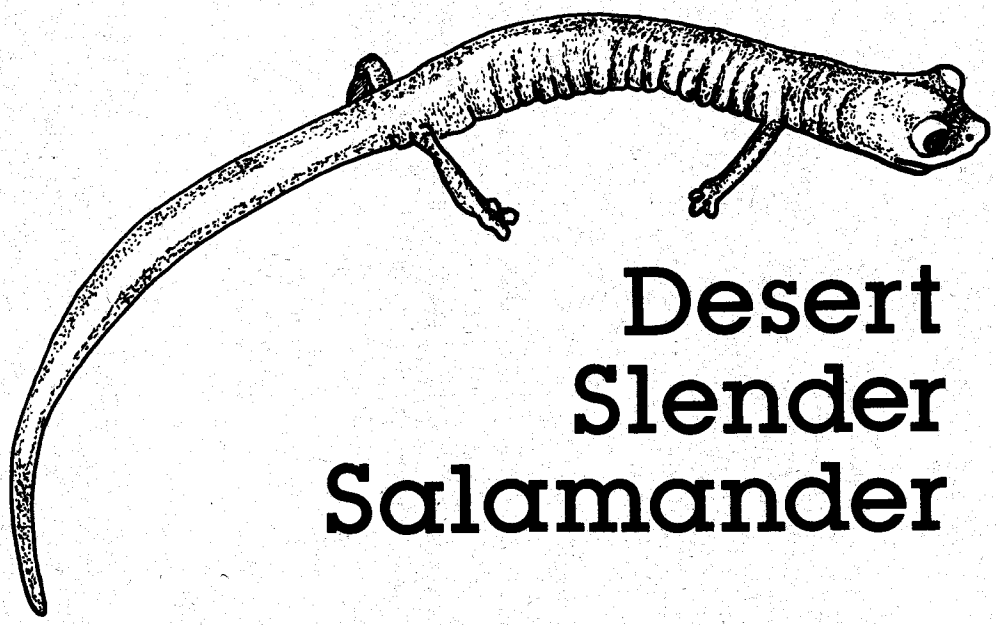
RECOVERY PLAN



Desert Slender Salamander

DESERT SLENDER SALAMANDER

RECOVERY PLAN

U.S. Fish and Wildlife Service

Portland, Oregon

In cooperation with

California Department of Fish and Game

and the

Hidden Palms Ecological Reserve Committee

June 1982

Approved: Robert A. Jantzen

Director, Fish and Wildlife Service

8/12/82

Date

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DESERT SLENDER SALAMANDER RECOVERY PLAN

PART I

INTRODUCTION

The desert slender salamander (Batrachoseps aridus), was discovered in 1969 by a California Fish and Game warden, Russell Murphy, as he dug out a small waterhole for bighorn sheep at an oasis on the lower desert slopes of the Santa Rosa Mountains in Riverside County, in southern California. The specimens represented a new species which was formally described by Brame (1970) a year later.

From the several primitive characters this species possesses and because it is isolated by large expanses of desert from other species of Batrachoseps, systematists suspect that the desert slender salamander may have been isolated from other salamanders for hundreds of thousands to several million years. Apparently it is a relictual species that had a wider distribution during wetter geologic epochs. Attempts to locate other populations of B. aridus have been unsuccessful; however, a Batrachoseps was discovered in 1981 in Guadalupe Canyon, approximately 7.2 km (4.5 mi) from the B. aridus site. The salamanders at this new site have been tentatively identified as B. aridus. At this time the range, status, and systematic affinities of this population are not known.

A committee was established by the California Department of Fish and Game (CDFG) in 1974 to determine what action, if any, should be taken

to assure the survival of the desert slender salamander. Their report constituted the initial basis for the formulation of this recovery plan.

Taxonomy

The desert slender salamander is a member of the family Plethodontidae, the largest family of salamanders, containing about two-thirds of the world's species. Members of the family are commonly known as "lungless salamanders." On the basis of anatomy, the desert slender salamander is considered a primitive species of its genus. It may be most closely related to B. wrightii, a species found in more mesic habitats in northwest and central Oregon [Hidden Palms Ecological Reserve Committee (HPERC), unpubl.] or to B. stebbinsi of the Piute and Tehachapi Mountains in Kern County (Brame 1970).

