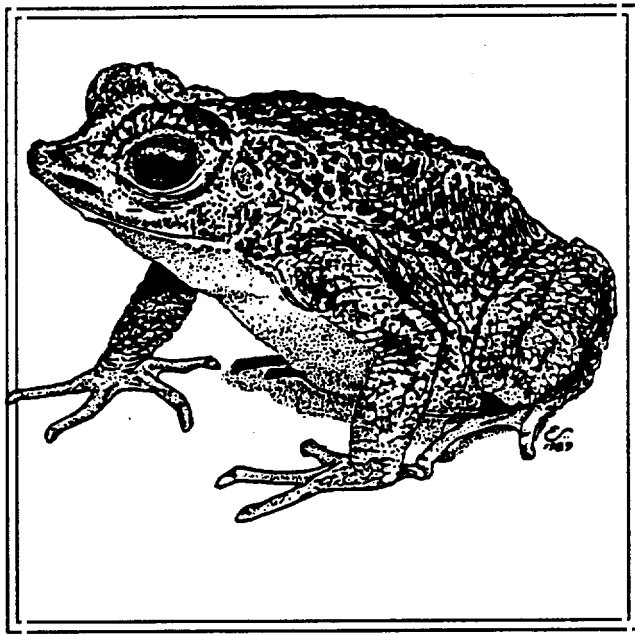


# RECOVERY PLAN

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## Puerto Rican Crested Toad



U.S. Fish and Wildlife Service



RECOVERY PLAN FOR THE  
PUERTO RICAN CRESTED TOAD  
(PELTOPHYRNE LEMUR)

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Date:

August 7, 1992

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Recovery plans delineate reasonable actions which are believed to be required to recover and/or protect listed species. Plans are published by the U.S. Fish and Wildlife Service, sometimes prepared with the assistance of recovery teams, contractors, State agencies, and others. Objectives will be attained and necessary funds made available subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities. Recovery plans do not necessarily represent the views nor the official positions or approval of any individuals or agencies involved in the plan formulation, other than the U.S. Fish and Wildlife Service. They represent the official position of the U.S. Fish and Wildlife Service only after they have been signed by the Regional Director as approved. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery tasks.

Literature citations should read as follows:

U.S. Fish and Wildlife Service. 1992. Recovery Plan for the Puerto Rican crested toad (Peltophryne lemur). Atlanta, Georgia. 19 pp.

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Fish and Wildlife Service Reference Service  
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**EXECUTIVE SUMMARY OF THE RECOVERY PLAN FOR THE  
PUERTO RICAN CRESTED TOAD PELTOPHRYNE LEMUR**

**Current Status:** This species is listed as threatened. Two populations are known in Puerto Rico (Guánica and Quebradillas). Historically, the species was found in nine locations in Puerto Rico and in one location in Virgin Gorda, British Virgin Islands.

**Habitat Requirements and Limiting Factors:** The Puerto Rican crested toad inhabits low-elevation arid or semi-arid, rocky areas with an abundance of limestone fissures and cavities in well drained soil. Habitat loss and predation are the principal threats.

**Recovery Objective:** Delisting.

**Recovery Criteria:** To establish and/or maintain six breeding populations viable for 10 years of the Puerto Rican crested toad, and to establish and/or maintain five captive populations.

**Actions Needed:**

1. Prevent further population decline and habitat loss.
2. Continue to propagate Puerto Rican crested toads suitable for reestablishment in the wild.
3. Establish at least three populations in the north and three in the south.
4. Develop an islandwide education program.

**Total Estimated Cost of Recovery:** Recovery costs for the Puerto Rican crested toad have been estimated at \$214,200.00 for the first 3 years. Subsequent expenditures will depend on the results of preliminary studies and therefore cannot be estimated at this time.

**Date of Recovery:** Delisting should be initiated when recovery criteria are met.

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## I. INTRODUCTION

The Puerto Rican crested toad (Peltophryne lemur) is the only native bufonid of Puerto Rico and the Virgin Islands. In Virgin Gorda, British Virgin Islands, the species has not been observed for at least 2 decades and is believed to be extirpated. Data on historical abundance in Puerto Rico is scarce. However, Pregill (1981b) speculated that the Puerto Rican crested toad was common throughout its habitat during the late Pleistocene period, based on cave fossil deposits. Historically, the species has been considered rare (Rivero 1978, Evans and Sarmiento 1982, Paine 1984) and thought to be extinct prior to 1966 (García-Díaz 1967). However, Pregill (1981b) and Thomas in Pregill (1981b) suggested that the animal probably was more common than thought because of inappropriate collection methods and because of the scarcity of sightings due to its semifossorial existence. Fresh water shrimpers near the Guajataca Commonwealth Forest on the north coast of Puerto Rico used to observe the toads when they came out to breed after heavy rains (Jorge Moreno, Puerto Rico Department of Natural Resources, pers. comm., 1991).

The Puerto Rican crested toad was determined to be a threatened species on August 4, 1987, pursuant to the Endangered Species Act of 1973, as amended (U.S. Fish and Wildlife Service 1987). This Rule became effective on September 3, 1987.

### Description

The Puerto Rican crested toad was first named and described by Cope (1868) and was later placed in the genus Bufo (Stejneger 1904). Recently, the native bufonids of the Greater Antilles have been regrouped under the genus Peltophryne, because of their presumed monophyletic origin (Pregill 1981a). The Puerto Rican crested toad is a medium-sized toad, 64 to 120 millimeters (2.5 to 4.5 inches) in snout-vent length, yellowish-olive to blackish-brown in color, with prominent supraorbital crests and a distinctive long, upturned snout. Males are considerably smaller than females, and exhibit less prominent crests (Rivero et al. 1980, Paine 1985, U.S. Fish and Wildlife Service 1987). Sexual dichromatism (males being more yellow than females) exists and is most apparent immediately prior to and during reproduction (Moreno 1985; Paine 1985; Bob Johnson, Metro Toronto Zoo, pers. comm., 1992). More detailed descriptions may be found in Stejneger (1904), Rivero et al. (1980), Pregill (1981a), and Miller (1985).

### Distribution and Abundance

The Puerto Rican crested toad is endemic to Puerto Rico and Virgin Gorda, both on the Puerto Rican Shelf. It is known from nine scattered localities in Puerto Rico and one in Virgin Gorda (Figure 1). The known historic distribution in Virgin Gorda is

