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DISTRIBUTION AND ABUNDANCE OF SEALS IN THE BEAUFORT SEA, AMUNDSEN GULF, AND PRINCE ALBERT SOUND, 1984

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SUMMARY

The fourth in a series of seal monitoring surveys was flown over the Beaufort Sea, Amundsen Gulf, and Prince Albert Sound from 15-21 June 1984. Ice conditions in the Beaufort Sea were intermediate between the extremes of 1981 and 1982; the seal numbers there continued to be stable. The estimated population in Amundsen Gulf was down to 32 000—56% of the 1982-1983 level—but that in Prince Albert Sound continued constant at 18 000. Regressions showed ringed seal habitat preferences in accordance with earlier results, and no effect of industrial activity.

RÉSUMÉ

La quatrième d'une série de recensements aériens de population de phoques annelés et de phoques barbus a été complété entre le 15 et le 21 Juin 1984 dans la mer de Beaufort, le golfe d'Amundsen et la baie du Prince Albert. Les conditions de glaces dans la mer de Beaufort étaient intermédiaires entre celles, plus extrêmes, observés en 1981 et 1982, et les populations de phoques de cette région ont maintenus des niveaux relativement constants. La population de phoques annelés estimée dans le golfe d'Amundsen, elle, a diminué jusqu'à 32 000, soit 56% du niveau observé à deux reprises, en 1982 et 1983. Par contre, celle de la baie du Prince Albert est restée constante à 18 000 phoques annelés. L'analyse par régressions multiples de l'utilisation des différents types d'habitats a donné les mêmes résultats que dans les années précédentes et on n'a pu observer aucun effet de l'activité industrielle sur la distribution de phoques annelés.

INTRODUCTION

The ringed seal (Phoca hispida) is a widespread inhabitant of Arctic seas, being the only Arctic seal well adapted to live in unbroken fast ice. It is also a prominent component of the Arctic marine ecosystem, in which it is the staple food of the polar bear (Lentfer 1982). It has, in the past, been important as food for man and dog; and, more recently, its skin has provided a major cash crop for the people of northern Canada. It has been chosen as a subject species for environmental baseline and monitoring studies (Finley 1976; Finley and Johnston 1977; Alliston and McLaren 1981) both because of its intrinsic importance and because any serious disruption in the marine ecosystem should affect populations of such a species; namely, a large mammal near the top of the food chain.

Throughout the winter, the ringed seal lives under the ice and snow cover of the frozen sea. When warm weather occurs in late May or early June, seals haul out on the surface of the ice, often for many hours at a time. The results of behavioural studies (Finley 1979; Smith and Hammill 1981; Kingsley[1]) suggest that most seals in an area may be visible simultaneously at the daily peak of haul-out in early afternoon. This visibility of ringed seals at this time of year has been used in designing census studies by aerial survey (McLaren 1966; Burns and Harbo 1972; Smith 1973; Smith et al. 1979; Helle 1980; Kingsley et al. 1985).

A program of aerial surveys was started in 1974 as a part of the Beaufort Sea Project of environmental baseline studies. A decrease in the estimated ringed seal population in the first two years of survey, from 42 000 in 1974 to 22 000 in 1975 (Stirling et al. 1977), prompted the continuation of the program to track the natural variation over a longer time span. The estimates stayed low until 1977 (23 000). However, in 1978, for no identifiable cause, the estimate rose to 61 000, its highest recorded level, only to fall again in 1979 to an intermediate level of 37 500 (Stirling et al. 1982).

