

# Results of the Third Seal Survey in the King Haakon VII Sea, Antarctica

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The third in the series of annual censuses in the King Haakon VII Sea, Antarctica, was carried out in January and February 1976. An area of 193 km<sup>2</sup> was surveyed from the M.V. RSA. The population density of crabeater seals *Lobodon carcinophagus* and leopard seals *Hydrurga leptonyx* compared well with the results of other workers and the two previous censuses in the King Haakon VII Sea. The density of Ross seals *Ommatophoca rossi* compared well with the results of the two previous surveys, and is higher than recorded elsewhere by other authors. The percentage species composition of the sample reflected the density relationship. Crabeater and Ross seals occurred in largest numbers on ice floes between 06h00 and 18h00, with a peak haul-out period between 08h00 and 14h00. Weddell seals were most commonly observed between 14h00 and 16h00, and leopard seals were only seen between 04h00 and 18h00.

Gedurende Januarie en Februarie 1976 is die derde van 'n reeks van jaarlikse opeenvolgende opnames van robbe in die Koning Haakon VII-see, Antarktika, gemaak. Tydens hierdie opname vanaf die M.V. RSA is 193 km<sup>2</sup> gesensus. Die bevolkingsdigtheid van die Krabeterrobbe *Lobodon carcinophagus*, die Luiperdrobbe *Hydrurga leptonyx* en die Ross-robbe *Ommatophoca rossi* vergelyk goed met die resultate verkry gedurende die vorige twee opnames. Die digtheid van die Ross-robbe bevolking is hoër as dié verkry deur ander werkers. Die persentasiespesies-samestelling is 'n weergawe van die digtheids verwantskap. Krabeterrobbe en Ross-robbe kom meestal tussen 08h00 en 14h00 op ysskotse voor. Die Weddell-robbe is meestal waargeneem tussen 14h00 en 16h00 terwyl Luiperdrobbe net vanaf 04h00 tot 18h00 waargeneem is.

## Introduction

The third annual seal survey of the King Haakon VII Sea took place in the period from 04h00 on 25 January to 17h05 on 30 January, during the 1976 annual relief of the South African expedition at Sanae. Censuses were also made during short voyages concerned with other research programmes. While the M.V. RSA was stuck fast in heavy pack ice during the period 12h00 on the 27th to 02h00 on 29 January 1976, the diurnal rhythm of crabeater seals was recorded.

## Methods

When traversing through pack ice, all seals observed were recorded, as well as ice cover, floe size and surface type (according to Hall-Martin, 1974). Sea and air temperatures were recorded hourly. Observations were made from the bridge of the RSA, 10 m above the waterline. The data were recorded on prepared sheets and note was made of whether the observations fell within or beyond the 200-m transect strip on either side of the ship. At all observations the time was recorded. Transect width was assessed using the method proposed by Siniff, Cline & Erickson (1970).

During the 1976 voyage, the ship's position was monitored constantly by 'Omega' navigational equipment, although during the 1974 and 1975 voyages conventional navigation and dead reckoning only were relied on for positional data and distance travelled. It was not possible to determine the total area of pack ice in the King Haakon VII Sea during any of the three surveys.

Group sizes were recorded at every observation throughout the 1976 voyage. The definition of a group given by Siniff *et al.* (1970) was adhered to.

## Results and discussion

All voyages undertaken by Hall-Martin (1974), Wilson (1975), and during the 1976 survey are shown in Fig. 1.

### Population density

An area of 193 km<sup>2</sup> was surveyed in 1976. Crabeater seals occurred at a density of 1,49 per km<sup>2</sup>, Ross seals at 0,24 per km<sup>2</sup>, Weddell seals at 0,15 per km<sup>2</sup>, and leopard seals at 0,04 per km<sup>2</sup>. Total seal density of all species combined was 2,02 per km<sup>2</sup> (Table 1). From eight published reports (Table 3) it appears that crabeater seal density is highest in the Weddell Sea, Weddell seal density is highest in the Western Ross Sea, Ross seal density is highest in the King Haakon VII Sea, and leopard seal density is reasonably constant throughout with a slightly higher density in the Western Ross Sea.

