Environmental Case Study
Wolves and Moose on Isle Royale

Isle Royale National Park occupies the largest island in Lake Superior, the largest freshwater lake in the world. It is a spectacular wilderness setting of high rocky ridges covered by a dense boreal forest (fig. 6.1). Cut off from the mainland of Minnesota and Ontario by 30 km (20 mi) of rough, deep, very cold water, the island is a mostly closed ecosystem that is a unique laboratory for studying large animal population dynamics.

Moose Population Growth and Decline

The original large herbivore of the island was the woodland caribou. Caribou were abundant until about 1900, but disappeared early in this century due to hunting and human-caused changes in the habitat. About the time that caribou became extinct on the island, moose first appeared. We suppose they swam from the mainland or crossed on ice that occasionally forms a bridge to the island. They must have found an ideal situation; the shrubs and aquatic plants on which they prefer to browse were plentiful, and there were no major predators to limit their population growth.

The number of moose increased slowly at first. In 1915, it is estimated that about two hundred moose were on the island, or one moose for each 2.6 sq km (1 sq mi). Then, in the 1920s, there was a moose population explosion on Isle Royale. As figure 6.2 shows, the number jumped to about five thousand in 1928.

In the summer of 1929, famous wildlife biologist Adolph Murie went to the island to study the moose situation. He reported that all the tender branches on which the moose browse in the winter were eaten back as high as the moose could reach. Much of the summer food (aquatic plants and annuals) was also badly depleted. He predicted that disease and starvation would soon cause a population crash extensive die-off. As you can see in figure 6.2, his prediction came true. By 1941, only 171 moose were found on the island—fewer than twenty years before. Clearly, unrestrained growth of the moose population surpassed the limits of the environment and resulted in a catastrophic population decline.

Moose-Wolf Equilibrium?

In the early 1940s, shortly after the moose population on Isle Royale declined so precipitously, wolves appeared on the island in pairs and small groups, presumably having crossed on the ice during previous winters. There were no permanent human inhabitants on the island at the time, so we don't know exactly when the first wolves arrived or how many there were in those early years. By 1957, when the first systematic census was taken, twenty-one wolves were on the island (fig. 6.2).

You might think that the wolves, arriving as they did when the moose were weakened by starvation, could have exterminated their prey completely. Instead, the wolves and moose established an oscillating balance (fig. 6.3). While moose and wolf populations have risen and fallen over the years, the moose have not reached such high numbers nor degraded the environment as badly as in 1928–29. We call the maximum number of individuals of any species that can be supported on a long-term basis by a particular ecosystem its carrying capacity. Because of environmental variation and other factors, populations rarely reach or maintain this maximum level, however.

Wolves and Moose in Trouble

In 1988, an alarming decline in the wolf population on Isle Royale was observed. The annual winter survey revealed only twelve wolves in three small packs, down from fifty wolves only six years earlier. Scientists proposed several possible causes for this population crash. It may have been the food supply. Although moose were plentiful, they were young and healthy—perhaps too difficult for the wolves to catch. Diseases might have been introduced by dogs or stray wolves from the mainland. Some scientists believe the problem may be genetic. When a population starts with only a few founding individuals and is highly inbred, as are the wolves of Isle Royale, defective genes are likely to be expressed. A high rate of reproductive failures and infant mortality may result.

After several years in which high mortality rates kept the population as low as ten animals, the wolves successfully bore and raised more pups in the late 1990s. The total number rose to 24 in 1997. However, even fifty wolves may not be a viable population over the long term, no matter how ideal the environment or how carefully the species is protected.

Moose, also, have demographic problems. An abundance of food and lack of effective predation allowed the moose population to grow to 2400 animals in 1995. Lack of food, an infestation of ticks, and an unusually harsh winter in 1997 killed 80 percent of the moose on the island. One lesson we can learn from this story is that population dynamics can be highly variable, especially in an area as small and isolated as an island.