

Hoffmann's Slender-Flowered Gilia

(Gilia tenuiflora ssp. hoffmannii)

5-Year Review: Evaluation and Summary



Photo: Kathryn McEachern, USGS

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

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GENERAL INFORMATION:

Species: *Gilia tenuiflora* ssp. *hoffmannii*

FR citation: 62 FR 40954

Date listed: July 31, 1997

Classification: Endangered

BACKGROUND:

Most recent status review:

U.S. Fish and Wildlife Service. 2009. *Gilia tenuiflora* ssp. *hoffmannii* (Hoffmann's Slender-Flowered Gilia) 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:

Gilia tenuiflora ssp. *hoffmannii* (Polemoniaceae) is an annual forb that occurs only on Santa Rosa Island in Santa Barbara County, California, about 25 miles (40 kilometers) from the mainland. Santa Rosa Island is owned by Channel Islands National Park (CINP) and is managed for natural resource conservation.

Santa Rosa Island had non-native ungulate herbivores from 1844 to 2020 (Table 1, McEachern *et al.* 2016 pp. 759-760, Andrew Adams pers. comm. 2021), which greatly affected island plants and vegetation. At the time of *Gilia tenuiflora* ssp. *hoffmannii* listing in 1997, cattle, elk, mule deer, and horses were still on the island. Cattle were removed between listing and the 2000 recovery plan, and elk and mule deer were removed between the 2009 5-year review and 2015. The final two horses died of natural causes on the island in December 2020 and were the last non-native ungulates in CINP.

Table 1. Non-native ungulate herbivores on Santa Rosa Island (McEachern *et al.* 2016 pp. 759-760, Andrew Adams pers. comm. 2021). Bold text indicates animals present on the island after *Gilia tenuiflora* ssp. *hoffmannii* listing.

common name	scientific name	dates present
donkeys	<i>Equus africanus asinus</i>	1800s
goats	<i>Capra aegagrus hircus</i>	1883 - Early 1900s
fallow deer	<i>Dama dama</i>	1890 - 1949
sheep	<i>Ovis aries</i>	1844 - 1960s
pigs	<i>Sus scrofa domestica</i>	1853 - 1993
cattle	<i>Bos taurus</i>	1844 - 1998
elk	<i>Cervus canadensis</i>	1879 - 2011
mule deer	<i>Odocoileus hemionus</i>	1880 - 2015
horses	<i>Equus ferus caballus</i>	1844 - 2020

At time of the 1997 listing, the threats to *Gilia tenuiflora* ssp. *hoffmannii* were soil damage, habitat alteration, and herbivory caused by non-native ungulates, the disruptive effects of a service road and fence at the largest (East Point) population of the plant, and the inadequacy of regulatory mechanisms that allowed continued damage by non-native ungulates. The 2000 recovery plan identified competition with non-native grasses, and extinction by random naturally occurring events due to limited distribution and small population sizes. The 2009 5-year review evaluated the continued importance of these threats and identified climate change and climate change related sea level rise as new, potential threats. This five-year review evaluates the current status of these threats to *Gilia tenuiflora* ssp. *hoffmannii*, and identifies no new threats to the species.

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 May 20, 2021. 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.

Population data:

Distribution and abundance:

Historically and currently, *Gilia tenuiflora* ssp. *hoffmannii* has been found in three populations separated by a few miles: East Point (also called Abalone Rocks), Skunk Point, and Carrington Point (Table 2). The three populations are designated by the California Natural Diversity Database (CNDDDB, CDFW 2022) as three Element Occurrences. There have been no added reports of *Gilia tenuiflora* ssp. *hoffmannii* to CNDDDB since the 2009 5-year review. The East Point occurrence has had demographic monitoring most years from 1995 to 2021 (Schneider and Carson 2019 p. 39, McEachern and Gados 2021 p. 11); however, total numbers of plants for the population were not usually estimated.

Table 2. *Gilia tenuiflora* ssp. *hoffmannii* populations and recent documented abundances. CNDDDB = California Natural Diversity Database, EO = Element Occurrence

CNDDDB EO #	population	year	source	# of plants
1	East Point	1993	CDFW 2022	several hundred
1	East Point	1994	CDFW 2022	hundreds of thousands
1	East Point	1995-2008	CDFW 2022	20,000 – 256,000
1	East Point	2019	Schneider and Carson 2019 pp. 46 - 48	5,700
2	Carrington Point	1994	CDFW 2022	88
2	Carrington Point	2000	CDFW 2022	present
2	Carrington Point	2015	McEachern and Gados 2021 p. 10	400
2	Carrington Point	2019	Schneider and Carson 2019 pp. 46 - 48	48
3	Skunk Point	1994	CDFW 2022	3000 - 3500
3	Skunk Point	2018	McEachern and Gados 2021 p. 10	17
3	Skunk Point	2019	Schneider and Carson 2019 pp. 46 - 48	85

CNDDDB EO #	population	year	source	# of plants
3	Skunk Point	2020	McEachern and Gados 2021 p. 10	0
3	Skunk Point	2021	Schneider <i>et al.</i> 2021	0

Trends in abundance:

It is difficult to determine any trends in the abundance of *Gilia tenuiflora* ssp. *hoffmannii* because the data are sparse and unevenly distributed over time and among the populations. The data appear to suggest that numbers at East Point and Skunk Point are fewer in recent years than at times in the 1990s and 2000s.

