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Distribution of Harp and Hooded Seals in Offshore Waters of Newfoundland

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Abstract

Surveys conducted in offshore waters of Newfoundland and Labrador (NAFO Div. 2J and 3KL) between 1991 and 1993 indicate that both harp seals (*Phoca groenlandica*) and hooded seals (*Cystophora cristata*) were present in offshore waters during the winter. Hooded seals appeared to utilize the slope edge and northern areas to a greater extent than harp seals. The waters near the border of Div. 3K and 3L may be an important wintering area for both species. Harp seals were particularly abundant in this area in 1992 and 1993. Groundfish hydroacoustic surveys 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 occurrence of pre-spawning concentrations of cod, *per. se*. The distribution of both species shifted northward by April. The movement of harp seals northward continued into July, at which time no hooded seals were present.

Key words: Abundance, *Cystophora cristata*, distribution, harp, hooded, migration, Newfoundland, *Phoco groenlandica*

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 and their prey. For example, by incorporating data on abundance (Roff and Bowen, 1983, Stenson *et al*., 1993, MS 1994, Shelton *et al*., MS 1992), energy requirements of individuals, and geographical, seasonal and age-related variations in diet (Ross, 1993, Lawson *et al*., 1995) 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 seals (*Phoca groenlandics*) and hooded seals (*Cystophora cristata*). General patterns are based on anecdotal sightings from inshore areas and surveys of the whelping and/or moulting concentrations which are insufficient 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 harp seals in the Northwest Atlantic were described by Sergeant (1965, 1991). Harp seals have been considered to be a near-shore species. During the summer, most reside in Arctic waters, occurring as far north as Thule in northwest Greenland and extending west to Hudson Bay. In the autumn, they migrate southward along the coast of Labrador, usually reaching the Strait of Belle Isle by late-November or December. They then split into two groups, one moving into the Gulf of St. Lawrence while the other remains off the coast of Newfoundland and Labrador. The latter form 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 on the pack ice. Following the moult, harps seals disperse and eventually follow the receding pack ice northward to the summer feeding grounds in the Arctic.

Detailed data on the distribution of seals in Div. 2J and 3KL, particularly during the winter, is limited. Robinson (1897) and Chafe (1923) reported that harp seals over-winter on the Grand Bank, although Sergeant (1991) thought this to be unlikely. Fisher (1955) reported that the timing of the southward migration may have changed between the early-1920s and the 1950s. Earlier in the century, harp seals were reported to migrate only as far northward as southwest Greenland during the summer months, possibly due to the presence of ice further north. Fisher (1955) suggested that the warmer temperatures which occurred in the early-1950s may have reduced the amount of ice, extending the summer range of harp seals to northwest Greenland, thereby delaying their return to Newfoundland waters. 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 distribution of harp seals have changed.

The hooded seal is 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, MS 1993). Since historical data on distribution have been based primarily on inshore sightings, 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 to moult from late-June through August (Kovacs and Lavigne, 1986, Sergeant, 1976). After the moult, they disperse widely. Kapel (1975) reports that hooded seals move west past Cape Farewell and along the coast of west Greenland as far north as Thule. Little is known about hooded seal distribution during the autumn and winter although they have been reported off the coast of Newfoundland in January and February (Stenson and Kavanagh, unpubl. data). Rasmussen (1960) has also reported hooded seals feeding on the Grand Banks during February.

To increase our knowledge of the distribution of both species, a series of sighting surveys were carried out in the offshore waters of Newfoundland between 1991 and 1993. The preliminary results of these surveys, which provide a relative index of abundance for seals in the area, are presented in this paper.

Materials and Methods

Marine mammal sighting surveys were conducted during Canadian Department of Fisheries and Oceans research cruises operating in Div. 2J and 3KL between 1991 and 1993. The objective of the majority of these cruises was to estimate groundfish abundance (Table 1). During each cruise a trained observer maintained a marine mammal 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. Occasionally changes in heading were not noted and the transect was continued. Therefore, the calculated effort represents the minimum possible. Sighting effort was stratified according to year and season (January–March, April–May, June–August, September–December) for each NAFO subunit area (Fig. 1).

During each transect, the area within a 180° swath in front of the vessel was scanned and the number, heading, activity and species of all seals observed were recorded. 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 with which hooded seals were identified suggests that the majority of unknown sightings were, in fact, harp seals. Therefore, all seals listed as unknown were combined with harp seals for these analyses. The number of unknowns accounted for less than 4% of the total number of seals observed.

TABLE 1. Summary of research survey trips between 1991 and 1993 during which marine mammal watches were conducted.

Dates	NAFO Div.	Purpose
3–25 February, 1991	2J3KL	Groundfish hydroacoustic survey
20 Jul–5 Aug, 1991	2J3KL	Oceanographic research
5 Feb–4 Mar, 1992	2J3KL	Groundfish hydroacoustic survey
15–30 Apr, 1992	3K	Marine mammal research
7–27 Apr, 1992	2J3KL	Groundfish research
7–27 Apr, 1992	3KL	Groundfish research
4 Feb–2 Mar, 1993	2J3KL	Groundfish hydroacoustic survey
10–25 Feb, 1993	3KL	Marine mammals research
11–21 May, 1993	3KL	Marine mammals research

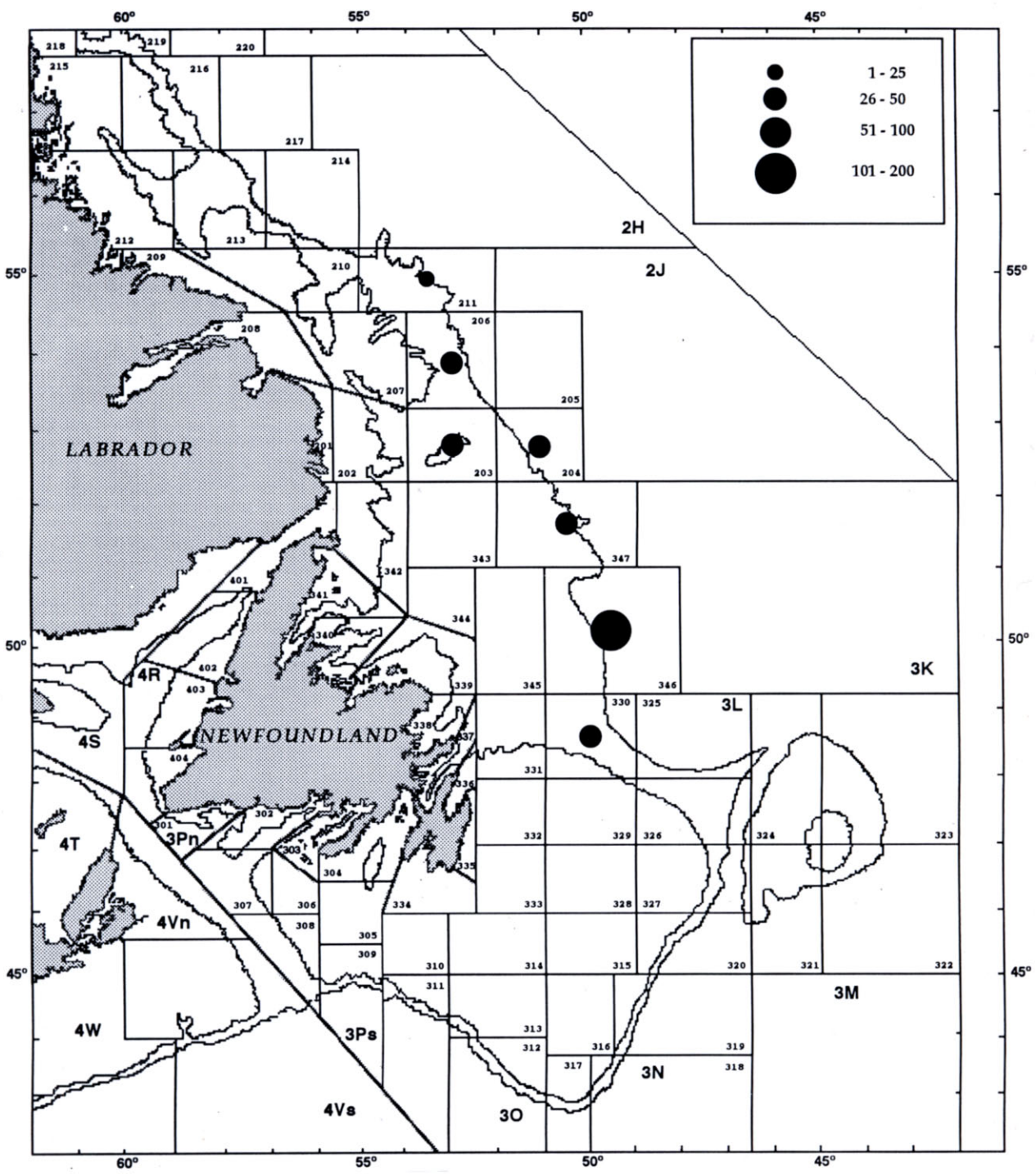

Fig. 1. Kilometers of sighting effort deployed during surveys conducted during February 1991.