Description

The desert slender salamander is relatively small, measuring less than 102 mm (4 inches) in total length. It is not sexually dimorphic, except in that the female is larger in size and the male possesses papillate vents (Brame 1970). Important characters for identification are: toes numbering only four (characteristic of all Batrachoseps); small size, with the largest specimen measuring 48.4 mm (1.9 inches) in standard length (snout to vent length), 47.8 mm (1.9 inches) in tail length; large, rounded head; tail usually shorter than standard length; 17 or 18 (usually) costal grooves; and limbs, when appressed to sides of the body, leaving only 4 to 6.5 intercostal folds uncovered.

The coloration is blackish maroon to deep chocolate dorsally with numerous tiny bluish-silver iridiophores and scattered large patches of gold iridiophores. Ventrally, the belly is dark blackish maroon and the tail is light "flesh" colored (Brame 1970).

Historical and Current Distribution

No information is available on the historical distribution of the desert slender salamander. Since the species was first discovered in 1969, it has only been found in its originally described restricted location, and at one other possible location (this new population has yet to be formally verified as B. aridus). Paleontological information would be necessary to provide information on its past distribution.

The current known distribution of the desert slender salamander consists of a single site, known as Hidden Palms Canyon, that lies at the box end of a side canyon of Deep Canyon, a large gorge draining desert slopes of the Santa Rosa Mountains, Riverside County, California. Water seeping from the shaded north and northeast-facing walls of the box-end canyon provides moisture necessary for survival of the salamander population. The desert slender salamander has been found in cracks of the rock wall, in limestone sheeting formed as a result of the seepage, in moist dirt, in nearby plant debris, under loose rocks, and along the ephemeral flow of water that usually extends less than one hundred meters down the canyon. Based on salamander sightings, the habitat is less than 0.4 ha (1 acre) in size, and in fact, has been calculated to consist of a minimum of 41.4 m^2 (451.3 ft^2) (Bleich, unpubl.).

Derham Guiliani, funded by the Bureau of Land Management (BLM), discovered a possible additional site in 1981 in Guadalupe Canyon, approximately 7.2 km (4.5 mi) southeast of the type locality (Giuliani, pers. comm.), that is administered by BLM. Five specimens, consisting of three adults and two juveniles, were observed under two rocks in a seepage area during an inventory study by BLM to locate additional populations. The taxonomic relationship between this population and that of Deep Canyon is not known at this time.

Ecology and Behavior

The desert slender salamander is reported as exhibiting an unusual defensive posture. In response to disturbance, it frequently winds itself up into a watchspring-like coil. This response is typical for all species of Batrachoseps. The desert slender salamander may also elevate its tail either curved upward or nearly straight up. The tail thus presented looks like a common earthworm (Brame, Long, and Chiri 1973). Although some information would indicate that this behavior is common to all bolitoglossine salamanders, tail elevation was not observed during a study of this species for the CDFG (Bleich 1978).

Information is lacking on the relationship of ambient temperature to desert slender salamander activity. Another species, B. major, has been shown to have body temperatures that approximated soil temperatures over a range of 4 to 21°C (Cunningham 1960).

Food for the desert slender salamander likely consists of arthropods. Flies (Drosophila sp.) and ants are known to comprise part of the diet, but their importance remains undetermined (Bleich, unpubl.). Whether the emergence or abundance of any arthropods affects the activity or limits the size of the salamander population is unknown.

The western skink (Eumeces skiltonianus), a likely predator of this salamander, has been observed in the vicinity. The ringneck snake (Diadophis punctatus) is a potential predator that, although not observed locally, has been found in similar terrain and elevations. Other animals also undoubtedly prey upon the desert slender salamander.

The influence of season, temperature, moisture, food supply, predation, and breeding on surface activity and population size are unknown. Hence, precise limiting factors cannot be delineated with any certainty; however, it is suspected that an appropriate moisture level is of critical importance.

