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Ecological Studies of Wolves on Isle Royale, 1980-1981

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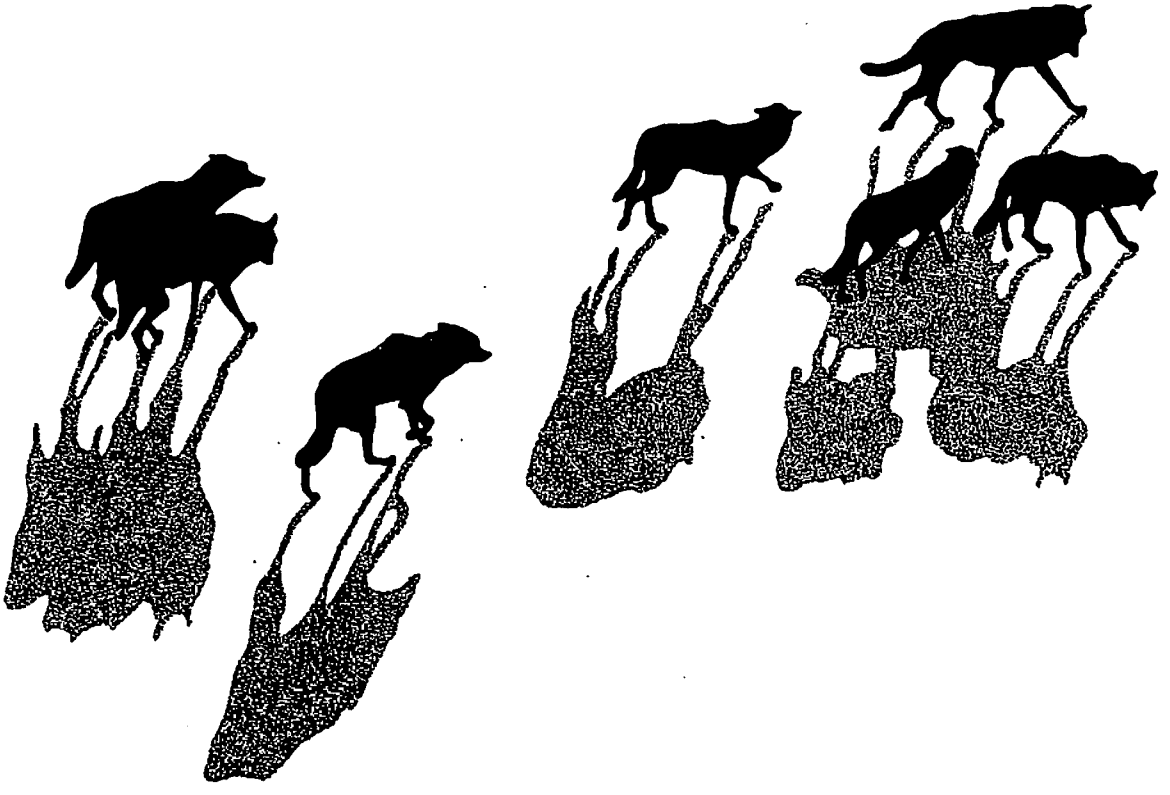
ECOLOGICAL STUDIES OF WOLVES ON ISLE ROYALE

ANNUAL REPORT

1980-81



ECOLOGICAL STUDIES OF WOLVES ON ISLE ROYALE*

Annual Report - 1980-81

(Covering the twenty-third year of research)

by

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INTRODUCTION

For approximately five years Isle Royale has supported the world's highest density of wild wolves, while its moose population has been relatively stable at about half the density of a decade ago. In 1981 we saw the most dramatic wolf decline in the 23-year history of the research project, as the population fell from 50 to 30 individuals. This was the natural outcome of events during the past decade, which saw the wolf population rapidly increase during a period of both high moose vulnerability and beaver density.

A gradual decline in moose habitat was evident at the inception of this research in the late 1950's, but the moose population did not show a decline until the early 1970's, exhibiting a lag period of about a decade. The wolf decline followed in turn, after another lag period of roughly a decade, so we view the entire sequence of events from the 1936 fire through the resulting rise and fall of prey and predator populations as requiring about 45-50 years. Changes in wolf, moose, and beaver populations over the last 12 years are shown in Figure 1.

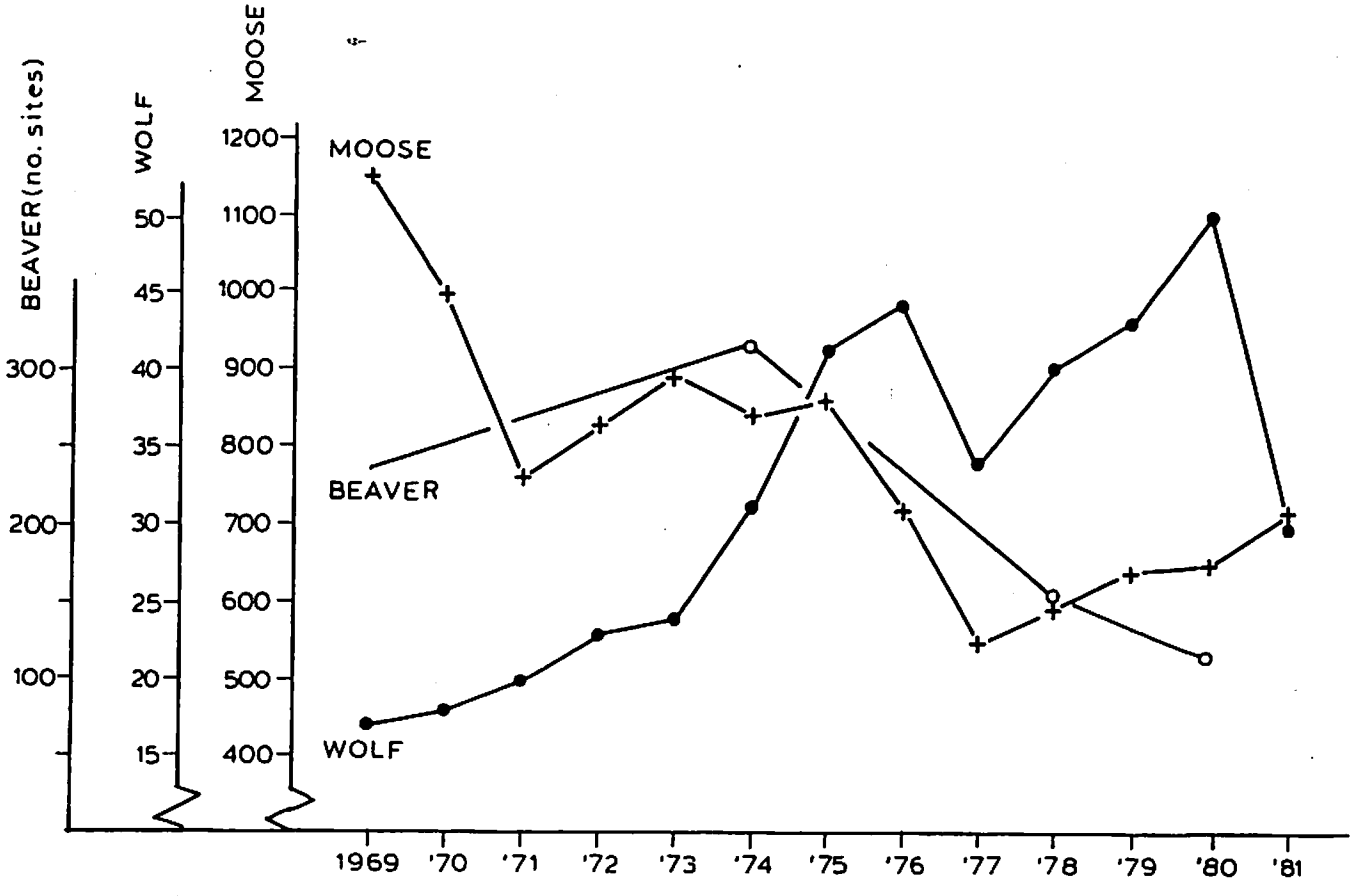

Figure 1. Population levels of wolves, moose, and beaver at Isle Royale National Park, 1969-81. Methods used to determine animal density are partially explained in this report.

During 1980-81 Philip W. Stephens continued work on his master's thesis research, aimed at refining techniques to measure annual change in moose density; his thesis should be completed late in 1981. Summer field personnel concentrated on examinations of moose carcasses and searching for summer wolf activity, especially evidence of pup production and survival. Hiking mileage of all summer personnel totaled 1,015 mi (1,634 km), including 265 mi (426 km) off-trail. Peterson directed summer field work in 1980, with personnel scheduled as follows:

May 22 - August 27, 1980: Mark S. Cramer
May 22 - August 20, 1980: Douglas W. Smith
May 22 - Sept. 3, 1980: Philip W. and Susan M. Stephens
May 28 - August 27, 1980: Rolf and Carolyn Peterson et al.

