Island Malacothrix

(*Malacothrix squalida*)

5-Year Review: Evaluation and Summary

Photo: Heather Schneider, Santa Barbara Botanic Garden

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

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GENERAL INFORMATION:

Species: *Malacothrix squalida*
FR citation: 62 FR 40954
Date listed: July 31, 1997
Classification: Endangered

BACKGROUND:

Most recent status review:
U.S. Fish and Wildlife Service. 2010. *Malacothrix indecora* (Santa Cruz Island malacothrix) and *Malacothrix squalida* (island malacothrix) 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 40 species in California, Nevada, and Oregon. Notice of initiation of reviews; request for information (87 FR 5832), February 2, 2022.

ASSESSMENT:

Introduction:
Island malacothrix *(Malacothrix squalida*, Asteraceae) is an annual forb that grows to 30 centimeters (12 inches) tall and has light yellow flowers. The species generally occurs on rocky canyon flats or slopes on shallow soils in coastal scrub vegetation at elevations of less than 200 meters (656 feet). The species occurs on Middle Anacapa Island (Ventura County) and Santa Cruz Island (Santa Barbara County), California. The islands are about 20 - 40 kilometers (10 - 20 miles) from the mainland, and Middle Anacapa is about 13 kilometers (8 miles) from Santa Cruz Island. Both islands are part of Channel Islands National Park (CINP), but most of Santa Cruz Island (76%) is private property of The Nature Conservancy (TNC). Both CINP and TNC lands are managed for natural resource conservation.

Anacapa Island and Santa Cruz Island each had non-native mammalian herbivores (Table 1, McEachern *et al*. 2016 pp. 759-760) which greatly affected island plants and vegetation. At the time of island malacothrix listing in 1997, black rats were still on Anacapa Island and sheep, pigs, cattle, and horses were still on Santa Cruz Island. Black rats were eradicated from Middle Anacapa Island in 2002 (Howald *et al.* 2005). On Santa Cruz Island, cattle were removed between the 1997 listing and the 2000 recovery plan, and sheep, pigs, and horses were removed by the time of the 2010 5-year review.

Table 1. Non-native mammalian herbivores on Anacapa Island and Santa Cruz Island (McEachern *et al*. 2016 pp. 759-760). Bold text indicates species present on the islands after the island malacothrix 1997 listing. Note that there is no evidence that European rabbit ever was established on Middle Anacapa Island (Collins *in litt.* 2022).

common name	scientific name	dates present Anacapa Island	dates present Santa Cruz Island
European rabbit	*Oryctolagus cuniculus*	1930s - 1960s	never present

common name	scientific name	dates present Anacapa Island	dates present Santa Cruz Island
goat	*Capra aegagrus hircus*	never present	late 1880s, 1919 - 1920
black rat	*Rattus rattus*	~1853 - **2002**	never present
sheep	*Ovis aries*	1869 - 1937	1853 - **2001**
pig	*Sus scrofa domestica*	never present	1852 - **2006**
cattle	*Bos taurus*	never present	1830 - **1999**
horse	*Equus ferus caballus*	never present	1830 - **2009**

At the time of 1997 listing (Service 1997), the major threats to island malacothrix were loss of soil and habitat alteration from historical sheep grazing and ongoing pig rooting, and seabird roosting and nesting on Middle Anacapa Island. More general threats included decreased reproductive vigor and stochastic extirpation and extinction due to limited distribution. The 2000 recovery plan (Service 2000) added no additional threats, and the 5-year review (Service 2010) added competition with nonnative grasses. This current 5-year review analyzes these threats, as well as the potential effects of climate change on island malacothrix, and conflict between island malacothrix and other protected 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 February 2, 2022. 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:
The 2010 5-year review (Service 2010) established that, at that time, there were two extant occurrences of island malacothrix, and one historical occurrence that had not been seen since 1886 (Table 2). This has not changed for the current 5-year review. The two presumed extant occurrences are on the ridge of Middle Anacapa Island and at Potato Harbor on Santa Cruz Island. However, plants have not been seen at the Middle Anacapa Island occurrence since 1998. The historical occurrence is at Prisoners Harbor on Santa Cruz Island. Given that Prisoners Harbor is currently split by the border between TNC and CINP, the historical occurrence could have occurred on either one or both of the current landowners' property.

