5-15-1985

Ecological Studies of Wolves on Isle Royale, 1984-1985

Rolf O. Peterson
Michigan Technological University, ropeters@mtu.edu

Richard E. Page
Michigan Technological University

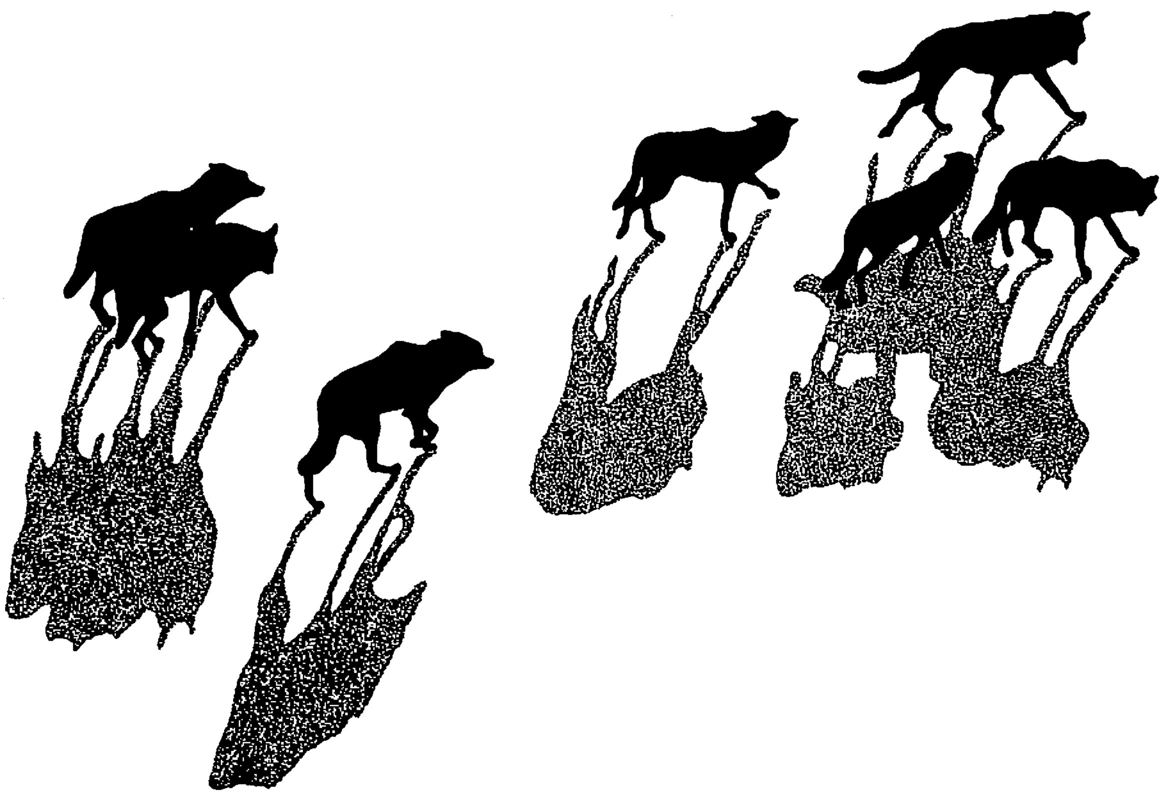
Kenneth L. Risenhoover
Michigan Technological University

Follow this and additional works at: https://digitalcommons.mtu.edu/wolf-annualreports

ECOLOGICAL STUDIES OF WOLVES ON ISLE ROYALE

ANNUAL REPORT

1984-85



Ecological Studies of Wolves on Isle Royale*

Annual Report - 1984-85

(Covering the twenty-seventh year of research)

by

Rolf O. Peterson
Department of Biological Sciences
Michigan Technological University
Houghton, MI 49931 U.S.A.

(with the assistance of graduate
students Richard E. Page and
Kenneth L. Risenhoover)

15 May 1985

*During the past year this research was supported by major funding from the U.S. National Park Service, National Geographic Society, Resources for the Future, Boone and Crockett Club, Charles Ulrick and Josephine Bay Foundation, National Wildlife Federation, and National Rifle Association, with additional donations from Randall F. Absolon, Linda S. Carter, P. Marc Carter, and Roxanne Henkin's second grade class at Lines School, Barrington, Illinois.

Funds were provided for production of this report by the Harder Foundation.

Tax-deductible donations to support continuing research on Isle Royale wolves and moose can be sent to: Wolf-moose study, Michigan Tech Fund, Alumni House, Michigan Technological University, Houghton, Michigan 49931

Cover page drawing by Fred Montague, RFD #5, Monticello, Indiana 47960.

(Results reported here are preliminary; please do not cite in publications without the permission of the author.)

Summary

During its 27th year this study remained focused on wolf-moose interaction, with an additional goal of understanding the link between moose forage levels and population dynamics. Thus we are involved in 3 levels of this ecosystem: carnivore, herbivore, and vegetation.

In 1985 the wolf population at Isle Royale changed little in total size from 1984 (Fig. 1). The moose population, on the other hand, is increasing steadily as recruitment remains relatively high and mortality low. The wolf population has been stabilized by relatively high mortality of undetermined cause. We predict that this wolf-moose system will continue to cycle at long intervals on the order of three decades.

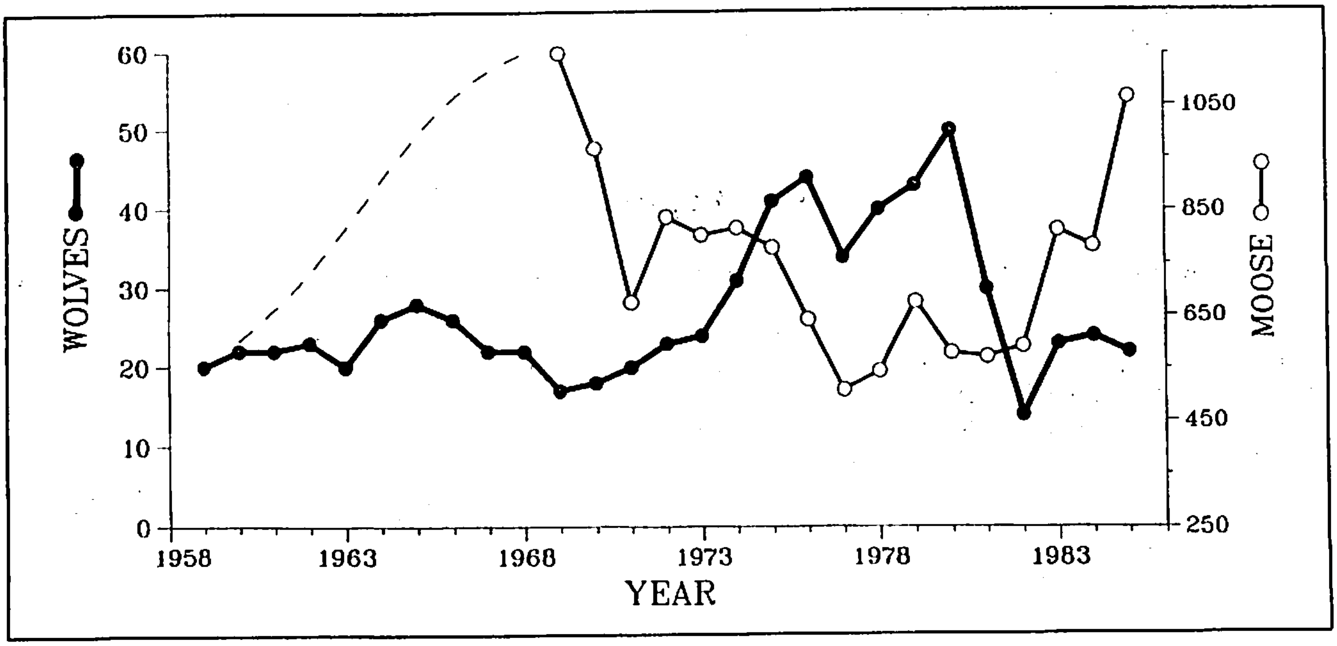
The wolf population of 22 animals remained partitioned into 3 packs, but evidently only 2 reproduced in 1984. One pack increased, one showed decline, and one remained at the same level as in 1984. Survival rate for wolves present in winter 1984 was 62%, relatively low for a protected population. Territorial overlap was not significant in 1985, indicating that interpack aggression has apparently subsided from the levels observed in the early 1980's.

The estimated moose population (and 95% confidence interval) in 1985 was 1062 plus-or-minus 222, a considerable increase over the 1984 estimate. In 4 years the moose population has grown by 400-500 moose from a low of about 600 in 1981.

The beaver population continued to increase during 1982-84 after reaching a low level during the peak in wolf numbers in 1980. Moose and beaver each constituted about half of the remains identified in summer wolf scats.

Seventeen moose were radio-collared during the past year as part of a study of moose foraging behavior. Individual home ranges of these moose covered 5-10% of the island in summer and most utilized smaller areas in winter. Two adult males traveled over most of the length of the island. Remote monitoring of activity indicated that moose were moving and/or feeding about 50% and 37% of the time in summer and midwinter, respectively. In winter moose fed to a surprising extent on windfelled trees, especially balsam fir. Lichens on standing and fallen trees provided another unique source of moose forage.

Figure 1. Wolf and moose population fluctuations, Isle Royale National Park, 1959-85.



