

CANDIDATE ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC NAME: *Partula radiolata*

COMMON NAME: Guam tree snail; akaleha

LEAD REGION: Region 1

INFORMATION CURRENT AS OF: February 2003

STATUS/ACTION (Check all that apply):

New candidate

Continuing candidate

Non-petitioned

Petitioned - Date petition received: ____

90-day positive - FR date: ____

12-month warranted but precluded - FR date: ____

Is the petition requesting a reclassification of a listed species?

Listing priority change

Former LP: ____

New LP: ____

Latest date species first became a Candidate: _____

Candidate removal: Former LP: ____ (Check only one reason)

A - Taxon more abundant or widespread than previously believed or not subject to a degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.

F - Range is no longer a U.S. territory.

M - Taxon mistakenly included in past notice of review.

N - Taxon may not meet the Act's definition of "species."

X - Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Partulidae (Snail)

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Guam

CURRENT STATES/COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Guam

LEAD REGION CONTACT (Name, phone number): Scott McCarthy, 503-231-6131

LEAD FIELD OFFICE CONTACT (Office, name, phone number): Pacific Islands (Ecological Services), Mike Richardson, 808-541-3441

BIOLOGICAL INFORMATION:

The three genera and 123 tree snail species of the family Partulidae are restricted to the high-elevation Pacific islands of Polynesia (excluding Hawaii), Melanesia, and Micronesia (Cowie 1992 and Paulay 1994). These snails have received increased attention in recent years due to

declining numbers throughout their range and, in some cases, due to extinction (Clarke et al. 1984; Murray et al. 1988; Hopper and Smith 1992; Miller 1993). The high islands of the Mariana archipelago historically supported five species of partulid tree snails, and represent the northwestern limit of the geographical range of the Partulidae.

The genus *Partula* has four species found only in the Mariana Islands, and 94 additional species recorded from other Pacific islands. Thirty-seven of these 98 species are extinct in the wild including the Guam endemic *Partula salifana*, which has not been seen since 1946 (Pearce-Kelly et al. 1994). An additional 37 species are declining in numbers, and 24 species are of indeterminate status due to insufficient information. The genus *Samoana* is represented in the Mariana Islands by a single species, *Samoana fragilis*. Twenty additional species are recorded from other islands in the Pacific basin. Ten of these 21 species are declining in numbers, including the Mariana Islands endemic. The status of 11 other species is unknown (Pearce-Kelly et al. 1994). Four partulid species are in the genus *Eua*, which are confined to the Polynesian islands of Tonga and Samoa in the south Pacific. One of these is known to be declining in numbers, while the status of each of the remaining three species is unknown (Pearce-Kelly et al. 1994).

Overall, 30 percent of the 123 partulid species are extinct and 39 percent are declining toward extinction. For 31 percent of the species, the current status cannot be characterized due to insufficient information. In no case has a Partulid tree snail species been shown to have stable or increasing numbers of individuals or populations.

The biology of several of the partulid tree snails of the Mariana Islands is currently being studied by B.D. Smith at the University of Guam (B. Smith, pers. comm., 1996). While detailed information from these studies is not currently available, general information on the biology of closely related partulid tree snails have been published and reviewed by Cowie (1992). As with all terrestrial pulmonate snails, the Mariana Islands tree snails are hermaphroditic. In general, Partulid snails begin reproducing in less than 12 months and may live up to 5 years. Up to 18 young are produced each year and some species, such as the humped tree snail of the Mariana Islands, may be self-fertile. While most terrestrial snails lay eggs, the Partulid tree snails give birth to fully developed young. The snails are generally nocturnal, living on bushes or trees and feeding on decaying plant material. There are no known natural predators of these snails, although many of these species are currently threatened by alien snail predators. These partulids, including those of the Mariana Islands, prefer cool, shaded forest habitats (Crampton 1925; Cowie 1992; Smith 1995) with high humidity and reduced air movement that might otherwise lead to excessive water loss.

