

Thysanocarpus conchuliferus
(Santa Cruz Island Fringe-pod)

**5-Year Review:
Summary and Evaluation**



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**U.S. Fish and Wildlife Service
Ventura Fish and Wildlife Office
Ventura, California
August 2009**

5-YEAR REVIEW

Thysanocarpus conchuliferus (Santa Cruz Island Fringepod)

1. GENERAL INFORMATION

Purpose of 5-Year Review:

The U.S. Fish and Wildlife Service (Service) is required by section 4(c)(2) of the Endangered Species Act (Act) to conduct a status review of each listed species at least once every 5 years. The purpose of a 5-year review is to evaluate whether or not the species' status has changed since it was listed (or since the most recent 5-year review). Based on the 5-year review, we recommend whether the species should be removed from the list of endangered and threatened species, be changed in status from endangered to threatened, or be changed in status from threatened to endangered. Our original listing of a species as endangered or threatened is based on the existence of threats attributable to one or more of the five threat factors described in section 4(a)(1) of the Act, and we must consider these same five factors in any subsequent consideration of reclassification or delisting of a species. In the 5-year review, we consider the best available scientific and commercial data on the species, and focus on new information available since the species was listed or last reviewed. If we recommend a change in listing status based on the results of the 5-year review, we must propose to do so through a separate rule-making process defined in the Act that includes public review and comment.

Species Overview:

Thysanocarpus conchuliferus is a delicate annual, blooming from March through April, which produces only one seed per flower. It is a small annual herb in the Brassicaceae family and is endemic to Santa Cruz Island (Junak et al. 1995). This species occurs on rocky outcrops, on ridges and canyon slopes, and is associated with a variety of herbs, ferns, grasses, dudleya, and spike-moss (Santa Barbara Botanic Garden 1994). The largest threats to the species are alteration of habitat due to prior presence of nonnative animal species, and stochastic extinction due to small numbers of populations and individuals.

Methodology Used to Complete This Review:

This review was prepared by the Ventura Fish and Wildlife Office, following the Region 8 guidance issued in March 2008. The recovery plan and personal communications with experts were our primary sources of information used to update the species' status and threats. We also collected information from the Internet, published and unpublished literature, and direct field observation. We received no public comments in response to our Federal Register notice initiating this 5-year review. This 5-year review contains updated information on the species' biology and threats, and an assessment of that information compared to that known at the time of listing or since the last 5-year review. We focus on current threats to the species that are attributable to the Act's five listing factors. The review synthesizes all this information to evaluate the listing status of the species and provide an indication of its progress towards

recovery. Finally, based on this synthesis and the threats identified in the five-factor analysis, we recommend a prioritized list of conservation actions to be completed or initiated within the next 5 years.

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Federal Register Notice Announcing Initiation of This Review: A notice announcing initiation of the 5-year review of this taxon and the opening of a 60-day period to receive information from the public was published in the Federal Register (FR) on February 14, 2007. We did not receive any information on *Thysanocarpus conchuliferus* as a result of this request.

Listing History

Original Listing

FR Notice: 62 FR 40954

Date of Final Listing Rule: July 31, 1997

Entity Listed: *Thysanocarpus conchuliferus* (species)

Classification: Endangered

Associated Rulemakings: None

Review History: No complete status reviews have been conducted since the time of listing.

Species' Recovery Priority Number at Start of 5-Year Review: The recovery priority number for *Thysanocarpus conchuliferus* is 2, according to the Service's 2008 Recovery Data Call for the Ventura Fish and Wildlife Office, based on a 1-18 ranking system where 1 is the highest-ranked recovery priority and 18 is the lowest (Endangered and Threatened Species Listing and Recovery Priority Guidelines, 48 FR 43098, September 21, 1983). This number indicates that the taxon is a species that faces a high degree of threat and has a high potential for recovery.

Recovery Plan or Outline

Name of Plan: Thirteen Plant Taxa from the Northern Channel Islands Recovery Plan

Date Issued: July 26, 2000

II. REVIEW ANALYSIS

Application of the 1996 Distinct Population Segment (DPS) policy

The Act defines species as including any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate wildlife. This definition limits listings as distinct population segments (DPS) only to vertebrate species of fish and wildlife. Because the species under review is a plant and the DPS policy is not applicable, the application of the DPS policy to the species listing is not addressed further in this review.