Peterson conducted an aerial survey of moose just after leaf-fall during October 18-20, piloted by Donald E. Glaser (Wings North, Grand Rapids, MN). At this time Philip C. Shelton conducted an aerial count of active beaver lodges, with results summarized in a special supplement to this report.

As in the past, most of our data on the wolf population was obtained in winter. The 1981 winter study extended from January 21 to March 11. Peterson was present for the entire period, with the research aircraft again piloted by Don Glaser. National Park Service personnel that participated were: Roy A. Peterson, Jan. 21-Feb. 3; J. Robert Stottlemyer, Jan. 21-Feb. 3 and Feb. 26-Mar. 11; Charles L. Dale and Craig C. Axtell, Feb. 3-Feb. 19; Donald R. Brown and Stuart L. Croll, Feb. 19-Feb. 26; Larry T. Wiese, Feb. 26-Mar. 11. Supply flights were flown by the Ely Aviation Unit, Superior National Forest, USFS.

MOOSE POPULATION DYNAMICS

Much of our current effort is directed at a determination of moose density and population composition while the population is at a relatively stable low level. In 1981 we completed a series of 3 annual aerial censuses using an intensive search pattern over small plots distributed across the island. We have also continued to evaluate the following potential indicators of moose density:

1) Moose seen per hour of flying in winter, excluding intensive searches over census plots. These amount to transect flights interspersed with frequent circling, generally associated with wolf tracking or observation and totaling 60-100 flying hours per year. These data have been recorded during 1973-81.

2) Moose observed per km hiked in summer, tallied during 500-1,500 km of hiking by project personnel each year. These data have been recorded during 1970-80.

While both of these indices are affected by many factors in addition to moose density, the extensive coverage of the island and the internal consistency of our methods over the years lend distinct advantages to these techniques. The two indices are independent, yet are reasonably well-correlated; this is the basis for our assumption that they provide a more accurate indication of annual fluctuations in moose density than aerial censuses. Confidence limits for our moose censuses (ca. 25% of the estimate at the 95% level) are so large that moose density would have to change by at least 40% before it could be shown by a census to have changed at all. Nonetheless, the aerial censuses provide the only available means to determine absolute density.

Moose Surveys - Summer and Fall, 1980

Ground surveys in summer and an aerial survey in late October provided information on moose population composition, relative density, and calf production and survival (Figure 2 and Tables 1 & 2). In a preliminary analysis of summer moose observations, we have attempted to standardize all data since 1970 in order to provide an annual indicator of moose abundance. Such observations are

subject to many biases and one focus of Stephen's work is to provide a basis for consistently evaluating summer moose observations recorded each year. Factors known to affect ground observations include concentrations of cows with calves on islands, decreasing probability of observing bull moose as the summer progresses, a predominance of cow moose near certain human settlements, extensive use of aquatic habitats in June, and a progressive decline in the probability of observing moose during summer.

Calf production and survival are of obvious interest, given the extremely high wolf density over the past several years. Summer observations suggested an unusually high level of calf production in 1979, but survival of this cohort was not high, indicated by subsequent aerial surveys in 1979 and 1980. The 1980 cohort was, proportionately, about the same as cohorts over the past 5-6 years. Since we are not sure of the timing of the wolf decline over the past year, we have no conclusion at this time on the effect of the wolf reduction on calf survival.

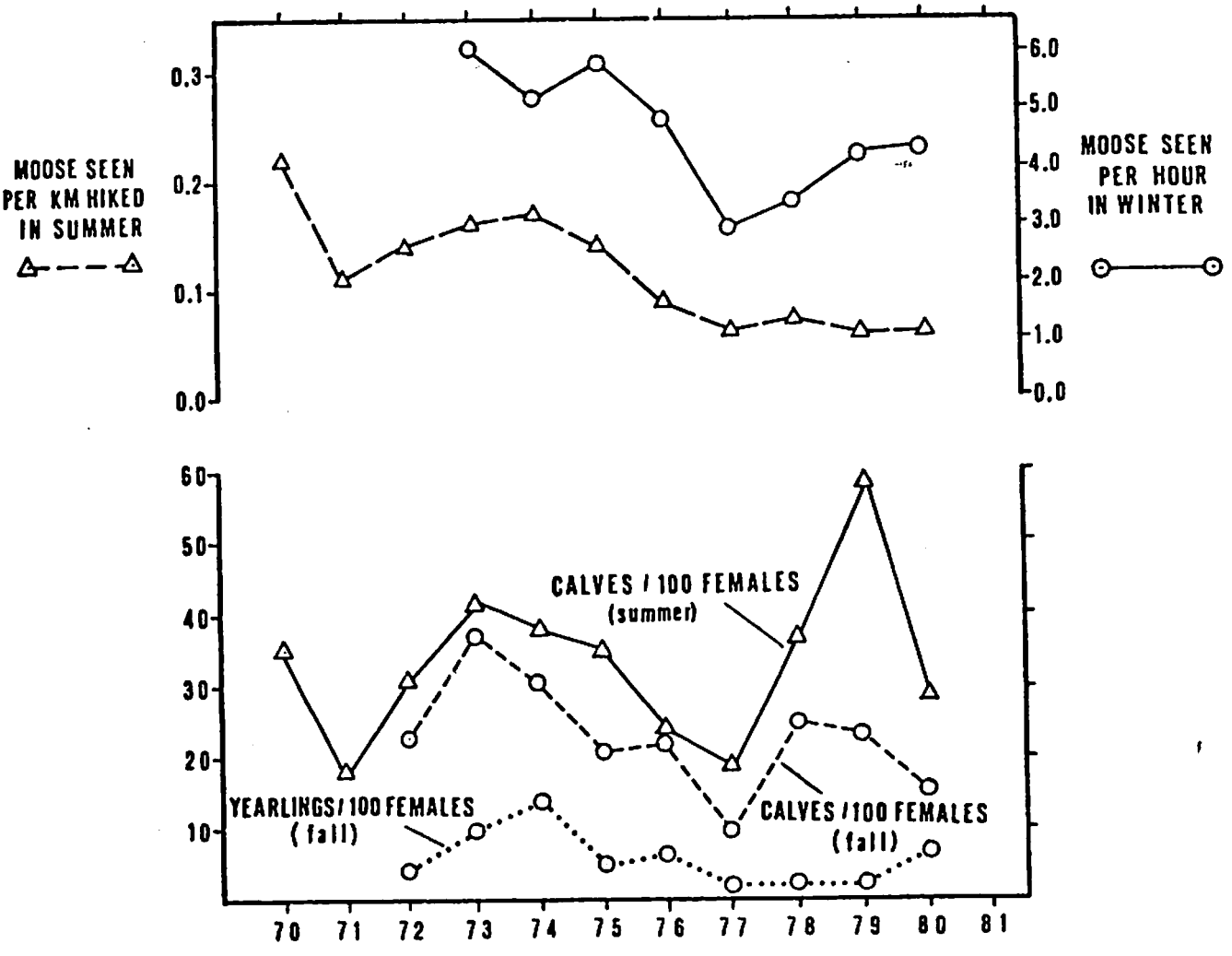

Figure 2. Yearly changes in some moose population parameters. (Ground-based observations have triangles; aerial observations have circles.)
Upper Graph: Two ratios of relative moose abundance on Isle Royale.
Lower Graph: Trends in calf production and survival, 1970-80.

Table 1. Summer (June - August) ground observations of moose on Isle Royale, 1970-80. These include only standardized observations made by wolf project personnel.

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Total observed	158	93	152	172	114	156	104	46	66	88	47
Males	57	33	70	69	34	64	39	13	23	32	10
Females	74	44	61	69	55	65	49	26	30	33	28
Calves	26	8	19	28	21	23	12	5	11	19	8
Unk. sex (non-calves)	1	8	2	6	4	4	4	2	2	4	1
Sex ratio (males/100 females)	77	75	115	100	62	98	80	50	77	97	36
Calves per 100 females 1/	35	18	31	41	38	35	24	19	37	58	29
No. sets of twins	4	1	2	3	4	1	0	0	2	2	0

1/ Includes yearling females, most of which are probably unproductive but which cannot be reliably distinguished from older cows.

Table 2. Autumn aerial composition surveys of Isle Royale moose, 1972-80.