Reproductive Biology

Little is known about the breeding habits or courtship of any species of Batrachoseps. For the garden slender salamander (B. major) and California slender salamander (B. attenuatus) egg laying seems to occur not long after the first heavy rains of the winter (November to January). It is believed courtship and breeding occur very shortly before egg laying in these latter two species (Arnold, pers. comm.). The relictual

slender salamander (B. pacificus relictus) at the southern end of its Sierran range is semiaquatic and appears to deposit its eggs much later, in the spring or summer (Brode, unpubl. data; Murray, unpubl. data). The eggs of the desert slender salamander have never been observed.

Habitat Description

Climate of the area is characterized by low and erratic rainfall, high summer temperatures, and strong vernal winds. Rainfall at a site of equal elevation 1.6 km (1 mi) from the Hidden Palms Canyon salamander habitat averaged 10 cm (3.94 in) a year for the two years previous to April 1976. Based on comparisons with rainfall at the Deep Canyon Desert Research Center, 3.2 km (2 mi) away from Hidden Palms Canyon and 606 m (2,000 ft) lower, this rainfall level fits the average for the 15 years previous to 1976. Total rainfall during 1976 and 1977 was well above average with values of 39.4 cm (15.5 in) and 22.5 cm (8.9 in) respectively, near the salamander site.

Temperatures for the period 1974 through 1977 had an average low of 15°C and an average high of 25°C. In July average highs were 35°C, and lows were 25°C. In January mean maximum temperature was 16°C, and mean low temperature was 7°C. Freezing temperatures occur less than two nights per year on the average.

Normally dry waterfalls and steep canyon walls of igneous and metamorphic rock are found above and below the salamander habitat. Exposed bedrock,

talus, and coarse-grained sand form surface material on surrounding slopes. Rocks are strongly fractured and geologic faulting is evident. Granodioritic rocks associated with the Southern California Batholith are common, but the site is located in a region where major rock types meet, and older metamorphic sediments are intermixed with the granodiorite.

Plants typical of desert oases occupy the salamander habitat(s). A few California fan palm (Washingtonia filifera) and narrow-leaved willow (Salix exigua) occur in the streambed at the Hidden Palms Canyon site. Clinging to the canyon walls are squaw-waterweed (Baccharis sergiloides), stream orchid (Epipactis gigantea), maidenhair fern (Adiantum capillus-Veneris), and sugarbush (Rhus ovata). Numerous other species are also present.

The watershed and slopes surrounding the salamander habitat in Hidden Palms Canyon are dominated by typical desert plants including agave (Agave deserti), mojave yucca (Yucca shidigera), burrobush (Ambrosia dumosa), and galleta grass (Hilaria rigida) in addition to a rich assortment of low shrubs and cacti. Sixty to 80 percent of the ground is bare of perennial vegetation.

The salamander habitat in Hidden Palms Canyon lies within an area heavily utilized by the peninsular bighorn sheep (Ovis canadensis cremnobates), a State listed rare species. The rim of Deep Canyon is within the sheep's summer concentration area and is heavily used for grazing. The rim is also a preferred lambing area because of its close proximity to the spring in Deep Canyon and suitable escape cover.

Amphibians and reptiles associated with the oasis include the red-spotted toad (Bufo punctatus), California tree frog (Hyla cadaverina), western skink (Eumeces skiltonianus), chuckwalla (Sauromalus obesus), and the speckled rattlesnake (Crotalus mitchelli). Birds and mammals noted at the oasis include the cactus wren (Campylorhynchus brunneicapillus), the black-throated sparrow (Amphispiza bilineata), the bighorn sheep (Ovis canadensis), desert wood rat (Neotoma lepida), and the antelope ground squirrel (Ammospermophilus leucurus). A more complete description of the mammalian fauna is available in Ryan (1968).

Habitat Requirements

Information on habitat requirements of the desert slender salamander is meager. One obvious need is a constantly moist environment. Unlike lizards, salamanders have a damp skin through which they breathe 1/. Exposure to warm, dry air results in rapid water loss and extended exposure results in death by desiccation. For the desert slender salamander, this presents special environmental constraints, in that it is now confined to the small area constantly provided with moisture in a region that is otherwise characterized by high temperatures and a pronounced lack of water. Perpetuation of a moist habitat is essential to the salamander's survival.

1/ Salamander in this family are commonly known as "lungless salamanders" and breathe only through the skin.

