

**Soft-Leaved Paintbrush**  
*(Castilleja mollis)*

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



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

**December 2007**

## **5-YEAR REVIEW**

**Species reviewed:** Soft-Leaved Paintbrush (*Castilleja mollis*)

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## **5-YEAR REVIEW**

### **Soft-Leaved Paintbrush (*Castilleja mollis*)**

#### **I. GENERAL INFORMATION**

##### **A. Methodology used to complete the review**

This review was conducted by Jen Lechuga from the Ventura Fish and Wildlife Office, U.S. Fish and Wildlife Service (Service). Information was gathered from a variety of sources, including published and unpublished literature, information from species experts, especially the staff of the National Park Service (NPS) and U.S. Geological Survey-BRD (USGS) at the Channel Islands National Park, and the Ventura Fish and Wildlife Office species files. A series of annual progress reports written by an NPS-appointed Scientific Panel were of particular importance. These progress reports span a period from 1998 through 2005 and track the impacts of herbivore activity on *Castilleja mollis* as well as mean number of inflorescences, mean plant cover, and level of soil disturbance at Jaw Gulch. Dirk Rodriguez of the NPS provided valuable information about the status of the species at Jaw Gulch. Studies completed by Kathryn McEachern and Katherine Chess of the USGS, Julie Christian of the NPS, and Jill Bushakra (formerly of California Polytechnic State University, San Luis Obispo) provided valuable information on the demography of *Castilleja mollis* and on the plant's genetics at Jaw Gulch and Carrington Point. Kate Faulkner of the NPS provided updated ungulate estimates of the population spanning a period from 1987 to 2005. Comments and information from our files and are incorporated into this review as appropriate.

##### **B. Reviewers**

###### **Lead Regional Office:**

R8, California/Nevada Operations Office:

Diane Elam, Deputy Division Chief for Listing, Recovery, and Habitat Conservation Planning, (916) 414-6464

###### **Lead Field Office:**

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Jen Lechuga, HCP Coordinator, (805) 644-1766 ext. 224

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##### **C. Background**

###### **1. FR Notice citation announcing initiation of this review:**

The initial FR notice was published on March 22, 2006 (71 FR 14538) and initiated a 60-day request for information. A second FR notice was published on April 3, 2006

(71 FR 16584). We received no information from the public in response to these notices.

**2. Listing history:**

Original Listing

FR notice: 62 FR 40957

Date listed: July 31, 1997

Entity listed: Species (*Castilleja mollis*)

Classification: Endangered

**3. Associated rulemakings:**

None

**4. Review History:**

None

**5. Species' Recovery Priority Number at start of review:**

The species' priority number is 2 (based on a 1-18 ranking system where 1 is the highest recovery priority and 18 is the lowest). This denotes a full species facing a high degree of threat and a high potential for recovery.

**6. Recovery Plan or Outline:**

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

Date issued: September 26, 2000

Dates of previous revisions: N/A

## II. REVIEW ANALYSIS

### A. Application of the 1996 Distinct Population Segment (DPS) policy

**1. Is the species under review listed as a DPS?**

No. The Endangered Species Act (ESA) 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.

## B. Recovery Criteria

1. **Does the species have a final, approved recovery plan containing objective, measurable criteria?**

Yes.

2. **Adequacy of recovery criteria.**

- a. **Do the recovery criteria reflect the best available and most up-to-date information on the biology of the species and its habitat?**

No. The species is believed to be dependent on a host plant for survival (Kathryn McEachern, USGS-BRD, pers. comm. 2006a and b), and studies by McEachern et al. (2003) show that the maximum distance seedlings survive from the host plant is 50 cm. A parameter to measure the percent of community cover and species composition is recommended because this information would indicate whether habitat within populations is being further fragmented, restored, or stable.

- b. **Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and is there no new information to consider regarding existing or new threats)?**

Yes.

3. **List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information. For threats-related recovery criteria, please note which of the 5 listing factors\* are addressed by that criterion. If any of the 5-listing factors are not relevant to this species, please note that here.**

Pursuant to the recovery plan, the following downlisting recovery criteria apply to *Castilleja mollis*:

1. Maintain the existing distribution with multiple colonies in each population on Santa Rosa Island.

This criterion addresses Factors A, C, D, and E.

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\* A) Present or threatened destruction, modification or curtailment of its habitat or range;  
B) Over-utilization for commercial, recreational, scientific, or educational purposes;  
C) Disease or predation;  
D) Inadequacy of existing regulatory mechanisms;  
E) Other natural or manmade factors affecting its continued existence.

When *Castilleja mollis* was listed, the species was only known to occur in two areas on Santa Rosa Island: Carrington Point in the northeast corner of the island, and west of Jaw Gulch and Orr's Camp along the north shore of the island (see Figure 1) (USGS 2006; U.S. Fish and Wildlife Service 2000). The two populations are still found in these locations. Although both of these locations are being monitored, no clear pattern has emerged as to the status of these populations (see section C.1.a below for details on these studies). Therefore, this criterion has not yet been met; however, it is current for the recovery of the species.

2. Maintain stable or increasing population trends with evidence of natural recruitment for a period of 15 years that includes the normal precipitation cycle.

This criterion addresses Factors A, C, D, and E.

Management actions on Santa Rosa Island to reduce the threats from ungulates have had a positive effect on the populations of *Castilleja mollis* at Jaw Gulch and Carrington Point. Elk on the island tend to frequent areas around the Jaw Gulch population, whereas deer tend to frequent the Carrington Point area more often (McEachern, pers. comm. 2006b). Since the removal of cattle in 1998, seedling establishment was recorded for the first time (McEachern, pers. comm. 2006a); however, we do not have information on the amount of recruitment at each site. Since the reduction in deer (*Odocoileus hemionus*) numbers on Santa Rosa Island, the amount of herbivory and soil disturbance has decreased (Schreiner et al. 2006).

The information gathered to date is inconclusive on whether populations are increasing or decreasing. In addition, we do not have 15 years' worth of data to meet this criterion. Therefore, maintaining or increasing populations over a 15-year period has not been achieved; however, this criterion continues to be helpful in tracking the species' recovery.

3. Damage from non-native mammals is significantly reduced.

This criterion addresses Factors A, C, D, and E.

The Scientific Panel has been monitoring inflorescence damage and soil disturbance as indicators of direct impacts to *Castilleja mollis* from non-native ungulates at Jaw Gulch since 2000. The data indicate that the percentage of soil disturbed both inside and outside the exclosures has decreased over the 5-year period from 2000 to 2005 (Schreiner et al. 2006). The differences between these direct impacts inside and outside the exclosure were not significant. This suggests that damage to inflorescences observed did not result strictly from non-native ungulates. Jaw Gulch monitoring information suggests that the amount of damage from non-native ungulates has decreased. The Scientific Panel did not monitor ungulate impacts to the population at Carrington Point. We do not have information at this time to conclude that the amount of damage resulting from non-native ungulates has significantly

decreased at both population sites. Therefore, this criterion has not been fully met, but is a useful parameter for the species' recovery.

Note that Factor B (overutilization for commercial, recreational, scientific, or educational purposes) was not specifically addressed in the recovery plan because it was not considered a threat to the species at the time of listing.

Pursuant to the recovery plan, specific criteria for delisting include the following:

1. Expansion of individuals into potential habitat within population boundaries.

This criterion addresses Factors A, C, D, and E.

Individual plants have not expanded into potential habitat and the two populations have not changed their range. This criterion has not yet been met (McEachern per. com 2006b), but is current because spread of individuals into potential habitat would be an indicator of recruitment, and therefore recovery.

2. No decline after downlisting for 10 years.

This criterion addresses Factors A, C, D, and E.

