Santa Cruz Island fringepod (*Thysanocarpus conchuliferus*)

5-Year Review:
Evaluation and Summary

Photo: Bill Hoyer

U.S. Fish and Wildlife Service
Ventura Fish and Wildlife Office
Ventura, California

December 2021

Santa Cruz Island fringepod (*Thysanocarpus conchuliferus*) 5-Year Review: Evaluation and Summary

GENERAL INFORMATION:

Species: *Thysanocarpus conchuliferus*
FR citation: 62 FR 40954
Date listed: July 31, 1997
Classification: Endangered

BACKGROUND:

Most recent status review:
U.S. Fish and Wildlife Service. 2009. Santa Cruz Island fringepod *(Thysanocarpus conchuliferus*) 5-Year Review: Summary and Evaluation. Ventura Field Office. Ventura, California.

FR Notice citation announcing this status review:
Initiation of 5-Year Status Reviews of 76 species in California and Nevada. Notice of initiation of reviews; request for information. (86 FR 27462), May 20, 2021.

ASSESSMENT:

Thysanocarpus conchuliferus (Brassicaceae) is an annual herb that occurs on Santa Cruz Island in Santa Barbara County, California, and in the Santa Monica Mountains in Los Angeles and Ventura Counties, California. Santa Cruz Island is about 20 miles (32 kilometers) from the mainland and is part of Channel Islands National Park (CINP). All known *Thysanocarpus conchuliferus* individuals on the island occur within a private inholding owned by The Nature Conservancy (TNC), which manages the land for natural resource conservation. The species has been known from Santa Cruz Island since 1888 (Consortium of California Herbaria (CCH) 2021), and was considered endemic to the island until plants that match the current species description were identified in the Santa Monica Mountains in 2008 (CCH 2021). Genetic analysis has not yet been conducted to assess if the Santa Monica Mountains plants are the same taxon as the Santa Cruz Island plants; for the purpose of this review, they are considered to be the same. The Santa Monica Mountains plants were mentioned but not discussed in the 2009 5-year review. The *Thysanocarpus conchuliferus* occurrences in the Santa Monica Mountains are on land owned by the Santa Monica Mountains National Recreation Area, California State Parks, and the Santa Monica Mountains Conservancy, which is managed for natural resource conservation.

Santa Cruz Island has a history of largely unrestrained herbivory by non-native ungulates: 1830-1999 for cattle (*Bos taurus*), 1853-2001 for sheep (*Ovis aries*), and 1852-2006 for pigs (*Sus domesticus*) (McEachern *et al*. 2016 pp. 759-760). While these animals were completely removed by the time of the 2009 5-year review, and the condition of native vegetation is improving (Beltran *et al.* 2014 entire), residual effects of non-native herbivores remain. The

Santa Monica Mountains also have a history of grazing, but the occurrence and intensity of grazing is not known specifically for the locations of the Santa Monica Mountains *Thysanocarpus conchuliferus.*

The threats to the species at listing were specifically for Santa Cruz Island, but some are also applicable to the mainland. At the time of the 1997 listing, the threats to *Thysanocarpus conchuliferus* were identified as soil loss, habitat alteration, and predation resulting from feral pig rooting, loss of individuals by over-collecting, extinction by random events, and vulnerability to reduced reproductive vigor because of small population sizes. The 2000 recovery plan did not identify additional threats. The 2009 5-year review added competition with non-native species, changed fire frequency, and climate change effects. The current 5-year review identifies trampling by recreation as an additional threat for Santa Monica Mountains plants. While the threats to *Thysanocarpus conchuliferus* were identified specifically for Santa Cruz Island plants, at least some can be applied to Santa Monica Mountains populations.

Below we evaluate the current status of and threats to *Thysanocarpus conchuliferus.*

Information acquired since the last status review:
This 5-year review was conducted by the U.S. Fish and Wildlife Service (Service) Ventura Fish and Wildlife Office. Data for this review were solicited from interested parties through a Federal Register notice announcing this review on January 27, 2020. We also contacted species experts to request any data or information we should consider in our review. Additionally, we conducted a literature search and a review of information in our files.