Table 2. Island malacothrix occurrences and documented abundances. **CNDDB** = California Natural Diversity Database (CDFW 2022), **EO** = Element Occurrence, **MAI** = Middle Anacapa Island, **SCZ** = Santa Cruz Island, CCH2 = Consortium of California Herbaria 2 database.

CNDDB EO #	island	occurrence	year	source	# of plants
2	MAI	Knife Edge to Fish Camp	1931, 1963, 1978	CCH2 2022	present
2	MAI	Knife Edge to Fish Camp	1986	CCH2 2022	20
2	MAI	Knife Edge to Fish Camp	1998	CCH2 2022	15
1	SCZ	Prisoners Harbor	1866	McEachern *et al.* 2010	present
3	SCZ	Potato Harbor area	1968	CCH2 2022	present
3	SCZ	Potato Harbor area	2006	McEachern *et al.* 2010	23
3	SCZ	Potato Harbor area	2018	Schneider and Carson 2020	present?

CNDDB EO #	island	occurrence	year	source	# of plants
3	SCZ	Potato Harbor area	2019	Schneider and Carson 2019	present
3	SCZ	Potato Harbor area	2020	Schneider and Carson 2020	present?
3	SCZ	Potato Harbor area	2021	Schneider *et al.* 2020	none found
3	SCZ	Potato Harbor area	2022	J. Knapp, TNC, pers. com. 2022	present

Abundance:
Generally, abundances of island malacothrix have not been recorded; when they have been, there are fewer than 2 dozen plants (Table 2).

Trends in abundance:
There are not enough repeat data to determine trends in abundance.

Conservation seed banking:
There is one accession of wild collected island malacothrix seed in a Center for Plant Conservation approved conservation seed bank (Table 3). This is for the Santa Cruz Island Potato Harbor occurrence. There is no accession of the Middle Anacapa Island occurrence.

Table 3. Island malacothrix conservation seed banking at a Center for Plant Rescue approved facility. Data from CaPR 2022. **CNDDB** = California Natural Diversity Database, **EO** = Element Occurrence, **SCZ** = Santa Cruz Island, **SBBG** = Santa Barbara Botanic Garden.

CNDDB EO #	population	island	collection date	facility	# maternal lines	# seeds
3	Potato Harbor	SCZ	6/7/2019	SBBG	4	292

Fifty-eight seeds collected in 2020 from Potato Harbor were sown in the nursery in 2021 (Schneider *et al.* 2021 p. 19). Only one of these seeds germinated. Because island malacothrix is self-compatible, SBBG staff were able to hand pollinate within the plant, and the plant produced 4,566 seeds. This is the first known nursery propagation of the species, and the first known seed bulking. Although the initial germination was low, preliminary tests show that many of the seeds appear viable, and seeds will be saved both for conservation seed banking and restoration use.

EVALUATION OF THREATS:

At the time of 1997 listing (Service 1997), the major threats to island malacothrix were identified as loss of soil and habitat alteration from historical sheep grazing and ongoing pig rooting, and seabird roosting and nesting on Middle Anacapa Island. More general threats at time of listing included decreased reproductive vigor and stochastic extirpation and extinction due to limited distribution. The 5-year review (Service 2010) added competition with nonnative grasses. This current 5-year review assesses the current relevance of these threats, as well as the potential effects of climate change on island malacothrix, and conflict between island malacothrix and other protected species.