Information on the Species and its Status

Description and Taxonomy

Thysanocarpus conchuliferus was described by Greene in 1886 based on material he and Brandegee collected on Santa Cruz Island where they found it common on mossy shelves and crevices of high rocky summits and northward slopes (Greene 1886). It was once recognized as a variety of *Thysanocarpus laciniatus* (Jepson 1925); however, it has been recognized as a distinct species since 1944 (Abrams 1944, Rollins 1993).

Individuals of *Thysanocarpus conchuliferus* have one to several branches that reach 2 to 4 inches (10 to 20 centimeters) in height. The narrow, linearly lobed alternate leaves terminate in a cluster of minute pink to lavender flowers. Each plant can produce up to 50 flowers, with each flower producing only one seed. While all members of this genus have round, flattened fruits with wings, *T. conchuliferus* is the only species in the genus that has a bowl-shaped fruit with perforated or lobed margins and spreading pedicels (Junak et al. 1995).

Life History

Thysanocarpus conchuliferus is a small annual herb in the mustard family (Brassicaceae) that blooms from March through April. Like other members of this family, *T. conchuliferus* is self-compatible (Preston 1986, Wilken in litt. 2007). Under insect-free greenhouse conditions, Wilken found that seed production ranged from 90 to 100 percent (Wilken in litt. 2007). He also found that, although the germination rate of 5-month old seeds was low (5 to 30 percent depending on treatment), the germination rate of 1-year old seed was between 80 and 100 percent (Wilken in litt. 2007).

Habitat

Santa Cruz Island is the largest (96 square miles (249 square kilometers)) and most topographically diverse of the Channel Islands. It is rough and mountainous with deep canyons and limited large areas of flat land. Much of the northern shore is rugged, with cliffs dropping to the sea, interspersed with small pocket beaches at the mouths of canyons. Longer stretches of beach are found along the western and southern shores. A large central, fault-controlled valley is nestled between two mountain ranges for much of the island's length that creates a dry interior condition (Santa Cruz Island Foundation 2007). The highest point, Picacho Diablo, is 2,470 feet (753 meters) above sea level.

The entire island has a Mediterranean climate: cool, rainy winters and warm, dry summers. Due to the island's relatively large size and varied topography, a number of micro-climates exist. The coastal areas are mild throughout the year. Temperatures rarely rise above 85 degrees or fall below 35 degrees, although the Central Valley may reach over 100 degrees or drop to 20 degrees in the winter (Santa Cruz Island Foundation 2007).

The main habitat types on the islands include coastal dune, coastal bluff, grasslands, coastal sage scrub, chaparral, oak and ironwood woodlands, riparian woodlands, and conifer forest; various plant associations within these types have been described by Dunkle (1950), Philbrick and Haller (1977), Minnich (1980), and Clark et al. (1990). However, starting in the mid-1800s, sheep and pigs that had been brought to the island proliferated and significantly altered these communities through browsing, rooting and by facilitating the spread of nonnative species (Junak et al. 1995).

Thysanocarpus conchuliferus occurs mostly on shaded north-facing rock faces, slopes, and canyon bottoms (Junak et al. 1995). We believe that the current locations where this species occurs are refugia sites and it may have been more common throughout the island in oak woodland and chaparral vegetation. In fact, Hochberg et al. (1980) reported that *T. conchuliferus* was more common in locations scattered across the island early in the 1900s. Island chaparral is found throughout Santa Cruz Island, primarily on the north-facing slopes. Oak woodland occurs on north-facing slopes and shaded canyons in the Central Valley and on the north side of the island (NPS 2002). Due to the historic grazing practices and feral herbivores on the island, however, the mosaic of vegetation types was altered. With the recent removal of the feral sheep and pigs it is expected that these native shrubs will begin to expand and change what is now annual grassland back to other communities such as coastal sage scrub and island chaparral (NPS 2002).

Distribution and Abundance

Thysanocarpus conchuliferus is endemic to Santa Cruz Island. Junak et al. (1995) reported that it occurs from the north slopes of the island between Lady's and Prisoner's Harbors, the Central Valley near Lagunitas Secas in Cañada de la Portezuela, and on the south side of the island on Sierra Blanca Ridge. Fourteen historical locations are known from herbarium records; all locations are on the western portion of the island that is now owned by The Nature Conservancy (TNC). However, by the time of listing, only one population was considered extant (62 FR 40954).

