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Distribution of Harp and Hooded Seals in Offshore Waters of Newfoundland

by

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Abstract

Surveys of the offshore waters of Newfoundland and Labrador (NAFO Areas 2J3KL) were conducted from Platforms of Opportunity between 1991 and 1993. Results indicate that both harp and hooded seals are present in offshore waters during the winter. Although hooded seals appear to utilize the slope edge and northern areas to a greater extent than harp seals, the area near the 3KL border may be an important area for both species during the winter. Harp seals were particularly abundant in this area in 1992 and 1993. The results of groundfish hydroacoustic surveys of the area indicate that high densities of cod were present in this area in 1992 but not 1993, suggesting that the reason for the presence of seals in the area may not be the pre-spawning concentrations of cod, *per se*. By April, the distribution of both species shifted northward. The northward shift of harp seals continued into July, by which time hooded seals had left the area for the moulting patch in east Greenland.

Introduction

Knowledge of the distribution of a species is necessary to understand its role in the ecosystem. This is particularly important if we wish to understand interactions among predators such as seals and their prey. For example, by incorporating data on abundance (Bowen et al. 1987, Stenson et al. 1991, Shelton et al. 1992), energy requirements of individuals, and geographical, seasonal and age-related variations in diet (Ross 1993, Lawson and Stenson, unpublished data) and distribution, we may be able to estimate the impact of a seal species on commercial fish. Unfortunately, relatively few details are known about the distribution and migratory patterns of pelagic species such as harp and hooded seals. General patterns are based on anecdotal sightings from inshore areas and surveys of the whelping and/or moulting concentrations. However, these provide only partial data on harp seals and very little for hooded seals. As such, they are insufficient to allow us to estimate the impact of seals on a species such as cod. Stomach samples collected from seals on the whelping and moulting patches indicate that they do not feed extensively during these periods. Samples from inshore areas provide data on diet and distribution in these areas but anecdotal reports of seals in offshore areas during non-breeding periods indicate the need to examine, in greater detail, the entire potential range of these species.

The distribution and migration patterns of the harp seal (*Phoca groenlandica*) in the Northwest Atlantic was described by Sergeant (1965, 1991). Generally, harp seals are considered to be a near-shore species. During the summer, the majority of harp seals reside in the Canadian Arctic and Greenland waters, occurring as far north as Thule in northwest Greenland and extending west to Hudson Bay. In the fall, they migrate southward down the coast of Labrador, usually reaching the Strait of Belle Isle by late November or December. There they split into two groups, one which moves into the Gulf of St. Lawrence while the other remains off the coast of Newfoundland and Labrador. The population which remains in the Atlantic forms large whelping concentrations on the pack ice off southern Labrador or northeast Newfoundland in early March. Following mating (mid through late March), the animals disperse until the moulting period (mid April through mid May) when they again form large concentrations hauled out on the pack ice. Following the moult, harps seals disperse and eventually follow the receding pack ice north to the summer feeding grounds in the Arctic.

Detailed data on the distribution of seals in NAFO area 2J3KL, particularly during the winter, is limited. Robinson (1897) and Chafe (1923) reported that harp seals winter on the Grand Banks, although based on studies conducted between the late 1940's and mid 1980's, Sergeant (1991) thought this to be unlikely. Fisher (1955) reported that the timing of the migration into southern waters may have changed between the early 1920s and the 1950s. He hypothesized that the warmer temperatures which occurred in the early 1950's may have extended the summer range of harp seals to northwest Greenland, thereby delaying their return to Newfoundland waters. Earlier in the century, harps were reported to migrate only as far northward as southwest Greenland during the summer months, possibly due to the greater ice extent associated with cooler temperatures. In recent years, reports of seals occurring in areas where they had not been reported previously or at unusual times of year suggest that the seasonal and annual distribution and movements of harp seals have changed.

The hooded seal is considered to be a pelagic, deep-diving species which appears to prefer offshore waters where they feed on deep water fish such as Greenland halibut and redfish (Ross 1992). Since historical data on distribution has been based primarily on inshore sightings or sightings of the breeding and moulting concentrations, very little is known about the distribution of hooded seals in Canadian waters. Like harp seals, hooded seals whelp on the pack ice off the coast of southern Labrador or northeastern Newfoundland from mid March through early April. Hooded seals disperse following mating, eventually migrating to eastern Greenland by late June to moult. After the moult, which may not conclude until the end of August (Kovacs and Lavigne 1986, Sergeant 1976), hoods disperse widely. Some migrate south and west past Cape Farewell and then move north along the coast of west Greenland reaching as far as Thule (Kapel 1975). Little is known about hooded seal distribution during fall and winter months. Rasmussen (1960) has reported hoods feeding on the Grand Banks during February.

To increase our knowledge of offshore distribution of both species, a series of sighting surveys were carried out between 1991 and 1993 from platforms of opportunity on Fisheries and Oceans research cruises. These surveys provide an index of relative abundance of seals in different areas. This paper presents the preliminary results of these surveys.

