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SANTA CRUZ LONG-TOED SALAMANDER RECOVERY PLAN



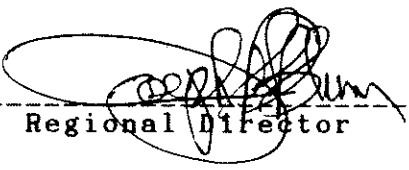
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RECOVERY PLAN

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Revision Approved: 
Regional Director

12/23/85
Date

THIS IS THE COMPLETED REVISED SANTA CRUZ LONG-TOED SALAMANDER RECOVERY PLAN. IT HAS BEEN APPROVED BY THE U.S. FISH AND WILDLIFE SERVICE. IT DOES NOT NECESSARILY REPRESENT OFFICIAL POSITIONS OR APPROVALS OF COOPERATING AGENCIES, AND IT DOES NOT NECESSARILY REPRESENT THE VIEW OF ALL INDIVIDUALS WHO PLAYED THE KEY ROLE IN PREPARING THIS PLAN. IT HAS BEEN REVISED BY MONTY D. KNUDSEN IN COOPERATION WITH THE SANTA CRUZ LONG-TOED SALAMANDER RECOVERY TEAM AND DELINEATES REASONABLE ACTIONS WHICH ARE BELIEVED TO BE REQUIRED TO PLACE THE ASSIGNED SPECIES IN THE BEST POSSIBLE POSITION. THIS PLAN IS SUBJECT TO MODIFICATION AS DICTATED BY NEW FINDINGS AND CHANGES IN SPECIES STATUS AND COMPLETION OF TASKS DESCRIBED IN THE PLAN. GOALS AND OBJECTIVES WILL BE ATTAINED AND FUNDS EXPENDED CONTINGENT UPON APPROPRIATIONS, PRIORITIES, AND OTHER BUDGETARY CONSTRAINTS.

LITERATURE CITATION SHOULD READ AS FOLLOWS:

U.S. Fish and Wildlife Service, 1986. Santa Cruz Long-toed Salamander Recovery Plan. U.S. Fish and Wildlife Service, Portland, OR. 64 pp.

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Santa Cruz Long-toed Salamander Recovery Plan

Executive Summary

1. Point or condition when the species can be considered non-endangered?

When breeding populations of the Santa Cruz long-toed salamanders are maintained with approximately equal sex ratios at or above 2,600 animals at Valencia Lagoon and 6,500 animals at Ellicott Slough for a minimum of 10 years, and at least 3 additional sites are secured and adequately managed to support self-maintaining populations of at least 2,600 breeding animals each with approximately equal sex ratios and recruitment equal to or exceeding mortality.

2. What must be done to reach recovery?

Continue maintaining breeding populations at Ellicott and Valencia with the above numbers of animals and securing at least three additional sites with at least 2,600 breeding adults with equal sex ratios, recruitment equal to or

exceeding mortality and maintaining all habitats in optimum condition.

3. What specifically must be done to meet the needs of #2?

Conduct periodic population assessments at Ellicott and Valencia, develop assessment techniques, conduct vegetation surveys, monitor habitat and water quality, survey and evaluate additional sites with populations, secure at least 3 additional sites and manage to insure breeding populations of at least 2,600 animals in approximately equal sex ratios and recruitment equalling or exceeding mortality.

4. What management/maintenance needs have been indentified to keep the species recovered?

Continue population monitoring and law enforcement efforts, continue to provide controlled public access and interpretive programs for Ellicott and Valencia and expand programs as additional sites are secured. Maintain planning liason with Santa Cruz

and Monterey Counties. Undertake management actions as necessary to maintain habitat in optimum condition and numbers of breeding animals at or above identified target levels.

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SANTA CRUZ LONG-TOED SALAMANDER

RECOVERY PLAN

PART I

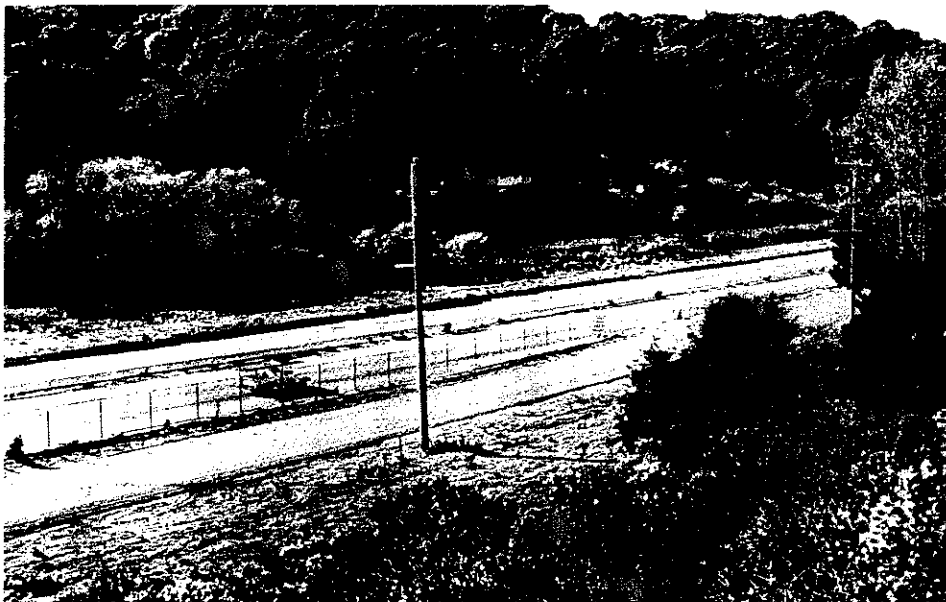
INTRODUCTION

Brief Overview

The Santa Cruz Long-toed Salamander (Ambystoma macrodactylum croceum) was discovered in 1954 at Valencia Lagoon, Rio del Mar, Santa Cruz County, California (Russell and Anderson 1956). This information was not generally known to public agencies until Caltrans proposed to convert State Route 1 to a freeway in 1969. The highway project eliminated the type locality, a freshwater lagoon (Plate I). Also, about this time the only other known breeding pond, Ellicott Station, was threatened by a proposed mobile home park. These threats and the limited distribution of the salamander resulted in its listing as an endangered species by the U.S. Fish and Wildlife Service (32 FR 4001, March 11, 1967) and the California Fish and Game Commission.



Valencia Looking Southwest Across State Route 1 Prior To Freeway (Interchange) Construction (FWS Photo Spring 1967)



Valencia Looking Southwest Across State Route 1 After Freeway (Interchange) Construction (DFG Photo Winter 1975)

Plate I VALENCIA BEFORE AND AFTER FREEWAY CONSTRUCTION

Since its listing, many steps have been taken by the California Department of Fish and Game, Santa Cruz County and the Service to protect, restore, and manage the species and its habitat. Breeding sites and upland areas at Ellicott Pond and Valencia have been acquired by the State of California, Department of Fish and Game (1975) and the U.S. Fish and Wildlife Service (Sharp 1975).

These actions appear to have halted further degradation of the breeding ponds at Valencia and Ellicott but may not be sufficient to insure the survival of this subspecies. This revised recovery plan identifies the requirements for the recovery and perpetuation of this subspecies and proposes orderly and comprehensive actions to meet these requirements.

