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## Eradication of Invasive Rodents on Islands of the United States

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**ABSTRACT** Many invasive rodents have become established in the United States and its territories. The list of invasive species includes several species of rats (*Rattus* spp.), house mice (*Mus musculus*), nutria (*Myocastor coypus*), Gambian giant pouched rats (*Cricetomys gambianus*), arctic ground squirrels (*Spermophilus undulates*), hoary marmots (*Marmota caligata*), voles (*Microtus* spp.), and deer mice (*Peromyscus* spp.). Some were introduced inadvertently (e.g., stowaways on ships or in cargo) while others were introduced purposefully (e.g., for the fur industry). Other less common reasons include rodents being put on islands as a source of food for people or introduced foxes and rodents put on islands to study rodent species interactions. In many cases, these rodents have caused serious damage to native flora and fauna, agriculture, and other resources and have resulted in disease introductions (e.g., Howald et al. 2007, Witmer and Proulx 2010, Witmer and Singleton 2010, Fall et al. 2011).

**KEY WORDS** eradication, introductions, invasive species, management, United States, vertebrates.

Since the early 1990s, agencies have been eradicating rodents from various islands, primarily for conservation purposes. Witmer et al. (2011) documented the attempted eradications of introduced rodents in the United States and its territories. Of about 40 island eradication attempts, 22 (55%) or more appear to have succeeded. For several islands, however, it is too early to determine if the attempted eradication has been successful or not. Additionally, experimental rat eradication trials on 12 small islands in The Bay of Islands, Adak, Alaska, failed, or rapid re-invasion occurred, and those perhaps should not be included in the list of more concerted eradication efforts. In some cases, what appeared to be failed eradications may have resulted from rapid re-invasion by rats from nearby islands, suggesting the need to eradicate rats from groups of islands as an unit. Genetic analyses of DNA from rats before and after eradications are helping sort out the issue of re-invasion versus failed eradications. Numerous additional eradications are underway or being planned. Most rodent eradications around the world have used the second-generation anticoagulant brodifacoum (Howald et al. 2007). In the United States, however, most eradications have used the first generation anticoagulant diphacinone. Initial rodent eradications used hand-broadcast and bait station of rodenticides, but in recent years, aerial broadcast via helicopter has become common. This allows rodent eradications on much larger and more rugged islands. A variety of mitigation measures are employed to reduce nontarget hazards and environmental impacts. Examples include the rodenticide type,

formulation, method and timing of baiting; placement of some nontarget wildlife species in captivity until after the baiting operation; removal of rodent carcasses; and avoidance of bait placement in aquatic systems (Witmer et al. 2007b).

A number of challenges remain with invasive rodent management and eradication in the United States. Some of the challenges faced include the public and agency concerns about the use of toxicants and traps, land access (especially to private lands), public attitudes, resource availability, and detection and monitoring difficulties (Witmer and Hall 2011). Nonetheless, we will hopefully continue to relieve the burdens on insular ecosystems caused by rodent introductions. The flora and fauna of islands generally respond favorably and rapidly after invasive rodents are removed. Endemic, threatened, or endangered species can be, and have been, re-introduced after successful rodent eradications. For example, the endangered St. Croix ground lizard (*Ameiva polops*) was recently re-introduced to Buck Island in the U.S. Virgin Islands after the successful eradication of roof rats (*Rattus rattus*; Witmer et al. 2007a).

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