	Oct. 17-19, 1972	Oct. 23-25, 1973	Oct. 22-25, 1974	Oct. 21-22, 1975	Oct. 18-20, 1976	Oct. 18-20, 1977	Oct. 17-18, 1978	Oct. 25-26, 1979	Oct. 18-20, 1980
Total observed	114	192	117	157	120	75	118	250	106
Adult bulls	47	73	43	61	50	29	53	102	51
Yearling bulls 1/	2	8	7	4	3	1	1	2	3
Cows	53	81	51	76	55	41	51	119	45
Calves	12	30	16	16	12	4	11	27	7
Bulls/100 cows	93	100	98	86	96	73	106	87	120
% Yearlings 2/	4	10	14	6	6	3	2	2	6
% Calves	11	16	14	10	10	5	9	11	7
Calves /100 cows 3/	23	37	31	21	22	10	25	23	16
Yearlings/100 cows 3/	4	10	14	5	6	2	2	2	7

1/ Bulls with spikes or small forked antlers were considered yearlings.
2/ % Yearlings = yearling bulls/(adult bulls + yearling bulls).
3/ Yearling females are included in the total number of cows observed.

During the aerial moose survey on October 18-20, we again used an intensive circling technique over large blocks of the island to minimize biases caused by differential habitat selection by moose during the post-rut period. Bull moose were classified as "yearlings" or "non-yearlings" according to antler size and the non-yearlings further classified by antler size as "teens" (less than ca. 5 years old) or "primes" (approximately 5-10 years old) (Table 3). The classification of non-yearlings followed criteria developed by A.B. Bubenik, Ontario Department of Lands and Forests. Moose were more solitary in 1980 than in 1979 (Table 4), and very little courtship behavior was noted; feeding was the predominant activity in 1980.

Table 3. Autumn age distribution of bull moose, 1980 (aerial survey).

Age	Number	% of classified adults
Yearlings	3	6%
Teens	22	43%
Primes	26	51%
Unknowns (non-yrling)	3	--
TOTAL	54	100%

Table 4. Autumn group-size class distribution of moose (calves excluded). Percentages are in parentheses. Determined by aerial count.

Year	Group Size							Total No. of Groups	Average Group Size
	1	2	3	4	5	6	15		
1979	92(67)	26(19)	15(11)	1(1)	2(1)	1(1)	1(1)	138	1.6
1980	58(77)	11(15)	5 (7)	1(1)	0	0	0	75	1.3
Overall	150(70)	37(17)	20 (9)	2(1)	2(1)	1(1)	1(1)	213	1.5

Winter Aerial Census, 1981

An aerial census utilizing intensive search over a sample of small plots appears to be the best method to determine actual moose density on Isle Royale. This technique has been employed during 10 winters since 1966, using a common pool of ca. 70 plots originally laid out by P.A. Jordan. Jordan and M.L. Wolfe considered the 1969 census by Wolfe to be the most accurate of those conducted between 1966 and 1970, providing an estimate of 1369 moose (assuming 80% sightability). The final estimate depends critically upon a stratification scheme in which the island is divided into 4 zones or strata of relative moose density on the basis of previous censuses and current track abundance in the year of the census. The plots themselves provide an estimate of moose density for each stratum. The importance of accurate stratification can be judged from Figure 3, where the total number of moose counted on the same plots in different years can be seen to vary relatively little, in spite of an estimated population decline of almost 50%. The five plots that were on small offshore islands show greater interyear variation and generally higher density than mainland plots in the same stratum. We have recently concluded that disproportionate emphasis has been placed on small island plots in previous censuses, resulting in an average

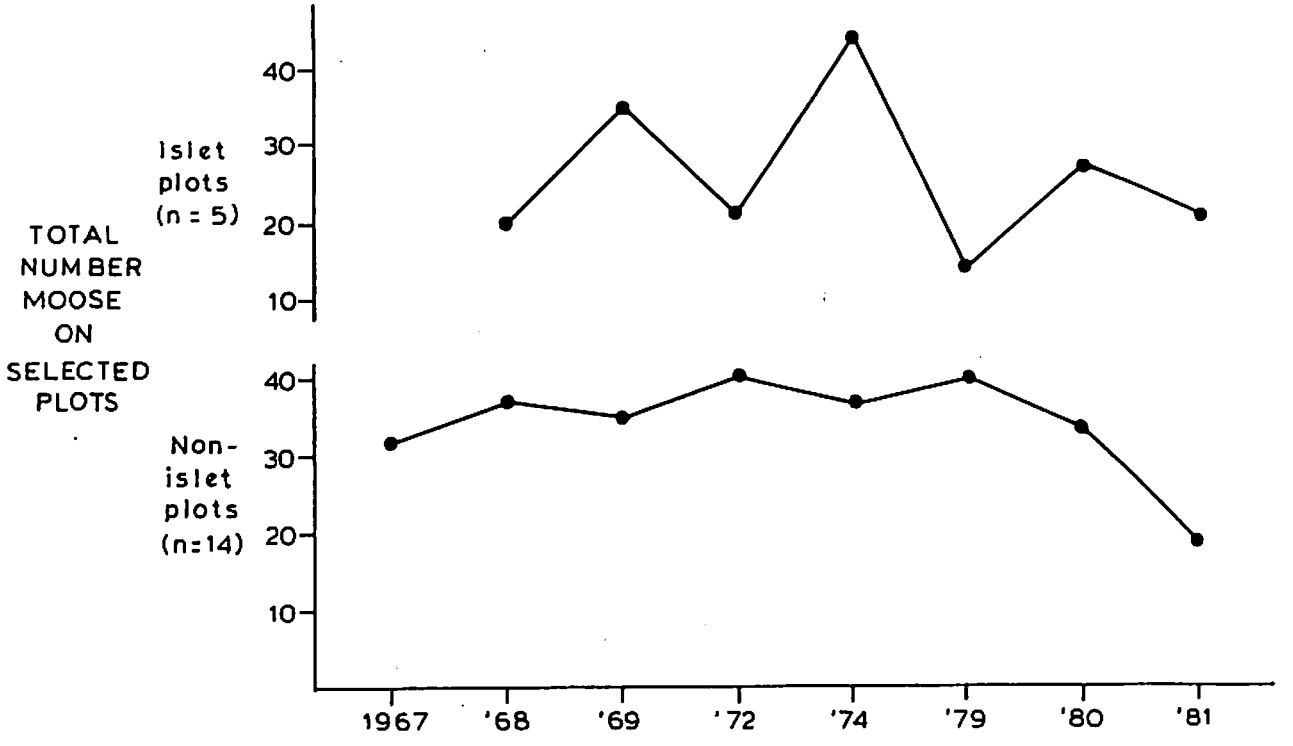

Figure 3. Fluctuations in total number of moose counted on islet vs. non-islet plots during censuses conducted between 1967 and 1981. Islets are small, outer islands which are adjacent to the main island.

overestimation of the moose population of 8.7% (range: 0-15.8%). We also re-checked plot areas using a 256 dot/sq.in. grid and found a consistent underestimation in plot areas used in censuses prior to 1972, which further inflated total moose population estimates by an additional 7%. We believe a downward adjustment in the 1969 estimate of 15.7% is thus in order, yielding a corrected estimate of 1,154 moose as the peak population achieved in the late 1960's, compared to the 1369 reported earlier.

In 1981 we revised our winter census procedure accordingly, the major changes being:

1) an increased effort to accurately delineate stratum boundaries (estimated from relative track abundance 3-4 days after fresh snow),

2) elimination of all plots on offshore islands, substituting instead a complete "intensive search" count of moose in these areas, and

3) addition of more plots in high density strata where sampling variance is highest, with elimination of plots in low density strata where intensive sampling is not required.

The expected decrease in sampling variance resulting from a reallocation of plots (to more accurately reflect current distribution) did not materialize, partially because in 1981 moose were distributed rather atypically in apparent response to low snow depths. Fewer moose were found in traditional wintering areas along south-facing shorelines (Figure 4), and more were located in high, interior areas (even the 1936 burn). The resulting 1981 estimate and 95% confidence interval (Tables 5 & 6) was 481±132, or 17% lower than the 1980 estimate (adjusted by elimination of island plots). Other indices of moose abundance (Figure 2), however, either increased slightly or showed no change, and our conclusion is that the population did not change significantly between 1980 and 1981. Our best estimate of the 1980 population is 650 moose.

We are currently attempting to reconstruct "best estimates" for the Isle Royale moose population for 1969-81, using aerial censuses to provide end points for this period and population indices to indicate inter-year fluctuations. Our preliminary result was shown graphically in Figure 1.