The Pacific tree snail (*Partula radiolata*) was first collected by Quoy and Gaimard during the French Astrolabe expedition of 1828 (Crampton 1925). The Pacific tree snail is restricted to the island of Guam. However, Pfeiffer erroneously reported it to occur on the island of New Ireland in the Bismarck Archipelago, approximately 2,253 kilometers (1,400 miles) to the south of Guam. This error was perpetuated by other authors, most recently by Parkinson et al. (1987). This mistake in location was originally corrected by Crampton (1925) in his definitive monograph of the Partulidae of the Mariana islands. The most recent compilation of information on the entire family (Pearce-Kelly et al. 1994) agrees with Crampton in listing the Pacific tree snail as endemic to the island of Guam.

Since the work of Crampton (1925), no significant evaluation of *Partula radiolata* occurred until the 1980s and 1990s. In 1989, Hopper and Smith (1992) resurveyed 34 of Crampton's 39 sites on Guam plus 13 new sites. Crampton (1925) found *Partula radiolata* at 37 of the 39 sites and collected between 2 to 312 snails from each site; a total of 2,278 individuals were collected. The actual population sizes were probably considerably larger since the purpose of Crampton's collections was to evaluate geographic differences in shell patterns and not to assess population size. Nine of the 34 sites resurveyed by Hopper and Smith (1992) still supported these snails in 1989. Hopper (D. Hopper, University of Hawaii, pers. comm., 1997) estimated that the total number of snails at these sites were approximately 1,000 snails. Since 1989, the Crampton site with the largest remaining population of *Partula radiolata* (estimated at greater than 500 snails) has been completely eliminated by the combined effects of a land clearing for a residential development and a subsequent series of typhoons in 1990, 1991, and 1992 (Smith 1995).

Of the 13 new sites surveyed by Hopper and Smith (1992), seven supported populations of *Partula radiolata*; one of these was eliminated in 1991-1992 by wildfires that burned into ravine forest occupied by the snails (Smith and Hopper 1994). Additional surveys by Smith (1995) found five additional populations of *Partula radiolata*. Service surveys of 15 sites on the Guam Naval Magazine located one additional population, while ground shells of tree snails were found in abundance at all locations (Miller and Asquith, Service, Pacific Islands Office, pers. comm., 1996). To date, there are 20 sites that still support small populations of *Partula radiolata*. At one of these sites, snails were moved to a new location due to the development of a golf course on the tree snail habitat (Smith 1995). The best estimate for the total number of remaining snails is less than 2,000.

Hopper and Smith (1992) estimated that the number of sites that support *Partula radiolata* have decreased by 74 percent since Crampton's work in 1920. Habitat loss to development as well as man-made and natural disasters such as wildfires and typhoons continues to threaten the continued existence of the remaining populations. If the recent rate of loss of populations (3 of 23 sites since 1989 or about 0.5 sites per year) continues, the species will be extinct by about the year 2039.

THREATS:

A. The present or threatened destruction, modification, or curtailment of its habitat or range.

Crampton (1925) described the habitat requirements of the partulid tree snails of the Mariana Islands as follows: "...the indispensable requisites are that there shall be a sufficiently high and dense growth to provide shade, to conserve moisture, and to effect the production of a rich humus. Hence the limits to the areas occupied by Partulidae are set by the more ultimate ecological conditions which determine the distribution of suitable vegetation." In fact, the ecological settings that meet the basic requirements for partulid snail were numerous in the Mariana Islands prior to World War II. They include coastal strand vegetation, forested river borders, and lowland and highland forests (Crampton 1925). Crampton (1925) further describes the intact structure of native Mariana forests as having four general levels: the high trees; the shrubs and *Pandanus*; the cycads and taller ferns; and the succulent herbs. He notes that the Mariana Islands partulid tree snails preferentially live on subcanopy vegetation and do not use the high canopy trees.

Prior to the arrival of humans, the Mariana Islands were believed to be mostly forested (Fosberg 1960, 1971). With the arrival and population growth of the aboriginal Chamorro people 4,000 years ago (Carano and Sanchez 1964), native forests began to be cleared and savanna grasslands began to develop (Mueller-Dumbois 1981). During the Spanish occupation of the Mariana Islands (1521-1899), alien goats, pigs, cattle, and deer were introduced. Extensive herds of cattle were noted on the main islands, with some herds numbering in excess of 10,000 head. Large numbers of pigs, goats and deer were also present (Engbring *et al.* 1986; Carano and Sanchez 1964). These animals, along with extensive logging, further contributed to the expansion of savanna grasslands and directly altered the understory plant community and overall forest microclimate. All of these changes resulted in a continuing decline in area and quality of tree snail habitat.