Ross seals have occurred at a consistently high density in

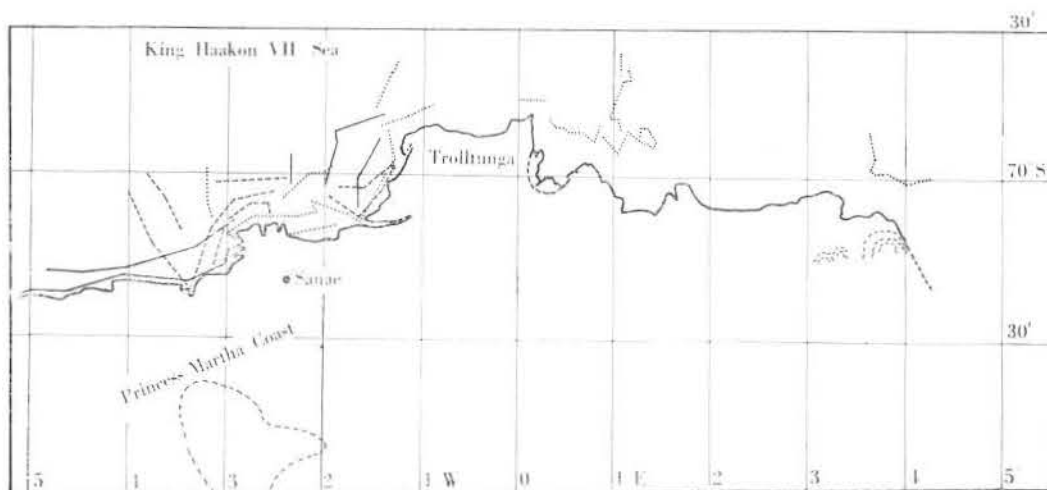


Fig. 1. Map of the Princess Martha Coast, Queen Maud Land, Antarctica, showing routes taken by the M.V. RSA during seal census in 1974 (—), 1975 (---), and 1976 (-.-).

**Table 1**  
Results of the seal census in the King Haakon VII Sea, Antarctica, 19 January-14 February 1976. Only seals within 200 m of the ship were recorded

Date of census	Time	Starting position	Finishing position	Ice conditions		Area surveyed (km <sup>2</sup> )		Seals observed					Total
				Range		Mean	Crab	Ross	Leopard	Weddell	Unidentified		
				Range	Mean								
19.1.76	07h45-10h00	69°38'S, 1°18'W	69°45'S, 1°27'W	0.5-0.7	0.7	5.92	7	3	0	0	0	10	
19.1.76	13h00-16h00	70°09'S, 1°53'W	70°11'S, 2°22'W	0.6-0.8	0.7	9.64	8	0	0	12	2	22	
24.1.76	11h45-12h55	70°11'S, 2°35'W	70°11'S, 2°28'W	0.6-0.8	0.7	4.43	5	4	0	0	0	9	
24.1.76	14h20-16h30	70°11'S, 2°28'W	70°14'S, 2°47'W	0.5-0.8	0.7	8.88	3	4	0	0	1	8	
25.1.76	04h00-23h45	70°13'S, 2°50'W	69°50'S, 1°21'W	0.1-0.9	0.4	32.60	51	17	2	9	7	86	
26.1.76	00h10-02h00	69°50'S, 1°22'W	69°47'S, 0°57'W	open-0.3	0.1	7.41	0	0	1	1	3	4	
26.1.76	04h20-06h10	69°44'S, 0°02'E	69°44'S, 0°10'E	0.2-0.7	0.5	3.70	3	0	2	0	0	5	
26.1.76	07h20-18h00	69°49'S, 0°21'E	69°50'S, 0°48'E	0.4-0.9	0.7	10.36	10	0	0	3	0	13	
26/27.1.76	18h30-12h00	69°50'S, 0°49'E	69°51'S, 1°16'E	0.4-0.9	0.8	17.76	17	11	4	4	4	36	
29.1.76	02h00-04h50	69°48'S, 1°05'E	69°36'S, 1°04'E	0.6-0.8	0.7	15.57	14	4	0	0	0	18	
29.1.76	12h00-21h00	69°52'S, 3°37'E	70°00'S, 4°15'E	0.2-0.8	0.6	14.82	20	2	0	0	1	23	
30.1.76	09h00-17h25	69°01'S, 7°25'E	69°33'S, 9°27'E	0.2-0.5	0.4	45.93	5	0	4	0	0	9	
13.2.76	06h30-13h08	69°59'S, 1°53'E	70°05'S, 2°25'W	0.4-0.7	0.6	8.16	144	1	0	0	0	145	
14.2.76	20h44-22h30	70°09'S, 3°08'W	69°59'S, 3°13'W	open-0.6	0.3	7.14	0	1	0	0	0	1	
						192.56	287	47	8	29	18	389	
							1.49	0.24	0.04	0.15		2.02	
							73.8	12.1	2.1	7.4	4.6	100.0	

