

Castilleja grisea
(San Clemente Island Indian Paintbrush)

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

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

September 2007

5-YEAR REVIEW

Species reviewed: *Castilleja grisea* (San Clemente Island Indian Paintbrush)

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I. GENERAL INFORMATION

I.A. Methodology used to complete the review: This review was compiled by Christine Beck of the Carlsbad Fish and Wildlife Office (CFWO) and considered office files, available literature, new survey information, and interviews of individuals involved with surveying, research, and management of this species.

I.B. Reviewers

Lead Region: Diane Elam and Mary Grim, California-Nevada Operations Office, 916-414-6464.

Lead Field Office: Karen Goebel and Christine Beck, Carlsbad Fish and Wildlife Office, 760-431-9440.

I.C. Background

I.C.1. FR Notice citation announcing initiation of this review: On July 7, 2005, the U.S. Fish and Wildlife Service announced initiation of the 5-year review and asked for information from the public regarding the status of *Castilleja grisea* (70 FR 39327). A second notice announcing the 5-year review and extending the request for information until January 3, 2006, was published on November 3, 2005 (70 FR 66842). No information was received.

I.C.2. Species status: In the 2005 Recovery Data Call for the Carlsbad Fish and Wildlife Office, the status of *Castilleja grisea* was described as “Improving.”

I.C.3. Recovery achieved: The 2005 Recovery Data Call for the Carlsbad Fish and Wildlife Office estimated that 0 to 25 percent of the overall progress towards the recovery goals had been made.

I.C.4. Listing history

Original Listing

FR notice: 42 FR 40682

Date listed: The final rule was published on August 11, 1977, and became effective September 12, 1977.

Entity listed: *Castilleja grisea* (Dunkle), Species, a flowering plant.

Classification: Endangered.

I.C.5. Associated rulemakings: None.

I.C.6. Review History: No status reviews have been completed since the time of listing.

I.C.7. Species' Recovery Priority Number at start of review: In the 2005 Recovery Data Call for the Carlsbad Fish and Wildlife Office, *Castilleja grisea* was assigned a recovery priority of "8," indicating that the species faces a moderate degree of threat but also has a high potential for recovery.

I.C.8. Recovery Plan or Outline:

Name of plan: Recovery Plan for the Endangered and Threatened Species of the California Channel Islands

Date issued: January 26, 1984

Dates of previous revisions: No previous plans exist.

II. REVIEW ANALYSIS

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

II.A.1. Is the species under review listed as a DPS? No. The Endangered Species Act defines species as including any subspecies of fish or wildlife or plants and any distinct population segment of any species of vertebrate wildlife. This definition limits listing as DPS to only 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.

II.B. Recovery Criteria

II.B.1. Does the species have a final, approved recovery plan containing objective, measurable criteria? No. Although there is a recovery plan that identifies general goals and objectives towards attaining recovery, one of the objectives of the plan (No. 4, pp. 111-112) is to develop specific criteria for reclassifying or delisting the species (*e.g.*, the size of populations and/or amount of suitable habitat needed).

II.C. Updated Information and Current Species Status

II.C.1. Biology and Habitat

Castilleja grisea was one of the first plant species to be listed pursuant to the Endangered Species Act. Many of the early plant listings were made on the basis of the species' inclusion in a report to Congress on January 9, 1975, by the Secretary of the Smithsonian Institution (House Document No. 94-51 of the 94th Congress, 1st Session). That report was primarily comprised of a list of over 3,100 U.S. vascular plant taxa that the scientists who compiled it considered to be endangered, threatened, or possibly extinct. The Smithsonian report and the proposed rule to list *Castilleja grisea* (41 FR 24523, 42 FR 40682), however, did not include specific information regarding the ecology, demographics, or natural history of the species.