The recovery plan states that, until research shows otherwise, recovery objectives for downlisting sub-shrubs and herbaceous species should target securing several populations containing a minimum of 2,000 plants each (but preferably more) (U.S. Fish and Wildlife Service 2000). In addition, there should not be a declining trend for a period of 10 or more years. This criterion has not yet been met and may not be appropriate. Counting individual plants tends to be difficult, and the NPS uses other parameters such as percent cover to measure population abundance. The Scientific Panel's monitoring reports show a decline in percent cover of *Castilleja mollis* since 2003. This decline in cover may be a result of a possible lag effect with goldenbush (*Isocoma menziesii* var. *sedoides*) that decreased in percent cover from 2002 to 2003 (see section C.1.a below for details) (Schreiner et al. 2006). Based on this monitoring information and the fact that *Castilleja mollis* is a long-lived species, 10 years may not be sufficient to indicate that populations are self-maintaining and can withstand natural stochastic events such as droughts. We recommend that the Service consider increasing the duration of the trend to 20 years to provide more certainty on the status of the species. In addition, the Service may consider using another parameter for measuring abundance to help managers determine when and if the criterion has been met.

3. All potential habitat has been surveyed. This criterion addresses Factors A, C, and E.

Surveys of all potential habitat were completed in 1994, 1995, and 1996 (McEachern, pers. comm. 2006c). Plants were not found in other areas of the island besides Jaw



Gulch and Carrington Point. This criterion has been met and is appropriate because it provides information on the species population status, numbers, and locations.

The recovery plan recommends generalized recovery actions for all 13 listed species (including *Castilleja mollis*) on the northern Channel Islands. The primary actions and the extent to which they have been implemented are included in the Appendix.

## C. Updated Information and Current Species Status

### 1. Biology and Habitat:

#### a. Abundance, growth and vigor (as measured by number of inflorescences, stem length, and cover):

Individual *Castilleja mollis* plants are multi-stemmed and grow in close proximity to each other, thereby creating a mat of stem growth which makes it difficult to discern individual plants. The NPS and Scientific Panel use some surrogate parameters to assess abundance and population trends. The number of inflorescences, percent cover, and stem length are used as indicators of plant abundance, growth, and vigor. Seedling recruitment and mortality rates of individual plants are also monitored as indicators of population trends (McEachern, pers. comm. 2006b; Rodriguez, pers. comm. 2006).

Monitoring information provided by Schreiner et al. (2006) indicates that the number of inflorescences and percent cover of *Castilleja mollis* has decreased at Jaw Gulch. The mean number of inflorescences per stem at Jaw Gulch declined both within and outside the enclosure from 2000 (26.7 inside enclosure vs. 22.5 outside) to 2005 (0.0 inside enclosure vs. 0.2 outside) (Schreiner et al. 2006). A decline in the number of inflorescences has also been reported at Carrington Point (McEachern unpublished). The cover at Jaw Gulch declined 65 and 62 percent inside and outside the enclosures, respectively, from 2000 to 2004 (Schreiner et al. 2005). The fact that this pattern has been observed at both study sites indicates that a large-scale factor, such as weather, is influencing inflorescence production (McEachern, *in litt.* 2006b; McEachern, pers. comm. 2006c).

At this time we cannot determine whether the populations are expanding or decreasing at either site. Results from demographic studies will not be available in time for this review. Furthermore, due to the lack of information on recruitment and mortality rates at each site, and the percent cover at Carrington Point, we do not know if the species has increased, decreased or maintained its distribution at each site. There is a small incidence of mortality; however the cause of mortality in 2005 is not known (McEachern, pers. comm. 2006b; 2006c).

b. Seed biology and seedling establishment:

In the greenhouse, plants can easily be propagated from seeds; however, their continued growth and survival is dependent upon establishing a relationship with a host plant. Goldenbush (*Isocoma menziesii* var. *sedoides*) is believed to be the preferred host plant (E. Painter, *in litt.*; 1995, M. Wetherwax, *in litt.* 1995). Since *Castilleja mollis* is a partially parasitic perennial, a limiting factor to seedling establishment is the presence of perennial shrub hosts within at least 50 centimeters (19.7 inches) (McEachern, pers. comm. 2006a, McEachern and Chess 2000; McEachern et al. 2003). Preliminary results show that the loss of host plants reduces the ability of soft-leaved paintbrush to survive beyond the seedling stage (McEachern, pers. comm. 2006a; 2006b). These data cause researchers to conclude that habitat fragmentation might be one factor hindering the spread of *Castilleja mollis* within the current boundaries of the populations (McEachern et al. 2003).

In the field, McEachern has observed an increase in seedling establishment since cattle were removed in 1998 and the number of ungulates was reduced (McEachern, pers. comm. 2006a; 2006b). Additional information on recruitment rates was not available in time for this review. Before 1998, there was little to no recruitment of seedlings observed in the study plots (McEachern and Chess 2000).

c. Habitat - host plant conditions:

Because *Castilleja mollis* is believed to require the presence and close proximity of a host plant (goldenbush) to establish new individuals, efforts have also been made to monitor goldenbush for percent cover. From 2000 to 2005, data show a possible lag effect between the percent cover of the host shrub and *Castilleja mollis*: from 2001 to 2003, goldenbush percent cover declined; and from 2003 to 2005, *Castilleja mollis* percent cover declined (Schreiner et al. 2006). However, current data are insufficient to determine whether there is a statistically significant correlation of decline in percent cover between *Castilleja mollis* and that of its host plant.

It is well established that *Castilleja mollis* requires the coastal scrub bluff community, which includes goldenbush, to establish and survive. This habitat has been degraded and fragmented due to the presence of cattle (until 1998), elk, and deer. Demographic studies conducted by USGS-BRD suggest that *Castilleja mollis* has the ability to recover if habitat fragmentation is stopped and habitat is restored (McEachern, pers. comm. 2006a).

d. Genetics, genetic variation, or trends in genetic variation:

Bushakra and McEachern (2003) completed a study on the genetic relatedness of the two disjunct populations of *Castilleja mollis*. They found the following: 1) within-population variations are high, indicating neither population is clonal; 2)

the populations of *Castilleja mollis* at Jaw Gulch and Carrington Point are related and have a similar amount of genetic diversity, indicating the possibility that a larger, continuous population has been fragmented, which was likely the result of the introduction of grazers to the island 100 years ago (Bushakra and McEachern 2003); and 3) hybridization is occurring with *Castilleja affinis* at Carrington Point (Bushakra and McEachern 2003), the extent of which is unknown.

e. Taxonomic classification or changes in nomenclature:

The nomenclature of *Castilleya mollis* has not changed since the taxon was listed in 1997. At the time of listing the genus *Castilleja* was placed in the Scrophulariaceae (figwort family). However, based on molecular systematic studies using DNA sequences of three plastid genes, Olmstead et al. (2001) transferred the hemiparasitic group Castillejiinae to the Orobanchaceae. This systematic treatment will be followed in the upcoming revision of the Jepson Manual (Weatherwax 2007). Upon review and in agreement with available systematic and floristic literature and consultation with species experts, we intend to propose amending part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations to reflect the transfer of *Castilleja* taxa including *C. mollis* from the family Scrophulariaceae to the family Orobanchaceae. This transfer does not alter the definition or distribution of the listed entity *Castilleja mollis*.

f. Spatial distribution, trends in spatial distribution:

Two specimens of *Castilleja mollis* were collected on San Miguel Island by Elmore in 1938, but plants have not been seen there since. Since the time of listing, *Castilleja mollis* has only been observed at two locations on Santa Rosa Island, Carrington Point and Jaw Gulch. Therefore, on a large spatial scale, there has been no change in distribution of the species since the time of listing. On a finer spatial scale, the reduction in cover of *Castilleja mollis* has occurred and is attributable to fragmentation caused by ungulates within the bounds of the populations. Between 2000 and 2005, the percent cover of *Castilleja mollis* at Jaw Gulch declined 83 percent outside the exclosures and 69 percent inside the exclosures (Schreiner et al. 2006). In contrast, during the same time period, the percent cover of the host plant (goldenbush) increased slightly overall by 5 percent both outside and inside the exclosure. In addition, goldenbush is more abundant overall than *Castilleja mollis* (Schreiner et al. 2006).