Description and Taxonomy

The Santa Cruz long-toed (Ambystoma macrodactylum croceum) is a small [holotype snout vent length 57.2 mm (2.25 in)], dark colored salamander of the family ambystomatidae (Plate II). Its taxonomic status is well established (See Ferguson 1961, Anderson 1960,



Plate II
SANTA CRUZ
LONG-TOED
SALAMANDER

(From original photograph
by John Brode, California
Department of Fish & Game
approx. X 3.25)

Russell and Anderson 1956). It differs from the nominate form by the dull orange or metallic yellow dorsal markings which are a series of discrete, irregular patches; and greatly reduced dorsal head markings of small scattered dots often absent anterior to the eyes (Ferguson 1961). The ventral surface is sooty black. The vomerine teeth form a continuous or broken row across the roof of the mouth. Adults reach a total length of about 127 mm (5 inches).

Status and Distribution

The Santa Cruz long-toed salamander is a relict form of a species that was widespread throughout much of California during and immediately after the last Pleistocene ice advance, 10,000 to 12,000 years ago (Ruth and Tollestrup 1973). It has been postulated that during subsequent climatic changes and drying conditions in California following the end of the Pleistocene epoch (Stebbins 1949, Raven and Axelrod 1978), several populations of the ancestral species became isolated in the area of Santa Cruz, California, 840 km (522 miles) south of the nearest coastal population of the species and 240 km (149 miles)

southwest of the nearest Sierra Nevada population (Anderson 1967, Russell and Anderson 1956, Ruth and Tollestrup 1973). In adapting to the very different conditions far from the main range of the species, the Santa Cruz populations evolved during the last several thousand years into a distinct subspecies.

At the time of its discovery in 1954 only the Valencia Lagoon population (also referred to as Rio Del Mar) was known (Russell and Anderson 1956). Two years later an additional population was found at Ellicott, approximately 6.4 km (4 miles) southsoutheast of Valencia (Anderson 1967). Further intensive efforts by the California Department of Fish and Game in cooperation with the Service to determine the essential habitat of this endangered animal uncovered two additional populations at Bennett Slough (sometimes called Struve Pond) and Seascape with potential sites at Moro Cojo and McCluskey Slough (Figure 1). Appendix A provides legal descriptions of the Ellicott and Valencia sites.

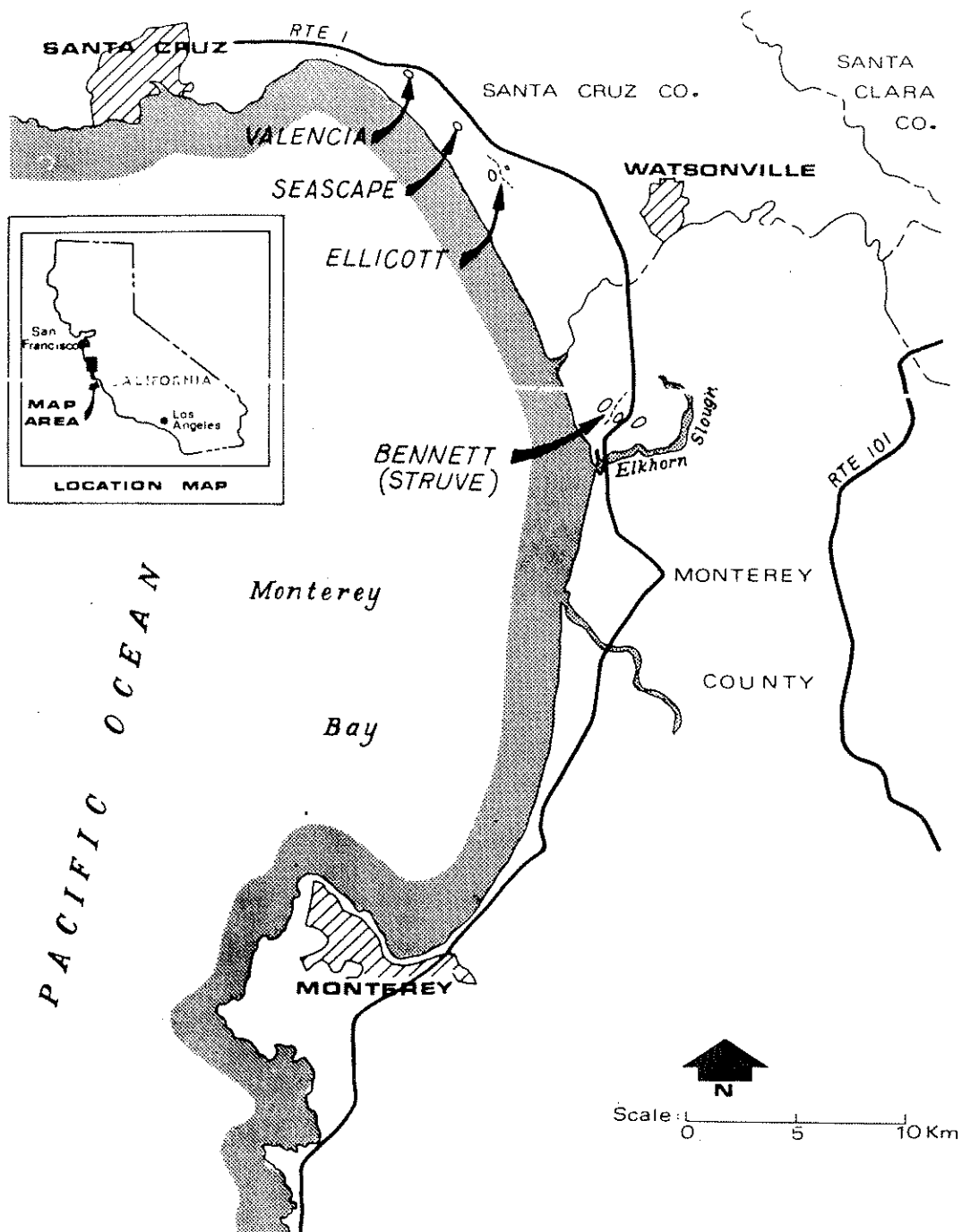


Figure 1. Known distribution of the Santa Cruz long-toed salamander: Valencia, Seascape, Ellicott, and Bennett.

Life History

The Santa Cruz long-toed salamander spends most of its life underground in animal burrows and along the root systems of plants in upland chaparral and woodland areas protected from heat and the drying rays of the sun. These areas surround the breeding ponds and extend from a few hundred feet away to as much as a mile or more. Adult salamanders leave their upland chaparral and woodland summer retreats with the onset of the rainy season in late September and October, and begin their annual migration to the breeding pond. Salamanders migrate only on nights of rain, mist, or heavy fog. They arrive at the breeding pond from November through February, with most arriving in January and February. Peak breeding occurs during January and February because early rains usually are not sufficient to fill the pond. As salamanders enter the pond they pair up, court and breed.

Female Santa Cruz long-toed salamanders have specialized and selective egg-laying habits. Eggs are laid singly on submerged stalks of spike rush (Eleocharis) or other vegetation about 2-3 cm (1 inch)

apart (Anderson 1960). Free floating, unattached, and clustered eggs have also been observed. Each female lays about 200 eggs per year.

After courtship and egg-laying adult salamanders leave the pond through early March returning to the same general areas where they spent the previous summer. The eggs, and later the larvae, are left unattended.

Details on larval life history are based, in part, on information from a near relative (Ambystoma talpoideum) (Shoop 1960). Eggs usually hatch in about a week. The larvae remain in the pond environment until they reach a minimum size of about 32 mm (1.3 inches) snout-vent length (S-V) (Anderson 1960). Once this size is reached, the larvae may metamorphosis in a relatively short time if the pond environment becomes unsuited for continued larval growth. However, a complex of factors determine the timing of metamorphosis (Werner 1986, Wilbur and Collins 1973, Wilbur 1976, Smith-Gill and Berven 1979). Metamorphosis typically occurs from early May to mid-August. The body size at initiation of metamorphosis

is variable, ranging from 36-48 mm (1.3 - 1.8 inches, S-V). In A. talpoideum metamorphosis can be induced in the laboratory by starvation, pollution of the water, increased water temperatures, or drying of the aquatic habitat (Schoop 1960).