The sighting effort and sightings were totalled for each stratum. The relative abundance of harp and hooded seals were expressed as the number of sightings per 1 000 km of effort in each subunit.

Results

Sighting effort

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

Data on the spring distribution were obtained during surveys conducted in April 1992 (Fig. 4). Good coverage was obtained from most of Div. 2J and 3KL with the exception of the northern Div. 2J, northwest Div. 3K, and southern Div. 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 Div. 2J and 3KL (Fig. 5, Table 2). Unfortunately, the shelf edge of Div. 2J and the central area of Div. 3L were not surveyed.

Harp seals

Harp seals were observed in the majority of the areas surveyed during the winter period although the number of seals sighted per 1 000 km was lower in 1991 (Fig. 6) than in either 1992 (Fig. 7) or 1993 (Fig. 8, Table 3). Few seals were observed in Div. 2J in any of the three years. In 1991, the highest densities of seals were observed in the northern area of Div. 3L (area 347). Similar densities of seals were found in this area in 1992, although higher densities were observed in the southern area of Div. 3K (345, 346) and the northern area of Div. 3L (330). Similarly, high densities of seals were observed in southern Div. 3K and northern Div. 3L in 1993. Low densities of seals occurred in the remainder of Div. 3L in all years.

During the spring of 1992, large concentrations of harp seals were observed in areas 344 and 345 (Fig. 9, Table 3). These concentrations consisted mainly of moulting seals. In contrast to the winter surveys, seals were present in most of the areas of Div. 2J but were absent or present in low numbers in Div. 3L, suggesting a northward shift in their distribution.

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 Div. 3KL and were present in only one area (331) south of the Strait of Belle Isle (Fig. 10, Table 3).

Hooded seals

Distinct differences were observed between the distribution patterns of harp and hooded seals (Fig. 11–13, 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 Div. 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. 14, Table 4). With the exception of those observed near the harp seal moulting patch (area 344), hooded seals were restricted primarily to the shelf edge of Div. 3K and northern area of Div. 2J. Hooded seals were rare in southern area of Div. 2J and were present in only one area within Div. 3L (area 325) where less than four seals/1 000 km were observed.

No hooded seals were observed during the surveys conducted during the summer of 1991 (Fig. 15, Table 4).

Discussion

The results of winter surveys indicate that the southern Div. 3K/northern Div. 3L area was important to over-wintering harp seals in 1992 and 1993. Although seals were found in other areas, the highest concentrations were found in areas 330, 331, 345 and/or 346 in both years. Few seals were seen in these areas in 1991 but this may have been due to the lack of sighting effort in areas 331 and 345 and the low amount of effort in areas 330 and 346 during this survey. This area of high seal densities appeared to be similar to the regions in which the greatest densities of Atlantic cod (*Gadus morhua*) were observed during hydroacoustic surveys conducted during February 1991 and 1992 (Baird *et al.*, MS 1992). A similar survey in 1993, however, did not find 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 the occurrence of 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 as the basis of Sergeant's (1991) comments are unknown. If they were based on actual survey data,

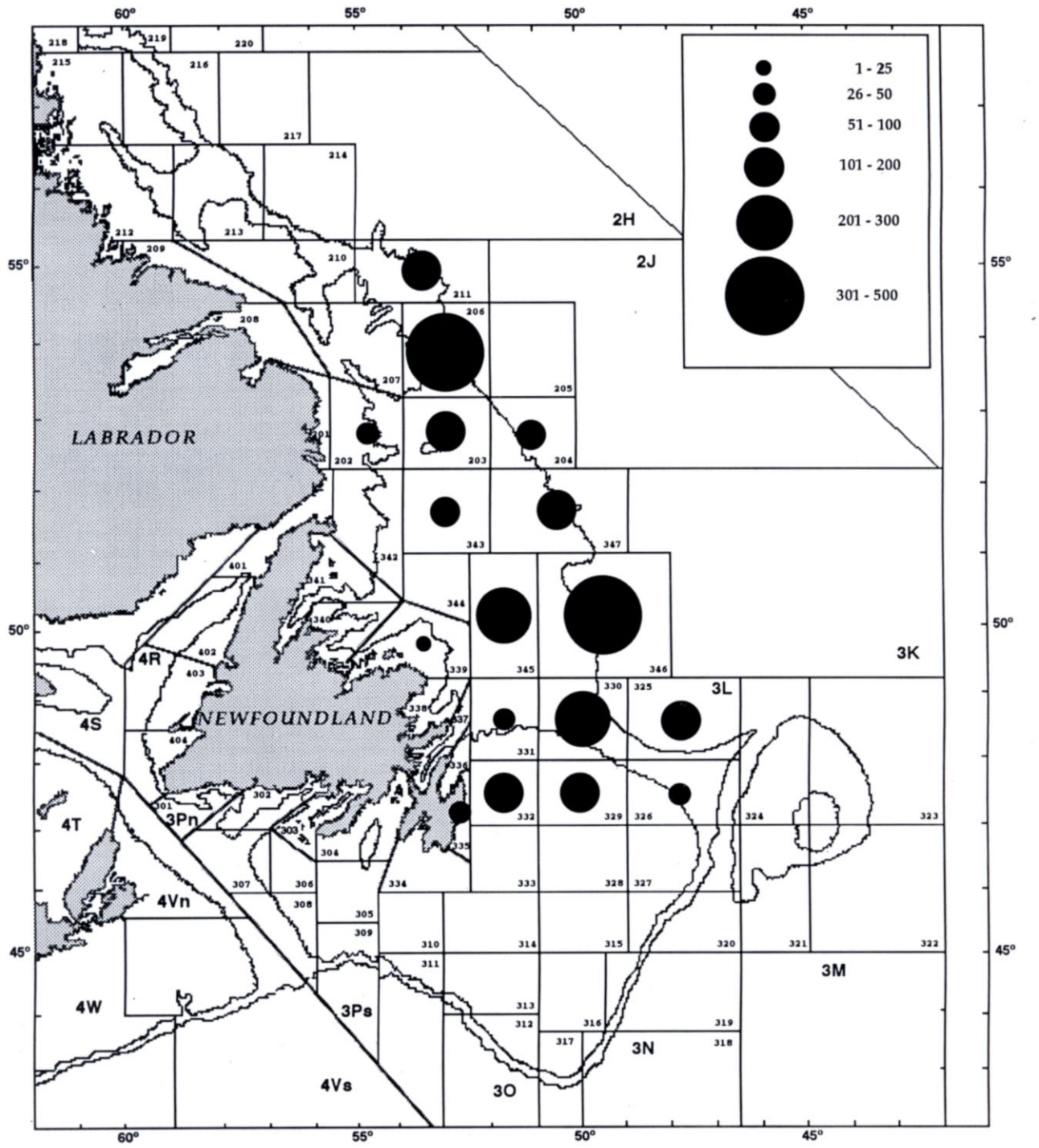

Fig. 2. Kilometers of sighting effort deployed during surveys conducted during February 1992.