**2. Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)**

**a. Present or threatened destruction, modification or curtailment of its habitat or range:**

At the time of listing, habitat alteration, soil loss, and the loss of goldenbush (as a probable host plant) were identified as threats to *Castilleja mollis* (62 FR 40957).

We have information that indicates the direct dependency of *Castilleja mollis* on the coastal goldenbush scrub community (McEachern, pers. comm. 2006a). Before 1998, cattle grazing and ungulates rutting caused large gaps in the coastal goldenbush community. These gaps were then invaded by non-native grasses, inhibiting *Castilleja mollis* from making root connections with the goldenbush host plant. Competition with non-native plant taxa was also identified as a threat to *Castilleja mollis* in the final recovery plan (U.S. Fish and Wildlife Service 2000). *Castilleja mollis* is forced to compete with the invasive annual grasses for water and nutrients. This competition weakens the paintbrush, which may contribute to the failure of seedlings to make root connections with the goldenbush host plant (McEachern 2004a). We do not have information on the degree to which competition with non-native plants affects *Castilleja mollis*. However, it is not considered the largest threat to the recovery of the species (Chaney, pers. comm. 2006). Although all cattle have been removed from Santa Rosa Island and deer numbers have decreased, elk numbers have increased since 2001 (see Figures 2 and 3). This is believed to be a continuing factor hindering *Castilleja mollis* recovery on the island (McEachern 2003).

Information on soil loss is not available; however, soil disturbance at Jaw Gulch was monitored by the Scientific Panel (Schreiner et al. 2006). The percentage of soil disturbed by ungulate activity declined from 2000 to 2005, with the exception of a brief, sharp increase in 2004. Between 2000 and 2005 at Jaw Gulch, soil disturbance decreased more inside the enclosure (79 percent) than outside (56 percent), although the difference was not statistically significant (Schreiner et al. 2006). This information suggests that the impacts from ungulates decreased over the 5-year period from 2000 to 2005, which corresponds with a decline in ungulate abundance during that period. Overall we do not have sufficient information to conclude that elk and deer impacts on the habitat, soil loss, and goldenbush decline have substantially decreased since listing. However, past habitat fragmentation that occurred as a result of grazing and trampling is still considered a major threat to the species.

**b. Over utilization for commercial, recreational, scientific, or educational purposes:**

At the time of listing, this was not identified as a factor. We know of no commercial, recreational, or educational activities focused on *Castilleja mollis*.

**c. Disease or predation:**

When *Castilleja mollis* was listed, the most severe threat to the plant was browsing and trampling by deer and elk. Deer also used the plants as bedding. The recovery plan (U.S. Fish and Wildlife Service 2000) described the greatest threats to the two existing populations of *Castilleja mollis* as being deer and elk trampling and uprooting the plants and their goldenbush hosts when scraping during the rutting season. The most recent information available on *Castilleja*

*mollis* mortality is from a study by McEachern and Chess (1999). They reported that mortality ranged from 6 to 56 percent per study plot from 1994 to 1998, and that stem breakage and browsing by predators was common.

Elk and deer were introduced to Santa Rosa Island in 1930 (McEachern 2004b). Until recently, the number of elk and deer on the island was quite high. Elk numbered 891 in 1987 and approached a peak of 1,114 in 1995 (Faulkner, *in litt.* 2006). Elk numbers actually increased by approximately 29 percent from December 1998 to December 2005 but are lower in 2005 (approximately 691) than they were in January 1996 (1,114) (see Figure 2) (Faulkner, *in litt.* 2006; Rodriguez, *in litt.* 2006b). Deer numbered about 900 in 1995, then they reached a peak of 1,550 in 1997 (see Figure 3) (Faulkner, *in litt.* 2006). Deer numbers were reduced by approximately 69 percent from December 1998 (1,230) to December 2005 (377). It is worth noting that the actual number of deer was documented to be consistently higher than the permitted level for at least some portion of each year from 1998 through early 2003 (Figure 7) (Faulkner, *in litt.* 2006). Deer and elk are being removed from the island on a phased schedule, with complete removal by 2011 (United States District Court for the Central District of California 1997; Rutherford and Chaney 1999).

The listing rule also noted cattle herbivory as a problem for the species, but cattle were removed from Santa Rosa Island in 1998. Cattle removal and the reduction in the number of deer have, so far, not resulted in substantial improvements in *Castilleja mollis*. Corresponding with the reduction efforts on the island, monitoring by the Scientific Panel in 2006 indicated that herbivory of inflorescences by ungulates (mainly elk) was low from 2000 to 2005. The number of seedlings has also increased slightly (McEachern, pers. comm. 2006a), which corresponds with the elimination of cattle and the reduction in the number of deer (see Figures 2 and 3). The amount of area disturbed at Jaw Gulch also declined over a 5-year period (see Figures 4 and 5) (Schreiner et al. 2006). However, the numbers of inflorescences and the amount of cover have declined.

Data indicate that the principle threats to vegetative regrowth and inflorescence production may be something other than, or in addition to, ungulate herbivory and trampling. The average number of inflorescences at Jaw Gulch declined between 2000 (26.7 and 22.5 inside and outside the enclosure, respectively) and 2005 (0.0 and 0.2 inside and outside the enclosure, respectively) (Dirk Rodriguez, NPS, *in litt.* 2006a). The percent of damaged inflorescences both inside and outside the enclosure at Jaw Gulch did not change from 2000 to 2005 (see Figure 6) (Schreiner et al. 2006, Rodriguez, *in litt.* 2006a). The same trend in damaged inflorescence numbers was also observed at Carrington Point (McEachern, *in litt.* 2006a).

The percent cover at Jaw Gulch declined 65 and 62 percent inside and outside the enclosures, respectively, from 2000 to 2005 (Schreiner et al. 2006). There has not been a significant difference in the percentage of damaged inflorescences inside

and outside the enclosure in any year since 2000 (Schreiner et al. 2006). Trends in the number of inflorescences and percent cover suggest that a large-scale event, such as weather, may also influence flowering and growth (McEachern, *in litt.* 2006b; McEachern, pers. comm. 2006c). Insect-caused damage to inflorescence has been observed recently (McEachern and Chess 2000; McEachern, pers. comm. 2006b). However, information on the degree of damage caused by insects is not yet available.

