964	–	10	–	–	–	2	–	–	13	–
1965	–	–	–	–	–	–	–	–	13	–
1966	–	50	–	–	–	–	–	–	14	–
1967	–	69	–	–	–	–	–	–	26	–
1968	–	–	–	–	–	–	–	–	38	–
1969	–	29	–	–	–	–	–	–	20	–
1970	–	30	–	–	–	1	–	–	26	–
1971	13	37	–	–	–	1	–	–	25	–
1972	29	26	–	–	1	–	–	–	83	–
1973	3	–	–	–	–	–	–	–	–	–
1974	20?	–	–	101[a]	–	–	–	3	3	–
1975	75	73	–	–	2	–	–	–	8	–
1976	80	5	–	–	4	–	–	–	5	–
1977	64	–	–	–	1	–	–	–	35	–
1978	52	–	–	–	–	–	–	–	32	–
1979	28	–	–	–	2	–	–	–	67	–
1980	–	–	–	–	–	–	–	–	14	–
1981	182	–	–	–	3	–	–	–	–	–
1982	163	–	–	–	2	–	–	–	–	–
1983	69	835	–	–	–	–	–	–	294	–
1984	426	415	1 465	–	9	4	8	–	403	–
1985	–	702	–	–	–	14	–	–	350	–
1986	16	–	–	–	–	–	–	–	1 441	1
1987	–	–	–	–	–	–	–	–	36	–
1988	–	–	–	–	–	–	–	–	3	–
1989	–	–	–	–	–	–	–	–	8	–
1990	–	–	–	–	–	–	–	–	7	–
1991	–	–	–	–	–	–	–	–	–	–
1992	–	–	–	–	–	(3)	–	–	21	–
1993	–	–	–	–	–	–	–	–	–	–
1994	–	–	–	–	–	–	–	–	–	–
SUM	2 507	2 281	1 465	101	24	23	8	3	3 172	1
	4 788				**50**					

[a] 72 subadults, 7 adult males and 19 adult females.

Results

Harp seals tagged at Newfoundland

The total number of tags (and brands) of Newfoundland origin reported from Greenland (1 037) constitute about 2% of the number of marked animals (55 912). It might be more appropriate to relate the Greenland recoveries to the "surviving tags", i.e. subtracting the number of tagged animals recaptured during the initial whelping and moulting period before calculating recovery rates for Greenland, but the relevant

information was not available for all tagging experiments in time for preparing this manuscript. It was estimated that the overall rate resulting from such an exercise would be of the order 2.5–3%.

There were, however, significant differences between recovery rates of the various experiments, and there was an apparent change from the earliest to the latest experiments: During the years 1949–54 a total of 1 548 harp seals were tagged at Newfoundland, of which 97 (6.3%) were recovered later (Rasmussen and Øritsland, 1964; Sergeant, 1965; Bowen and Sergeant, 1983). Fifty-five (55) of the recaptures (3.6%) were done in the ice fields immediately after tagging, 15 (1.0%) in Greenland during the following summer, and 2 (0.1%) at Labrador-Newfoundland during the first autumn migration. During the following four years more recoveries were reported from the whelping/moulting layers (13), Greenland (8), Arctic Canada (2) and the autumn migration (2). Most of the recoveries for this period thus came from the ice fields (total 4.4%), followed by Greenland (1.5%).

Similar detailed information was not available for all the later periods, but estimates of the recovery rates in Greenland can be given: For the period 1963–70 the Greenland recoveries constituted less than one percent (0.85) of the surviving tags, of which the majority (0.65%) was reported during the first year of life (Table 1). For this period, as for the previous period, there were few reports of recapture of tagged seals after the second year of life (about 0.06%). One of these represented, however, the longest life-span recorded for a harp seal tag: An animal tagged at the Front in 1970 was recaptured in Greenland in September 1995.