Materials & Methods

Marine mammal sighting surveys were conducted during Fisheries and Oceans research cruises between 1991 and 1993. The majority of these surveys occurred during cruises directed towards groundfish (Table 1). During each cruise a trained observer maintained a watch from the bridge or crows nest. Observers recorded the start and end locations (latitude and longitude) for each transect. Transects were terminated at the end of each 2 hour watch or when the vessel changed heading. The total sighting effort was calculated as the straight line distance between the start and end of the transect, in kilometres. Occasionally changes in heading were not noted and the transect was continued. Therefore, the calculated effort represents the minimum possible. Sighting effort was classified according to year and season (January-March, April-May, June-August, September - December) and total for each NAFO Subunit area.

The area within a 180° swath in front of the vessel was scanned and all information on numbers, headings, activities and species of any seals observed were noted. If the species could not be positively identified, it was coded as 'unknown'. Examination of sightings for which the species was originally considered as 'unknown', but were later verified and the relative ease wth which hooded seals were identified suggests that the majority of unknown sightings were, in fact, harp seals. Therefore, all unknown seals were combined with harp seals for these analyses. Unknown seals accounted for less than 4% of the total seals observed.

The relative abundance of harp and hooded seals was expressed as the number of *sightings per 1000 km of effort in each subunit.*

Results

Sighting effort

Sighting surveys were conducted in winter (February) 1991, 1992, and 1993 (Fig. 1, Table 2). The total amount of effort expended in February 1991 was low, particularly in 3L. Good coverage was obtained from all areas in 1992 while northern 2J was not examined in 1993. *The southern portion of 3L was not surveyed in any year.*

Data on the spring distribution was obtained during surveys conducted in April 1992 (Fig. 2). Good coverage was obtained from most of 2J3KL with the exception of the northern 2J, northwest 3K, and southern 3L. A total of 3,217.5 km were surveyed (Table 2).

The summer distribution of seals was examined during surveys conducted in July and August 1991. Although only 1,038.25 km were surveyed, they were distributed relatively evenly over the shelf region of 2J3KL (Fig. 2, Table 2). Unfortunately, the shelf edge of 2J and the central area of 3L were not surveyed.

Harp seals

Harp seals were observed in almost all of the areas examined during the winter period although the number of seals sighted per 1000 km was lower in 1991 than in either 1992 or 1993 (Fig. 3, Table 3). Few seals were observed in 2J in any of the three years. In 1991, the highest densities of seals were observed in northern 3L (area 347). Similar densities of seals were found in this area in 1992 although much greater densities were observed in southern 3K (345, 346) and northern 3L (330). Similarly, high densities of seals were observed in southern 3K and northern 3L in 1993. Low densities of seals occurred in the remainder of 3L in all years.

During the spring of 1992, large concentrations of harp seals were observed in 344 and 345 (Fig. 4, Table 3). These concentrations primarily consisted of moulting seals hauled out on the pack ice. In contrast to the winter period, seals were present in most of the areas of 2J but were absent or present in low numbers in 3L, suggesting a northward shift in the distribution of harp seals.

Although sighting effort was low in many areas, the results of surveys conducted during the summer period indicate a northward, inshore migration of harp seals. No seals were observed in offshore areas of 3KL and seals were present in only 1 area (331) south of the Strait of Belle Isle (Fig. 4, Table 3).

Hooded Seals

Distinct differences were observed between the distribution patterns of harp and hooded seals (Fig. 5, Table 4). Hooded seals were more abundant than harp seals during the winter surveys conducted in 1991, although they were less abundant in 1992 and 1993. In all three years hooded seals were more likely to be encountered along the continental shelf and in northern areas than along the Grand Bank. With the exception of 1993, few hooded seals were present in 3L, although low numbers were present in area 330 in all years.

Hooded seals were present in relatively few areas during the spring survey period (Fig. 6, Table 4). With the exception of seals observed near the harp seal moulting patch (area 344), hooded seals were restricted primarily to the shelf edge of 3K and northern 2J. Although harp seals were common in area 345 during the same surveys, no hooded seals were present. Hooded seals were rare in southern 2J and were present in only 1 area within 3L (area 325) where less than 4 seals/1000 km were observed.

No hooded seals were observed during the cruises conducted in the summer period of 1991 (Fig. 6, Table 4).

Discussion

The results of winter surveys indicate that the southern 3K/northern 3L area was important to wintering harp seals in 1992 and 1993. Although seals were found in other areas, the highest concentrations were found in 330, 331, 345 and/or 346 in both years. Few seals were seen in these areas in 1991 but this may have been affected by the lack of sighting effort in 331 and 345 and the low amount of effort in 330 and 346 during the first survey. This area of high seal densities appear to be similar to the regions in which the greatest densities of cod were observed during hydroacoustic surveys conducted during February 1991 and 1992 (Baird *et al.* 1992). A similar survey in 1993, however, did not find Atlantic cod in the area (Bishop, pers. com) although seals were still present in densities similar to those seen in 1992. This suggests that the reason for the presence of seals in the area may not be pre-spawning concentrations of cod, *per se*.

