Survival and Fecundity of American and Pacific Marten Populations

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Two species of martens, American and Pacific, occur in North America (Dawson and Cook, 2012). American martens (*Martes americana*) are distributed from the Atlantic coast through the boreal forests of Canada to Alaska. Pacific martens (*Martes caurina*) are found from the Rocky Mountains to the Pacific coast and from California to Southeast Alaska. Both species are closely associated with and heavily dependent on old-growth forests (Buskirk, 1992). Multiple studies across the ranges of the two species revealed that these mustelids rarely use open canopy forest habitats and their abundance is lower in areas where large swaths of old-growth forests have been logged (Godbout and Ouellet, 2010). Although American and Pacific martens naturally occurred (separately) on several islands in the Alexander Archipelago of Southeast Alaska, in the 1930s the Alaska Game Commission (the federal agency that managed wildlife resources in the territory before Alaska became a state in 1959) introduced animals (mostly American martens) from the mainland to some of the larger islands (e.g., Chichagof and Prince of Wales) to provide economic opportunities for rural communities (Paul, 2009).

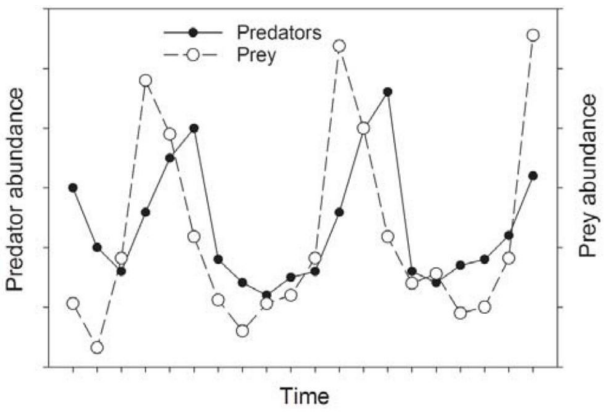

Figure 1. A theoretical representation of predator-prey cycles illustrating a 1-year time lag between the change in predator numbers and the change in prey.

In many northern latitudes, predators and their prey exhibit cyclic dynamics. Predator numbers rise following an increase in prey abundance and then decline when prey populations crash, usually exhibiting a time lag (Figure 1). Th is relationship is driven by the effects of food availability on survival and reproduction of predators.

Figure 2. An American marten on Chichagof Island wearing a collar with a radio-transmitter. This individual and many others like him were followed for several months to years to determine habitat use and survival rate. Photo by Gail Blundell, used with permission.

In Southeast Alaska, marten numbers track those of long-tailed voles (*Microtus longicaudas*) and Keen's mice (*Peromyscus keeni*). To determine the relationship between these small mammals and abundance, survival, and reproduction (vital rates) of martens, scientists from state and federal agencies (Alaska Department of Fish and Game [ADFG], US Forest Service [USFS], and US Fish and Wildlife Service [FWS]) and several universities have conducted long-term studies on several of the islands and the mainland of Southeast Alaska (Ben-David et al., 1997; Flynn and Schumacher, 2009; Pauli et al., 2012). In these studies, martens were live-captured, fitted with radio-transmitters (Figure 2) and followed through several months to years to determine survival (Flynn and Schumacher, 2009). Concurrently the abundance of small mammals was quantified using various trapping methods. Finally, marten carcasses (which are usually discarded after the skin is removed) were purchased from fur trappers and used to investigate the body condition of the animal (in terms of fat reserves) and reproduction as indicated by corpora lutea counts in the ovaries (for females only), which represent the number of kits born (Flynn and Schumacher, 2009).

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On Chichagof Island marten fecundity varied from 0.44–2.70 kits per female (in some years many females did not produce any young so on average each had 0.44 of a kit; in other years each female produced 2–4 kits and on average each had 2.70). As shown in Figure 3, fecundity was dependent on the abundance of small mammals (Flynn and Schumacher, 2009). Marten annual survival ranged from 0.34–1.00 (or the number of marked animals that survived each year ranged from 34% to 100%). Although the relationship with the availability of small mammals was not as clear, in years with high abundance of these prey, most martens survived (0.65–0.82). In years after the mice and voles declined, few martens survived (0.34–0.54). In the three years when small mammal abundance was low, mortality from fur trapping was 62.5–93.8% of the total (Flynn and Schumacher, 2009). The strong relationship between marten abundance and that of small mammals with a 1-year time-lag was also observed when data from all marten studies in Southeast Alaska were combined (Flynn et al., 2004; M. Ben-David, unpublished data).