The United States Geological Survey Biological Resources Division (USGS-BRD) conducted the most recent surveys for *Thysanocarpus conchuliferus* during the 2003 to 2005 growing seasons. They searched historical locations and potentially suitable habitat areas. In 2003, they searched 7 historical sites and the region west of Picacho Diablo. *Thysanocarpus conchuliferus* was observed at three locations (up-canyon from Lady's Harbor Beach, upper west fork of Orizaba Canyon, west of Portezuela Ruins); all three populations were determined to be consistent with historical locations.

During March and April 2004, the survey team continued to focus its search in the general area west-northwest of Picacho Diablo and east of Lagunitas Secas. Numerous collections were made from here between 1969 and 1980, and the area contains numerous rock buttes and rock

outcrops, both in canyon bottoms and on slopes and ridges (McEachern et al. 2008). In this area, USGS-BRD observed three populations in the east fork of Trident Canyon that they determined to be possible historical locations. In 2005, they searched historical locations along Pelican Trail up Tinker's Canyon, Gallina Canyon, Lady's Canyon, and on the southern portion of the island along El Tigre Ridge and observed a new population in Lady's Canyon and a historical population along El Tigre Ridge. In addition, a new, small population was observed just above a new population of Hoffmann's rockcress (*Arabis hoffmannii* – another extremely rare island species) at Trident-Lady's Canyon.

Thysanocarpus conchuliferus is currently known from 10 locations on the island (See Table 1 below). While four of the observed populations were determined to be historical locations, it is unknown whether the others are new populations or historical locations. The non-specific information that accompanies most early collections makes it difficult, if not impossible, to verify specific historical locations.

Table 1: USGS-BRD 2003-2005 Survey Results for *Thysanocarpus conchuliferus* on Santa Cruz Island (modified from McEachern et al. 2008)

Survey Date	Site Name	Approximate. Size (feet ²)	2003 Population Count	2004 Population Count	2005 Population Count
3/25/2003	Lower Lady's	108	63	-	-
3/25/2003	Upper West Fork Orizaba	215	125	-	-
3/25/2003	El Tigre	86	-	-	67
3/26/2003 4/12/2004 3/14/2005	Portezuela	32	10	5	10
4/13/2004 3/12/2005	Trident Ridge	1,076	-	219	755
4/17/2004 3/13/2005	Trident-Lady's Ridge	969	-	203	359
4/18/2004 3/13/2005	Upper East Fork Trident	65	-	35	55
3/25/2003	Baby's	Not recorded	28	-	-
4/08/2005	Middle Lady's	452	-	-	51+
5/14/2005	Trident-Lady's Ridge East	43	-	-	10

Seven of the 10 populations observed between 2003 and 2005 contained less than 100 individuals and only three of the populations contained more than 100 individuals. To derive an estimate of total numbers of individuals, we added the individuals from populations observed in the 2003 surveys to those individuals from populations observed in the 2005 surveys; this results in an estimate on the order of 1,500 individuals.

A putative population was observed on Santa Catalina Island, collected in Avalon Canyon in 1929; however, we do not have any further information about this population (Consortium of California Herbaria 2009). In addition, a small population of *Thysanocarpus* was discovered in

the Santa Monica Mountains in 2008; although individuals of this population have morphological similarities to *Thysanocarpus conchuliferus*, its identity has not been resolved at this time (Elvin in litt. 2009). We do not discuss these two occurrences further in this review.

Five-Factor Analysis

FACTOR A: Present or Threatened Destruction, Modification or Curtailment of its Habitat or Range:

At the time of listing in 1997, we stated that the historic and continuing presence of non-native animals on the island, particularly feral pigs (*Sus scrofa*), was the largest threat to the species (for a detailed discussion on the history of non-native animals on the island, please refer to the final rule to list the species (62 FR 40954)). In particular, Klinger (1994) noted that pigs had uprooted all known sites for the *Thysanocarpus conchuliferus*.