This pattern changed during the following years: About 2.3% of the harp seals tagged during 1971–77 were reported from Greenland, of which 0.95% were during the first year of life, 0.39% during the second, 0.45% from 2–4 year old seals, and 0.48% from seals older than 5 years (up to 18 years). From the large scale tagging during 1978 to 1980, 546 tags have been returned from Greenland, corresponding to 2.68% of the surviving tags, distributed with 0.63, 0.59, 0,59 and 0.88% at the above-mentioned age groups, respectively. For the last large scale tagging experiment in 1983, 262 tags have up till now been sent in from Greenland (total 2.20% of surviving tags with 0.48, 0.34, 0.70 and 0.68% from age group 0, 1, 2–4 and 5+, respectively).

The regional and seasonal distribution of tags or brands reported from Greenland is illustrated by Table 4 and Fig. 1–2. As they all were from seals taken in deliberate hunting, they would be expected to reflect the pattern of the hunting activity.

A total of 19 (1.9%) of the tags of Newfoundland origin were reported from North Greenland (Thule district), 378 (37.0%) from North West Greenland (Upernavik and Uummannaq districts), 394 (38.6%) from Central West Greenland (the Disko Bugt region), 134 (13.1%) from Southwest Greenland, 68 (6.7%) from South Greenland (Narsaq, Qaqortoq and Nanortalik districts), 27 (2.6%) from Southeast Greenland (Ammassalik district), and 1 tag (0.1%) from Northeast Greenland (Scoresbysund). This regional, as well as the seasonal, distribution was in general agreement with the known distribution of catches of harp seals in Greenland (Rosendahl, 196; Kapel, 1975).

There were, however, some interesting features when the distribution pattern in greater details: From the early tagging programs (1949–69), most of the Greenland recoveries came from the Disko Bugt region (42%), particularly the inner part of the bay (35%). During the following period. 1970–77, the same region again accounted for about 42% of all recoveries, but in recent taggings only 19% came from the inner part of the bay, whereas 23% were reported from the southwestern area, the entrance to the Disko Bugt. This area continued to contribute with a high percentage of the recoveries from the large scale experiments in 1978, 1979, 1980 and 1983 (35, 22, 33 and 19%, respectively), whereas rather few tags were received from the inner part of the Bay (9, 12, 15 and 9%, respectively).

During the 1949–69 tagging period, the number of returns from the regions north and south of the Disko Bugt was almost equal (31 and 27%, respectively), and there was no recovery from East Greenland. During the following period (1970–77), however, 50% of the reports were from the northern regions (Uummannaq, Upernavik and Thule districts), and less than 7% from Southwest and South Greenland – and 1% from Ammassalik, Southeast Greenland. The northern regions continued to contribute with many tags from the 1978, 1979, 1980 and 1983 year-classes (34, 47, 31 and 43%, respectively), and increased numbers came from the southern regions (20, 13, 17 and 28%) or from Ammassalik district (3, 5, 4 and 1%). Only one harp seal tag of Newfoundland origin has been reported from Scoresbysund, Northeast Greenland (tagged in the Gulf 1980, recovered 3 1/2 years later).

The seasonal distribution of tag returns have varied over the years within the different regions, but apparently without any obvious trend. A general

TABLE 4. Recoveries in Greenland of harp seals tagged at Newfoundland, 1949–94, by month, district and recovery age.