Seal density per km<sup>2</sup> in 192.56 km<sup>2</sup>  
Percent species composition in survey area

**Table 2**  
Number of seals hauled out on pack ice during different time periods in the King Haakon VII Sea, Antarctica, 19 January-14 February 1976

Species	Time periods																Totals										
	00h00-02h00		02h00-04h00		04h00-06h00		06h00-08h00		08h00-10h00		10h00-12h00		12h00-14h00		14h00-16h00			16h00-18h00		18h00-20h00		20h00-22h00		22h00-24h00			
	1	3	3	2	2	3	12	63	86	71	49	39	16	4	4	4		3	3	4	3	3	0	0	0	0	4
Crabeater seals																											
Ross seals	3	2	2	0	0	1	3	8	4	8	13	16	6	4	5	1	3	6	3	5	3	0	0	0	1	4	
Weddell seals	1	0	0	0	0	1	1	3	3	2	17	4	4	3	3	0	4	3	3	3	0	0	0	0	1	58	
Leopard seals	0	0	0	0	0	4	2	1	0	3	2	2	0	0	0	0	2	0	0	0	0	0	0	0	0	37	
Unidentified	3	1	17	3	3	17	3	4	10	16	20	3	9	9	3	3	2	9	3	3	3	0	0	4	0	14	
*Hours per period	4.83	4.00	6.50	6.50	6.58	11.0	6.58	11.0	12.25	12.05	13.67	9.92	7.50	8.23	6.25	102.78	78	91	28	15	15	9	9	9	9	554	
Total seals observed	8	6	35	35	72	102	72	102	88	78	91	28	22	15	9	9	22	22	15	15	9	9	9	9	9	102.78	
Number of seals observed per hour	1.66	1.50	5.38	5.38	10.94	9.27	7.18	6.47	6.66	6.47	6.66	2.82	2.93	1.82	1.44	5.39	2.82	2.82	1.82	1.82	1.44	1.44	1.44	1.44	1.44	5.39	

\*Number of hours per time period spent on census voyages

the King Haakon VII Sea over the past three years (Condy, 1976) despite the different pack ice conditions encountered each year. Hall-Martin (1974) reported an average pack ice concentration of 0,1–0,4, Wilson (1975) reported an average concentration of 0,3–0,5, while in 1976 the average concentration was 0,6–0,8.

The reasons why Ross seals should be more numerous in the area surveyed by the *RSA* are not known. Siniff *et al.* (1970) demonstrated a relationship of chlorophyll content and depth of euphotic zone to crabeater seal abundance in the Weddell Sea. No tests of any sort have been made in the King Haakon VII Sea, but since Ross seals feed mainly on squid (Laws, 1964; King, 1964), the occurrence of squid and related factors deserves investigation.

### Species composition

Species composition observed during the 1976 survey is given in Table 1, while that of all seals observed throughout the entire voyage is given in Table 4. During the survey 73,8 per cent of seals occurring within the transect strip were crabeater seals, 12,1 per cent were Ross seals, 2,1 per cent were leopard seals, and 7,4 per cent were Weddell seals.

During the 1976 survey, crabeater, Ross, and leopard seals were found predominantly in the pelagic pack ice. This agrees with the finding of Eklund & Atwood (1962), Laws (1964), Øritsland (1970a), Ray (1970), Siniff *et al.* (1970), Stirling & Kooyman (1971), Erickson *et al.* (1971), Hall-Martin (1974), and Wilson (1975). Most reports indicate that the Weddell seal is primarily an inhabitant of fast ice (Mansfield, 1958; Stirling, 1969a & 1969b; Stirling, 1971; Stirling, 1972; Stirling & Greenwood, 1972; Stirling, 1974) but it does occur in relatively small numbers in pack ice (Ray, 1970; Øritsland, 1970a; Erickson *et al.*, 1971), and usually remains

near the continent (Siniff *et al.*, 1970). During the 1976 survey Weddell seals were encountered initially on fast ice, but later, following the break-up of the fast ice, also on ice floes in the bukten and pelagic pack ice, although never further than a kilometre from the ice shelf.