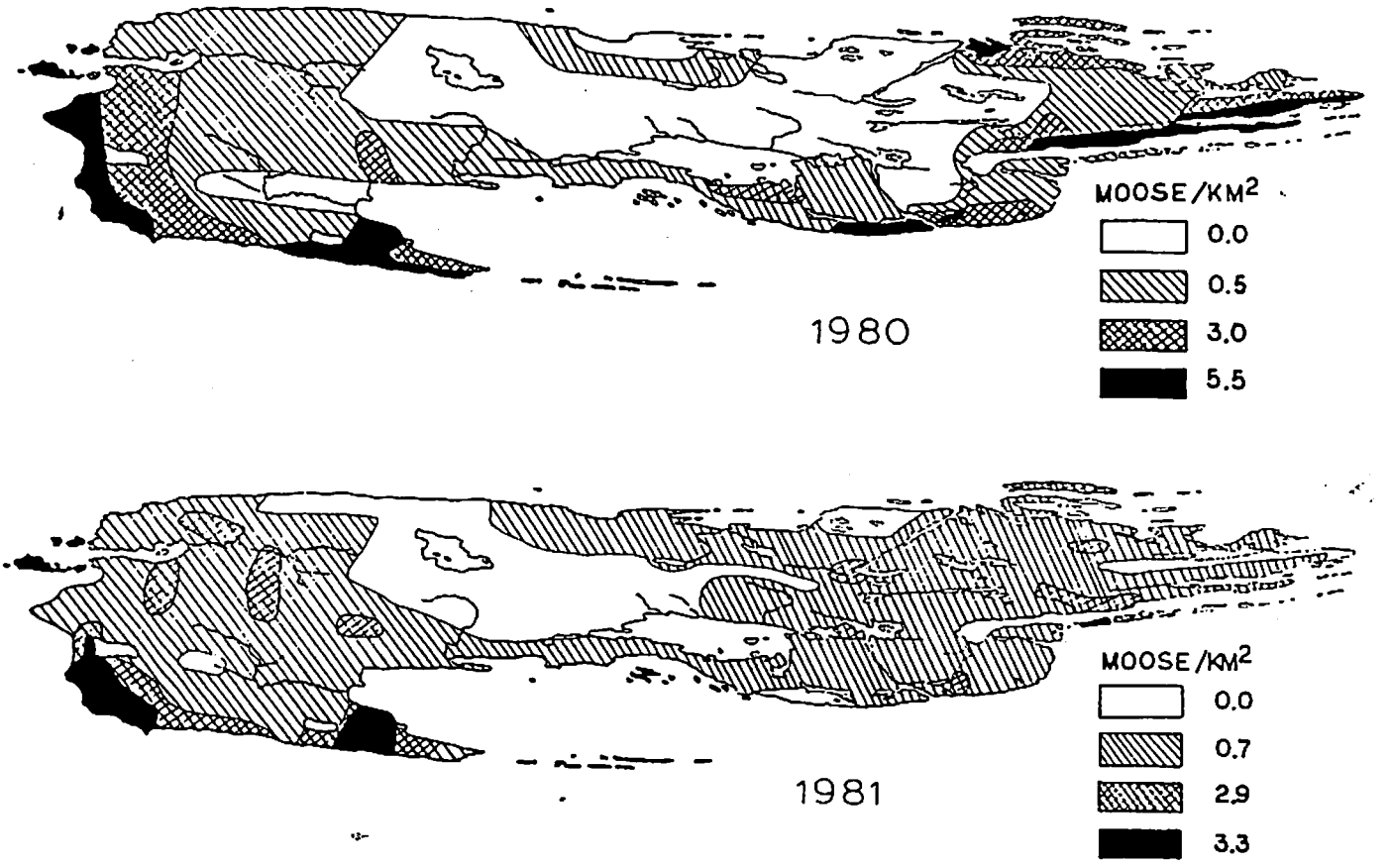

Figure 4. Midwinter distribution of moose on Isle Royale, 1980 and 1981.

Table 5. Results of midwinter aerial moose census, 1981.

Zone	Area(km²)	No. of plots	Proportion of zone counted	Moose counted	Flying intensity (min/km²)	Moose per km²	Estimated total from direct count	Assumed sightability	Adjusted total
0	112.2	8	7.9%	0	9.2	0.00	0	85%	0
1	363.9	26	7.5%	16	10.5	0.59	214	85%	252
2 1/	61.1	31	50.2%	81	12.1	2.64	161	85%	189
Islets 2/	9.0	---	100%	34	16.4	4.36	33	85%	40
Overall	544.9	65	13.4%	131			408	85%	481

1/ Strata 2 and 3 were combined because their densities were similar, and overall precision was improved.

2/ A complete count of all major islets was made.

Table 6. Results of winter aerial "censuses" on Isle Royale.

Year	"Census" Estimate ± 95% C.I. (corrected for sightability)	Estimated Sightability	No. of Strata	Remarks
1979	888 ± 170 (±19%)	0.83 1/	4	Excellent counting conditions
1980	585 ± 164 (±28%)	0.83 1/	4	More rigorous stratification
1981	481 ± 132 (±27%)	0.85 2/	3	Moose distribution more scattered

1/ Sightability probably differed between the 2 most dense strata.
2/ Sightability did not appear to differ among the 3 strata.

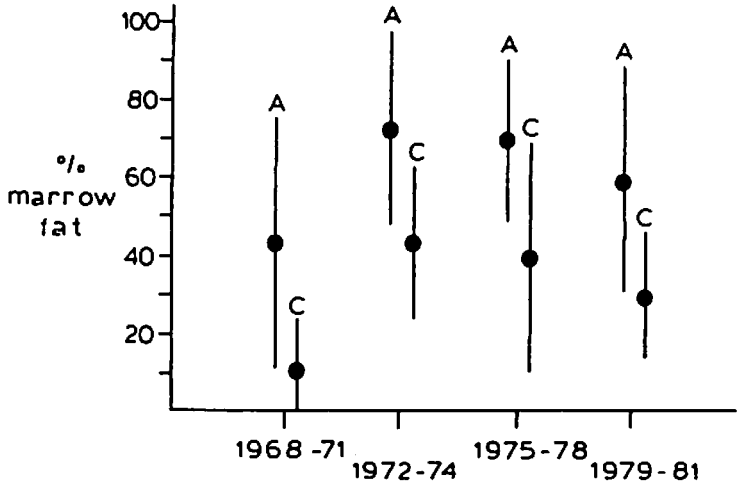

Figure 5. Trends in marrow fat reserves of wolf-killed moose on Isle Royale. A=adult moose, C=calf moose; mean and one standard deviation are indicated.

Other Findings Pertaining to Moose

All bone marrow fat samples collected through 1981 have been analyzed and are summarized in Figure 5. There was a substantial increase in marrow fat in both calves and adult moose between 1968-71 (generally severe winters with high moose density) and 1972-74 (substantially lower moose density and generally less severe winters). There was relatively little change in moose condition (indicated by marrow fat in wolf-kills) between the mid-1970's and the present.

We have generally assumed that moose probably colonized Isle Royale early in this century after swimming the 20-25 km from the Canadian mainland, largely because we have never seen moose travel any distance over open ice, even when snow-covered. In this regard, one crossing observed in 1981 warrants mention. On March 9 we found a cow moose and yearling traveling across Siskiwit Bay, a large bay on the south shore of the island, moving south from the Malone Bay area toward a string of small offshore islands. The ice was smooth and covered with wind-crusted snow. The pair was traveling rapidly, and they were apparently aware of a wolf bedded on the ice 3 km away, closely watching their progress. The moose went 5.8 km straight across the ice to Paul's Island, a tiny island covered with mountain ash, a highly favored browse species. This was our last flight, so we had no subsequent observations. The single wolf returned to the main island without showing any further interest in the two moose.

THE WOLF POPULATION, 1980-81

Last year (1980) the Isle Royale wolf population reached a high point of 50 individuals, in spite of a continuing decline in their food supply. Winter predation rates have generally declined since the mid-1970's, and extremely high carcass utilization and other indicators suggested a marginal food supply in winter. A substantial decline in the beaver population since 1978 and generally low calf abundance indicated a year-round scarcity of food, certainly in comparison to the mid-1970's. The 40% reduction in the wolf population, which we attribute to a reduced food supply, resulted from high mortality rather than egress, since lack of ice precluded travel to the mainland.

