A CALVING GROUND AND POPULATION ESTIMATE FOR THE BLUENOSE CARIBOU HERD IN 1983

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ABSTRACT

Two reconnaissance surveys were conducted of the tundra and some forested sections of the Bluenose caribou (Rangifer tarandus groenlandicus) herd's range. From 27-30 May caribou were spread at low densities over a broad area south of Paulatuk and south and southeast of Bluenose Lake. Prior to 4-6 June caribou had moved north into the Melville Hills and closer to the coast northeast of Bluenose Lake. Five strata were delimited and intensively surveyed. Immediately following the surveys caribou were classified within each stratum to determine the proportion of breeding cows. An unusally low proportion of breeding cows on the calving ground (28%) may have been due to inaccurate composition estimates and/or some breeding cows not being censused. There were not sufficient resources to census thinly scattered breeding cows outside the delimited strata. We estimated 21,500 ± 2,040 (S.E.) animals on the calving ground and a total herd size of between 30,000 and 50,000.

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INTRODUCTION

Studies within the last 5 years (Brackett et al. 1982, Carruthers and Jakimchuk 1981, Latour and Heard 1985) indicate that the Bluenose caribou herd was stable in size at 25-40,000 caribou (Table 1). These estimates were obtained from transect surveys of caribou on their winter range or on their calving grounds in the Melville Hills and near Bluenose Lake.

This report describes the results of a calving ground survey in May and June 1983.

Table 1. Bluenose calving ground surveys, 1978-1983.

Year	Caribou (older than 1 year)	Total population	Source
1978	10,800±1,000	27,000	Brackett et al. 1982
1979	13,800±2,000	34,500	Brackett et al. 1982
1981	17,200±1,600	38,000±18,000	Latour and Heard 1985
1983	21,500±2,000	33,500±14,300	This study

MATERIALS AND METHODS

The study area extended south to just below the treeline and was bounded in the west by the Anderson River, in the east by Coronation Gulf and in the north by the Arctic Ocean (Fig. 1). The study area was divided into east and west halves by the Hornaday River. One aircraft (Cessna 185) was stationed at both Paulatuk and Bluenose Lake. Reconnaissance of the west half of the study area was conducted by the Paulatuk team and the east half by the Bluenose Lake team. Regular radio contact enabled the two teams to co-ordinate survey efforts.

Observers were positioned in the left and right rear seats of each aircraft with a navigator-recorder seated in the front beside the pilot. Reconnaissance flight lines were drawn 25 km apart on 1:250,000 topographical maps and most reconnaissance flying adhered to these lines except in areas where we wished to determine the limits of caribou distribution or the nature of earlier movements. Reconnaissance was flown at an altitude of 122 m and an airspeed of 180-190 km/hr. All caribou observed, both inside and outside a 400 m strip, on both sides of the plane, were recorded on tape along with a separate checkpoint number for each sighting. Determination of the outer boundary of the strip was facilitated by wooden dowels attached to the wing struts. Strip widths were checked for accuracy by flying over ground markers at survey altitude. Caribou were classified as yearlings, cows, cows with calves or bulls.

After reconnaissance was completed we delineated, on 1:250,000 maps, the boundaries of calving areas. Densities of