In Table 6 data on the species composition of Antarctic seals are presented. The figures indicate the same pattern of distribution as obtained from the list of density estimates (see Table 3). The leopard seal maintains a relatively uniform proportion relative to the other species throughout, but appears to be least abundant in the King Haakon VII Sea, where the Ross seal occurs more abundantly than elsewhere.

The results confirm the views of Laws (1964) and King (1964) that the distribution of Ross seals is localized, and that the King Haakon VII Sea is one such area, although there may be others.

### Group size

The data on group sizes of the four species are shown in Tables 7 and 8. The largest group of crabeater seals seen consisted of 8 individuals. Hall-Martin (1974) recorded one group of 8 and 8 groups of more than 10 individuals, while Wilson (1975) recorded no groups larger than 6 individuals during his survey, but describes the occurrence of large aggregations observed during another, unassociated survey. It is clear from the reports of Hall-Martin and Wilson that when pack ice concentration is reduced to a few scattered floes, group size of crabeater seals suddenly becomes very high.

However, although crabeater seals are semi-gregarious, they occurred more often as solitary individuals (mean group size of 1,49 individuals per group) during the 1976 survey. In Table 9 mean group sizes for the four Antarctic phocids from

Table 6  
Species composition of seals in pelagic Antarctic pack ice

References	Date of census	Region	Composition (%)			
			C	W	R	L
*Ray, 1966	Dec.–Jan., 1965/66	Western Ross Sea, 165°–175°E	48,1	—	3,0	5,2
**Stirling, 1969a	Jan.–Feb., 1967 & 1968	Western Ross Sea, 163°–170°E	36,9	54,9	0,5	7,7
Ray, 1970	29 Dec.–12 Jan., 1965/66	Western Ross Sea, 165°–173°E	48,1	43,8	2,9	5,2
Eklund & Atwood, 1962	17 Dec.–10 Jan., 1956/57	Ross Sea, 166°–177°E	97,0	—	0,8	2,2
Mean		Ross Sea	57,5	49,4	1,8	5,1
Bonner & Laws, 1964 & Laws, 1964	Summers of 1950–1952	Weddell Sea, 20°W–10°E	81,4	—	11,5	7,1
Øritsland, 1970b	25 Aug.–31 Oct., 1964	Weddell–Scotia Seas, 37°–55°W	84,7	—	1,7	12,8
†Siniff <i>et al.</i> , 1970	30 Jan.–15 Mar., 1968	Weddell Sea, 37°–60°W	92,1	6,6	0,08	1,2
Erickson <i>et al.</i> , 1971	Jan.–Mar., 1968, 1969 & 1970	Weddell Sea, 29°–60°W	96,9	2,0	0,01	1,0
Mean		Weddell Sea	88,8	4,3	3,3	5,5
**Nel, 1966	Dec.–Feb., 1963/64	King Haakon VII Sea, 1°–6°W	80,8	3,3	12,5	3,3
**Hall-Martin, 1974 (transects only)	17 Jan.–2 Feb., 1974	King Haakon VII Sea, 1°–6°W	74,3	0,6	22,3	1,1
Hall-Martin, 1974 (all seals counted)	17 Jan.–10 Feb., 1974	King Haakon VII Sea, 1°–6°W	80,6	0,3	16,8	2,3
Wilson, 1975 (transects only)	20–30 Jan., 1975	King Haakon VII Sea, 2°–4°W	58,5	4,0	32,4	0,7
Condy, this report (transects only)	19 Jan.–14 Feb., 1976	King Haakon VII Sea, 3°W–9°E	73,8	7,4	12,1	2,1
Condy, this report (all seals counted)	19 Jan.–14 Feb., 1976	King Haakon VII Sea, 3°W–9°E	76,4	8,0	12,6	3,0
Mean		King Haakon VII Sea	74,1	3,9	18,1	2,1
*Zenkovich, 1962	7 Dec.–13 Feb., 1957/58	Indian Ocean, 65°E–165°E	84,7	—	0,4	5,0
*Eklund, 1964	25–28 Jan., 1957	Indian Ocean, 105°E–112°E	92,8	—	1,3	5,9
Mean		Indian Ocean	88,9	—	0,9	5,5
Prévost, 1964	Jan, 1961	West of Terre Adélie, 130°E	89,9	—	—	2,1
Øritsland, 1970a	Dec.–Feb., result of combining various reports		82,6	—	1,3	7,3
All above		mean	76,6	13,1	7,8	4,2

\*From Øritsland, 1970a  
\*\*Calculated for this report

†Combined results of shipboard and helicopter counts  
C = Crabeater, W = Weddell, R = Ross and L = Leopard seals.