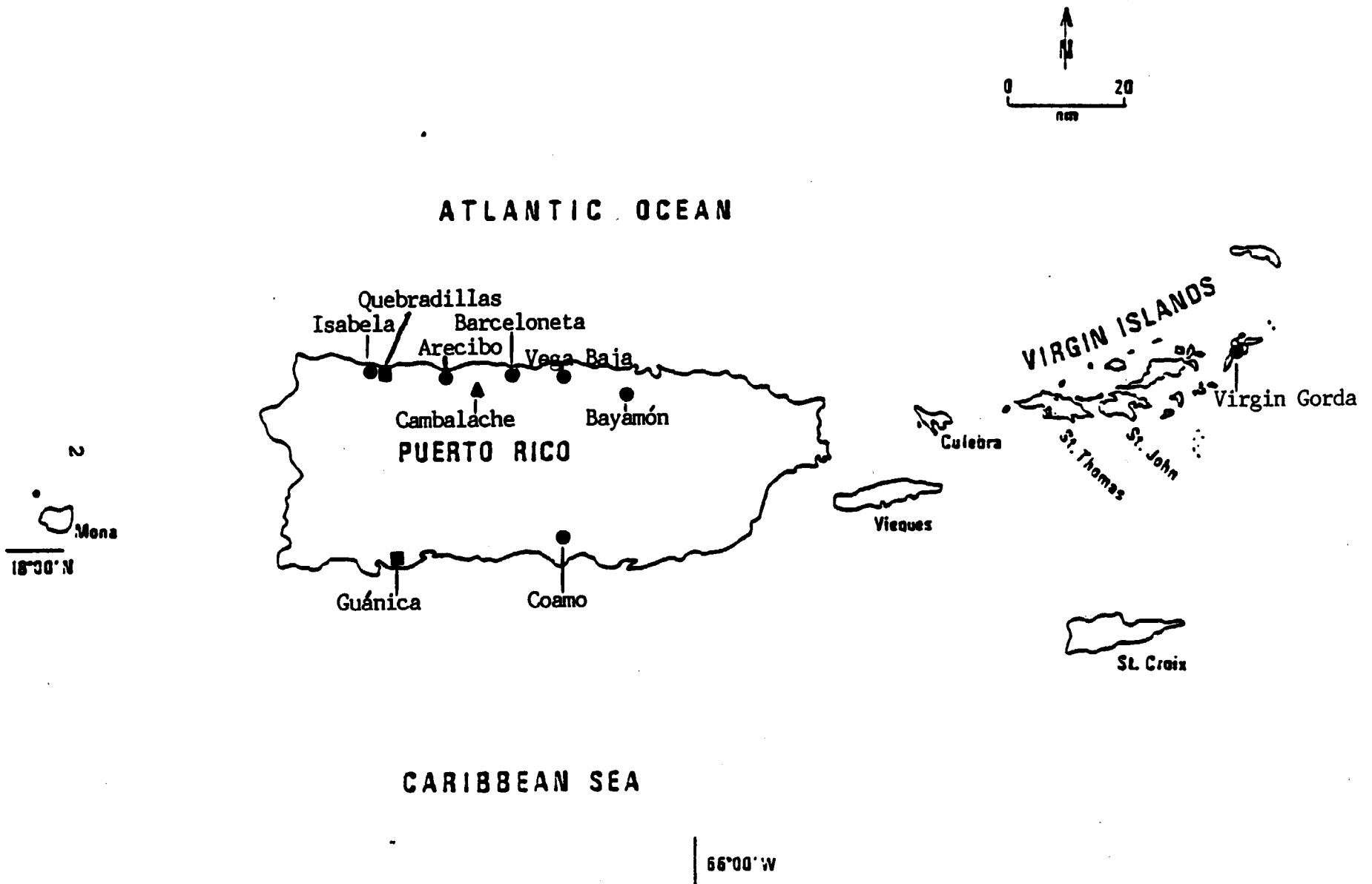


Figure 1. Map of the Puerto Rican Shelf indicating localities from which the Puerto Rican crested toad has been collected (●), current populations (■), and release site (▲).

limited. The species is thought to be extinct on this island, since it has not been observed there in many years. Specimens were last collected in 1964 by Thomas (1976).

At present, its range in Puerto Rico is limited to two known, isolated populations (Figure 1). The Guánica population, although small, is relatively stable and consists of approximately 2,000 individuals (Miguel Canals, Puerto Rico Department of Natural Resources, pers. comm., 1991). The Quebradillas population consists of approximately 25 to 50 individuals. However, no standardized quantitative population estimates have been obtained. Genetic research indicates that the two populations are distinct and must be managed separately. Nothing is known about population numbers in other localities, especially since the species is very difficult to detect.

### Habitat

In Puerto Rico, the crested toad occurs at low elevations (not exceeding 200 meters) where it appears to prefer arid or semi-arid, rocky areas with an abundance of limestone fissures and cavities in well drained soil (Rivero et al. 1980, Moreno 1985, Paine 1985). However, one historical site is a grassy field (Moreno 1985).

Post reproductive movements were investigated by Bob Johnson of the Metro Toronto Zoo in 1990. For 3 weeks following reproduction, 11 radiotracked toads moved into the hills surrounding the breeding pond. Dead-end holes in the limestone bedrock were used as daytime retreats as were underground chambers in the bedrock. The toads used small holes to access the underground chambers which often afforded lateral access under the rock. Toads were able to scramble up vertical rock faces and could be found in holes at least 45 centimeters (18 inches) above the ground in these vertical rock faces. Toads moved up to 1.5 kilometers (0.9 mile) in 3 nights before taking up residence in an area where movements averaged 10 meters (33 feet) a night. These latter movements were centered in an activity area with the toad often returning to a retreat that had been utilized several days previously.

### Reproduction

Maturation time of the Puerto Rican crested toad in the wild is not known. Paine (1985) suggested that it probably does not occur before the second year of life. In captivity, maturation based on reproduction was observed within 1 year of age (Paine 1985).

In the wild, breeding appears to be sporadic, highly dependent upon occasional heavy rains (Moreno 1985; Ernesto Estremera, pers. comm., 1991) concentrated in a very short period. When



rainfall and surface water are adequate, more than one breeding event may occur in a single season. It is doubtful that the same animals emerge to breed more than once a year (Bob Johnson, pers. comm., 1992). Although there is no direct evidence from the Puerto Rican crested toad to support this point of view, studies with other Bufonids lead to the conclusion that many species are biannual breeders and particularly so for females who must develop sufficient lipid stores to fuel egg development.

In Guánica (Moreno and Canals 1985), two breeding ponds are found at Tamarindo Beach and another pond is found in Ciénaga, Barinas. In Quebradillas, toads have been found in sites along Quebrada Bellaca in San José and Quebrada La Sequia in Barrio Coto (Ernesto Estremera, pers. comm., 1991).

The species emerges to breed after heavy showers resulting in an accumulation of no less than 5 centimeters (2 inches) if the soil is saturated. Bob Johnson (Metro Toronto Zoo, pers. comm., 1992) believes that small rainfall episodes (less than 7 inches) may only attract to the breeding pond a very local population which resides within 1 to 2 kilometers (1 mile) from breeding ponds. Heavy rains (7 to 13 inches) are sufficient to attract the whole breeding population from up to 3 kilometers (2 miles). It is also possible that toads residing near the breeding pond are, in fact, members of the population which have lipid stores sufficient to take part in reproduction and move toward the breeding site for that reason or as the result of small increases in rainfall or ground water.

Males emerge first. They distribute themselves among emergent vegetation and begin to call. Females follow and swim toward the males. Amplexus (i.e., mating) then occurs. After about 1 hour, the females swim toward the vegetation and lay a string of eggs, which are then wrapped around the vegetation. The females leave the ponds and return to the forest soon after completing this process. The males may stay in the pond 1 or 2 days after the females have left (Moreno and Canals 1985). Eggs hatch within 24 hours. Tadpoles metamorphose within 18 to 25 days and quickly disperse. In Guánica, toadlets may travel up to 4 linear kilometers (2.5 miles) from the breeding pond (Moreno 1985). Apparently, there is high fidelity to breeding sites that offer the right combination of elevation, topography, and fresh water (U.S. Fish and Wildlife Service 1987).