The presence of seals in offshore waters during the winter confirms historical reports by Robinson (1897) and Chafe (1923), but are in contrast to more recent studies by Sergeant (1965, 1991). Unfortunately, it is difficult to determine if this represents a shift in distribution in recent

years. If Sergeant's (1991) comments concerning the absence of harp seals in offshore waters during the winter were supported by actual surveys, the results of this study would suggest a change in distribution. However, if Sergeant's comments were based on the lack of anecdotal reports of seals, as appears likely, it is possible this apparent change in distribution simply reflect a change in effort. Although a few large concentrations of seals were observed, comparing these to reports and sightings in nearshore areas (Stenson unpubl. data) suggests that the majority of harp seals are inshore at this time of the year.

By April, the majority of the seals had moved inshore to form moulting concentrations. In 1992, these were located north of Cape Freels. The general distribution of seals appeared to be shifted northward as indicated by the low number of sightings in 3L and the increased densities of seals observed in northern 2J. The northward migration of harp seals was well developed by July. There also appeared to be a movement toward coastal areas by the summer. No seals were observed in offshore areas during this survey, although reports of incidental catches of harp seals in gillnets set near the Virgin Rocks in 1992 (Stenson and Kavanagh, unpubl. data) indicates that seals remain in 3L as late as July in some years.

Hooded seals were observed primarily in deeper water along the continental slope during the winter surveys. This is not unexpected considering the importance of deep water fish such as Greenland halibut and redfish in their diet (Ross 1993) and supports an earlier report of hooded seals feeding on the Grand Banks in February (Rasmussen 1960). Some differences were observed among years. In 1991 and 1992, hooded seals were distributed primarily in 2J and 3K whereas in 1993, the largest concentration was observed in northern 3L. Incidental catches of hooded seals by commercial cod trawlers during January and February, 1991 and 1992 indicate that they were also present near the 3KL border in all three years. Unlike harps, hooded seals are seldomly reported from inshore areas, suggesting that the majority of the population remains offshore during the winter.

Few hooded seals were found in the southern portions of the survey area during April. The presence of seals on the continental shelf (area 344) may reflect movement away from the whelping areas which traditionally occur in this area. The absence of hooded seals during surveys conducted in July is most likely due to a movement away from southern Canadian waters to the moulting area in the Denmark Strait.

Although this study provides data on the relative distribution of harp and hooded seals in offshore areas, it does not allow us to estimate the total abundance in these areas. Seals are extremely difficult to observe in the water, both because of their size and the short surfacing intervals. For example, recent data indicate that hooded seals remain underwater for 85% of the time when in open water (Stenson *et al* unpublished data). Therefore, the probability of sighting a seal along the centre line of the transect (g(0)) is likely to be much less than 1. This value must be determined before any estimate of total abundance can be made (Eberhart *et al.* 1979). Also, we must be extremely cautious before making comparisons among the densities observed in different years or seasons. To date, the data has not been corrected for different observers, vessels or sighting conditions.

This study is the first step toward identifying the migratory patterns of harp and hooded seals in offshore areas. It has shown that seals do utilize these areas and that hooded seals appear to utilize the slope edge and northern areas to a greater extent than harps. However, the area near the 3KL border may be an important feeding area for both species during the winter.

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Table 1. Summary of vessel trips between 1991 and 1993 during which marine mammal watches were conducted.

Vessel	Dates	Areas covered	Purpose
Gadus Atlantica	Feb. 3 - 25, 1991	2J3KL	Groundfish hydroacoustic survey
Dawson	July 20 - Aug.5, 1991	2J3KL	Oceanographic cruise
Gadus Atlantica	Feb.5 - Mar.4, 1992	2J3KL	Groundfish hydroacoustic survey
Beothic Endeavor	Apr. 15 - 30, 1992	339, 344, 345 & 347	Marine Mammals moulting charter
Northern Kingfisher	Apr. 7 - 27, 1992	2J3KL	Groundfish sounder survey
Nfld. Lynx	Apr. 7 - 27, 1992	3KL	Groundfish sounder survey
Gadus Atlantica	Feb. 4 - Mar. 2, 1993	2J3KL	Groundfish hydroacoustic survey
Brandal	Feb. 10 - 25, 1993	3KL	Marine Mammals seal distribution & sampling

Table 2. Total sighting effort in kilometers expended during DFO vessel cruises between 1991 and 1993

NAFO Area	Sub-area	1991 Winter	1991 Summer	1992 Winter	1992 Spring	1993 Winter
2J	201		10.18			
	202		28.97	26.27	44.08	
	203	32.76		171.79	86.44	81.81
	204	34.38		63.66	49.47	51.00
	206	40.15		473.62	199.61	105.06
	207		113.87		86.26	
	208		20.10			
	210		5.23			
	211	3.71	82.71	133.21	98.60	
3K	339		11.80	18.46	140.49	
	341		77.34			
	342		141.37			
	343		31.36	73.70		
	344		13.79		45.55	
	345		6.26	255.50	41.84	
	346	100.56	51.96	321.73	424.58	319.03
	347	37.34	105.40	176.51	153.97	168.07
3L	325		8.57	158.32	253.40	41.01
	326		59.95	26.63	423.79	37.43
	327		2.63		233.94	
	328				68.45	
	329			188.76	182.59	88.33
	330	34.38		280.10	311.36	731.41
	331		207.37	26.40	44.15	12.49
	332		7.84	157.66	142.71	15.66
	333					141.29
	335		52.55	35.66	52.35	1.75
	336				31.03	63.07
	337				76.92	
	338				25.93	
TOTAL		**283.28**	**1038.25**	**2517.96**	**3217.51**	**1857.39**