District[+]	Recovery age group (yr)	Month recovered III	IV	V	VI	VII	VIII	IX	X	XI	XII	I	II	Unknown	Total
THU	>5	–	–	–	–	–	1	5	2	1	1	–	–		10
	2–4	–	–	–	–	–	–	5	2	–	–	–	–		7
	1	–	–	–	–	–	1	1	–	–	–	–	–		2
	0	–	–	–	–	–	–	–	–	–	–	–	–		–
	SUM	**–**	**–**	**–**	**–**	**–**	**2**	**11**	**4**	**1**	**1**	**–**	**–**		**19**
UPV	>5	–	–	1	3	2	6	23	25	11	2	–	–		73
	2–4	–	–	–	4	5	14	19	23	2	–	–	–	1	68
	1	–	–	–	–	2	10	14	4	3	–	–	–	1	34
	0	–	–	–	–	8	8	5	3	1	–	–	–		25
	SUM	**–**	**–**	**1**	**7**	**17**	**38**	**61**	**55**	**17**	**2**	**–**	**–**	**2**	**200**
UMQ	>5	–	–	–	5	8	8	1	1	1	1	–	–		25
	2–4	–	–	–	3	4	11	4	1	1	–	–	–		24
	1	–	–	–	–	6	31	7	5	3	1	–	–		53
	0	–	–	–	–	5	45	23	3	2	–	–	–	3	81
	SUM	**–**	**–**	**–**	**8**	**24***	**96***	**35**	**10**	**7**	**2**	**–**	**–**	**3**	**185***
CWe	>5	–	–	–	5	8	1	3	3	6	2	3	–	4	35
	2–4	–	–	1	7	4	4	4	3	3	2	2	–	1	31
	1	–	1	–	2	2	4	1	6	1	2	2	–	1	22
	0	–	–	–	1	5	14	17	11	–	–	2	1		51
	SUM	**–**	**1**	**1**	**15**	**19**	**23**	**25**	**23**	**10**	**6**	**9**	**1**	**6**	**139**
CWw	>5	–	–	1	11	11	9	3	15	20	12	4	–	1	87
	2–4	4	3	–	4	4	3	3	10	9	14	6	3		63
	1	1	–	–	–	4	3	5	10	4	5	8	4		44
	0	–	–	–	1	12	8	7	9	5	6	8	7		63
	SUM	**5**	**3**	**1**	**16**	**32***	**23**	**19***	**44**	**38**	**37**	**26**	**14**	**1**	**259***
SW	>5	4	1	4	8	7	3	–	7	2	2	–	3	2	43
	2–4	–	–	2	11	2	2	–	2	1	2	1	–		23
	1	6	1	3	4	–	–	–	–	1	2	4	3		24
	0	–	–	1	9	4	3	–	1	3	9	4	9		43
	SUM	**10**	**2**	**10**	**32**	**13**	**10***	**–**	**10**	**7**	**15**	**9**	**15**	**2**	**135***
S	>5	–	–	–	5	1	–	–	–	1	–	–	–		7
	2–4	–	–	1	3	2	1	–	–	–	–	–	–		7
	1	2	–	–	4	4	1	1	–	2	1	–	–		15
	0	–	–	4	11	15	5	–	2	–	1	–	–		38
	SUM	**3***	**–**	**5**	**23**	**22**	**7**	**1**	**2**	**3**	**2**	**–**	**–**		**68***
AMM	>5	–	–	–	–	–	5	1	2	4	–	–	–		12
	2–4	–	–	–	–	2	1	–	–	–	–	–	–		3
	1	–	–	–	–	2	–	1	1	1	–	–	–		5
	0	–	–	–	–	1	3	1	1	–	–	–	–		6
	SUM	**–**	**–**	**–**	**–**	**6***	**9**	**3**	**4**	**5**	**–**	**–**	**–**		**27***
SCO	>5	–	–	–	–	–	–	–	–	–	–	–	–		–
	2–4	–	–	–	–	–	–	1	–	–	–	–	–		1
	1	–	–	–	–	–	–	–	–	–	–	–	–		–
	0	–	–	–	–	–	–	–	–	–	–	–	–		–
	SUM	**–**	**–**	**–**	**–**	**–**	**–**	**1**	**–**	**–**	**–**	**–**	**–**		**1**
??	2–4	–	1	–	–	–	–	–	–	–	–	–	1		2
	0	–	–	–	–	–	–	–	–	–	–	–	1	1	2
	SUM	**–**	**1**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**2**	**1**	**4**
TOT	>5	4	1	6	37	37	33	36	55	46	20	7	3	7	292
	2–4	4	4	4	32	23	36	36	41	16	18	9	4	2	229
	1	9	2	3	10	20	50	30	26	15	11	14	7	2	199
	0	–	–	5	5	50	86	53	30	11	16	14	18	4	309
	SUM	**18***	**7**	**18**	**84**	**133***	**208***	**156***	**152**	**88**	**65**	**44**	**32**	**15**	**1 037***

[+] See Fig. 1 for district names.
* indicate that the sum include recoveries of unknown age (because the year of tagging is not known).