### Reasons for Listing

Habitat. Because of specific use of already limited breeding sites, the species may be vulnerable to habitat destruction and human interference. Destruction of one breeding pond may result in the elimination of that particular population. Although little is known about populations in the northern part of the island, agricultural and urban development in this area may have

reduced once abundant populations. Historical breeding sites have been filled or drained for construction, cultivation, and mosquito control (U.S. Fish and Wildlife Service 1987). In the Guánica Commonwealth Forest, the practice of draining the breeding pond for easier beach access was stopped by Forest Manager, Miguel Canals in 1984 (Devison 1990). The reduced level of urban development in southwestern Puerto Rico may account for the extant population at Guánica. At present, both the northern and southern populations are threatened by development projects in areas adjacent to and/or including their breeding sites.

Overutilization. Overcollection of Puerto Rican herpetofauna is known to have occurred in the past, a factor which may have contributed to the reduction in numbers and possibly to elimination of the toad from certain localities.

Predation. Predation has not been documented as a factor in the decline of this species. However, predation by the common anole (Anolis cristatellus) and Puerto Rican ground lizard (Ameiva exsul) on recently metamorphosed toadlets (Jorge Moreno, pers. comm., 1991; Bob Johnson, pers. comm., 1992) and by birds on dispersing toadlets may be heavy (Miguel Canals, pers. comm., 1989; Bob Johnson, pers. comm., 1992) and could become a significant factor if populations are greatly reduced by other problems.

Potential predators suggested by Evans and Sarmiento (1982) were feral dogs and cats, mongooses (Herpestes auropunctatus), and the giant marine toad (Bufo marinus). The latter was introduced in the 1920's for control of white grubs in the sugar cane fields (Rivero 1978, Paine and Duval 1985). Predation by the marine toad has been known to occur in Guánica (Miguel Canals, pers. comm., 1989). Schmidt (1928) and Paine and Duval (1985) suggested that the marine toad was competing with the crested toad for spawning sites, food, and habitat. Rivero et al. (1980) believed that the crested toad was scarce before the introduction of the marine toad, although they did not disregard the possibility of competition between the two species. Johnson and Paine (1990) observed the metamorphosis and dispersal of both the marine toad and the crested toad from the Tamarindo breeding pond. Despite the removal of a number of marine toad egg strings by Guánica forestry staff, their estimates of marine:crested tadpole ratios averaged 20:1. They observed no apparent impact of these densities on the crested toad. However, marine tadpoles metamorphosed about 2 days earlier than crested tadpoles. Both species of toadlets used stones, rocks, and wood as refuges from high temperatures and strong drying onshore wind. Toadlets exposed for more than a few seconds died. Because of the larger size and number of marine toadlets, crested toadlets were excluded from refuges. This may be the most significant impact of the marine toad on the crested toad.

Other predators found in breeding areas include crabs (Cardisoma sp.), beetles (Coleoptera), dragonflies (Odonata), other aquatic insects (Miguel Canals, pers. comm., 1991), and rats (Rattus sp.).

Predation by mongooses may be another factor affecting the species. Schmidt (1928) speculated that the mongoose was responsible for the scarcity of the toad. In a study conducted by Johnson and Paine (1990), three toads were predated by mongoose in their first night. At Guánica Commonwealth Forest, mongoose densities are highest on the low elevation scrub forest which surrounds the breeding ponds at Tamarindo Beach. Mongoose densities at this elevation were estimated at 50 individuals per kilometer (Vilella 1989).

Other threats. Ponds in Quebradillas are found in areas used for cattle since the 1950's. These areas are regularly sprayed with herbicides and chemical fertilizers, which could affect the toads when rain and runoff from pastures fill cattle troughs constructed to take advantage of natural drainage channels. These cattle troughs are used by the toads for breeding. In addition, one of the ponds was drained and is currently being used as a junkyard, thus eliminating a site that could have been used as breeding habitat by the toads. Previously, these areas had been used for sugar cane and tobacco cultivation.

The Puerto Rican crested toad populations are vulnerable to demographic and environmental catastrophe. These isolated populations may be reduced to levels beyond which they could not recover if a natural disaster (hurricane, fire, flood, tidal wave) or a prolonged drought were to occur, especially since reproduction in this species appears to rely on climatic events. When compounded with the reduced availability of breeding sites, these factors increase the likelihood of whole populations being eliminated. For example, in 1985, heavy rains brought on by a tropical wave caused one of the breeding ponds in Guánica to overflow, washing out the road and causing the eggs to be carried out to sea (Miguel Canals, pers. comm., 1991).

### Conservation Efforts

The U.S. Fish and Wildlife Service (1987) listed the Puerto Rican crested toad as threatened, which affords it protection under the Endangered Species Act of 1973, as amended. Regulations prohibit certain activities involving endangered or threatened species, as specified in Section 9 of the Act, unless permits are issued.

The Puerto Rican crested toad also is listed as threatened under the Regulation to Govern the Management of Threatened and Endangered Species in the Commonwealth of Puerto Rico (Department of Natural Resources 1985). Commonwealth permit approval is necessary for all activities involving this species.

Since the southern population is found in the Guánica Commonwealth Forest, there is constant monitoring of that population by the Forest biologist and the breeding areas are blocked off during reproduction. Talks are given to visitors, school children, and university students but an islandwide education program needs to be developed.

The Quebradillas population is monitored by Mr. Ernesto Estremera (a Quebradillas High School science teacher), high school students, and other members of the community. However, existing personnel are not able to cover all ponds during one breeding event.

In 1980, Dr. Juan Rivero of the University of Puerto Rico at Mayagüez collected two male and two female toads, which were donated to the Puerto Rico Zoological Gardens. Progeny from the 1981 reproduction were placed at the Buffalo Zoological Gardens and the Brookfield Zoo (Evans and Sarmiento 1982, Paine and Duval 1985). In 1982, six northern toads were collected and taken to the Puerto Rico Zoological Gardens, and their progeny were placed at the Buffalo Zoological Gardens and the Indianapolis Zoo. Adults and their remaining progeny were released at the collection site (Paine and Duval 1985). The species has been intensively managed at the Buffalo Zoological Gardens and a captive propagation/release program was begun in 1983 with the release of 75 toadlets in 1983 and close to 800 toadlets in 1984 (Paine 1985). The latter were released at the Cambalache Commonwealth Forest on the north coast. However, it is not known whether this release effort was successful because the population has not been monitored at this site.

The Puerto Rican crested toad was the first amphibian species to have an American Association of Zoological Parks and Aquariums (AAZPA) Species Survival Plan (SSP) in 1984 (Paine 1985). In 1985, twenty toadlets were collected from Guánica by representatives from the Metro Toronto Zoo and the Department of Natural Resources (Johnson 1990). These toadlets formed the basis for a southern founder population to be managed under the AAZPA SSP program. Breedings of these founders resulted in two additional releases of toadlets into the Guánica Forest. It has difficult to assess the success of reintroductions because of the small size of the toadlets. To date, the only measure of success has been the presence or absence of toadlets at release sites (Bob Johnson, pers. comm., 1992).

Radio-tracking of 12 captive-raised toads in 1989, and 12 wild, post-reproductive toads in 1990, has provided data on survivorship, home range, and habitat use (Johnson 1990).

Current research includes genetic (i.e., mitochondrial DNA) analyses to determine whether the two known populations of the Puerto Rican crested toad are distinct, and demographic and habitat characterization studies.