The desert slender salamander is reclusive. Preliminary observations indicate the species spends most of its life within porous soil, bedrock fractures, or limestone sheeting, where seepage provides the requisite moisture. Occasionally the salamander is found above ground, either under loose rocks and other surface objects by day or exposed and active by night.

Probably the most important structural component of the habitat is the porous limestone sheeting that covers portions of the canyon wall in the type locality. The material has built up over a period of years due to seepage and precipitation of the solutes. By possessing a moist interior environment when other nearby retreats dry out, the sheeting may be a refuge of last resort for the salamander. Decay of plant roots and developmental patterns of the sheeting may account for the tunnels and pockets that provide retreats within the sheeting.

The existing limestone sheeting in Hidden Palms Canyon is shaded during most of the year due to the angle of the sun and orientation of the walls. Most of the sheeting is located away from the direct path of floodwaters. That portion of sheeting in the floodpath was eroded down to bedrock during the severe tropical storms of September 1976. The loss of limestone sheeting, intermixed soil, and plant material represented a loss of approximately one-third of the available salamander habitat.

Although the salamander habitat in Hidden Palms Canyon is quite small [less than 0.2 ha (0.5 acre)], it depends on an approximately 182 ha (440 acre) watershed for sustenance in the form of subterranean water. Water does not usually reach the salamander site as streamflow but rather as seepage from groundwater that is in turn replenished by rainfall on the watershed above.

Data on the quantity, quality, and chemical content of the water and soil characteristics are lacking. Because of the relatively pristine condition of the watershed and surrounding slopes, contamination of soil or water is unlikely. However, any eventual developments on private lands within the watershed above the Hidden Palms Canyon site could contribute to seepage contamination or changes in water percolation rates.

Population Density

The population size of the desert slender salamander is under current investigation. During the course of a year-long study in Hidden Palms Canyon, the maximum number of salamanders seen in a single night was 21 (Bleich, unpubl. data). Studies on other species of Batrachoseps indicate that only a fraction of a given salamander population is on the surface at any one time. Hendrickson (1954) found the average reappearance of marked individuals of B. attenuatuswas 9 percent, and Cunningham (1960) found a 4 percent reappearznce for B. major. Bleich (1978) provided a very approximate population estimate for the Hidden Palms Canyon oasis of 182.6 to 514.7 individuals based upon reappearance estimates derived for related species (Cunningham 1960).

Threats

The continued existence of the desert slender salamander is threatened by a variety of factors including its extremely restricted distribution. Since salamanders require moist conditions, desiccation of the environment during a prolonged drought could be disastrous. Maintenance of the salamander habitat in Hidden Palms Canyon is dependent on seepage from groundwater originating on the 178 ha (440 acre) watershed above the box canyon. Groundwater pumping or water diversion projects in this watershed could indirectly destroy salamander habitat. At present the watershed is undeveloped except for a highway, scattered homesites, and dirt roads. However, since 80 percent of the watershed is privately owned, additional development of the area is anticipated.

Erosion, precipitated by storms of unusual severity (as occurred in September 1976), may cause additional deterioration of the habitat. Although some of the damage in Hidden Palms Canyon caused by this one storm has been repaired, future erosion of prime habitat is still possible.

Human activity at the site appears to be minimal. The steep walls around the Hidden Palms Canyon site hide the oasis and discourage access, even though it is only 0.8 km (0.5 mi) from a State highway. Refuse, campfires, foot trails, or other evidence of public use have not been encountered. However, because the area occupied by the salamander is so small, permanent damage easily could be inflicted, purposely or inadvertently.

Although protected by Federal law and listed as Endangered by both the Federal and State governments, the desert slender salamander may still be subject to illegal taking. There is no known commercial exploitation of any species in this genus, but unrestrained scientific collection of specimens could place the species in jeopardy because of its extremely limited numbers (Rado, pers. comm.).

Legal Status

From the extremely restricted distribution, limited habitat, and small population size of the desert slender salamander, it was apparent in the early 1970's that the species was in a precarious state of existence. On May 21, 1971, the California Fish and Game Commission declared it to be endangered under provisions of the 1970 California Endangered Species Act. The desert slender salamander was listed as "endangered" by the International Union for the Conservation of Nature and Natural Resources in the second edition of the Red Data Book in 1973. It was determined to be an Endangered species by the U.S. Fish and Wildlife Service in 1973, (Federal Register , 4 June 1973, vol. 39 (106): 14678).