If water is available to the larvae for a longer period of time, it may be advantageous for them to remain in the pond. A larger body size at metamorphosis increases resistance to desiccation, makes the individual less vulnerable to predation, and increases the size range of food items that can be eaten (see also Werner 1986 for a detailed discussion).

As the pond begins to dry, the juvenile salamanders seek underground refuge at or near the pond. During the next rainy season, these recently metamorphosed juveniles disperse farther away from the pond not returning until they reach sexual maturity at 3-4 years. Minimum adult size is about 50 mm (2 inches, S-V).

Causes of Decline

By 1955 Valencia Lagoon had been reduced by one-

third to one-half of its original 1.14 acres by highway construction (R. Stebbins, field notes, 1955). In 1969 the remaining lagoon was drained. An artificial pond was constructed by Caltrans at the Valencia site in 1970 as mitigation for the highway development, and now provides successful replacement breeding habitat for the salamander. This so-called "mitigation pond" enables the Santa Cruz long-toed salamander to survive and reproduce, but at lower and more vulnerable population levels than the previous natural lagoon. Although the breeding pond and several of the adjacent upland parcels are now owned by the Department of Fish and Game, residential development on the oak-covered hillside adjacent to Valencia encroaches upon the terrestrial habitat of the salamander, and additional development remains a potential threat to the remaining upland habitat.

Survival of the Ellicott population of SCLTS was threatened in 1971 when the landowner applied to Santa Cruz County to rezone the tract of land, including the pond itself, for a trailer park development. Subsequent purchase of the pond site and adjacent parcels by the U.S. Fish and Wildlife Service and

Wildlife Conservation Board secured the entire pond area and most of the surrounding habitat; but, development proposals and improper land uses on adjacent parcels still pose potential threats to portions of the terrestrial habitat at Ellicott.

Little information is available on two other known populations, at Bennett Slough and Seascape pond. The privately owned Bennett Slough habitat appears to be threatened by encroaching agriculture and saltwater intrusion, while proposed residential development threatens the population at the privately owned Seascape site. An environmental impact report is being prepared for the proposed residential development at Seascape pond. This report supposedly will identify means to protect the salamander and its habitat on site, while providing some level of development. Data on the Bennett Slough situation are inconclusive, but salt intrusion appears to be an imminent threat to the population at the site.

Limiting and Threatening Factors

The restricted distribution of the Santa Cruz long-toed salamander appears to be the result of climatic changes that occurred in California over the last 10,000 - 12,000 years. Consequently, the major factor limiting the distribution of the Santa Cruz long-toed salamander at present is the naturally restricted availability of suitable habitat. Moreover, the very restricted and disjunct distribution of the various populations coupled with a number of natural and human-associated threats places significant uncertainty on the survival of the salamander in the wild. The principal factors affecting the species' survival include fluctuating weather patterns, the amount and stability of available habitat, predators, disease, genetic structure of each population, and activities of man.

Sufficient rainfall is required to provide habitat. In the absence of adequate rainfall breeding habitat becomes critically limited. Suitable breeding habitat must include a relatively shallow, preferably, ephemeral pond that is available from November through

March, with adequate submerged and emergent aquatic plants for cover, egg-laying, and nursery purposes. Plants also provide habitat for the food items eaten by larvae and young salamanders. However, some open water is necessary as excessive emergent plant growth may interfere with larval development by blocking sunlight.

Another vital habitat feature is the availability of relatively dense vegetative cover adjacent to or within short migrating distance (less than mile or 1.6 km) from the breeding pond. Apparently, such cover is preferred in a consolidated, humid, sandy-loam soil type, occupied by abundant populations of mice, gophers, moles, and other tunneling and burrowing mammals or ground-dwelling animals. Therefore, suitable upland non-breeding habitat must include appropriate cover adequately protected from denundation from any cause (fire, local clearing, trampling by man or livestock, land developments, erosion and siltation, disease, etc.).

Protection of available phreatophytic cover and edge detritus fringing the pond habitat is important. Of equal importance is the protection of available upland

oak and other woodlands and the relatively dense understory or ground cover into which the salamanders emigrate and live during the period from April to November.

Availability of food probably is not a serious limiting factor for mature salamanders if the habitat is large and in good condition. Larvae and incompletely metamorphosed salamanders are much more sensitive to food supply. Consequently any activity that reduces food resources for the immature salamanders can cause serious losses to the population. Premature drying of breeding ponds, or contamination by pesticides or other toxic substances, or increased salinity could cause major losses to the populations directly, or indirectly by reducing populations of invertebrate food items of larvae and juvenile salamanders.

All natural enemies of the Santa Cruz long-toed salamander are not known. This is partly a consequence of the secretive habits of the salamanders. It is likely that other amphibian species within the habitat account for some predation. The non-native bullfrog (Rana catesbiana) could threaten some populations but

its threat can be minimized by maintaining ephemeral breeding and nursery ponds or selective removal of bullfrog adults and larvae. Possible predation by herons (Ardea herodias, Butorides striatus, Egretta spp.), kingfishers (Ceryle alcyon), owls (Tyto alba, Bubo virginianus, Otus kennicotti), blackbirds (Agelaius spp.), grebes (Podilymbus podiceps and Podiceps spp., etc.), is minimized because of the secretive, primarily nocturnal activities of mature salamanders above ground and the availability of sufficient cover. Garter snakes (Thamnophis spp.) are probably one of the most significant predators especially during the pond phase of the life cycle. In breeding and nursery ponds, large numbers of eggs, larvae, and incompletely transformed salamanders may be lost each season from garter snakes or even predaceous aquatic insects. However, with sufficient breeding habitat, populations of the salamander should be able to maintain themselves despite these natural predators.

The diseases and parasites affecting the Santa Cruz long-toed salamander are unknown, but probably account for some losses during each phase of the life cycle, especially during the egg and larval stages. By

maintaining several populations at different locations, the chances of extinction from disease or parasites is minimized.

There was little evidence of road kills during the salamander migrations at either Ellicott or Valencia. Consequently, this threat is considered minimal. Urban expansion and associated human activities pose the greatest single threat to the Santa Cruz long-toed salamander. Therefore, the primary efforts of the recovery plan are to reverse or halt the habitat loss resulting from human activities within the range of the species.

Recovery Plan Update

Preparation of the original Santa Cruz Long-toed Salamander Recovery Plan began in late June 1975 and was submitted in final form to the U.S. Fish and Wildlife Service in July 1976 by the Santa Cruz Long-toed Salamander Recovery Team. The plan was approved by the Director of the Service on September 28, 1977. Since that time a number of actions recommended in the original plan have been completed and are summarized below.

Management actions at Ellicott have focused on vehicular trespass, erosion control, and removal of pampas grass (Cortaderia atacamensis) and eucalyptus trees (Eucalyptus globulus) (task number 1222, 1223, 131)^{1/}. Vehicular trespass has been eliminated and most of the erosion (caused by off-road vehicles) has been controlled (122311, 122312). The pampas grass and eucalyptus trees, however, remain a problem and more effective methods of control are being investigated by the California Department of Fish and Game in cooperation with the Service. Lands purchased by the Service at Ellicott have been partially fenced (1224). The San Francisco Bay National Wildlife Refuge, which administers the Service's portion of the Ellicott area (figure 2) will complete the fencing so as soon as possible.

Enforcement of "take" provisions pursuant to Section 9 of the Endangered Species Act of 1973, as amended, continues, though according to the California

^{1/} Task numbers from the original plan.