Personnel, Schedules, and Publications

During the past year we were aided in the field by an unusually large number of people, primarily associated with the collaring and monitoring of moose. The following individuals were responsible for field work in summer 1984:

Rolf O. Peterson	21 May-11 July
Kenneth L. Risenhoover	27 May-10 August, 20-27 October
Edith N. Greene	21 May-15 August
Timothy G. Laske	21 May-15 August
M. Lynn Jebson	27 May-30 August
Mark S. Cramer	24 August-23 October
Noel K. Hanson	6-23 August
Patrick R. Charmley	21 May-20 June
Tina L. Dorsey	21 May-20 June

Additional personnel assisting with the moose collaring effort were Ullyses S. Seal, Mary Alice Seal, Steve M. Schmitt, and Daniel H. Monson. We are particularly grateful for the assistance with experimental drugs provided by Drs. Schmitt and Seal during moose-collaring.

The 1985 winter study commenced on 15 January and continued until March 7. Pilot Donald E. Glaser again piloted the study aircraft, and he and Peterson were present the entire period. Richard E. Page assisted during 15-29 January. Kenneth L. Risenhoover and Timothy N. Ackerman conducted studies of moose foraging behavior throughout the winter study period and remained on the island together with M. Lynn Risenhoover after departure of the winter crew. National Park Service personnel assisting during the winter study were Bruce W. Reed (who preceded us), Jay F. Wells (15-29 January), Craig C. Axtell (29 January - 4 February), Gregg W. Yarrow (4-12 February), Paul Gerrish (12-22 February), Janis M. Meldrum (22-27 February), Douglas R. Boose (27 February - 7 March). Supply flights were flown by the Ely Aviation Unit, Superior National Forest, U.S. Forest Service.

The following publications appeared during the past year (reprints available upon request):

Peterson, R. O., R. E. Page, and K. M. Dodge. 1984. Wolves, moose, and the allometry of population cycles. *Science* 224:1350-1352.

Peterson, R. O., J. D. Woolington, and T. N. Bailey. 1984. Wolves of the Kenai Peninsula, Alaska. *Wildl. Monogr.* 88. 50 pp.

Stephens, P. W. and R. O. Peterson. 1984. Wolf-avoidance strategies of moose. *Holarctic Ecology* 7:239-244.

Seal, U. S., S. M. Schmitt, and R. O. Peterson. 1984. Carfentanil and xylazine for immobilization of moose on Isle Royale. *J. Wildl. Diseases* 21:48-51.

The Wolf Population, 1984-85

Wolf numbers have apparently stabilized near the long-term average level after a decade of dramatic fluctuation. A population crash in 1980-82 left only 14 survivors, but three packs have persisted since that time. The past history of this population and current pack status leads us to predict that no more than 2 packs can reproduce and thrive under present conditions.

The Harvey Lake Pack (HLP) has the poorest food base, little exclusive territory, and has been attacked by both neighboring packs. The HLP alpha female was killed by the West Pack II (WPII) in February, 1984, so we expended considerable effort in summer 1984 to determine if this pack reproduced. A careful field check of all known summer homesites used by this pack for several years revealed no den or other evidence of reproduction in the HLP. On the other hand, we obtained visual confirmation of at least 2 pups in the East Pack II (EPII) and documented use of a traditional summer homesite by the WPII.

During the 1985 winter study we confirmed that reproduction was limited to the EPII and WPII. Observations of behavior and individual appearance of wolves in each pack were sufficient to accurately determine the minimum number of pups per pack (Fig. 2). The WPII contained 4 pups, the EPII had 3 pups, and no pups were evident in the HLP. With 7 pups present among 22 wolves in 1985, only 15 of the 24 wolves (62%) from 1984 survived the past year. Survival rates of protected wolves are usually greater than 70%. No wolf carcasses were recovered during the past year and we have not been able to determine the cause of this mortality.

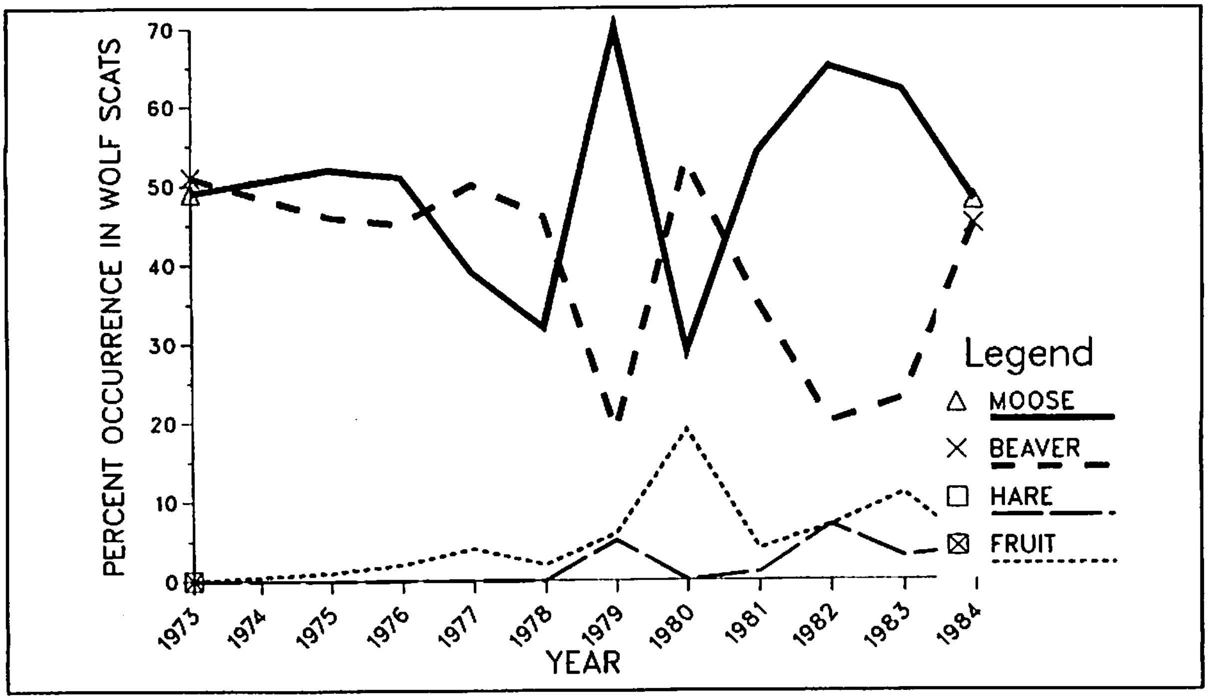
Pups in the EPII were generally small, indicating retarded summer growth, while WPII pups were approximately adult-sized. Summer prey in 1984 continued to be moose and beaver. Each species occurred with equal frequency in summer scats in 1984, but since small prey are overrepresented in this type of analysis the data indicate primary reliance on moose in midsummer (Fig. 3). Beaver may figure more prominently in early spring, before the appearance of moose calves. Adult moose hair constituted 45% of the moose remains in scats, a departure from the usual predominance of calves. This may reflect significant reliance on relatively abundant yearlings in summer.

We are cooperating with U.S. Fish and Wildlife Service biologist L. David Mech in assessing evidence of parvovirus in Isle Royale wolf scats. As explained in the 1983-84 Annual Report, there is circumstantial evidence implicating this disease in the 1980-82 wolf decline.

Total wolf numbers remained virtually the same in 1985 as in 1984, in spite of more than 1/3 turnover in the population. The same 3 packs were recognized in 1985 as in 1984 and territory distribution was generally the same. The WPII remained unchanged at 10 wolves, the HLP declined from 6 to only 3 wolves, and the EPII increased from 5 to 7 individuals.

Figure 2. East Pack II rests (left) while scrutinizing a raven at Daisy Farm Campground dock. A pup (right) showed most interest in a vain attempt to catch the bird.

Figure 3. Prey occurrence in summer wolf scats, 1973-85.



The spatial organization of the 3 packs in 1985 was similar to 1984, except that territorial overlap declined to insignificance in 1985 (Fig. 4). It remains to be seen if the HLP will persist; this probably depends largely on the size of the pack territory claimed by the WPII. The HLP alpha pair actively scent-marked in 1985 (territorial behavior) and remained in a small area that was not violated by the other packs.

Mutual courtship behavior was observed in the EPII alpha pair on 15 and 17 February and vaginal bleeding was documented for the WPII alpha female on 8 February. No courtship behavior was observed in the HLP alpha pair but there was no doubt that an adult male and female were present. On this basis we expect one litter of pups in both the EPII and WPII packs, and it is likely that the HLP pack will also produce offspring in 1985.

All 3 packs in 1985 were killing moose at a rate that was below average for Isle Royale packs of equivalent size in the past (Table 1). Kill rates were obtained for each pack for periods of up to 6 weeks. The WPII killed 8 moose during this period and fared considerably better than either of the other packs. The EPII killed 3 moose and the HLP killed only 1 moose, but added at least 1-3 beaver in late February (Fig. 5).

Even though the EPII killed more moose than the neighboring HLP, food availability per wolf was low because of the relatively large size of the EPII. We infer from this a marginal prospect for increase for both HLP and EPII, while the WPII seems to have good potential for increase. This is consistent with the fact that 75% of the current moose population is found in the territory of the WPII.

Figure 4. Isle Royale wolf pack territories indicated by movements, 1980-85.