This monitoring effort was continued from 1981 with a further series of aerial surveys at the request of Dome Petroleum Limited, Esso Resources Canada Limited, and Gulf Canada Resources Inc. It was designed to monitor the populations of ringed seals and bearded seals (Erignathus barbatus) as indicated by the numbers hauled out on the ice in early summer, and to attempt to relate temporal and spatial variations in density to the distribution of industrial activity connected with hydrocarbon exploration and development. Whereas the 1974–1979 series had covered the entire Canadian Beaufort Sea from the Alaskan border to Cape Parry, and had extended northward up the west coast of Banks Island, the new design covered only the area off the Mackenzie Delta and the Tuktoyaktuk Peninsula. Areas in Amundsen Gulf and Prince Albert Sound were also surveyed as controls unaffected by industrial activity. The 1984 results are presented in this report, and are compared with those of the previous surveys in this series and, as far as possible, with those of the earlier surveys.

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[1]Kingsley, M., unpublished data.

METHODS

SURVEY DESIGN AND FLYING

The 1984 survey used the same design as those of the previous years (Kingsley et al. 1982a; Kingsley and Lunn 1983; Kingsley 1984). It was a strip transect design, with all the transects oriented north–south. In the Beaufort Sea (Area 1) the transects were spaced every 15′ of longitude from 129° 15′ W to 136° 30′ W and were about 160 km long; the northwestern limit was 70° 40′ N and the northeastern 71° 40′ N (Figure 1).

Control areas were defined in Amundsen Gulf (Area 2) and in Prince Albert Sound (Area 3). The offshore area in Amundsen Gulf was chosen for comparison with the offshore area in the Beaufort Sea where drilling was taking place, so that population trends or possible changes in distribution that might be attributable to offshore hydrocarbon exploration could be compared. Underlying this comparison was an assumption that these two offshore areas were inhabited by populations of similar age and sex composition. However, the 1974–1979 series of surveys in the Beaufort Sea (Stirling et al. 1982) showed that some changes in numbers or distribution occur because of major ecosystem perturbations, whether or not identifiable, and that others may occur independently of changes in the ecosystem. Therefore, a second control area was chosen in Prince Albert Sound, an area of very good breeding habitat and dependable ice cover, so that any major regional change in ringed seal numbers could be separated from local changes related to ice cover. It was thought likely that such an area of good breeding habitat might be occupied by a population with a different age or sex composition from that in the offshore areas. In these control areas, the transects, which were still oriented north–south, were spaced 20′ of longitude apart. There were two reasons for this: first, when these surveys were first flown, an extended survey of seals in the high Arctic was also covering part of Amundsen Gulf, and had its transects spaced every 40′ of longitude, so a 20′ spacing fitted in with this; secondly, the 20′ spacing also reflected the higher densities of seals in these areas, on the principle that high densities, other things being equal, should lead to more precise estimates of density than low ones. The southern limit of survey was 70° 30′ N in Area 2, and 70° 00′ N in Area 3; the westernmost transect was at 123° 00′ W and the easternmost at 114° 20′ W.

The survey methods were developed for an earlier series of surveys flown from 1974 through 1979 over the Beaufort Sea (Stirling et al. 1982). The survey was flown at 152 m (500 ft) in a Cessna 337 "Skymaster." Transects were delimited by an alignment of strut and window marks, and were 0.4 km (0.25 miles) wide on each side of the aircraft. The strips on each side did not meet under the aircraft; there was a blind strip that was not included in the measured half-mile transect. Data were collected continuously by two-minute intervals. Ringed and bearded seals were counted, and incidental sightings of other marine mammals were recorded. Ice cover was estimated to the nearest eighth by both observers. One observer recorded the ice age and its condition—"fast," "large floe," "small floe," or "rotten"—and the occurrence of fog or rain, while the other recorded the wind speed and the cloud cover on and near the transect; "clear," "scattered," "broken," or "overcast."

A departure from the practice of previous years was the addition of two extra transects to the start of the survey, to the west of the western limit given above for Area 1, so that the observers, and the pilot, could practise starting transects, seeing seals, and recording data.