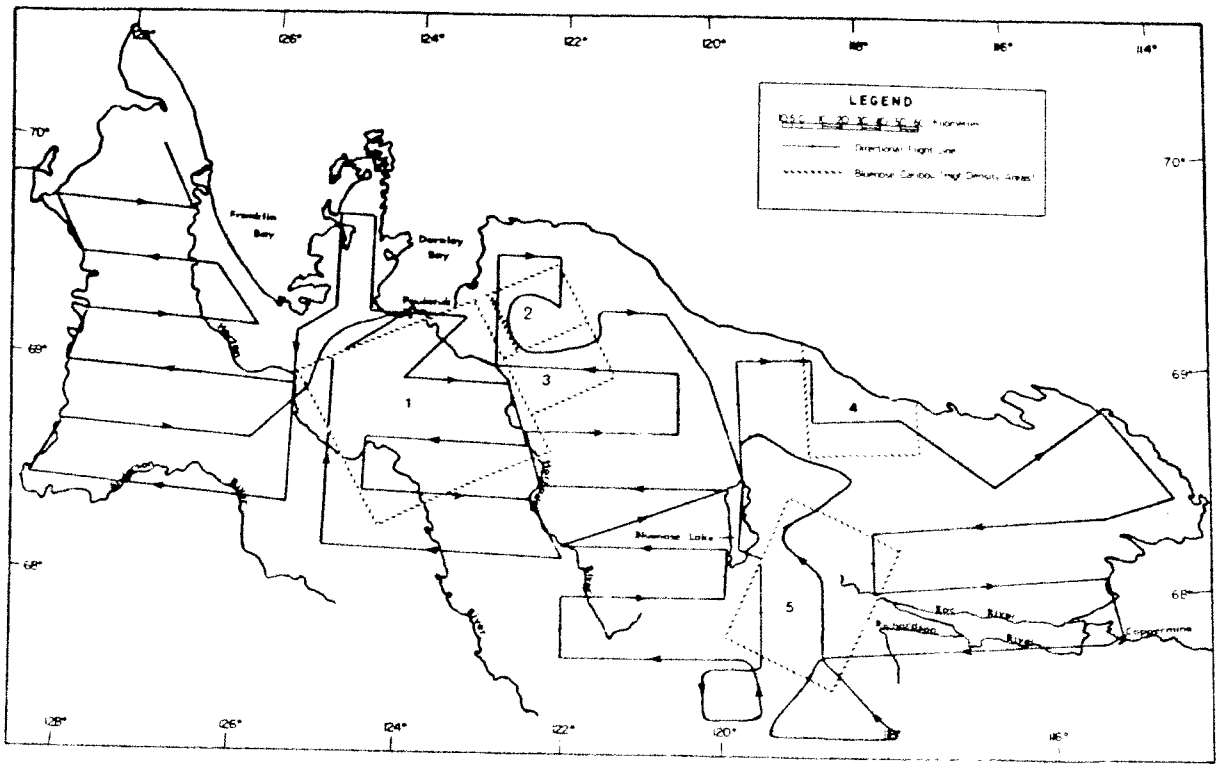

Figure 1. Reconnaissance flight lines flown 27-30 May 1983 during the Bluenose calving ground survey and the location of calving areas as determined on 4-6 June 1983.

cows with calves were calculated for each area and survey effort (i.e., number of transects) for each area was directly related to density. Transects were oriented perpendicular to the long axis of each area (hereafter termed stratum) and were evenly spaced with a random starting point along the axis. These transects were flown as for the reconnaissance flights at an airspeed of 160-170 km/hr. Population estimates and variances were calculated according to Jolly's (1969) method 2.

Immediately after the transect survey, the composition of caribou in the strata was determined. Caribou were approached in a Bell 206B helicopter flying at an altitude of approximately 60 m. The approach was deliberately slow and oblique to the caribou in order to minimize stress to the animals. When within good observation distance (approximately 100 m), two observers classified all caribou on their respective sides of the aircraft. Most caribou could be classified at distances which did not unduly disturb them. If individuals began running we broke off the fly-past or slowed down, thereby broadening the distance between us and the caribou. We classified caribou as cow with calf, cow having a distended udder (i.e., breeding cow), cow having no distended udder (i.e., non-breeding cow), yearling or bull.

We also recorded all sightings of muskoxen, grizzly bears, wolves and wolverines.