Island versus mainland plants:
As mentioned above, there have been recent discoveries of mainland populations of *Thysanocarpus* that fit the current description of *Thysanocarpus conchuliferus*, which had previously been considered to be endemic and restricted to Santa Cruz Island. The community of local botanists tentatively accepts that *Thysanocarpus conchuliferus* occurs both on the island and on the mainland (CCH 2021, K. McEachern pers. comm. 8 December 2021). However, there is also a consensus that, given morphological differences and the geographic disjunction, there should be phylogenomic analysis to definitively establish whether the mainland and island plants are the same or different taxa (Guilliams *in litt*. 2021). A phylogenetic study was recently completed for the whole genus *Thysanocarpus* (Alexander *et al.* 2010), but that study was completed before material from the Santa Monica Mountains was available. Incorporating Santa Monica Mountains plant samples into the existing phylogeny should be possible (Guilliams *in litt.* 2021). Better knowledge of the genetic separation of the island and mainland plants has implications for assessing the species status of *Thysanocarpus conchuliferus*, and if the mainland plants definitively are *Thysanocarpus conchuliferus*, then understanding the status of the species will be significantly improved.

Population data:
Distribution and abundance: Santa Cruz Island
At the 1997 listing, there were 14 historical populations of *Thysanocarpus conchuliferus* known from Santa Cruz Island, 10 which had been confirmed as extant in a 1980 study (Hochberg *et al.*1980 p. 98), and only one which was known to be extant in 1997. *Thysanocarpus conchuliferus* has been documented by the California Natural Diversity Database (CNDDB

2021) as 15 Element Occurrences (EOs) on Santa Cruz Island, and none of their observations are newer than the 2009 5-year review. The 2009 5-year review presents preliminary data from a project to revisit all Santa Cruz Island historical locations (McEachern *et al.* 2008); the completed project was published after the 2009 5-year review was published (McEachern *et. al* 2010 pp. 19-21).

The McEachern *et al.* (2010) report surveyed 16 of 20 historical or possibly historical sites, and found plants at 4 of these 16 surveyed sites (Table 1). The low number of sites with plants may not reflect extirpation at any particular site; it may reflect natural variability in germination relative to the timing of the surveys. McEachern *et al.* (2010) also found 3 new sites, because they encountered previously unknown groups of plants, which previously may have been represented solely by the soil seed bank. McEachern *et al.* (2010) did not crosswalk their site numbers and names with the CNDDB EO numbers.

Table 1. Historical and newly discovered *Thysanocarpus conchuliferus* sites on Santa Cruz Island surveyed from 2003-2006 (McEachern *et al.* 2010).

USGS Site #	site type	site name	status 2003-2006	# years surveyed 2003-2006
1	historical	Lower Lady's	extant	1
2	historical	South of Pelican (Tinker's Canyon)	none found	1
3	historical	Twin Harbor	not surveyed	0
4	historical	Laguna Canyon, west branch	none found	1
5	historical	Picacho Blanco	none found	1
6	historical	Canyon above Fry's Harbor	not surveyed	0
7	historical	West of Prisoners	none found	1
8	historical	Canyon ~1/2 way between Prisoner's and Pelican	none found	1
9	historical	West of Picacho Diablo	none found	2
10	historical	Northwest of Picacho Diablo	none found	3
11	historical	Middle Christy Canyon	not surveyed	0
12	historical	Gallina Canyon, south of Red Peak	none found	1
13	historical	Red Peak	none found	1
14	historical	Upper East Fork Orizaba	not surveyed	0
15	historical	Upper West Fork Orizaba	extant	1
16	historical	El Tigre	extant	2
17	historical	Portezuela	extant	4
18	possible historical	Trident Ridge	extant	3
19	possible historical	Trident-Lady's Ridge West	extant	3
20	possible historical	Upper East Fork Trident	extant	3
21	new	Baby's	extant	1
22	new	Middle Lady's	extant	1
23	new	Trident-Lady's Ridge East	extant	2

In 2014, an observation of no plants was made at the Portezuela site, USGS Site #17 (CNDDB 2014).

In the last 5 years, The Nature Conservancy staff and volunteers have found *Thysanocarpus conchuliferus* plants at one possible historical site in the Red Peak area and at least several new

sites in canyons adjacent to the well-known Portezuela site (K. Niessen pers. obs.), but detailed information about these sites is unavailable.

Recent surveys under a Section 6 grant found what are likely several new occurrences (Schneider and Carson 2019 p.35). The locations and other specific data of these occurrences have not yet been reported. Some of these new occurrences have several hundred plants and may reflect the presence of established soil seed banks.

