Pacific Science (1988), vol. 42, nos. 3–4

The Extinction of *Partula* on Moorea[1]

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ABSTRACT: Land snails of the genus *Partula* from the island of Moorea in French Polynesia have for more than a century provided a natural laboratory for the study of variation, genetic polymorphism, and speciation. As a result of the intentional introduction of the predatory snail *Euglandina rosea*, all the species of *Partula* from Moorea are now extinct in the wild. Since *Euglandina* is spreading rapidly on Tahiti, the demise of *Partula* on that island also is imminent. Attempts are being made through the International Union for the Conservation of Nature for the captive breeding of those stocks that remain in the laboratory.

OWING TO THEIR unusual diversity, land snails of the genus *Partula* inhabiting the island of Moorea in French Polynesia have excited the interest of students of variation and evolution for more than a century (Crampton 1932, Garrett 1884, Johnson et al. 1986, Murray and Clarke 1980). In an earlier paper (Clarke et al. 1984), we reported a threat of imminent extinction of these animals following the introduction of the predatory snail *Euglandina rosea*. This note simply documents the final stage of that unfortunate chain of events.

The tragedy was set in motion in 1967 by the introduction of *Achatina fulica*, the giant African snail, into Tahiti for food. It quickly spread to the other islands of the Society group and became a serious agricultural pest. The subsequent introduction of *Euglandina* was a misguided attempt to control the enormous populations of *Achatina*, despite the lack of evidence that *Euglandina* has ever been effective in doing so (Mead 1979). The impact of *Euglandina* on *Partula*, however, has been disastrous (Clarke et al. 1984, Pointier and Blanc 1984).

FIELD WORK, 1987

Recognizing that a number of species of *Partula* were in grave danger of extinction, the Captive Breeding Specialist Group of the International Union for the Conservation of Nature (IUCN) arranged a meeting in London during April 1987 to consider steps for their rescue. The working party recommended, among other things, an immediate attempt to collect any remaining Moorean species to supplement the stocks already held in captivity. Supported by the IUCN, two of us (J. Murray and E. Murray) spent 3 weeks in June and July 1987 in French Polynesia surveying the current situation and collecting the species that could still be found.

On the basis of an extensive survey of Moorea, we believe that the *Partula* of that island are extinct in the wild. We visited 16 valleys on the island, paying particular attention to two possibilities for locating relict populations. First, populations might be present high up in the heads of the valleys. We climbed to the ridge crest in four valleys, Paparoa, Faamaariri, Uufau, and Maramu, and searched without success (Figure 1). We know that *Partula* formerly occupied at least three of these crests, and probably all four. Moreover, *Euglandina* was found at or near the top in every case. Second, populations might be cut off and protected by minor geographical or ecological barriers. We visited three valleys that might provide such isolation, Tehaoa and