RESULTS

Reconnaissance

During 27-30 May, 27 and 15 hours of reconnaissance were flown by the Bluenose Lake and Paulatuk teams, respectively. On 27-28 May the tundra and scrub forest area east of the Anderson River, south to Tsoko Lake, east to the Hornaday River and the Bathurst and Parry peninsulas were reconnoitered by the Paulatuk team (Fig. 1). On 27-30 May the tundra east of the Hornaday River west to Coronation Gulf and south to Horton Lake and the headwaters of the Bloody and Haldane rivers were reconnoitered by the Bluenose Lake team.

Caribou were thinly scattered over a broad area south of Paulatuk in small groups of 1-6 individuals and no calves were observed. No caribou were observed on the Bathurst Peninsula. Numerous north-south oriented tracks were seen on the Anderson River area especially where the southwestern most transect intercepted the river (Fig. 1). Snow cover was variable at 20-80 percent and was more extensive than in other years, based on our experience with this area.

East of the Hornaday River, caribou cows were thinly distributed in small groups from the Rae River to within 20 km of the mainland coast. There was a low density distribution, composed mainly of cows and yearlings, from Bluenose Lake south for 60 km. No calves were seen. Snow cover was 95 percent south of the lake and no melt water was present. On 30 May the Melville Hills had very few caribou and no calves present. Snow cover was

40-95 percent, which, like most of the study area, was higher than that seen in previous work.

Nowhere on the study area did we see caribou moving north in the earnest manner usually associated with their spring migration to the calving grounds. Numerous, well-defined trails indicated that caribou had moved north out of the Dease River area 1-2 weeks before our work in the area.

As calving had not begun, we decided to forego stratification and allow the caribou more time to concentrate. We returned to Inuvik until 4 June. On 4-6 June caribou were still spread over a wide area south of Paulatuk between the Horton and Hornaday rivers and south almost to the treeline. Several newborn calves were observed. Caribou were more concentrated in the Melville Hills and some newborn calves were observed. Caribou were thinly distributed as singles and small groups northeast of Bluenose Lake to the coast. No caribou were observed in the Rae and Richardson river valleys, unlike the first reconnaissance. There were now very few caribou south and southwest of Bluenose Lake. Thus, there appeared to have been a broad northward movement of caribou since the first reconnaissance, although nowhere did concentrations approach that seen by ourselves and others for the Bluenose herd.

Stratification

Five strata were established after a second reconnaissance flight (Fig. 2). Preliminary densities, based on our reconnaissance observations, were highest in the southern Melville