Distribution and abundance: Santa Monica Mountains

CNDDB has no records of *Thysanocarpus conchuliferus* in the Santa Monica Mountains. However, there are Consortium of California Herbaria (CCH 2021) records that give georeferenced locations of 13 collections of *Thysanocarpus conchuliferus* in Ventura and Los Angeles Counties. Two additional observations with no collections are in Ventura County (Mendelson *in litt.* 2021a, 2021b). Using the CNDDB convention of ¼ mile (400 meters) separation between occurrences (CDFW 2018 entire), these 15 records can be grouped into 8 occurrences, 4 in Los Angeles County and 4 in Ventura County. Occurrences are numbered by order of initial collection date. Two of the Los Angeles County occurrences are close together in Malibu Creek State Park; the other two are close together in Triunfo Creek Park (owned by the Santa Monica Mountains Conservancy). The 4 Ventura County occurrences are all in the vicinity of Sandstone Peak and Boney Ridge in the Santa Monica Mountains National Recreation Area.

Most of these occurrences probably burned in the November 2018 Woolsey Fire (Mendelsohn *in litt.* 2021b). Six of the eight occurrences have not been documented in any way since the fire. However, when Sandstone Peak # 4 (occurrence 2) was observed in 2019, it had over 100 plants, and when Triunfo Creek Park (occurrence 8) was collected in 2020, hundreds of plants were observed.

Table 2. Records of *Thysanocarpus conchuliferus* in the Santa Monica Mountains (CCH 2021, Mendelsohn *in litt.* 2021a, 2021b). Most are collections, except for Tri Peaks and Sandstone Peak # 4, which are observations (Mendelsohn *in litt.* 2021a, 2021b). The date given for the Tri Peaks observation is a database recording date, not the observation date.

collection date	occurrence #	county	location	primary collector	collector number	number of plants
3/27/2009	3	Los Angeles	MASH Site, Malibu Creek State Park	Gibson	5386	small population
3/27/2009	4	Los Angeles	Pentachaeta Trail	Elvin	6212	< 500
3/27/2009	5	Los Angeles	Lost Cabin, Malibu Creek State Park	Elvin	6215	ca. 750
3/30/2020	8	Los Angeles	Triunfo Creek Park	Guilliams	5732	few hundred
3/1/2008	1	Ventura	Boney Ridge, W of Sandstone Peak	Burgess	7793	rare
3/19/2008	2	Ventura	ca. 300 m WNW of Sandstone Peak	Elvin	5942	25-50
3/19/2008	1	Ventura	ca. 750 m WSW of Sandstone Peak	Elvin	5943	50-100
3/19/2008	2	Ventura	ca. 200 m N of Sandstone Peak	Elvin	5937a	ca.50
3/28/2009	6	Ventura	Tri Peaks near Boney Mtn.	Sagar	1326	unrecorded
4/4/2009	2	Ventura	Sandstone Peak # 1	Valois	s.n.1	38

collection date	occurrence #	county	location	primary collector	collector number	number of plants
4/4/2009	2	Ventura	Sandstone Peak # 2	Valois	s.n.2	50
4/4/2009	2	Ventura	Sandstone Peak # 3	Valois	s.n.3	90
2/7/2011	7	Ventura	Tri Peaks	none	none	unrecorded
2/22/2017	1	Ventura	Boney Ridge, N of Sandstone Peak	Burgess	10363	rare
7/4/2019	2	Ventura	Sandstone Peak # 4	none	none	100-1000

Trends in abundance:

There are little data that reflect trends in population abundance for *Thysanocarpus conchuliferus*. McEachern *et. al* (2010) present repeat survey data from 2003-2006 surveys on Santa Cruz Island (Table 3), although not all sites were surveyed every year during those years. Several sites do share a pattern of high plant numbers in 2005 followed by low plant numbers in 2006, and at some of the sites there are no plants found in 2006. Some sites were sampled more than one year and never had any plants. These observations may represent normal variation in germination in response to variation in environmental cues, or may be the result of visits during the growing period that are not at the optimal dates for observing plant emergence.

The data from Santa Monica Mountains occurrences do not allow any meaningful interpretation of trends in abundance.

Table 3: *Thysanocarpus conchuliferus* plant counts on Santa Cruz Island for sites that have surveys in two or more consecutive years (McEachern *et al.* 2010).