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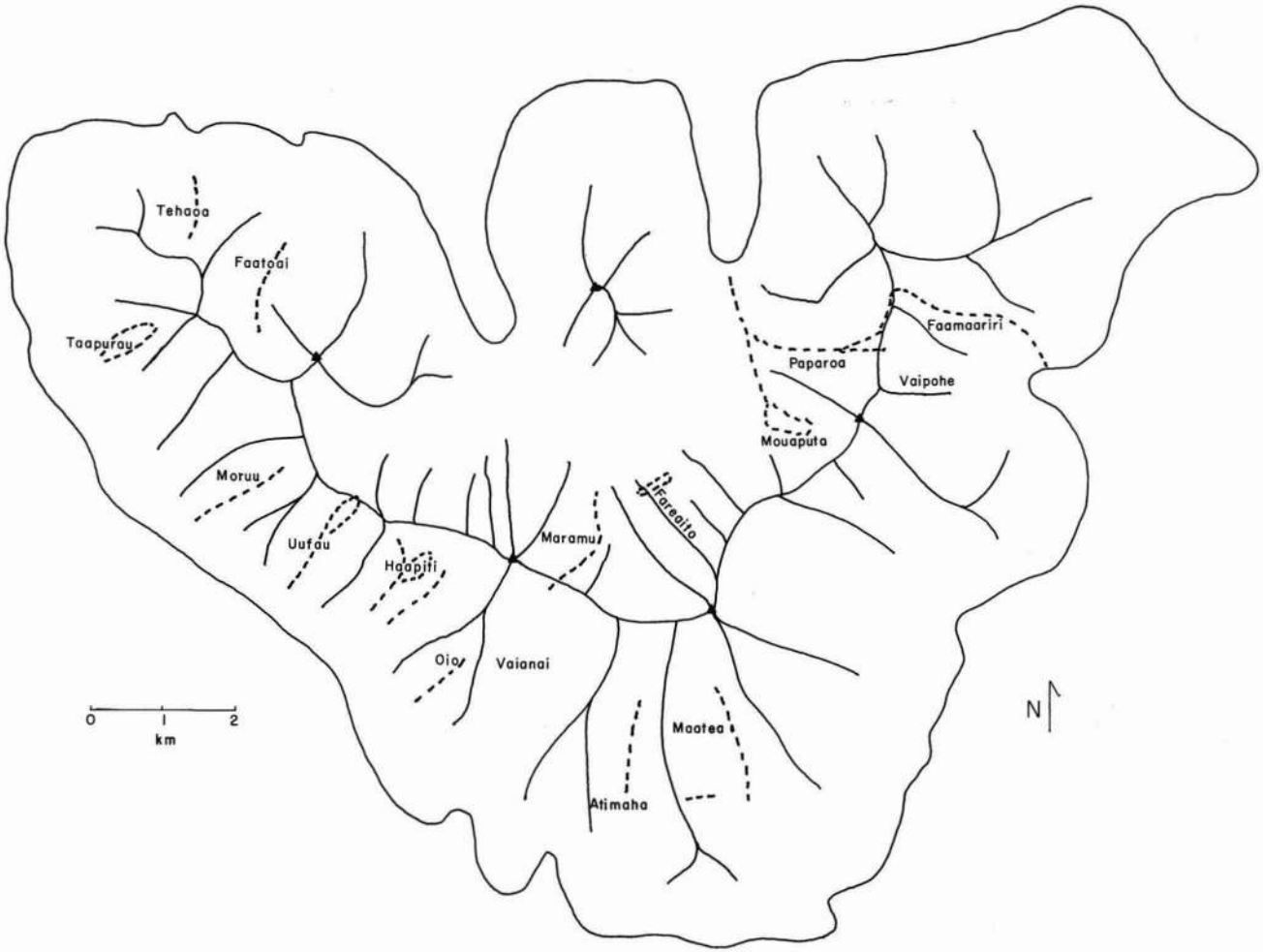

FIGURE 1. A map of Moorea showing field work undertaken in 1987. Solid lines mark the mountain ridges. Dashed lines indicate routes followed in searching for *Partula*.

Taapurau in the northwest and Oio in the south. In each valley we found living *Euglandina* but no *Partula*. While we cannot, of course, be absolutely sure that there are no surviving populations of *Partula*, we believe the probability is very small. We conclude that *P. suturalis* (including *P. dendroica*), *P. taeniata*, *P. tohiveana* (including *P. olympia*), *P. mooreana*, *P. aurantia*, *P. mirabilis*, and *P. exigua* all should be considered extinct in the wild; and *P. exigua*, of which no living animals survive in captivity, is considered completely extinct. The last wild *Partula* on Moorea were seen in Haapiti Valley during November 1986 (by B. Clarke), and samples were collected for captive breeding.

On Tahiti, *Partula* still exist, but the situation is deteriorating rapidly. In 1984, the area invaded by *Euglandina* extended from Taravao to Papara on the south coast (Figure 2). Our samples from 1987 show that, unless there has been some leapfrogging, the infested area now extends all the way to Pirae in the northwest. We have positive evidence for the persistence of *Partula* in only two valleys, Tiarei (Honofea) and Mahaena. The remaining populations represent *P. otaheitana rubescens*, *P. affinis*, *P. hyalina*, and *P. clara*.

On Huahine, *Euglandina* has not yet been introduced, and *Partula* species continue to flourish. We have confirmed that *P. varia* and *P. rosea* are still represented by substantial