Metro Toronto Zoo has produced 2,000 posters explaining the difference between the Puerto Rican crested toad and the marine toad, and requesting that any sightings of the crested toad be reported to biology teachers or Department of Natural Resources personnel. The posters were printed on synthetic paper so that they will not deteriorate when posted outdoors and should last a number of years. These have been distributed to schools and posted throughout toad areas in the north and the south of Puerto Rico. Several reports of toad sightings have resulted, although no crested toads have been identified to date (Bob Johnson, pers. comm., 1992).

## II. RECOVERY

### A. Objective and Criteria

The objective of this recovery plan is to provide direction for restoring the Puerto Rican crested toad to a self-sustaining status, thereby permitting it to eventually be removed from the list.

Delisting the Puerto Rican crested toad will be considered when at least three wild populations of 1,500 to 2,000 animals are established and maintained for each race, northern and southern, and at least five captive populations of 300 animals each have been established.

B. Narrative Outline for Recovery Actions

1. Prevent further population decline and habitat loss. The protection of Puerto Rican crested toad populations and their habitat should be continued by public agencies and encouraged for private landowners. This will help prevent the extinction of the species.
  - 1.1 Monitor existing populations. Regular monitoring of the Guánica and Quebradillas populations should be given the highest priority. Yearly monitoring will generate trend data so that population status can be assessed.
  - 1.2 Search for historical and new populations. Historical sites and other suitable habitat should be searched for new populations.
  - 1.3 Manage the northern and southern populations. Manage the two races separately. This outline should be followed for each race.
    - 1.31 Protect Commonwealth-owned habitat. To minimize disturbance, roads adjacent to ponds should be closed and breeding areas should be fenced, posted, and patrolled during breeding events.
    - 1.32 Protect existing habitat on private lands. Landowners of Puerto Rican crested toad habitat should be contacted and encouraged to voluntarily protect habitat which they control. Breeding areas should be fenced and posted during breeding events.
      - 1.321 Develop Habitat Conservation Plans. Destruction of occupied habitat constitutes a potential take of the species under the Endangered Species Act of 1973, as amended. Incidental take permits under Section 10(a)(1)(B) of the Act may be applied for by developing a Habitat Conservation Plan for the species.
  - 1.33 Enhance breeding areas. Activities such as dune rehabilitation, drainage control, planting vegetative cover, fencing certain areas, and construction of artificial ponds in suitable sites may lead to increased production and population increases.

- 1.4 Determine the extent of predation and competition by other species. The evaluation of other species' interactions with Puerto Rican crested toads will point out the significance of those species as competitors or predators and the need for possible management actions, such as predator or removal.
2. Continue to propagate Puerto Rican crested toads suitable for reestablishment of the species in the wild. Develop a strategy that interactively manages captive and wild populations for mutual support and survival. Implement Puerto Rican Crested Toad SSP Masterplan recommendations.
  - 2.1 Complete establishment of and maintain captive populations. Survey available captive propagation facilities and establish new captive colonies when possible to meet recovery objective. Obtain necessary founders from the northern and southern populations for the captive program to maintain genetic diversity.
  - 2.2 Develop captive propagation program in Puerto Rico. Establish and maintain a self-sustaining breeding population in a captive propagation facility in Puerto Rico.
  - 2.3 Continue or initiate captive propagation research. Continue or initiate nutritional studies and husbandry work, research on cryopreservation of genetic material, characterization of threshold stages of reproduction to provide indexes for management and to understand reproductive mechanisms, and other relevant studies.
  - 2.4 Maintain integrity of broodstock through continued implementation of a breeding program with the American Association of Zoological Parks and Aquariums (AAZPA). The Service will cooperate with AAZPA to ensure that the Puerto Rican crested toad studbook is accurately maintained. Service recovery activities will be coordinated with participating zoo personnel to ensure that excess toads are available for reestablishment efforts. This cooperative effort will also facilitate selection of toad recipients and ensure that participating zoos and facilities strictly adhere to established management regulations and protocols.
3. Establish at least six wild populations, three in the north and three in the south in Puerto Rico. To preserve genetic integrity and prevent genetic drift, it has been determined that at least three disjunct self-sustaining populations from the north and south will be needed. These populations will have to support approximately 1,500 to 2,000 animals each for a period of 10 years before delisting can be considered.



- 3.1 Classify physiographic features of northern and southern breeding habitat. Relevant habitat variables at the known breeding sites should be identified and analyzed to identify microhabitat preferences.
  - 3.2 Identify introduction sites. Based on habitat characterization, potential introduction sites should be identified. New sites need to be as remote as practical to minimize the chance of single catastrophic loss. Priority should be given to Commonwealth and other protected lands initially.
  - 3.3 Implement and evaluate release program. Release Puerto Rican crested toads in selected sites. Released toads must be carefully monitored over time to ensure their survival and to assess the success of the release program.
4. Develop an islandwide education program. Both Commonwealth and Federal agencies should become involved in the education of the public on the importance of protecting endangered and threatened species, such as the Puerto Rican crested toad, and the laws protecting them, and on general conservation values as well.
    - 4.1 Establish a cooperative public information program with local media. Prudent use of the media (newspapers, magazines, radio, and television) is an effective means of educating the public. Maintenance of photographic records will provide information for immediate release.
    - 4.2 Prepare slide presentations. Presentations should be given to local school groups and organizations. These might be combined with general presentations on all endangered species found in Puerto Rico.
    - 4.3 Prepare illustrative brochure. Prepare brochure stressing the importance of protecting the Puerto Rican crested toad and its breeding sites. Distribute throughout schools and at conservation activities.
    - 4.5 Continue to distribute the Puerto Rican crested toad poster prepared by Metro Toronto Zoo. Post at and near breeding sites and distribute throughout schools in the island.

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### III. IMPLEMENTATION SCHEDULE

The Implementation Schedule that follows outlines actions and estimated costs for the recovery program. It is a guide for meeting the objective discussed in Part II of this Plan. This schedule indicates task priorities, task numbers, task descriptions, duration of tasks, the responsible agencies, and lastly, estimated costs. These actions, when accomplished, should bring about the recovery of the species and protect its habitat. It should be noted that the estimated monetary needs for all parties involved in recovery are identified and, therefore, Part III reflects the total estimated financial requirements for the recovery of this species.

Priorities in Column 4 of the following Implementation Schedule are assigned as follows:

- Priority 1 - An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.
- Priority 2 - An action that must be taken to prevent a significant decline in species population/habitat quality or some other significant negative impact short of extinction.
- Priority 3 - All other actions necessary to provide for full recovery of the species.