Castilleja grisea is a highly branched perennial subshrub in the figwort family (Scrophulariaceae). The species is endemic to San Clemente Island (Chuang and Heckard 1993) and is the only representative of the genus *Castilleja* found on the island (Helenurm *et al.* 2005). *Castilleja grisea* is typically 11.5 to 31.5 inches in height and covered with a dense white-wooly felt. Most *Castilleja* species have bisexual flowers disposed in terminal spikes. The flowers of *Castilleja grisea* are yellow. Its leaves alternate and are linear, approximately ½ inch to 2 inches long with 0 to 3 lobes (Chuang and Heckard 1993). The fruit is an ovoid capsule, less than ½ inch long, containing approximately 150 seeds (Junak and Wilken 1998). *Castilleja grisea* seeds are typically brown and less than 1/16 inch long. The seed coats are deeply netted, allowing the encapsulation of air, which may aid dispersal via water (Chuang and Heckard 1993; Muller 2005). Under natural conditions, plants typically produce 9 to 14 fruits. Both insect and hummingbird pollination of *Castilleja* have been reported (Grant 1994; Junak and Wilken 1998). In a recent study, Junak and Wilken (1998) found that 67 to 71 percent of *Castilleja grisea* flowers produced fruits and significantly more flowers than fruits were produced. This data suggests that *Castilleja grisea* may either be self-incompatible or strongly dependent on insect or hummingbird visitation for pollination and seed set. *Castilleja grisea* seeds typically germinate the spring following seed set as temperatures begin to warm (Muller 2005).

All members of the genus *Castilleja* are considered hemiparasitic. Their roots tap into the root system of other species to ensure an adequate water, and possibly nutrient, supply (Junak and Wilken 1998). Parasitism in *Castilleja* seems to be a generalist phenomenon with taxa parasitizing plants within a wide range of families, including Asteraceae, Fabaceae, Polygonaceae, Poaceae, and Rosaceae (Muller 2005). Currently, Dr. Steve Junak of the Santa Barbara Botanical Garden has been contracted by the U. S. Department of the Navy, Southwest Division, to verify that *Castilleja grisea* is indeed hemiparasitic (K. O'Connor pers. comm. 2006). Greenhouse experiments are also being conducted to determine which plant species may be acting as hosts for *Castilleja grisea*.

Distribution

The original range and distribution of *Castilleja grisea* on San Clemente Island is speculative because its decline began before thorough botanical studies were completed. However, *Castilleja grisea* has expanded its distribution to include steep canyon walls on the western side of the island since initial surveys were conducted in 1996 and 1997 (Junak and Wilken 1998). Occurrence data (as defined by the reporters, not equivalent to CNDDDB occurrences) for this species spans the southern two-thirds of the island, a distance of approximately 17.5 miles. Its distribution also overlaps the boundary of the Shore Bombardment Area (SHOBA) at the southern end of the island, with 48 (40 percent) occurrences inside and 71 (60 percent) occurrences outside of SHOBA (Junak and Wilken 1998; Junak 2006).

Abundance

Castilleja grisea was considered relatively common in the 1930s but declined steadily over the next 30 years. By 1963 it was reported as rare or occasional, and by 1978 few individuals were observed (Kellogg and Kellogg 1984). Surveys in 1996 and 1997, however, documented a total of 77 occurrences of *Castilleja grisea*, collectively comprising more than 3,500 individuals (Junak and Wilken 1998). Occurrences ranged from isolated plants to 600 individuals. *Castilleja grisea* was found in steep canyons on both sides of San Clemente Island and on coastal bluffs, slopes and flats around the island's perimeter. More recent surveys for *Castilleja grisea* were conducted in 2003 and 2004. Surveyors mapped an additional 42 locations and 1,120 individuals (Junak 2006). Occurrences ranged from isolated plants to 200 individuals. These new occurrences were mainly concentrated in steep canyons on the western side of the island, although a few were discovered near previously recorded individuals in the eastern canyons. Taken together, these two surveys suggest that *Castilleja grisea* can currently be found in approximately 119 locations on San Clemente Island and may number as high as 4,700 individuals.