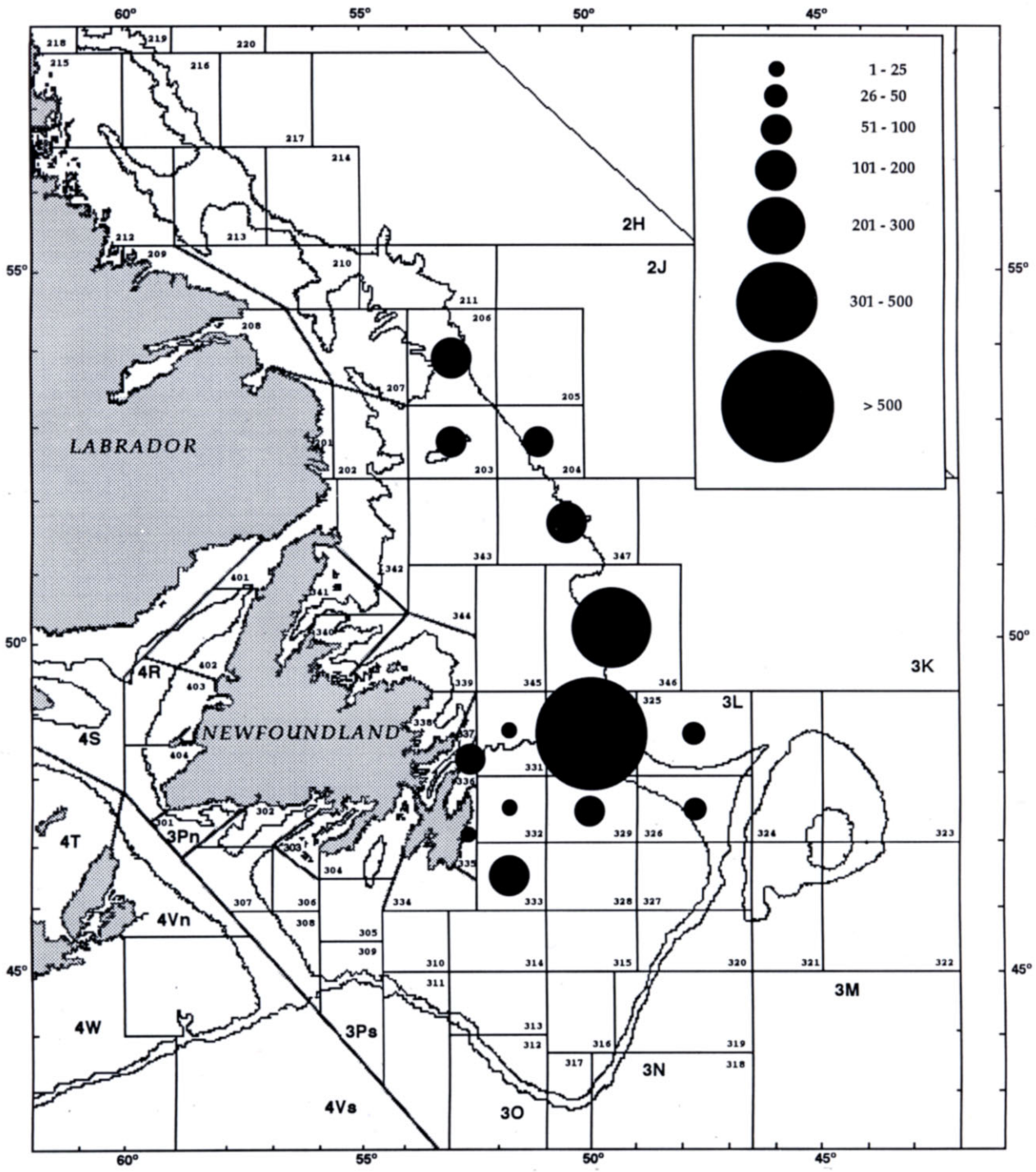

Fig. 3. Kilometers of sighting effort deployed during surveys conducted during February 1993.

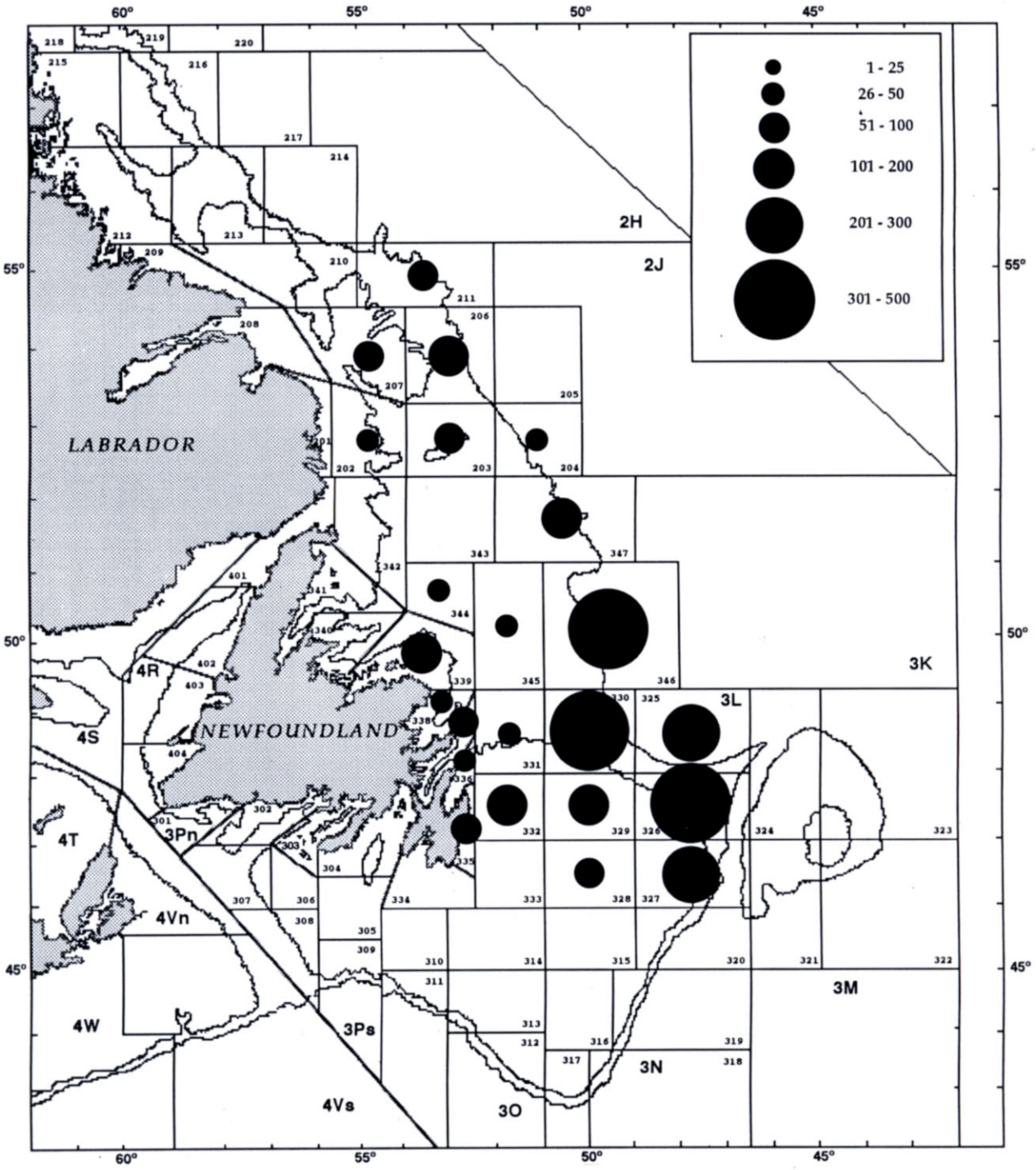

Fig. 4. Kilometers of sighting effort deployed during surveys conducted during April 1992.

TABLE 2. Total sighting effort (km) obtained during offshore sighting surveys between 1991 and 1993.

NAFO		1991		1992		1993
Div.	Subunit area	Winter	Summer	Winter	Spring	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	
		283.28	1 038.25	2 517.96	3 217.51	1 857.39

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, the apparent change in distribution may simply reflect a change in effort. Although a few large concentrations of seals were observed, a comparison of 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 harp 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 Div. 3L and the increased densities of seals observed in the northern part of Div. 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 near the Virgin Rocks in 1992 (Stenson and Kavanagh, unpubl. data) indicates that seals remain in Div. 3L as late as July in some years.

Hooded seals were seen mainly in the 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 in the Grand Bank area in February (Rasmussen, 1960). Some differences were observed among years. In 1991 and 1992, hooded seals were distributed primarily in Div. 2J and Div. 3K, whereas in 1993 the largest concentration was observed in the northern area of Div. 3L. Incidental catches of hooded seals by commercial cod trawlers during