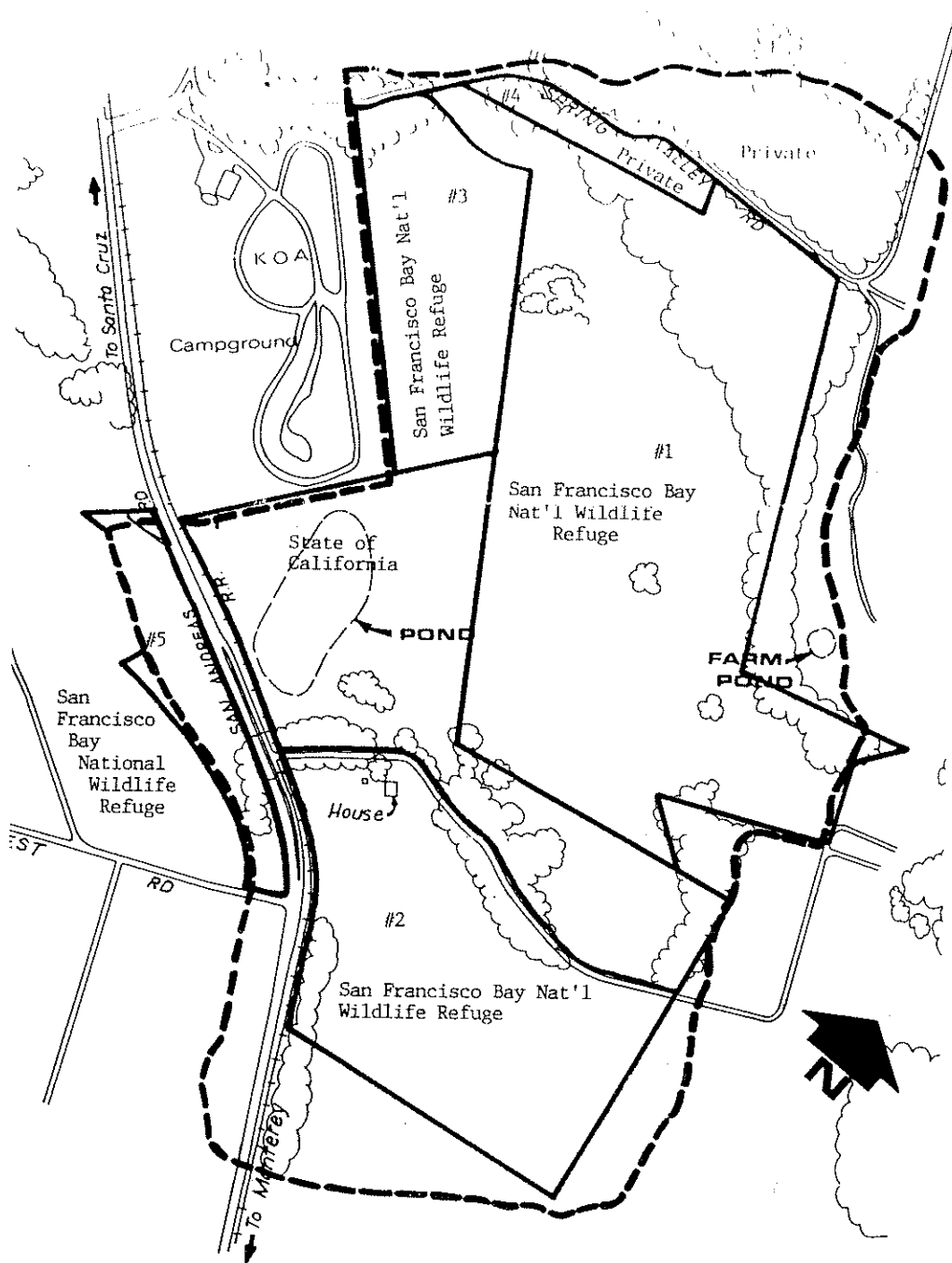


Figure 2. Land ownership at Ellicott, Santa Cruz County.

Department of Fish and Game, illegal collection (take) of the salamander has not been a problem (112). Nonetheless, the Department intends to continue patrolling the areas to prevent possible inadvertent collection of animals.

Fencing of the Valencia Lagoon core area and implementation of the engineering plan to restore the breeding pond (California Department of Fish and Game 1975) were completed in November 1978 (2223, 2224, 22221, 22222). The pond system appears to be working well. Metal flashing has been attached to the base of the fence along the east side of the pond to is fairly effective in preventing salamanders from leaving the core area to breed in the artificial and frequently dredged storm drainage channel (figure 3). However, this flashing needs periodic maintenance.

The status of Santa Cruz long-toed salamander populations at Bennett Slough, Moro Cojo, and McCluskey Slough is largely unknown at this time. The Nature Conservancy acquired a conservation easement over the Struve Pond area at Bennett Slough (412, 4231, 4233), but increasing salinities at the pond appear to