Habitat

Castilleja grisea is endemic to San Clemente Island and was originally described as relatively common (Helenurm *et al.* 2005). Today, most occurrences of *Castilleja grisea* are in steep rocky canyons on both the eastern and western sides of the island. It is also found on coastal bluffs, slopes and flats around the island's perimeter. Some of the largest occurrences are located in bowl-shaped swales on the coastal terraces in the southern portion of the island (Junak and Wilken 1998). *Castilleja grisea* is found in both coastal sage scrub and maritime cactus scrub plant communities between 30 and 1200 feet in elevation.

Based on vegetation mapping for the San Clemente Island Integrated Natural Resources Management Plan (INRMP), *Castilleja grisea* is mainly associated with two habitats on the island: canyon woodland (696.2 acres) and maritime desert scrub/terrace complex (6228.2 acres) (U. S. Department of the Navy, Southwest Division 2002). A few scattered occurrences can also be found in maritime desert scrub/grassland habitat and in grassland habitat just east of Pyramid Cove. *Castilleja grisea* habitat at Pyramid Cove is further subdivided into shallow, cobbly fine loam on slopes and terraces and maritime sage scrub-northeast escarpment. Occurrences of *Castilleja grisea* near Pyramid Cove account for 34 percent of the island's total number of individuals. *Castilleja grisea* is often associated with the following native plant species: *Encelia californica*, *Atriplex californica*, *Berberocactus emoryi*, *Bromus madritensis rubens*, *Opuntia* spp., and *Rhus integrifolia*.

The current habitat conditions for *Castilleja grisea* on San Clemente Island are the result of historic land use practices. From 1850 until 1934, San Clemente Island was used legally and illegally for sheep ranching, cattle ranching, goat

grazing and pig farming (U. S. Department of the Navy, Southwest Division 2002). These non-native herbivores greatly changed the vegetative landscape of San Clemente Island and were cited in the final rule (42 FR 40863) for the listing of *Castilleja grisea* as the main cause of this species' decline. Sheep were removed from the island in the 1930s, but feral goats and pigs were not completely eradicated until 1992. Since their removal, the vegetation on San Clemente Island has rebounded, and the status of many rare plants has improved (S. Junak, pers. comm. 2006).

Although *Castilleja grisea* may not have been a primary target of the mammalian herbivores, overgrazing probably led to the direct loss of plants through trampling and rooting. These grazing/rooting animals also altered the habitat by creating trail networks with bare, compacted soil. Defoliation from overgrazing by non-native herbivores has resulted in severe habitat degradation that likely curtailed the range of *Castilleja grisea* and other plant endemics on the island. Even following the removal of most of the non-native herbivores from the island, their legacy remains in the form of persistent and severe erosion. As noted in the listing rule for two additional species found on San Clemente Island, San Clemente Island woodland star (*Lithophragma maximum*) and Santa Cruz Island rockcress (*Sibara filifolia*), the increase in erosion has caused the loss of topsoil, loss of soil organic matter, and the reduction of soil nutrient cycling and water holding capacity (62 FR 42697). This may have led to the loss of the soil seed bank as well as the degradation and loss of suitable habitat. Erosion has been identified as a threat to both the canyon woodland and maritime desert scrub habitats where *Castilleja grisea* is currently found (U. S. Department of the Navy, Southwest Division 2002).

Contemporaneous with and likely aided by feral grazing animals, a large number of invasive non-native plant species have naturalized on San Clemente Island and have become a dominant component of most of the habitats. The invasion of non-native annual grasses on the island may have caused the greatest structural changes to *Castilleja grisea* habitat, especially in the coastal terraces and swales. Although most of the invasive species likely came to the island while it was being ranched, invasions by previously undocumented non-native grasses continue to be found on San Clemente Island with the recent discoveries of *Schismus* sp. and *Brachypodium distachyon* (S. Junak pers. comm. 2006, J. Dunn pers. comm. 2006).