Conservation seed banking:

There are 11 accessions of *Gilia tenuiflora* ssp. *hoffmannii* seed in Center for Plant Conservation approved conservation seed banks (Table 3). Most of these are from East Point from 5 different years across a more than 10-year period. There are two accessions from consecutive years from Skunk Point, and a single accession from Carrington Point.

Table 3. *Gilia tenuiflora* ssp. *hoffmannii* conservation seed banking at Center for Plant Rescue approved facilities.

CNDDDB = California Natural Diversity Database, EO = Element Occurrence, CBG = California Botanic Garden, SBBG = Santa Barbara Botanic Garden. Data from CaPR 2022.

CNDDDB EO #	collection date	facility	population	maternal line or unknown	# maternal lines	# seeds
3	5/20/1994	CBG	Skunk Point	unknown	unknown	8316
unknown	9/1/1995	CBG	unknow, from Garden plants	unknown	unknown	3750
3	9/1/1995	CBG	Skunk Point	unknown	unknown	2294
1	6/2/2006	SBBG	East Point	unknown	unknown	unknown
1	5/14/2012	SBBG	East Point	maternal	10 to 20	unknown
1	5/5/2016	SBBG	East Point	maternal	27	7626
1	4/22/2017	SBBG	East Point	maternal	8	unknown
1	4/24/2017	SBBG	East Point	maternal	10	unknown
2	4/22/2019	SBBG	Carrington Point	unknown	unknown	unknown
1	4/24/2019	SBBG	East Point	maternal	33	2093
1	4/25/2019	SBBG	East Point	maternal	27	2745

EVALUATION OF THREATS:

At time of the 1997 listing, the threats to *Gilia tenuiflora* ssp. *hoffmannii* were soil damage, habitat alteration, and herbivory caused by non-native ungulates, the disruptive effects of a service road and fence at the largest (East Point) population, and the inadequacy of regulatory mechanisms allowing continued damage by non-native ungulates. The 2000 recovery plan identified two additional threats: competition with non-native grasses and extinction by random naturally occurring events due to limited distribution and small population sizes. The 2009 5-year review evaluated the continued importance of these threats and identified climate change and associated sea level rise as new, potential threats. These identified threats are evaluated below. This current 5-year review identifies no new threats to *Gilia tenuiflora* ssp. *hoffmannii*.

Soil damage, habitat alteration, and herbivory caused by non-native ungulates:

With the complete removal of non-native ungulates from Santa Rosa Island, there has been passive vegetation recovery similar to that of neighboring Santa Cruz Island (Beltrane *et al.* 2014 entire), and there is little current indication of ongoing soil erosion and habitat alteration in areas where *Gilia tenuiflora* ssp. *hoffmannii* occurs. These direct threats have largely been minimized.

While direct impacts of non-native ungulate herbivores are gone, it is likely that the effects of non-native plants facilitated by the ungulates will continue into the future. This residual habitat alteration remains a threat.

Service road and fence:

The service road at East Point still exists, and with the implementation of the Channel Islands General Management Plan (2015, p. 169), this road has been decommissioned for driving in the area of the East Point population and is being allowed to passively recover. However, a single track of the road has been allowed to serve as a hiking trail, and some trampling damage by hikers to plants may still occur (K. Niessen, USFWS, pers. obs. 27 April 2022). The potential impacts of a trail are less than that of the road, and the threat to *Gilia tenuiflora* ssp. *hoffmannii* has diminished, but a threat still exists. The threat is likely minor because the area of trail in which the species occurs is very small compared to the area of the species in the whole at East Point.

The fence was removed by the time of the 2009 5-year review and is no longer of consequence.

Inadequacy of existing regulatory mechanisms:

At time of listing Santa Rosa Island was being managed as a working cattle ranch and as a commercial hunting preserve. There was concern that these then ongoing legal activities allowed continued soil damage and habitat alteration by non-native ungulates. With removal of the cattle in 1998, elk in 2011, and mule deer in 2014, the inadequacy of existing regulatory mechanisms as a threat to *Gilia tenuiflora* ssp. *hoffmannii* has been removed.