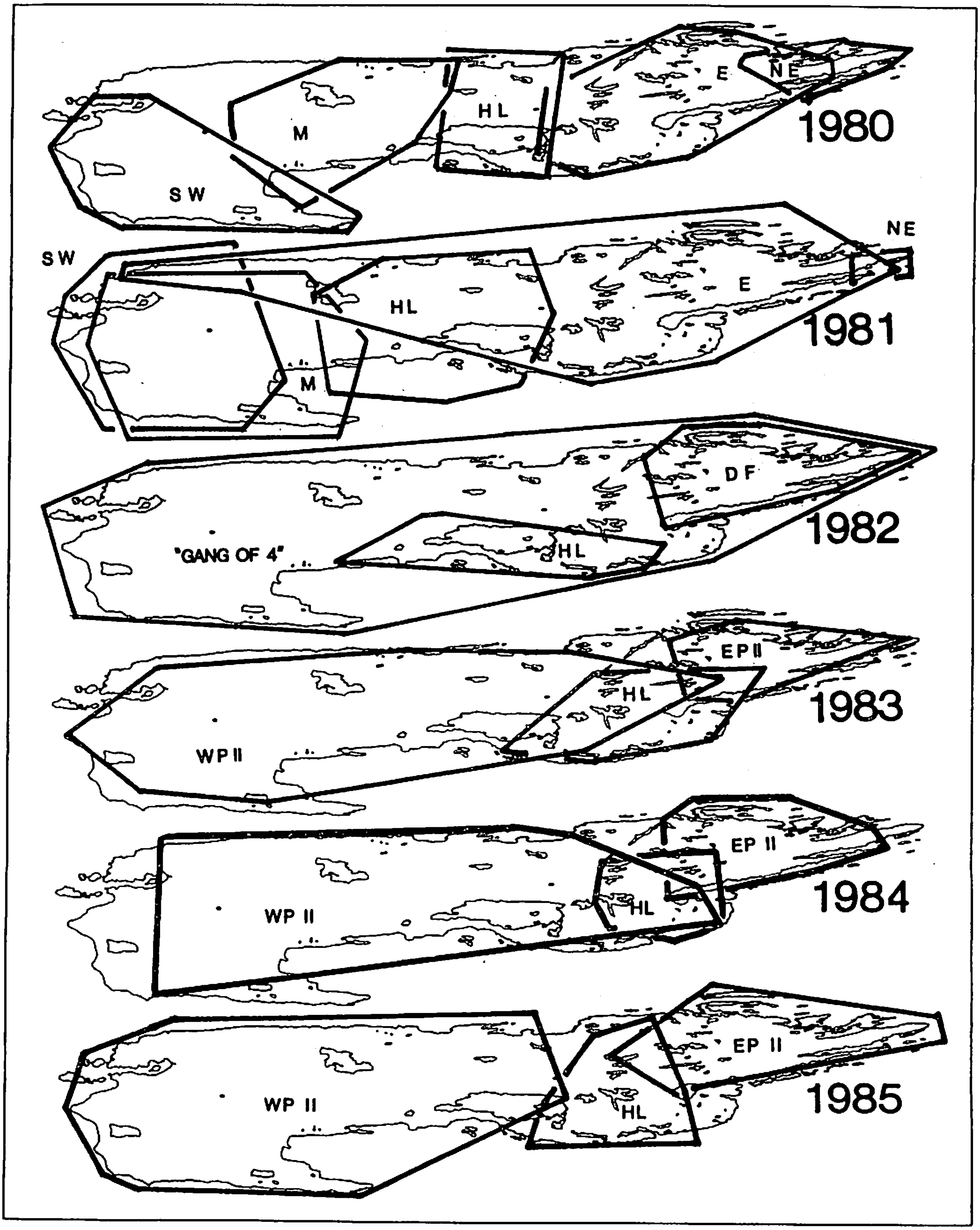


Figure 5. Adult member of East Pack II feeds on carcass of moose calf killed on the ice near Amygdaloid Island.

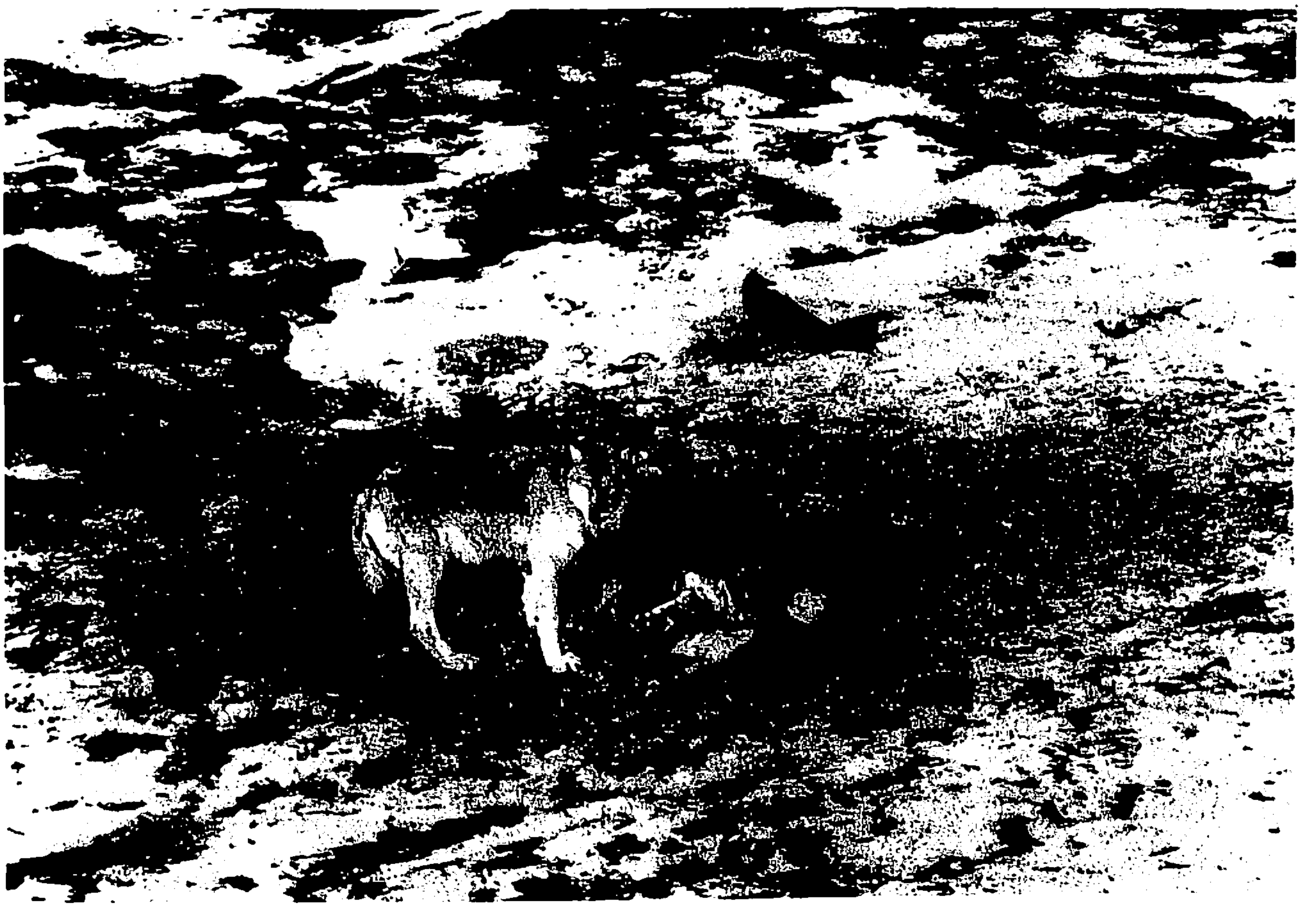


Table 1. Travel and kill rates for Isle Royale wolf packs.

	West Pack II 1985	Harvey Lake Pack 1985	East Pack II 1985	All packs, 1971-84 average (sample size)
Pack size	10	3	7	8.0 (35 packs, 14 years)
Travel rate (km/day)	10.3	5.3	6.1	9.8 (9,771 km/995 pack-days)
Kill interval (days)	5.3	33.0	11.3	5.4 (1,489 pack-days/276 kills)
Travel between kills (km)	47.5	174.9	68.9	40.4 (8,918 km/221 kills)

Most shorelines on the main island were ice-covered in 1985 and these formed principal travel routes for the EPII and WPII. Travel rate was average for WPII but below average for EPII and HLP, probably reflecting both sub-normal kill rates and poor mobility in snow for most of the study period (Fig. 6).

Through regular coverage of all parts of the island under good tracking conditions, we determined total loss of moose to predation for about 6 weeks in mid-winter. Predation rate data gathered in this fashion during the past 12 years (Fig. 7) reveals a peak in kill rate in the mid-1970's followed by a steady reduction to a low plateau, maintained since 1981. Apparently the moose population is increasing, but the number of vulnerable prey is not.

The Moose Population, 1984-85

During the past year we maintained our long-term study of wolf-moose relationships, now focusing on the response of moose to a release from the wolf predation pressure that held moose density low during the late 1970's. We also initiated a study of moose foraging strategies in winter; the first half of this comparative study of tundra and taiga moose has already been completed by Risenhoover in Alaska's Denali National Park.

Moose population size

A moose census was conducted using fixed-wing aircraft between 16 January and 8 February, 1985. Counting was done by intensively circling small plots comprising 17% of the island, which was stratified before the census on the basis of relative moose track abundance. A complete count of all small offshore islets was

Figure 6. Harvey Lake Pack traveling single file through chest-deep snow, with alpha female in front and alpha male second in line.

made and the total added to the estimated total for the main island. Eighty-five plots were flown, with 66 completed by 29 January. Conditions during January were excellent, with about 50 cm fresh snow and moose distributed primarily within mixed forests with high sightability. A movement into conifer cover was evident by 26 January, but most high density plots were counted before this occurred.