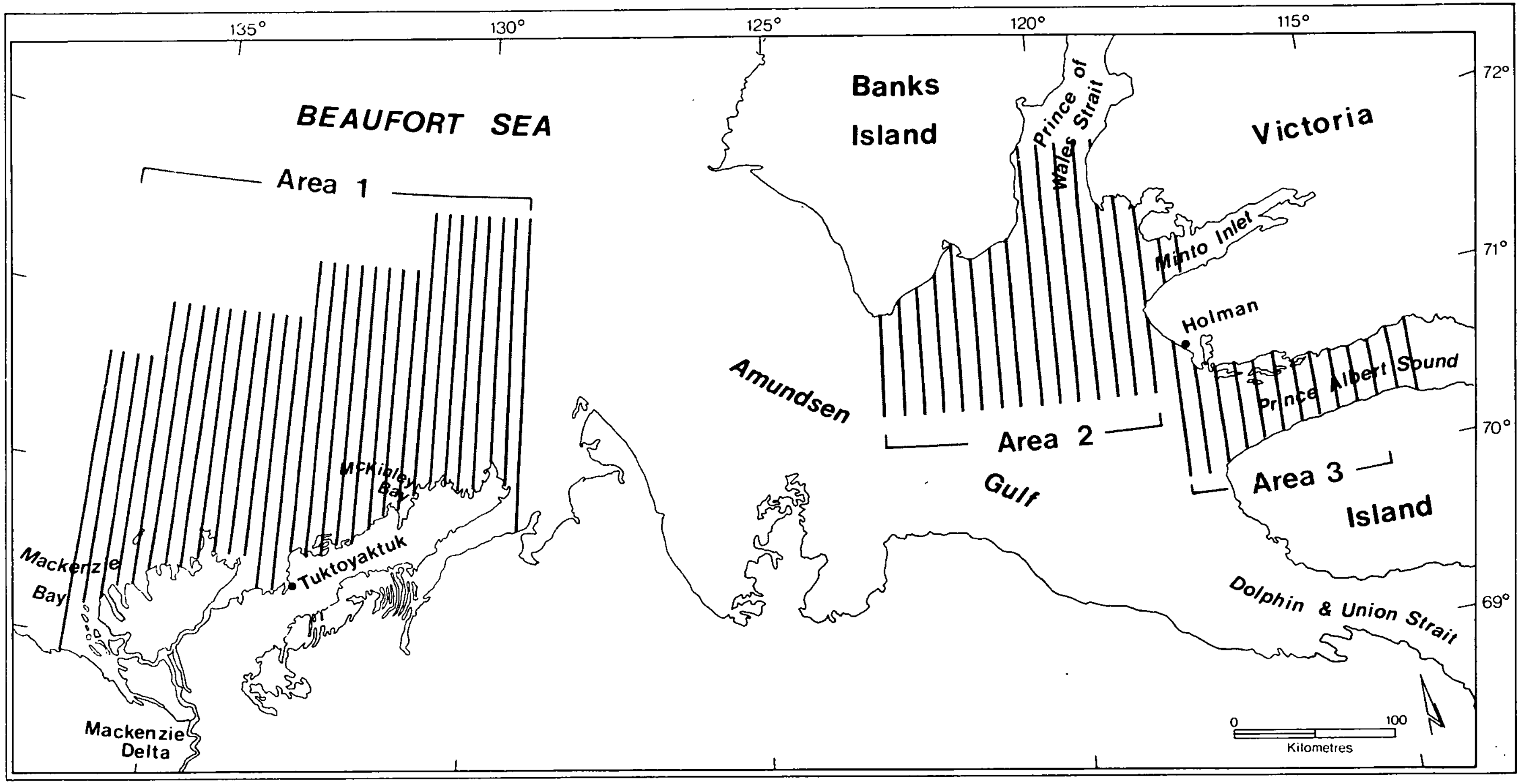

Figure 1. Study Areas and transect lines for seal monitoring surveys, Beaufort Sea, Amundsen Gulf, and Prince Albert Sound, 1984.