Soil and habitat alteration from historical sheep grazing and ongoing pig rooting:
With the complete removal of significant, non-native mammalian herbivores from Santa Cruz Island in 2006 (only 1-2 horses remained on the island until 2009), there has been significant

passive soil and vegetation recovery (Beltrane *et al.* 2014 entire). This is likely also the case on Anacapa Island, where sheep were removed in 1937 (rats were eradicated in 2002, but their effect is on plants is unknown). There is little current indication of continuing soil loss and habitat degradation from the past effects of non-native mammalian herbivores in areas where island malacothrix occurs (K. Niessen pers. obs. 2022). While direct impacts of non-native mammalian herbivores are gone, it is likely that the effects of non-native plants facilitated by the ungulates will continue into the future (see *Competition with non-native grasses* below). This residual habitat alteration remains a threat.

Seabird roosting and nesting on Middle Anacapa Island:
Seabird roosting and nesting continues on Middle Anacapa Island and remains a threat to that occurrence. While seabird presence has prevented surveys for island malacothrix during the time of year when the plant is identifiable, seabird biologists have provided off-season photos of known locations where the species was found (Schneider and Carson 2020 p. 10). These locations are largely covered in nests and guano, and do not appear suitable for the species at present.

Decreased reproductive vigor and stochastic extirpation and extinction due to limited distribution:
At time of listing there were two known extant occurrences of island malacothrix, and only one of them has been verified as extant in the last 25 years. Both above-ground and seedbank population sizes are generally unknown for island malacothrix, but above-ground numbers are always few, and it follows that the number of seeds in the soil are also few. Island malacothrix likely has seeds that remain viable for fewer than 10 years (K. McEachern, USGS, pers. comm. 2022). In the recent propagation effort (Schneider *et al.* 2021 p. 19), only one of 58 wild collected seeds germinated, perhaps indicating decreased reproductive vigor. Few plants in few locations, a small soil seedbank, and poor seed viability all make island malacothrix more vulnerable to population extirpation and species extinction (Gilpin and Soule 1986 p. 32). The threat of extinction for island malacothrix by random naturally occurring events due to limited distribution and small population sizes remains.

Competition with non-native grasses:
In the last 5-year review (Service 2010), island malacothrix was considered to be threatened by competition from non-native annual grasses. Since then, there has been no research examining the possible magnitude of this threat. It may be that non-native grasses have negative effect, but research is required. If non-native grasses are detrimental competitors, their effects may increase in the future. Non-native annual grasses may increase with anticipated climate change (Sandel and Dangremond 2012 entire), and thus negative effects of competition on island malacothrix may increase. The threat of competition from non-native annual grasses remains.

Climate change:
Expected climate change for the geographic region of the northern Channel Islands predicts both rising annual temperatures (Langridge 2018 pp. 13-15) and less frequent, more episodic rainfall (Langridge 2018 pp. 16-17). Changes in climate could threaten island malacothrix in two ways, as demonstrated by work with federally listed annual plants on Santa Rosa Island, including a close congener of island malacothrix, *Malacothrix indecora.* First, as vegetation and habitat shift

with climate change, island malacothrix might not be able to disperse to suitable germination or recruitment habitat (Levine *et al.* 2008 p. 796). Second, the proper environmental cues could occur less frequently or not at all, decreasing germination of island malacothrix and causing declines in abundance and possible extirpations (Levine *et al.* 2008 pp. 800-805; Levine *et al.* 2011 pp. 2241-2246).

In the California Channel Islands, climate change induced sea level rise is predicted to be about 0.25 m (0.8 ft) by 2050 (Sweet *et al*. 2022 p. 19) and 1.0 m (3.3 ft) by 2100 (Sweet *et al.* 2022 p. 23). The single location at which the island malacothrix has recently been seen, Potato Harbor on Santa Cruz Island, is on the immediate coast at an elevation of about 15 m (50 ft) and is on relatively soft substrate. This occurrence is threatened by storm surf erosion even without climate change, which increases the threat. The Middle Anacapa Island occurrence is at a higher elevation and is therefore less threatened by sea level rise.