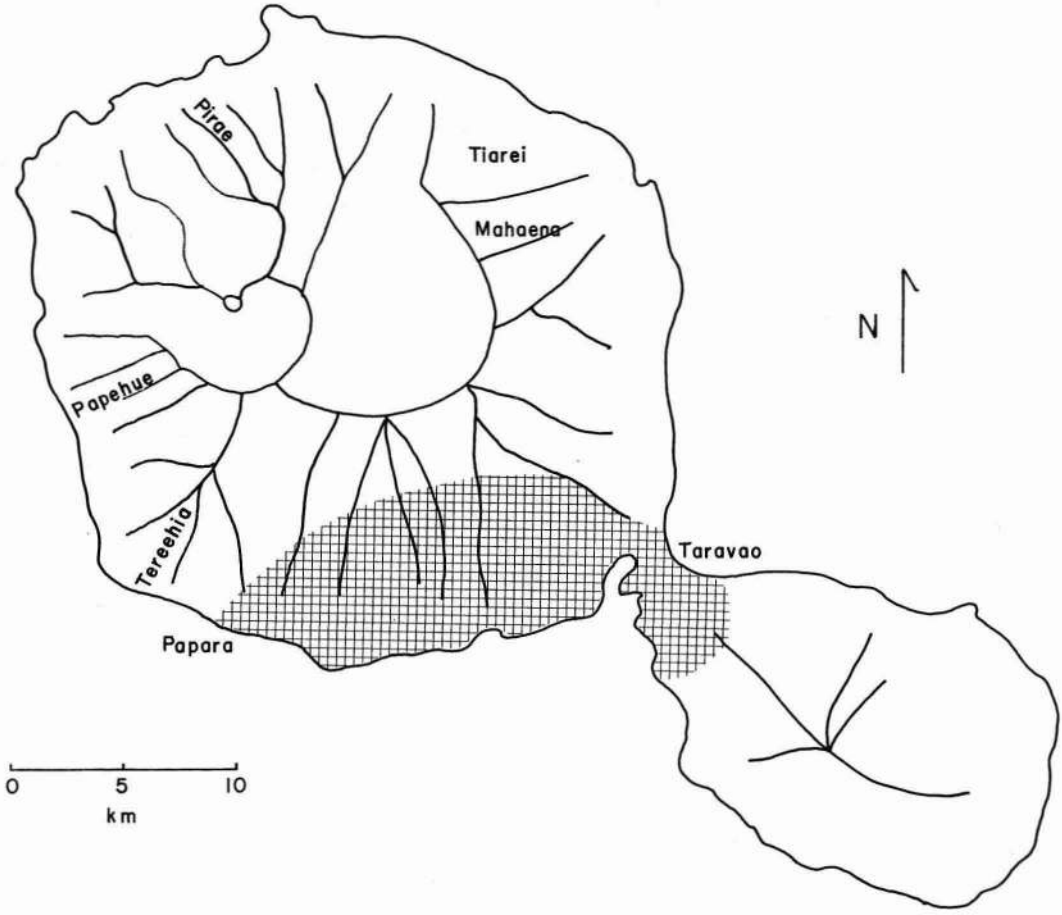

FIGURE 2. A map of Tahiti. Solid lines mark the mountain ridges. Cross hatching indicates the area known to be infested with *Euglandina rosea* in 1984. By 1987, *Partula* had disappeared from the valleys of Pirae, Papehue, and Tereehia, but could still be found in Tiarei and Mahaena.

populations, despite the fact that these two species are exploited for the trade in shell jewelry. The economic importance of these species might provide a basis for a campaign against the importation of *Euglandina*. There is no reason to believe that *P. arguta*, a rare montane species, is in danger. The introduction of *Euglandina* to any of the other islands should be rigorously discouraged.

CONSERVATION EFFORTS

Despite the loss of the wild populations of Moorean *Partula*, the situation is not hopeless. In the laboratories of our three home institutions, representatives of all the Moorean species except *P. exigua* are still living. Under the auspices of the Captive Breeding Specialist Group, efforts are being made to organize a captive breeding program at a number of zoos in the United States and Europe. The first breeding units have been established at the Jersey Wildlife Preservation Trust and at the London and Berlin zoos. Several institutions have expressed interest in cooperating in the captive breeding program.

We are also exploring the possibility of establishing enclosed wild populations of *Partula* on Moorea. Two biological stations on the island, the Centre de l'Environnement, Île de Moorea (Antenne de Museum National d'Histoire Naturelle) and the Gump Biological Station of the University of California (Berkeley), may be able to help with the establishment and monitoring of exclosures (fenced areas from which the carnivores have been removed).

Our initial hope that the wave of extinction created by *Euglandina* would be followed shortly by the disappearance of the predator has not yet been realized. We do not know how the sparse residual populations of *Euglandina* are maintaining themselves. Although the carnivore can eat *Achatina*, the African snails are now very scarce on Moorea. *Euglandina* can still be found even in those areas that have been longest devoid of *Partula*. The extermination of *Euglandina* by artificial control measures does not seem to be practicable, and we can only continue to hope for its natural elimination through unstable oscillations in an unusually simple predator-prey system, or through cannibalism.

ACKNOWLEDGMENTS

We thank the members of the Centre de l'Environnement, Île de Moorea, especially René Galzin and Joel André, for their interest in our work and their offer of support. We are indebted to Werner Loher and to Rick and Bonnie Steger for their hospitality at the Gump Biological Station of the University of California (Berkeley) on Moorea. Finally, we appreciate more than we can say the financial support of the Captive Breeding Specialist Group of the International Union for the Conservation of Nature, and particularly Ulysses Seal, who made the whole venture possible. We hope that the survival of at least some species of *Partula* will be their reward.

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