DATA ANALYSIS

Density estimates were calculated for each Area separately, and in two ways. It had been found in some previous surveys (Kingsley et al. 1982b) that ice of less than 6/8 cover only accounted for a small part of the survey area, and was not much used by ringed seals for hauling out on. Therefore, ringed seal densities had been calculated per unit area of habitat with ice cover of 6/8 or more. A preliminary check of the Beaufort Sea data for 1984 showed that there was more pack ice than usual in the 3/8 to 6/8 cover range. Therefore, total ice surface area, including all ice covers, was calculated for the study Areas, and ringed seal densities were calculated per unit area of ice surface by dividing the total seals counted on ice of all covers by the total ice surface area. This mean density was extrapolated over the study area to give an alternative population estimate; Stirling et al. (1982) had used this basis for their density and population calculations for the Beaufort Sea. The same calculations were also made for the three previous surveys in this series, so that the estimates could be compared.

The haul-out preferences of bearded seals are less clear-cut than those of ringed seals—their density decreases, if anything, in areas of high ice cover—so a simple density estimate per unit area of ice surface was calculated for them, and was extrapolated to a population estimate.

TABLE 1
Locations of industrial sites active in the year to June 1984

Position		Water depth class (m)	Distance to 25-m contour (km)	Distance to ice edge (km)
Latitude (N)	Longitude (W)			
69° 42′ 35″	136° 27′ 40″	<25	27.6	2.4
69 43 52	133 58 58	<25	36.2	21.9
69 46 48	136 01 19	<25	22.2	-1.5
69 48 35	135 19 53	<25	15.0	9.9
69 52 34	135 25 21	<25	9.7	-4.2
69 54 14	136 45 35	25-50	-7.7	*
69 58 57	133 30 50	<25	1.4	-6.0
69 59 33	133 05 55	<25	15.1	-6.0
70 01 07	136 27 30	25-50	-6.7	-31.9
70 03 32	133 42 45	25-50	-4.1	-16.0
70 03 57	137 13 06	25-50	-77.8	*
70 06 50	133 19 47	25-50	-0.9	-13.8
70 18 00	132 15 55	25-50	-22.2	-25.7
70 19 24	135 26 35	50-75	-40.0	-53.9
70 24 37	134 30 40	75-100	-37.4	-34.8
70 24 44	133 42 20	50-75	-43.4	-55.3
70 26 07	133 19 28	50-75	-37.3	-49.5

* Outside study area, therefore ice edge information is missing.

All density estimates were calculated for each Area separately; the Beaufort Sea Area was also split up into a fast-ice and a pack-ice sub-Area—the 25-m contour was taken as the boundary between the sub-Areas for all years (Kingsley 1984)—and densities and population estimates calculated separately.

Multiple linear regression was used to study the relationship of habitat factors to the abundance of ringed seals, and the effect of industrial activity on them. The author expected disturbance to be concentrated near active sites such as well-sites, borrow pits, berm- or island-building activity, and so on. Information was collected on 17 sites that had been active in the year before the survey, and their locations added to the data file (Table 1). If there was any local effect of industrial activity in reducing seal populations, it was expected to produce something like a funnel-shaped depression that would approximate to a negative multiple of the reciprocal of the distance from the site of activity. The proximities of the survey units—namely, the two-minute intervals of data collection—to the various active sites were calculated as the reciprocals of the distances between them, and used as an independent variable in regressions of density on habitat factors. The habitat factors offered as independent variables included ice cover and condition, weather, and water depth. The distance from the observational unit to the fast-ice edge was also offered: previous years seemed to show a higher density of seals close to the active industrial sites, and it was possibly because both the sites and the seals were to be found near the ice edge.

RESULTS

SURVEY FLYING AND ICE CONDITIONS

The survey was flown in seven days, from 15–21 June 1984, in generally good weather with no fog and little heavy overcast. The indicated outside air temperature at the survey altitude ranged from 8–13 °C.