Table 3  
Seal densities in pelagic Antarctic pack ice

References	Date of census	Method	Region	Number of seals counted						Area (km <sup>2</sup> )			Seals (km <sup>-2</sup> )		
				C	W	R	L	L	C	W	R	L			
*Stirling, 1969a	Jan.-Feb., 1967 & 1968	Shipboard	Western Ross Sea, 163°-173°E	82	122	1	17	324	0,25	0,38	0,003	0,05			
*Ray, 1970	29 Dec.-12 Jan., 1965/66	Aerial	Western Ross Sea, 165°-153°E	275	250	17	30	1 327	0,21	0,19	0,01	0,02			
			Western Ross Sea	357	372	18	47	1 652	0,22	0,23	0,01	0,03			
Simiff <i>et al.</i> , 1970	30 Jan.-15 Mar., 1968	Shipboard	Weddell Sea, 37°-60°W	879	25	1	15	621	1,41	0,04	0,002	0,02			
Simiff <i>et al.</i> , 1970	7 Feb.-14 Mar., 1968	Aerial	Weddell Sea, 40°-55°W	260	57	0	0	325	0,80	0,18	0	0			
*Erickson <i>et al.</i> , 1971	18 Feb.-24 Mar., 1969	Shipboard	Weddell Sea, 30°-52°W	1 136	10	3	22	459	2,47	0,02	0,006	0,05			
*Erickson <i>et al.</i> , 1971	8-11 Mar., 1969	Aerial	Weddell Sea, 29°-33°W	2 341	3	0	7	416	5,63	0,007	0	0,02			
			Weddell Sea	4 616	95	4	44	1 820	2,54	0,05	0,002	0,02			
Hall-Martin, 1974	17 Jan.-2 Feb., 1974	Shipboard	King Haakon VII Sea, 1°-6°W	133	1	40	2	186	0,72	0,005	0,22	0,01			
Wilson, 1975	20-30 Jan., 1975	Shipboard	King Haakon VII Sea, 2°-4°W	238	16	132	3	156	1,52	0,10	0,85	0,02			
Condy, 1976 (this report)	19 Jan.-14 Feb., 1976	Shipboard	King Haakon VII Sea, 3°W-9°E	287	29	47	8	193	1,49	0,15	0,24	0,04			
			King Haakon VII Sea	658	46	219	13	534	1,23	0,09	0,41	0,02			
Total			Antarctic pack ice	5 631	513	241	104	4 006	1,41	0,13	0,06	0,03			
Eklund & Atwood, 1962	25-28 Jan., 1957	Shipboard	Indian Ocean 105°-112°E	340 925	—	7 870	14 305	89 528	3,81	—	0,09	0,16			
Eklund & Atwood, 1962	17 Dec.-10 Jan., 1956/57	Shipboard	Ross Sea, 150°W-165°E	605 700	—	—	10 530	1 052 871	0,58	—	—	0,01			

\*Calculated for this report. C = Crabeater, W = Weddell, R = Ross and L = Leopard seals

Table 5

Distribution of crabeater, Ross, Weddell and leopard seals according to surface nature and size of floes in the King Haakon VII Sea, Antarctica, 19 January-14 February 1976

Species	Floe surface nature						Floe size (m <sup>2</sup> )		
	Smooth	Hum-mocked	n	n					
				< 500	500-1000	> 1000			
Crabeater seal	281 (79,8)	71 (20,2)	352 %	107 (30,4)	111 (31,5)	134 (38,1)	352 %		
Ross seal	30 (51,7)	28 (48,3)	58 %	30 (51,7)	20 (34,5)	8 (13,8)	58 %		
Weddell seal	33 (89,2)	4 (10,8)	37 %	8 (21,6)	7 (18,9)	22 (59,5)	37 %		
Leopard seal	8 (57,1)	6 (42,9)	14 %	10 (71,4)	3 (21,4)	1 (7,1)	14 %		

Table 4

Species composition of all identified seals observed (percent of totals in brackets) in the King Haakon VII Sea, Antarctica, 19 January-14 February 1976