Three adult wolves were found dead in 1980: one was a young adult killed by other wolves, and the other two were old, malnourished males with extremely heavy toothwear (one may have been injured by other wolves). One of the latter

two was recovered in July from an old mine pit filled with water; the wolf had fallen into the water and was not able to crawl out on an easy incline. The wolf lacked coronary fat and, in fact, no fat could be boiled from the entire carcass. Both kidneys were abnormally lobed, and the animal had 7 broken ribs (6 completely healed) and 2 broken canine teeth.

Additional evidence of summer food stress in 1980 was the observation of a gaunt wolf for several days at a lakeside campground, after the wolf had reportedly been fed fish scraps by a party the previous week. This animal was observed and photographed at close range by several people.

Finally, in 1980 we located only 2 litters of wolf pups in summer (numbering no more than 3 in Southwest Pack and 4 in Middle Pack). Subsequently, 1 pup was found in the Harvey Lake Pack in winter, 1981. Significantly, we found no evidence of any pups in the East Pack, in spite of a thorough knowledge of rendezvous sites used from 1973 through 1979; group howls were reported across the entire territory of this pack in 1980, and we speculated that no pups survived the summer in this pack.

NPS employee Jean Fitts observed 3 pups in the Middle Pack over a 5-day period in September, when the pups were feeding extensively on hawthorn fruit near a fire tower. The pups were variable in size and easily recognized as individuals, with average shoulder height of 22-24" (i.e. not obviously of small stature).

Summer food habits of wolves, determined from examinations of scats, indicated approximately a 50:50 reliance on beaver and moose calves, with no evidence of adult moose in scats recovered during summer (Figure 6).

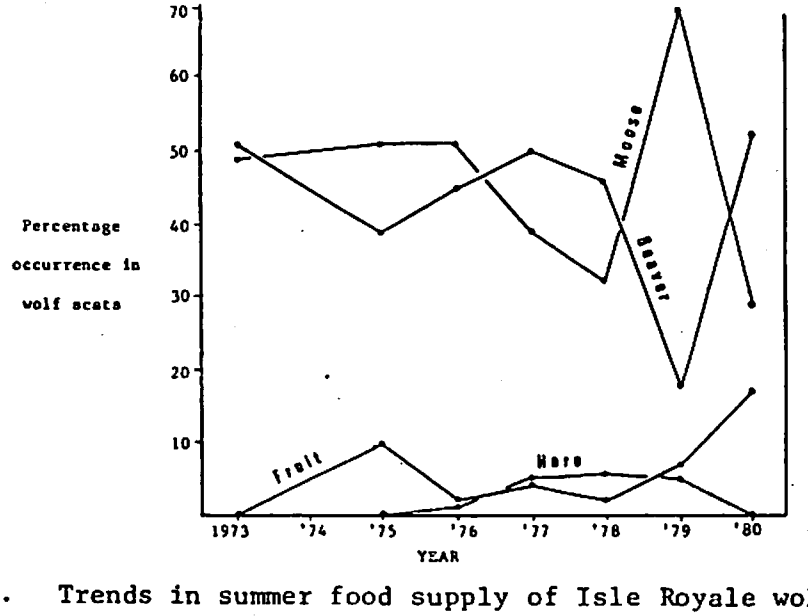

Figure 6. Trends in summer food supply of Isle Royale wolves.

Winter Wolf Census

Our best estimate of the 1981 wolf population was 30 individuals (Figure 7), distributed in 5 packs ranging in size from 2 to 8 wolves. Snow conditions and weather were not as favorable as usual for tracking, and we were never successful in confirming more than 27 wolves in any one day with observations of animals and tracks. Frequent pack splitting and extra-territorial movements compounded our censusing problems, but fortunately we had relatively little difficulty distinguishing packs.

The East Pack, which seems to have been unsuccessful in raising any pups in 1980, declined from 10 to 8 wolves, with a ninth wolf observed trailing the pack on 2 occasions. There were no wolves in the pack that were obviously pups (although normal-sized pups cannot be reliably distinguished from adults). The alpha female remained unchanged, this wolf now at least 11 years old (Figure 8). This year the alpha female was consistently in the rear third of the pack as they traveled, while she usually led the pack when she was younger. She still scent-marked and was dominant in interactions with pack members, however, and was the only female that we observed in estrous in 1981. She was courted by the same alpha male as in 1980, fourth in a succession of alpha males with whom she has paired.

Previously East Pack size was inversely proportional to food availability per wolf (Figure 9), but by 1980 both available food and pack size were declining, and total food availability for the pack fell to about the same level as the other packs. In 1981 we were able to determine travel rates for 50 days and predation rate for 70 days for the East Pack, adding to the composite assembled since 1971 (Table 7). In 1981 predation rates for the East Pack were lower than average, travel was higher than average, and for the first time we observed this pack utilizing the entire north shore of the island (see Figure 10), scent-marking along the way and making a kill in what was previously SW Pack territory.

The Middle Pack apparently underwent major changes as it declined from 14 to approximately 7 wolves, even though 3 pups were alive in this pack in September 1980. A large pack was never observed in traditional Middle Pack territory, and we could only speculate that a pack of 5-7 wolves in the Siskiwit Bay area was the Middle Pack (Figure 11). This pack also trespassed and scent-marked in traditional SW Pack territory near Windigo. Eventually several wolves split off from this group and used traditional Middle Pack trails and shortcuts in the island's interior, reinforcing our belief that these were indeed Middle Pack wolves. It is noteworthy that the Middle Pack continued to use its traditional summer homesites in 1980.

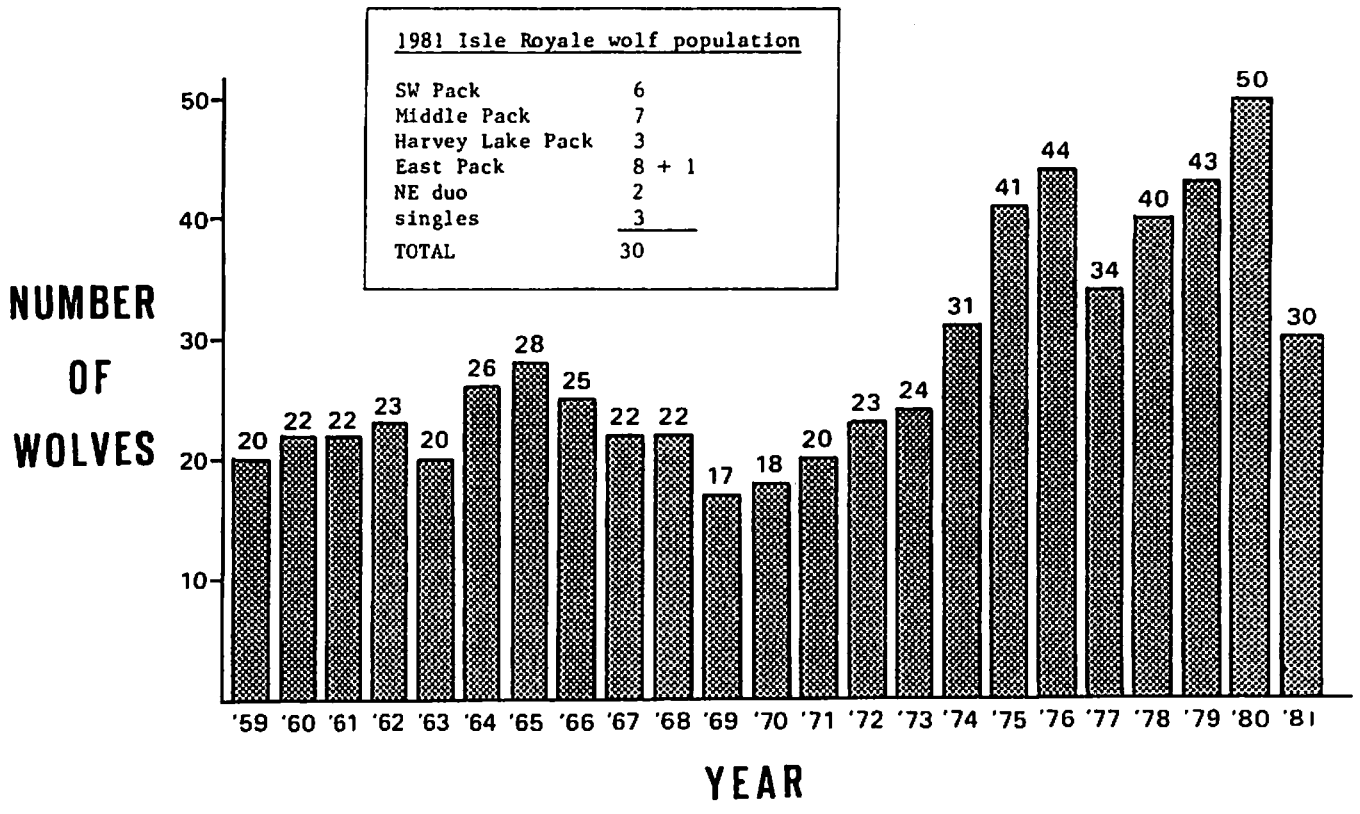

Figure 7. Midwinter wolf population level, Isle Royale National Park.