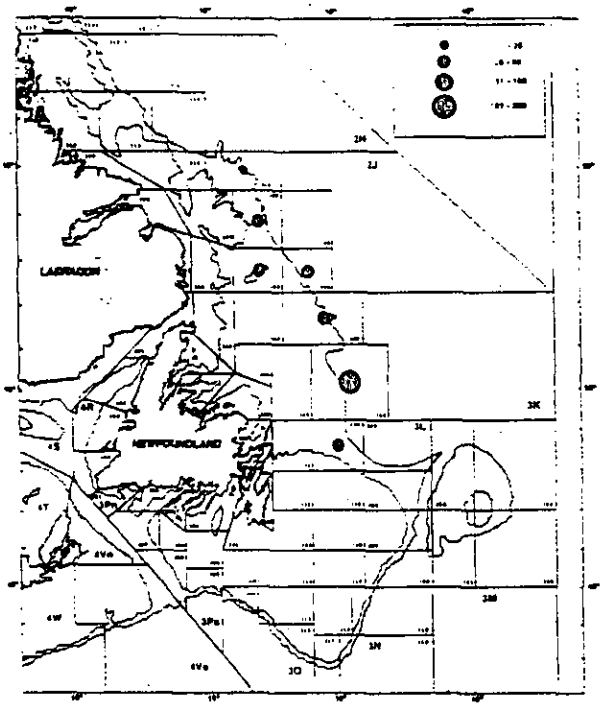
Table 3. Harp and 'unknown' seal sightings per 1000 kilometers of effort from marine mammal watches during DFO cruises between 1991 and 1993.

NAFO Area	Sub-area	1991 Winter	1991 Summer	1992 Winter	1992 Spring	1993 Winter
2J	201		98.23			
	202		34.88	0.00	0.00	
	203	30.53		23.28	11.57	12.22
	204	0.00		0.00	20.21	0.00
	206	0.00		4.22	0.00	0.00
	207		97.19		46.37	
	208		99.50			
	210		191.20			
	211	0.00	0.00	7.51	314.40	
3K	339		0.00	0.00		
	341		0.00			
	342		113.18			
	343		0.00	94.98		
	344		0.00			
	345		0.00	1972.60	1386.23	
	346	19.89	0.00	988.41	350.94	4623.39
	347	535.62	0.00	390.91	110.41	113.05
3L	325		0.00	18.95	11.84	438.92
	326		0.00	187.76	9.44	53.43
	327		0.00		8.55	
	328				0.00	
	329			168.41	0.00	203.78
	330	232.69		3238.13	9.64	1125.22
	331		4.82	0.00	0.00	4403.52
	332		0.00	6.34	0.00	0.00
	333					92.01
	335		0.00	28.04	0.00	0.00
	336					63.42
	337					
	338					

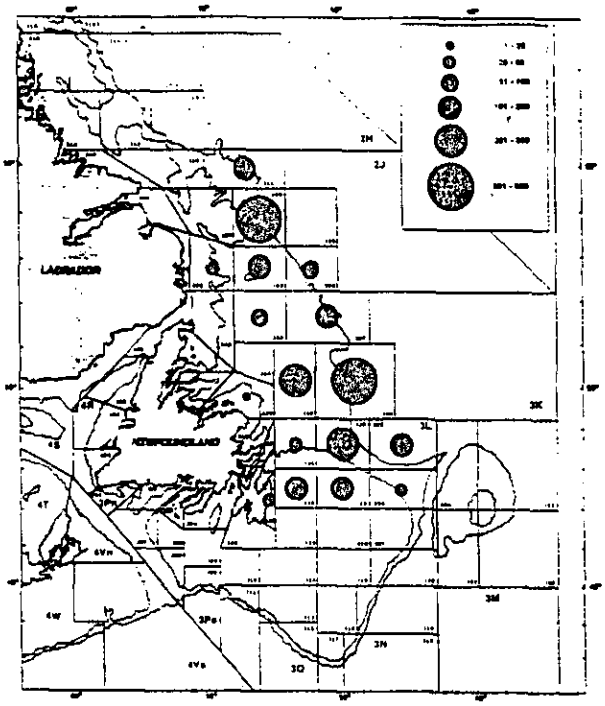
Table 4. Hooded seal sightings per 1000 kilometers of effort from marine mammal watches during DFO cruises between 1991 and 1993.