Temperatures in the western Arctic in the spring of 1984 had been warmer than normal, and ice breakup in the Beaufort Sea was well advanced, although the survey was flown a few days earlier than in previous years: from 15 through 19 June. The extent of ice in the fast-ice sub-Area of the Beaufort Sea was 8 700 km^2, the lowest value so far recorded, and the extent of 6/8+ cover in the pack-ice sub-Area was 9 900 km^2, less than in any year except 1982 (Table 2, Table 3). The pack ice was very thin, and looked like poor hauling-out locations for ringed seals; in this respect as well, conditions resembled those of 1982.

TABLE 2
Ice cover, ringed seal densities, and estimated visible seal populations in the fast- and pack-ice sub-Areas of the Beaufort Sea, 1981–1984, on ice of at least 6/8 cover

Sub-Area	1981	1982	1983	1984
Fast-ice sub-Area (<25 m depth)				
Total extent†	15.4	15.7	16.4	15.2
Extent of fast ice†	10.1	11.7	10.4	8.7
Extent of cover ≥6/8†	9.7	11.7	10.7	8.6
Mean seal density‡	0.062	0.408	0.173	0.358
Std error of density estimate‡	0.011	0.077	0.018	0.075
Est. visible population*	0.60	4.77	1.85	3.08
Pack-ice sub-Area (>25 m depth)				
Total extent†	31.9	31.7	32.1	31.4
Extent of cover ≥6/8†	25.5	1.8	15.2	9.9
Mean seal density‡	0.185	0.444	0.230	0.236
Std error of density estimate‡	0.014	0.115	0.031	0.043
Est. visible population*	4.72	0.80	3.50	2.34
Total est. visible population in Area 1*	5.32	5.57	5.35	5.42

† All extents in this table are in thousands of km^2.
‡ Densities and standard errors in seals·km^{-2}.
* Populations in thousands.

TABLE 3

Ice cover, ringed seal densities, and estimated visible seal populations in the fast- and pack-ice sub-Areas of the Beaufort Sea, 1981–1984, on total ice surface

Sub-Area	1981	1982	1983	1984
Fast-ice sub-Area (<25 m depth)				
Total extent†	15.4	15.7	16.4	15.2
Extent of ice surface†	10.9	11.9	11.6	9.7
Mean seal density‡	0.079	0.412	0.188	0.367
Std error of density estimate‡	0.016	0.075	0.021	0.062
Est. visible population*	0.87	4.92	2.19	3.57
Pack-ice sub-Area (>25 m depth)				
Total extent†	31.9	31.7	32.1	31.4
Extent of ice surface†	24.3	3.0	18.7	11.7
Mean seal density‡	0.203	0.296	0.223	0.283
Std error of density estimate‡	0.016	0.068	0.027	0.044
Est. visible population*	4.94	0.90	4.18	3.33
Total est. visible population in Area 1*	5.80	5.82	6.36	6.90

† All extents in this table are in thousands of km^2.
‡ Densities and standard errors in $seals \cdot km^{-2}$.
* Population estimates in thousands.

The ice conditions in Amundsen Gulf and Prince Albert Sound (Areas 2 and 3) were normal, with complete cover of fast ice on all except the westernmost transect, and some widely spaced cracks and leads (Table 4). The weather for the survey, flown from 19–21 June, was clear and sunny, and the ice surface was wet.

HABITAT REGRESSIONS

Ringed seal density ($seals \cdot km^{-2}$) was regressed on weather, time, and habitat factors. Binary variables were offered for ice cover and condition, weather, time of day, and water depth, and continuous variables for proximity to industrial sites and distance from the fast-ice edge. Regressions were run for the Area 1 data as a whole, with and without the distance from the ice edge in the list of candidate independent variables. The results (Table 5) were not inconsistent, but seemed to contain variables that may have been relevant to either the pack- or fast-ice sub-Areas, so separate regressions were run for the two.