Figure 8. Alpha female, East Pack, in 1981. This wolf has been dominant since the beginning of this pack and is now over 11 years of age (minimum). Photo on right was taken on Feb. 14, 1981, and shows vulval bleeding associated with estrous.

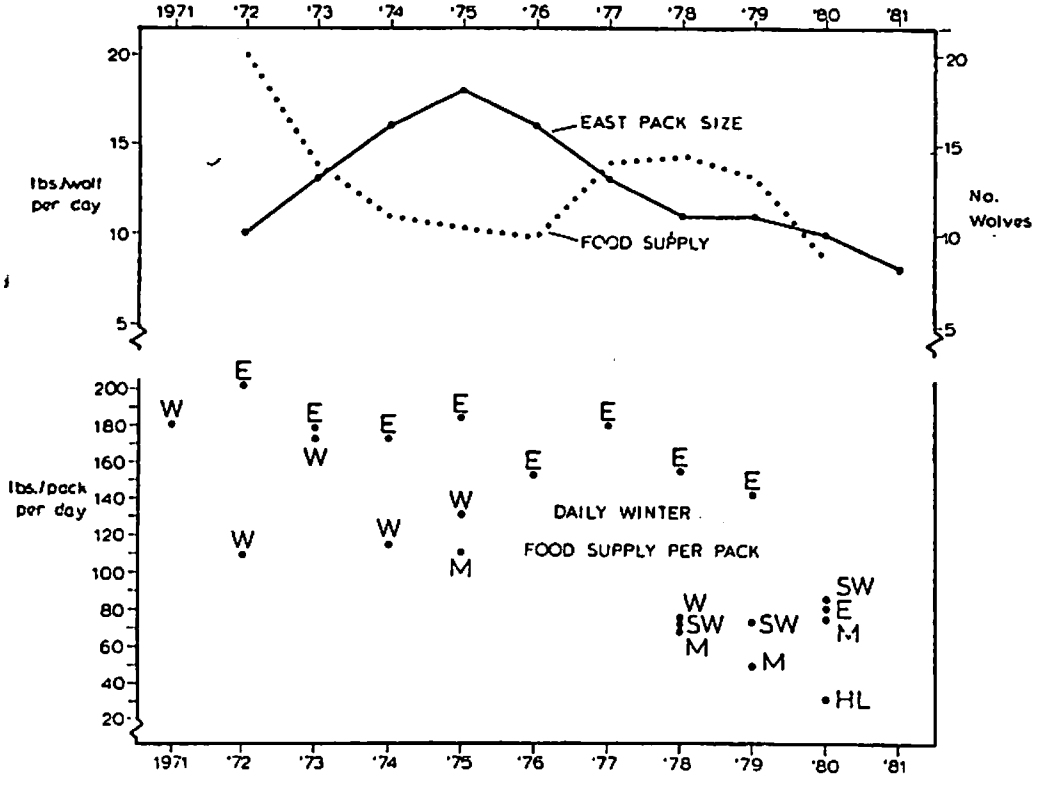

Figure 9. Upper graph: East Pack size and food availability per wolf, 1972-81. Lower graph: Predation rate as indicated by food availability per pack. E=East Pack, W=West Pack, M=Middle Pack, SW=Southwest Pack, HL=Harvey Lake Pack.

Table 7. Composite Isle Royale wolf pack, summarized from data on 25 wolf packs studied during 1971-1981*.

	All packs, 1971-81	Sample size
Average pack size	10.1 wolves	25 packs over 11 years
Average travel in midwinter	10.5 km/day	7,791 km in 738 pack-days
Average kill rates (moose)	1 kill/4.7 days	229 kills in 1,082 pack-days
Average amount of travel between kills	37.5 km	185 kills/6,936 km
Average proportion of calves among wolf-killed moose	33%	214 kills

*These data were compiled during January, February, and March, and can be safely applied only for the winter period. They are probably realistic data for the period November-April. Wolf-caused mortality rates for adult moose on Isle Royale are about 12 times higher in winter than in summer, based on antler development in all skeletons examined (Peterson 1977).

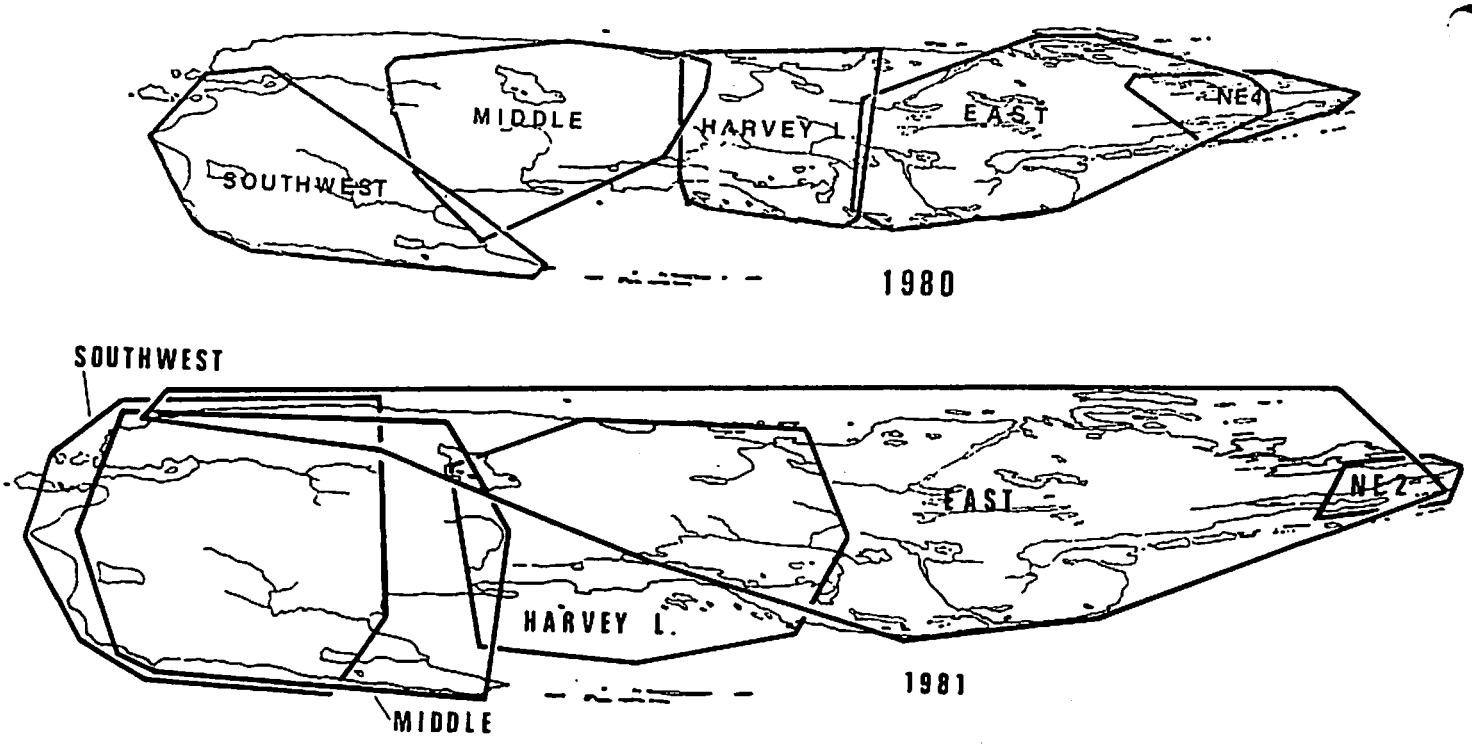

Figure 10. Extent of movements of Isle Royale wolf packs in winter, 1980-81.

The Southwest Pack was observed only once, and was difficult to locate and track in the forested SW end of the island. Since both Middle and East packs overlapped the movements of the SW Pack, the territory of this pack shown in Figure 10 is rather speculative. Summer howling suggested a total of about 3 pups in this pack in 1980.

The Harvey Lake Pack consisted of the same alpha pair as in 1980 plus one pup. The pup was noticeably smaller than the adults, indicating retarded development. The fate of 2 pups present in this pack in 1980 is unknown.

A pair of wolves (NE duo) was present at the extreme NE end of the island, where 4 wolves had been present in 1980.