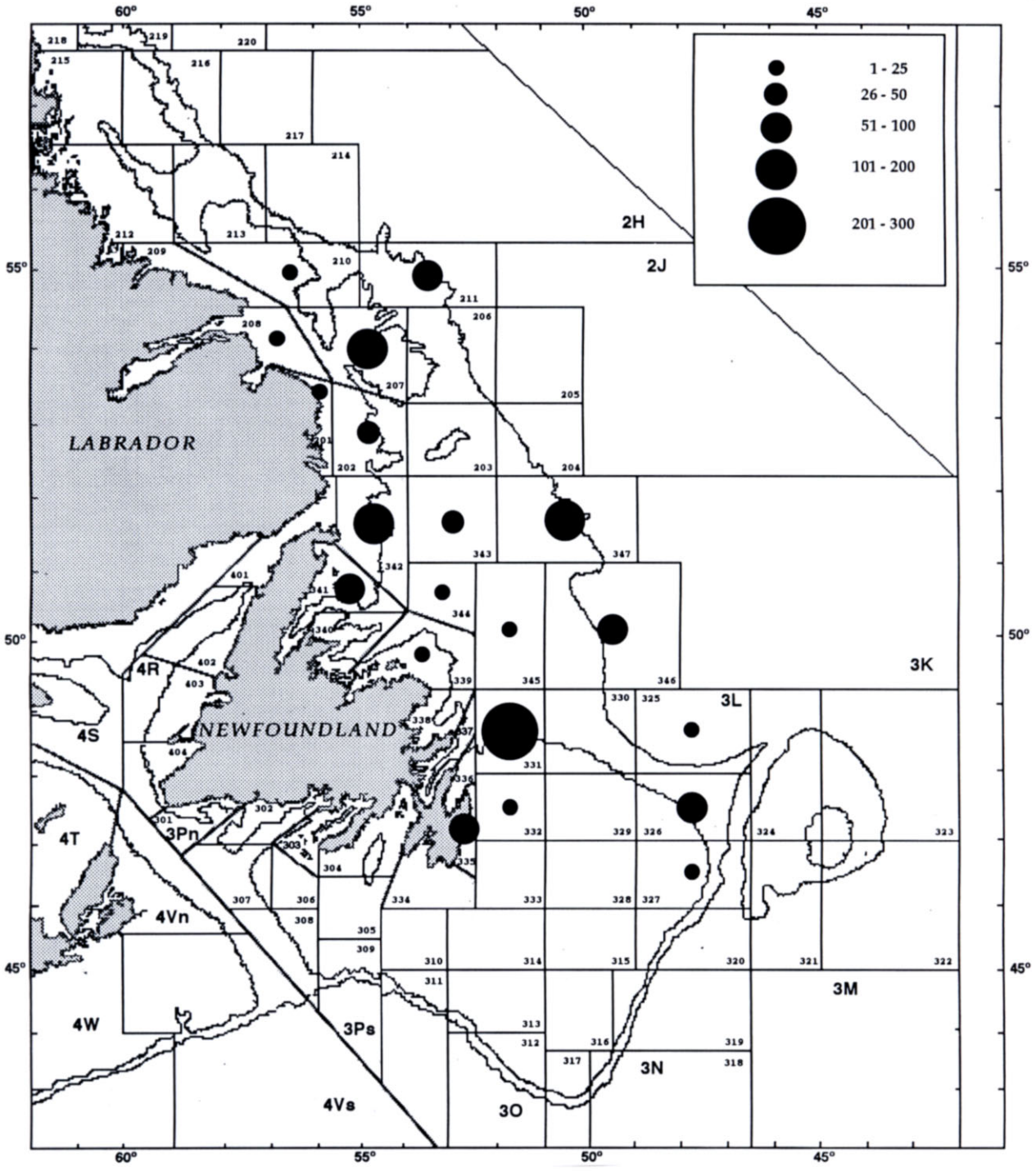

Fig. 5. Kilometers of sighting effort deployed during surveys conducted during July 1991.

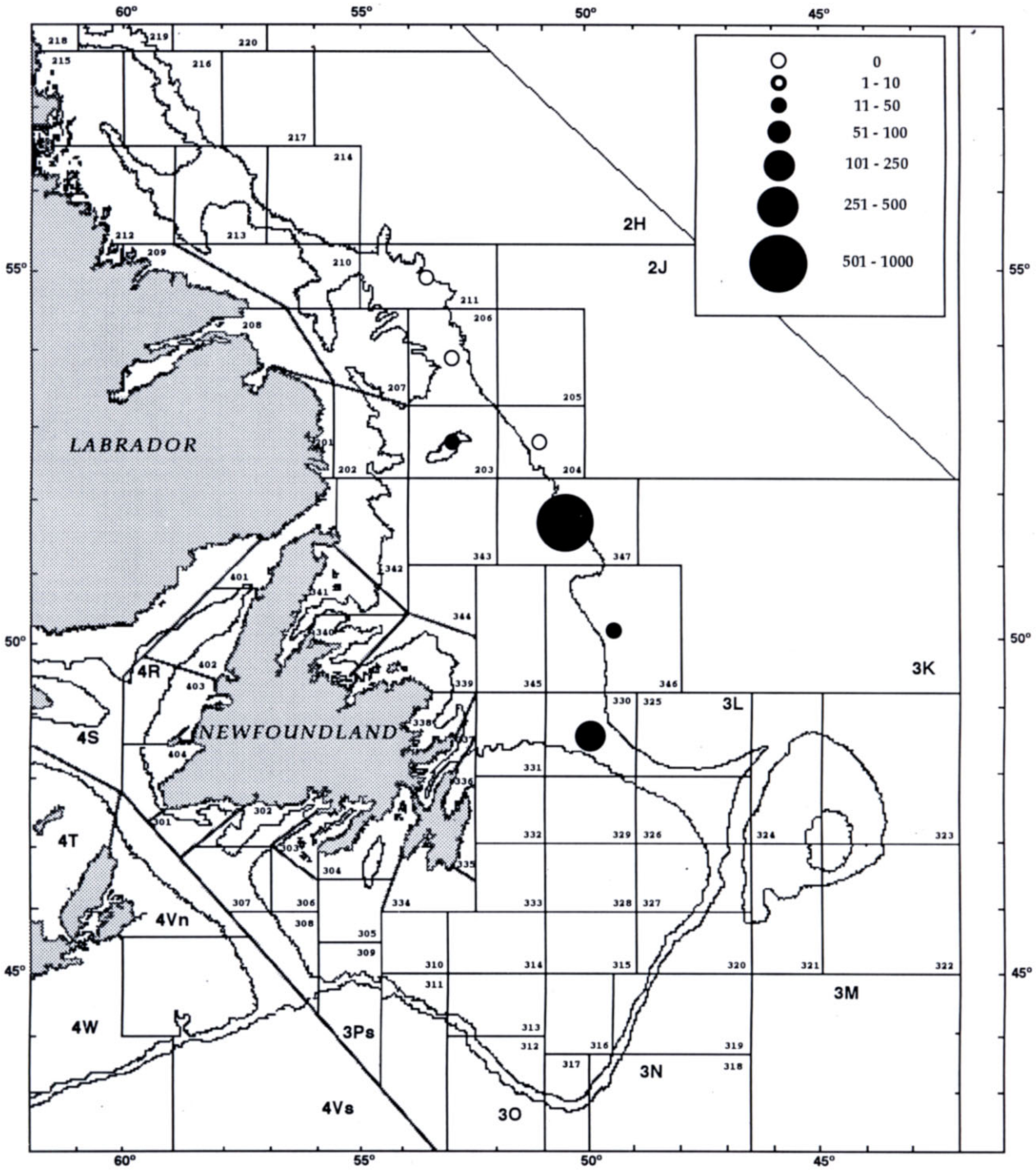

Fig. 6. Harp seal and 'unknown' seal sightings (per 1 000 km) during surveys conducted during February 1991.