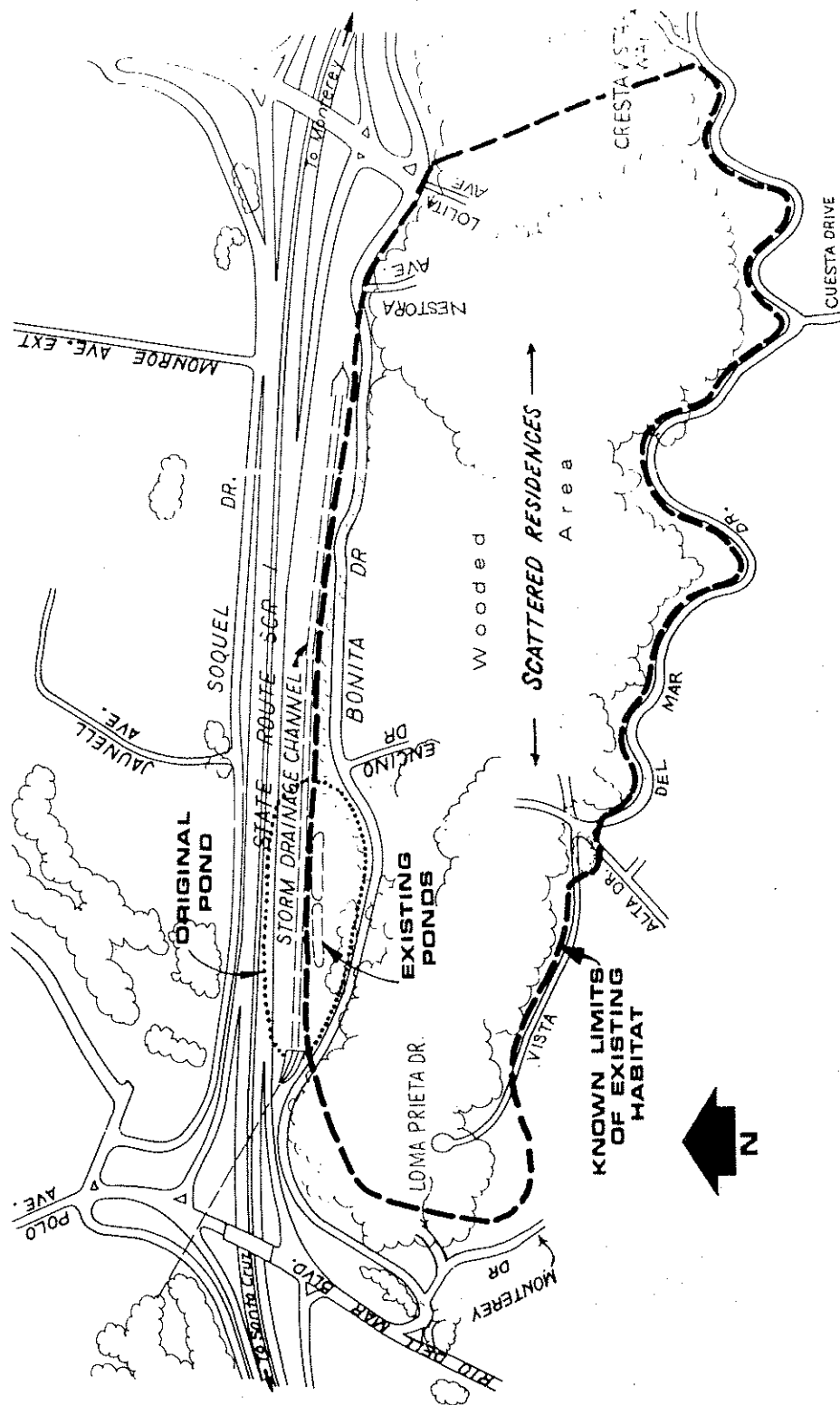


Figure 3. Habitat of the Santa Cruz long-toed salamander in Valencia Lagoon, Santa Cruz County.

prevent recruitment (Rainey 1985). Other sites in this region (e.g., Moro Cojo, McCluskey Slough) also may be threatened by increased salinities as well as several other factors (Rainey 1985). The population at Seascape (Plate III) appears vigorous and large (Stephen Ruth^{2/}, pers. comm. 1986), but a proposed housing development may threaten the site.

Public use at Ellicott has been permitted by the Department of Fish and Game for scientific and educational purposes (512). At present, the area has primarily been used by school groups visiting the reserve. Permission is granted through a letter of condition from the Department's Monterey Office and compliance with reserve regulations has been excellent.

Federal, State, and county protection regulations have been enforced as much as feasible (212). In January 1977, the Valencia site came under the jurisdiction of the California Coastal Commission. The Commission worked closely with the Santa Cruz Long-toed Salamander Recovery Team and California Department of Fish and

^{2/} Biologist Monterey Peninsula College, Monterey, California



BENNETT LOOKING WEST FROM NEAR
STATE ROUTE 1 (DFG PHOTO SUMMER 1975)



SEASCAPE LOOKING NORTH FROM HILL
ADJOINING POND (DFG PHOTO SUMMER 1975)

Plate III. Views of Santa Cruz long-toed salamander habitat
sites at Bennett Slough and Seascape, Santa Cruz
County, California.

Game to develop suitable guidelines for residential development in the Valencia area. The established Local Coastal Plan now implemented by the county has been relatively successful in curtailing development of some of the important upland summer retreat sites, but not all. Unfortunately, ordinances regarding building in the Salamander Protection Zone (Santa Cruz County) have not prevented additional habitat losses primarily because the county nor the Coastal Commission do not have the manpower or time to fully enforce the regulations.

An agreement between the Service and California Department of Fish and Game regarding management of the Ellicott site was signed in 1977 (12223). This agreement designates the Department of Fish and Game as manager for both State and Service lands. All Service lands at Ellicott have been included in the state designated Santa Cruz long-toed Salamander State Ecological Reserve.

The two tracts of land comprising area number 5 (figure 2) at Ellicott were purchased by the Service in 1977 and 1978 (122112). This completed the land acquisition

for this area as recommended in the original plan. The residual Caltrans property at Valencia was transferred to the California Department of Fish and Game in 1979 (222112). Six additional lots were purchased by the California Department of Fish and Game during 1981 and 1982 (221, 22212). Five of these lots front on Bonita Drive and form a block of undisturbed habitat in one of the major salamander migration corridors. The sixth lot lies in a ravine further up slope, also an important migration route (Figure 4).

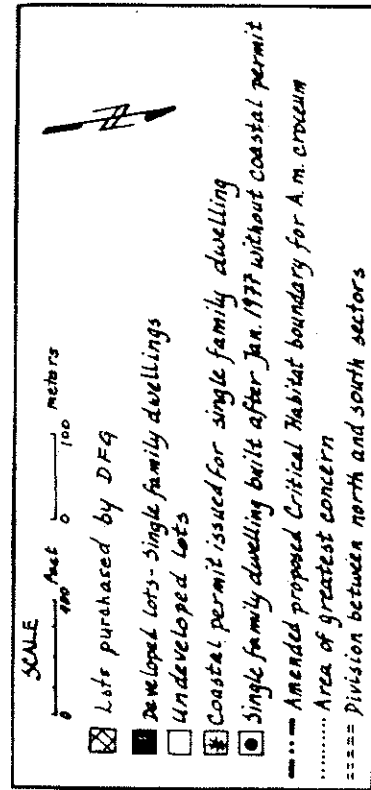
Investigations -- Population and migration studies were carried out by the California Department of Fish and Game in cooperation with the Service at Valencia during 1977-79 (211). The results of these studies are available in Reed (1979, and unpublished). The population at Ellicott was censused during 1979-80 under a Service contract (111). The results of the study indicated that the Ellicott population was healthy and viable (Reed 1980).

During 1977-78, Santa Cruz long-toed salamanders were confirmed at two additional sites, McClusky Slough



Figure 4. Hillside above Valencia Lagoon, Aptos, Santa Cruz County, showing land use and DFG purchases 1981-82.

(adapted from Reed, 1979)



and Moro Cojo Slough (Reed 1979 and unpublished), both in Monterey County (figure 5) (4111). Although investigations of several other sites by Reed failed to locate any other populations, seemingly suitable habitat exists at several areas near Elkhorn Slough. No population censuses have been conducted at localities other than Ellicott and Valencia (4112).