Last year we noted an unusually high number of single wolves and pairs, and pointed out that future change in the wolf population would depend heavily upon whether or not these wolves could become established in a territory and reproduce. It is clear that these wolves were uniformly unsuccessful in establishing new pack units, and it is likely that many perished. There were 48 living wolves in winter 1980, plus at least 8 pups surviving in summer 1980, so at least 26 wolves died to yield the 1981 total of 30 wolves.

Figure 11. Wolves clean up a kill on the shore of Siskiwit Bay. Although often outside their traditional territory, these wolves are believed to be Middle Pack members.

Figure 12. Agonistic behavior between two bull moose at Windigo, Feb. 16, 1981. These bulls were part of a group of three that fed and rested in close association in the Windigo area for at least three weeks. The above conflict arose when one bull apparently approached another too closely. Note low snow depths and balsam fir stubs sticking through the snow cover.

ASPECTS OF WOLF PREDATION

No fresh snow fell in the region between Dec. 31 1980 and our arrival on Jan. 21, so we were able to determine kill rates of Isle Royale wolves for 3 weeks prior to our arrival and for 6 weeks during winter study by repeated aerial searches of the entire island. We recorded 24 kills during 64 days, or 1 kill every 2.7 days for the entire wolf population.

Since peak kill rates were recorded in the mid-1970's there has been a steady decline in predation rates, in spite of a continuing high wolf density (Figure 13). Using the linear regression "best fit" to estimate total kill by wolves during the 6-month winter when adult moose are most vulnerable to wolves, we estimated 187 moose killed by 44 wolves during 1975-76, but only 94 moose killed by 50 wolves during 1979-80, or a decrease of 50% in predation while the wolf population increased 14%. In other words, there has been no correlation between wolf density and wolf predation over the past 6 years.

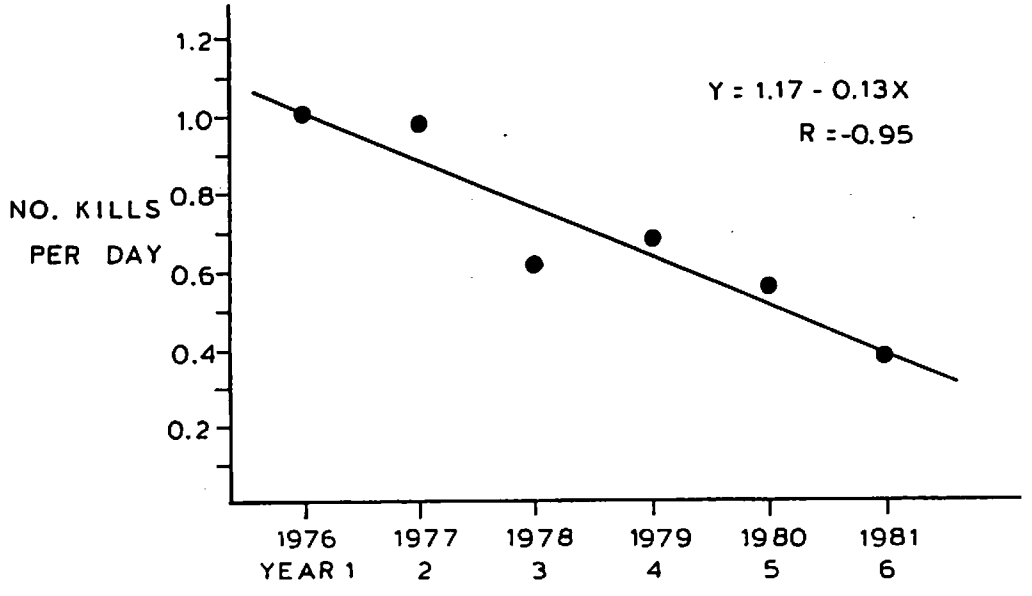

Figure 13. Island-wide predation rate in midwinter, 1976-81.

In the same vein, Figure 14 shows the rather poor correlation between kill rates of individual packs and pack size. That is, packs ranging in size from 7 to 20 wolves are all capable of killing moose at a maximum rate of once every 2.5 days, providing moose vulnerability is sufficiently high. The tendency for large packs to kill more often at the maximum observed rate could be attributed to the fact that data for large packs were gathered only during periods of high moose vulnerability; indeed, a food surplus resulting from high vulnerability might be a prerequisite for formation of individual packs with as many as 15-20 wolves.

We are currently determining age for all moose examined in 1980 and thus far in 1981, so these data are not yet available. Judging from the wear class distribution of these moose, they fall into the general pattern observed for the past several years; i.e. predation concentrated on calves and old adults.

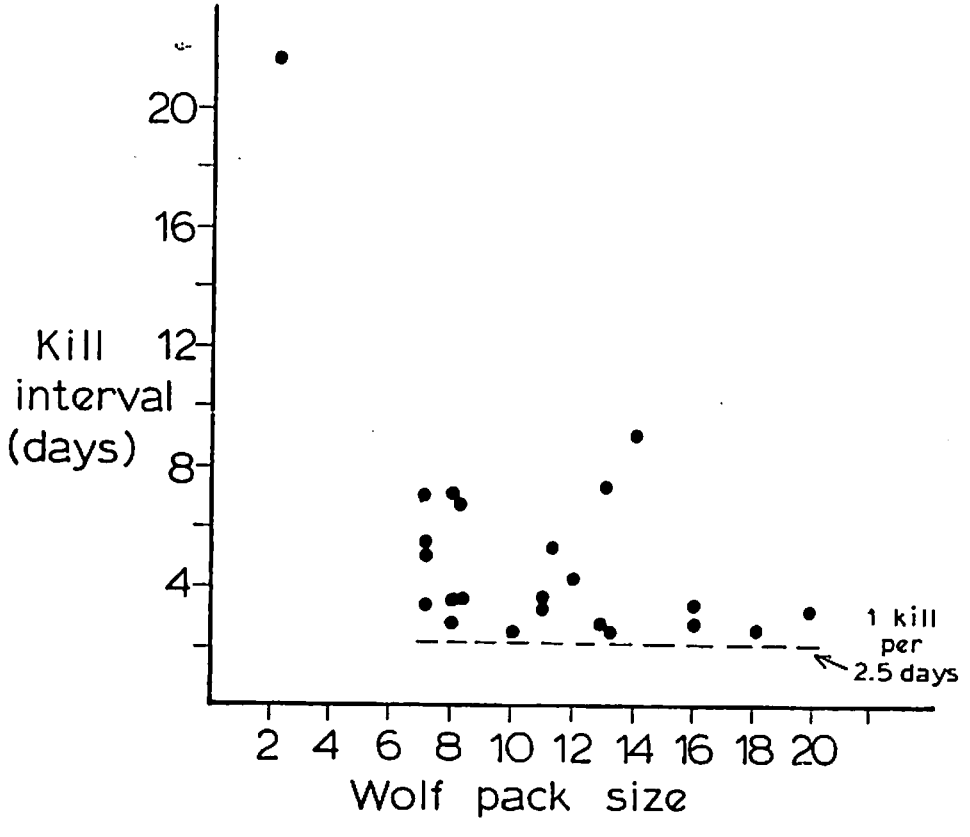

Figure 14. Relationship between pack size and frequency of kills. About 75% of these data were gathered at Isle Royale, the remainder at the Kenai Peninsula, Alaska.

Carcasses of 28 moose were located by aerial search during winter study 1981, including 15 that died prior to our arrival (Figure 15). We collected specimens from 15 carcasses thus far, leaving the rest for early summer examination. Included in the 15 moose examined were 2 calves, 1 yearling, and 1 prime-age bull with a broken leg that was scavenged after it died; the remaining 12 moose were old adults, with 7 showing evidence of arthritis in either the pelvis or posterior vertebrae.