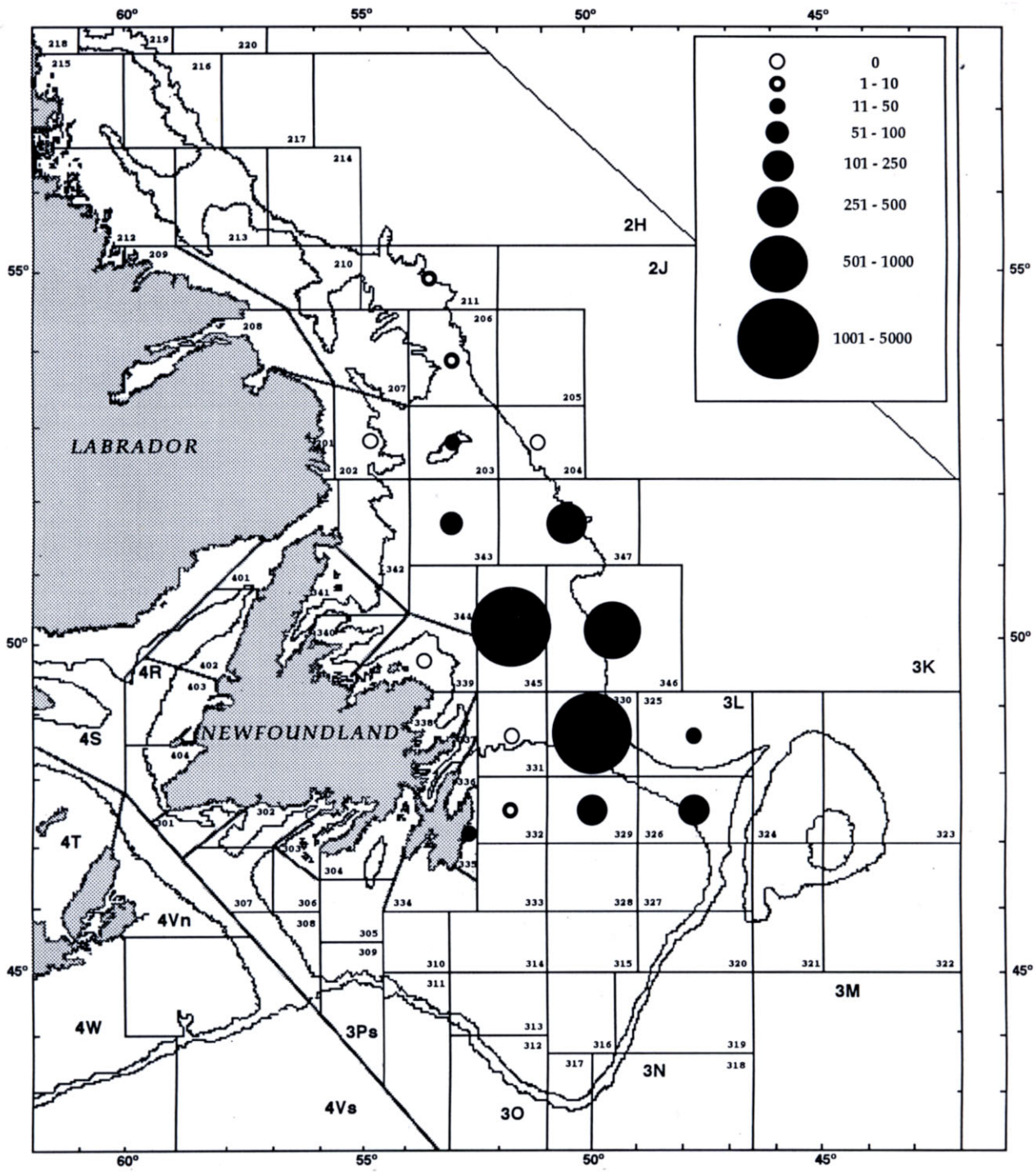

Fig. 7. Harp seal and 'unknown' seal sightings (per 1 000 km) during surveys conducted during February 1992.

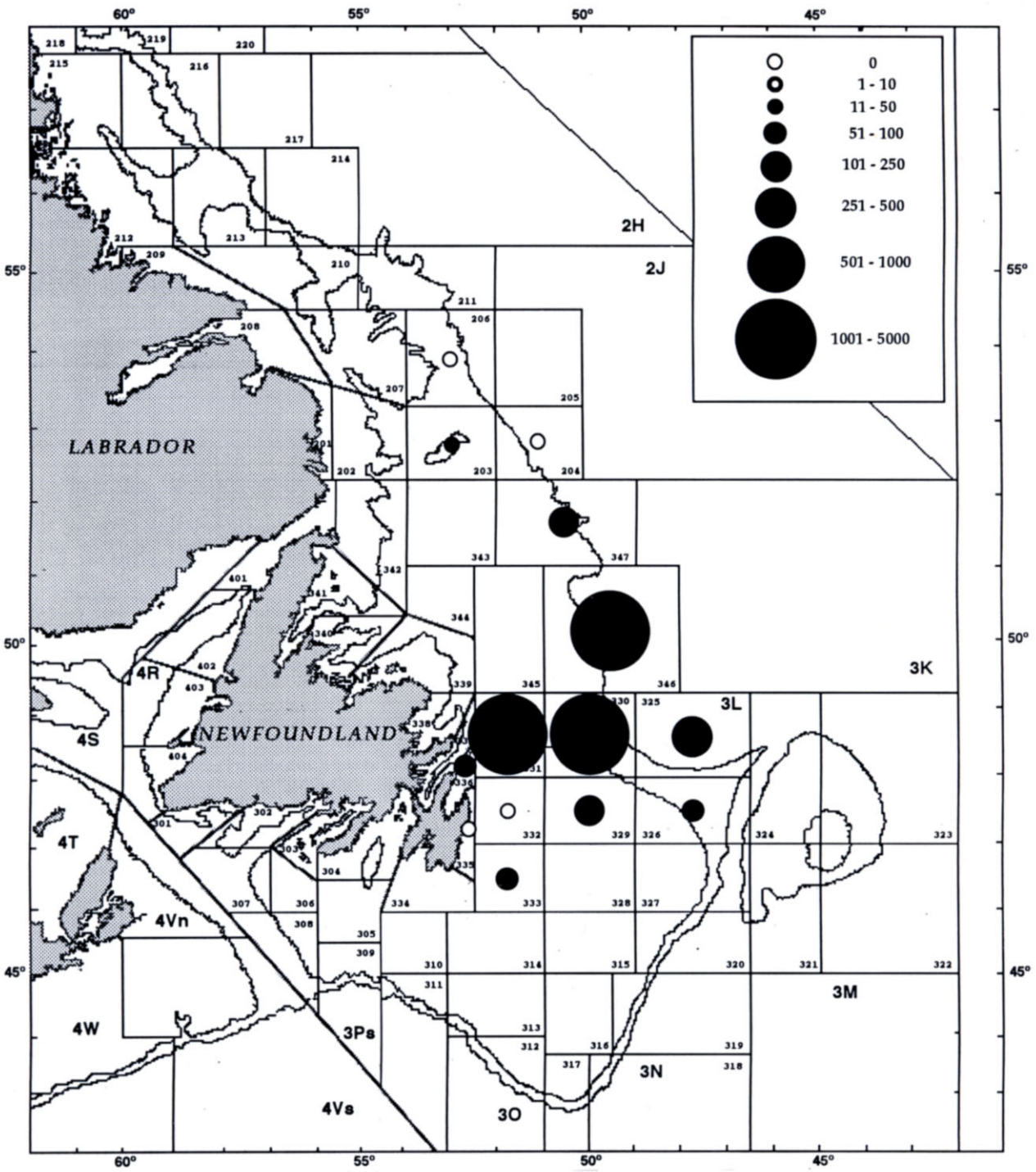

Fig. 8. Harp seal and 'unknown' seal sightings (per 1 000 km) during surveys conducted during February 1993.

TABLE 3. Harp seals and 'unknown' seals observed (per 1 000 km) during offshore sighting surveys between 1991 and 1993.

NAFO		1991		1992		1993
Div.	Subunit area	Winter	Summer	Winter	Spring	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	1 701.19	
	341		0.00			
	342		113.18			
	343		0.00	94.98		
	344		0.00		4 105.38	
	345		0.00	1 972.60	1 386.23	
	346	19.89	0.00	988.41	350.94	4 623.39
	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		3 238.13	9.64	1 125.22
	331		4.82	0.00	0.00	4 403.52
	332		0.00	6.34	0.00	0.00
	333					92.01
	335		0.00	28.04	0.00	0.00
	336				0.00	63.42
	337				65.00	
	338				38.56	

January and February of 1991 and 1992, indicate that they were also present near the border of Div. 3K and Div. 3L in all 3 years. Unlike harp seals, the hooded seals are seldom reported from inshore areas, suggesting that the majority of the population remains offshore during the winter.

Few hooded seals were observed in the southern portions of the survey area during April. The seals present on the continental shelf (area 344) may have been moving away from the whelping area which traditionally occurs in this area shortly before the survey was conducted. The absence of hooded seals during surveys conducted in July is 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 their total abundance in these areas. Seals are extremely difficult to observe in the water, both because of their size and the short surfacing intervals. Hooded seals may remain underwater for up to 85% of the time when they are in open water (Stenson *et al.*, unpubl. data). Therefore, the probability of sighting a seal along the centre line of the transect (g(0)) is likely to be much less than one. This value must be determined before any estimate of total abundance can be made (Eberhart *et al.*, 1979). Also, it is necessary to be extremely cautious about making comparisons among the densities observed in different years or seasons since these data have not been corrected for differences in observers, platforms or sighting conditions.

This study is the first step toward identifying the distribution of harp and hooded seals in offshore areas off Newfoundland. Although limited in nature, these surveys show that both species utilize these areas with the hooded seals inhabiting the slope edge and northern areas to a greater extent than harp seals. Also, the area near the border of Div. 3K and 3L may be an important feeding area for both species during the winter.