TABLE 4
Ice cover and condition in the study Areas at time of surveys, 1981–1984

			Percentage area					
		Survey area	Ice cover			Ice	Ice condition†	
Area	Year	($km^2 \cdot 10^3$)	0/8	≥6/8	8/8	surface*	Fast	Pack
1	1981	47.3	4.8	76.3	17.9	74.2	32.0	68.0
	1982	47.5	49.9	28.3	16.4	31.0	65.4	34.6
	1983	48.4	7.3	53.6	16.8	62.7	29.0	71.0
	1984	46.6	31.6	39.6	11.0	46.1	37.8	62.2
2	1981	21.0	74.3	21.6	11.4	22.2	58.9	41.1
	1982	21.3	0.0	100.0	100.0	99.9	100.0	0.0
	1983	21.0	8.0	89.1	85.6	90.1	98.9	1.1
	1984	21.2	5.7	93.3	91.6	93.4	100.0	0.0
3	1981	7.1	31.3	66.2	58.3	65.1	100.0	0.0
	1982	7.4	0.0	100.0	98.4	99.8	100.0	0.0
	1983	7.6	0.0	100.0	98.1	99.8	100.0	0.0
	1984	7.8	0.0	100.0	98.0	99.2	100.0	0.0

* Estimated total surface area of all fast and pack ice expressed as a percentage of the area surveyed.
† Percentage of the area with any ice cover.

These sets of results are quite clear and consistent with established understanding of ringed seal habitat preferences (Kingsley et al. 1982b; Stirling et al. 1982). In the fast-ice sub-Area, the density (seals·km^{-2} ice) rises with the ice cover, but decreases with increasing distance from the fast-ice edge, ringed seals being more numerous near the ice edge and avoiding the shallow water inshore. In the pack-ice sub-Area, there is also an increase of seal density with ice cover, but it appears as discontinuities at 3/8 and at 8/8 ice cover; there is also a reduction in density over the deeper water. The large positive coefficient for 8/8 ice cover in the pack-ice sub-Area results deserves comment. Although it has high statistical significance, and is responsible for a large part of the sum of squares due to the regression, it is based on a single observation of one very large floe—hence the 8/8 ice cover—that had 34 seals on it.

None of these results show any relationship between seal density at the time of survey and industrial activity during the previous year. The industrial activity was clustered in the western half of the study area (see Table 1), and the habitat regressions give no indication that there is any cumulative effect on the seal densities.

TABLE 5
Habitat and weather variables entering regressions of ringed seal density, Beaufort Sea, 1984

Variable	Coefficient (std error)*
All Beaufort Sea data; fast-ice edge distance not offered $r^2 = 21.4\%$	
Constant	0.556 (0.058)
Sun time >12:00	-0.257 (0.068)
Depth >50 m	-0.171 (0.065)
All Beaufort Sea data; fast-ice edge distance offered $r^2 = 25.0\%$	
Constant	0.552 (0.072)
Distance to ice edge (km·10^2)	-0.601 (0.117)
Suntime >12:00	-0.333 (0.067)
Depth >25 m	0.395 (0.104)
Ice cover ≥6/8	0.192 (0.069)
Fast-ice sub-Area only $r^2 = 22.5\%$	
Ice cover (proportion)	0.601 (0.094)
Distance to ice-edge (km·10^2)	-0.833 (0.277)
Pack-ice sub-Area only $r^2 = 35.8\%$	
Constant	0.443 (0.073)
Ice cover ≥3/8	0.250 (0.091)
Ice cover =8/8	4.078 (0.601)
Depth >50 m	-0.460 (0.092)

* The units for the coefficients and their standard errors are seals·km^{-2} of ice surface

DENSITIES OF RINGED SEALS AND SEAL HOLES

Beaufort Sea Sub-Area

Analysis of previous survey results has shown that ringed seals are usually seen hauled out on ice of high cover, and the author has usually presented density estimates for ice of 6/8 or higher cover, so as to have them comparable between different Areas or different years. For the 1984 Beaufort Sea data, densities were also calculated, for all levels of ice cover, per unit area of ice surface, because a preliminary check showed that densities so calculated seemed to be independent of ice cover, and the pack-ice sub-Area had much low-density pack ice.