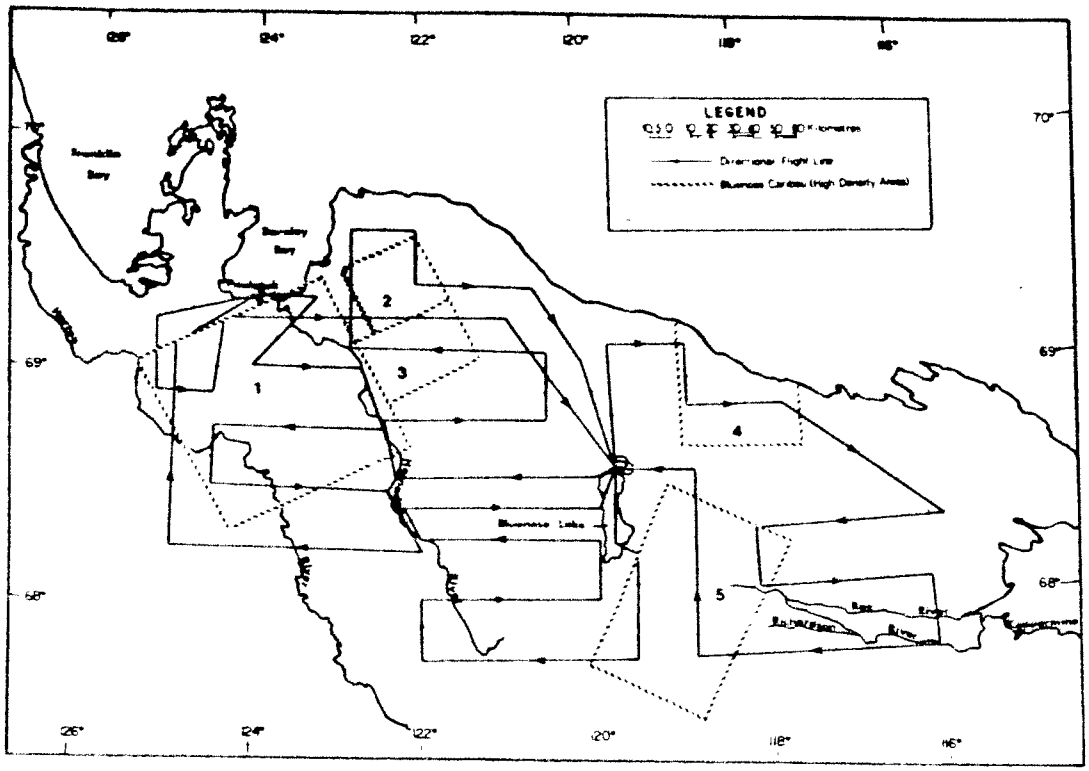

Figure 2. Reconnaissance flight lines flown 4-6 June 1983 during the Bluenose calving ground survey and location of calving areas.

Hills (stratum 3, 8.9/km^2), while the northern Melville Hills were of lower density (stratum 2, 3.2/km^2). Stratum 1 was the broad area of relatively moderate caribou density (3.2/km^2) south of Paulatuk. Strata 4 and 5 were relatively low density areas east and northeast of Bluenose Lake (both 2.3/km^2). Density values calculated from the strip transect surveys of each stratum (Table 2) are lower than the preliminary densities, but relative densities among stratum remained unchanged. There were 4,505 caribou (excluding newborn calves) seen on all five strata, resulting in an estimate of 21,500+2,040 caribou on the calving ground. Observability of caribou was generally good since we restricted flying to between 1100 and 1600 hrs to reduce glare from the sun. The extensive snow cover resulted in good contrast in most areas. Significant differences were detected between observers for both the Paulatuk and Bluenose Lake teams (Wilcoxon matched pairs test; $Z=-5.17$, $P>0.05$ and $Z=-5.03$, $P>0.05$).

Calving Ground Classification

We classified 2576 caribou from 11 to 13 June. Strata 1 and 5 contained low proportions of breeding cows and high proportions of yearlings and non-breeding cows (Table 3) relative to the other three strata. From this data and estimates of the number of caribou in each stratum (Table 2), we calculated estimates of the number of breeding females in each stratum (Table 4). There were an estimated 13,000$\pm$940 caribou cows on all five strata of which 6,000$\pm$360 were breeding cows.

Table 2. Strata characteristics and caribou observations during the strip transect survey of the Bluenose calving ground in June 1983.

	Stratum					
	1	2	3	4	5	
	9 June	9 June	10 June	10 June	8 June	Strata combined
N	121	45	56	73	101	396
n	17	17	28	15	13	90
$Z(km^2)$	8536	1174	1440	2395	5022	18,567
z	1198	442	728	515	650	3533
c	14%	38%	50%	21%	13%	23%
y	1999	264	1716	282	244	4505
R	1.67	0.60	2.36	0.55	0.38	1.16
Y	14,243	701	3394	1311	1885	21,535
Var(Y)	3,932,144	6866	92,399	61,763	65,082	$4.2X10^6$
SE(Y)	1983	83	304	249	255	2039
CV	0.139	0.118	0.090	0.190	0.135	0.095
df						16

N - maximum number of transects
n - number of transects surveyed
Z - stratum area (km^2)
z - strip area (km^2)
c - coverage (n/N)
y - number of caribou counted
R - caribou density (caribou/km^2)
Y - population estimate
Var(Y) - population variance
SE(Y) - standard error
CV - coefficient of variation
df - degrees of freedom (after Cochran 1977:90, 3rd Ed.)