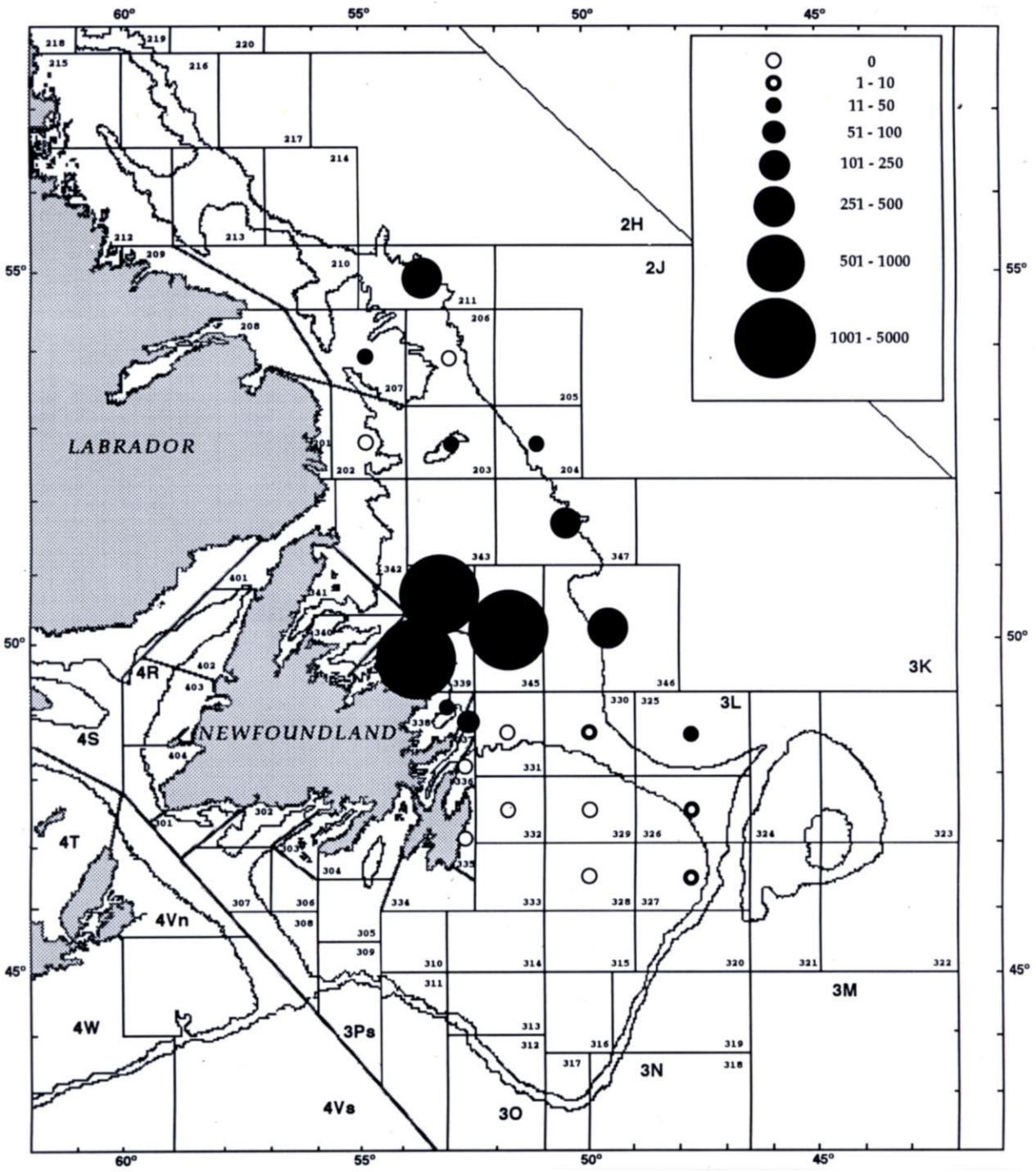

Fig. 9. Harp seal and 'unknown' seal sightings (per 1 000 km) during surveys conducted during April 1992.

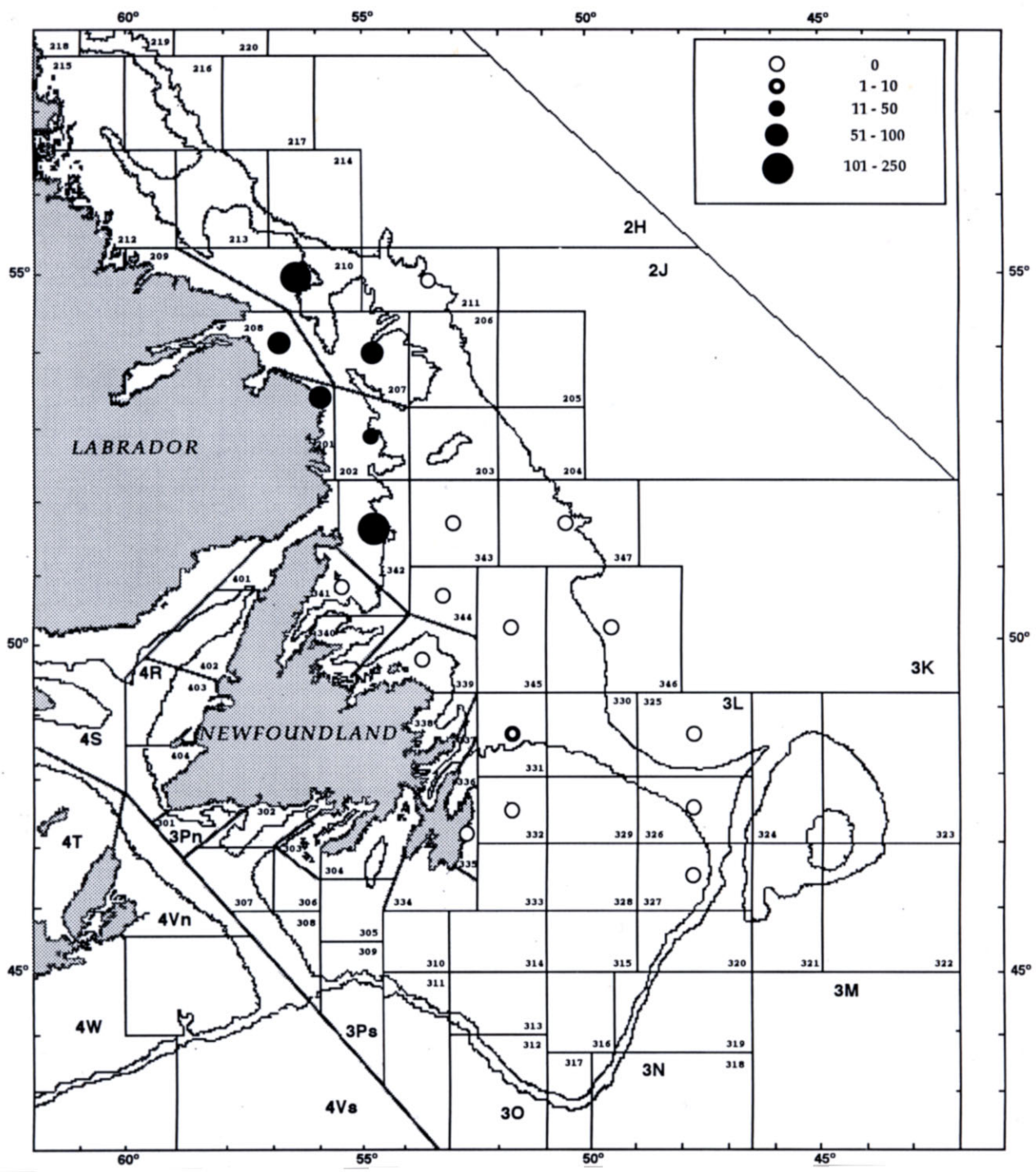

Fig. 10. Harp seal and 'unknown' seal sightings (per 1 000 km) during surveys conducted during July 1991.