The density and population estimates for 1981–1983 had led to the proposal of a model, based on habitat of ice cover 6/8 or more, which was "a constant visible population of about 5 400 seals, and a constant density on the floe ice of 0.21 seals·km^{-2}, with the balance of the population moving to the fast ice to haul out" (Kingsley 1984). The density on the pack ice in 1984 was 0.24 seals·km^{-2} and the estimated total visible population was 5 420, both results in line with the proposed model.

The population estimates extrapolated from the results for all ice covers, with densities expressed as seals·km^{-2} of ice surface, are higher than those based on cover of at least 6/8. The differences are small in 1981 and 1982, but are large in 1983 and 1984. In 1981, the pack ice sub-Area was well covered with ice and the extent of at least 6/8 cover was large. With so much preferred haul-out substrate available, few seals (18 of 425) were seen in ice of less than 6/8 cover, and the extrapolation from the habitat of at least 6/8 cover was close to that from all habitat. In 1982, the opposite extreme was reached: there was little pack ice, and the extrapolated population on the pack ice was small, so changes in it made little difference to the overall estimate. Seven of 65 seals were seen in the pack-ice sub-Area on ice of less than 6/8 cover.

In both 1983 and 1984, intermediate conditions occurred. There was moderate cover of pack ice (58% in 1983; 37% in 1984) and it was loose enough to have a significant component of cover less than 6/8. In these conditions, a larger part of the ringed seals seen (in 1983, 47 of 347; in 1984, 87 of 287) were in the low-cover pack ice, and their inclusion in the extrapolated population estimates raised them significantly.

Amundsen Gulf and Prince Albert Sound Sub-Areas

The inshore ice of Prince Albert Sound east of the Horizon Islands is good breeding habitat, with a high density of lairs and breathing holes (Smith and Stirling 1975). It freezes to stable fast ice, but with enough rafting and ridging to catch snow and give seals cover, and usually remains stable throughout the seals' breeding season. The ice of Amundsen Gulf is less stable. It frequently shifts and cracks in the course of the winter, and in some years may consolidate late or not at all. This instability may make it less preferred as breeding habitat for seals: Smith and Stirling (1978) give some data based on a timed dog-search technique showing slightly fewer birth-lairs in Amundsen Gulf than in Prince Albert Sound, although, as they previously (1975) pointed out, "offshore areas of shifting . . . ice are an important part of the breeding habitat."

It may be the case that preferred, stable ice habitat would be occupied to an optimum density regardless of regional variations in total population. Few data exist on the way in which seals occupy fast-ice habitat. However, Smith and Stirling (1978) recorded concurrent and roughly commensurate reductions in indices of breeding seal abundance in both inshore and offshore ice in the western Arctic between 1974 and 1975.

In 1981, there was little fast ice, and the density of seals on the ice that remained was high. The high density and low ice cover compensated for each other in Prince Albert Sound, to give a similar population estimate to those obtained in 1982–1984. This result is fortuitous, and does not show inherent stability: the density in Amundsen Gulf did not compensate for the small amount of fast ice and the population estimate was quite low. From 1982 to 1984, the population estimates for Prince Albert Sound were constant, within the limits of error: the variance between years was less than the mean error variance for an individual year's result.

The Amundsen Gulf population estimate was the same in 1983 as in 1982, but in 1984 was lower (Table 6). However, the weather and the ice conditions for the survey were similar to those of previous years; there had been nothing unusual in the process of freeze-up; and the survey was flown at the same time as in previous years. It is unlikely that this discrepancy results from inherent unreliability of aerial survey as a census technique for seals. Some results have shown that repeated counts on a single transect vary, and the reduction in counts was not uniform over the transects in Amundsen Gulf. However, results such as the three years of constant populations in Prince Albert Sound, and the similarity between years of the population estimates for survey strata in the high Arctic (Kingsley et al. 1985), show that the survey method, applied over a large area, is precise enough not to produce a 44% drop as a measurement error. The conclusion is that the survey result reflects a real drop in the surveyed population in Amundsen Gulf, and one that did not extend to the Prince Albert Sound sub-Area. There is, however, no supporting data on other indices of abundance, such as birth-lair surveys or underwater vocalization counts, only an unattributed report that seals were scarce near Holman in the spring 1985 hunting season. There is no confirmation from data on reproductive success or condition, either; when seals became less abundant in 1975 compared