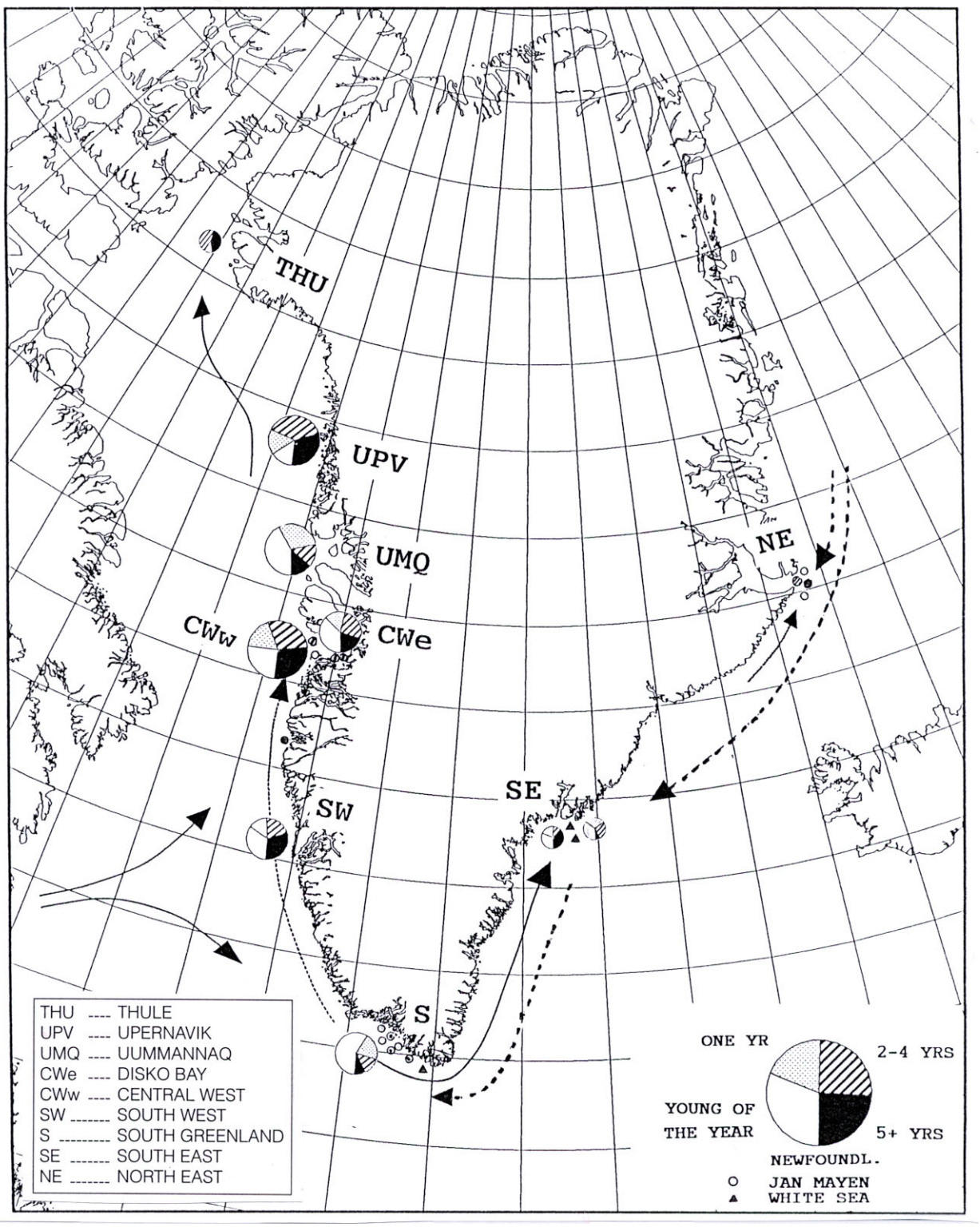

Fig. 1. Regional distribution of recoveries in Greenland of marked harp seals.