**d. Inadequacy of existing regulatory mechanisms:**

The Channel Islands National Park was established in 1980 by Public Law 96-199 “...to protect the nationally significant natural, scenic, wildlife, marine, ecological, archaeological, cultural, and scientific values of the Channel Islands in the State of California. . . .” The NPS purchased Santa Rosa Island from the Vail and Vickers Ranching Company in 1986. The cattle ranching operation and a subleased commercial deer and elk hunting operation were deeded continuing operating rights under 5-year renewable special use permits, renewable until the year 2011 (62 FR 40955). Special Use Permit would be issued to Vail and Vickers Company and the Vail family on condition that a range management plan would be adopted when the NPS issued the second special use permit. The plan, however, does not address protection of *Castilleja mollis*, among other taxa in the rule. Thus, the ESA provides protection to the species not afforded it through the range management plan. *Castilleja mollis* has received some protections through NPS guidelines for natural resource management; the special use permits had limited NPS’ ability to manage the land for recovery of federally listed species. Since then, however, NPS revised their general management plan (1998). This plan included cattle removal in 1998 and a phased approach to reduce the ungulate numbers to complete removal by 2011 (United States District Court for the Central District of California 1997). This plan has assisted NPS’s habitat management efforts on Santa Rosa Island. A draft NPS Conservation Strategy (1996) also included specific guidelines for *Castilleja mollis* that has assisted NPS in these efforts. NPS has worked with the Scientific Panel in monitoring the impacts of deer on the Jaw Gulch population. In addition, NPS and USGS-BRD have undertaken monitoring of both *Castilleja mollis* populations, as well as demographic and seed germination studies, and genetic analyses. Further, Congressional legislation passed in fall 2006 regarding the deer and elk on Santa Rosa Island may delay the planned removal of deer and elk on the island by 2011 (Faulkner, *in litt.* 2007).

Prior to being listed, *Castilleja mollis* was included on List 1B of the California Native Plant Society’s Inventory. Inclusion on List 1B indicates that a species is eligible for State listing, in accordance with section 1901, chapter 10 of the California Department of Fish and Game Code. The California Endangered Species Act (CESA) provides protection for plant species occurring only on private or State land. However, in the listing rule (62 FR 40957) the Service did not consider inclusion on List 1B provided adequate protection for the species

because it was not yet listed under CESA and occurred only on Federal land. Therefore, listing under the ESA was necessary to provide protections to the species that did not otherwise exist.

In summary, the ESA is the primary Federal law that provides protection for this species since its listing as endangered in 1997. Other Federal and State regulatory mechanisms, including the National Environmental Policy Act, provide discretionary protections for *Castilleja mollis* based on current management direction, but do not guarantee protection for the species absent its status under the ESA. Therefore, we continue to believe other laws and regulations have limited ability to protect the species in absence of the ESA.

**e. Other natural or manmade factors affecting its continued existence:**

At the time of listing, competition with invasive plant species was identified as a threat under this factor due to a high probability of preventing recruitment and causing habitat displacement of *Castilleja mollis*. Due to the small population size of this species, the listing rule noted that *Castilleja mollis* would be vulnerable to stochastic events (including variable weather patterns such as drought), reduced genetic integrity of the species, and depressed reproductive vigor (62 FR 40957). All of these issues remain as concerns for the recovery of the species.

Recent declines in inflorescence numbers and percent cover may be influenced by a large-scale environmental factor such as weather or climate (McEachern, *in litt.* 2006b; McEachern, pers. comm. 2006c). However, when comparing the overall decline in inflorescence numbers in *Castilleja mollis* with annual rainfall and drought, there does not seem to be a clear correlation. For example, the consistent decline of inflorescences and cover per year from 2000 to 2005 does not appear to have a direct correlation with periods of low rainfall from 2001-2002 (6.5 in) and in 2003-2004 (7.15 in), proceeded and followed by moderate to high rainfall years (see Figure 8) (Rodriguez, *in litt.* 2006c). However, it is important to note that we do not have enough monitoring information on *Castilleja mollis* to determine the effects of drought on growth, vigor, and reproductive success of this species.

In general, small population size leaves the endangered species more susceptible to extinction from a natural stochastic event. The conservation biology literature commonly notes the vulnerability of taxa known from one or very few locations and/or from small populations (e.g., Shaffer 1981, 1987; Primack 1998; Groom et al. 2006). In particular, small population size makes it difficult for this species to persist while sustaining the impacts of soil loss, habitat alteration, and drought.

Although we do not know the extent of hybridization with *Castilleja affinis* that is occurring, genetic studies of *Castilleja mollis* indicates that hybridization is occurring at Carrington Point (U.S. Fish and Wildlife Service 2000; Bushakra and McEachern 2003).

## D. Synthesis

The most serious threats identified to *Castilleja mollis* on Santa Rosa Island when it was listed in 1997 and when the recovery plan was issued in 2000 were habitat alteration, loss of goldenbush host plant, competition with non-native plant taxa, and damage and herbivory from the presence of cattle, the browsing, scraping, and stem damage from deer and elk, and use of the species as bedding by deer. These threats have generally been reduced since 1998.

*Castilleja mollis* has shown small improvements in some parameters. For example, seedling and juvenile establishment increased after cattle were removed and the numbers of deer and elk were actively managed (McEachern, pers. com. 2006a). Monitoring information from the Scientific Panel indicates that the amount of soil disturbance caused by ungulates has been low for the past 5 years and the amount of disturbance inside the exclosures at Jaw Gulch is not significantly different from that outside the exclosures (Schreiner et al. 2006). This suggests that reduction of ungulate numbers on the island has had a positive effect on the species recruitment (McEachern, pers. comm. 2006a; 2006b).

Despite management efforts taken by NPS to reduce threats associated with grazing and browsing by cattle, deer, and elk, and bedding activities of deer, the species has not shown significant signs of recovery, as measured by increases in either numbers of individuals (seedlings), percent cover, number of inflorescence per stem, and stem length growth. Browsing and stem breakage would exacerbate the reduction of flower and seed production in years with low rainfall or extreme climatic conditions. Impacts from natural events coupled with browsing and breakage could result in wider fluctuations in inflorescence numbers over the years, which would increase the risk of reproductive failure in some years (McEachern, *in litt.* 2006b). In summary, we do not have enough information to determine whether population sizes are stable or increasing

Threats that are currently contributing to the species inability to recover include the loss of genetic integrity, insect damage, herbivory, and habitat fragmentation from ungulate activity. As long as the coastal goldenbush scrub continues to be fragmented, the populations of *Castilleja mollis* may not be able to recover (McEachern, pers. comm. 2006a). Thus, limiting, and in some instances, eliminating these threats are necessary for the species' recovery. In addition, habitat restoration and connectivity of the goldenbush scrub community would be necessary for *Castilleja mollis* recovery. Therefore, we conclude that *Castilleja mollis* still meets the definition of endangered, and do not recommend a status change at this time.



### III. RESULTS

#### A. Recommended Classification:

- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change is needed

#### B. New Recovery Priority Number: 2 (no change)

### IV. RECOMMENDATIONS FOR FUTURE ACTIONS.

1. Because the removal of cattle and the reduction in deer have had a positive effect on seedling recruitment, the program to eliminate ungulates from the island by 2011 should continue as planned.
2. During the time that the special use permits are in effect, if targeted hunting of deer and elk is no longer effective, the NPS should consider other actions to reduce the threats of these animals to the species.
3. Based on the reports produced by the Scientific Panel, indeterminate threats, in addition to ungulate herbivory, scraping and general presence are contributing to the decline in the amount of inflorescence and percentage cover of *Castilleja mollis*. Therefore, other parameters that influence the species' ability to recover should be tracked at both locations where the species is found. In particular, the following monitoring actions are recommended: (a) monitor community species composition and cover to indicate whether the habitat is improving; (b) monitor rate of hybridization with *Castilleja affinis* to understand the level of threat this poses on recovering the species; (c) monitor damage to inflorescence, stems, and leaves caused by insects; (d) monitor the number of plants, or seedlings and juveniles within the populations; and (e) monitor the rate of erosion using soil depth/amount of litter.
4. The following downlisting measures outlined in the recovery plan should be implemented: (1) seed storage in a Center for Plant Conservation facility, and (2) development and implementation of host plant and weed management actions.
5. To secure several populations of *Castilleja mollis* containing a minimum of 2,000 plants each, efforts should focus on restoring coastal goldenbush scrub habitat so that there is reduced fragmentation within populations of *Castilleja mollis* on the island.