Competition with non-native grasses:

Levine *et al.* 2010 (pp. 134-139) found no significant effects of competitors, particularly the non-native annual grass *Bromus diandrus*, on *Gilia tenuiflora* ssp. *hoffmannii* at East Point. This was attributed to the low percent cover of vegetation naturally present in the coastal strand habitat. More recently, it has been reported that vegetative cover and associated thatch (likely from *Bromus diandrus*) are increasing at Skunk point, and this may be reflected in the low numbers of *Gilia tenuiflora* ssp. *hoffmannii* in recent observations (Table 2; (McEachern and Gados 2021 p. 10-11). There is also concern about the competitive effects of another non-native grass, *Brachypodium distachyon*, on the East Point population. *Brachypodium distachyon* was first discovered at the East Point population before 2007 (Service 2009), and despite several rounds of treatment, continued to persist into 2021 (McEachern and Gados 2021 p. 11). Also, *Brachypodium distachyon* may increase with anticipated climate change (see climate change discussion below). The concern about the threat of competition from non-native annual grasses remains.

Extinction by random naturally occurring events due to limited distribution and small population sizes:

At time of listing there were three known occurrences of *Gilia tenuiflora* ssp. *hoffmannii* on Santa Rosa Island; this is unchanged. Both above-ground and seedbank population sizes are generally unknown for *Gilia tenuiflora* ssp. *hoffmannii*, especially at the Carrington Point and Skunk Point populations. As shown by demographic monitoring at East Point (Table 3), above-ground abundance in plots can vary widely between years, with some years having extremely low numbers of plants. Experimental field germination rates at East Point have been low, below 5% (Levine *et al.* 2011 p. 2241), and the natural number of seeds in the soil seed bank is unknown. For annual plants in variable environments, seeds in the soil can have variable and often small germination fractions, but can remain viable in the soil for many years (Pake and Venable 1996 pp. 1431-1434). Given that soil seed bank sizes of *Gilia tenuiflora* ssp. *hoffmannii* are unknown, and may be small, the threat of extinction for *Gilia tenuiflora* ssp. *hoffmannii* by random naturally occurring events due to limited distribution and small population sizes remains.

Climate change:

In the 2009 5-year review, climate change effects, including sea level rise, were introduced as threats to *Gilia tenuiflora* ssp. *hoffmannii*. Changes in climate could threaten *Gilia tenuiflora* ssp. *hoffmannii* in two ways. First, as vegetation shifts with climate change, *Gilia tenuiflora* ssp. *hoffmannii* might not be able to disperse to suitable germination or recruitment habitat (Levine *et al.* 2008 p. 796). Second, the proper combination of early rainfall with cold temperature (and/or other environmental cues) could occur less frequently or not at all, decreasing germination of *Gilia tenuiflora* ssp. *hoffmannii* and causing declines in abundance and possible extirpations (Levine *et al.* 2008 pp. 800-805; Levine *et al.* 2011 pp. 2241-2246). Expected climate change for the geographic region of the islands does predict both rising annual temperatures (Langridge 2018 pp. 13-15) and less frequent, more episodic rainfall (Langridge 2018 pp. 16-17). In addition, the species is found at 3 – 43 meters (m) or 10 – 140 feet (ft) elevation. Sea level may rise by about 0.25 m (1 ft) by 2050 (Sweet *et al.* 2022 p. 19) and 1.0 m (3 ft) by 2100 (Sweet *et al.* 2022 p. 23). The stabilized coastal dune habitat in which *Gilia tenuiflora* ssp. *hoffmannii* is found is unprotected from the effects of rising sea level, and at least the lowest elevation plants are likely to be threatened in the future. These aspects of climate change remain threats to *Gilia tenuiflora* ssp. *hoffmannii*.

Another prediction with increasing annual temperature in California is an increasing dominance by non-native annual grasses (Sandel and Dangremond 2012 entire) in certain situations. If *Bromus diandrus* and *Brachypodium distachyon* cover increases further, the presumed competitive effects of these grass species would be more likely to threaten *Gilia tenuiflora* ssp. *hoffmannii*.

Summary of threats:

At time of the 1997 listing, the threats to *Gilia tenuiflora* ssp. *hoffmannii* were soil damage, habitat alteration, and herbivory caused by non-native ungulates, the disruptive effects of a service road and fence at the largest (East Point) population, and the inadequacy of regulatory mechanisms allowing continued damage by non-native ungulates. The 2000 recovery plan identified the additional threats of competition with non-native grasses and extinction by random

naturally occurring events due to limited distribution and small population sizes as threats. The 2009 5-year review evaluated the continued importance of these threats and identified climate change and sea level rise as new, potential threats. These identified threats are evaluated below. This current 5-year review identifies no new threats to *Gilia tenuiflora* ssp. *hoffmannii*.