Table 3. Number of caribou classified in each stratum of the Bluenose calving ground in 1983 and the percentage of each category contained within each stratum.

Stratum	1	2	3	4	5	Total
Yearlings	357 (50.0%)	33 (13.4%)	61 (8.1%)	48 (11.1%)	192 (44.1%)	691 (26.8%)
Non-breeding females	312 (43.7%)	28 (11.4%)	35 (4.7%)	58 (13.5%)	98 (22.5%)	531 (20.6%)
Bulls	5 (0.7%)	0 (0%)	1 (0.1%)	0 (0%)	4 (0.9%)	10 (0.4%)
Breeding cows	40 (5.6%)	185 (75.2%)	653 (87.1%)	325 (75.4%)	141 (32.4%)	1344 (52.2%)
Total	714 (100.0%)	246 (100.0%)	750 (100.0%)	431 (100.0%)	435 (100.0%)	2576 (100.0%)

Table 4. Estimates of the number of breeding and non-breeding cows in each stratum of the Bluenose calving grounds in 1983.

Stratum	Estimated number of caribou	Number of breeding cows	Number of non-breeding cows	Total cows
1	14,240	800	6220	7020
2	700	560	80	640
3	3390	2990	160	3150
4	1310	1010	180	1190
5	1890	600	420	1020
Total	21,530	5960	7060	13,020

The number of calves varied from 75 to 88 per 100 cows in strata 2-5. Stratum 1 had only 52 calves per 100 cows (Table 5). The overall calf-cow ratio was 82 calves per 100 cows.

Other Wildlife

Grizzly bears were sighted on 12 separate occasions during the study, for a total of 18 bears (Table 6). Most were sighted on the high rolling terrain within 50 km of Bluenose Lake.

A total of 352 muskoxen was recorded between the treeline and the arctic coast. The region drained by the Rae and Harding rivers contained most sightings.

No wolves or wolverines were observed.

Table 5. Calf-cow ratios on the Bluenose calving ground in 1983.

Stratum	1	2	3	4	5	Total
Cows with calves	21	162	528	280	106	1097
Breeding cows without calves	19	23	125	45	37	249
Calves per 100 breeding cows	52	88	81	86	75	Weighted average 67

Table 6. Grizzly bear sightings during the 1983 Bluenose caribou survey.

Date	Number of bears	Location
26 May	1	40 km NE of Bluenose Lake
27 May	2 (sow and coy)	along Anderson River
27 May	2	20 km N of Bluenose Lake
28 May	2	east end of Delesse Lake
28 May	1	13 km N, east end of Delesse Lake
5 June	4 (sow and 3 coy)	South end of Bluenose Lake
5 June	1	12 km E of Bluenose Lake
6 June	1	20 km E of Bluenose Lake
9 June	1	Melville Hills (middle of stratum 2)
11 June	1	5 km E of Bluenose Lake
12 June	1	Melville Hills (stratum 3)
13 June	1	Biname Lake (feeding on caribou carcass)

DISCUSSION

During this study, breeding cows of the Bluenose herd were distributed over a broader area than that reported in earlier studies (Hawley et al. 1979, Brackett et al. 1982, Latour and Heard 1985). Trails indicated that the caribou moved out of the forest onto the tundra in large groups which disbanded with individuals drifting north at varying speeds. One possible reason for this lack of concerted movement toward the usual calving grounds, broadly defined as the Melville Hills and the region around Bluenose Lake, was the lateness of spring in 1983. Very little melt had occurred by the initiation of this study, and by the end of the study, conditions were at least 3 weeks behind those of most years.

The calving ground estimate in 1983 (21,500) was 25% greater than in 1981 (17,200 Latour and Heard 1985), but an unusual result of this survey was the very low proportion of breeding females in stratum 1. Because two-thirds of the animals on the calving ground were within stratum 1, those data result in a very low estimate of breeding female numbers relative to 1981. The proportion of breeding females within the calving area is usually between 70 and 90%, regardless of year or caribou herd (Parker 1972, Heard 1981, Latour and Heard 1985). The low proportion of breeding females in stratum 1 and the low estimate of breeding female numbers requires explanation. The following are possible explanations:

1) Age specific pregnancy rates were well below average.