The resulting estimate and 95% confidence interval was 1062 plus-or-minus 222 moose (Fig.8). This represents a substantial increase over the 1984 estimate of 781 plus-or-minus 187. Although there is little doubt that the moose population is in a period of positive growth, we attribute much of the difference between 1984 and 1985 estimates to sampling error and perhaps increased sightability in 1985. We expect a positive rate of increase in the moose population as rate of increase in the moose population as long as wolf kill rate and moose recruitment remain at the present levels.

During most aerial moose censuses in forested habitats an unknown but often significant proportion of moose on plots are never seen. We will be assessing moose "sightability" on plots in 1985 and 1986 using the radio-collared moose. Our procedure in 1985 was as follows: one observer determined an approximate location for the moose and mapped out a plot around the moose. Care was taken to not reveal the location of the moose to the pilot. The radio-collars were brown or black in color and it was not possible for the pilot to tell if moose observed during the preliminary location were collared. The test plot was flown by a second observer within 24 hours, usually the next morning. If only one observer was available, the plot was not counted for at least 12 hours. Don Glaser served as pilot for all test plots and Page and Peterson were the observers.

Test plots were counted 29 times. In 10 cases the radio-collared moose moved off the plot before it was counted. Of the 19 trials when radio-collared moose were present on the plot, the moose was seen in 18 cases, indicating high sightability. Search pattern over the test plots was identical to that flown during normal census procedures. The radio-collared moose was not located until after the test plot had been covered. Since radio-collared moose often occurred with other moose, and since the collars were not easily seen, several low-level passes were made until the presence of a collar was confirmed.

Figure 7. Midwinter kill rate of Isle Royale wolves, 1974-85. Predation loss among moose has remained stable for the past 5 years, even though wolf numbers ranged from 14 to 30.

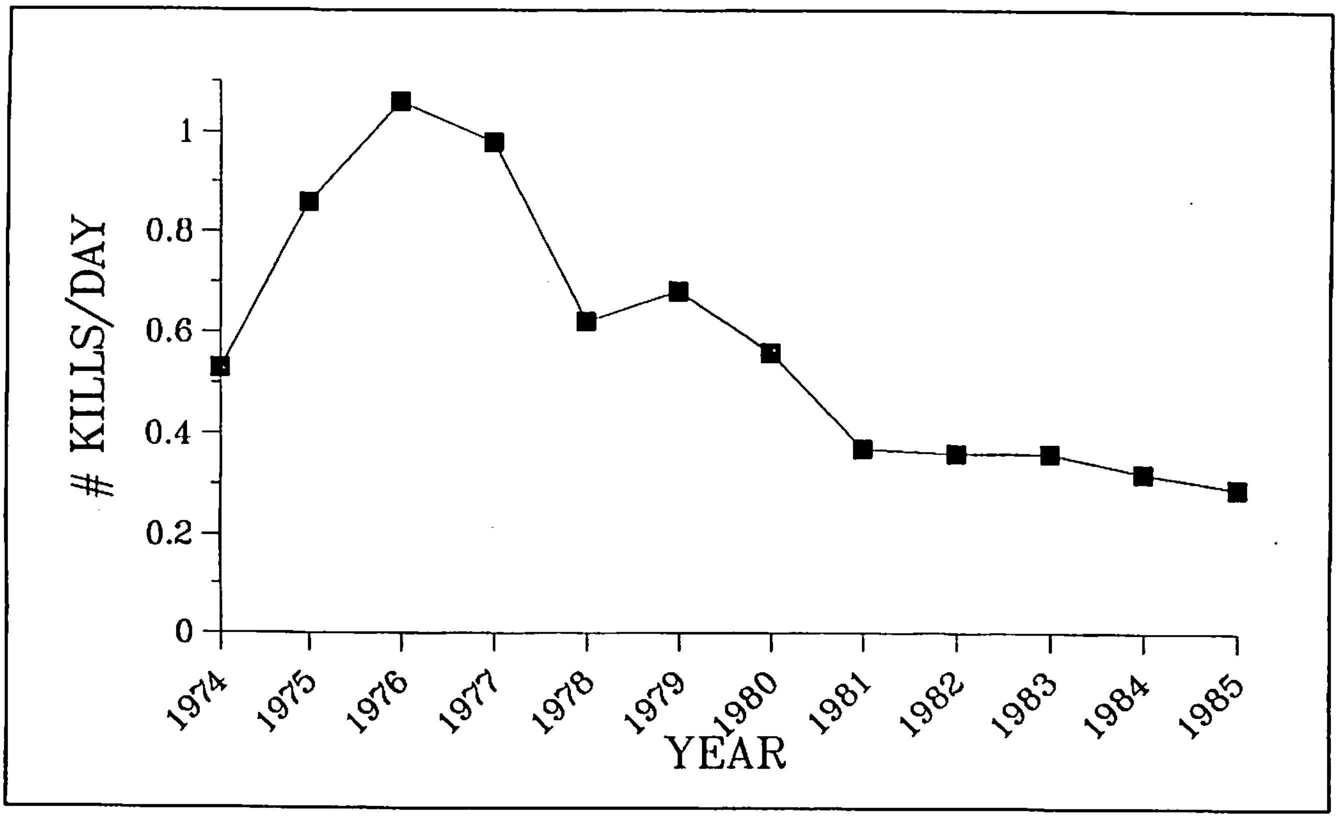


Figure 8. Distribution of moose during 1985 census.

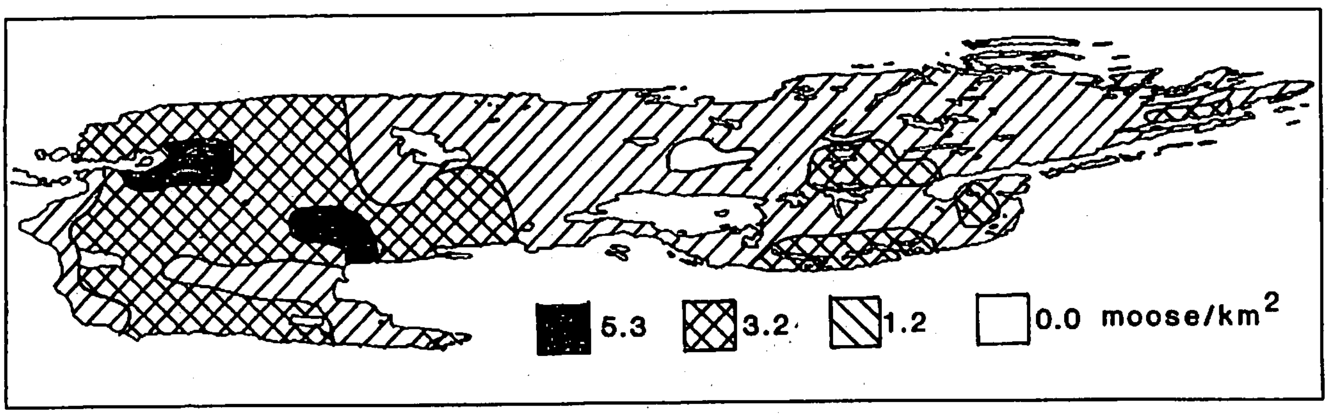


Figure 9. Autumn abundance of moose calves, determined by aerial survey after leaf-fall in October, 1972-84.

