Studies of the timber wolf in Isle Royale National Park

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THE TIMBER WOLF ON ISLE ROYALE

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Isle Royale is a 210-square-mile national park in northwestern Lake Superior, 17 miles from the nearest mainland. Forty-five miles long and 2 to 9 miles wide, it supports several northern types of climax and subclimax vegetation.

The most significant mammal inhabitants are moose, timber wolves, beavers, red foxes, snowshoe hares, and red squirrels. Moose appeared about 1912, before wolves were present. Numbers increased until browse was nearly exhausted, and a sizeable die-off occurred in the thirties. By the late forties the population had increased again. Timber wolves were reported in 1949, and Park Service studies later showed that they were killing moose and that browse was recovering.

Principal support for the present project is a three-year National Science Foundation grant. Funds were also contributed by the Wildlife Management Institute, the National Wildlife Federation, The Purdue Research Foundation, and Purdue University. The National Park Service has contributed food and aviation fuel for winter field work, plus general field administration, use of facilities, and the assistance of personnel. General technical supervision is under Durward L. Allen, Professor of Wildlife Management, Purdue University.

This three-year study is concerned with the ecology of the wolf, including the extent and effect of predation on the moose herd. Winters are spent on aerial surveys of moose and wolves, while spring and summer work includes studies of habitat, prey species, and summer food habits. Two fall semesters have been spent in academic studies on the Purdue Campus, and one remains. The 1959 fall academic work was interrupted for an eight-day field trip to Isle Royale. The period between winter and spring field work is spent preparing reports.

The first year's work showed that the island wolf population consisted of a pack of 16, a group of 3, and possibly a lone wolf. A satisfactory moose count was not obtained, but it was determined that an average of one moose was killed by the large wolf pack every three days during the winter study period. Calves and old adult animals were most frequently taken. Scat studies indicated that summer food of the wolf was mainly moose and beaver.

Summer Field Work, 1959

The second summer's field work extended from May 7 to August 19. Over 350 miles were hiked along all 85 miles of Park Service trails and along streams and ridges. Approximately 2,000 miles were traveled around the shore by boat and outboard motor.

A total of 209 wolf scats, 113 fox scats, and 91 unidentified scats were collected and brought to Purdue for analysis. Moose remains accounted for 70 percent of occurrences in 104 spring and summer wolf scats, whereas beaver remains constituted 13 percent. In 105 scats

of undetermined age, the occurrences were 76 percent moose and 10 percent beaver.

A den, recently dug by wolves, was found on May 21. No fresh tracks or other signs were seen in the vicinity, so the den was presumed to be an "extra" which wolves often make. This will be examined promptly in the spring of 1960.

Two moose carcasses were found fed upon by wolves, and it was determined that Isle Royale wolves will eat carrion. Carcasses or old remains of 17 other moose were found and the jaws collected for aging. Five of 12 adult remains which could be aged were of animals estimated to be 4 to 9 years old, and 7 were of individuals in the 9 to 15-year group. If enough records are collected, perhaps an accurate idea can be gained of the age classes of moose most subject to mortality.

Moose-observation forms were distributed to Park personnel and residents willing to record the sex and age of animals seen. Fourteen cooperators made 304 observations in which some individual animals undoubtedly were duplicated. Calves composed 25 percent of the moose observed, and with the assumption that 100 different individuals were seen, the 95 percent confidence interval limits are .17 and .35.

A pilot survey of beavers was made to determine if the apparent low beaver population was real, to note locations of presently-active colonies, and to discover if low food supply was possibly responsible for the population decrease. It was tentatively concluded that the beaver population had been headed for a crash because of dwindling food supplies and that wolves probably either accelerated the inevitable decrease or substituted for it.