		1991		1992		1993
NAFO Area	Sub-area	Winter	Summer	Winter	Spring	Winter
2J	201		0.00			
	202		0.00	0.00	0.00	
	203	335.78		11.64	0.00	12.22
	204	58.17		0.00	0.00	19.61
	206	547.95		14.78	5.01	9.52
	207		0.00		0.00	
	208		0.00			
	210		0.00			
	211	269.54	0.00	165.15	243.41	
3K	339		0.00	0.00		
	341		0.00			
	342		0.00			
	343		0.00	0.00		
	344		0.00			
	345		0.00	0.00	0.00	
	346	328.16	0.00	87.03	73.01	169.26
	347	214.25	0.00	33.99	227.32	17.85
3L	325		0.00	6.32	3.95	2974.88
	326		0.00	0.00	0.00	0.00
	327		0.00		0.00	
	328				0.00	
	329			0.00	0.00	0.00
	330	116.35		32.13	0.00	99.81
	331		0.00	0.00	0.00	0.00
	332		0.00	6.34	0.00	0.00
	333					0.00
	335		0.00	0.00	0.00	0.00
	336					0.00
	337					
	338					

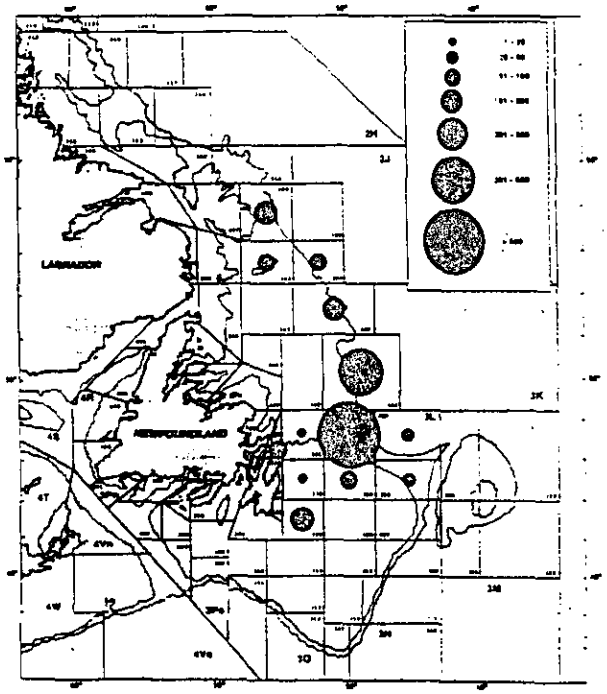
Fig.1 Sighting effort in kilometers: Winter, 1991 - 1993.



Winter 1991

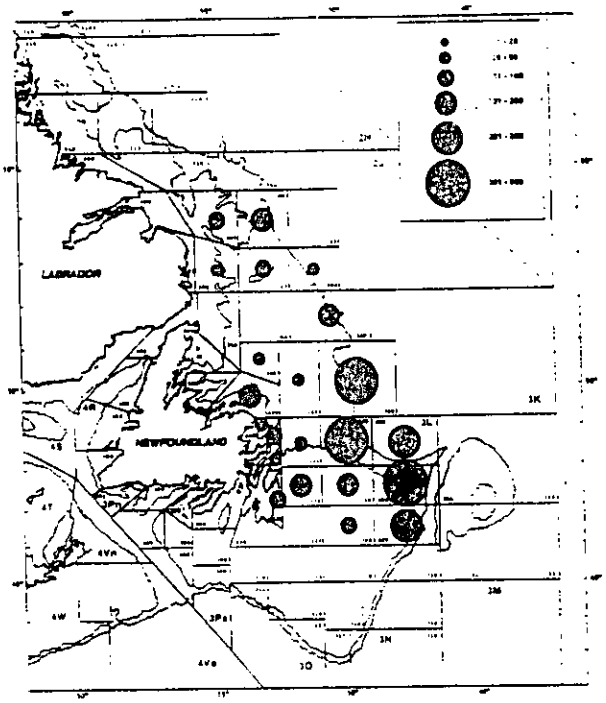


Winter 1992

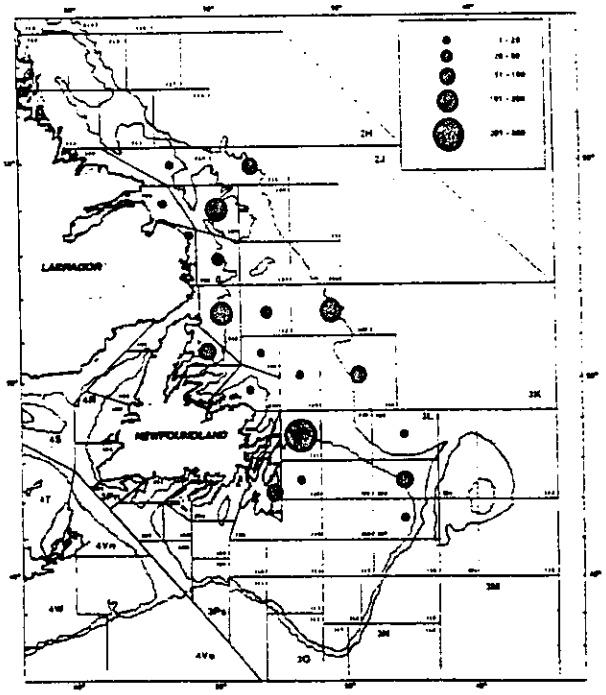


Winter 1993

Fig.2 Sighting effort in kilometers: Spring, 1992 and Summer, 1991.