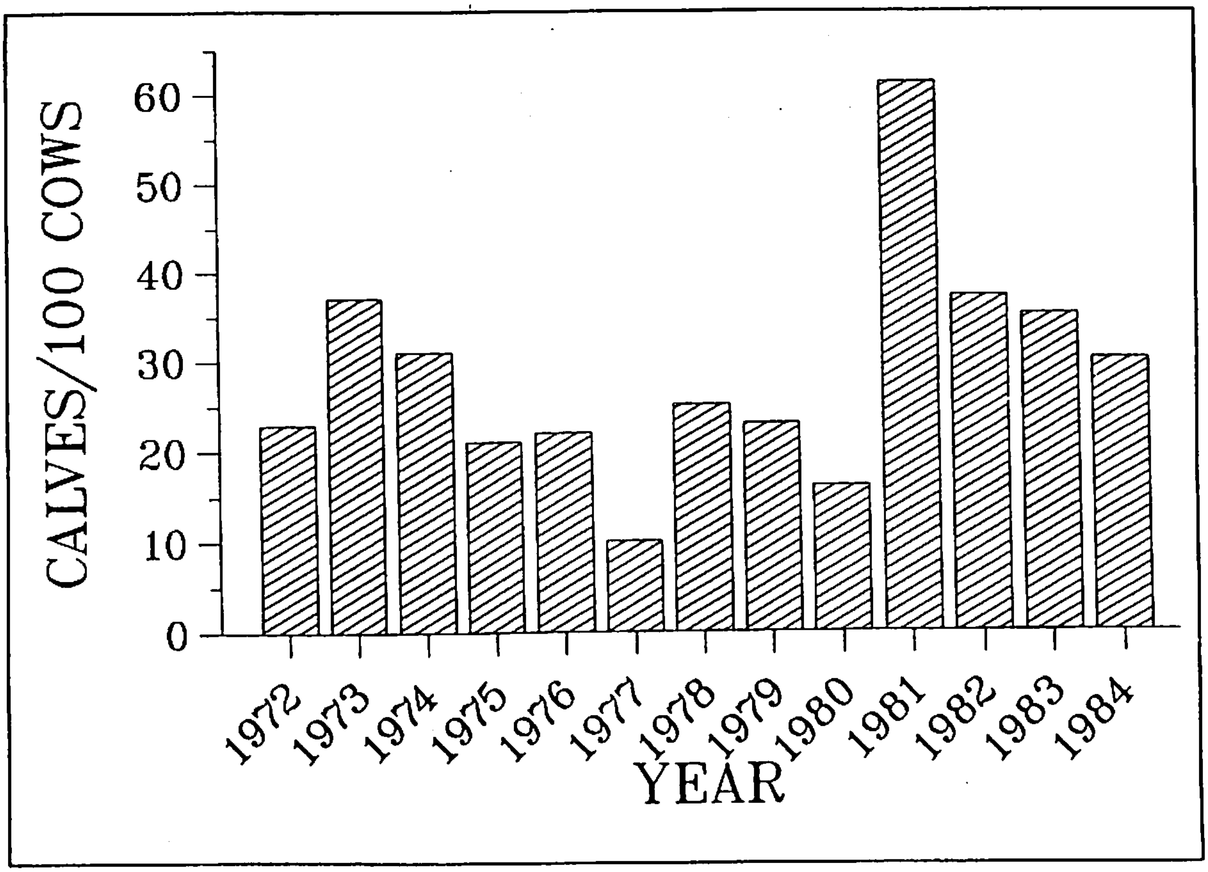
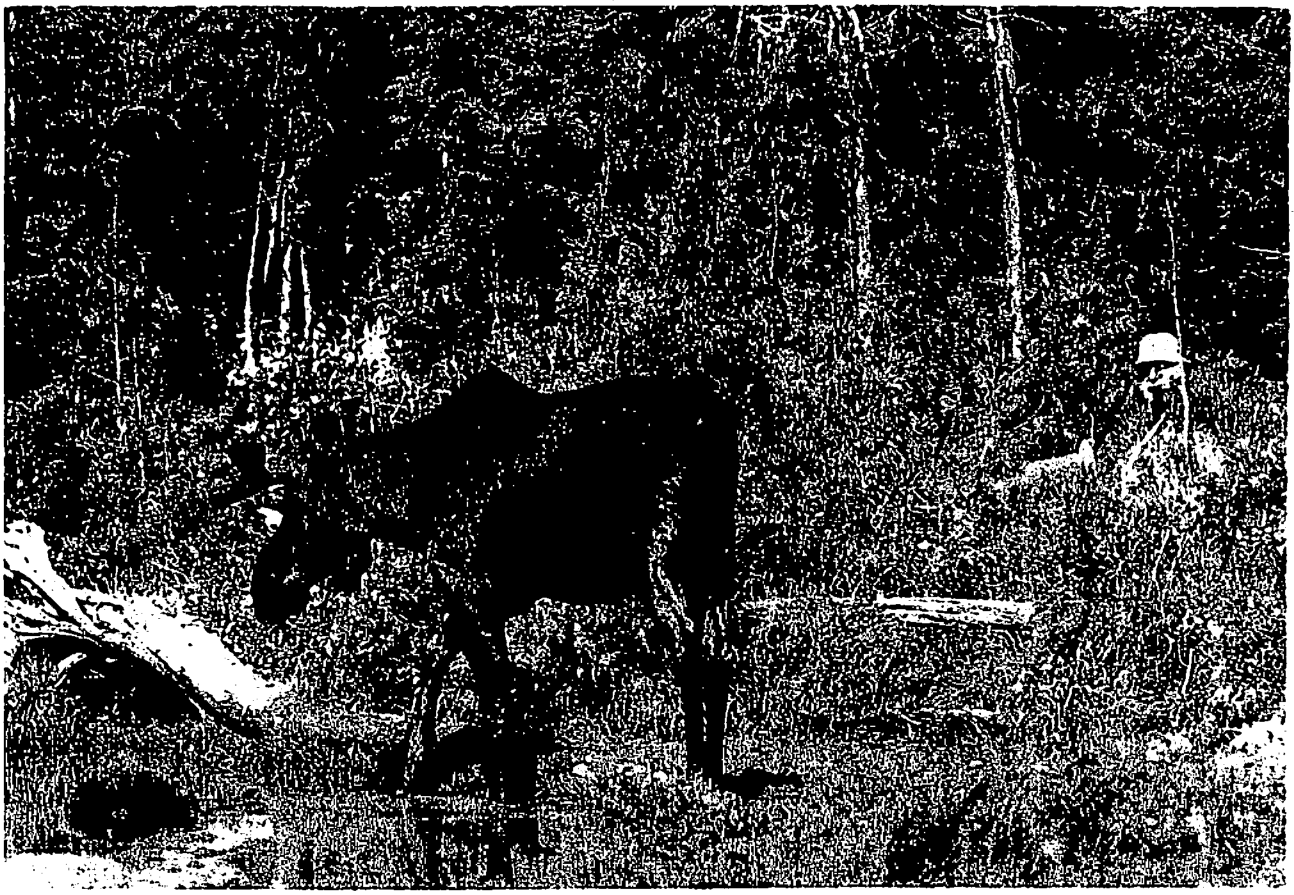


Figure 10. U. S. Seal studies former quarry, now radio-collared and serving as the focus of a study of moose foraging strategy.



Counting conditions in 1985 were near-optimum (fresh, shallow snow) and it is not yet clear if such high counting performance can be maintained every year. It is clear from regular relocations of the radio-collared moose that moose movement into conifer habitats leads to a deterioration in counting conditions soon after our usual arrival in mid-January.

Recruitment surveys

Aerial surveys in autumn and winter indicated that recruitment of 1984 calves was moderately high (Fig. 9). During an October composition survey 131 moose were classified according to sex and age. Calf abundance was 30/100 cows and we found 14 yearlings/100 cows. Calves composed 18% of all moose seen in autumn and 15% of 202 moose counted on census plots in midwinter. At least 6 sets of twins were observed on the island during the 1985 winter study; a similar number has been seen each year since 1981, but twins were exceedingly rare in winter during 1971-80.

Movements of radio-collared moose

Most of our field efforts in summer 1984 related to the radio-collaring and monitoring of moose at the SW end of Isle Royale which provide the focus of Risenhoover's study (Figs. 10 & 11). Capture efforts in late May were centered at mineral springs in this area, where we

Figure 11. Lightly-drugged cow moose is temporarily detained as final collar adjustments are made.

immobilized 14 moose with tranquilizer darts and outfitted them with transmitter collars (Telonics, Mesa, Arizona) designed to last 2 years. Three additional moose were collared in winter but one previously collared was killed by wolves, leaving a total of 16 collared moose in spring 1985.

The collars have motion and posture detection options which allow us to automatically record moose activity patterns on a continuous basis. Fixed antennas on National Park Service towers allowed accurate ground-tracking in summer over the SW end of the island, and moose were regularly located and observed from research aircraft during the winter study.

Individual moose have been located about 1,100 times in the past year, providing a preliminary look at moose movements and home range (Fig. 12). Summer home range size was about 40 sq.km. for females and about 50 sq.km. for males, or about 5-10% of the land area of Isle Royale. Movements of 2 collared yearlings generally exceeded those of older moose. Winter home ranges were usually smaller and often comprised a portion of the summer range. However, there was great variability in summer and winter movements among individuals. For some moose winter and summer areas were completely separate, and 2 bulls moved to the NE end of the island in winter (male 1490 returned to the SW end during March and April, 1985).

Figure 12. Movements (plus sex and age) of radio-collared moose, summer 1984 and winter 1985. Solid line polygons denote summer home range and dashed line polygons represent winter movements.