The presence of non-native animals, such as feral pigs and sheep (*Ovis domesticus*), adversely affected the island ecosystem. Their presence exacerbated the rate of soil loss and even after non-native animals are removed, loss of soils continues (Clark et al. 1990, Halvorson 1993). The soils are the foundation for the unique island ecosystems and the endemic species found within them. The importance of soils is found not only in their physical properties, but in their biotic properties as well. Healthy soils play host to a complex matrix of soil organisms, including fragile microbial components that assist in such processes as water-holding capacity, soil fertility, and nutrient cycling (60 FR 37993). Typical of the island soils is the presence of a cyanobacterial-lichen crust that facilitates stabilization of steep slopes and nutrient cycling (Belnap 1994). The crusts are extremely brittle during the dry summer months and can be eliminated by the shattering influences of trampling by non-native herbivores (Belnap 1994). Trampling and rooting results in the loss of leaf litter, which changes soil temperatures, increases the loss of moisture, reduces the humus layers, and results in reduced soil fauna (Bennett 1993).

Conservation Actions

The NPS and TNC co-manage Santa Cruz Island as one ecological unit and are responsible for preserving its biological and cultural heritage. To achieve this goal, TNC and NPS have partnered with several organizations to conduct research and implement various aspects of a multi-year program to restore island habitats. These organizations include the Institute for Wildlife Studies, the University of California Natural Reserve System, the Santa Cruz Island Foundation, the Santa Barbara Museum of Natural History, and the Santa Barbara Botanic Garden (The Nature Conservancy 2007).

The NPS and TNC have long considered the most critical management actions needed to achieve primary restoration of Santa Cruz Island to be the eradication of feral sheep and pigs and control of fennel (*Foeniculum vulgare*), a weed that has aggressively spread and taken over large areas of Santa Cruz Island. The NPS developed a restoration plan (NPS 2002) that included eradicating feral pigs and reducing the presence of large monoculture stands of fennel. By 2000, sheep were already completely removed from the island. In 2005, TNC and the NPS began eradicating feral pigs; by July 2006, 5,036 feral pigs had been eradicated, and they have not been seen on the island since 2006 (The Nature Conservancy 2007).

Substantial recovery of native vegetative communities has occurred following the removal of feral sheep and pigs from the island. Recovery may take various pathways across the different environments of the island, and some sites may change faster than others (McEachern et al. 2008). In fact, forests have regrown in bare areas and fields of wildflowers have returned (The Nature Conservancy 2007). However, re-establishment of the same conditions that originally supported *Thysanocarpus conchuliferus* and the other listed Santa Cruz Island taxa may not occur: non-native plants are prominent members of the plant communities across much of the island, and the flora, hydrologic regimes, and soil systems have changed as well. Therefore, recovery will depend as much on the community and habitat context as on population function in the rare plant taxa (McEachern et al. 2008).

FACTOR B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes:

At the time of listing, we stated that unrestricted collection of *Thysanocarpus conchuliferus* for scientific or horticultural purposes and excessive visits by individuals interested in seeing rare plants constituted a potential threat. In particular, the collection of whole plants or reproductive parts of those annual or herbaceous perennial taxa with fewer than 100 known individuals, including *T. conchuliferus*, could adversely affect the genetic viability and survivability of those taxa. Since the time of listing, we are not aware of any evidence that overutilization (i.e. overcollection) of *T. conchuliferus* is a threat.

FACTOR C: Disease or Predation:

At the time of listing, diseases were not known to be a threat to *Thysanocarpus conchuliferus* and are not a threat at the present time.

We discussed the potential threat of herbivores at the time of listing. The native island plants evolved in the absence of grazing and browsing pressures. Therefore, when herbivores were introduced to the islands starting in the 1850s, the vegetation suffered from reduced productivity and lower reproductive success. The impact of this predation to the overall status varies by species, with predation posing the most significance to those with the fewest and most accessible populations (62 FR 40954).

The threat of direct herbivory of *Thysanocarpus conchuliferus* has been eliminated since the non-native animals have been removed from the island. At this time, we do not know of any species that consumes *T. conchuliferus*.

FACTOR D: Inadequacy of Existing Regulatory Mechanisms:

TNC and the NPS co-manage the island as one ecological unit. TNC owns and manages the western 76 percent of the island where all currently known populations of *Thysanocarpus conchuliferus* occur, while the eastern 24 percent is owned and managed by NPS. The NPS-owned portion of the island is part of the Channel Islands National Park.