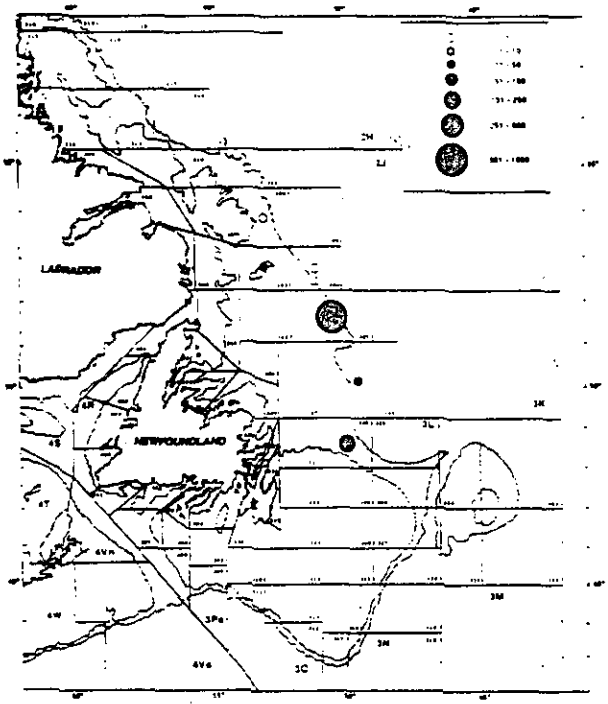


Spring 1992

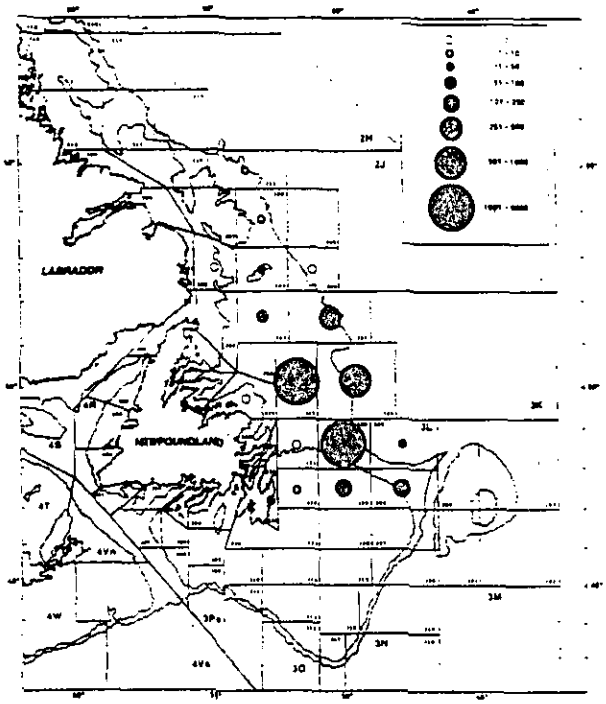


Summer 1991

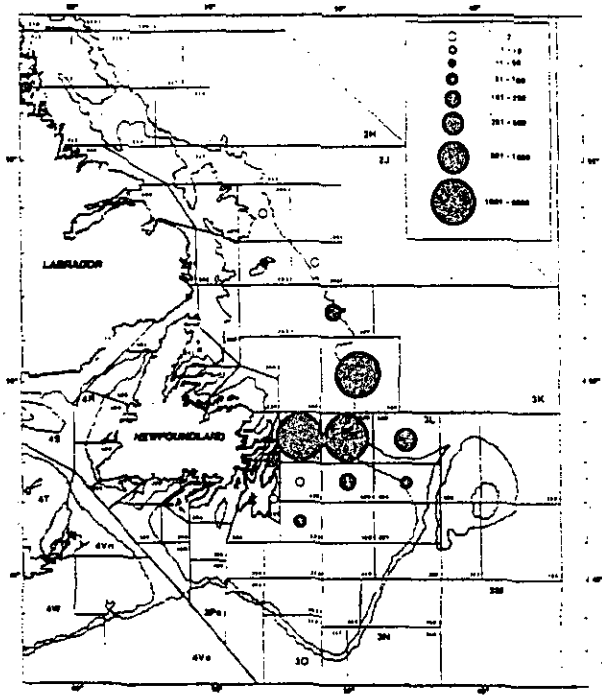
Fig.3 Harp seal sightings per 1000 kilometers of effort: Winter, 1991 - 1993.