USGS site #	USGS site name	2003 plant count	2004 plant count	2005 plant count	2006 plant count
9	West of Picacho Diablo	0	0	unknown	not surveyed
10	Northwest of Picacho Diablo	0	0	0	not surveyed
16	El Tigre	not surveyed	not surveyed	67	2
17	Portezuela	10	5	10	0
18	Trident Ridge	not surveyed	219	755	3
19	Trident-Lady's Ridge West	not surveyed	203	259	24
20	Upper East Fork Trident	not surveyed	35	55	7
23	Trident-Lady's Ridge East	not surveyed	not surveyed	10	0

Conservation seed banking:

There are few accessions of *Thysanocarpus conchuliferus* seed in Center for Plant Conservation (CPC) approved conservation seed banks (Table 4; California Plant Rescue (CaPR) 2021, Schneider 2021). All the collections are from Santa Cruz Island, very few of the known island occurrences are represented, and most collections from an occurrence are for a single year. No collections are from the Santa Monica Mountains. No collections are known to be by maternal line, either they are bulk collected, or data is lacking about how they were collected.

Restoration seed bulking:

In conjunction with the current Section 6 grant (Schneider and Carson 2019), Santa Barbara Botanic Garden is growing out *Thysanocarpus conchuliferus* plants and bulking seed for future restoration efforts (Schneider 2021).

Table 4. *Thysanocarpus conchuliferus* conservation seed banking. All seeds are bulk collections or data is lacking. CNDDB = California Natural Diversity Database, EO = Element Occurrence, SBBG = Santa Barbara Botanic Garden, NLGRP = National Laboratory for Genetic Resource Preservation. Data from CaPR 2021 and Schneider 2021.

CNDDB EO #	collection date	facility	location description	# seeds
1	4/14/2005	SBBG	Santa Cruz Island: first ridge E of Lagunitas Secas	50
1	4/17/2005	SBBG	Santa Cruz Island: second ridge E of Lagunitas Secas	60
1	4/18/2005	SBBG	Santa Cruz Island: west of and near Mt Diablo, N of trail to summit	60
1	4/20/2005	NLGRP	Santa Cruz Island: west of and near Mt Diablo, N of trail to summit	300
1	5/16/2006	SBBG	Santa Cruz Island (Trident Lady)	48
18	4/7/2019	SBBG	Santa Cruz Island; Portezuela Adobe - east fork	100
18	4/7/2019	SBBG	Santa Cruz Island	242
17	4/7/2019	SBBG	Santa Cruz Island	510
18	4/7/2019	SBBG	Santa Cruz Island	672

EVALUATION OF THREATS:

At the time of the 1997 listing, the threats to *Thysanocarpus conchuliferus* were specifically identified as soil loss, habitat alteration, and predation resulting from feral pig rooting, and loss of individuals by over-collecting. Other general threats to all island taxa in the same listing included extinction by random events and vulnerability to reduced reproductive vigor because of small population sizes. The 2000 recovery plan did not identify additional threats. The 2009 5-year review addressed the listing threats and added competition with non-native species, changed fire frequency, and climate change effects. The current review adds trampling by recreational activities. While the most of threats to *Thysanocarpus conchuliferus* were initially identified specifically for Santa Cruz Island plants, at least some can be applied to Santa Monica Mountains populations.

Soil loss from feral pig rooting:

With the complete removal of non-native ungulates from Santa Cruz Island, there has been passive vegetation recovery (Beltrane *et al.* 2014 entire), which has stabilized soil erosion in areas where *Thysanocarpus conchuliferus* occurs. This threat has largely been minimized.

Habitat alteration from feral pig rooting:

As with soil loss, as vegetation has recovered, habitat alteration from feral pig rooting has largely been minimized.

Predation by feral pigs:

Feral pigs were eliminated from Santa Cruz Island by 2006. Feral pigs are unreported from the Santa Monica Mountains (iNaturalist 2021). This threat has been eliminated.

Over-collecting:
As in the 2009 5-year review, there is currently no indication that over-collecting is a threat to *Thysanocarpus conchuliferus*.

Extinction from random naturally occurring events due to limited distribution:
The Santa Cruz Island and Santa Monica Mountains occurrences of *Thysanocarpus conchuliferus* are all small both in area and number of plants, and little is known about the general abundance of the species or the size of soil seed banks. The threat of extirpation of populations and extinction from random naturally occurring events due to limited distribution remains.

Decreased reproductive vigor because of small population sizes:
Germination trials and nursery cultivation of the resulting plants (Wilken *in. litt.* 2006) have shown that plants are self-compatible (can be fertilized by their own pollen) and autogamous (self-pollinating) and have very high percentage of seed set. Because of this, reproductive vigor is likely to be unrelated to population size. There appears to be no requirement for outcrossing. This threat is minimized.