2) There was an unusually large number of 2 and 3 year olds (i.e., largely pre-breeding age) females in the herd.

3) The calving ground was poorly defined and most of the breeding females were not censused.

4) The composition results in stratum 1 were inaccurate.

5) Some combination of the above.

There are two reasons why we feel that the first explanation is unlikely. Latour (1983) found that all seven hunter-killed cows he examined in April 1983 were pregnant and except for the Arctic Islands, low pregnancy rates have never been documented (Bergerud 1978). If pregnancy rates were low, then the 1983 calf crop would be small and could lead to a decline in the herd. Age structure estimates made in the future could test this possibility.

We rejected the second explanation because classification counts in March 1983 did not indicate any distortion in age structure favouring young animals (Williams and Elliott in prep.). Even so, this possibility could account only for the low proportion of breeding females on the calving ground, not their low number.

Some cows calved outside the census zone. Cows with calves were observed scattered throughout the area between strata 4 and 5 and we suspect that an unknown, but thinly distributed, number of cows calved east and southeast of stratum 4. Also, when conducting classification in stratum 3, it was our subjective impression that there were more caribou in that stratum than there had been during the strip transect survey. If so, the source of

those caribou remains unknown. Moreover, the yearling:cow ratio was 66:100 on the calving ground and only 44:100 in the previous March (Williams and Elliott in prep.), suggesting that about 7,000 cows (regardless of breeding status) were missed. However, the estimate of total females (breeding plus non-breeding) was similar in 1981 and 1983 (14,000 vs. 13,000, respectively).

The simplest explanation is probably that the composition counts in stratum 1 were inaccurate, but there are no direct reasons to doubt those results. Both observers were experienced, visibility and viewing conditions were good (e.g., group size and behaviour and terrain were conducive to obtaining unbiassed counts) and sampling was distributed over the entire stratum even though sample size was small. It is possible that many pregnant and/or post-partum cows did not have visible udders and were not accompanied by calves. (Unfortunately, antler characteristics were not systematically recorded but impressions were that most un-uddered cows were bald, therefore, not obviously still pregnant.) Udders would be difficult to detect if cows had calved unusually early and calf mortality was high, or if cows were to calve unusually late. We cannot explain why the timing of calving should have been atypical (either early or late) or why the results from stratum 1 should have differed from the other strata.

We concluded that the similarity in calving ground estimates among years, including 1983, was sufficient evidence to suggest that the Bluenose herd was probably stable or at least not rapidly declining, and that problems with calving ground definition and

the composition counts in stratum 1 resulted in an underestimate of breeding female numbers.

Total herd size could not be based on standard methods (e.g., Latour and Heard 1985) because of the problems with the reliability of composition data (i.e., if the calving ground composition data are correct, then we must discard our standard assumptions about the proportion of breeding females in the herd). We can get some idea of total population size if we assume that all of the yearlings were on the calving grounds, half of them were assumed to be females and all of the older females in the herd were on the calving ground. All of those assumptions will, if anything, tend to underestimate population size because the sex ratio of yearlings on the calving ground is usually biassed toward females (Heard pers. obs., Decker pers. comm.) and not all yearlings and older females were necessarily on the calving ground (see above). The estimate of the number of females is, therefore, about 17,200 (21,500 on the calving ground - 4,200 male yearlings and 100 bulls). Assuming that females make up 58% of the herd (Brackett et al. 1982) and the result is increased by 1.25 to correct for undercounting, then the estimate of total herd size is 37,000 (17,200 x 1.25/0.58). The precision of those estimates cannot be calculated but we feel it would be safe to assume that the herd was between 30,000 and 50,000 caribou. Surveys conducted in 1978 and 1979 (Brackett et al. 1982) did not include classification counts. Total population estimates from those surveys incorporated the assumption that 80% of the adults on the calving grounds were breeding females. This study illustrates the

danger of such assumptions. The 1981 estimate (Latour and Heard 1985) could be biassed as the classification data was not strata specific.