A brief review of the occurrence data collected in 1996 and 1997 reveals that *Castilleja grisea* was associated with non-native annual grasses in 24 of its 77 locations (31 percent) (Junak and Wilken 1998). Lists of associated species were not provided to us with the 2003/2004 data. As previously stated, *Castilleja grisea* mainly occurs in two habitat types on San Clemente Island: canyon woodland and maritime desert scrub/terrace complex. Percent cover data was collected in 1992 and 1993 for these two vegetation communities. Data (percent cover) for the 10 most abundant species was provided in the INRMP (U. S.

Department of the Navy, Southwest Division 2002). For the canyon woodland habitat, 3 of the 10 most abundant species were non-native annual grasses (*Bromus diandrus*, *Avena barbata*, and *Bromus madritensis rubens*). Together these 3 species accounted for 46 percent of the cover in the canyon woodland habitat. For the maritime desert scrub community, three of the four most abundant species were non-native annual grasses (*Vulpia myuros*, *Bromus madritensis rubens*, and *Avena barbata*) accounting for 39 percent of the vegetative cover.

The past and current fire regimes have also influenced the distribution of native and non-native flora on San Clemente Island. While the island was used for ranching, fires were set intermittently to increase the cover of forbs and grasses. After the island was purchased by the U. S. Department of the Navy in 1934, however, fire became a more common occurrence throughout much of the island. Fire history for most of the island has been documented since 1979. Since that time over 50 percent of the island has experienced at least one wildfire (U. S. Department of the Navy, Southwest Division 2002). Much smaller areas on the island have burned up to six times between 1979 and 2000. The majority of these fires have been caused by military training exercises that employ live ordnance in the Shore Bombardment Area (discussed below in Section II.C.2) (U. S. Department of the Navy, Southwest Division 2002).

In summary, current habitat conditions for *Castilleja grisea* on San Clemente Island are the result of historic and current land use practices including ranching and military training activities. Although *Castilleja grisea* populations have rebounded with the removal of feral grazers, its habitats remain degraded as a result of erosion, the invasion of non-native grass species, and possibly frequent and intense fires in the southern portion of its range.

Genetics

Helenurm *et al.* (2005) used allozymes (proteins that are used as genetic markers) to determine the overall level of genetic variation and genetic structure of *Castilleja grisea*. Leaf tissue was sampled from 19 occurrences (“populations”) spanning the range of *Castilleja grisea* on San Clemente Island. Seventeen to 55 individuals were haphazardly sampled from each occurrence. Genetic variation (number of alleles per locus, percent of loci that are polymorphic, and expected heterozygosity) was consistently high at both the species and population levels and was higher than usually found for endemic species. Several characteristics of *Castilleja grisea* were associated with higher levels of genetic variation in plants including sexual reproduction, a long-lived perennial herbaceous habit, late successional status, and an outcrossing, animal pollinated mating system. Helenurm *et al.* (2005) concluded that if population sizes of *Castilleja grisea* (ranging from 30 to 600 individuals at the time of publication) could be maintained or increased, there “would appear to be little cause for concern on genetic grounds regarding the long-term persistence of this species.” They go on to say that the levels of genetic variation are moderately high in *Castilleja grisea*,

especially considering its endangered status, its narrow geographic range, and that it is an endemic species of a small island. They conclude that the rapid recovery of *Castilleja grisea* populations following the removal of goats from the island was likely through recruitment from the seed bank. Their genetic data suggest that the seed bank has maintained substantial genetic diversity. Although innate dormancy does not appear to occur in *Castilleja grisea* (Junak and Wilken 1998), seeds may remain viable in the soil for many years through induced or enforced dormancy. In conclusion, Helenurm *et al.* (2005) state that the “present genetic data, in combination with the ecological recovery of *Castilleja grisea* since the removal of goats from San Clemente Island, suggest that this taxon is in no urgent danger of extinction.”