#### Key to abbreviations used in Implementation Schedule

FWE - Fish and Wildlife Service, Endangered Species Division  
PRDNR - Puerto Rico Department of Natural Resources  
Univ. - Universities  
AAZPA - American Association of Zoological Parks and Aquariums  
Zoo. - Zoological Park  
NGO - Nongovernmental organizations

**IMPLEMENTATION SCHEDULE**

Priority #	Task #	Task Description	Task Duration (Yrs)	Responsible Party			Cost Estimates (\$K)			Comments
				FWS Region	FWS Division	Other	FY 1	FY 2	FY 3	
1	11	Monitor existing populations	Ongoing	4	FWE	PRDNR	2	2	2	
2	12	Search for historical and new populations	1	4	FWE	PRDNR		20		
1	131	Protect Commonwealth-owned habitat	Ongoing	4	FWE	PRDNR	2.5	2.5	2.5	The 2.5K/year covers 131 and 132
2	1321	Develop Habitat Conservation Plans	Ongoing	4	FWE	PRDNR				
3	133	Enhance breeding areas	Ongoing	4	FWE	PRDNR	5	1	1	
2	14	Determine the extent of predation and competition by other species	3	4	FWE	PRDNR Univ.		44	32	

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**IMPLEMENTATION SCHEDULE**

Priority #	Task #	Task Description	Task Duration (Yrs)	Responsible Party			Cost Estimates (\$K)			Comments
				FWS Region	FWS Division	Other	FY 1	FY 2	FY 3	
2	32	Identify introduction sites	1	4	FWE	PRDNR				
2	33	Implement and evaluate release program	3	4	FWE	PRDNR		31	13	
3	41	Establish cooperative public information program with local media	Ongoing	4	FWE	PRDNR	3	3	3	
3	42	Prepare slide presentations	Ongoing	4	FWE	PRDNR	.5	.1	.1	
3	43	Prepare illustrative brochure	Ongoing	4	FWE	PRDNR NGO Univ.	10	2	2	
3	44	Continue to distribute poster prepared by Metro Toronto Zoo	Ongoing	4	FWE	PRDNR				

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**IMPLEMENTATION SCHEDULE**

Priority #	Task #	Task Description	Task Duration (Yrs)	Responsible Party			Cost Estimates (\$K)			Comments
				FWS Region	FWS Division	Other	FY 1	FY 2	FY 3	
2	21	Complete establishment of and maintain captive populations	Ongoing	4	FWE	PRDNR AAZPA	5	5	5	Cost includes 21, 23, and 24
2	22	Develop captive propagation program in Puerto Rico	Ongoing	4	FWE	PRDNR AAZPA Zoo Univ.	5	1	1	
2	17 23	Continue or initiate captive propagation research	Ongoing	4	FWE	PRDNR AAZPA Univ.				
2	24	Maintain integrity of broodstock through implementation of breeding program with AAZPA	Ongoing	4	FWE	PRDNR				
2	31	Classify physiographic features of northern and southern habitat	1	4	FWE	PRDNR	8			Includes 32

## II. RECOVERY

### A. Objective and Criteria

The objective of this recovery plan is to provide direction for restoring the Puerto Rican crested toad to a self-sustaining status, thereby permitting it to eventually be removed from the list.

Delisting the Puerto Rican crested toad will be considered when at least three wild populations of 1,500 to 2,000 animals are established and maintained for each race, northern and southern, and at least five captive populations of 300 animals each have been established.

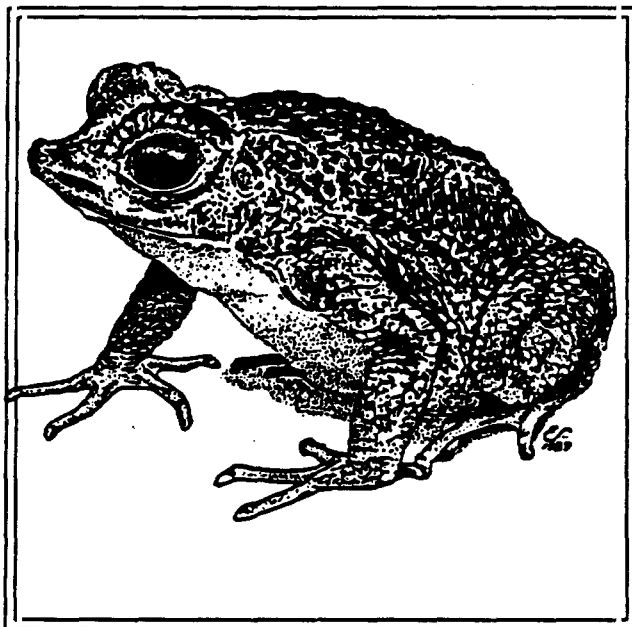


B. Narrative Outline for Recovery Actions

1. Prevent further population decline and habitat loss. The protection of Puerto Rican crested toad populations and their habitat should be continued by public agencies and encouraged for private landowners. This will help prevent the extinction of the species.
  - 1.1 Monitor existing populations. Regular monitoring of the Guánica and Quebradillas populations should be given the highest priority. Yearly monitoring will generate trend data so that population status can be assessed.
  - 1.2 Search for historical and new populations. Historical sites and other suitable habitat should be searched for new populations.
  - 1.3 Manage the northern and southern populations. Manage the two races separately. This outline should be followed for each race.
    - 1.31 Protect Commonwealth-owned habitat. To minimize disturbance, roads adjacent to ponds should be closed and breeding areas should be fenced, posted, and patrolled during breeding events.
    - 1.32 Protect existing habitat on private lands. Landowners of Puerto Rican crested toad habitat should be contacted and encouraged to voluntarily protect habitat which they control. Breeding areas should be fenced and posted during breeding events.
      - 1.321 Develop Habitat Conservation Plans. Destruction of occupied habitat constitutes a potential take of the species under the Endangered Species Act of 1973, as amended. Incidental take permits under Section 10(a)(1)(B) of the Act may be applied for by developing a Habitat Conservation Plan for the species.
    - 1.33 Enhance breeding areas. Activities such as dune rehabilitation, drainage control, planting vegetative cover, fencing certain areas, and construction of artificial ponds in suitable sites may lead to increased production and population increases.

# **RECOVERY PLAN**

## **Puerto Rican Crested Toad**



**U.S. Fish and Wildlife Service**



RECOVERY PLAN FOR THE  
PUERTO RICAN CRESTED TOAD  
(PELTOPHRYNE LEMUR)

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Approved:



James W. Pulliam, Jr.  
Regional Director, U.S. Fish and Wildlife Service

Date:

August 7, 1992

Recovery plans delineate reasonable actions which are believed to be required to recover and/or protect listed species. Plans are published by the U.S. Fish and Wildlife Service, sometimes prepared with the assistance of recovery teams, contractors, State agencies, and others. Objectives will be attained and necessary funds made available subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities. Recovery plans do not necessarily represent the views nor the official positions or approval of any individuals or agencies involved in the plan formulation, other than the U.S. Fish and Wildlife Service. They represent the official position of the U.S. Fish and Wildlife Service only after they have been signed by the Regional Director as approved. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery tasks.

Literature citations should read as follows:

U.S. Fish and Wildlife Service. 1992. Recovery Plan for the Puerto Rican crested toad (Peltophryne lemur). Atlanta, Georgia. 19 pp.

Additional copies may be purchased from:

Fish and Wildlife Service Reference Service  
5430 Grosvenor Lane, Suite 110  
Bethesda, Maryland 20814  
301/492-6403  
or  
1-800-582-3421

Fees for recovery plans vary, depending on the number of pages.

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## I. INTRODUCTION

The Puerto Rican crested toad (Peltophryne lemur) is the only native bufonid of Puerto Rico and the Virgin Islands. In Virgin Gorda, British Virgin Islands, the species has not been observed for at least 2 decades and is believed to be extirpated. Data on historical abundance in Puerto Rico is scarce. However, Pregill (1981b) speculated that the Puerto Rican crested toad was common throughout its habitat during the late Pleistocene period, based on cave fossil deposits. Historically, the species has been considered rare (Rivero 1978, Evans and Sarmiento 1982, Paine 1984) and thought to be extinct prior to 1966 (García-Díaz 1967). However, Pregill (1981b) and Thomas in Pregill (1981b) suggested that the animal probably was more common than thought because of inappropriate collection methods and because of the scarcity of sightings due to its semifossorial existence. Fresh water shrimpers near the Guajataca Commonwealth Forest on the north coast of Puerto Rico used to observe the toads when they came out to breed after heavy rains (Jorge Moreno, Puerto Rico Department of Natural Resources, pers. comm., 1991).

