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MAMMALS

Recovery efforts for the Vancouver Island marmot, Canada

The Vancouver Island marmot (*Marmota vancouverensis*) is a housecat-sized ground squirrel that is endemic to Vancouver Island, British Columbia, Canada (***see photo 1***). Like other marmots the species is colonial, fossorial, herbivorous and hibernates during winter. *M. vancouverensis* is closely related to the hoary marmot (*M. caligata*) and Olympic marmot (*M. olympus*) which occur on nearby mainland areas of British Columbia and Washington State. It differs from other species in fur colour and other physical and behavioural characteristics. On average, Vancouver Island marmots achieve sexual maturity at age 3 - 4, with females producing litters of 3 - 4 pups in alternate years. Some two-year-olds disperse but adults tend to be relatively sedentary, occupying home ranges of 1 - 30 ha depending upon local habitat conditions. The natural habitat of Vancouver Island marmots consists of subalpine meadows located at 900 - 1500 m a.s.l. Such meadows are thought to be maintained by avalanches or fire, are typically small in size (1 - 30 hectares), and comprise a small fraction (<1%) of the otherwise forested landscape. Consequently *M. vancouverensis* is rarer and more sparsely distributed than *M. caligata* or *M. olympus*, for which available habitat patches tend to be larger, more numerous, and closer together. The recent population history of *M. vancouverensis* is interesting. During the 1980s populations expanded dramatically, with marmots successfully colonizing man-made habitats created by clearcut logging of old-growth forests. Unfortunately this expansion was both localized and temporary. From a peak of 300 - 350 individuals at 29 - 34 colonies during the mid 1980s, population sizes declined precipitously (Bryant & Janz, 1996). By 1998 Vancouver Island marmots were nearly extinct in the wild, with fewer than 70 individuals recorded at 13 colonies, and solitary marmots occupying four of those sites.

Photo 1: Vancouver Island marmot (*Marmota vancouverensis*) - this particular individual was the first captive-born female to breed after release
© Andrew A. Bryant

Recent population declines were not related to habitat loss or reproductive failure. The proximate cause of decline was unsustainably high levels of predation by wolves (*Canis lupus*), cougars (*Felis concolor*) and golden eagles (*Aquila chrysaetos*), all of which occur naturally on Vancouver Island. Predator populations increased during the 1980s, apparently in response to changing populations of their principal prey (the black-tailed deer *Odocoileus hemionus*), which in turn are thought to have responded to widespread forestry operations (Bryant & Page, 2005). Given these trends, the Vancouver Island Marmot Recovery Team proposed that a captive-breeding and re-introduction program was essential if extinction of the species was to be prevented (Janz *et al.*, 2000).

Captive-breeding Program

The captive program began slowly, with six marmots being sent to the Toronto Zoo in 1997. Calgary Zoo joined the program a year later, followed by the privately-operated Mountain View Conservation and Breeding Centre in 1999. Finally, a specially-designed marmot facility was constructed at Mount Washington on Vancouver Island; the intent was that this facility would serve as a “halfway house” to habituate marmots to local conditions prior to release. This facility was completed in 2002. A total of 56 wild-born marmots were taken into captivity from 1997 through 2004. Most animals were captured as pups (n = 31) or yearlings (n = 8). This age-bias was intentional; the reasoning was that younger marmots would more readily habituate to captivity. In addition the intent was to minimize disruption to established breeding pairs at wild colonies. Marmots inhabiting man-made clearcut habitats were also preferentially targeted, and in three cases “sole survivors” from historically larger colonies were captured (Bryant,

2005). The management philosophy at all captive facilities was to minimize handling so that marmots might retain natural behavior. Animals were not on public display and strict quarantine protocols were followed to minimize the risk of between-facility disease transmission. Breeding pairs were selected and housed together based on a genetic studbook, and marmots were allowed to hibernate as they do in the wild (McAdie *et al.*, 2003). A total of 171 pups were born in captivity from 2000-2006, including 56 in 2006 alone. Annual survival rates were high (*S* = 95.3%) and the observed population growth rate was positive (lambda = 1.31).

Transplants of Wild-born and Releases of Captive-born Marmots

Re-introduction efforts involved transplants of wild-born marmots and releases of captive-born marmots. Efforts began modestly, with six marmots being captured from clearcut sites and transplanted to a single natural meadow in July of 1996. This initial experiment was unsuccessful, with four animals dying during hibernation, one apparently being killed by a predator, and one disappearing. Numbers of transplanted marmots thereafter remained small due to a lack of candidate animals, although in several cases solitary wild females were provided with a wild-born male to ensure the possibility of reproduction. The first two captive-born marmots were released in 2003. Numbers have gradually increased over time, with 31 animals being released in 2006 (***see table 1***). Given the current captive population size and growth rate, the Team envisions release of 30 - 50 marmots annually without negative demographic or genetic impacts to the captive population.