At the time of listing, we discussed several regulatory mechanisms that may provide protections to *Thysanocarpus conchuliferus*. The National Environmental Policy Act and the Endangered Species Act, Department of the Interior policies, and National Park Service policies and guidelines that apply to the management of resources on Santa Cruz Island remain in effect. Additionally, *T. conchuliferus* was on List 1B of the California Native Plant Society's Inventory at the time of listing (Tibor 2001), indicating that in accordance with sec. 1901, chapter 10 of the California Department of Fish and Game Code, it is eligible for State listing. Both the Native Plant Protection Act and the California Endangered Species Act prohibit take of State-listed plants on private and State lands, except under permit (sec. 1908 and sec. 2080 of the Fish and Game Code).

Thysanocarpus conchuliferus remains eligible for State listing, but has not been State-listed. We do not expect that State regulatory mechanisms would be applied because TNC is not likely to propose major changes in land use on Santa Cruz Island. TNC's mission is to preserve plants, animals, and natural communities that represent the diversity of life on earth by protecting the lands and waters they need to survive (The Nature Conservancy 2007). Thus, the inadequacy of regulatory mechanisms is not a likely threat to the survival of this species.

FACTOR E: Other Natural or Manmade Factors Affecting its Continued Existence:

At the time of listing, we discussed competition with non-native species, small population size, and changes in fire frequency as threats to the species.

Competition with Non-native Species

Past grazing and trampling by non-native animals has resulted in the conversion of native plant communities to non-native plant communities (Minnich 1980, Hobbs 1983). In the past, sources of incidental introductions of seed included wind-blown seed from the mainland and introductions from restocking non-native animals and operational equipment (vehicles and construction materials) (60 FR 37993). At the time of listing, several species of non-native, aggressive plant species were considered problematic invaders on the Channel Islands, including Australian fireweed (*Erechtites glomerata*), several species of iceplant (*Carpobrotus* spp., *Mesembryanthemum* spp.), several thistle species (*Centaurea* spp., *Cirsium* spp., *Silybum* sp.), German ivy (*Delairea odorata*), hoary cress (*Cardaria draba*), and Russian thistle (*Salsola iberica*). Santa Cruz Island has at least 170 non-native invasive plant species recorded. In particular, non-native annual grasses inhibit the establishment of *Thysanocarpus conchuliferus* individuals and expansion of populations (McEachern, pers. comm. 2007).

Conservation Actions

The Santa Cruz Island Restoration Plan proposed to remove large stands of fennel (by burning and subsequently applying herbicide) to help with the eradication of feral pigs because acres of dense stands of fennel complicate the eradication effort (McEachern 2004), and to benefit the native plant communities on the island; however, the efficacy of such a program is still being discussed (Wolstenholme, pers. comm. 2007). Currently, limited removal of fennel occurs along dirt roads and within 10 feet of the roads; *Thysanocarpus conchuliferus* does not occur within the roadside treatment areas (Cory, pers. comm. 2009). Additionally, both TNC and the NPS are

taking precautions to minimize the spread of invasive species through visitor education programs because seeds of non-native plants can be spread by hikers and campers during recreational activities.

The Service has been working with TNC, the NPS, and the County of Santa Barbara to eradicate both woody and herbaceous non-native plant species from the island. The Service has provided funding to the County of Santa Barbara, through the Partners for Fish and Wildlife and Private Stewardship Grant programs, to implement a program that would remove non-native woody species. In addition, the County of Santa Barbara proposed to remove approximately 24 acres (9.7 hectares) of incipient weeds and enhance approximately 2 acres (0.81 hectare) of habitat for three federally endangered plants, including *Thysanocarpus conchuliferus* (Service 2007).

Small Population Size

At the time of listing, *Thysanocarpus conchuliferus* was threatened by the risk of stochastic extinction due to its small population size. Conservation biology notes the vulnerability of taxa known from one or very few locations and/or from small and highly variable populations (Shaffer 1981, 1987; Primack 2006; Groom et al. 2006). In particular, *T. conchuliferus* is subject to catastrophic environmental events, such as storms, drought, fire, or landslides that could destroy a significant percentage of individuals (62 FR 40954). Although more populations are known now than at the time of listing, the number of populations and the total number of individuals are still small, and remain as a concern for the species.