Sweeping ecological changes took place during the Japanese occupation from 1914-1944 (Kanehira 1936; Fosberg 1960, 1971; Engbring *et al.* 1986). Extensive removal of native forests for the development of sugar cane was pursued on all of the main islands. These fields covered almost all of Tinian and much of Guam, Saipan, Rota, and Aguijan. In 1920, Crampton (1925) commented on the loss of partulid tree snail habitat. He stated that much deforestation had occurred in the southern half of Guam and that the savanna grassland habitat, which is unsuitable for tree snails, had greatly expanded during “recent centuries”. He also notes that extensive wood cutting has reduced the forest canopy.

During and after World War II dramatic reductions in partulid tree snail habitats (Forest, riparian, and coastal strand) occurred on the islands of Guam, Tinian, and Saipan where major military operations and landings were conducted. Following the war, open agricultural fields and other areas prone to erosion were seeded with tangantangan (*Leucaena leucocephala*) by the U.S. Military (Fosberg 1960). Tangantangan grows as a single species stand with no substantial understory. The microclimatic conditions are dry, with little accumulation of leaf litter humus, and are particularly unsuitable as partulid tree snail habitat (Hopper and Smith 1992). In addition, native forest cannot reinvade and grow where this alien weed has become established (Hopper and Smith 1992). The post-war establishment and operation of large military bases has also prevented the return of native forest that could support partulid tree snails. Today on the island of Guam, the U.S. military occupies approximately 17,500 hectares (43,243 acres) or 30 percent of the island, most (90+ percent) of which once was forested habitat that supported the endemic tree snails.

B. Overutilization for commercial, recreational, scientific, or educational purposes.

Overutilization is not known to be a factor currently affecting any of the Mariana Partulidae. Future overutilization of this species is not anticipated. However, necklaces or leis made from partulid snails shells are occasionally found for sale. Any collecting of *Partula radiolata* could significantly contribute to the continued decline of the species and the local extinction of specific populations.

C. Disease or predation.

Crampton (1925) states, “There are no other animals in the Mariana Islands whose presence or

activities influence the lives or numbers of Partulae, so far as observation goes.” Since World War II, several introductions of alien predators have completely changed this historic condition. Predation by the alien rosy glandina snail (*Euglandina rosea*) and the alien Manokwar flatworm (*Platydemis manokwari*) is a serious threat to the survival of all four species of partulid tree snails from the Mariana Islands. The predatory rosy glandina snail is native to the southeastern United States, and was introduced into the Mariana Islands in 1957 by the governments of Guam and the Commonwealth of the Northern Mariana Islands, following the recommendations of the State of Hawaii Department of Agriculture (Eldredge 1988). Since being introduced, this voracious predator of snails has been dispersed by humans throughout the main islands. The rosy glandina snail was imported to these and other Pacific islands as a biological control agent for another alien snail, the giant African snail (*Achatina fulica*), which is an agricultural pest. However, while its effectiveness as a biological control agent against the giant African snail is questionable (Christiansen 1984; Tillier and Clarke 1983; Mead 1961), field observations have established that the rosy glandina snail will readily feed on native Pacific island tree snails, including the Partulidae such as those of the Mariana Islands (Murray *et al.* 1988; Tillier and Clarke 1983; Miller 1993) as well as Hawaiian achatinellid tree snails (Hadfield *et al.* 1993). A study of the diet of the rosy glandina snail on the island of Mauritius in the Indian Ocean showed that this alien predator preferred native snails over the targeted alien giant African snail (Griffiths *et al.* 1993). On some or all of these tropical islands, the rosy glandina snail has expanded its normal terrestrial feeding behavior to include native snails found in arboreal habitats (Hadfield *et al.* 1993; Miller 1993; Murray *et al.* 1988). The rosy glandina snail has caused the extinction of many populations and species of native snails throughout the Pacific islands (Hadfield *et al.* 1993; Miller 1993; Hopper and Smith 1992; Murray *et al.* 1988; Tillier and Clarke 1983). Where it still resides, the rosy glandina snail represents a significant threat to the survival of native Mariana Islands snails, including the four remaining partulid tree snails: *Partula gibba*, *Partula langfordi*, *Partula radiolata*, and *Samoana fragilis*.