Conservation Efforts

Land Acquisition

Concommitant with listing the species as endangered was recognition of the need to preserve its habitat. In 1973, 55.9 ha (138 acres) of land surrounding Hidden Palms Canyon and including the habitat were purchased by the State of California with funds from the sale of personalized

license plates. In 1974 the land was placed under the directorship of the California Fish and Game Commission and established as the Hidden Palms Ecological Reserve within the Ecological Reserve System (State of California Ecological Reserve Act of 1968). It is managed by CDFG. Lands within this system are designated for "...the purpose of protecting rare and endangered wildlife or aquatic organisms...for the benefit of the general public to observe native flora and fauna and for scientific study."

Habitat Stabilization

Subsequent to the floods of September of 1976, the CDFG installed gabions to prevent undercutting of the remaining sheeting. This sheeting is located along the north-facing wall where the canyon's floor was lowered 1.8 m (6 ft) to 3.1 m (10 ft) during the floods. The gabions are large wire baskets containing rocks. These rockfilled baskets stand about 1.8 m (6 ft) high and run 11.3 m (37 ft) along the base of the wall.

Controlling Access

Purchase and removal of a residence within 0.2 km (1/8 mile) of Hidden Palms Canyon by CDFG reduced vandalism by unauthorized individuals using the residence.

The California Department of Transportation has placed boulder barricades along the nearby State highway to discourage parking of automobiles on on the Hidden Palms Ecological Reserve land. These steps were necessary to protect the fragile ecosystem of the preserve.

PART II

RECOVERY

Objectives

The prime objective of the Desert Slender Salamander Recovery Plan is to perpetuate the species by stabilizing, protecting, and monitoring existing habitat and maintaining a viable, self-sustaining population. In the event that a second or subsequent population(s) is discovered and found to be a viable self-sustaining population(s) of the same species, reclassification to threatened status may be warranted. Because of the species' extremely restricted distribution, low population numbers, and susceptibility to habitat destruction, it is unlikely that the status of the desert slender salamander will warrant delisting any time in the near future.

The Hidden Palms Canyon population of the desert slender salamander consists of probably fewer than 600 individuals and occupies a habitat of less than 0.2 ha (0.5 acre). Maintenance of population size and habitat, or even enhancement of such, at this one limited site would not be sufficient to warrant reclassification from endangered to threatened status. An increase in human activity such as additional groundwater pumping or water diversion in the above watershed which has seen limited use, could have serious consequences for the desert slender salamander and its habitat.

Maintenance of the species cannot be assured without the presence of at least two viable, self-sustaining populations whose habitats rely upon different watersheds for their sustenance (e.g., water supply). Insufficient information currently exists on the more recently discovered population in Guadalupe Canyon to warrant considering reclassifying the species to threatened status. Data regarding population size, amount of habitat, as well as size and ownership of the watershed will be necessary before any determination of this kind is made. Additional examination of other seepages between these sites should also be undertaken to determine if small populations may have been undetected during prior surveys for the CDFG and BLM. Additional surveys at unsurveyed seepages and springs in the general area may be needed to determine, as conclusively as possible, if any other populations of the desert slender salamander exist.

Step-down Outline

PRIME OBJECTIVE: To prevent the extinction of the desert slender salamander by stabilizing and protecting existing habitat(s) (estimated at one acre) and maintaining viable, self-sustaining population(s) within at least two sites; and determine the number and sizes of populations necessary for reclassifying the species to Threatened status and to an eventual delisted status.

1. Protect and manage Hidden Palms Ecological Reserve.
    11. Stabilize water component of habitat.
        111. Determine impacts on water component of habitat.
        112. Prevent diversion of storm runoff.
        113. Discourage local groundwater pumping.
        114. Determine source of underground water.
    12. Protect the watershed.
        121. Assess alternatives for protecting watershed.
        122. Determine necessity of protecting land.
        123. Evaluate components of watershed.
    13. Prevent catastrophic habitat loss.
    14. Determine parameters affecting and/or limiting the population.
        141. Determine habitat requirements.
        142. Examine ecology of the desert slender salamander.
        143. Assess impacts of climatological factors.