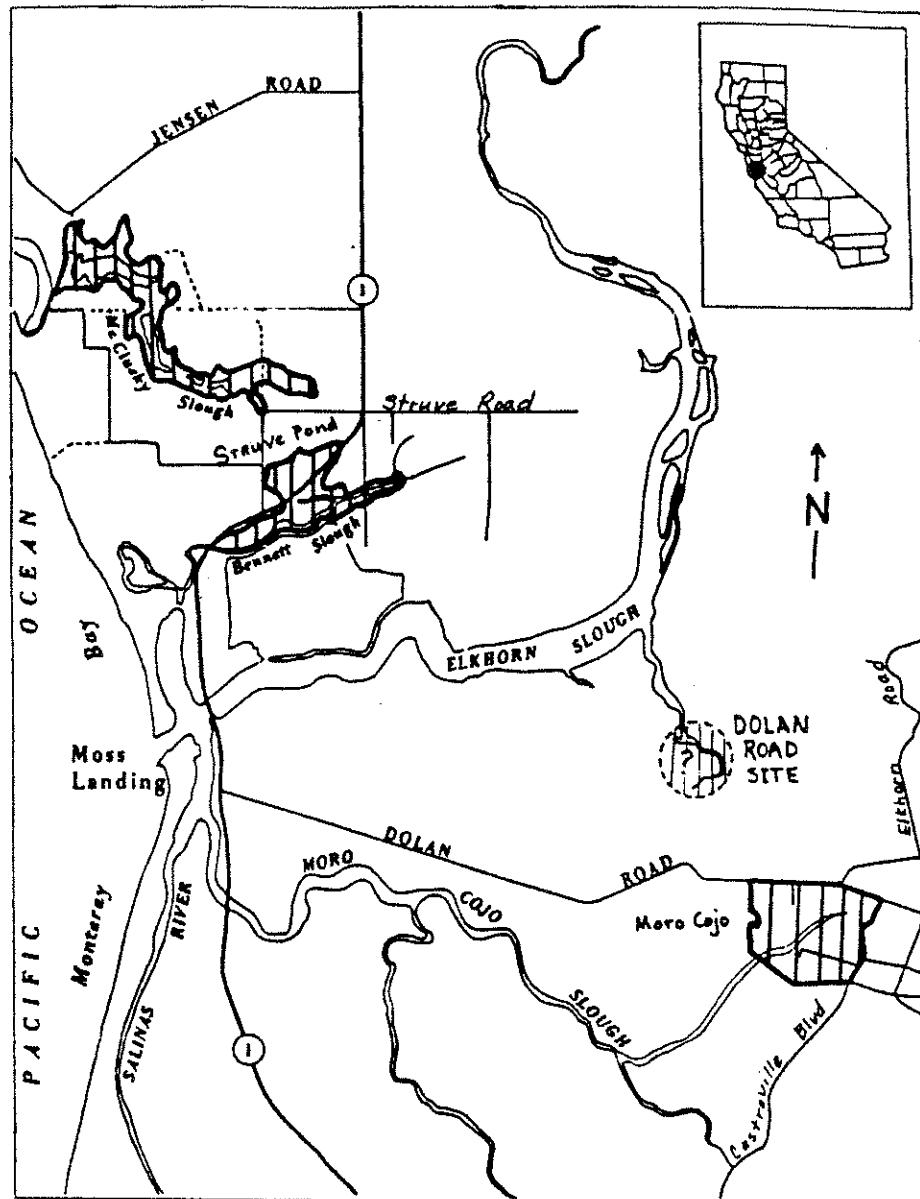


Figure 5. Known locations of the Santa Cruz long-toed salamander at Moro Cojo, Bennett Slough/Struve Pond and McCluskey Slough, and possible location north of Dolan Road.

REVISED PART II

RECOVERY

Objectives

Because many of the recovery actions outlined in the original recovery plan have been completed, several threats to the salamander have been reduced, but not sufficiently to change its status at this time. The prime objective of the original plan (restore the salamander to threatened status) was not quantified; however, this revised recovery plan includes a quantified prime objective to obtain threatened status and delisting that reflects additional information obtained in recent years. A revised narrative and implementation schedule are also included.

The new primary objective of the recovery plan is to restore the Santa Cruz long-toed salamander to non-threatened status (delisting) by maintaining populations at Ellicott Slough and Valencia Lagoon at or above the levels estimated during the first detailed study which quantified population levels, in 1979 and 1980 (2,600 and 6,500 breeding animals at Valencia and

at Ellicott, respectively; with an equal sex ratio); securing at least 3 additional sites with self-maintaining populations of at least 2,600 breeding animals and maintaining all secured habitats in optimum condition.

An intermediate goal of threatened status may be considered if populations at Ellicott and Valencia are maintained at or above population levels estimated in 1979 and 1980 for ten consecutive years and the habitat conditions remain stable for that period. Each salamander population must maintain the above numbers of breeding individuals with an approximately 1:1 sex ratio to assure continued reproductive vigor and long term adaptive potential. Each secured colony/population must be self-maintaining, that is not requiring any direct human assistance to successfully reproduce and maintain the target number of breeding animals^{1/}. All secured areas must provide sufficient acreage and habitat diversity to assure that each colony is capable of self-maintenance, (without direct

^{1/} i.e., this includes captive breeding, rearing or other direct human assistance in order to maintain population numbers.

human assistance even under adverse environmental conditions (such as, drought, heavy rains, high winds, etc.) 2/.

² exclusive of normal preserve maintenance activities such as fencing and patrolling.

Step-down Outline

Prime Objective. -- To restore the Santa Cruz long-toed salamander to non-threatened status and delist by maintaining populations at or above 6,500 and 2,600 breeding adults at Ellicott Slough and Valencia Lagoon, respectively with approximately 1:1 sex ratios, securing at least 3 additional sites with self-maintaining populations of at least 2,600 breeding animals, and maintaining all secured habitats in optimum condition.

1. Maintain breeding populations at Ellicott Slough and Valencia Lagoon at or above 1979-1980 existing levels and maintain habitat in optimum condition.
 11. Reduce mortalities to acceptable levels.
 111. Continue enforcing State, Federal, and County take and trespass regulations.
 112. Identify and evaluate mortality causes and implement management actions to prevent excessive losses.
 12. Manage populations at Ellicott and Valencia.
 121. Continue monitoring population periodically as necessary.
 1211. Monitor population size and

number of breeding animals in
each population.

1212. Develop alternate methods to
assess population status.

12121. Determine feasibility of
assessing status by
sampling larvae.

12122. Determine feasibility of
assessing status by
trapping adults.

122. Assess results of population monitoring
and develop/implement management
recommendations as necessary.

123. Undertake emergency protection as
necessary.

13. Insure that habitat at Ellicott and Valencia
is maintained in optimal condition.

131. Continue vegetation surveys at Valencia
and Ellicott and develop/implement
management recommendations as necessary.

132. Implement water quality studies.

133. Complete fencing of Service lands at
Ellicott Station.

134. Assess threats at Valencia and Ellicott.
2. Provide at least 3 additional secure sites.
 21. Evaluate population status at other locations and recommend priorities for protection.
 211. McCluskey Slough
 212. Bennett Slough/Struve Pond
 213. Seascape
 214. Moro Cojo
 215. Other sites as identified
 22. Evaluate threats and protection potential for each identified site and recommend priorities.
 221. McCluskey Slough
 222. Bennett Slough/Struve Pond
 223. Seascape
 224. Moro Cojo
 225. Dolan Road Site
 226. Other sites as identified.
 23. Select and secure at least 3 additional sites.
3. Conduct a program of conservation education and public information.
 31. Provide informational signs at Valencia and Ellicott.

- 32. Continue to control public use at Ellicott.
- 33. Continue interpretive program.
- 34. Continue advising public agencies and private businesses means to protect regarding salamander habitat.
- 341. Maintain coordination with county agencies regarding restoration and management.
- 342. Continue to provide information to all interested parties.

Narrative

The prime objective of this revised recovery plan is to restore the Santa Cruz long-toed salamander to non-threatened status and delist by maintaining populations at Ellicott Slough and Valencia Lagoon at or above existing levels^{3/}, securing at least 3 additional sites with self-maintaining populations of at least 2,600 breeding animals, and maintaining all secured habitats in optimum condition.

1. Maintain breeding populations at Ellicott Slough and Valencia Lagoon at or above 1979-1980 levels and maintain habitat in optimum condition.

At this time two areas, each supporting presumably viable populations of the salamander, are known. These are at Ellicott Slough and Valencia Lagoon (Reed 1979, 1980). These areas are relatively the recovery plan. Population levels that have secure from development because they are publicly owned (California Department of Fish and Game and

^{3/} 2600 breeding animals at Valencia and 6500 at Ellicott with approximately equal numbers of males and females.

the Service). Consequently, the populations at Ellicott and Valencia are of primary concern to been estimated for each of these areas appear to be sufficient to maintain viable populations in perpetuity (Reed 1979, 1980). It is therefore assumed that these levels provide good recovery landmarks and that population levels at Valencia and Ellicott should not drop below these estimated levels.

11. Reduce mortalities to acceptable levels.

To accomplish task #1 it will be necessary to minimize salamander mortalities at acceptable levels.

111. Continue enforcing State, Federal, and County take and trespass regulations.

Continued enforcement of State, Federal and County prohibitions against illegal taking and trespass regulations is necessary to prevent losses to the populations from human activities.

112. Identify and evaluate mortality causes and implement management actions to prevent excessive losses.

Because mortality sources are not well

known it is important that mortality causes be identified and evaluated and that management recommendations be developed and implemented to keep mortalities down to acceptable levels.