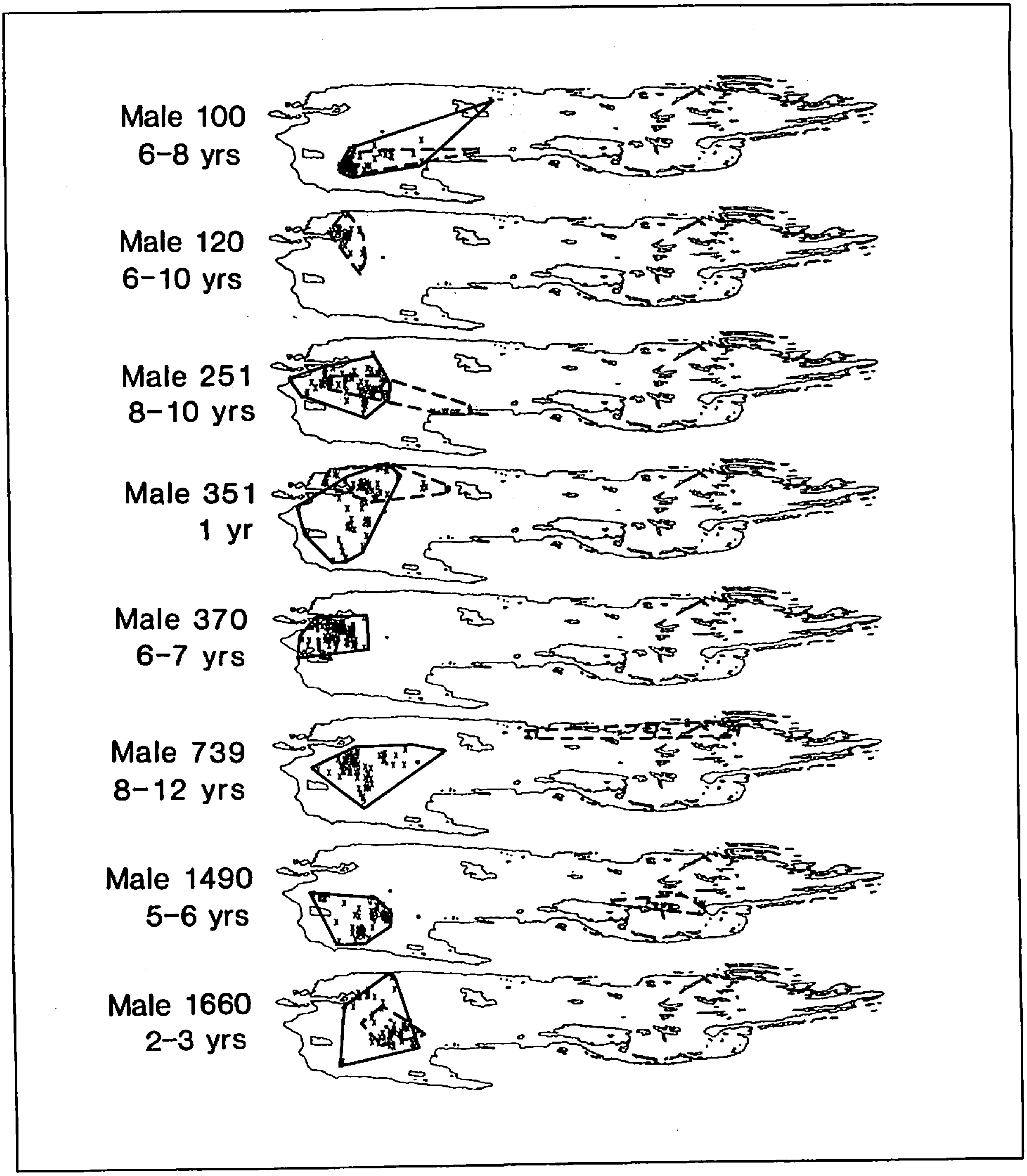
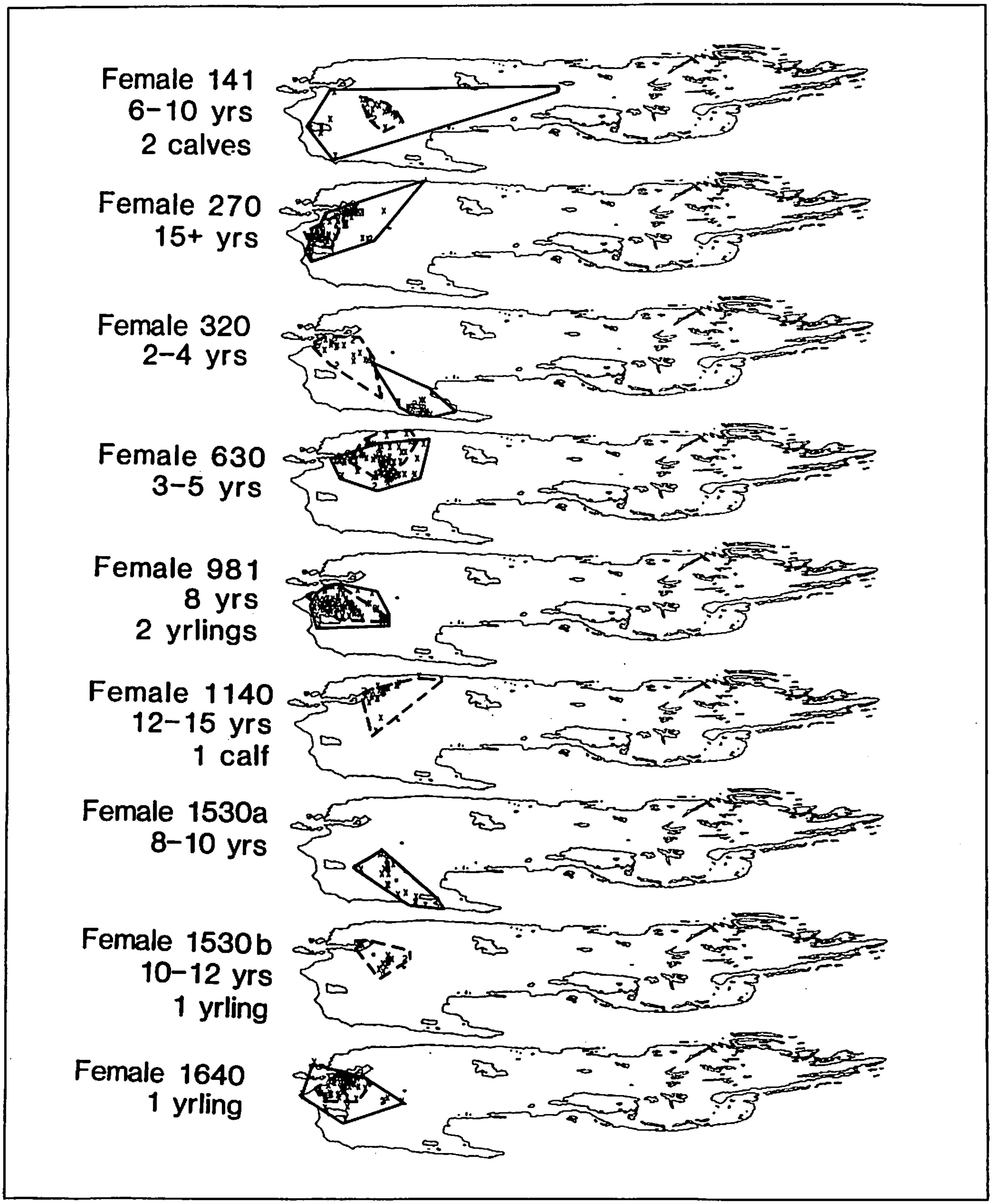


Fig. 12b


Female 141
6-10 yrs
2 calves
Female 270
15+ yrs
Female 320
2-4 yrs
Female 630
3-5 yrs
Female 981
8 yrs
2 yrlings
Female 1140
12-15 yrs
1 calf
Female 1530a
8-10 yrs
Female 1530b
10-12 yrs
1 yrling
Female 1640
1 yrling

Moose foraging and activity patterns

In January and February moose fed on 20 different browse species as well as arboreal lichens (Fig. 13). Based on the proportion of observed bites during foraging bouts balsam fir is the most important species in the winter diet of moose on Isle Royale, accounting for 42% of all bites. Beaked hazel, mountain ash, red-osier dogwood and northern white cedar together accounted for an additional 41% of all bites.

Windthrown trees, especially balsam fir, paper birch, and cedar, appeared to be an important source of forage for Isle Royale moose in winter. Balsam fir windfalls alone accounted for 12% of all bites observed. In addition, moose spent a substantial amount of time feeding on arboreal lichens growing on the bark of both standing and fallen trees.

In summer moose were active (moving and/or feeding) about 50% of a 24-hr day. They were most apt to be bedded at sunrise and most active just before midnight. Overall, moose were slightly more active at night than during daylight hours. In midwinter collared moose were active 37% of the time and exhibited impressive synchrony during a cycle of 5 feeding periods in 24 hours. The greatest synchrony was observed as moose arose from beds shortly after sunrise and began to bed down at sunset. Feeding periods averaged 102 minutes and were followed by a period of inactivity and rumination. These bedded period averaged 177 minutes. In general, moose in winter were more active during daylight hours.

Figure 13. Female 630 feeding on hazel in winter.

Moose mortality and parasites

Only 16 moose carcasses were located during the 1985 winter study, the smallest total since 1970 (Fig. 14). All but one of the carcasses were examined on the ground. Two wolf kills made prior to our arrival (including a radio-collared cow moose) were located, plus 13 wolf-kills dating from the winter study and one malnutrition death from early winter. After 3 winters when few calves were killed, calf proportion increased to 36% of 14 kills in 1985, near the long-term average.

Bare skin was once again evident on many moose seen from aircraft after January. During close observations of moose by Risenhoover and Ackerman and aerial relocations of radio-collared moose it became obvious that during February and early March ticks were an increasing source of irritation (Fig. 15). Ticks were evident in moose beds and occasionally were found at carcasses of wolf-kills. When immobilized in early February, male 120 harbored about 1 tick/sq. inch on his back.

Other Wildlife Species

Fox observations were notably infrequent during the 1985 winter, although the usual 3 divided up the prime locations in front of the Windigo bunkhouse. Foxes were seen at only 2 kills, and other observations totaled 10 per 100 hours flying time (Fig. 16). The latter figure was similar throughout the early 1980's suggesting a stable population. The number of foxes seen at carcasses may have declined simply because of the reduced number of wolf-kills.

Otter sign was seen at 9 sites throughout the island during the winter study. Otter tracks and slides were commonly observed along the Malone Bay shoreline.

Beaver activity was not seen above-ice until the thaw in late February. Thereafter beaver sign was evident at 6 sites, including 3 that were visited (and utilized) by the Harvey Lake Pack.

Mountain ash fruit and cones on conifers (balsam fir, northern white cedar, and white spruce) were exceedingly abundant in 1984, possibly in response to drought stress during the previous summer (1983). In winter, foxes and ravens made extensive use of mountain ash fruit. Mixed flocks of redpolls, purple finches, and pine siskins were abundant, and white-winged crossbills were occasionally observed.

Beaver population trends (contributed by Philip C. Shelton)

Beaver numbers have been monitored every other year after leaf fall since 1978 by aerial counts of food piles and other signs of activity. Complete counts also were made in 1962 and 1974, and partial counts in 1969 and 1973 (Fig. 17). All counts were made by P. C. Shelton.