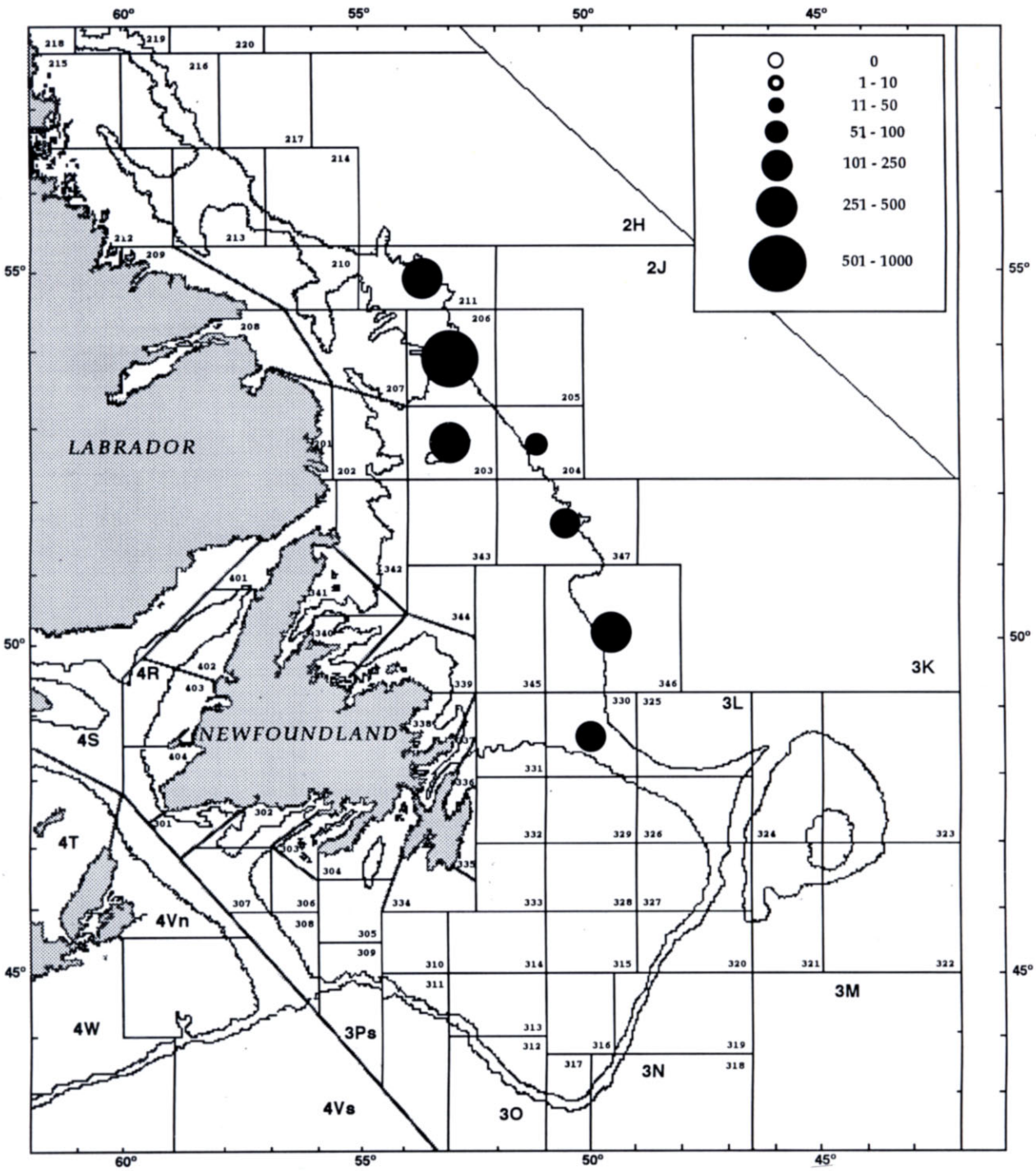

Fig. 11. Hooded seal sightings (per 1 000 km) during surveys conducted during February 1991.

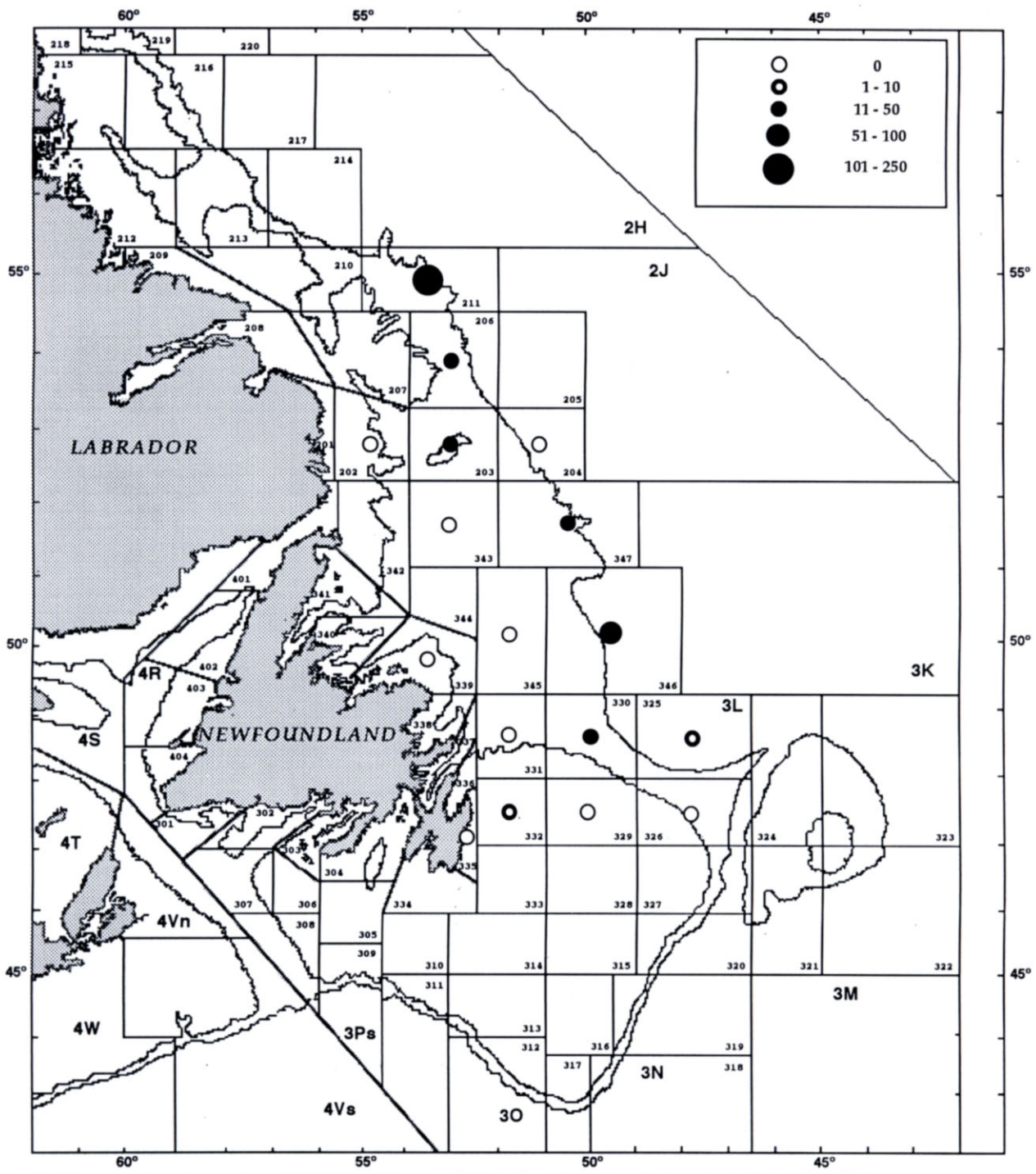

Fig. 12. Hooded seal sightings (per 1 000 km) during surveys conducted during February 1992.

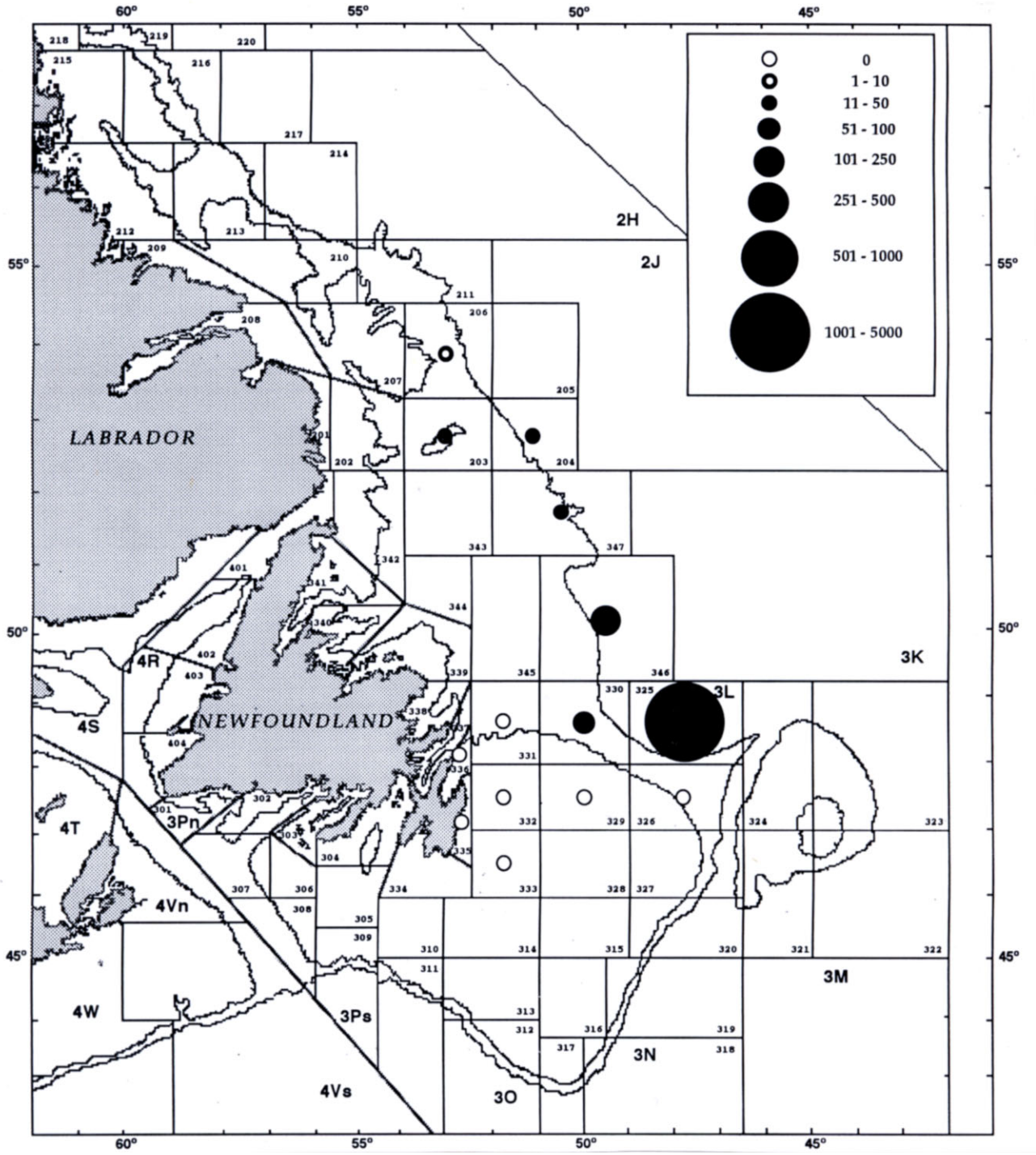

Fig. 13. Hooded seal sightings (per 1 000 km) during surveys conducted during February 1993.