Ice condition	Species				Totals
	Crabeater	Ross	Weddell	Leopard	
Pelagic pack ice	352 (76,4)	58 (12,6)	37 (8,0)	14 (3,0)	461 (100,0)
Ice floes in bukten	18 (66,7)	3 (11,1)	5 (18,5)	1 (3,7)	27 (100,0)
All pack ice	370 (75,8)	61 (12,5)	42 (8,6)	15 (3,1)	488 (100,0)
Fast ice	0 (0)	2 (20,0)	7 (70,0)	1 (10,0)	10 (100,0)
Totals	370 (74,3)	63 (12,6)	49 (9,8)	16 (3,2)	498

Table 7

Group sizes of crabeater seals in pack ice in the King Haakon VII Sea, Antarctica, 19 January–14 February 1976

No. of seals per group	Observed frequency	Percentage of total	Total no. counted
1	169	68,4	169
2	56	22,7	112
3	13	5,3	39
4	2	0,8	8
5	3	1,2	15
6	2	0,8	12
7	1	0,4	7
8	1	0,4	8
Totals	247	100,0	370

Mean group size: 1,49 individuals per group

various reports are listed, and from these results it appears that solitary crabeater seals are more commonly observed despite their reported semi-gregariousness. Most reports indicate that aggregations of more than 4 individuals are in fact unusual, and when they occur they do so in a very localized area. Paucity of ice floes is probably only one contributing factor to the occurrence of aggregations of crabeater seals, but other factors such as the presence of killer whales, *Orcinus orca*, and physio-chemical factors of the ocean in localized areas must also be important causative agents. The relationship of chlorophyll content and depth of euphotic zone to crabeater seal abundance demonstrated by Siniff *et al.* (1970) is one such example.

From Tables 8 and 9 it is clear that in January and February, Ross, leopard and Weddell seals in the King Haakon VII Sea occur solitarily. Most authors (Laws, 1964; Marlow,

1967; Øritsland, 1970a; Siniff *et al.*, 1970; Ray, 1970; Erickson *et al.*, 1971) regard leopard and Ross seals as solitary species which probably remain so throughout the year. Weddell seals form large breeding aggregations on fast ice (Stirling, 1969b, 1971, 1974; Øritsland, 1970a; Ray, 1970).

#### Distribution in relation to pack ice conditions

In 1976 crabeater seals were most commonly found (77,8 per cent of all observations) in an ice concentration ranging from 0,6 to 0,8 (Table 8). Hall-Martin (1974) found that 84,3 per cent of crabeater seals observed occurred in pack ice concentrations of 0,1–0,3, and Wilson (1975) found that they were most common (61,3 per cent) in ice concentrations of 0,2–0,5 with a second peak of occurrence (26,1 per cent) in a concentration of 1,0.

Ross seals showed a similar trend in 1976 to that of the crabeater seals, 75,9 per cent occurring in pack ice having a concentration ranging from 0,6–0,8. Both Hall-Martin (1974) and Wilson (1975) found a similar relationship between the occurrence of crabeater and Ross seals in relation to ice concentration during their surveys.

Weddell seals appeared to prefer medium to heavy pack ice concentrations in 1976, while leopard seals were evenly distributed throughout the full range of ice concentrations encountered. It is of interest to note that in 1976, 64,0 per cent of leopard seals observed occurred within 300 m of the edge of the northern limits of the pack ice, 15 to 40 kilometres offshore. The remainder occurred near the edge of leads or polynya's within the pack ice or along the ice shelf. Only Wilson (1975) has recorded seals in pack ice with a concentration of 1,0 in the King Haakon VII Sea. In 1976 pack ice with a concentration of 1,0 did occur but was impenetrable, and consisted of a continuous layer of solid ice. When the

Table 8

Group sizes of Ross, Weddell and leopard seals in pack ice in the King Haakon VII Sea, Antarctica, 19 January–14 February 1976

Species	No. of seals per group	Observed frequency	Percentage of total	Total no. counted
Ross seal	1	57	96,6	57
	2	2	3,4	4
	Totals	59	100,0	61
Weddell seal	1	42	100,0	42
	Totals	42	100,0	42
Leopard seal	1	13	92,9	13
	2	1	7,1	2
	Totals	14	100,0	15

Mean group size: Ross seals, 1,03 individuals; Weddell seals, 1,00 individuals; Leopard seals, 1,07 individuals.