Fall Field Work, 1959

It was decided that 1959 would be the most convenient year to obtain an aerial sampling of the percent of calves in the moose population. Thus Dr. Allen and Dave Mech spent from October 26 to November 2 on Isle Royale. On an estimated 40 percent of the island, 150 moose were observed during 11 hours of flying. The percent of calves in the sample was 22, with 95 percent confidence interval limits of .16 and .27.

A few field trips were also taken, and wolf-howling records obtained from the Ontario Department of Lands and Forests were found to stimulate responses from wild wolves. The records will be used in 1960 for locating active dens, as has been done in Ontario.

Fall Preparations for Winter Field Work

Windigo was again chosen as base camp for winter field work. Therefore before leaving Isle Royale in November, the Park rangers supplied the Windigo root cellar with canned food and the fire cache with dry food. Ten barrels of aviation fuel were located on the Windigo dock and six at Mott Island.

Winter Field Work, 1960

This research extended from February 4 to March 21. Flying conditions were unusually favorable; the plane was grounded only three days because of adverse weather. Three other days were forfeited for the aircraft's 100-hour check in Eveleth, Minnesota. A total of 185 hours were flown.

Upon our arrival this year, there was less ice along the Isle Royale shore than there was last year. Only the well-protected bays contained solid ice. However, by March 1 most bays, harbors, and areas around islands were frozen. Snow depth on the level in wind-protected areas varied from 12 to 16 inches. About 4 inches of snow fell during the study period, most of which drifted.

Wolf numbers, movements, and behavior

Because wolves traveled inland so much this year and because tracking conditions were poor, the number of wolves on Isle Royale had to be inferred from the fact that during the 185 hours of aerial observation of every part of the island, only four different groupings of animals were seen: 16, 3, 2, and 1. The group of two seemed to be part of the pack of three; the single animal may have been the other member or a different individual. The group of three was seen within a few minutes after the pack of 16 was observed, so it was concluded that there were at least 19 wolves on Isle Royale this winter, and possibly 20, just as in 1959.

Again this year, most wolf observations were made on the pack of 16. Whenever possible, the animals were tracked, followed by air, and observed from altitudes of 50 to 800 feet, usually from about 300. The plane had no evident effect on the wolves.

The wolves traveled overland more this year, probably because of better snow conditions. They covered from 9 to 67 miles between kills, averaging 28 miles. No correlation was noted between wind direction and the direction the animals traveled after leaving kills. Twice the pack headed in one direction for many miles and then turned around and headed back.

On March 1 the pack appeared to attempt leaving Isle Royale. At 4:55 p.m. the wolves were heading northward across the ice about a mile north of the upper end of the island. They continued toward Canada for another half-mile, gradually turned a half-mile eastward toward Passage Island, became discouraged upon reaching rough ice, and returned to Isle Royale.

Two kills and a third carcass were investigated within 45 minutes after the 16 wolves started feeding on them. Some of the animals ran while the investigator was 150 yards away, while others remained until he was within 50 feet. Although reluctant to return to the carcasses for a few hours after being disturbed, the animals eventually finished them.

Copulation was witnessed once this year, on February 4. Other indications of mating activity were noted on February 7, 14, 19, and 20, and on the 22nd, one pair made unsuccessful attempts at copulation. Little work on behavior was done from February 23 to 29 because of the moose census and the 100-hour check. However, from March 1 on, no sign of mating was seen.

In 1959, a lone cowering individual followed the pack of 15 wolves and three times in one day was attacked by two of the animals. This year an inferior-acting individual was a member of the pack of 16 and was assumed to be the same animal. It still traveled behind the others and seldom mingled with them, but only once, at a time of much mating activity, did it actually run from them.

On February 7, all 16 wolves chased a lone wolf at least half way across Moskey Basin to the north shore of the bay. It outran the others and upon reaching the shore continued at top speed into the woods and then northeastward at leaat another quarter-mile without stopping. The pack gave up when it reached shore.