12. Manage populations at Ellicott and Valencia.

Delisting requires that each population be self-maintaining, thus not requiring human intervention. The existing breeding populations at Ellicott and Valencia appear to be sufficient for self-maintenance (Reed 1979, 1980 and unpubl.). Management programs must continue to insure self-maintenance of the existing salamander populations.

Management programs should be modified as necessary in response to new study findings.

121. Continue monitoring population periodically as necessary.

To assure that the Valencia Lagoon and Ellicott Slough populations are indeed self-maintaining, continued monitoring is critical. An adequate monitoring program will indicate unusual trends (i.e., precipitous

population declines from drought or other destructive events) and thus assist in developing management models.

1211. Monitor population size and number of breeding animals in each population.

The basic elements of a population monitoring program have been described by Reed (1980) and should include efforts to monitor total numbers and breeding numbers of each population at least every 2-4 years, population age structure, and vigor at least every 5-10 years.

1212. Develop alternate methods to assess population status.

Because existing monitoring methods are extremely time consuming and costly, it would be advantageous to develop some alternative methods to assess the population status and undertake

them every year, if possible.

12121. Determine feasibility
of assessing status by
sampling larvae.

By sampling larvae, it may be possible to assess the population status. Recent efforts in this regard by the California Department of Fish and Game were inconclusive.

Therefore, an intensive study to determine the feasibility of using this technique is needed.

12122. Determine feasibility
of assessing status by
trapping adults.

In addition to larval sampling, a modified

trapping technique for adults may be feasible and should also be studied. Other more cost effective and biologically accurate methods may also be developed, and the plan should provide for any methodology that may be applicable.

122. Assess results of monitoring and implement management recommendations as necessary.

As information from the monitoring program is generated, the data must be evaluated to make management decisions and modify the management program. 123.

123. Undertake emergency protection as necessary.

Such measures would be dictated by specific events and therefore cannot be

planned for here other than anticipating the potential need. These might include placement of sediment barriers to prevent filling in of the pond from upslope development, salvage of individuals in case of disease or outbreak of parasites or emergency salvage of individuals from periodic dredging of the roadside channel at Valencia. No specific actions are recommended at this time.

13. Insure that habitat at Ellicott and Valencia is maintained in optimal condition.

Since populations of the salamander at Ellicott and Valencia seem to be successful and reproductively vigorous, the habitat conditions probably are at least satisfactory. However, recognizing that wetland communities are dynamic systems, community changes must be monitored and evaluated to assure that optimum habitat conditions at Valencia and Ellicott are maintained.

131. Continue vegetation surveys at Valencia and Ellicott and implement management recommendations as necessary.

Vegetation surveys should be continued at Ellicott and Valencia to provide data for management guidance. Pampas grass removal should continue to reduce encroachment into salamander habitat.

132. Implement water quality studies.

At this time there appears to be a need for intensive water quality studies (e.g., pH, temperature, dissolved oxygen, salinity) because vegetation growth around the breeding pond appears to be changing the water quality at Ellicott. Other sites should be studied as well to provide comparisons. Such studies should be conducted every year for the first 3 years.

133. Complete fencing of Service lands at Ellicott

Lands purchased by the Service at Ellicott have been partially fenced. The San Francisco Bay National Wildlife

Refuge must complete the fencing at Ellicott.

134. Assess threats at Valencia and Ellicott.

Although Salamander habitats at Valencia Lagoon and Ellicott Slough have been secured via acquisitions by the California Department of Fish and Game and the Service, some concern remains regarding the status of the local populations there (Ruth^{4/} pers. comm. 1986). Results of the population monitoring program and vegetation studies should provide data on the long-term survivability of these populations. A determination of whether it is threatened rather than endangered will require a thorough evaluation of the existing populations and threats at Valencia Lagoon and Ellicott Slough as well as the stability of the habitats there.

^{4/} See footnote 2 Part I.

2. Provide at least 3 additional secure sites.

To improve the probability of survival for the salamander, it will be necessary to secure at least 3 additional sites capable of supporting self-maintainable populations. The first priority would be to secure the sites most significant to the continued existence of the salamander.

21. Evaluate population status at other locations and recommend priorities for protection.

The population status at all other surviving locations should be evaluated and priorities assigned based upon the site's significance to the maintenance and survival of the salamander. Known areas include McCluskey Slough (211), Bennett Slough/Struve Pond (212), Seascape (213), and Moro Cojo (214). In addition, it is possible that still other small enclaves exist (especially near Elkhorn Slough, Dolan Road), these sites should be surveyed (215) (Figure 3).

22. Evaluate threats and protection potential for each identified site and recommend priorities.

After all potential sites have been identified and biologically evaluated, each one should be assessed in terms of protectability, taking into account ownership, modes of protection, and costs. This will assist in choosing which sites to protect and selecting the most cost effective method for accomplishing protection for McCluskey Slough (321), Bennett Slough (322), Seascape (323), Moro Cojo (324), Dolan Road (325), and other sites as identified (326).

23. Criteria of primary importance in this selection process include:

1. Biological characteristics present, including population number and size and whether total area is of sufficient size to maintain a healthy, self-perpetuating population.
2. Importance of area in ensuring the long-term recovery of the subspecies.
3. Potential for on-site, long-term, effective management of Santa Cruz long-

toed salamander populations and habitats.

Criteria of secondary importance include:

4. Location of area within the known range
of the Santa Cruz long-toed salamander.
5. Land ownership pattern and tract size.
6. Proximity to secured habitat areas.
7. Optimum benefit to Santa Cruz long-toed
salamander recovery program in relation to
costs of securing and amount of effort
necessary to secure the land.
8. Benefits to other Federally-listed listed
or candidate species.

24. Select and secure at least 3 additional
sites.

After screening and evaluating candidate
parcels, it will be necessary to secure
specific areas for long-term protective
management. This process will entail
examination of all feasible means to protect
sensitive habitat on existing parcels. These
mean include fee acquisition, lease,
easement, and management agreement.
Development of management plans for each

secured site shall involve cooperation and coordination with the California Department of Fish and Game.

3. Conduct a program of conservation education and public information.

The program of conservation education and public information has been effective to date in assisting with the protection of this species and should be continued. Perhaps a volunteer naturalist program could be initiated at some of the publicly owned sites.

31. Provide informational signs at Valencia and Ellicott.

Informational signs at Valencia Lagoon and Ellicott Slough serve to inform visitors about the sensitivity of the areas. These signs should be maintained.

32. Continue to control public use at Ellicott.

Public use at Ellicott has been effectively controlled by requiring all visitors to obtain a letter of condition prior to each visit. This policy should be continued.

33. Continue interpretive program.

Although a major interpretive program for the SCLTS has not been established, visitors to Ellicott Slough have been provided with information on the salamander and shown the area during their visits. This program should continue to provide worthwhile benefits at relatively low cost.

Consideration should also be given to using volunteers to conduct guided tours through the area.

34. Continue advising public agencies and private businesses regarding means to protect salamander habitat.

Although development threats are no longer imminent at Ellicott and Valencia, ongoing human developments in close proximity to salamander habitat present some additional threats. Also, other salamander sites at Moro Cojo, Bennett Slough, and Seascape are not adequately secured from adverse impacts. Thus, in order to achieve the prime objective at least 3 additional sites must be secured. Planning advice must be provided to local agencies and businesses to assist in

protecting these other critical sites.

341. Maintain coordination with county agencies regarding restoration and management.

The California Department of Fish and Game and the Service have been in contact with the various county and local agencies, thus keeping them informed of the sensitivity of the salamander habitats and providing planning assistance to insure that state and local projects do not adversely impact the areas. This program should continue.