The threats to *Gilia tenuiflora* ssp. *hoffmannii* of soil erosion and habitat alteration from non-native ungulate herbivores have been minimized because these animals have been completely removed from Santa Rosa Island. The threat from the East Point service road has been reduced but remains because the road has become a trail, and the effects of the fence at East Point have been eliminated because the fence was removed more than 15 years ago. With the complete removal of non-native ungulates, the threat of the inadequacy of regulatory mechanisms has been removed. While direct impacts of non-native ungulate herbivores are gone, it is likely that the effects of non-native plants facilitated by the ungulates will continue into the future. Additionally, increased effects of non-native grasses are predicted under climate change, and this may extend to the infestation of *Brachypodium distachyon* at the East Point *Gilia tenuiflora* ssp. *hoffmannii* location. There are only three populations of *Gilia tenuiflora* ssp. *hoffmannii*, which have highly variable above-ground population sizes and unknown soil seed banks. Given this, the threat of extirpations and extinction from small population effects and stochasticity remains. Climate change projections, including warmer temperatures and more episodic rainfall, may decrease the frequency of required germination cues, including low temperature early season rainfall, thus decreasing above-ground population sizes. Climate change may also shift vegetation in such a way that germination and recruitment no longer occur where there is a *Gilia tenuiflora* ssp. *hoffmannii* seed bank. Finally, since climate change induced sea level rise is expected to be about 1.0 m by 2100, *Gilia tenuiflora* ssp. *hoffmannii* plants near the species lower elevational limits (3 m) are likely to be threatened in the future.

EVALUATION OF DOWNLISTING AND DELISTING CRITERIA:

The current status of criteria in the 2000 Recovery Plan (Service 2000, pp. 66) is as follows:

Downlisting criteria for *Gilia tenuiflora* ssp. *hoffmannii*

1. *Establish 10 populations on Santa Rosa Island.*
 - No new populations of *Gilia tenuiflora* ssp. *hoffmannii* have been established. This criterion has not been met, but the 2009 5-year review discusses why it may be an unattainable criterion due to lack of available habitat for establishment of additional populations.
2. *The established populations remain stable or increase for a period of 15 years that includes the normal precipitation cycle.*
 - No new populations of *Gilia tenuiflora* ssp. *hoffmannii* have been established. 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 not been met.

4. *Seed germination and propagation techniques understood.*
 - Levine *et al.* (2010, 2011) studied the seed germination of *Gilia tenuiflora* ssp. *hoffmannii* in the field. This criterion has been met.
5. *Life history research conducted.*
 - McEachern and Gados (2021) and Levine *et al.* (2008, 2010, 2011) have focused on life history aspects of the species. This criterion has been met.
6. *Competitive effects of non-native grasses understood.*
 - While there has been research on the effects of competition of non-native annual grasses on *Gilia tenuiflora* ssp. *hoffmannii*, the potential competitive effects of increasing non-native annual grass cover, particularly *Brachypodium distachyon*, are not understood. This criterion has not been met.
7. *If declining, determine cause and reverse trend.*
 - Data are not available to effectively evaluate trends in abundance, especially in the seed bank. This criterion has not been met.

Delisting criteria for *Gilia tenuiflora* ssp. *hoffmannii*

1. *Discover or establish five additional populations.*
 - This criterion has not been met, but the 2009 5-year review discusses why it may be an unattainable criterion due to lack of available habitat for establishment of additional populations.
2. *No decline after downlisting for 10 years.*
 - This criterion is not currently applicable.
3. *All potential habitat surveyed.*
 - The available appropriate habitat is limited and accessible and has been surveyed repeatedly since listing, with no new populations found. This criterion has been met.

CONCLUSION:

The evaluation of threats affecting the species under the factors in 4(a)(1) of the Act and the analysis of the status of the species in our 2022 5-year review remain accurate reflections of the species current status. After reviewing the best available scientific information, we conclude that *Gilia tenuiflora* ssp. *hoffmannii* remains an endangered species.

RECOMMENDATIONS FOR FUTURE ACTIONS:

1. Continue monitoring the East Point population of *Gilia tenuiflora* ssp. *hoffmannii*.

2. Better define suitable germination and growth microhabitat for *Gilia tenuiflora* ssp. *hoffmannii*, especially in relationship to non-native grass *Brachypodium distachyon* competition.
3. Control and strive for eradication of *Brachypodium distachyon* at the East Point occurrence.
4. Establish a regular survey monitoring schedule for *Gilia tenuiflora* ssp. *hoffmannii* at the Skunk Point and Carrington Point populations.
5. Collect seed, especially from the Skunk Point and Carrington Point populations, for restoration seed bulking, and augment these populations with population-specific seed to boost population sizes.
6. Improve the completeness of coverage of *Gilia tenuiflora* ssp. *hoffmannii* in conservation seed banks, with all populations over a wider range of years.

APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approved _____

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