144. Assess requisites of successful reproduction.

1441. Conduct necessary reproductive studies using captive related species.

1442. Conduct necessary reproductive studies on the desert slender salamander.

145. Analyze impacts of predation and other mortality factors on population(s).

146. Examine other factors affecting survivability.

15. Monitor the population.

151. Determine the size and extent of the population.

152. Determine age class structure and composition.

153. Determine the life-cycle of the desert slender salamander.

154. Define activity patterns.

16. Monitor the habitat at Hidden Palms Canyon.

161. Record physical changes in the habitat.

1611. Set up photo plots.

1612. Photograph sites in March and July.

1613. Monitor soil temperature, moisture conditions, water supply, and other climatological factors.

1614. Examine gabion structure.

1615. Assess need for additional stabilization or restoration of desert slender salamander habitat at Hidden Palms Canyon Ecological Reserve.

162. Implement program for assessing water quality.

2. Develop and implement management plans for other naturally occurring populations of the desert slender salamander.

21. Verify identity of suspected new populations of B. aridus.

22. Monitor the population(s) at new sites.

221. Assess population numbers.

222. Determine age class structure and composition.

223. Determine factors affecting reproductive success.

224. Determine factors affecting survivability.

23. Monitor the physical changes in the habitat at new site(s).

231. Set up photo plots.

232. Photograph sites in March and July.

233. Monitor soil temperature, moisture conditions, water supply, and other climatological factors.

234. Determine if habitat restoration is necessary.

235. Implement program for assessing water quality.

24. Conduct surveys of springs and oases in Santa Rosa and San Jacinto Mountains. (See also 33, and 312).

3. Assess feasibility and necessity of introducing the desert slender salamander at particular sites.

31. Determine historical range of desert slender salamander.

311. Examine and/or obtain additional paleontological or other data pertaining to distribution.

312. Conduct additional thorough field surveys of potential habitat (see also 24, 33).

32. Monitor selected potential sites for physical parameters.

33. Examine springs and oases on the desert slopes of the Santa Rosa and San Jacinto Mountains for potential transplantation sites (see items 24 and 312).

34. Develop holding, breeding, and rearing methodology for desert slender salamander using common species of Batrachoseps.

4. Minimize unauthorized disturbance to the desert slender salamander and its habitat(s).

41. Enforce State and Federal regulations protecting the desert slender salamander and its habitat.

42. Coordinate recovery efforts with law enforcement personnel.

43. Relocate road pullout to more distant location.

44. Encourage CalTrans to refrain from modifying the water drainage patterns along State Highway 74.

45. Construct interpretive displays of the desert slender salamander in the local community, refraining from publicizing the exact location of the habitats.

451. Establish interpretive display at Vista Point.

452. Establish interpretive display at Whitewater.

5. Determine the number and sizes of populations necessary for reclassifying the species to Threatened and to delist.

51. Number and distribution of populations.

52. Size and characteristics of individual populations.

53. Habitat characteristics necessary to support self-sustaining population(s).

Narrative

The primary goal of this recovery plan is to prevent the extinction of the desert slender salamander by protecting existing habitat(s), estimated at less the 0.4 ha (1 acre) and maintaining viable, self-sustaining populations within at least two sites, and determine the number and size of populations necessary for reclassifying the species to Threatened and eventual delisting.

To accomplish this goal, it is necessary to make the Hidden Palms Canyon habitat and any other verified sites as secure as possible from natural catastrophes and human disturbance. Since moisture is a critical decisive factor in the maintenance of a suitable habitat, it is imperative to prevent the diversion of storm runoff from the watershed (112) and preclude excessive groundwater pumping (113). The water source for the habitat should be clearly defined (111) and delimited (114). Alternatives for protecting the watershed should be assessed (121) and the best options for securing that portion responsible for supplying water to the salamander site proposed as determined necessary (122, 123).

Little information is available on the life history, behavior, ecology, reproductive biology, population dynamics, or habitat

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1/ Keyed to Outline

requirements of the desert slender salamander. The lack of data is primarily attributable to the recent discovery of this species. Studies to collect and analyze data on the above are necessary to provide for appropriate and effective management of this species (141-146). In addition, the Hidden Palms Canyon population of desert slender salamander should be carefully monitored for size and extent of the population (151), age class structure (152), life cycle (153), and activity patterns (154). Such close scrutiny should provide valuable insight into limiting factors and possible ways to overcome such population constraints.