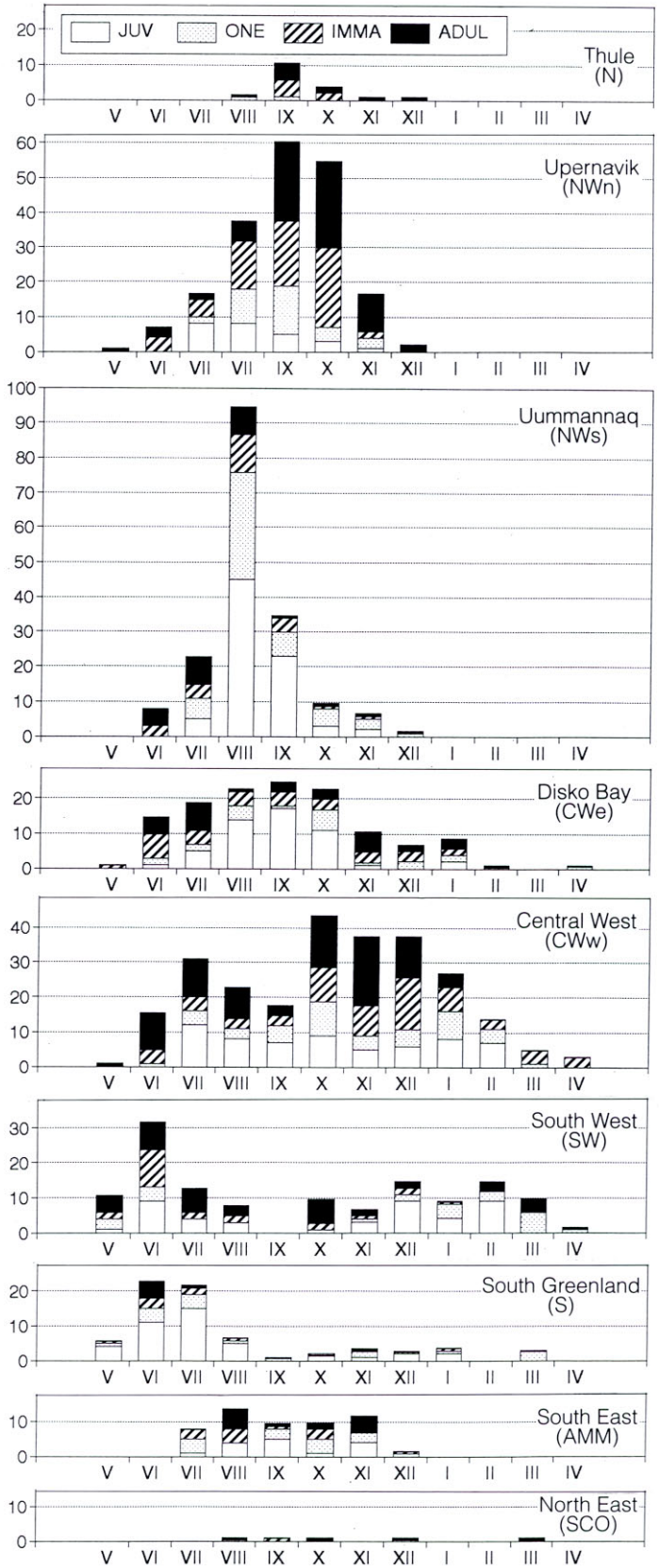

Fig. 2. Distribution by region, month and age of recoveries in Greenland of harp seals marked at Newfoundland (Gulf and Front). [JUV – <one year; ONE – one year old; IMMA – immature (2–4 years); ADUL – adult (≤5 years).

observation was that quite a few tags were reported from the winter and spring months, not only from immature animals but also from adults.