Taxonomy

Castilleja grisea was first described by Dunkle in 1943. Munz (1958) later treated the taxon as a subspecies under *C. hololeuca* [*C. hololeuca* E. Greene subsp. *grisea* (Dunkle) Munz]. More recent analysis by Chuang and Heckard (1992) placed *C. hololeuca* as a subspecies under *Castilleja lanata*, leaving *Castilleja grisea* as a distinct species (Muller 2005).

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

II.C.2.a. Present or threatened destruction, modification or curtailment of

its habitat or range: As stated above, non-native herbivores were cited in the final rule (42 FR 40863) for the listing of *Castilleja grisea* as the main cause of the decline of this species. With the final removal of these herbivores in 1992, the vegetation on San Clemente Island has rebounded, and the health of *Castilleja grisea* populations has improved (S. Junak pers. comm. 2006). Although the main threat to the recovery of *Castilleja grisea* has been eliminated, persistent erosion resulting from historic overgrazing and competition with naturalized invasive non-native plant species still pose a threat to the recovery of this species. Other threats to the species not listed in the final rule include alteration of its habitat by military training activities and unnaturally high fire frequencies in the southern portion of its range.

Erosion

Defoliation from overgrazing on San Clemente Island caused increased erosion over much of the island, especially on steep slopes where denuded soils can be quickly washed away during storm events. Erosion has been identified in the INRMP (U. S. Department of the Navy, Southwest Division 2002) as a threat to the canyon woodland habitat. Although more vegetative cover is now present, erosion is still a threat to the recovery of *Castilleja grisea*, especially in areas where it grows in proximity to roads (E. Kellogg pers. comm. 2006). The main circulation artery on San Clemente Island begins at the Airfield and extends for 20 miles in a southerly direction. It traverses almost the entire length of the

island. Only the northern six miles of the road are fully paved. Other secondary roads occur throughout the island, and these roads are either unpaved or only partially paved. During storm events, run-off from these roads washes into the steep canyon areas where *Castilleja grisea* is found (E. Kellogg pers. comm. 2006). Storm water run-off can cause severe erosion in these canyons and scour the root systems of many plant species. If the water is traveling fast enough, it can completely uproot the plant. Based on maps provided in the INRMP, approximately 12 occurrences of *Castilleja grisea* occur in proximity to the main north-south road, and these occurrences are concentrated in the southern portion of the island where the road is unpaved. At least an additional 20 occurrences of *Castilleja grisea* occur in proximity to secondary roads. According to the INRMP, condition of the island's roads are "poor and non-maintainable" because of poor drainage during the rainy season (U.S. Department of the Navy, Southwest Division 2002). Currently, an evaluation of road erosion priorities is underway, and the results will be incorporated into subsequent INRMP updates (U.S. Department of the Navy, Southwest Division 2002). If proper Best Management Practices are implemented including avoidance measures, road maintenance activities targeted at erosion control would likely benefit *Castilleja grisea*.

Non-native Species

Another threat to the recovery of *Castilleja grisea* is the spread of invasive non-native plants into its habitat. A large number of plant taxa have colonized San Clemente Island and several annual grasses including *Avena barbata*, *Bromus* spp., and *Vulpia myuros* cover large portions of *Castilleja grisea* habitats. These non-native grasses may compete with *Castilleja grisea* for space or other resources such as light, water, and nutrients. Non-native plant species can also alter ecological processes such as nutrient cycling or the prevalence of fire (U. S. Geological Survey 2004). As stated above, non-native annual grasses were found associated with *Castilleja grisea* in 31 percent of its locations in 1996 and 1997 and percent cover of these species was over 40 percent in *Castilleja grisea* habitats (Junak and Wilken 1998; U. S. Department of the Navy, Southwest Division 2002).