The Puerto Rican crested toad was determined to be a threatened species on August 4, 1987, pursuant to the Endangered Species Act of 1973, as amended (U.S. Fish and Wildlife Service 1987). This Rule became effective on September 3, 1987.

### Description

The Puerto Rican crested toad was first named and described by Cope (1868) and was later placed in the genus Bufo (Stejneger 1904). Recently, the native bufonids of the Greater Antilles have been regrouped under the genus Peltophryne, because of their presumed monophyletic origin (Pregill 1981a). The Puerto Rican crested toad is a medium-sized toad, 64 to 120 millimeters (2.5 to 4.5 inches) in snout-vent length, yellowish-olive to blackish-brown in color, with prominent supraorbital crests and a distinctive long, upturned snout. Males are considerably smaller than females, and exhibit less prominent crests (Rivero et al. 1980, Paine 1985, U.S. Fish and Wildlife Service 1987). Sexual dichromatism (males being more yellow than females) exists and is most apparent immediately prior to and during reproduction (Moreno 1985; Paine 1985; Bob Johnson, Metro Toronto Zoo, pers. comm., 1992). More detailed descriptions may be found in Stejneger (1904), Rivero et al. (1980), Pregill (1981a), and Miller (1985).

### Distribution and Abundance

The Puerto Rican crested toad is endemic to Puerto Rico and Virgin Gorda, both on the Puerto Rican Shelf. It is known from nine scattered localities in Puerto Rico and one in Virgin Gorda (Figure 1). The known historic distribution in Virgin Gorda is

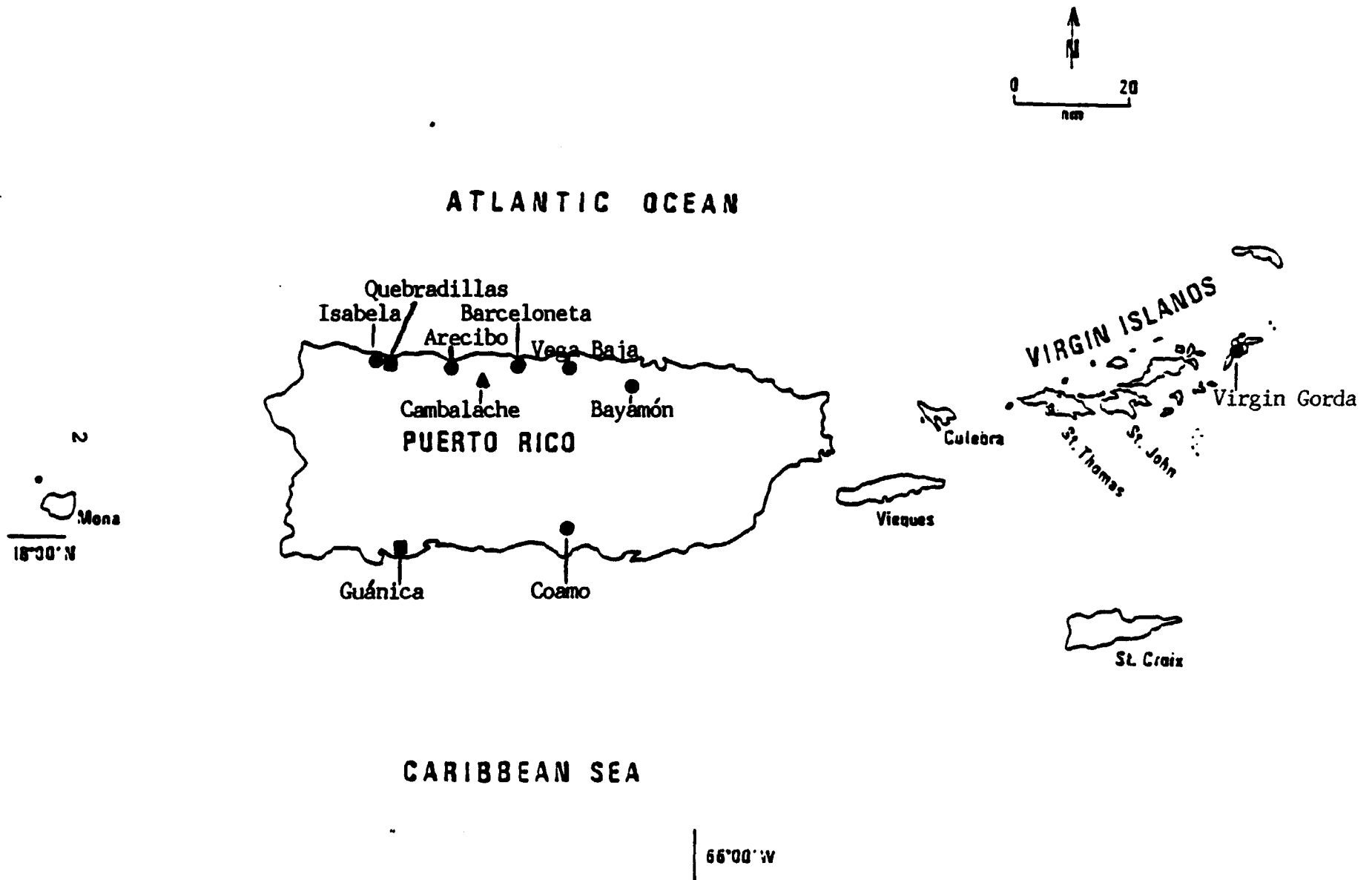


Figure 1. Map of the Puerto Rican Shelf indicating localities from which the Puerto Rican crested toad has been collected (●), current populations (■), and release site (▲).

limited. The species is thought to be extinct on this island, since it has not been observed there in many years. Specimens were last collected in 1964 by Thomas (1976).

At present, its range in Puerto Rico is limited to two known, isolated populations (Figure 1). The Guánica population, although small, is relatively stable and consists of approximately 2,000 individuals (Miguel Canals, Puerto Rico Department of Natural Resources, pers. comm., 1991). The Quebradillas population consists of approximately 25 to 50 individuals. However, no standardized quantitative population estimates have been obtained. Genetic research indicates that the two populations are distinct and must be managed separately. Nothing is known about population numbers in other localities, especially since the species is very difficult to detect.

### Habitat

In Puerto Rico, the crested toad occurs at low elevations (not exceeding 200 meters) where it appears to prefer arid or semi-arid, rocky areas with an abundance of limestone fissures and cavities in well drained soil (Rivero et al. 1980, Moreno 1985, Paine 1985). However, one historical site is a grassy field (Moreno 1985).