In 1981, Latour and Heard (1985) found 92 calves:100 parous and post-partum cows between 11 and 13 June. In 1983, the corresponding ratio was only 82:100 on the same dates. It is not possible to determine if this difference, even if significant, represents differential mortality or a difference in the timing of most births between years.

Latour and Heard (1985) saw only one wolf in 51.5 hours of flying, while we saw none. This suggests that calf mortality from wolf predation on the Bluenose calving grounds was probably low. However, the density of bears on the calving grounds appears to be much higher than other NWT calving grounds. Several of the grizzly bears we observed were in areas of high densities of cows with recently born calves. Bear predation during calving could cause significant mortality in the Bluenose herd.

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PERSONAL COMMUNICATIONS

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Appendix A. Number of caribou observed per transect in strata 1-5.

Transect	Area (km^2)	Left observer	Right observer	Total
Stratum 1				
1	72	9	38	47
2	71	24	42	66
3	71	28	90	118
4	71	72	132	204
5	71	72	58	130
6	71	11	38	49
7	71	61	95	156
8	70	91	110	201
9	70	86	202	288
10	70	44	47	91
11	70	65	151	216
12	70	25	46	71
13	70	26	51	77
14	70	12	23	35
15	70	25	20	45
16	70	31	85	116
17	70	36	53	89
Total	1198	718	1281	1999
Stratum 2				
1	26	14	12	26
2	26	12	12	24
3	26	24	9	33
4	26	13	19	32
5	26	8	10	18
6	26	1	7	8
7	26	1	12	13
8	26	5	3	8
9	26	5	2	7
10	26	1	6	7
11	26	1	14	15
12	26	22	6	28
13	26	5	9	14
14	26	5	9	14
15	26	0	5	5
16	26	3	3	6
17	26	5	1	6
Total	442	125	139	264

Appendix A continued

Transect	Area (km^2)	Left observer	Right observer	Total
Stratum 3				
1	26	46	59	105
2	26	72	51	123
3	26	58	80	138
4	26	56	92	148
5	26	36	112	148
6	26	28	79	107
7	26	14	47	61
8	26	43	48	91
9	26	20	10	30
10	26	27	32	59
11	26	11	13	24
12	26	26	29	55
13	26	20	39	59
14	26	52	31	83
15	26	9	27	36
16	26	12	34	46
17	26	17	17	34
18	26	29	9	38
19	26	12	22	34
20	26	20	30	50
21	26	11	28	39
22	26	8	20	28
23	26	25	30	55
24	26	12	38	50
25	26	3	16	19
26	26	6	14	20
27	26	6	12	18
28	26	6	12	18
Total	728	685	1031	1716
Stratum 4				
1	50	6	4	10
2	48	22	22	44
3	47	9	11	20
4	43	18	50	68
5	39	6	4	10
6	36	8	9	17
7	35	13	5	18
8	33	2	6	8

Appendix A continued

Transect	Area (km^2)	Left observer	Right observer	Total
Stratum 4 continued				
9	30	3	3	6
10	28	4	8	12
11	26	2	8	10
12	26	3	7	10
13	25	3	16	19
14	25	7	6	13
15	24	10	7	17
Total	515	116	166	282
Stratum 5				
1	50	6	22	28
2	50	10	5	15
3	50	3	3	6
4	50	6	15	21
5	50	4	1	5
6	50	6	5	11
7	50	4	3	7
8	50	18	2	20
9	50	12	22	34
10	50	8	7	15
11	50	12	18	30
12	50	12	16	28
13	50	11	13	24
Total	650	112	132	244
Total for all strata	3533	1756	2749	4505