Monitoring of the habitat at Hidden Palms Canyon (16) is essential to delineate habitat parameters which may be crucial to the species' survival. Factors to be monitored include soil temperature, moisture conditions, water supply, and other climatological elements (1613). Physical changes will be monitored by analyzing photos taken at 5 to 10 established photograph sites (1611) in late March and late July each year (1612). The gabion structure recently installed at Hidden Palms Canyon needs to be assessed for its stability and effectiveness in preventing catastrophic habitat losses (13, 1614). Additional stabilization or restoration of the habitat needs to be evaluated and recommendations proposed (1615). A program for assessing water quality and quantity needs to be developed. One objective would be an early warning of unfavorable trends in this element of the habitat

in an effort to initiate timely corrective measures (162).

Thirty potential salamander sites were surveyed during a recent Bureau of Land Management area investigation. Aside from Guadalupe Canyon, apparently only two additional sites, Agua Bonita and Cat Canyon, are suitable as habitat, although no specimens were found at either locality. A follow-up survey of oases and springs in the Santa Rosa and San Jacinto Mountains during periods of high surface moisture should be undertaken to determine if any additional populations of the salamander are present. The survey should concentrate on sites (seeps, springs etc.) in drainages where the presence of this species has been confirmed (24). Any newly discovered population should be verified as to its correct systematic status (21), and if determined B. aridus, the population must be carefully assessed and monitored (22). The size (221) and age class structure (222) should be determined and factors affecting their reproductive success (223) and survivability (224) should be determined. Only through a better understanding of the species' ecology can it be determined what management objectives are essential for its recovery. Newly discovered habitat should be monitored for physical changes in soil moisture levels, pH, temperature (233). A program for assessing water quality and quantities is appropriate (235). Since the site may only be visited twice a year by authorized personnel, the extent of the monitoring effort for physical parameters will be limited by the capability of the equipment. One method for recording changes and trends is through

the establishment of five to ten photographic points randomly distributed in the habitat (231). Photographs would be taken each year in mid- to late March and July (232). Regular evaluation of the photographs will aid in determining detrimental changes and proposing corrective actions (234).

If no other new populations are located, the necessity and feasibility of reintroductions must be determined (3). It should be emphasized that while the need to reintroduce desert slender salamanders into any habitat will be carefully assessed, as it is hoped that the species can be maintained without such manipulation. It is the policy of the USFWS not to introduce organisms outside their known historical range. In order to determine the historical distribution of this species (31), all appropriate paleontological evidence will be examined; additional information may need to be obtained (311). Additional thorough field surveys of potential habitat may be necessary (312). The species' habitat requirements and status must be evaluated to determine if reintroduction is biologically feasible and essential to the conservation of the species.

Potential sites for reintroduction or transplantation may be selected based upon surveys of the area and the recognized habitat requirements of the species (141, 142). Potential transplant sites should be monitored for both biotic and abiotic factors (32, 33). Methodology for holding, breeding, and rearing DSS should be developed using common species of Batrachoseps (34).

Since the population(s) are so small and occupy such limited areas, it is mandatory to minimize unauthorized disturbance to the salamanders and their habitat(s) (4). An unauthorized collection of this species could quickly remove a significant portion of the population. Enforcement of State and Federal laws protecting the species (41) and coordination with law enforcement personnel (42) should reduce the likelihood of illicit collecting. The Fish and Wildlife Service has determined that Critical Habitat for the desert slender salamander will not be designated. Any such a proposal would necessitate publication of a detailed map indicating the precise location of the population (Section 4, Endangered Species Act of 1973, as amended). Publishing such a map would not be in keeping with the best conservation efforts for the species as it would increase the likelihood of vandalism and collecting. Public support may be generated through the development and installation of interpretative displays (45, 451, 452) which help provide a better understanding of this Endangered species and the issues pertaining to its recovery.

While maintaining the current population is the immediate concern, eventual improvement of the species' status demands that information concerning criteria for recovery be collected and analyzed (5). The population/habitat parameters for downlisting to Threatened and for delisting are unknown at this time, but will include number and distribution of populations (51), size and characteristics of individual populations (52), and habitat characteristics necessary to support self-sustaining populations (53).