Post reproductive movements were investigated by Bob Johnson of the Metro Toronto Zoo in 1990. For 3 weeks following reproduction, 11 radiotracked toads moved into the hills surrounding the breeding pond. Dead-end holes in the limestone bedrock were used as daytime retreats as were underground chambers in the bedrock. The toads used small holes to access the underground chambers which often afforded lateral access under the rock. Toads were able to scramble up vertical rock faces and could be found in holes at least 45 centimeters (18 inches) above the ground in these vertical rock faces. Toads moved up to 1.5 kilometers (0.9 mile) in 3 nights before taking up residence in an area where movements averaged 10 meters (33 feet) a night. These latter movements were centered in an activity area with the toad often returning to a retreat that had been utilized several days previously.

### Reproduction

Maturation time of the Puerto Rican crested toad in the wild is not known. Paine (1985) suggested that it probably does not occur before the second year of life. In captivity, maturation based on reproduction was observed within 1 year of age (Paine 1985).

In the wild, breeding appears to be sporadic, highly dependent upon occasional heavy rains (Moreno 1985; Ernesto Estremera, pers. comm., 1991) concentrated in a very short period. When



rainfall and surface water are adequate, more than one breeding event may occur in a single season. It is doubtful that the same animals emerge to breed more than once a year (Bob Johnson, pers. comm., 1992). Although there is no direct evidence from the Puerto Rican crested toad to support this point of view, studies with other Bufonids lead to the conclusion that many species are biannual breeders and particularly so for females who must develop sufficient lipid stores to fuel egg development.

In Guánica (Moreno and Canals 1985), two breeding ponds are found at Tamarindo Beach and another pond is found in Ciénaga, Barinas. In Quebradillas, toads have been found in sites along Quebrada Bellaca in San José and Quebrada La Sequia in Barrio Coto (Ernesto Estremera, pers. comm., 1991).

The species emerges to breed after heavy showers resulting in an accumulation of no less than 5 centimeters (2 inches) if the soil is saturated. Bob Johnson (Metro Toronto Zoo, pers. comm., 1992) believes that small rainfall episodes (less than 7 inches) may only attract to the breeding pond a very local population which resides within 1 to 2 kilometers (1 mile) from breeding ponds. Heavy rains (7 to 13 inches) are sufficient to attract the whole breeding population from up to 3 kilometers (2 miles). It is also possible that toads residing near the breeding pond are, in fact, members of the population which have lipid stores sufficient to take part in reproduction and move toward the breeding site for that reason or as the result of small increases in rainfall or ground water.

Males emerge first. They distribute themselves among emergent vegetation and begin to call. Females follow and swim toward the males. Amplexus (i.e., mating) then occurs. After about 1 hour, the females swim toward the vegetation and lay a string of eggs, which are then wrapped around the vegetation. The females leave the ponds and return to the forest soon after completing this process. The males may stay in the pond 1 or 2 days after the females have left (Moreno and Canals 1985). Eggs hatch within 24 hours. Tadpoles metamorphose within 18 to 25 days and quickly disperse. In Guánica, toadlets may travel up to 4 linear kilometers (2.5 miles) from the breeding pond (Moreno 1985). Apparently, there is high fidelity to breeding sites that offer the right combination of elevation, topography, and fresh water (U.S. Fish and Wildlife Service 1987).

#### Reasons for Listing

Habitat. Because of specific use of already limited breeding sites, the species may be vulnerable to habitat destruction and human interference. Destruction of one breeding pond may result in the elimination of that particular population. Although little is known about populations in the northern part of the island, agricultural and urban development in this area may have

reduced once abundant populations. Historical breeding sites have been filled or drained for construction, cultivation, and mosquito control (U.S. Fish and Wildlife Service 1987). In the Guánica Commonwealth Forest, the practice of draining the breeding pond for easier beach access was stopped by Forest Manager, Miguel Canals in 1984 (Devison 1990). The reduced level of urban development in southwestern Puerto Rico may account for the extant population at Guánica. At present, both the northern and southern populations are threatened by development projects in areas adjacent to and/or including their breeding sites.

Overutilization. Overcollection of Puerto Rican herpetofauna is known to have occurred in the past, a factor which may have contributed to the reduction in numbers and possibly to elimination of the toad from certain localities.

Predation. Predation has not been documented as a factor in the decline of this species. However, predation by the common anole (Anolis cristatellus) and Puerto Rican ground lizard (Ameiva exsul) on recently metamorphosed toadlets (Jorge Moreno, pers. comm., 1991; Bob Johnson, pers. comm., 1992) and by birds on dispersing toadlets may be heavy (Miguel Canals, pers. comm., 1989; Bob Johnson, pers. comm., 1992) and could become a significant factor if populations are greatly reduced by other problems.

Potential predators suggested by Evans and Sarmiento (1982) were feral dogs and cats, mongooses (Herpestes auropunctatus), and the giant marine toad (Bufo marinus). The latter was introduced in the 1920's for control of white grubs in the sugar cane fields (Rivero 1978, Paine and Duval 1985). Predation by the marine toad has been known to occur in Guánica (Miguel Canals, pers. comm., 1989). Schmidt (1928) and Paine and Duval (1985) suggested that the marine toad was competing with the crested toad for spawning sites, food, and habitat. Rivero et al. (1980) believed that the crested toad was scarce before the introduction of the marine toad, although they did not disregard the possibility of competition between the two species. Johnson and Paine (1990) observed the metamorphosis and dispersal of both the marine toad and the crested toad from the Tamarindo breeding pond. Despite the removal of a number of marine toad egg strings by Guánica forestry staff, their estimates of marine:crested tadpole ratios averaged 20:1. They observed no apparent impact of these densities on the crested toad. However, marine tadpoles metamorphosed about 2 days earlier than crested tadpoles. Both species of toadlets used stones, rocks, and wood as refuges from high temperatures and strong drying onshore wind. Toadlets exposed for more than a few seconds died. Because of the larger size and number of marine toadlets, crested toadlets were excluded from refuges. This may be the most significant impact of the marine toad on the crested toad.

Other predators found in breeding areas include crabs (Cardisoma sp.), beetles (Coleoptera), dragonflies (Odonata), other aquatic insects (Miguel Canals, pers. comm., 1991), and rats (Rattus sp.).

Predation by mongooses may be another factor affecting the species. Schmidt (1928) speculated that the mongoose was responsible for the scarcity of the toad. In a study conducted by Johnson and Paine (1990), three toads were predated by mongoose in their first night. At Guánica Commonwealth Forest, mongoose densities are highest on the low elevation scrub forest which surrounds the breeding ponds at Tamarindo Beach. Mongoose densities at this elevation were estimated at 50 individuals per kilometer (Vilella 1989).

Other threats. Ponds in Quebradillas are found in areas used for cattle since the 1950's. These areas are regularly sprayed with herbicides and chemical fertilizers, which could affect the toads when rain and runoff from pastures fill cattle troughs constructed to take advantage of natural drainage channels. These cattle troughs are used by the toads for breeding. In addition, one of the ponds was drained and is currently being used as a junkyard, thus eliminating a site that could have been used as breeding habitat by the toads. Previously, these areas had been used for sugar cane and tobacco cultivation.

The Puerto Rican crested toad populations are vulnerable to demographic and environmental catastrophe. These isolated populations may be reduced to levels beyond which they could not recover if a natural disaster (hurricane, fire, flood, tidal wave) or a prolonged drought were to occur, especially since reproduction in this species appears to rely on climatic events. When compounded with the reduced availability of breeding sites, these factors increase the likelihood of whole populations being eliminated. For example, in 1985, heavy rains brought on by a tropical wave caused one of the breeding ponds in Guánica to overflow, washing out the road and causing the eggs to be carried out to sea (Miguel Canals, pers. comm., 1991).