Another case of intraspecific aggression was probably averted on March 6 when the pack of three wolves ran anxiously from Grace Island to Washington Island while the 16 animals were heading across Grace Harbor. Neither pack could see the other, but the 16 animals kept looking toward the three, which were running and watching their back-trail.

Most of the eight observations of the small wolf pack were made along the northwest shore of the island, whereas the 16 wolves rarely traveled this area during the study period. The shore region from McCargoe Cove to the Lake Desor vicinity was not covered by the large pack. This might indicate that the 16 wolves respect the small group's territory, or it might mean that conditions are better where the 16 wolves usually spend their time, the three animals being forced to live on the less favorable portion of the island.

Hunting and killing techniques

The hunting and killing techniques of the 16 wolves were observed with much success this year. Last year's experience showed that good observations could be made if the wolves are followed continuously after leaving a kill. During the 37 hours the wolves were observed hunting, they failed to detect at least 15 animals in 10 groupings within about 300 yards of them and made 35 attempts to chase or attack moose (69 individuals). The hunting and killing of three calves and one adult was witnessed from start to finish. Another adult was seen attacked, wounded, and held at bay until dark, after which it was killed.

Apparently the wolves are hungry soon after they leave a kill, for while traveling, they attempt to attack all moose detected. An unsuccessful attempt was made exactly 35 minutes after the pack had left a kill.

The wolves detect many moose when directly downwind from them, but they also track some. In several instances, moose (11 individuals) discovered the wolves first and in each case quickly ran off. During 12 actual attacks, involving a total of 27 animals, the moose ran off without getting killed. All were pursued but either got far enough ahead or ran until the wolves gave up. Apparently if the moose can stay at least 100 yards ahead for a brief period, the pack will soon give up. Even when the wolves do catch up, many moose continue running until their pursers tire. In seven instances (nine animals) the moose ran at least half a mile before the wolves abandoned chase. Three chases lasted about $2\frac{1}{2}$ miles, and another about 3 miles before the wolves gave up. Eight moose, involved in seven attacks, ran as the wolves approached but stopped when overtaken and stood their ground until the wolves left. Eleven others (seven cases) stood their ground when first approached. While at bay, moose charge the wolves and kick at them. With one possible exception, animals using this defense drove the wolves off within 30 seconds to 5 minutes.

The cow's defense of her calf is quite stereotyped. Upon detecting the wolves, she runs to the rear of the calf and protects its rump. When running, the cow stays close behind the calf and threatens any wolf that comes close. If separated from the calf, she tries to return to the original position behind it; If the cow and calf can keep close enough together they seem to be quite invulnerable. The cow kicks at the wolves behind her, and the calf charges the wolves in from of it.

When the wolves come upon a standing moose, they lunge toward it several times but are readily frightened away by its charges. After "testing" the moose for a few minutes, the animals usually give up and leave. When moose run before the pack gets to them, the wolves put on a burst of speed. In open areas wolves ran faster than moose, but through thick swamps, heavy cover, blow-down, or snowdrifts, they lost ground.

After catching up to a moose, most of the wolves remain strung out behind, but a few keep alongside, awaiting an opportunity to attack. It is not known exactly what makes a moose vulnerable, but poor physical condition and quick tiring are suspected.

When chasing a cow and calf, the wolves try to separate them. While some animals harass the cow, others stay with the calf. If the cow can't keep up with the calf, if thick cover separates the two, or if the cow is too busy chasing off wolves, those animals near the calf immediately attack it. If successful in keeping the cow and calf apart for more than a few seconds, they can easily pull the calf down. In one instance two wolves killed a calf separated from the cow.

Wolves may pursue a moose at top speed for more than 20 minutes in the course of which they travel about 3 miles. After extended chases they usually rest for at least 10 minutes.