Changes in Fire Frequencies

Fire has been precluded as an ecological process on the Channel Islands for over 150 years. The life history requirements of *Thysanocarpus conchuliferus* are based upon the occurrence of fires to promote reproduction and reduce competition with other species. Due to ranching activities, characteristic fire intensities and durations have shifted from long duration and high intensity with brush fuels to short duration and light intensity with grass fuels because the fuel load (the amount of standing and downed vegetation) has changed from brush (heavy) to grass (light). The absence of fire created an imbalance in recruitment and regeneration of ecosystem components, including *T. conchuliferus*. Many of the brushland species will not regenerate without fire and with age will die. In addition, browsing and grazing animals had reduced the probability of survival for these fire-adapted species by removing seeds and seedlings, which could be devastating to recruitment following a fire event. Consumption of *T. conchuliferus* seedlings could effectively terminate the subsequent generation needed to re-establish the seed bank (60 FR 37993).

Climate Change

Current climate change predictions for terrestrial areas in the Northern Hemisphere indicate warmer air temperatures, more intense precipitation events, and increased summer continental drying (Field et al. 1999, Cayan et al. 2005, Intergovernmental Panel on Climate Change 2007). However, predictions of climatic conditions for smaller sub-regions such as California remain uncertain. It is unknown at this time if climate change in California will result in a warmer trend with localized drying, higher precipitation events, or other effects. While we recognize that

climate change is an important issue with potential effects to listed species and their habitats, we lack adequate information to make accurate predictions regarding its effects to particular species at this time.

III. RECOVERY CRITERIA

Recovery plans provide guidance to the Service, States, and other partners and interested parties on ways to minimize threats to listed species, and on criteria that may be used to determine when recovery goals are achieved. There are many paths to accomplishing the recovery of a species and recovery may be achieved without fully meeting all recovery plan criteria. For example, one or more criteria may have been exceeded while other criteria may not have been accomplished. In that instance, we may determine that, over all, the threats have been minimized sufficiently, and the species is robust enough, to downlist or delist the species. In other cases, new recovery approaches and/or opportunities unknown at the time the recovery plan was finalized may be more appropriate ways to achieve recovery. Likewise, new information may change the extent that criteria need to be met for recognizing recovery of the species. Overall, recovery is a dynamic process requiring adaptive management, and assessing a species' degree of recovery is likewise an adaptive process that may, or may not, fully follow the guidance provided in a recovery plan. We focus our evaluation of species status in this 5-year review on progress that has been made toward recovery since the species was listed (or since the most recent 5-year review) by eliminating or reducing the threats discussed in the five-factor analysis. In that context, progress towards fulfilling recovery criteria serves to indicate the extent to which threat factors have been reduced or eliminated.

The recovery plan that includes *Thysanocarpus conchuliferus* (Service 2000) contains generalized downlisting criteria for a suite of 13 plant species that occur on the northern Channel Islands. For downlisting subshrubs and herbaceous plants, the recovery goal is to secure several populations that contain a minimum of 2,000 individuals; however, this general criterion for downlisting subshrubs and herbaceous plants may not be an accurate recovery target for *T. conchuliferus*. The downlisting criterion specific to *T. conchuliferus* includes:

1. Discover or establish 10 populations on Santa Cruz Island that are stable or increasing with evidence of natural recruitment for a period of 15 years that includes the normal precipitation cycle (addresses Listing Factors A, C, and E). While the intent of this criterion is relevant, global climate change presents uncertainty as to what constitutes 15 years of normal precipitation. This criterion has not been met, although some progress has been made. Since the time the recovery plan was written, the number of known populations (some historical and some new) has increased from 1 to 10; however, many of these populations are small and the total number of individuals from all populations has not reached the goal for the size of just one population. Moreover, we do not have 15 years of data to make a determination that the populations are stable or increasing. In 2003, the U.S. Geological Survey, Western Ecological Research Center, Channel Islands Field Station (USGS) began a conservation and recovery research program for nine listed taxa on Santa Cruz Island. The program includes compilation of herbarium records, field survey and demography monitoring to determine population status and trends, field and greenhouse experiments to identify techniques for population conservation, and out-planting trials on the island. Related research continued through early 2007 with project

funding from the National Park Service (NPS) Natural Resource Preservation Program. The USGS is currently seeking additional funding to continue demographic monitoring and further develop recovery prescriptions for the plants (McEachern et al. 2008).