342. Continue to provide information to all interested parties.

Descriptive leaflets and small pamphlets prepared for distribution to visitors to the Ellicott Slough Ecological Reserve should continue to be made available.

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PART III
IMPLEMENTATION SCHEDULE

The schedule that follows is a summary of actions and costs for the Santa Cruz long-toed salamander recovery program. It is a guide to meet the objectives of the recovery plan as elaborated upon in Part II, Narrative Section. This table indicates the priority in scheduling tasks to meet the objectives, which agencies are responsible to perform these tasks, a suggested time-table for accomplishing these tasks, and the estimated costs to perform them. Implementing Part II is the action of the recovery plan that, when accomplished, will bring about the recovery of the species.

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

Acquisition - A

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

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

Other - O

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

RECOVERY ACTION PRIORITIES

- 1 = An action that must be taken to prevent extinction or to prevent the species from declining irreversibly.
- 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.
- 3 = All other actions necessary to provide for full recovery for the species.

Recovery Plan Implementation Schedule for the Santa Cruz Long-Toed Salamander

GENERAL CATEGORY	TASK DESCRIPTION	TASK #	PRIOR- ITY #	TASK DURA- TION (YRS)	RESPONSIBLE PARTY	COST ESTIMATES (\$1,000)				FY 4	Comments
						FY 1	FY 2	FY 3			
Maintain Populations at Ellicott and Valencia											
02	Continue enforcing laws to prevent taking and trespass.	111	2	ongoing	CDFG*	2.0	2.0	2.0	2.0	2.0	
R6	Identify mortality causes and implement management actions.	112	2	2	SE CDFG*	0.5 5.0	0.5 5.0				
R1	Monitor population size and number of breeding animals.	1211	2	ongoing	SE CDFG*	5.0 8.0	5.0 8.0	5.0 8.0	5.0 8.0	5.0 8.0	Should be conducted at least every 2 years.
R4	Determine feasibility of assessing status by sampling larvae.	12121	2	2	SE CDFG*	1.0 1.5	1.0 1.5				

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GENERAL CATEGORY	TASK DESCRIPTION	TASK #	PRIOR- ITY #	TASK DURA- TION (YRS)	RESPONSIBLE PARTY	COST ESTIMATES (\$1,000)				Comments
						FY 1	FY 2	FY 3	FY 4	
R4	Determine feasibility of assessing status by live trapping adults.	12122	2	3	SE CDFG*	0.5 1.5	0.5 1.5	0.5 1.5		
M4	Assess results of population monitoring and implement management actions.	122	2	ongoing	SE CDFG*	1.0 2.0	1.0 2.0	1.0 2.0	1.0 2.0	
M7	Implement emergency management.	123	1	TBD	SE CDFG*		TBD TBD			Determined by stochastic events
Maintain Habitat at Ellicott and Valencia										
R2	Continue vegetation surveys at Valencia and Ellicott and implement management as necessary.	131	2	ongoing	CDFG*	6.0	5.0	5.0	5.0	

Recovery Plan Implementation Schedule for the Santa Cruz Long-Toed Salamander

GENERAL CATEGORY	TASK DESCRIPTION	TASK #	PRIOR- ITY #	TASK DURA- TION (YRS)	RESPONSIBLE PARTY	COST ESTIMATES (\$1,000)				Comments
						FY 1	FY 2	FY 3	FY 4	
R14	Implement water quality studies.	132	2	3	SE CDFG*	1.0 3.5	1.0 3.5	1.0 3.5		After the first 3 years monitoring should be done as necessary.
M3	Complete fencing at Ellicott.	133	2	1	REF	2.5				Major portion completed in FY84.
M3	Assess threats at Valencia and Ellicott.	134	2	TBD	*SE CDFG*		TBD TBD			Largely administrative costs.
Secure Additional Sites										
R1	Evaluate population status at McCluskey slough.	211	2	3	SE* CDFG	5.0 0.5	5.0 0.5	5.0 0.5		

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GENERAL CATEGORY	TASK DESCRIPTION	TASK #	PRIOR- ITY #	TASK DURA- TION (YRS)	RESPONSIBLE PARTY	COST ESTIMATES (\$1,000)				Comments
						FY 1	FY 2	FY 3	FY 4	
R1	Evaluate population status at Struve Pond.	212	2	3	SE* CDFG	3.0 0.5	3.0 0.5	3.0 0.5		
R1	Evaluate population status at Seascap.	213	2	3	SE* CDFG	2.0 0.5	2.0 0.5	2.0 0.5		
R1	Evaluate population status at Moro Cojo.	214	2	3	SE* CDFG	2.0 0.5	2.0 0.5	2.0 0.5		
R1	Evaluate population status at other sites as identified.	215	2	3	SE* CDFG		TBD TBD			
R14	Evaluate threats and protection potential for all sites.	22	2	2	SE* CDFG		TBD TBD			Includes 321-325

Recovery Plan Implementation Schedule for the Santa Cruz Long-Toed Salamander

GENERAL CATEGORY	TASK DESCRIPTION	TASK #	PRIOR- ITY #	TASK DURA- TION (YRS)	RESPONSIBLE PARTY	COST ESTIMATES (\$1,000)				Comments
						FY 1	FY 2	FY 3	FY 4	
Public Information and Education										
01	Provide informational signs at Valencia and Ellicott.	31	3	ongoing	SE CDFG*	0.5 1.0	0.5 1.0	0.5 1.0	0.5 1.0	
M7	Continue to control public use at Ellicott.	32	2	ongoing	CDFG*	2.0	2.0	2.0	2.0	
01	Continue interpretive program.	33	3	ongoing	CDFG*	1.5	1.5	1.5	1.5	
01	Coordinate with county agencies.	341	2	ongoing	CDFG*	0.5	0.5	0.5	0.5	
01	Provide information to all interested parties.	342	3	ongoing	CDFG*	0.5	0.5	0.5	0.5	

Agency abbreviations
 * Lead Agency
 CDFG California Department of Fish and Game
 FWS U.S. Fish and Wildlife Service
 LE Law Enforcement
 SE Endangered Species
 RES Research
 REF Refuges
 SCC Santa Cruz County
 Ongoing Currently underway
 TBD To Be Determined

APPENDIX A

On the basis of the best information currently available, the lands and waters described below appear to comprise the most important habitats for the species' survival. Any proposal to use or modify these lands and/or waters should be carefully evaluated for possible effects on the survival of the Santa Cruz long-toed salamander.

A. Valencia Lagoon area - comprising an estimated 26 ha (65 acres) of public and privately-owned lands including approximately 2.4 ha (6 acres) owned by the State of California, Department of Fish and Game, in Santa Cruz County, California, as follows:

1. Santa Cruz long-toed Salamander Ecological Reserve, as delineated by Section 643, Title 14, California Administrative Code (Jan. 1975).
2. T11S, R1E, N 1/2 Sec. 17 (estimated to include all lands within "known limits of existing habitat" as indicated in Figure 3).

B. Ellicott Station area - comprising approximately 12 ha (29.72 acres) owned by the State of

California, 47 ha (116.1 acres) owned by the U.S. Fish and Wildlife Service, and 4.6 ha (11.36 acres) of private land adjacent to the State and Federal lands, totalling approximately 63.6 ha (157.18 acres), in Santa Cruz County, California, as follows:

1. Santa Cruz long-toed Salamander Ecological Reserve as delineated in Section 643, Title 14, California Administrative Code (Jan. 1974).
2. T11S, R1E, SW 1/4 of Section 35 (estimated to include all lands within "known limits of existing habitat" as indicated in Figure 2).