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2006a. Kathryn McEachern, Plant Ecologist, U.S. Geological Survey-BRD, Channel Islands Field Station. Telephone conversation on research, population trends, and various other information pertinent to the Five-Year Review. May 2006.

2006b. Kathryn McEachern, Plant Ecologist, U.S. Geological Survey-BRD, Channel Islands Field Station. Meeting to obtain a better understanding of population trends, and to verify information for the Five Year Review. May 16, 2006.

2006c. Kathryn McEachern, Plant Ecologist, U.S. Geological Survey-BRD, Channel Islands Field Station. Telephone conversation verifying information on inflorescence trends, percent cover, availability of weather information, and surveys completed for the Five Year Review. June 7, 2006.

2006. Sarah Chaney, National Park Service, Channel Islands Field Station. Telephone conversation regarding weed management in locations where *Castilleja mollis* and *Arctostaphylos confertiflora* are found. June 8, 2006.

VI. FIGURES

***Castilleja mollis***  
**distribution on Santa Rosa Island**

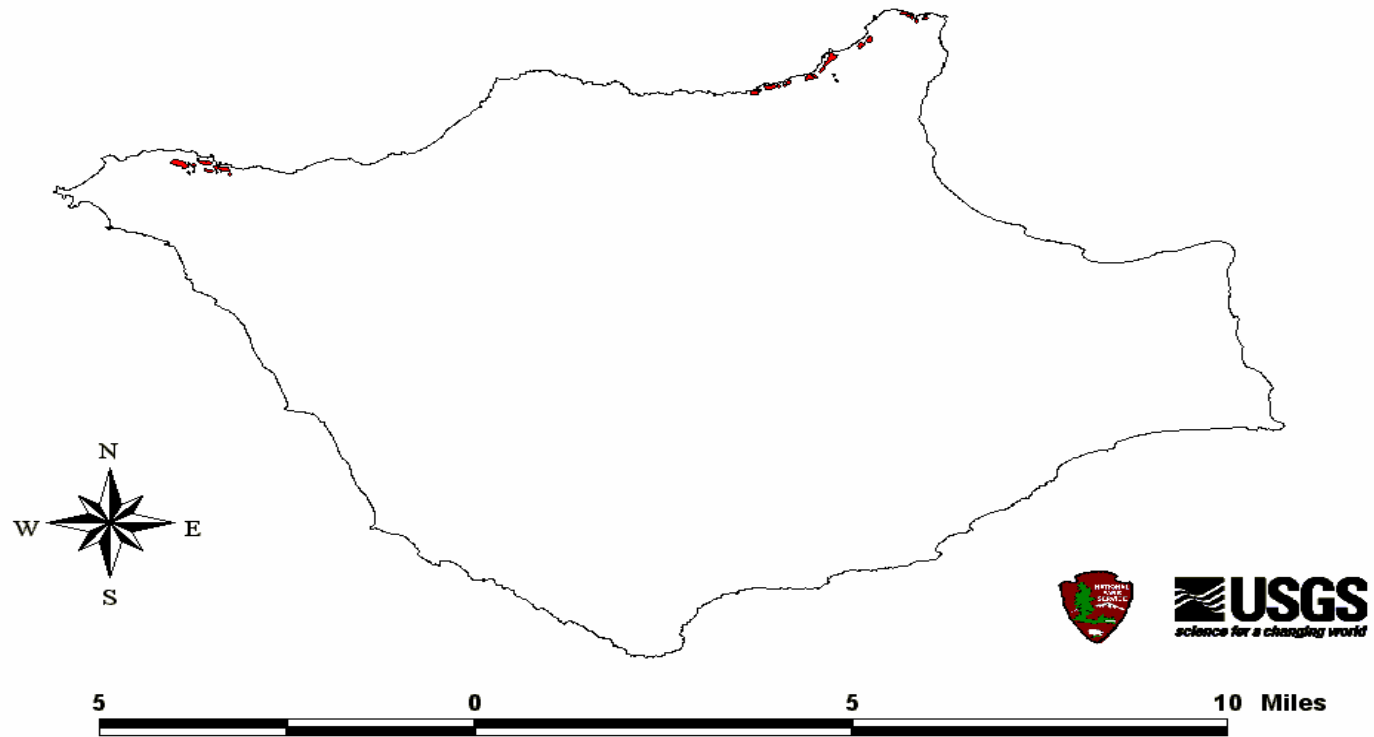


Figure 1. *Castilleja mollis* distribution on Santa Rosa Island. The area to the northeast is Carrington Point and that to the northwest is Jaw Gulch (USGS May 16, 2006)

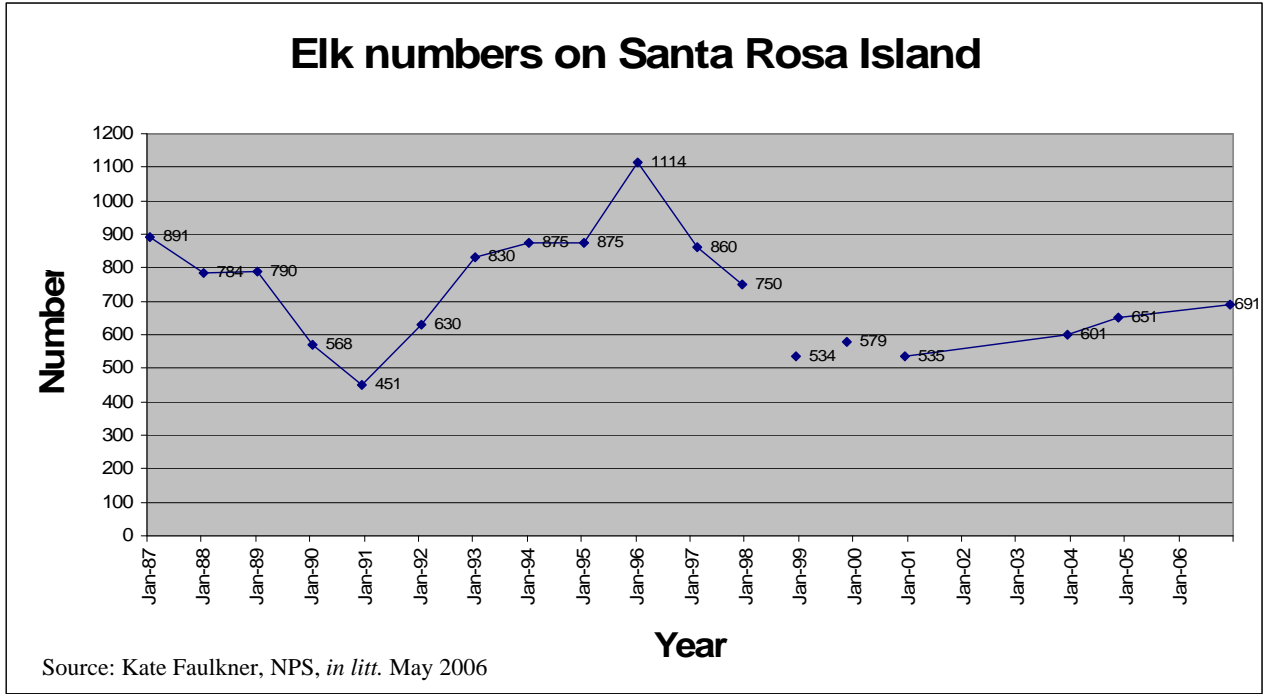


Figure 2. Estimated elk (*Cervus canadensis roosevelti*) abundance on Santa Rosa Island, 1987-2006.