Fire

An associated threat from the invasion of non-native annual grasses is the increased fuel load they provide for fire. Because annual grasses vary in density with rainfall, they have the potential to significantly alter the fuel load in wet years. They also provide a fuel that is easily ignitable due to the short time needed for fuel moisture to drop to low levels. For example, in the Mojave Desert, an increase in fire frequency and intensity in this once sparsely vegetated biome has been attributed to the invasion and proliferation of non-native annual grasses (Brooks 1999; Brooks and Esque 2004). Non-native annual grasses can also extend the fire season by more than a month because they dry out sooner than

the native herbaceous flora. The relationship between fire and the ecology of *Castilleja grisea*, however, has not been studied. The INRMP states that fire may aid the dispersal of *Castilleja grisea* individuals as members of the genus *Castilleja* tend to follow fire and other non-catastrophic events (U. S. Department of the Navy, Southwest Division 2002). The INRMP also states that occasional fires may be beneficial to *Castilleja grisea* based on the fact that a monitored population in Pyramid Cove peaked in 1984 after a fire in 1983 and then declined during subsequent years (U. S. Department of the Navy, Southwest Division 2002). However, more frequent fires could be detrimental to this species by facilitating the invasion of non-native competitors, overwhelming *Castilleja*'s tolerance threshold to fire, and/or depleting the seed bank. If this species is hemiparasitic, population fluctuations may also be tied to its host's response to fire.

Land Use

San Clemente Island is owned by the U. S. Department of the Navy and with its associated offshore range complex is the primary maritime training area for the Navy Pacific Fleet and Navy Sea, Air and Land (SEALS). The island also supports training by the U. S. Marine Corps, the U. S. Air Force, and other military organizations. As the last range in the eastern Pacific Basin where many training operations are performed prior to troop deployments, portions of the island receive intensive use (U. S. Department of the Navy, Southwest Division 2002). Although the Navy has adopted an INRMP to help integrate its mission with resource protection on the island, 30 percent of *Castilleja grisea* individuals and 40 percent of its occurrences are located in an intensively used area known as the Shore Bombardment Area (SHOBA) (Junak 2006).

SHOBA covers approximately the southern one-third of San Clemente Island and supports a variety of training operations involving both live and non-live munitions fire. These operations include: Naval Surface Fire Support (NSFS), which involves live fire from ships to the Impact Areas; Combined Arms exercises, which involve practicing coordination of all supporting arms of the Navy, Marine Corps, and Air Force such as NSFS, Artillery, Mortars, Fixed Wing Aircraft and Helicopters; amphibious training of Marine Corps Artillery Units using live fire; close air support/strike using both live and inert munitions from fixed wing aircraft and helicopters; targeting precision guided munitions with lasers; explosive ordnance disposal; and naval Special Warfare operations. Certain munitions exercises involve the use of incendiary devices such as illumination rounds, white phosphorous and tracer rounds, which pose a high risk of fire ignition (U.S. Fish and Wildlife Service 2002).

Because of the elevated risk of fire associated with these training activities, live and non-live munitions fire is targeted towards two delineated Impact Areas within SHOBA where training disturbances and repeated fires are concentrated. Strip burning and fire retardant are used to maintain fuel breaks around these

impact areas and to limit the spread of fires. Because of the dangers associated with unexploded ordnance, however, it is not safe to implement certain measures to combat fire in and around the Impact Areas, including the use of helicopters from any altitude to make water drops. Instead, fires are controlled by back-burning and holding the fire along a road, fuel break, or other fuel treated area (U. S. Department of the Navy, Southwest Division 2002). Much of the remainder of SHOBA serves a buffer function where there is less intensive use and fire suppression can be used to protect sensitive resources, such as *Castilleja grisea*. The Navy has adopted a set of fire management policies and practices to minimize the risk of fires spreading from the impact areas to adjoining habitat, including: maintenance of fire breaks around impact areas; restrictions on the times and conditions when certain munitions can be used during the fire season; and the presence of a fire-fighting helicopter on-island during periods of military training within SHOBA (U.S. Fish and Wildlife Service 1997, 2002). These factors help to minimize, but do not eliminate the threat of fire and fire suppression activities on *Castilleja grisea*.