A change in the age composition has occurred: as already mentioned, rather few recaptures of seals older than two years of age were made prior to 1978 (26.6%). For the following four tagging experiments, about half of the tags were recovered from immature 2–4 years old (21, 19, 26 and 32%, respectively) or adult seals (>5 years, 34, 28, 36 and 30%).

Harp seals tagged at Jan Mayen

Of the 44 harp seal tags of Jan Mayen origin reported from Greenland since 1977, 28 (64%) were returned from Ammassalik, Southeast Greenland (Table 5). Most of them were caught between July and November, and the majority (26) were young or immature animals (less than 4 years old). This is in contrast to the harp seals tagged at Newfoundland caught in the same district and same months, of which 44% were more than 5 years old.

Two young-of-the-year and a ten year old harp recovered in Scoresbysund district, Northeast Greenland, were also caught between summer and late-autumn, but an eight year old animal was taken in mid-March, possibly heading for the near-by whelping patch.

Twelve harp seals tagged at Jan Mayen have been reported from West Greenland, seven from South Greenland and five further north as far as in the Disko Bugt (approximately 70°N). Most of them were immature animals caught in late-autumn or early-winter, but a five year old animal was taken in Southwest Greenland in May.

Harp seals tagged in the White Sea

Three harp seals tagged in the White Sea whelping region in 1992 were recaptured in Greenland the same year, two in Ammasalik district and one in the southernmost district of West Greenland (Nanortalik).

Hooded seals

Of the 58 recoveries of hooded seals tagged in the Northwest Atlantic (Gulf, Front, Davis Strait), 33 (57%) were recaptured in Ammassalik district, Southeast Greenland (Fig. 3). The main hunting season in this area is July–August, and there are few recoveries before or after this season. Most recaptures (21) were one or two year old animals, but three young-of-the-year bluebacks and three adult (5+) hooded seals were also reported. From this district were also reported one recapture of a hooded seal tagged in the Denmark Strait (17 years after tagging!) and the one and only Jan Mayen recovery, in May at the age of seven years.

From South and Southwest Greenland 18 hooded seals originating from the Northwest Atlantic whelping patches and 2 from the Denmark Strait moulting area have been reported. Most were caught between late-March and early-June (15) or late July–August (3). Four were few months old bluebacks, five were one-year old, and the remainder aged up to 10 years.

There were 7 hooded seals reported from Central or North West Greenland. One was a blueback tagged in the Davis Strait and recaptured in late-May just south of the Disko Bugt. Two other bluebacks and a one-year old were taken farther north in Northwest Greenland in October–November. Three older animals (4–6 years) were reported from May, June and August, respectively.

Discussion

The distribution of recoveries of harp and hooded seals in Greenland were in general accordance with the known distribution of catches, but the relative contribution of recoveries from districts or regions varied and did not always reflect the relative importance of catches in the area in question. This may in part be due to different attitudes to the importance of reporting a recapture; it is likely that reporting is more efficient in the hunting districts than in the fishing district, partly because the local population through contact with researchers on field work is more aware of the studies of seals being carried out.

The observed change of geographical distribution of recoveries from the early experiments to the more recent ones was probably influenced both by the above-mentioned factors and a real change in hunting effort. The growing importance of shrimp fishery in the Disko Bugt area may thus have led to both a real decrease in seal hunting effort and less interest in reporting.

The early results from tag recoveries gave the impression, that the Greenland hunting was mostly directed towards young animals. Results from the large tagging experiments between 1978 and 1983 have, however, resulted in recoveries of many tags from older harp seals, which seems to indicate that quite a few adult harps spend the summer and autumn in Greenland waters. In fact, some of them (and thus not only young or immature animals) seem to stay in open water areas along the coast of Greenland until late in winter or early-spring. Whether this is a new feature, or just a new piece of information obtained by the intensive tagging programs, is not easy to determine, both because the tagging effort has varied over the years and because the reporting effort as mentioned is likely to vary as well.

TABLE 5. Recoveries in Greenland of harp seals tagged at Jan Mayen, 1977–91, by month, district and recovery age.