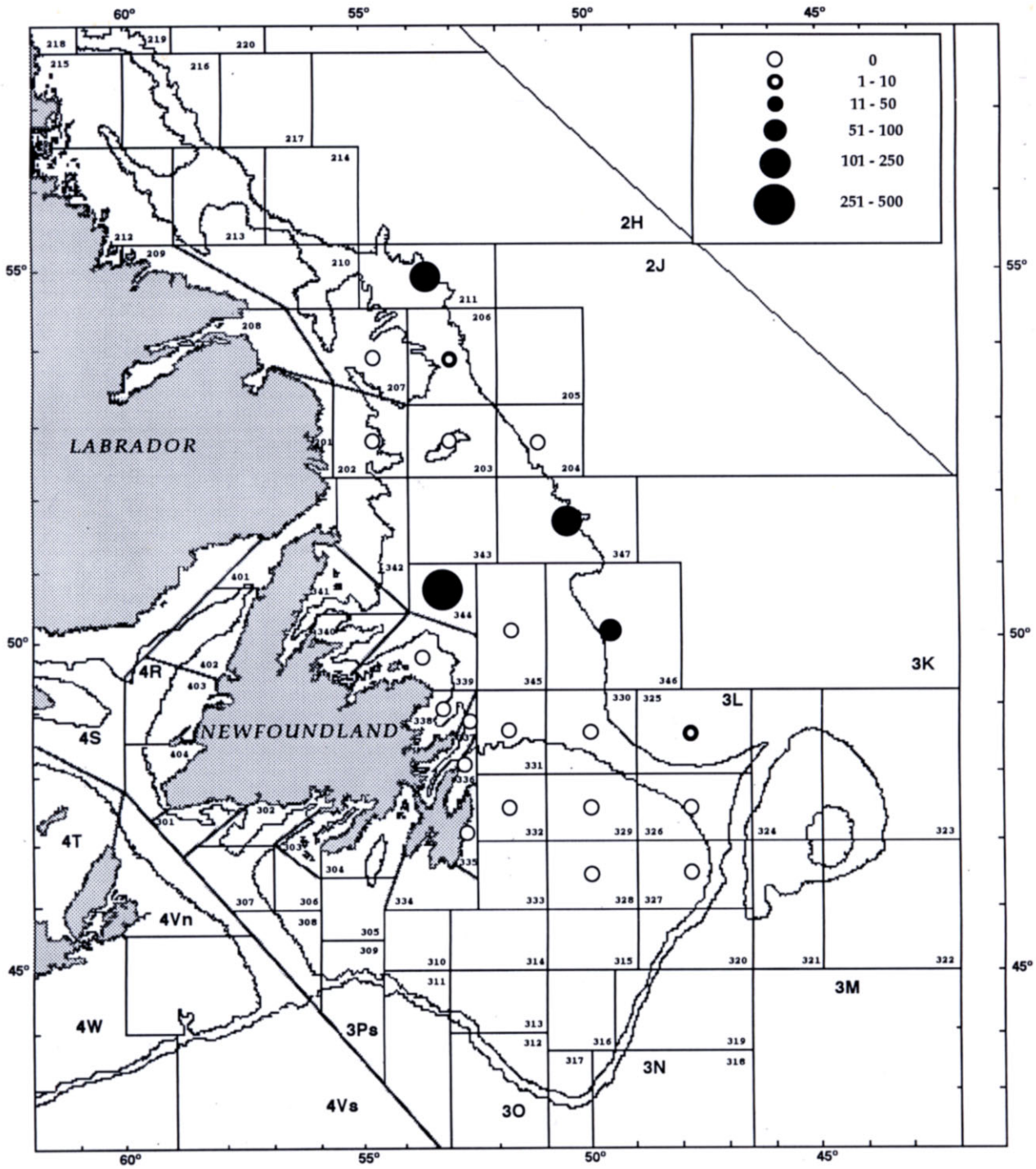

Fig. 14. Hooded seal sightings (per 1 000 km) during surveys conducted during April 1992.

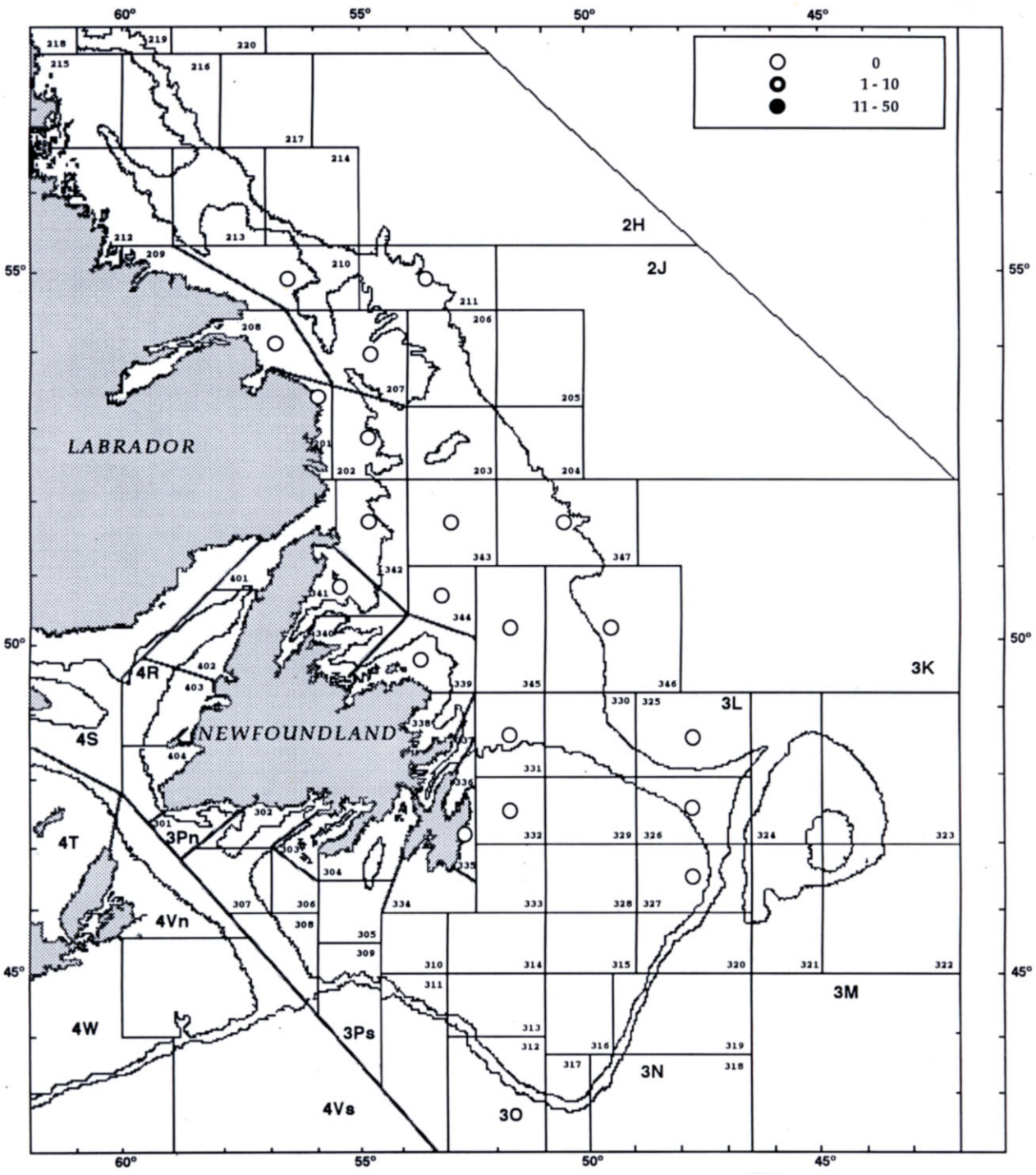

Fig. 15. Hooded seal sightings (per 1 000 km) during surveys conducted during July 1991.

TABLE 4. Hooded seals observed (per 1 000 km) during offshore sighting surveys between 1991 and 1993.

NAFO		1991		1992		1993
Div.	Subunit 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	0.00	
	341		0.00			
	342		0.00			
	343		0.00	0.00		
	344		0.00		263.44	
	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	2 974.88
	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	0.00
	337				0.00	
	338				0.00	

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