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Predation on Turtles and Tortoises by a "Subsidized Predator"

— SUMMARY REPORT —

WILLIAM I. BOARMAN

U.S. Geological Survey, Biological Resources Division, 6221 Box Springs Blvd., Riverside, CA 92507, USA
[e-mail: william_boarman@usgs.gov]

While predation is a natural source of mortality for turtles and tortoises, it can become an important factor affecting the survival of populations that are in decline. Predators can be assigned to two categories: those that cause natural levels of mortality and those that elevate mortality to unnaturally high levels. "Subsidized predators" are those animals, native or introduced, whose populations flourish as a result of close association with humans and human-altered habitats. The "subsidies" provided to these predators by humans include ready access to food, water, and shelter, which increase their chances of (1) survival during times when resources are limited, (2) greater reproductive success, and/or (3) expanding their geographic range.

In the Mojave and Colorado deserts of the southwestern United States, populations of the common raven, *Corvus corax*, have undergone tremendous increases in recent years (over 1000% from 1968 to 1992, Boarman and Berry, 1995). These increases are attributable to increased food and water from landfills, urban expansion, agriculture, and other human activities, as well as to additional nesting sites provided by high-tension electric line towers, telephone poles, bridges, other artificial structures, and cultivated trees. Ravens, in addition to coyotes (*Canis latrans*), kit foxes (*Vulpes macrotis*), and other native predators, prey on hatchling and juvenile (up to seven years old) desert tortoises (*Gopherus agassizii*), a species designated as "Threatened" under the U.S. Endangered Species Act. Two hundred fifty tortoise shells were found beneath one active raven nest in the Western Mojave Desert of California over a two-year period. Shells showing evidence of raven predation have been found beneath raven nests, electric transmission towers, telephone poles, signs, fence posts, and trees, as well as on the desert floor away from elevated perches. Evidence of predation includes holes pecked into the soft or thin portions of the carapace or plastron and head or limbs removed.

A plan, under development by the United States Bureau of Land Management (USBLM), to reduce raven predation on desert tortoises focuses primarily on reducing the food subsidies responsible for maintaining high raven densities. The plan also calls for elimination of specific ravens, monitoring the interactions between raven and juvenile tortoise populations, study of raven ecology, and cooperation with other government agencies to ensure a coordinated strategy. The long-term plan seeks to reduce the availability of anthropogenic subsidies, thereby decreasing the number of ravens. The USBLM is working with landfill managers and sponsors of proposed large-scale landfill projects to ensure that garbage will remain covered day and night. Methods are also being developed to modify sewage containment practices and to limit other sources of water. Experiments are planned to test chemical repellents (e.g., methylanthranilate) that may deter ravens from eating garbage or drinking water at specific locations.

Removal of ravens will be limited those individuals known to prey on juvenile tortoises and all ravens hunting within specific, limited areas where the tortoise populations are declining rapidly and raven predation is known to occur. More aggressive elimination will be implemented only when scientific evidence shows that broader, non-specific removal is necessary to effect the recovery of tortoise populations. Rifles, shotguns, and trapping will be used to kill or remove the targeted ravens.

Knowledge of the ecology and behavior of the predator is essential to design an effective program. Research now being conducted by the U.S. Geological Survey will focus on the dynamics of raven territoriality, dispersal, and daily movements among natural and anthropogenic resources to better understand the contributions that anthropogenic subsidies make to raven predation on tortoises. The relative effectiveness of reducing predation on tortoises by shooting, poisoning, live trapping, relocating, and disrupting the behavior of the birds is also under investigation.

Because the goal of the program is to improve survival of juvenile tortoises, its success will be measured by a significant increase in the numbers of juveniles in tortoise populations. Therefore, improved methods to monitor numbers of hard-to-find juvenile tortoises will also be developed and tested. Population trends must be measured with proper controls to ensure that any observed increases in juvenile numbers are not due to other negative factors.

Corvids and other subsidized predators are threats to certain turtle and tortoise species in other parts of the world. For example, brown-necked ravens (*Corvus ruficollis*) prey on juvenile Mediterranean spur-thighed

tortoises (*Testudo graeca*) and Egyptian tortoises (*Testudo kleinmanni*) in Israel (Geffen and Mendelssohn, this volume). While the plan under development by the USBLM is specifically tailored to the biological, political, and economic circumstances in the United States, it may be adaptable to similar problems elsewhere (Boarman, 1993).

Factors to consider when evaluating a predator management program are whether (1) the predator in question is at least partially responsible for either causing the population to decline or preventing recovery, (2) the proposed solutions will solve the problems caused by predation, (3) reducing predation will alone effect the recovery of the threatened populations, or other measures may also be required, and (4) the predator itself is an endangered or threatened species (Boarman, 1993).

LITERATURE CITED

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