District[1]	Recovery age group (yr)	Month recovered III	IV	V	VI	VII	VIII	IX	X	XI	XII	I	II	Unknown	Total
THU		–	–	–	–	–	–	–	–	–	–	–	–		–
UPV		–	–	–	–	–	–	–	–	–	–	–	–		–
UMQ		–	–	–	–	–	–	–	–	–	–	–	–		–
Cwe	>5	–	–	–	–	–	–	–	–	–	–	–	–		–
	2–4	–	–	–	–	–	–	–	–	–	1	–	–		1
	1	–	–	–	–	–	–	–	–	–	–	–	–		–
	0	–	–	–	–	–	–	–	–	1	–	–	–		1
	SUM	–	–	–	–	–	–	–	–	1	1	–	–		2
Cww	>5	–	–	–	–	–	–	–	–	–	–	–	–		–
	2–4	–	–	–	–	–	–	–	–	–	1	1	–		2
	1	–	–	–	–	–	–	–	–	–	–	–	–		–
	0	–	–	–	–	–	–	–	–	–	–	–	–		–
	SUM	–	–	–	–	–	–	–	–	–	1	1	–		2
SW	>5	–	–	1	–	–	–	–	–	–	–	–	–		1
	2–4	–	–	–	–	–	–	–	–	–	–	–	–		–
	1	–	–	–	–	–	–	–	–	–	–	–	–		–
	0	–	–	–	–	–	–	–	–	–	–	–	–		–
	SUM	–	–	1	–	–	–	–	–	–	–	–	–		1
S	>5	–	–	–	–	–	–	–	–	–	–	–	–		–
	2–4	–	–	–	–	–	–	–	–	–	–	1	–		1
	1	1	–	1	–	–	–	–	–	–	–	1	–		3
	0	–	–	–	–	–	–	–	–	–	1	2	–		3
	SUM	1	–	1	–	–	–	–	–	–	1	4	–		7
AMM	>5	–	–	–	–	–	1	–	–	1	–	–	–		2
	2–4	–	–	–	–	1	3	1	3	–	1	–	–		9
	1	–	–	–	–	2	–	2	3	2	–	–	–		9
	0	–	–	–	–	–	1	4	–	3	–	–	–		8
	SUM	–	–	–	–	3	5	7	6	6	1	–	–		28
SCO	>5	1	–	–	–	–	–	–	1	–	–	–	–		2
	2–4	–	–	–	–	–	–	–	–	–	–	–	–		–
	1	–	–	–	–	–	–	–	–	–	–	–	–		–
	0	–	–	–	–	–	1	–	–	–	1	–	–		2
	SUM	1	–	–	–	–	1	–	1	–	1	–	–		4
TOT	>5	1	–	–	1	–	1	–	1	1	–	–	–		5
	2–4	–	–	–	–	1	3	1	3	–	3	2	–		13
	1	1	–	1	–	2	–	2	3	2	–	1	–		12
	0	–	–	–	–	–	2	4	–	4	2	2	–		14
	SUM	2	–	1	1	3	6	7	7	7	5	5	–		44

[1] See Fig. 1 for district names.

For hooded seals the most striking result is that almost all recoveries came from markings in the Northwest Atlantic (including the Denmark Strait). Only one tag from the Jan Mayen whelping patches has been reported from Southeast Greenland recently, which means that the recovery rate in Greenland is much lower for that region. Recaptures from other areas (with less hunting effort than Southeast Greenland) indicate that hooded seals from the Greenland Sea primarily disperse in the