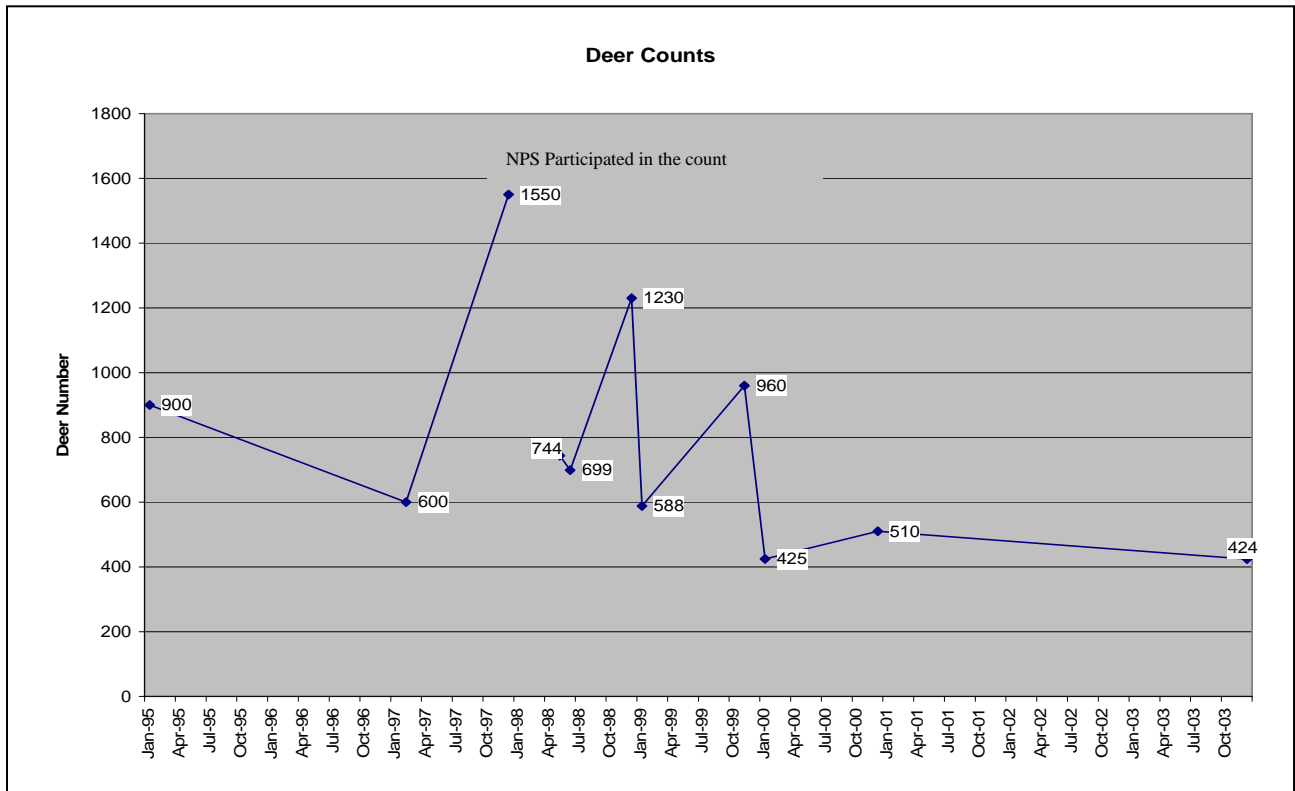


Figure 3. Estimated deer (*Odocoileus hemionus*) abundance on Santa Rosa Island, 1995-2003.

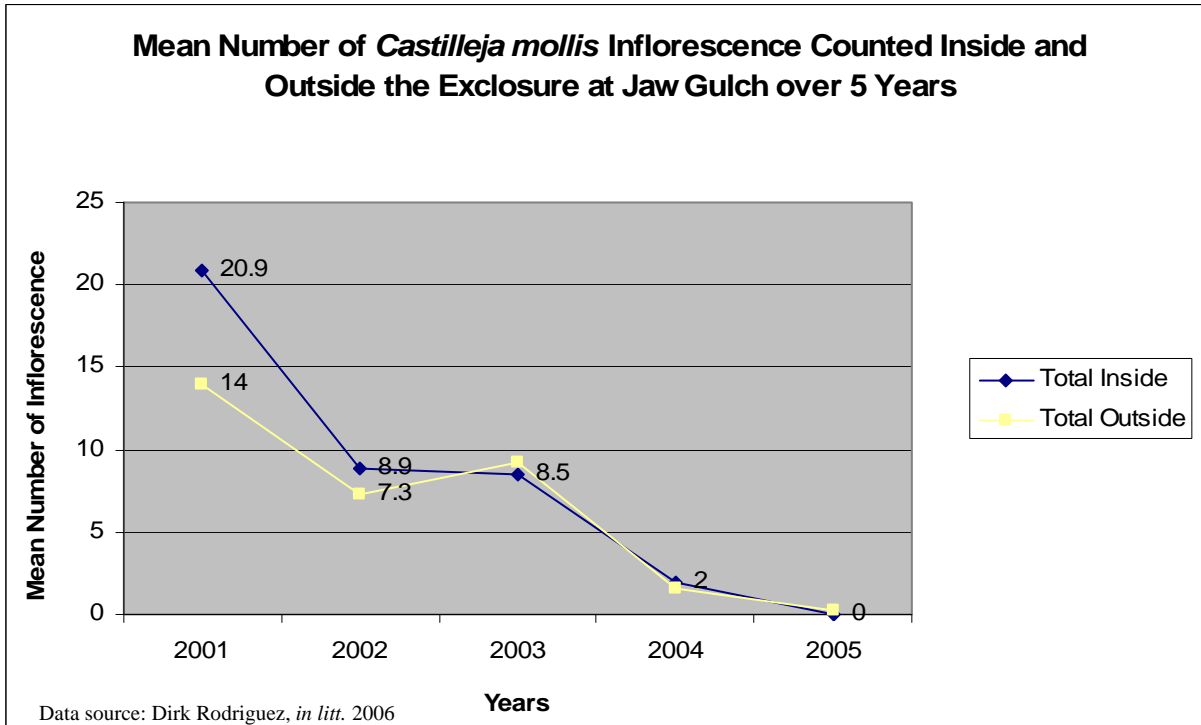


Figure 4. Mean number of *Castilleja mollis* inflorescences at Jaw Gulch, 2001-2005.