Figure 14. Distribution of moose carcasses located during the 1985 winter study. All but one were killed by wolves.

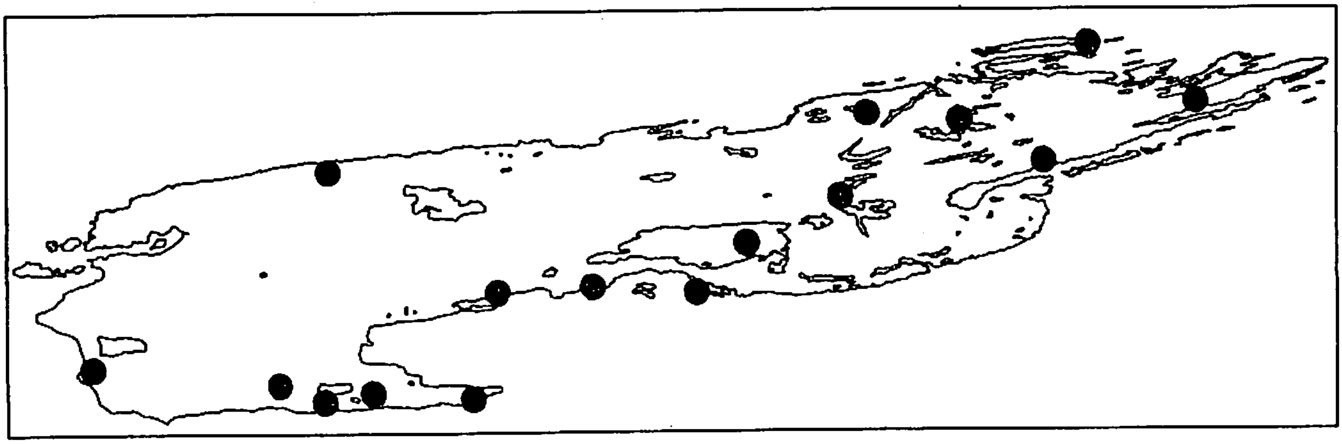


Figure 15. Cow moose chases young bull away from mineral lick, May 1984. Heavy loss of winter hair from neck and upper back is caused largely by winter tick irritation.

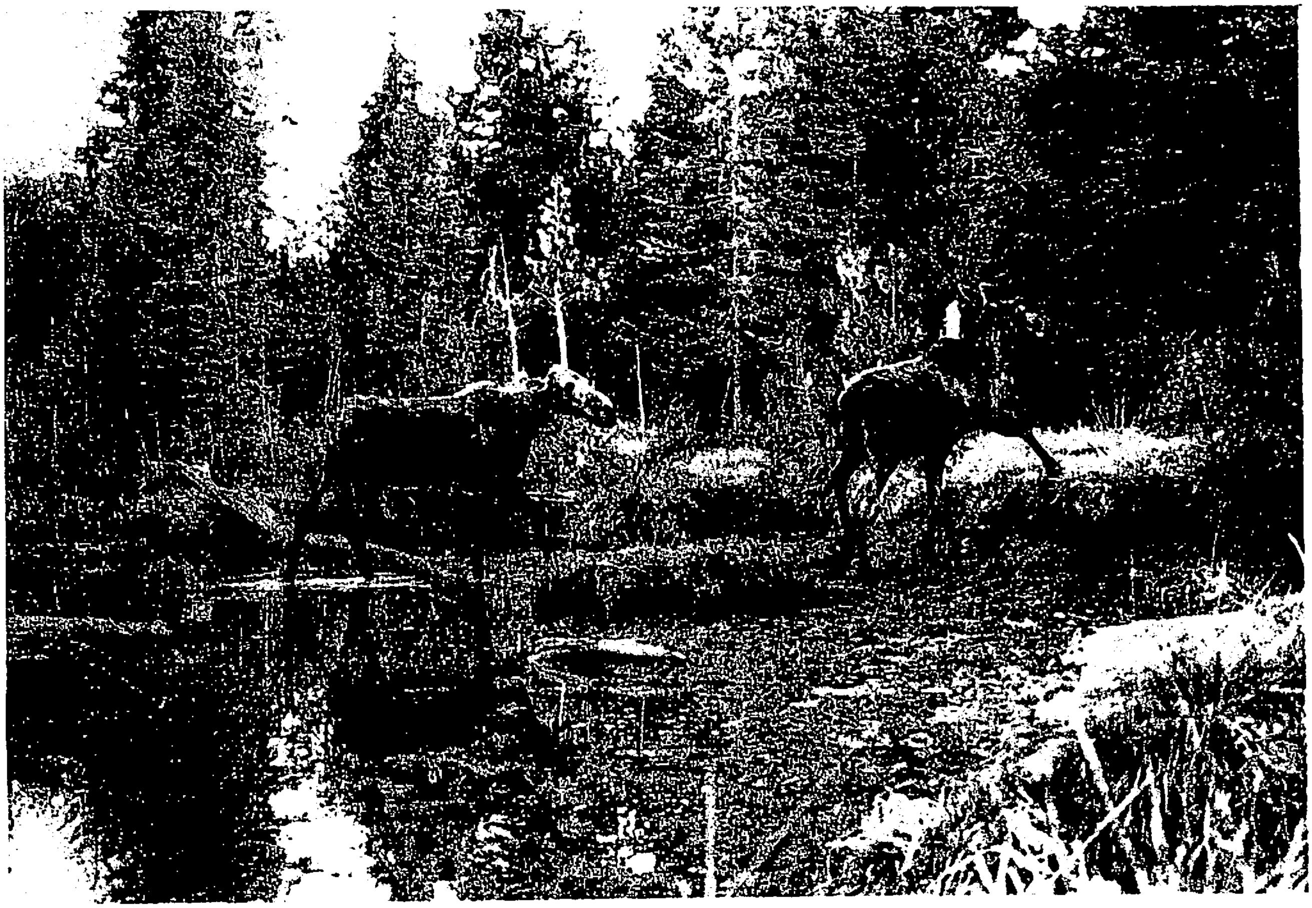
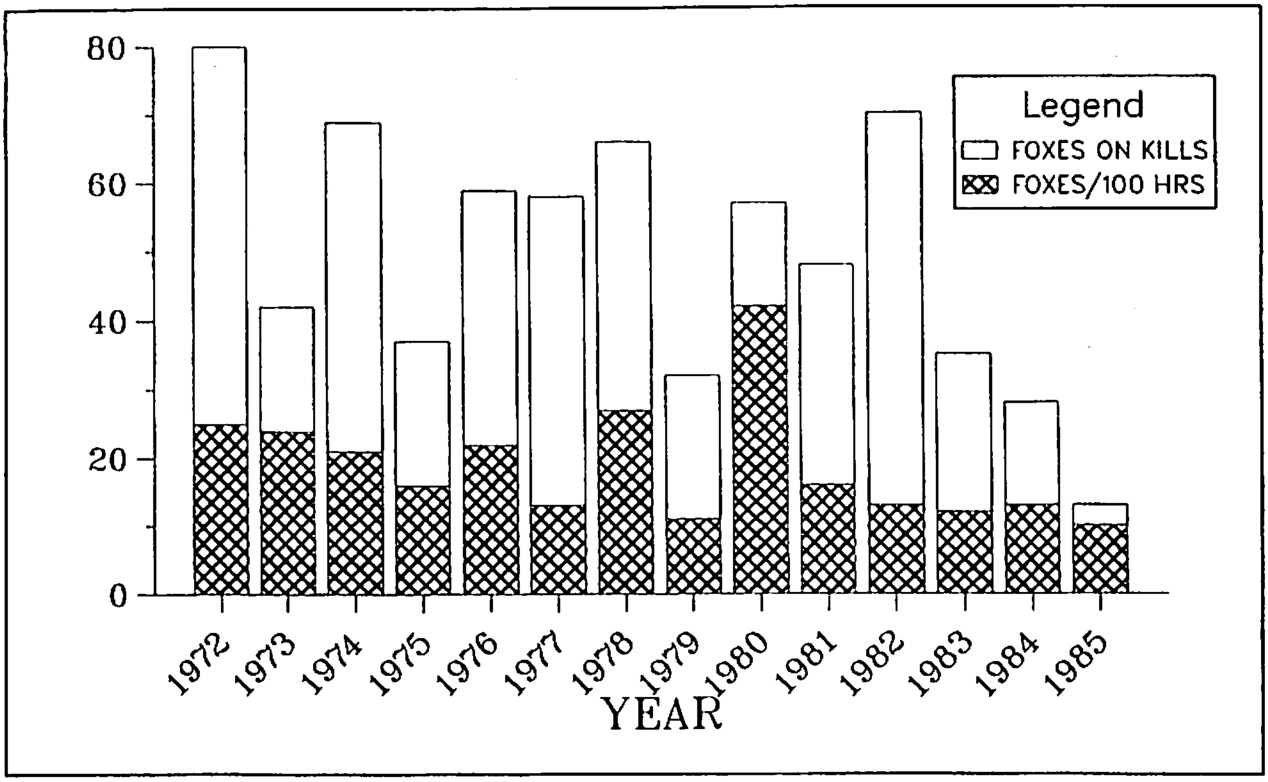


Figure 16. Index to fox observations from aircraft, 1972-85. Lower bar is the number of foxes seen away from moose carcasses/100 hours, while the upper bar is the sum of the maximum number of foxes seen at each carcass.