Table 9

Mean group sizes of seals in pelagic Antarctic pack ice

Reference	Date of observations	Region	Mean group size			
			Crab	Weddell	Ross	Leopard
*Nel, 1966	Dec. 1963–Feb. 1964	King Haakon VII Sea, 1°–6°W	1,10	—	—	—
**Kenyon, 1967	Jan.–March, 1967	Cruise round Antarctic Continent	1,30	—	—	—
Siniff <i>et al.</i> , 1970	30 Jan.–15 March, 1968	Weddell Sea, 37°–60°W	2,2	—	—	—
Erickson <i>et al.</i> , 1971	Jan.–March, 1969	Weddell Sea, 29°–60°W	2,1	—	—	—
"	Jan.–March, 1970	Weddell Sea, 29°–60°W	1,3	—	—	—
"	Jan.–March, 1968, 69, 70	Weddell Sea, 29°–60°W	2,1	—	—	—
Hall-Martin, 1974	Jan.–Feb., 1974	King Haakon VII Sea, 1°–6°W	2,4	1,00*	1,03*	1,00*
Wilson, 1975	Jan. 1975	King Haakon VII Sea, 2°–4°W	1,4	—	1,09*	—
Condy, 1976 (this report)	Jan.–Feb., 1976	King Haakon VII Sea, 3°W–9°E	1,49	1,00	1,03	1,07

\*Calculated for this report; \*\*From Siniff *et al.* (1970).

Table 10

Total number of seals counted in pack ice during census period related to pack ice concentration in the King Haakon VII Sea, Antarctica, 19 January–14 February 1976

Species	Ice concentration in tenths									Totals
	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	
Crabeater seals	19	16	13	8	15	84	148	42	7	352
Ross seals	1	2	1	2	3	9	23	12	5	58
Weddell seals	2	1	2	9	1	5	5	10	2	37
Leopard seals	0	3	1	4	0	1	3	0	2	14

ship was beset on 27–29 January, ice concentration was only 0,8–0,9 and it was the abundance of brash ice between floes that led to the ship's predicament.

Laws (1953), Eklund & Atwood (1962), King (1964), Ray (1970), and Wilson (1975) consider that Ross seals prefer concentrated pack ice. Siniff *et al.* (1970) and Erickson *et al.* (1971) stated that their results did not support this theory. Results from the past three surveys of the King Haakon VII Sea indicate that Ross seals occur most commonly in ice with a concentration of 0,6–0,7, and are also common at a lower concentration (of 0,3). The abundance of Ross seals in this area suggests that pack ice concentration is not the only factor as was previously believed, but that there are also other factors as yet unknown.

Data on the occurrence of seals according to floe size and surface nature for the 1976 survey are shown in Table 5, and the results for the past three surveys have been combined in Fig. 2. They indicate that both Ross and crabeater seals prefer smooth-surfaced floes. Ross seals show a distinct preference for small floes while crabeater seals show no particular preference for floe area. Ray (1970) states that in pack ice Weddell seals prefer large, hummocked ice floes. During the 1975 and 1976 surveys they occurred more often on large, smooth ice floes. Since this species occurs mainly on fast ice which is both smooth and extensive in area, it seems reasonable to expect that they would show a similar preference in the case of pack ice.

#### Diurnal rhythm

The data presented in Table 2 show that there was a maximum number of observations per survey hour between 06h00 and 16h00. Crabeater and Ross seals haul out throughout the 24-hour cycle, but from approximately 04h00 the number of seals hauled out begins to increase, reaching a peak between 10h00 and 12h00, and by 18h00 most have returned to the water. Nel (1966) observed most crabeater seals between 09h00 and 12h00, and Siniff *et al.* (1970) obtained highest densities of crabeater seals between 12h00 and 14h00. Erickson *et al.* (1971) report a peak haul-out period for this species between 11h00 and 14h00, and Hall-Martin (1974) and Wilson (1975) between 08h00 and 12h00. Most reports are in agreement that there is a peak haul-out period for crabeater and Ross seals from 08h00 to 14h00, starting about 06h00 and tailing off at about 18h00. Stirling (1969a) suggests a peak haul-out period for Weddell seals between 14h00 and 16h00, and results from this survey support his observations. Leopard seals were seen between 04h00 and 18h00 only.