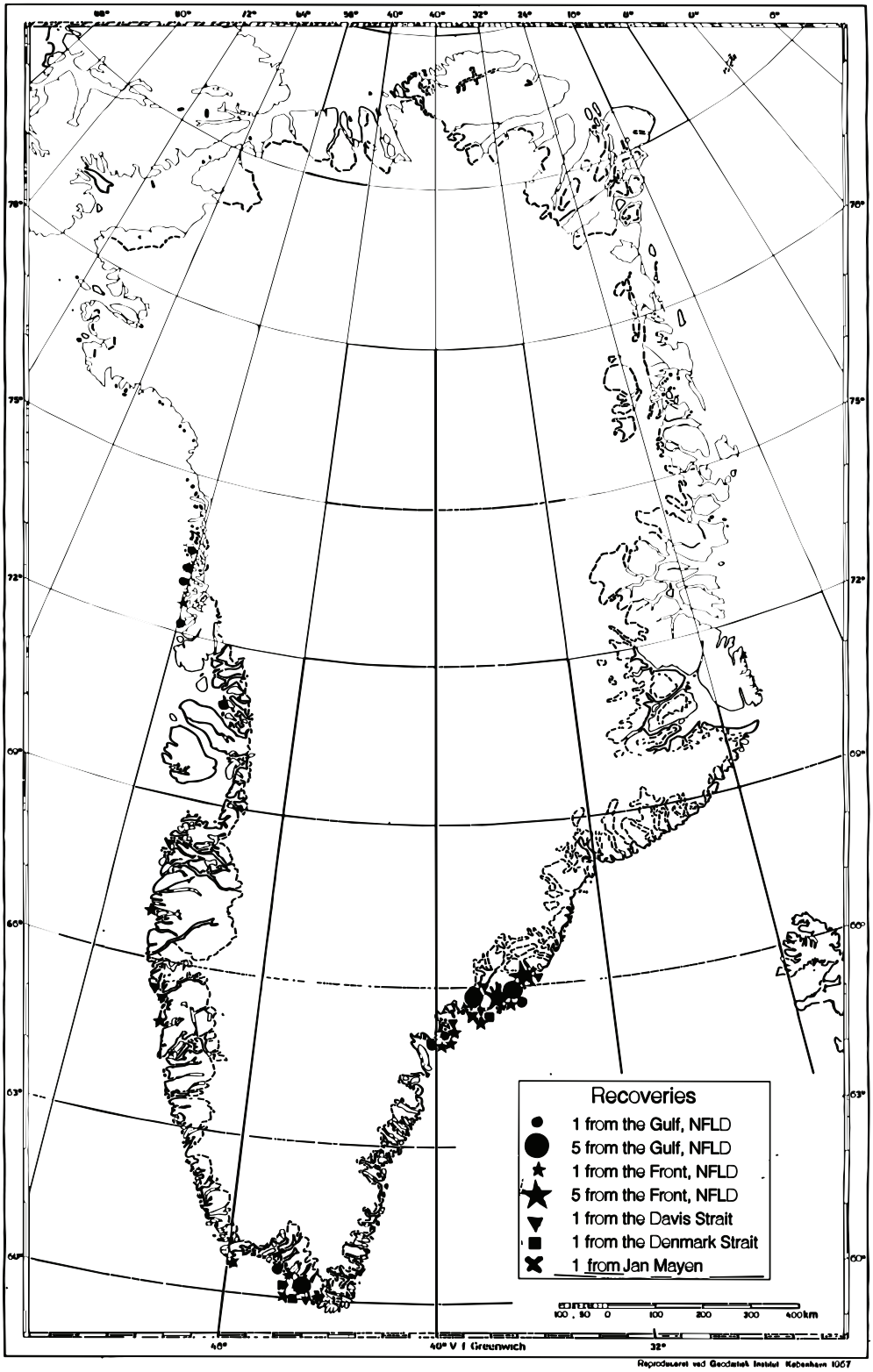

Fig. 3. Recoveries in Greenland of marked hooded seals.

eastern part of the North Atlantic (Øien and Øritsland, MS 1987, MS 1991, MS 1992, Folkow and Blix, 1995).

The recaptures of harp and hooded seals in Greenland thus contribute to the knowledge of migration and dispersal of these species, and new details in this pattern may still be found. It is, however, unlikely that the information can be used in any quantitative way, e.g. for mark-recapture assessments, for a number of reasons including that the reporting efficiency is unknown, and can hardly be calculated.

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