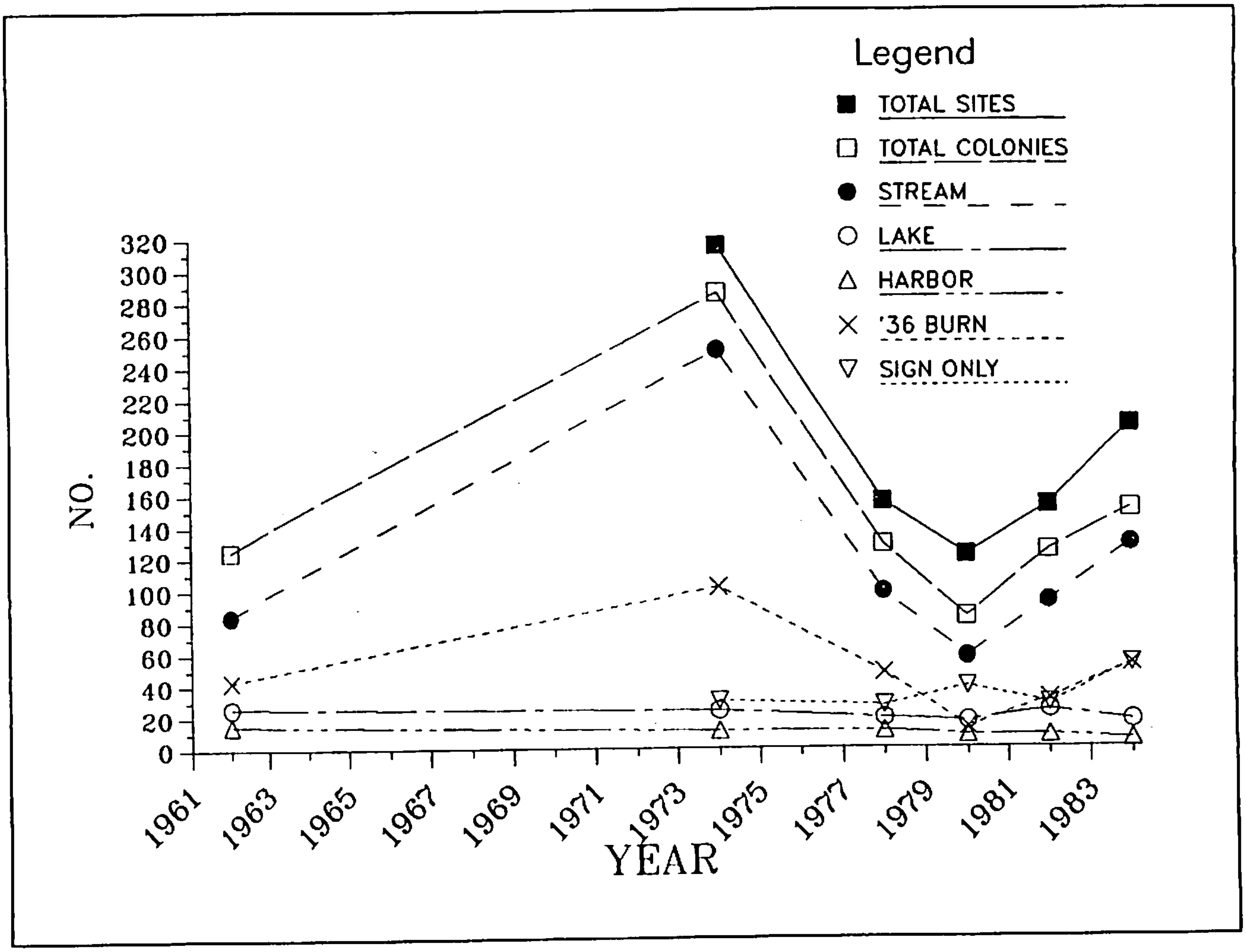


Fluctuations in beaver numbers during this period are thought to have been influenced primarily by wolf predation. In the early 1960's the population was recovering from a low in the 1950's which probably resulted from epizootic tularemia. As the population increased up to at least 1974, wolf predation on beavers increased as shown by the increased presence of beaver remains in summer wolf scats. As the wolf population expanded rapidly beaver numbers declined, reaching a low point when wolf numbers peaked in 1980. After wolves "crashed" the beaver population began a steady increase.

In 1984 the number of beaver colonies was slightly over half the maximum number recorded in 1974. Distribution by habitat was similar to previous patterns in that most of the change was in stream-dwelling beavers. Harbor beavers continue to decline; many of these colonies are among the oldest established colonies on the island and their food supplies of deciduous vegetation continue to be depleted.

From the air, aspen (prime food) cutting was identified at 15 sites, including three in the 1936 burn and 12 in the 100-yr-old forest on the NE third of the island. Among these 12 were five ponds that had been built within the last one to three years. At two of these, aspen trees had been cut that fell into the ponds. At several others aspen cutting was less than 10 meters from the pond, and the maximum distance noted was 25 meters. Thus, although beavers have occupied some sites for 50 years or more and have thoroughly depleted food resources, there are still new sites being occupied, and old growth aspen is still being exploited.

Figure 17. Beaver population trends, determined from aerial survey by P. C. Shelton. The 1936 burn classification is a special designation not included in the total.



Winter Weather and Snow/Ice Conditions

Temperatures were uniformly below 0 deg. C after a mid-December thaw that reduced the snow pack to only a few inches. New snow just prior to our arrival brought depths to about 40 cm when the winter study commenced. Temperatures remained below freezing until late February (Fig. 18), and snow depths in open areas remained at 40-50 cm. A thaw initiated crusting conditions on 24 February and a major snowfall of 40 cm was experienced on 3 March.

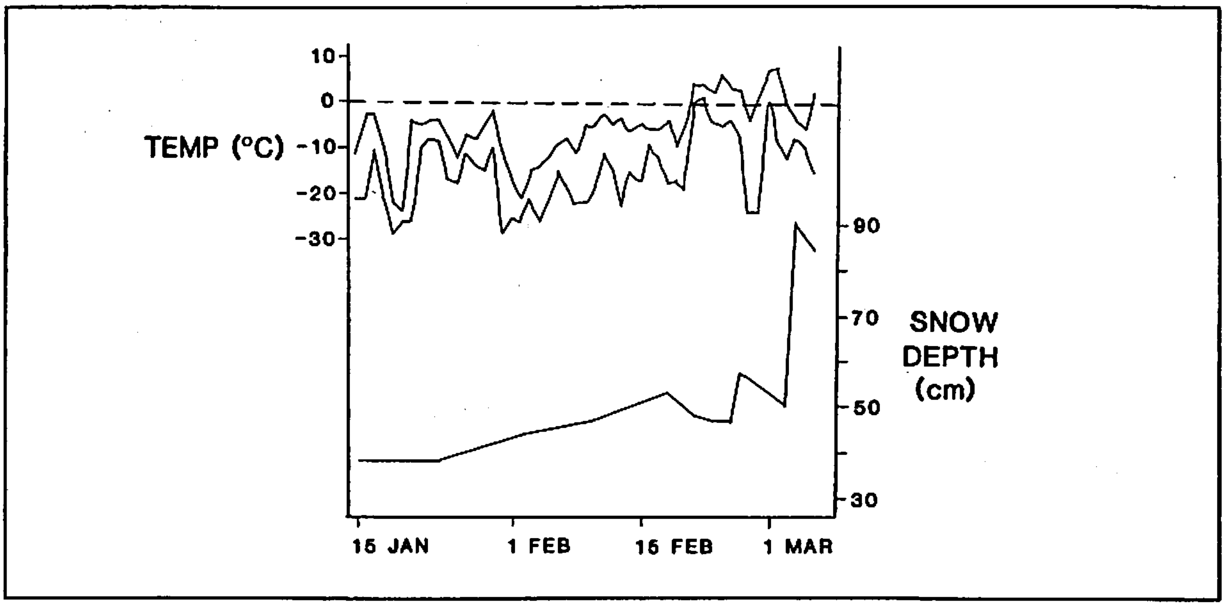
A total of 99 cm new snow fell during the 7-week study; there was no rain (for a change!). Average daily minimum and maximum temperatures were -15.4 deg. C and -5.6 deg. C, respectively.

An ice bridge to the mainland formed soon after our arrival in January and persisted past the end of the winter study. It was very rough ice and there was no evidence of any wolf movement across this bridge. There was ample shoreline ice around the periphery of Isle Royale except along exposed south-facing shores.

Wolf mobility was hampered considerably by the relatively deep, soft snow (density 0.12-0.21

g/cm) that existed during most of the winter study. Travel through the island's interior by packs was always single-file, with frequent rests. The first surface crust that formed in late February supported 80 g/sq.cm., giving wolves only occasional support (wolf weight-load-on- track is about 100 g/sq.cm.). Within a week this crust was strengthened until it supported 550 g/sq.cm., finally providing wolves with solid footing. The heavy snowstorm of early March once again created unfavorable snow conditions for wolves that persisted through the end of the study.

Figure 18. Snow depth and daily temperature range at Windigo during 1985 winter study.



Bull moose displays antlers (top, preceeding page) near yearling cow moose in late October. Below (preceeding page), the same bull sleeps soundly as activity subsided at the end of the rut.

(Following page, above) Harvey Lake Pack alpha male begins feeding on bull moose that he and one other wolf killed, the only kill made by this pack in seven weeks in 1985.

(Following page, below) Computer-generated relief map of Isle Royale by Eric A. Jones.