

The Olympic Marmot: Ecology and Research



females particularly valuable to a marmot population. If a breeding-age adult is killed, it takes years to replace her. The death of several breeding-age females can have serious, long-term effects on the population.

The meadow habitat of Olympic and other mountain-dwelling marmots is distributed in discontinuous patches of varying size and quality. Meadows may contain just one marmot pair and their off-spring, although some larger patches are home to several family groups totaling 40 or more marmots. Small numbers can leave local populations vulnerable to the effects of inbreeding and to extinction due to random events. Thus, migration among local populations is critical for the survival of these groups and, ultimately, for the survival of the species. Marmots are highly sedentary except for a short window when sub-adults may disperse. Recent study of radio-tagged Olympic marmots indicates that about half the females and two-thirds of the males disperse at age two or three. The males may travel several kilometers but the females rarely move more than a few hundred meters. The lack of substantial long-distance movement by females suggests that recolonization of vacant patches may take a very long time.

Marmot Ecology

Marmots (genus *Marmota*) are house-cat sized, burrowing members of the squirrel family. Their closest relatives are prairie dogs and ground squirrels. There are 14 species of marmots worldwide. The eastern woodchuck or groundhog is the most widespread of the six North American species. The Olympic marmot (*Marmota olympus*) is the second rarest of the North American marmots. After evolving in isolation for thousands of years, the Olympic marmot differs in coat color, vocalization, and chromosome number from the closely-related Vancouver Island and hoary marmots.

Marmots are supremely adapted to living on cold, windswept grasslands and exposed mountain slopes where snow covers the ground for all but a few short months. They forage on grasses, sedges, and most herbaceous plants. They dig burrows in which they shelter from predators and weather, bear and nurse their young, and hibernate for up to eight months of the year. Marmots are the largest of the deep hibernators. The body temperature of a hibernating marmot drops to <40°F and the heart rate may drop to 3 beats per minute. In contrast, the body temperature of a hibernating bear does not drop below about 88°F and bears are easily aroused from hibernation. Although marmots do warm themselves briefly every 10 days or so, they do not eat or drink during hibernation.

Marmots, particularly those that live at high-elevations, have an unusually “slow” life-history for rodents. Olympic marmots can live into their teens but do not reach reproductive maturity until at least age 3. In fact, the average age of first reproduction for females is 4.5 years. Among reproductive-age Olympic marmots, about 35% of females wean young in an average year. Litters of 1-6 pups first come above ground in late July or early August, and about half of these young die before the following spring. The long maturation period, low rate of reproduction, and relatively high rate of juvenile mortality combine to make adult



The Recent History of Olympic Marmots

Marmots have been documented in the Olympic high country since the Press, O’Neil, and other expeditions began recording the fauna of these mountains in the 1880s. Through the 1950s, explorers, hikers, and scientists shot marmots for sport, food, and museum collections. Yet the animals remained numerous in the 1960s when David Barash conducted his seminal, 3-year study of Olympic marmot behavior. For the most part, the marmots were then left alone by researchers for the rest of the 20th century.

In the late 1990s, three factors led to concerns about the current and future status of the Olympic marmot. Rangers and long-time park visitors noticed that marmots were missing from some long-occupied meadows. At the same time, the nearby and closely related Vancouver Island marmot rapidly declined from 300 to fewer than 30 individuals in the wild. Finally, it became clear that climate change would strongly affect high-elevation regions.

In 2002, researchers from the University of Montana began investigating the reported declines of Olympic marmots. Foot surveys quickly established that marmots had disappeared from many long-occupied sites and that there had been no colonization of new sites. Studies on ear-tagged and radio-tagged marmots showed that marmot numbers continued to decline by about 10% per year at still-occupied sites through 2006. Disease, human disturbance, and direct effects of climate change were considered and ruled out as possible causes of the declines. Instead, coyote predation on adult female marmots appeared to be the immediate threat to marmots. During the period 2002-2006, survival of the important adult female marmots was extremely low and predation by coyotes was the most common cause of death. Analysis of coyote scat throughout the park indicated that in some areas, marmots constitute as much as 20% of coyote summer diet. In 2006, the total population of Olympic marmots was thought to be fewer than 1000. Fortunately, in 2007-2010, marmot survival rates were higher and numbers at some well-studied colonies stabilized.

Coyotes were not present on the Olympic Peninsula prior to the 20th century and were considerably less common in the high country until recently. Why have coyotes become a threat to marmots in recent years and why does their impact vary so much across time? It is suspected that warm winters and low snowpack allow coyotes to flourish at higher elevations than they could otherwise. Although this relationship has not been fully established, it would explain the marmot declines in recent decades as well as the recent increase in marmot survival. Snowpack in the Olympics Mountains was generally high prior to the late 1970s when a period of low snowpack commenced and persisted until 2007. Beginning in 2007, snowpack has been generally at or above average. The decline in the marmot population during the 1990s and early 2000s, followed by the recent stabilization, is consistent with the hypothesis that coyote predation is affected by snowpack.

Regardless of the immediate cause of the marmot declines, it is almost certain that climate change will affect the marmots



Photo by S.C. Griffin

in the future. The composition, quality, and timing of their food supply will change; forest will replace some meadowland; hotter daytime temperatures may force marmots to forage at dawn and dusk when predators are more abundant and harder to detect; and the predator community itself may change. Some effects may be positive – a longer growing season may allow marmots to grow more quickly, mature earlier, and breed more often. All these changes come on the heels of years of fire suppression, which may have reduced the total area of meadow available to marmots and limited the dispersal of young marmots among these meadows.

Winter is the safest time of year for marmots

It has long been assumed that many marmots, particularly young-of-the-year, exhaust their energy reserves and then die during hibernation. It has been suggested that deep snow reduces hibernation-related mortality because snow insulates the burrows. If true, warmer winter temperatures due to climate change might spell disaster for marmots. However, the assumption of high overwinter mortality was based on observations of summer to summer survival of ear-tagged marmots. In contrast, observations of radio-tagged marmots over eight recent winters, including one with a record low snowpack, found that over-winter survival rates of all ages of marmots is near or at 100%. Overwinter survival is similarly high in Vancouver Island marmots. In both species, active season predation accounts for almost all mortality.



Photo by Rick Klawitter