In all five cases witnessed where moose were killed, the animal's rump and flanks were attacked first. This slowed the moose and occupied its attention. In at least four instances, the nose was then grabbed by one wolf; in the fifth case trees obscured the view. The nose-hold seems quite effective, for while the moose tries to shake the wolf loose, others continue to work on its rump, flanks, shoulders, and throat. Three calves and one adult were each killed within 10 minutes. The other adult had its nose and rump well-chewed but managed to shake the wolves and stand them off from 2:30 to at least 6:40 p.m. They tried attacking the wounded animal several more times that afternoon but were held off. Nevertheless, the wounds, although probably not mortal, were bleeding and making the moose stiff and less agile. Sometime after 6:40 p.m. it was killed.

Frequency of kills

This year the 16 wolves killed nine calf and four adult moose between February 5 and March 20 and also ate an adult and calf found dead. Thus they ate 10 calves and five adults in 44 days, or an average of one moose per three days. However, the pack once went 109 hours between kills.

Sex, age, and condition of moose killed

Nine calves, 3 cows, and 1 bull were killed by the 16 wolves during the study period. In addition, remains were found of two cows presumably killed by the 16 wolves before the study period; both were revisited by the pack. The pack of three wolves also fed upon and probably killed at least two cows during this period. Of the eight adults, five had estimated ages of from 5 to 9 years; two, 10 years; and one was judged at least 15 years old. The composition of the adult moose population is unknown, but probably there are a fair number of 1 to 4-year-old animals. Since none of the 13 adult moose killed during the 1959 and 1960 winter study periods is less than 5 years old, it appears that 1 to 4-year-old individuals are least vulnerable at this season.

All previous moose censuses and surveys made in connection with the wolf project indicate that calves compose less than 30 percent of the population. Since about 70 percent of the predation during the winter study period was on calves, these animals are undoubtedly most frequently taken.

The fall moose census indicated a fairly even adult sex ratio, and since cows composed 75 percent of the adult moose killed by wolves, it appears that cows are more vulnerable then bulls at this time of year.

Femurs were examined of all moose killed or found dead. All those from kills contained healthy marrow. Marrow was fat-deficient in one old bull found and eaten by the wolves. This animal also had severe "lump jaw". Another old moose, thought to have been killed by the three wolves, also had a jaw necrosis. A calf investigated within 45 minutes after being killed was infested with ticks (Dermacentor albipictus).

Predation efficiency

Twenty-seven attempts (58 animals) were witnessed where the wolves actually "tested" the moose-- where the moose escaped after the wolves caught up to it. Seven of these attempts were successful; thus, seven of 58 animals were killed. (Five of these kills were witnessed, and two occurred in areas completely obscured from the air.) Therefore, the 16 wolves seem to have an average of 12 percent success— one animal is killed out of about every eight chased or attacked. If these figures can be validly applied to the period of ice and snow conditions similar to those during the study period, probably about December 1 to April 30, about 200 moose probably were chased or attacked during that period. It seems that diseased, crippled, heavily-parasitized, and old individuals would be weeded out quickly.

Moose census

The moose census was taken principally in the 10 days between February 13 and March 2, and all except 25 animals were counted between February 13 and 25. The entire island was covered during 45 hours of flying, and 529 moose were seen; the herd was estimated at 600. The same techniques were used as in 1959, but this year there was much less wind and a different pilot. Perhaps the investigator's ability to spot moose had improved also.

Last year 176 moose were seen on the same area where 439 were spotted this year. The higher count undoubtedly resulted, at least in part, from better counting conditions, for the herd could not have increased so much in one year.

Seventeen percent of animals seen were calves. This figure agrees well with those obtained by the fall count (22 percent) and the summer survey (25 percent) since it has been shown that wolves are taking a disproportionate number of calves.

Seven sets of twin calves were noted this year, six of which were on the southwest third of the island. During the census, 12 bulls with "Cervina-type" antlers were observed. March 12 was the latest date an antlered moose was seen.

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This is the final "summary" report of the wolf study. Field work will be terminated at the end of the winter period, 1961, after which a thesis covering the three years of work will be prepared in publication form.