Competition with non-native species:
One of the historical consequences of ranching with non-native ungulate herbivores has been the introduction and expansion of non-native plants. With the cessation of ranching activities, there has been passive recovery of the vegetation of Santa Cruz Island. This is especially true in some of the woody vegetation types that surround occurrences of *Thysanocarpus conchuliferus*. The occurrences are generally in more open areas, and the associated species lists are generally comprised of native herbs and forbs, and not non-natives (CNDDB 2021). This is also the case for Santa Monica Mountains occurrences (CCH 2021). It may be that at the scale of the individual plant, competition with non-native species is not important. This threat remains, but the magnitude of the threat may vary with location.

Changed fire frequency:
The 2009 5-year review characterizes *Thysanocarpus conchuliferus* on Santa Cruz Island as requiring periodic fire to open up the vegetation and promote reproduction and reduce competition with other species. The 5-year review suggests that island fires have become less frequent in the ranching era and that is detrimental for the species. This is unsupported by any references. To the contrary, available sources (CNDDB 2021, CCH 2021) suggest that the species is generally found in habitat patches with fairly sparse native vegetation that will not readily carry fire. Changed fire frequency is unlikely to be a threat to the species on Santa Cruz Island.

Climate change:
The 2009 5-year review introduced climate change as a threat to *Thysanocarpus* conchuliferus on Santa Cruz Island. Expected climate change for the geographic region of the islands predicts both rising annual temperatures (Langridge 2018 pp. 13-15) and more episodic rainfall (Langridge 2018 pp. 16-17). Changes in climate could threaten *Thysanocarpus conchuliferus* in two ways. First, as habitat shifts with climate change, *Thysanocarpus conchuliferus* propagules and populations might not be able to disperse to suitable habitat (Levine *et al.* 2008 p. 796).

Second, the proper combination of environmental cues could occur less frequently or not at all, decreasing germination and causing declines in abundance and possible stochastic extirpations (Levine *et al.* 2008 pp. 800-805; Levine *et al.* 2011 pp. 2241-2246). The mainland Santa Monica Mountains plants occur in somewhat different habitats than the Santa Cruz Island plants, and could respond differently.

Another prediction with increasing annual temperature in California is an increasing dominance of non-native annual grasses in the vegetation (Sandel and Dangremond 2012 entire). If non-native grass cover increases in areas where *Thysanocarpus conchuliferus* occurs, the competitive effects of the grasses could negatively affect the species.

With changing climate, fire frequency in the Santa Monica Mountains is expected to increase, also increasing non-native annual grass cover (Hall *et al.* 2018 p. 53), and possibly leading to more fires at *Thysanocarpus conchuliferus* occurrences. As noted above, most Santa Monica Mountains occurrences were burned by the November 2018 Woolsey Fire. Because they characteristically occur in sparse vegetation that does not carry fire well, and the fire occurred at a time of year when these annual plants have not emerged from the seed bank, the fire may not have had negative effects on the occurrences. The two occurrences for which post-fire information is available both had numbers of plants in the hundreds. However, if non-native annual grass cover increases and fires increase in frequency and/or intensity at *Thysanocarpus conchuliferus* occurrences, the species could be negatively impacted.

Trampling by recreational activities:
On Santa Cruz Island, TNC prohibits unmonitored access, and so trampling is not a concern. Trampling by hikers or mountain bikers may be a threat at some of the Santa Monica Mountains occurrences (Sagar *in litt.* 2021). Social trails have been formed that cross the Triunfo Creek Park occurrence, and examination of aerial photography shows trails very close to occurrences in the Sandstone Peak area. Trampling remains a threat in limited areas.

Summary of threats:

At the time of the 1997 listing, the threats to *Thysanocarpus conchuliferus* were specifically identified as soil loss, habitat alteration, and predation resulting from feral pig rooting, and loss of individuals by over-collecting. Other general threats to all island taxa in the same listing included extinction by random events and vulnerability to reduced reproductive vigor because of small population sizes. The 2009 5-year review added competition with non-native species, changed fire frequency, and climate change effects. This review adds trampling by recreational activities. These current importance of these threats are summarized below.