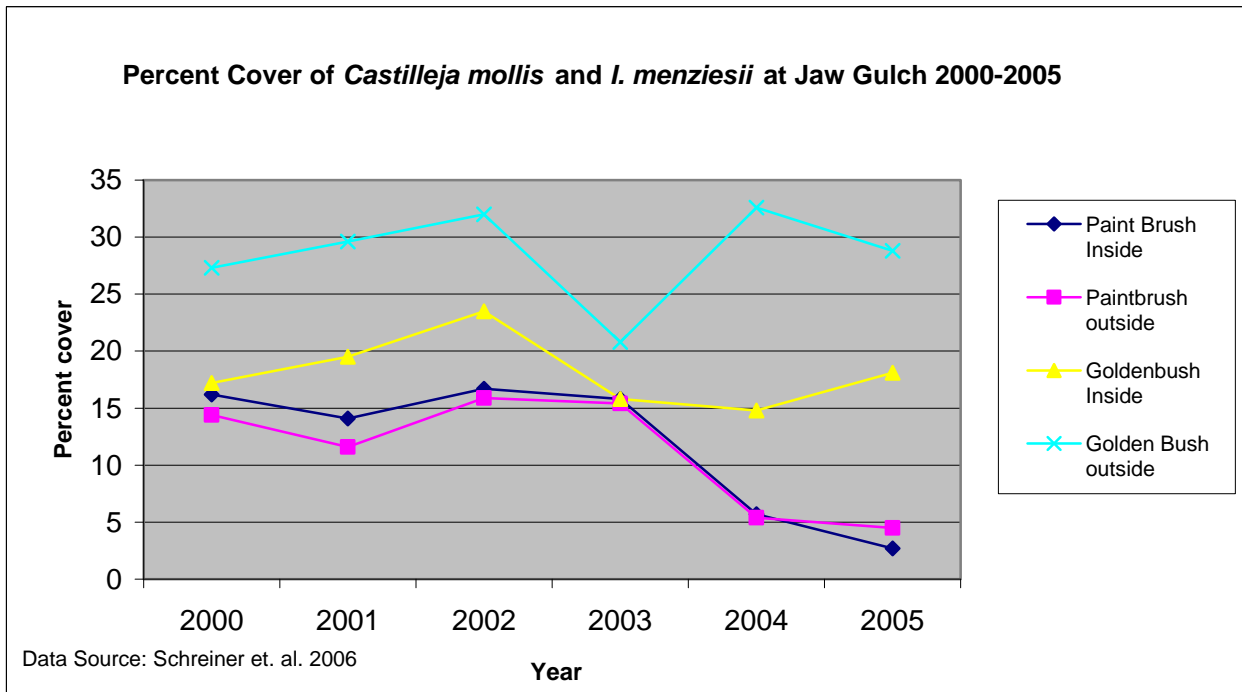


Figure 5. *Castilleja mollis* percent cover in relation to its host plant, *Isocoma menziesii*.

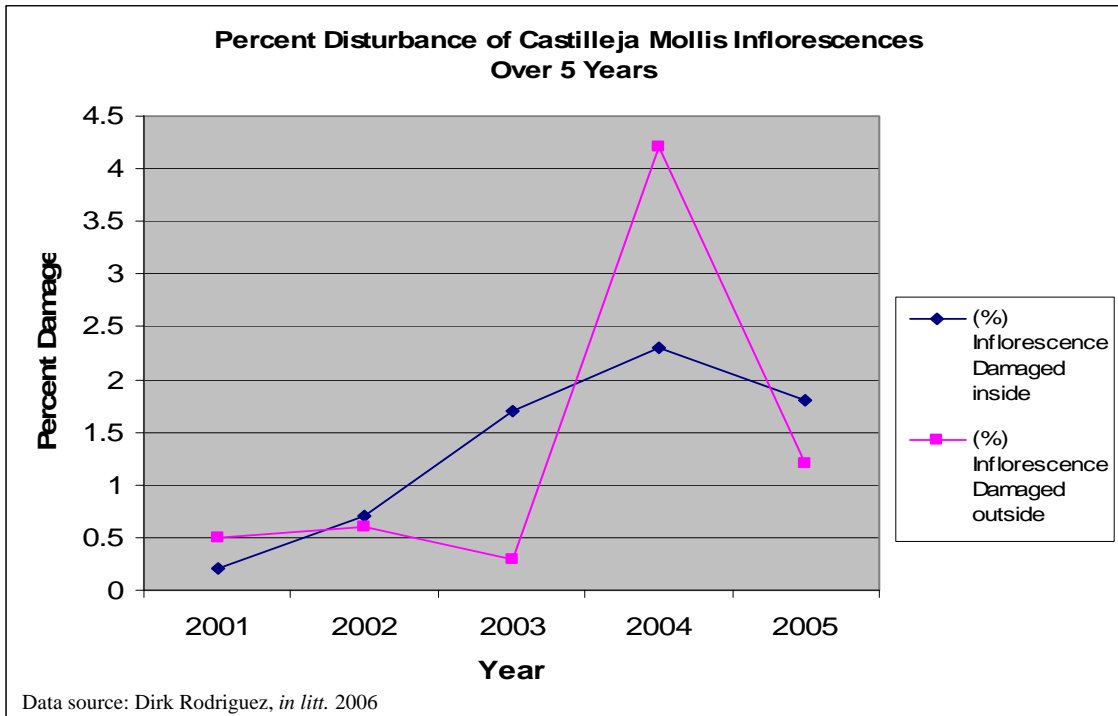


Figure 6. Percent of damaged *Castilleja mollis* inflorescences at Jaw Gulch, 2001-2005.

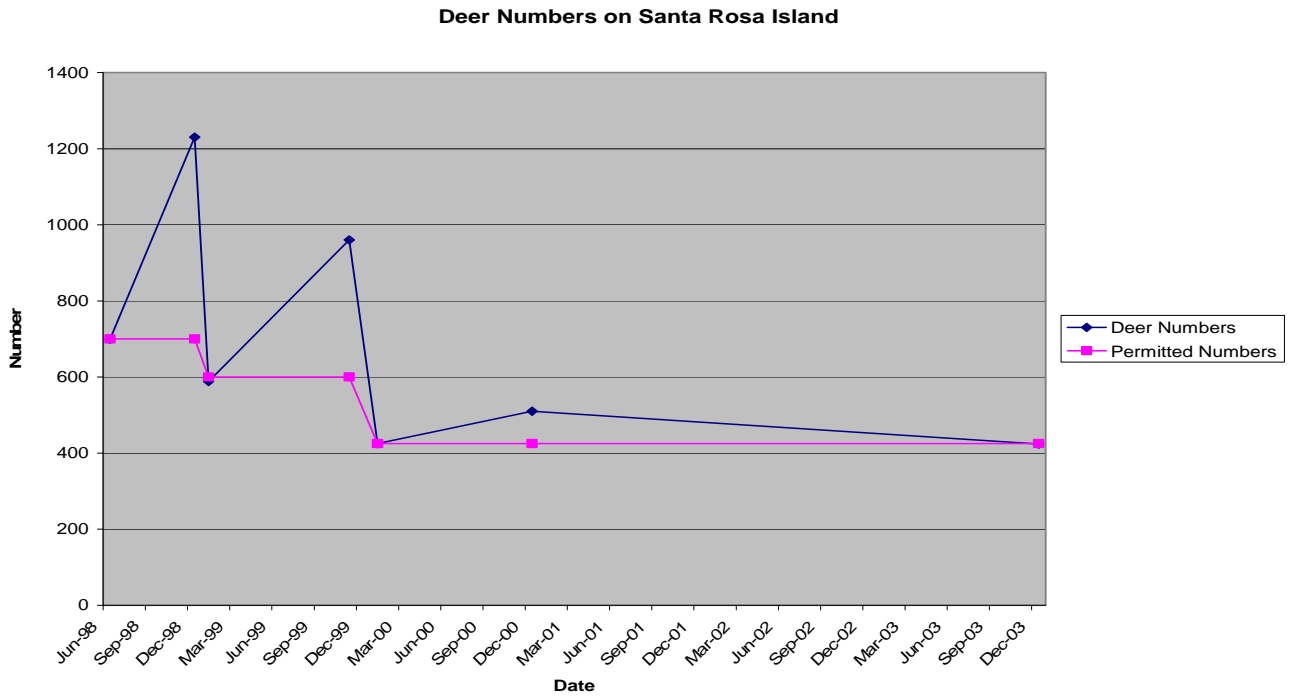
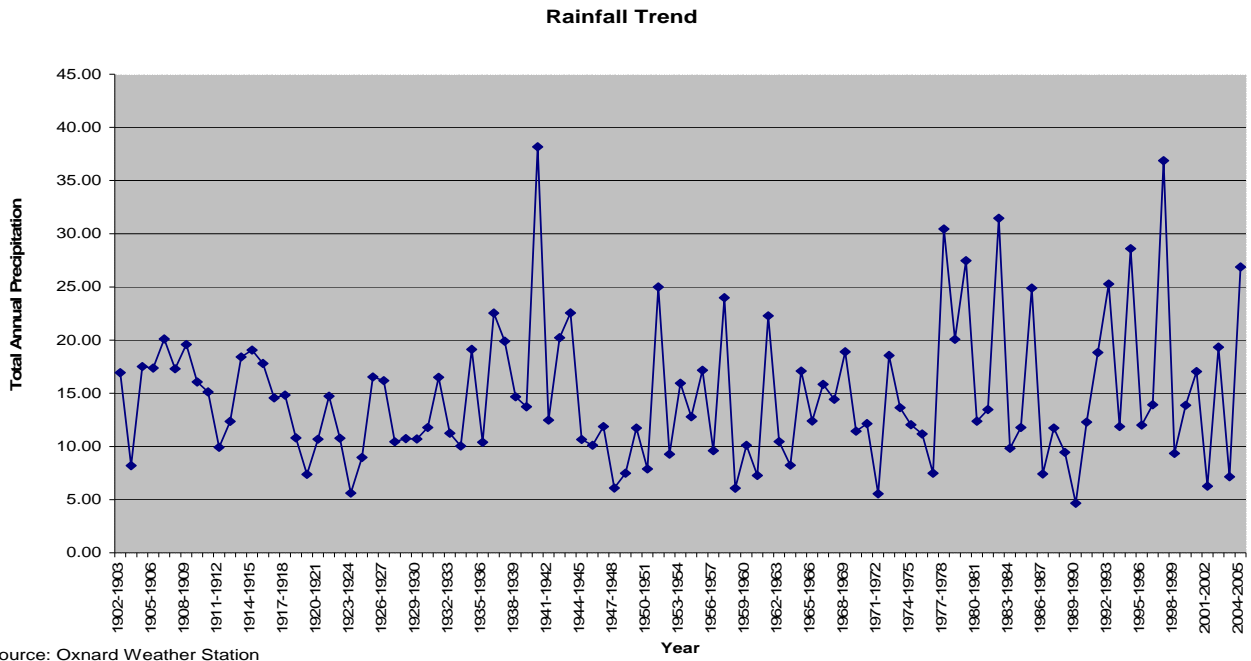