Release methods were straightforward. After being surgically implanted with a radio transmitter (Bryant & Page, 2005) and allowed to recover, marmots were released in natural meadows that were historically or currently occupied by marmots. Most individuals were provided with a plywood shelter box and food for several weeks; other releases were "hard" with no site preparation or supplemental feeding. A variety of age-classes and group sizes were released, including yearlings, two-year-olds and adults, with group sizes of two being most common (range = 1 - 6). Marmots were monitored using radio-telemetry, with some sites being visited daily and others only every week or two. At one site an electrified fence was erected in an effort to deter terrestrial predators (***see photo 2***). At another site several anti-predator approaches were employed simultaneously, including human "shepherds", radios left playing in tents, tape-recordings of barking dogs, and use of "bear-banger" noisemakers.

Photo 2: Shelter box & anti-predator fence at Green Mountain 2005 © Andrew A. Bryant

Table 1: Annual numbers of marmots taken into captivity, transplanted and released

	Into captivity 1				Transplanted 2		Released 3			
Year	Male (m)	Female (f)	Total	N captured as pups	Male (m)	Female (f)	Male (m)	Female (f)	Total	N subsequently recaptured
1996			-		3	3			6	
1997	2	4	6	2 f					-	
1998	6	2	8	3 m					-	
1999	9	10	19	6 m, 4 f					-	
2000	3	2	5	2 m, 2 f		2			2	1f
2001	3	4	7	2 m, 3 f	1				1	
2002	4	2	6	2 m, 2 f					-	
2003	4		4	2 m	2		2	2	6	1 f
2004		1	1	1 f			5	4	9	
2005			-				11	4	15	
2006			-				20	11	31	1 m
Totals	31	25	56	17 m, 14 f	6	5	38	21	70	1 m, 2 f

Notes: 1) wild-born marmots (excluding three recaptures of previously released marmots); 2) wild-born marmots with little or no time spent in captivity prior to release & 3) captive-born or wild-born marmots that spent at least one winter in captivity prior to release.

Success to Date

The captive-breeding component of the recovery project has been resoundingly successful. Re-introduction success is more difficult to evaluate, and it would be premature to describe efforts as successful or unsuccessful. The Team designed short-term measures-of-success that are sequential, explicit and measurable, with the intention of determining what factors encourage success. The measures included:

- Immediate post-release site-fidelity and survival.
- Use of historical marmot habitat (burrows, vegetation and lookout spots).
- Weight gain (similar to that of wild marmots).
- Social behavior (grooming, nose-greeting and sleeping behavior).
- Anti-predator behavior (whistling or retreat into burrows when approached).
- Timing of hibernation (compared to wild marmots).
- Survival rate during hibernation (compared to wild marmots).
- Site-fidelity and appropriate social behavior in subsequent spring.
- Successful reproduction in subsequent years.

All of these measures of success have been achieved, although not all were achieved by all animals. Some marmots quickly adapted to release habitats and behaved just as their wild-born counterparts do, eating grasses and flowers, gaining weight, whistling when an eagle flew over, digging burrows and hibernating at appropriate times. One milestone was achieved in 2002, when a transplanted male produced a pup with a wild-born female. Another milestone was reached in 2004 when a captive-born male produced pups after mating with a wild female. In 2006 two captive-born marmots that were released in 2004 produced a litter of 4 pups, becoming the first captive-born pair to achieve the 9th measure of success. Other marmots were less successful, dispersing immediately from the release site, showing up in unsuitable habitat, or choosing sites that prevented successful hibernation. A few marmots made impressive (1 - 27 km) dispersal movements to other historical marmot habitats, where more often than not there was no potential mate present. Other re-introduced marmots were killed by wolves, cougars or golden eagles, just as wild marmots were (Bryant & Page, 2005). The anecdotal evidence to date is that it is easier to introduce a male to a female rather than vice versa, that marmots can be successfully introduced at any time from May through September, and that while presence of existing burrows and marmots is an asset, they are not essential.

It will take many more years of patient data-collection to quantify the various factors that may encourage or discourage successful re-introduction, but the fact remains that there are marmots on five mountains at which extinction occurred during the 1990s, and that captive-born marmots can and have survived and bred in the wild. Ultimately the prognosis is hopeful.

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Florida panther re-introduction, Florida, USA

The Florida panther (*Puma concolor coryi*) is the last subspecies of *Puma* still surviving in the eastern United States. Historically occurring throughout the southeastern United States, today the panther is restricted to less than 5% of its historic range in one breeding population of less than 100 animals, located in south Florida. The panther is threatened with extinction and human development in panther habitat negatively impacts recovery. Panthers are wide ranging, secretive, and occur at low densities. They require large contiguous areas to meet their social, reproductive, and energetic needs. Panther habitat selection is related to prey availability (i.e., habitats that make prey vulnerable to stalking and capturing are selected). Dense understory vegetation provides some of the most important feeding, resting, and denning cover for panthers. Habitat degradation, fragmentation, and loss are among the greatest threats to panther survival, while human's lack of tolerance is one of the greatest threats to panther recovery. Problems associated with being a single, small, isolated population and vehicle strikes have continued to keep the panther population at its current low numbers. Potential panther habitat throughout the Southeast continues to be affected by urbanization, residential development, conversion to agriculture and silviculture, mining and mineral exploration, and lack of land use planning that incorporates panther needs. The recovery strategy for the Florida panther is to maintain, restore, and expand the panther population and its habitat in south Florida, expand