TABLE 6
Ringed seal and seal-hole densities, and estimated visible seal populations, Amundsen Gulf and Prince Albert Sound, 1981–1984

Area and year	Ringed seal density (std err.) (km^{-2})	Seal-hole density (std err.) (km^{-2})	Holes/seal	Estimated visible seal population ($\cdot 10^3$)
Amundsen Gulf (Area 2)				
1981	3.08 (0.66)	3.74 (0.54)	1.21	14.0
1982	2.61 (0.26)	3.60 (0.18)	1.38	54.9
1983	3.02 (0.15)	5.72 (0.22)	1.89	56.5
1984	1.60 (0.16)	6.14 (0.28)	3.84	31.2
Prince Albert Sound (Area 3)				
1981	3.46 (0.67)	4.65 (0.54)	1.31	16.9
1982	2.03 (0.21)	3.61 (0.23)	1.78	15.0
1983	2.34 (0.13)	5.34 (0.35)	2.28	17.8
1984	2.37 (0.26)	7.08 (0.78)	2.98	18.3
Areas 2 and 3 combined				
1981	3.28 (0.46)	4.25 (0.45)	1.30	30.9
1982	2.46 (0.20)	3.60 (0.15)	1.46	70.5
1983	2.82 (0.11)	5.61 (0.19)	1.99	74.3
1984	*	*	*	49.5

* The mean densities in the separate Areas are too different for an overall mean density to make sense.

with 1974, there was also a drop in the pregnancy rate (Stirling et al. 1977) and in the mean girth of adult and immature ringed seals (Smith and Geraci 1975).

DENSITIES AND POPULATIONS OF BEARDED SEALS

The habitat preferences of bearded seals have been examined in previous studies, both in the western Arctic (Stirling et al. 1982) and in the high Arctic (Kingsley et al. 1985). This species has consistently been found to be associated with shallower water, and with rotten or broken ice rather than with the extensive fast ice where ringed seals are counted in the greatest numbers. In this series of surveys, almost all bearded seals were seen in the shallow-water areas of the eastern part of Area 1; very few were in the deeper Areas 2 and 3. The densities of bearded seals were calculated on a base of square kilometres of ice surface, and varied much from year to year. In 1981, the density was 2.051/100 km^2 ice (std error 0.306); in 1982, it was up to 8.68 (s.e. 1.375); in 1983, it was 5.67 (s.e. 0.702); and in 1984, only 1.42 (s.e. 0.35). The estimated visible populations of bearded seals in the Beaufort Sea Area for 1981 through 1984 from these density estimates are 720, 1 276, 1 722, and 450; the variation in ice surface area compensated somewhat for the varying density.

CONCLUSIONS

The ringed seal population in the Beaufort Sea study area has been constant over the four years of survey. Densities on the fast and pack ice compensated for each other and for variations in the ice cover to give population estimates between 5.3 and 5.6 thousand seals on ice of at least 6/8 cover, and between 5.8 and 6.9 thousand if all ice covers are included.

The densities and populations in the control Areas in Amundsen Gulf and Prince Albert Sound had been constant for the two years before this, but in 1984, the population estimate for Amundsen Gulf inexplicably dropped to 56% of the earlier level. The Prince Albert Sound population estimate did not show a similar drop, and stayed at its former level.

In the western part of the study area, where industry had been active in the year before the 1984 survey, no evidence of reductions in seal density was shown by regression of ringed seal density on habitat factors including proximity to industrial activity.

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