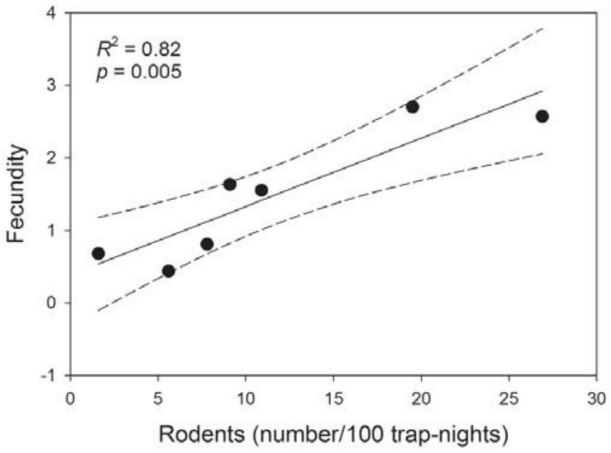

Figure 3. The relationship between the index of rodent abundance (represented as the number captured in 100 trap nights) and the fecundity of martens on Chichagof Island, Alaska. Fecundity was measured as the number of corpora lutea counts in the ovaries of adult females. The solid line is the regression and the dashed line the 95% confidence intervals around that line. This figure was created from data published by ADFG Biologists Rod Flynn and Tom Schumacher (Flynn and Schumacher, 2009).

Most striking is the relationship between small mammal abundance in one year and marten abundance in the following (which is a result of high fecundity and high survival in years with many rodents, and low fecundity and low survival in years with few prey; Figure 4). The strong relationship between marten abundance and that of small mammals with a 1-year time-lag was also observed when data from all marten studies in Southeast Alaska were combined (Figure 4).

Both male and female martens reach sexual maturity at around 15 months of age, and approximately 80% of females are sexually mature in their second year of life (Age Class 1; Clark et al., 1987). However, even these females will not give birth until their third year (Age Class 2). Martens, similar to many other mustelids, have a unique reproductive strategy. Following mating, the fertilized eggs develop into blastocysts (tiny embryos composed of about 128 cells), which stop developing for another 190–250 days (Clark et al. 1987). This delayed implantation of embryos ensures that kits are born during the best time of year in terms of food availability. Thus, similar to survival, fecundity of martens changes with age.

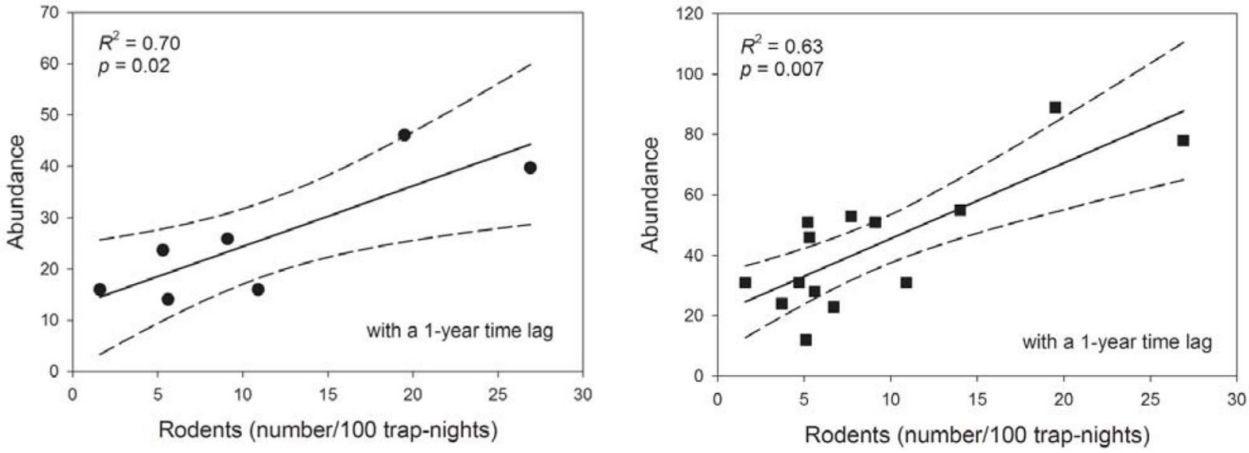

Figure 4. The relationship between the index of rodent abundance (represented as the number captured in 100 trap nights) and the abundance of martens on Chichagof Island (on the left) and across several sites in Southeast Alaska (on the right). Because the area trapped varied at the different sites, marten abundance was normalized to the same area (16,200 ha).