The threats of soil loss and habitat alteration from feral pig rooting have been minimized by the passively recovering vegetation after the elimination of pigs from Santa Cruz Island. The threat of direct predation through feral pig rooting has been removed with the elimination of the pigs. There is no indication that over-collecting has or is occurring, and this is no longer considered to be a threat. The threats of population extirpation and extinction from random events because of small population sizes remain, but the threat of extirpation or extinction because of vulnerability

to reduced reproductive vigor is not important given the reproductive biology of the species. The threat of competition with non-native plants remains and may be site-dependent, and this threat may increase as climate change favors the growth of non-native grasses. Changed fire frequency, particularly reduced fire frequency of woody vegetation on Santa Cruz Island, is not likely to be a threat. Climate change threats include potentially reduced availability of sites suitable for population persistence or migration, changing environmental conditions that alter proper germination cues, competition with non-native annual grasses, and more frequent and/or intense fire carried by non-native annual grasses. Finally, some occurrences in the Santa Monica Mountains may be threatened by trampling by recreational activities.

EVALUATION OF DOWNLISTING AND DELISTING CRITERIA:

The current status of criteria in the 2000 Recovery Plan (Service 2000, pp. 67-68) follows below. Criteria do not include Santa Monica Mountains plants.

Downlisting criteria for *Thysanocarpus conchuliferus*

1. *Discover or establish 10 populations on Santa Cruz Island*
    - At the 1997 listing there were 14 historical populations, 10 which had been confirmed extant in a 1980 study, and one which was known to be extant in 1997. McEachern *et al.* (2010) found plants at 7 historical or possible historical sites and 3 new sites. TNC and Section 6 grant work have found at least one possible historical site and at least several new sites, and but detailed information about these sites is lacking. This criterion may have been met, but requires additional information.
2. *Maintain stable populations for a period of 15 years that includes the normal precipitation cycle.*
    - There has not been sufficient repeat monitoring to evaluate population stability over any time period. This criterion has not been met.
3. *Seed stored in CPC cooperating facilities.*
    - There is seed in CPC (Center for Plant Conservation) cooperating facilities, but it is not comprehensive across the species range or across years. This criterion has been partially met.
4. *Seed germination and propagation techniques understood.*
    - Nursery experiments show that seeds of the species can be successfully germinated, and reproductive plants readily grown. This criterion has been met.
5. *Successful outplanting techniques developed.*
    - Outplanting techniques have not been developed for this species. This criterion has not been met.
6. *Life history research conducted.*
    - Life history research has not been conducted for this species. This criterion has not been met.
7. *Pig damage controlled*
    - Pigs have been eliminated from Santa Cruz Island, and are unreported from the Santa Monica Mountains. This criterion has been met.
8. *If declining, determine cause and reverse trend.*

- Data are not available to evaluate trends in abundance and if the species is declining. This criterion has not been met.

Delisting criteria for *Thysanocarpus conchuliferus*

1. *Discover or establish five additional populations on Santa Cruz Island.*
   - This criterion has not been met.
2. *No decline after downlisting for 10 years.*
   - This criterion is not currently applicable.
3. *All potential habitat surveyed.*
   - Surveys have not been conducted frequently enough on either Santa Cruz Island or in the Santa Monica Mountains to cover all potential habitat in space and time. This criterion has not been met.

CONCLUSION:

We reviewed the best available scientific information and evaluated the threats affecting *Thysanocarpus conchuliferus* in 2021 under factors in 4(a)(1) of the U.S. Endangered Species Act of 1973 (as amended). There has been a reduction in threats since time of listing, more occurrences are known, and the range of the species may have expanded to include both Santa Cruz Island and the Santa Monica Mountains. However, there is uncertainty in the genetic separation of island and mainland plants and trends in abundance are unknown at this time. Therefore, we conclude that the species still meets the definition of an endangered species and recommend no change in status at this time.

RECOMMENDATIONS FOR FUTURE ACTIONS:

1. Conduct genetic studies to evaluate if the plants in the Santa Monica Mountains are the same taxon as Santa Cruz Island *Thysanocarpus conchuliferus.*
2. Begin annual monitoring of Santa Cruz Island occurrences of *Thysanocarpus conchuliferus* and continue surveying for new populations. If Santa Monica Mountains plants are definitively determined to also be *Thysanocarpus conchuliferus*, begin monitoring and continue surveys to evaluate trends in abundance.
3. Improve the completeness of coverage of *Thysanocarpus conchuliferus* in conservation seed banks, with more occurrences over more years.

APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approved JENNY MAREK Digitally signed by JENNY MAREK Date: 2021.12.21 13:37:30 -08'00' Date 12/21/2021

Acting for Stephen P. Henry, Field Supervisor

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