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PART III

IMPLEMENTATION SCHEDULE

Table I, which follows, is a summary of scheduled actions and costs for the desert slender salamander recovery program. It is a guide to meet the objectives of the Desert Slender Salamander Recovery Plan, as elaborated upon in Part II, Action Narrative Section. This table indicates the priority in scheduling tasks to meet the objectives, which agencies are responsible to perform these tasks, a time-table for accomplishing these tasks, and lastly, the estimated costs to perform them. Implementing Part III is the action of the recovery plan, that when accomplished, will satisfy the prime objective. Initiation of these actions is subject to the availability of funds.

GENERAL CATEGORIES FOR IMPLEMENTATION SCHEDULES

Information Gathering - I or R (research)

1. Population status
2. Habitat status
3. Habitat requirements
4. Management techniques
5. Taxonomic studies
6. Demographic studies
7. Propagation
8. Migration
9. Predation
10. Competition
11. Disease
12. Environmental contaminant
13. Reintroduction
14. Other information

Management - M

1. Propagation
2. Reintroduction
3. Habitat maintenance and manipulation
4. Predator and competitor control
5. Depredation control
6. Disease control
7. Other management

Acquisition - A

1. Lease
2. Easement
3. Management agreement
4. Exchange
5. Withdrawal
6. Fee title
7. Other

Other - O

1. Information and education
2. Law enforcement
3. Regulations
4. Administration

Task Priority

Priority 1 - All actions that are absolutely essential to prevent extinction of the species.

Priority 2 - All actions necessary to maintain the species' current population status.

Priority 3 - All other actions necessary to provide for full recovery of the species.

IMPLEMENTATION SCHEDULE

GENERAL CATEGORY	PLAN TASK	TASK NO.	TASK PRIORITY	TASK DURATION (Yrs.)	RESPONSIBLE AGENCY* FWS REGION	FWS PROGRAM	OTHER AGENCIES[2]	FISCAL YEAR COSTS 1/ (EST.) (in $1,000's) FY'83	FY'84	FY'85	COMMENTS/NOTES
I2	Monitor soil temperature, moisture conditions, and water supply	233	2	Ongoing			* BLM	-	-	-	
R4	Determine if habitat restoration is necessary	234	1	Ongoing	1	SE			5		
I2	Implement program for assessing water quality	235	1	1			* CDFG BLM		x Unknown		
I2	Conduct thorough field surveys **	312	2	2			* CDFG	7.5	7.5	-	
I2	Locate and examine springs	33	2	2			* BLM CDFG	7.5 -	7.5 -	- -	
I13	Develop holding, breeding and rearing methodology for DSS using common species of Batrachoceps	34	2	3			* CDFG BLM	5.0 -	5.0 -	5.0 -	
02	Enforce State/Federal regulations	41	2	Ongoing	1	SE	* CDFG BLM		Unknown		
02	Coordinate with enforcement personnel	42	2	Ongoing	1	LE	CDFG BLM		Unknown		
M3	Relocate road pullout	43	2	1			* CalTrans		Completed		
M3	Refrain from altering water drainage patterns along Highway 74	44	1	Ongoing			* CalTrans CDFG		Unknown		
R14	Determine habitat/population criteria for changing status and delisting	5	1	3	1	*SE	BLM CDFG	5 5 5	5 5 5	5 5 5	

1/ An "x" in a column indicates preferred starting time.

2 Agency abbreviations:

FWS = U.S. Fish and Wildlife Service (SE = Endangered Species Program)

BLM = Bureau of Land Management
CDFG = California Department of Fish and Game
CalTrans = California Department of Transportation

* Agency with lead responsibility

APPENDIX A

AGENCIES CONTACTED DURING AGENCY REVIEW

Responded

* U.S. Fish and Wildlife Service - - Washington, D.C. and Portland, OR
* Bureau of Land Management - - Riverside, CA
* California Department of Fish and Game - - Sacramento and Long Beach, CA
* California Department of Transportation - - Sacramento, CA
* University of California, Riverside (W.W. Mayhew) - - Riverside, CA