While the *RSA* was beset on 28 January approximately 22 km off the ice shelf (69°51'S, 1°15'E), the diurnal rhythm of crabeater seals through one 24-hour cycle was studied. Local ice concentration was 0,8 with abundant brash ice between floes. Observations were made from the bridge, 10 m above the waterline, and only seals within 300 m of the ship were included. Air and sea temperature were recorded each hour, air temperature from the Stevenson screens on either side of the bridge (always recorded on the leeward side), and sea temperature at a depth of two metres by the ship's engineers. The sun shone continually throughout the study

and wind speed averaged four knots. The results are shown in Fig. 3. It appeared that as air temperature rose above 0°C, the crabeater seals began to return to the sea, but as air temperature rose above sea temperature (–1° to –3° C) they hauled out in greater numbers. Further studies are required to confirm these trends.

#### Predation

No killer whales, *Orcinus orca* were observed during this survey. Of all crabeater seals seen, 62,5 per cent were scarred, while 3,2 per cent of Ross seals were scarred. Hall-Martin (1974, unpublished report) found that 63 per cent of crabeater seals and no Ross seals were scarred, and Wilson (1975, unpublished report) found that 25,2 per cent of crabeater seals and 0,8 per cent of Ross seals observed had scars. The reason for these scars is unknown, although some may be attributed to killer whales.

#### Elephant seals

On 19 January a lone adult male elephant seal, *Mirounga leonina*, was observed swimming in an area of open water against the ice shelf between Otter and Muskeg bukta. Hall-Martin (1974) observed a lone elephant seal on an ice floe in Muskeg bukta on 10 February 1974.

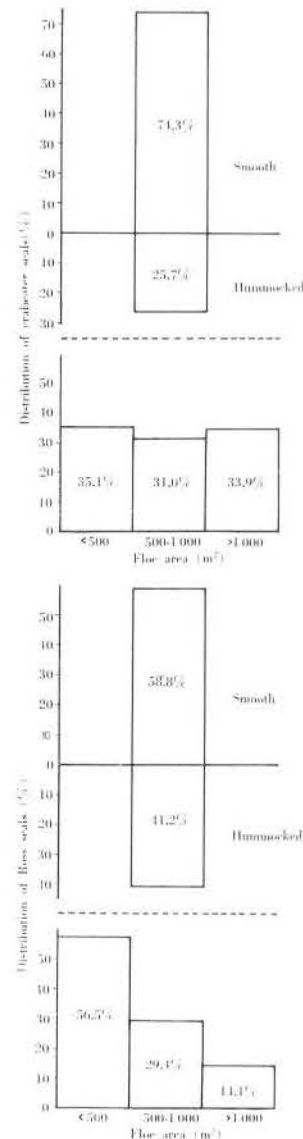


Fig. 2. Distribution of crabeater and Ross seals according to area and surface nature of ice floes in the King Haakon VII Sea, Antarctica, in January and February 1974, 1975 and 1976.

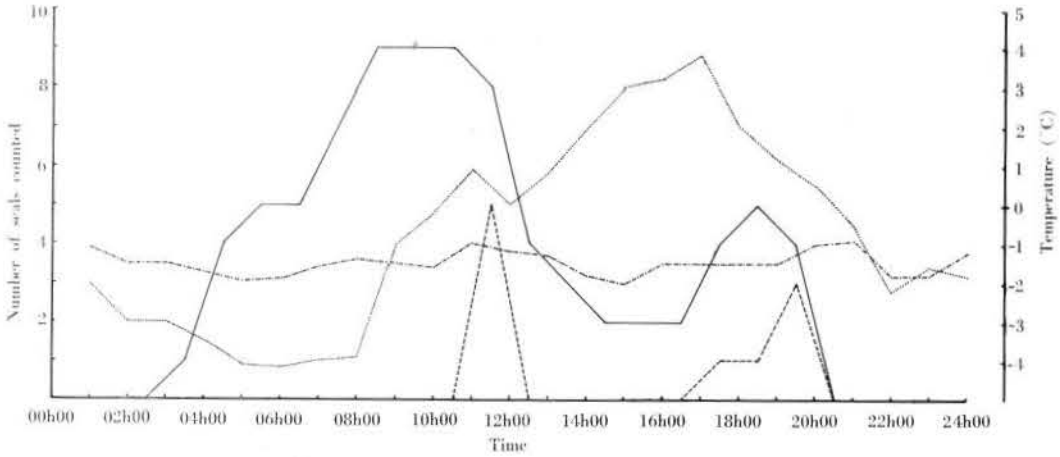


Fig. 3. Diurnal cycles of crabeater seals on 28 January 1976, King Haakon VII Sea: number of seals on ice floes (—), seals seen swimming (---), air temperature (· · ·) and sea temperature (- · - ·).

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