Conflict between species:
No collections of island malacothrix have been made from the Middle Anacapa Island occurrence since 1998, the year after the species was listed. Part of the reason is that plants are detectable only during a time of year that coincides with seabird roosting and nesting, and island access is currently not allowed when seabirds might be disturbed. This has been described as an example of a conflict between the needs of rare plants and protected fauna (Schneider and Carson 2020 p. 9). Island malacothrix is arguably the most endangered plant species at CINP, with only two occurrences, and only a maximum of about two dozen plants recorded at either of those occurrences at any time. To understand the status of this endangered plant, surveys for island malacothrix need to be conducted on Middle Anacapa Island at the appropriate time period in its life history.

Summary of threats:
The threats to island malacothrix from soil and habitat alteration from historical sheep grazing and pig rooting have been substantially decreased. However, the competitive effects of non-native plants that were facilitated by non-native mammalian herbivores, especially of non-native annual grasses, remains, and may well increase under climate change. Climate change may also threaten island malacothrix by causing spatial shifts in habitat that the species cannot follow, and disrupt germination cues and conditions such that successful recruitment decreases. Additionally, rising sea level may erode the location on Santa Cruz Island, where the most accessible of the two populations of the species occurs. The Middle Anacapa Island population remains threatened by seabird roosting and nesting activities, but any assessment of that occurrence has been blocked by restricted access because of that roosting and nesting. Finally, the species remains threatened by decreased reproductive vigor and stochastic extirpation and extinction because it has so few populations, so few individuals, perhaps a small seed soil bank, and perhaps seeds of low viability.

EVALUATION OF DOWNLISTING AND DELISTING CRITERIA:

The current status of criteria in the 2000 Recovery Plan (Service 2000, pp. 67) is as follows:

Downlisting criteria for island malacothrix

1. *Discover or establish 10 populations on Anacapa and Santa Cruz Islands.*
    - No new populations of island malacothrix have been discovered or established since the recovery plan. This criterion has not been met.
2. *Maintain stable populations for a period of 15 years that includes the normal precipitation cycle.*
    - No populations have been monitored since the time of the recovery plan. This criterion has not been met.
3. *Seed stored in CPC cooperating facilities.*
    - There is seed for only one location from one year stored in a CPC (Center for Plant Conservation) cooperating facility. This criterion has not been met.
4. *Seed germination and propagation techniques understood.*
    - Seeds have been successfully germinated and bulked in the nursery. This criterion has been met.
5. *Successful outplanting techniques developed.*
    - No outplanting of this species has been done. However, experimental outplanting of the close relative *Malacothrix indecora* has been conducted (Levine *et al.* 2008, 2010, 2011), and the techniques are likely applicable. The intent of this criterion has been met.
6. *Life history research conducted.*
    - Life history research has not been conducted for this species. However, the life history of the close relative *Malacothrix indecora* has been well researched (Levine *et al.* 2008, 2010, 2011) and is likely similar. The intent of this criterion has been met.
7. *Weed management plan developed and implemented.*
    - Channel Islands National Park has no weed management plan. This criterion has not been met.
8. *If declining, determine cause and reverse trend.*
    - Data are not available to effectively evaluate trends in abundance. This criterion has not been met.

Delisting criteria for island malacothrix

1. *No decline after downlisting for 10 years.*
    - This criterion is not currently applicable.
2. *All potential habitat surveyed.*
    - Habitat on Middle Anacapa Island has not been surveyed recently because of seabird related access issues. There is other potential habitat on West and East Anacapa Island and Santa Cruz Island that has not been surveyed for the species. This criterion has not 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 indicate that the species remains in danger of extinction throughout its range. Therefore, after reviewing the best available scientific information, we conclude that island malacothrix remains an endangered species.

RECOMMENDATIONS FOR FUTURE ACTIONS:

1. Gain regular annual access to Middle Anacapa Island for meaningful surveys.
2. Continue searching for additional populations of island malacothrix on Anacapa and Santa Cruz Islands.
3. Establish regular monitoring for known natural populations of island malacothrix on both islands.
4. Conduct outplantings to establish new populations on both islands.
5. Improve the completeness of coverage of island malacothrix in conservation seed banks, with both natural populations over a wide range of years.

APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approved STEPHEN HENRY Digitally signed by STEPHEN HENRY Date: 2022.08.31 12:04:46 -07'00'

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