Predation on native partulid tree snails by the terrestrial Manokwar flatworm is also a threat to the long-term survival of these snails. This voracious snail predator was introduced into Guam in 1978 and has been spread by humans throughout the main Mariana Islands (Eldredge 1988). It has proven to be an effective biological control agent for the giant African snail, but has also contributed to the decline of native tree snails, in part due to its ability to ascend into trees and bushes that support native snails. Areas with populations of the flatworm usually lack partulid tree snails or have declining numbers of snails (Hopper and Smith 1992). The first bio-control efforts directed at the giant African snail were conducted on the small island of Aguijan (also known as Aguijan or Goat Island) in the Mariana Archipelago (see Eldredge 1988 for a reviewed the history of the giant African snail in Micronesia). In May 1950, approximately 400 Kibwezi gonaxis snails (*Gonaxis kibweziensis*) were released on Aguijan Island. One year later, the number of Kibwezi gonaxis was estimated at 21,750, and the number of giant African snails was 1,122,500. Kondo (1952) concluded that this snail predator had little effect on the giant African snail. Two years later, Peterson (1954) observed Kibwezi gonaxis snails feeding on native snail species and on the giant African snail and cannibalizing its own young. By mid-1954, the population of Kibwezi gonaxis on Aguijan was estimated to be 80,800, and the giant African snail was estimated at 37,600 individuals (Davis 1954). Davis (1954) concluded that this snail predator was approximately 60 percent effective. Based on these conclusions, Kibwezi gonaxis snails were shipped to Hawaii and other Pacific islands for biological control of the giant African snail (Eldredge 1988).

D. The inadequacy of existing regulatory mechanisms.

Currently, no formal or informal protection is given to *Partula radiolata* by Federal agencies or by private individuals or groups. In 1996, the Government of Guam listed this species as endangered on Guam (5 GCA, Section 63205.(c), "The Endangered Species Act" of Guam), but this does not afford the species any protection.

E. Other natural or manmade factors affecting its continued existence.

Naturally occurring random events can affect the continued existence of *Partula radiolata* due to the small numbers of populations and individuals that remain. Physical events such as typhoons and droughts could eliminate one or more of the 20 remaining populations. This is especially true due to several life-history features of this and all other partulid tree snails (Cowie 1992): reproductive rates are low; eggs are not laid as in most terrestrial snails, but the young are born live; dispersal is very limited with most individuals remaining in the tree or bush into which they were born. All of these traits make these snails very sensitive to any stochastic event that could lead to a reduction or loss of reproductive individuals.

FOR RECYCLED PETITIONS:

- a. Is listing still warranted? ____
- b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? ____
- c. Is a proposal to list the species as threatened or endangered in preparation? ____

d. If the answer to c. above is no, provide an explanation of why the action is still precluded.

LAND OWNERSHIP:

All but six of the 20 sites that currently support snails are on lands owned by private land-owners. The remaining sites are on lands owned by the U.S. Military. Land ownership issues in Guam and The Commonwealth of the Northern Mariana Islands are highly controversial.

PRELISTING:

On Guam the Service is pursuing the establishment of a 11,395 ha (28,158 acre) refuge overlay on military lands. This would cover 19.6 percent of the total land area of the island of Guam, and would include six of the 20 remaining populations of this species.

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LISTING PRIORITY (* after number)

THREAT

Magnitude	Immediacy	Taxonomy	Priority
High	Imminent	Monotypic genus	1
		Species	2 *
		Subspecies/population	3
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/population	6
Moderate to Low	Imminent	Monotypic genus	7
		Species	8
		Subspecies/population	9
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

Rationale for listing priority number:

Magnitude:

Imminence:

APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes to the candidate list, including listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all additions of species to the candidate list, removal of candidates, and listing priority changes.

Approve: Rowan Gould March 6, 2003
Regional Director, Fish and Wildlife Service Date

Concur: _____
Director, Fish and Wildlife Service Date

Do not concur: _____
Director, Fish and Wildlife Service Date

Director's Remarks:

-

-

Date of annual review: 2/03
Conducted by: _____

Comments:

-

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