In 1997, the Navy proposed reducing the existing restrictions on ordnance use in Impact Areas 1 and 2 in SHOBA such that the size of the impact area during the fire season could be expanded (U.S. Fish and Wildlife Service 2002). This action likely increased the fire frequency within the boundaries of maintained fuel breaks. In 1997, four *Castilleja grisea* occurrences were located within these fuel break boundaries, and it was believed they would burn on a more frequent and regular basis than prior to the proposed action. Therefore, a decrease in abundance of and reduced potential for regeneration of these individuals was expected to occur as a result of the proposed action (U.S. Fish and Wildlife Service 2002). An additional 21 occurrences were located in SHOBA outside of fuel breaks and were also at high risk from fire (Junak and Wilken 1998; Junak 2006). Since 1979, 10 of these occurrences have burned (U. S. Department of the Navy, Southwest Division 2002). Forty-four *Castilleja grisea* occurrences are located in the aerial suppression zone (U. S. Fish and Wildlife Service 2002). Fire suppression foams are sprayed from the air to impede fire. The effect of these foams on *Castilleja grisea* is currently unknown (U.S. Fish and Wildlife Service 2002).

The Navy proposes to change fire management policies and practices in the near future through adoption of a Fire Management Plan (FMP) that is in preparation. It is hoped that the FMP will provide greater flexibility regarding when various munitions can be used during the fire season (K. O'Connor pers. comm. 2006). The FMP will also likely modify the conditions when certain fire protection resources must be available and ready for use on the island (*e.g.*, a dedicated fire helicopter) (U. S. Department of the Navy 2001; K. O'Connor pers. comm. 2006). By using real-time weather and fire forecasting to determine when certain munitions can be used and when helicopters must be present, these modifications to the fire management policies could alter the effectiveness of fire suppression

measures to protect *Castilleja grisea* by increasing the logistical complexity of fire hazard reduction and strategic response.

II.C.2.b. Overutilization for commercial, recreational, scientific, or educational purposes: This factor was determined not to be applicable in the final rule (42 FR 40682); although voucher herbarium specimens of *Castilleja grisea* individuals and seeds have been collected for ecological research, genetic research, and conservation banking purposes (Junak and Wilken 1998; Helenurm *et al.* 2005). Because San Clemente Island is a military installation, public access to it is restricted by the Navy, thus limiting the potential for overutilization to threaten *Castilleja grisea*.

II.C.2.c. Disease or predation: The grazing of feral goats and the rooting of feral pigs was considered a serious threat to *Castilleja grisea* in the final rule (42 FR 40682). As stated above, however, these non-native mammalian predators/browsers were removed from San Clemente Island in 1992. Currently, no other predators or diseases on San Clemente Island are known to pose a significant threat to *Castilleja grisea*.

II.C.2.d. Inadequacy of existing regulatory mechanisms:

Federal Laws

This factor was determined not to be applicable in the final rule (42 FR 40682). At that time, the regulatory mechanisms with potential to protect *Castilleja grisea* were the National Environmental Policy Act (NEPA) and the Endangered Species Act (ESA). NEPA requires Federal agencies to integrate environmental values into their decision making processes by considering the environmental impacts of their proposed actions and reasonable alternatives to those actions. The ESA requires all Federal agencies to insure that any action authorized, funded or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species. Additionally, section 9(a)(2)(B) of ESA prohibits the destruction, damage, or moving of an endangered plant that occurs on Federal property.