Winter 1991

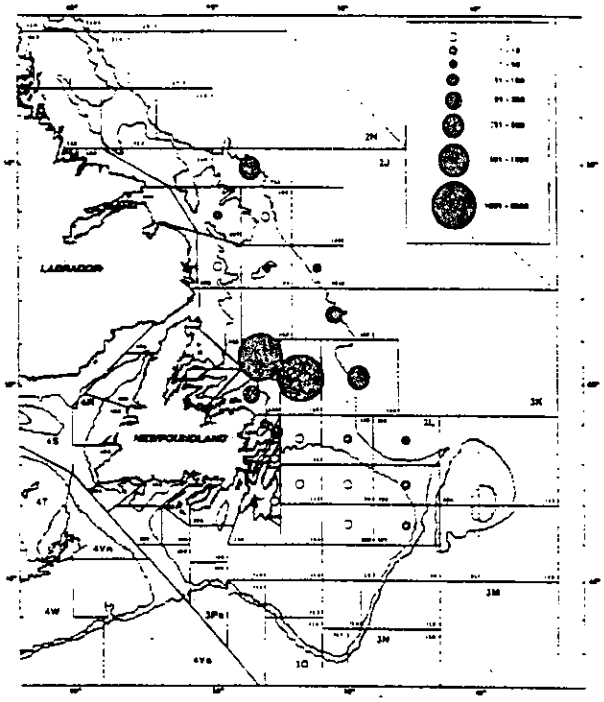


Winter 1992

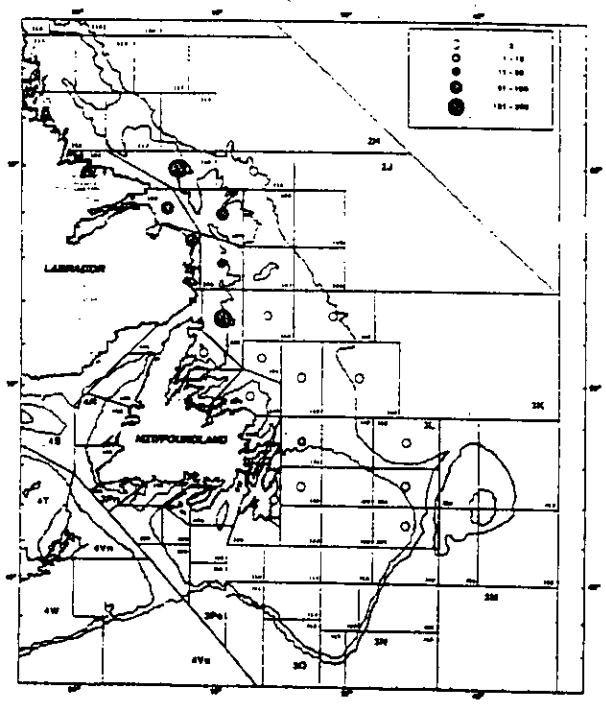


Winter 1993

Fig.4 Harp seal sightings per 1000 kilometers of effort: Spring, 1992 and Summer, 1991.