Figure 7. Estimated deer counts compared to permitted deer numbers, 1998-2003.





Source: Oxnard Weather Station  
 Transmitted by Dirk Rodriguez, NPS, May 2006

Figure 8. Annual precipitation (inches), Oxnard, California, National Weather Service Forecast Office, 1902-2005.

## VII. APPENDIX

The recovery plan recommends generalized recovery actions for all 13 listed species (including *Castilleja mollis*) on the northern Channel Islands. The primary actions and the extent to which they have been implemented are:

1. Provide protection and adaptive management of currently known (and in some cases historic) sites.

Removal of cattle in 1998 and the reduction in deer numbers have lessened the impact to the species. The number of deer has been adaptively managed since 1998 through targeted and general hunts based in part on the amount of disturbance at the *Castilleja mollis* study sites at Carrington Point and Jaw Gulch (Figure 1) (McEachern, pers. comm. 2006b; Schreiner et al. 2001; Kate Faulkner, NPS, *in litt.* 2006).

2. Provide evidence that the populations at these sites are stable or increasing over a number of years, which is determined by the life history of the individual species.

The status of the populations at either of the two sites cannot be determined with any certainty at this time. Although the number of seedlings has increased slightly (McEachern, pers. comm. 2006a), corresponding with the reduction in the number of cattle and deer (see Figures 2 and 3), the number of inflorescences and amount of cover have declined (see section C.1.a below for details on these studies).

3. Support and intensify active control programs where herbivory or habitat alteration by alien animals exists.

Cattle were removed from Santa Rosa Island in 1998. Deer and elk are being removed on a phased schedule, to be completely removed by 2011 (United States District Court for the Central District of California 1997; Rutherford and Chaney 1999) (see section C.2.c. below for details).

4. Develop and implement a plan to achieve the goals and standards of the Conservation Strategy.

The draft Conservation Strategy sets goals and standards by which recovery of the listed plant communities on the islands can be measured as ungulate numbers decrease. The draft Conservation Strategy was prepared by biologists from the National Park Service; U.S. Fish and Wildlife Service; and the U.S. Geological Survey, Biological Resources Division in February 1996. The settlement agreement (United States District Court for the Central District of California 1997) formalized a schedule for the ungulate numbers to be eliminated by 2011 using a phased approach. The NPS and the Vail and Vickers Company are working together to implement the settlement agreement. Achievement of this recovery action is in progress.

The recovery plan also includes specific actions needed for *Castilleja mollis* as follows:

1. Seed is stored in Center for Plant Conservation cooperating facilities.

Seeds have not yet been stored with the Center for Plant Conservation (McEachern, pers. comm. 2006b).

2. Seed germination and propagation techniques are understood.

Seed germination and out-planting studies were completed by McEachern, Chess, and Christian in 2003. Results show that seeds are viable and germination is not a problem (see section C.1.a below for details).

3. Successful outplanting techniques are developed.

Untreated seeds germinated readily (McEachern, pers. comm. 2006b). Germinated seeds were transplanted when the seedlings reached 2 centimeters (cm) (1 inch (in)) to potential suitable habitat on Santa Rosa Island. The study showed that seedlings needed to be within 50 cm (20 in) of a host plant.

4. Host plant and weed management plan are developed and implemented.

Host plant management and weed management plans have not been developed nor implemented (McEachern, pers. comm. 2006b; Sarah Chaney, NPS, pers. comm. 2006).

5. Life history research is conducted that aids in the conservation and recovery of the species.

Demographic studies of *Castilleja mollis* have been conducted by McEachern, Chess and Christian (McEachern et al. 2003; McEachern, pers. comm. 2006b). The studies collected information on the following: (1) length of longest stem to determine plant growth; (2) amount of herbivory on inflorescences; (3) amount of stem breakage; (4) number of inflorescences; (5) recruitment rate; and (6) mortality rate. However, the results of these studies were not available in time for this report.

6. Hybridization with *Castilleja affinis* is understood.

*Castilleja mollis* grows in close proximity with a closely related species, *Castilleja affinis*, at both population sites on the island, therefore hybridization is a concern (McEachern and Chess 2000). Based on genetic studies completed by Bushakra and McEachern (2003), there was no evidence of cloning in *Castilleja mollis*. *Castilleja mollis* appears to be genetically distinct from *Castilleja affinis*; however, results suggest that genes from *C. affinis* have been introduced into the *C. mollis* populations.

7. If declining, determine the cause and reverse trend.

Demographic studies completed by McEachern et al. (2003) indicate that recruitment and stem number of *Castilleja mollis* have increased since cattle were removed and ungulate numbers were reduced on Santa Rosa Island. Reducing the number of ungulates on the island will help reduce the amount of associated impacts (browsing, scraping, and physically damaging inflorescence).

**U.S. FISH AND WILDLIFE SERVICE  
5-YEAR REVIEW of  
Soft-leaved Paintbrush (*Castilleja mollis*)**

**Current Classification:** Endangered

**Recommendation resulting from the 5-Year Review:**


- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change is needed

Appropriate Listing/Reclassification Priority Number, if applicable: N/A

**Review Conducted By:** Jen Lechuga


**FIELD OFFICE APPROVAL:**

Field Supervisor, Fish and Wildlife Service

Approve  Date 12/31/07

**REGIONAL OFFICE APPROVAL:**

Regional Director, Fish and Wildlife Service

Approve  Date 1/10/08