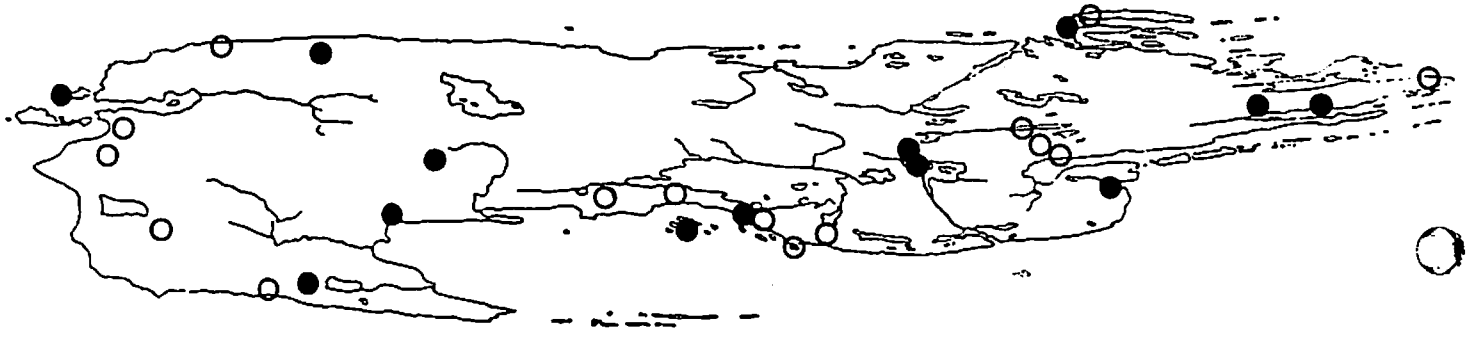

Figure 15. Distribution of moose carcasses located by aerial search in 1981. Closed circles denote kills made during the 1981 winter study, while open circles indicate kills and other mortality occurring prior to our arrival.

OTHER MAMMALS

Beaver activity was noted at 5 sites during extremely warm weather in the last half of February. The East Pack killed at least 1 beaver on Tobin Harbor on March 3. Otter sign was observed only twice, both times in the Washington Creek drainage. Fox utilization of moose carcasses was about average (Figure 16), although far fewer carcasses were available. Foxes seen apart from moose carcasses were recorded slightly less frequently than usual, after a peak last year.

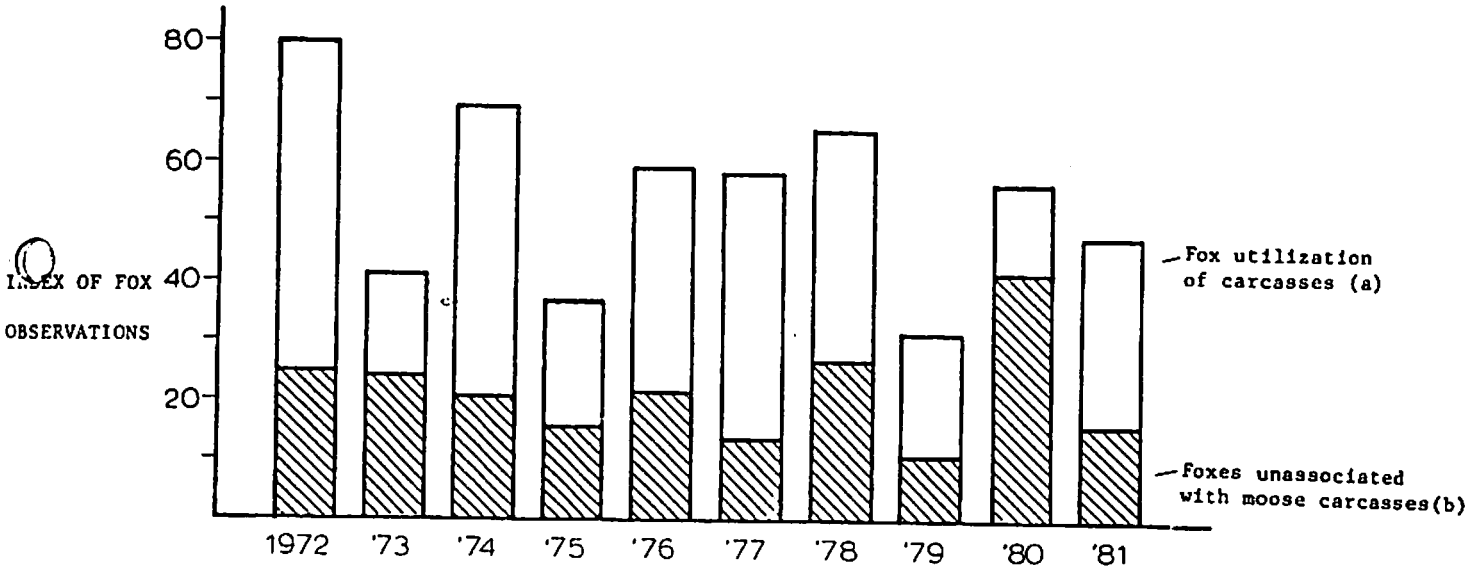

Figure 16. Midwinter fox observations, 1972-81. (a) is the sum of the maximum number of foxes seen on each moose carcass, (b) other fox observations per 100 hours of flying (more than 1 km from a moose carcass).

Beaver Studies, Fall 1980 by Philip C. Shelton

During the period 14-24 October 1980, Philip C. Shelton surveyed beaver colonies by air and ground and attempted to live-trap three colonies. Fred Stroble of Shawano Flying Service, Shawano, Wisconsin, flew the float-equipeed Super Cub for the aerial count, as he did in 1978. Weather was favorable for efficient counting during most of the 12 hours flying time, 20-22 October, when the count was made.

Results of the aerial count and those of 1974 and 1978 follow:

	1974	1978	1980
Colonies with food piles:			
Streams	249	99	58
Lakes	26	19	17
Harbors	11	11	8
Total	286	129	83
Sites with fresh cutting or fresh mud on house or dam.	30	27	39
Total sites with any signs of activity	316	156	122

Live-trapping was largely unsuccessful. In 26 trap-nights at three colonies only two beavers were caught, an adult male on upper Tobin Creek, and an adult female at Baker Point. Nothing was caught in 14 trap nights at a second Tobin Creek site which had a fresh house and small food pile. The two beavers handled showed no abnormalities. Parasitic beetles were found on both, the male had one and the female more than 10 with similar amounts of combing effort expended on the rump and hips of both. Neither of these beavers was tagged, but a tagged beaver was seen at the Tobin Creek colony where the male was captured. This animal was at least six years old, for no beavers have been tagged since 1974.

The decline in numbers of colonies with food piles was essentially linear from 1974 through 1980. As noted in 1978, the decline was most noticeable in stream colonies; lake and harbor colonies declined less steeply, but the small number of these preclude meaningful conclusions. Lake and harbor animals may be less vulnerable to wolf predation or to spread of diseases. The increased number and proportion of sites with no visible food pile but with fresh cutting or fresh mud on house or dam may indicate fragmentation of colonies resulting from predation. Lack of success in trapping might indicate a reduction in numbers of animals per colony, at least for the Tobin Creek area, but much more intensive trapping would be required to verify this possiblity.

Beaver food supplies have declined at least since the 1940's, but birch and hazel stands still occur within a few meters of many ponds, and aspen is still available at several sites. Food depletion appears to be most severe at harbor sites which, as noted above, have declined less rapidly than stream sites. Cutting by high beaver populations of the mid-1960's through the mid-1970's no doubt significantly increased foraging distances, making vulnerability to wolf predation high, and the continued decline in beaver numbers was expected, in view of high wolf numbers through 1980.

WINTER WEATHER AND SNOW CONDITIONS

Especially noteworthy in 1981 was shallow snow cover and exceptionally warm weather during the last half of February. We opened camp on Jan. 21 in the midst of a brief thaw, with only 20-45 cm snow on the ground. For the next three weeks temperatures were below normal, and snow depths increased to 30-55 cm. The last two weeks in February brought thawing conditions and rain, with the temperature rarely dropping below -4 deg.C for the entire period. Average daily maximum (-2.2 deg.C) and minimum (-11.1 deg.C) temperatures were above normal for the entire seven weeks. Total precipitation during the winter study was 8.7 cm, including 2.5 cm that fell as rain. Total snowfall during this time was 48 cm.

Snow depths were generally below average and the snowpack was greatly compressed during the February thaw. At that time many south-facing slopes and shorelines were bare of snow, but were covered again in early March when colder temperatures returned along with a more normal snowfall pattern.

After February 24, when daily minimum temperature finally dropped below 0 deg.C, a very strong and durable crust topped the snow profile. The crust was about 3 cm thick and could support an average of 6,400 g/sq.cm, underlain by layers supporting about 1,000 g/sq.cm. Needless to say, we could walk anywhere without snowshoes or skis. Moose calves consistently walked on top of the crust, which occasionally supported an adult moose. Adult moose often broke through the firm crust, however, and we observed one set of bloody tracks, presumably from cuts on the moose's legs. The crust probably did not seriously hamper moose, since snow depth at this time was only 20-45 cm and warm weather after mid-March undoubtedly caused an early snowmelt.

Since the early part of the 1980-81 winter was relatively cold with little snow, we had reasonably good ice around the entire island and excellent landing conditions on interior lakes and protected bays. At no time did we observe continuous ice to the mainland.