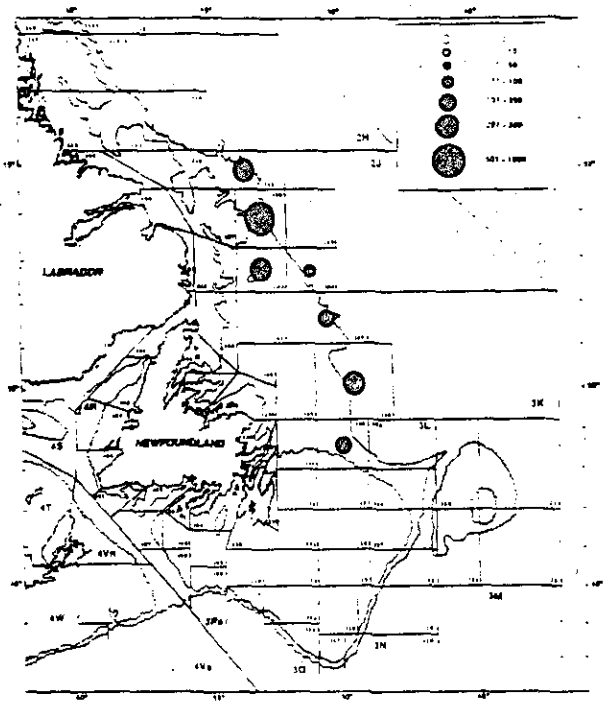


Spring 1992

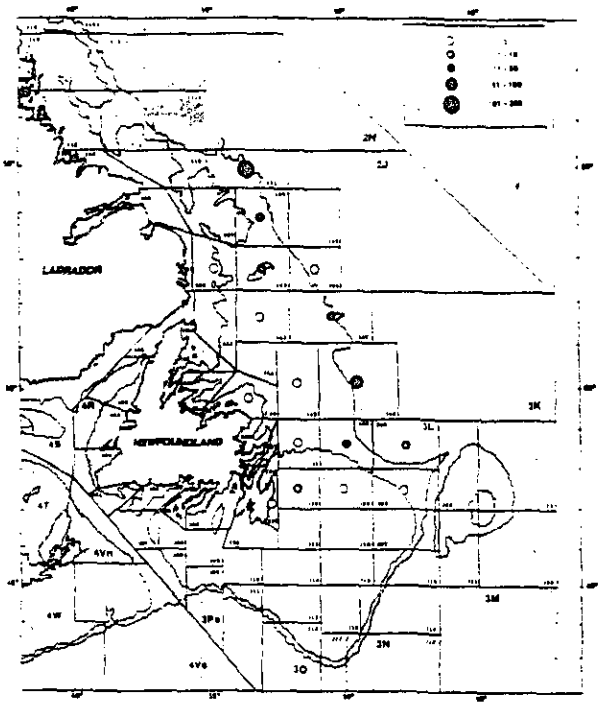


Summer 1991

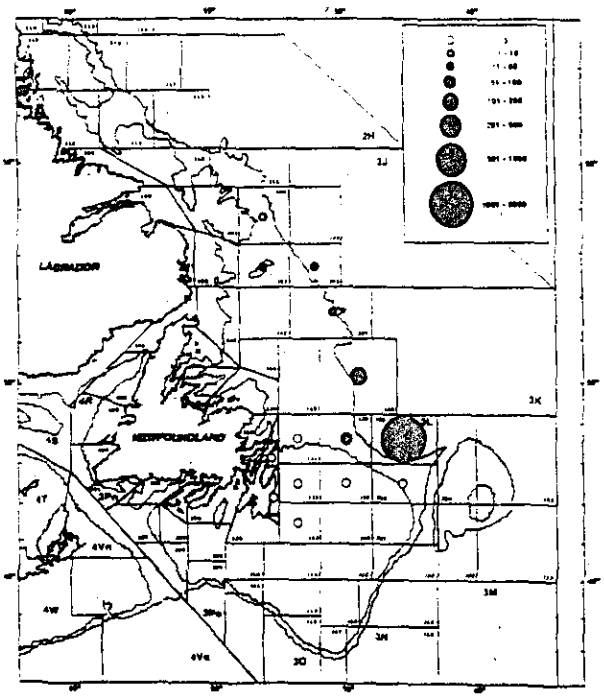
Fig.5 Hooded seal sightings per 1000 kilometers of effort: Winter, 1991 - 1993.



Winter 1991

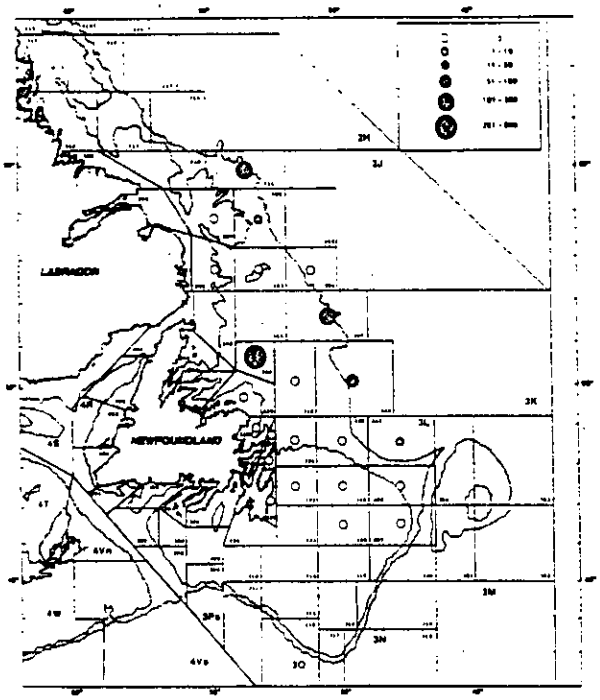


Winter 1992

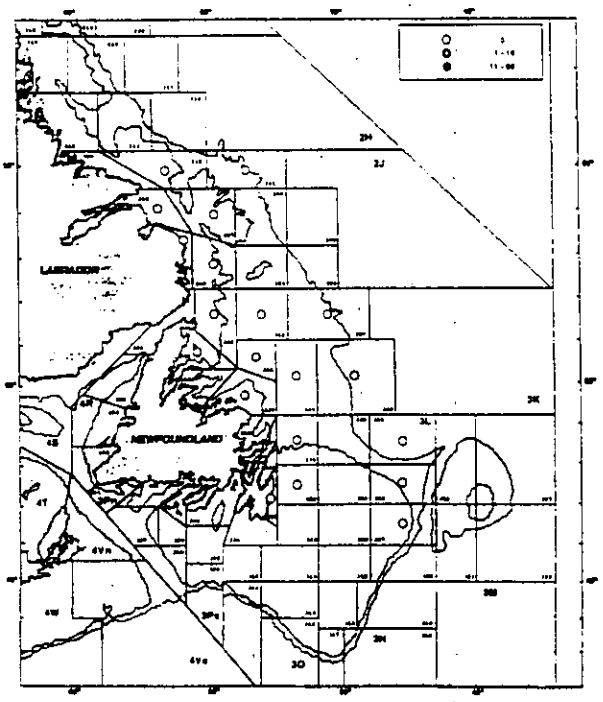


Winter 1993

Fig.6 Hooded seal sightings per 1000 kilometers of effort: Spring, 1992 and Summer, 1991.



Spring 1992



Summer 1991