### Conservation Efforts

The U.S. Fish and Wildlife Service (1987) listed the Puerto Rican crested toad as threatened, which affords it protection under the Endangered Species Act of 1973, as amended. Regulations prohibit certain activities involving endangered or threatened species, as specified in Section 9 of the Act, unless permits are issued.

The Puerto Rican crested toad also is listed as threatened under the Regulation to Govern the Management of Threatened and Endangered Species in the Commonwealth of Puerto Rico (Department of Natural Resources 1985). Commonwealth permit approval is necessary for all activities involving this species.

Since the southern population is found in the Guánica Commonwealth Forest, there is constant monitoring of that population by the Forest biologist and the breeding areas are blocked off during reproduction. Talks are given to visitors, school children, and university students but an islandwide education program needs to be developed.

The Quebradillas population is monitored by Mr. Ernesto Estremera (a Quebradillas High School science teacher), high school students, and other members of the community. However, existing personnel are not able to cover all ponds during one breeding event.

In 1980, Dr. Juan Rivero of the University of Puerto Rico at Mayagüez collected two male and two female toads, which were donated to the Puerto Rico Zoological Gardens. Progeny from the 1981 reproduction were placed at the Buffalo Zoological Gardens and the Brookfield Zoo (Evans and Sarmiento 1982, Paine and Duval 1985). In 1982, six northern toads were collected and taken to the Puerto Rico Zoological Gardens, and their progeny were placed at the Buffalo Zoological Gardens and the Indianapolis Zoo. Adults and their remaining progeny were released at the collection site (Paine and Duval 1985). The species has been intensively managed at the Buffalo Zoological Gardens and a captive propagation/release program was begun in 1983 with the release of 75 toadlets in 1983 and close to 800 toadlets in 1984 (Paine 1985). The latter were released at the Cambalache Commonwealth Forest on the north coast. However, it is not known whether this release effort was successful because the population has not been monitored at this site.

The Puerto Rican crested toad was the first amphibian species to have an American Association of Zoological Parks and Aquariums (AAZPA) Species Survival Plan (SSP) in 1984 (Paine 1985). In 1985, twenty toadlets were collected from Guánica by representatives from the Metro Toronto Zoo and the Department of Natural Resources (Johnson 1990). These toadlets formed the basis for a southern founder population to be managed under the AAZPA SSP program. Breedings of these founders resulted in two additional releases of toadlets into the Guánica Forest. It has difficult to assess the success of reintroductions because of the small size of the toadlets. To date, the only measure of success has been the presence or absence of toadlets at release sites (Bob Johnson, pers. comm., 1992).

Radio-tracking of 12 captive-raised toads in 1989, and 12 wild, post-reproductive toads in 1990, has provided data on survivorship, home range, and habitat use (Johnson 1990).

Current research includes genetic (i.e., mitochondrial DNA) analyses to determine whether the two known populations of the Puerto Rican crested toad are distinct, and demographic and habitat characterization studies.

Metro Toronto Zoo has produced 2,000 posters explaining the difference between the Puerto Rican crested toad and the marine toad, and requesting that any sightings of the crested toad be reported to biology teachers or Department of Natural Resources personnel. The posters were printed on synthetic paper so that they will not deteriorate when posted outdoors and should last a number of years. These have been distributed to schools and posted throughout toad areas in the north and the south of Puerto Rico. Several reports of toad sightings have resulted, although no crested toads have been identified to date (Bob Johnson, pers. comm., 1992).

**IMPLEMENTATION SCHEDULE**

Priority #	Task #	Task Description	Task Duration (Yrs)	Responsible Party			Cost Estimates (\$K)			Comments
				FWS Region	FWS Division	Other	FY 1	FY 2	FY 3	
2	32	Identify introduction sites	1	4	FWE	PRDNR				
2	33	Implement and evaluate release program	3	4	FWE	PRDNR		31	13	
3	41	Establish cooperative public information program with local media	Ongoing	4	FWE	PRDNR	3	3	3	
3	42	Prepare slide presentations	Ongoing	4	FWE	PRDNR	.5	.1	.1	
3	43	Prepare illustrative brochure	Ongoing	4	FWE	PRDNR NGO Univ.	10	2	2	
3	44	Continue to distribute poster prepared by Metro Toronto Zoo	Ongoing	4	FWE	PRDNR				

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**IMPLEMENTATION SCHEDULE**

Priority #	Task #	Task Description	Task Duration (Yrs)	Responsible Party			Cost Estimates (\$K)			Comments
				FWS Region	FWS Division	Other	FY 1	FY 2	FY 3	
1	11	Monitor existing populations	Ongoing	4	FWE	PRDNR	2	2	2	
2	12	Search for historical and new populations	1	4	FWE	PRDNR		20		
1	131	Protect Commonwealth-owned habitat	Ongoing	4	FWE	PRDNR	2.5	2.5	2.5	The 2.5K/year covers 131 and 132
2	1321	Develop Habitat Conservation Plans	Ongoing	4	FWE	PRDNR				
3	133	Enhance breeding areas	Ongoing	4	FWE	PRDNR	5	1	1	
2	14	Determine the extent of predation and competition by other species	3	4	FWE	PRDNR Univ.		44	32	

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**IMPLEMENTATION SCHEDULE**

Priority #	Task #	Task Description	Task Duration (Yrs)	Responsible Party			Cost Estimates (\$K)			Comments
				FWS Region	FWS Division	Other	FY 1	FY 2	FY 3	
2	21	Complete establishment of and maintain captive populations	Ongoing	4	FWE	PRDNR AAZPA	5	5	5	Cost includes 21, 23, and 24
2	22	Develop captive propagation program in Puerto Rico	Ongoing	4	FWE	PRDNR AAZPA Zoo Univ.	5	1	1	
2	17 23	Continue or initiate captive propagation research	Ongoing	4	FWE	PRDNR AAZPA Univ.				
2	24	Maintain integrity of broodstock through implementation of breeding program with AAZPA	Ongoing	4	FWE	PRDNR				
2	31	Classify physiographic features of northern and southern habitat	1	4	FWE	PRDNR	8			Includes 32



### III. IMPLEMENTATION SCHEDULE

The Implementation Schedule that follows outlines actions and estimated costs for the recovery program. It is a guide for meeting the objective discussed in Part II of this Plan. This schedule indicates task priorities, task numbers, task descriptions, duration of tasks, the responsible agencies, and lastly, estimated costs. These actions, when accomplished, should bring about the recovery of the species and protect its habitat. It should be noted that the estimated monetary needs for all parties involved in recovery are identified and, therefore, Part III reflects the total estimated financial requirements for the recovery of this species.

Priorities in Column 4 of the following Implementation Schedule are assigned as follows:

- Priority 1 - An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.
- Priority 2 - An action that must be taken to prevent a significant decline in species population/habitat quality or some other significant negative impact short of extinction.
- Priority 3 - All other actions necessary to provide for full recovery of the species.

#### Key to abbreviations used in Implementation Schedule

FWE - Fish and Wildlife Service, Endangered Species Division  
PRDNR - Puerto Rico Department of Natural Resources  
Univ. - Universities  
AAZPA - American Association of Zoological Parks and Aquariums  
Zoo. - Zoological Park  
NGO - Nongovernmental organizations

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