The recovery plan identifies general delisting criteria for the suite of 13 plants, which focuses on increasing the number of populations either through surveying historical sites and potential habitat within historical range to locate currently unknown populations or introducing several additional populations of the species. Delisting criteria specific to *Thysanocarpus conchuliferus* include the following:

1. Discover or establish 5 additional populations on Santa Cruz Island (addresses Listing Factors A, C, and E). This criterion has not been met. This criterion is relevant with respect to the recovery of the species. However, the exact number, size, and configuration of the populations needed to assure recovery may need to be refined in the future based on the results of the long-term conservation and recovery research program described above.
2. No decline after 10 years of downlisting (addresses Listing Factors A, C, and E). This criterion has not been met. This criterion is relevant with respect to the recovery of the species; however, what constitutes a “decline” over this period of time should be refined.

IV. SYNTHESIS

At the time of listing, only one out of 14 of the historical locations was known to support a population of *Thysanocarpus conchuliferus*. Based on the recent field surveys conducted by USGS-BRD, we estimate that Santa Cruz Island contains approximately 1,500 *T. conchuliferus* individuals. Only 3 of the 10 observed locations consisted of more than 100 individuals and no location contained close to 2,000 individuals. The number of known populations has increased since the time of listing (from 1 to 10); this is most likely due to a combination of reduced threats and increased survey effort.

Thysanocarpus conchuliferus still meets the definition of endangered because, although there may be a few more populations known than at the time of listing, the large-scale alteration of its habitat has had long-term impacts to its reproductive capabilities and distribution. Santa Cruz Island supports an abundance of non-native invasive plant species that are capable of preventing recruitment and causing habitat displacement of *T. conchuliferus*, particularly non-native annual grasses. Furthermore, the absence of fire has created an imbalance in recruitment and regeneration of ecosystem components, including *T. conchuliferus*. The life history requirements of *T. conchuliferus* are based upon the occurrence of fires to promote reproduction and reduce competition with other species. Additionally, given that this species is limited to Santa Cruz Island, the small numbers of individuals makes this species vulnerable to stochastic extinction. Feral sheep and pigs have been completely removed as a threat to *T. conchuliferus*, and the implementation of the restoration plan is expected to have positive long-term effects on native plant communities, including habitat for *T. conchuliferus*. However, even after non-native animals are removed, loss of soils continues, the biotic and physical properties that have been degraded or lost altogether remain and currently provide poor conditions for seedling

germination and species establishment. With active and ongoing restoration of native plant communities, such as the programs headed by Santa Barbara County and TNC and its partners, native plant communities and the *T. conchuliferus* are expected to benefit.

V. RESULTS

Recommended Classification:

- Downlist to Threatened
- Uplist to Endangered
- Delist (indicate reasons for delisting per 50 CFR 424.11):
 - Extinction*
 - Recovery*
 - Original data for classification in error*
- No Change

New Recovery Priority Number: 8

We recommend that the recovery priority number be changed from 2 (high degree of threat and high recovery potential) to 8 (moderate degree of threat and a high recovery potential). We believe this change is appropriate because feral pigs and sheep that were known to uproot and trample *Thysanocarpus conchuliferus* have been completely removed from the island. Non-native grasses continue to restrict the expansion of *T. conchuliferus*, but the degree of threats to this species has been reduced with the removal of feral pigs and sheep.

VI. RECOMMENDATIONS FOR FUTURE ACTIONS

1. Continue to support restoration of the native habitats on Santa Cruz Island through existing partnerships and exploration of new opportunities.
2. Assist the USGS-BRD, the NPS, and TNC to obtain additional funding to continue field surveys, demographic monitoring, outplantings, and population viability analyses to assess the overall health of the population. Additional information could reveal a trend in the status of *Thysanocarpus conchuliferus* and determine if this species is moving toward recovery or if more recovery efforts should be implemented. Additional research could further define life history strategies and population dynamics necessary to refine the delisting criteria and guide recovery efforts.
3. Work cooperatively with NPS and USGS-BRD to refine the general downlisting criteria. Securing several populations of *Thysanocarpus conchuliferus* that each contains a minimum of 2,000 plants is an unrealistic goal and is not an accurate recovery target for this species.

VII. REFERENCES

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