In 1977, concurrent with the listing of *Castilleja grisea*, six species found on San Clemente Island were federally listed including San Clemente loggerhead shrike (*Lanius ludovicianus mearnsi*), San Clemente Island sage sparrow (*Amphispiza belli clementine*), island night lizard (*Klauberina riversiana*), San Clemente broom (*Lotus dendroideus* var. *traskiae*), San Clemente Island larkspur (*Delphinium variegatum* ssp. *kinkiense*), and San Clemente Island bush mallow (*Malacothamnus clementinus*) (42 FR 40682). In 1997, two additional species found on San Clemente Island, San Clemente Island woodland star (*Lithophragma maximum*) and Santa Cruz Island rockcress (*Sibara filifolia*), were listed as endangered (62 FR 42692). If *Castilleja grisea* were not listed, it could receive regulatory protection through the obligation of the Navy to consult with the U.S. Fish and Wildlife Service under section 7 of the ESA in those cases

where it occurs in habitat occupied by these other listed species. Through the consultation process, the Service works with the Navy to identify measures that will avoid, minimize and promote the conservation of listed species potentially impacted by any proposed project.

State Laws

In 1982, *Castilleja grisea* was listed as endangered under the California Endangered Species Act (CESA); however, the State has regulatory authority on military installations in only rare circumstances. This would also apply to the California Environmental Quality Act (CEQA). CEQA review of a proposed project is only required of California public agencies, including local and regional agencies (Remy *et al.* 1996). Therefore, CEQA review is not required for Federal projects or projects on military lands unless the lead agency is a non-Federal agency (*e.g.* a privately run ski resort built on Forest Service lands). Because *Castilleja grisea* occurs only on San Clemente Island, which is entirely owned by the Federal Government, CEQA and CESA afford it little additional protection.

San Clemente Island INRMP

In 2002, pursuant to the Sikes Act Improvement Act of 1997, the Navy adopted an Integrated Natural Resources Management Plan (INRMP) for San Clemente Island. An INRMP is a plan that is intended "...to guide installation commanders in managing their natural resources in a manner that is consistent with the sustainability of those resources while ensuring continued support of the military mission" (U. S. Department of the Navy, Southwest Division 2002).

Of relevance to the protection of *Castilleja grisea*, the San Clemente Island INRMP includes an objective to: "Protect, monitor, and restore plants and cryptograms in order to manage for their long-term sustainability on the island" (p. 4-37, U.S. Department of the Navy, Southwest Division, 2002). Associated with this objective are a number of proposed management strategies that include: consideration of *Castilleja grisea* as a "management focus plant" such that it is considered independently from its associated plant community for management; conducting status surveys for this species; ensuring that management focus plants have a network of suitable sites; performing pollination studies on *Castilleja grisea*; and continuing to apply genetic research and management approaches to its management. Other INRMP strategies targeted towards the terrace complex of maritime desert scrub, in which *Castilleja grisea* occurs, include: accelerating the recovery of shrubs on terrace faces and flats; reducing the percent cover of invasive plants from the 1992-93 baseline of 41% on terrace faces and 53% on terrace flats; controlling erosion, particularly in association with active and abandoned roads; and establishing a preliminary fire return interval of 5 years in grassy areas and 10 years or longer in shrublands (U. S. Department of the Navy, Southwest Division 2002).

To date, concerted efforts have been made to control escape of fire from the

Impact Areas and to reduce the cover of non-native species (K. O'Connor pers. comm. 2006). The Navy has also funded rare plant surveys that have documented new occurrences of *Castilleja grisea* and field studies that have determined some aspects of its reproductive potential.

For purposes of the INRMP, San Clemente Island has been divided into 18 Management Units (U. S. Department of the Navy, Southwest Division 2002). These Management Units were ranked for both military and natural resource value. *Castilleja grisea* occurs in 12 of these management units, including 2 units that have the highest military value ranking: Pyramid Cove and China Cove (Table 1). Pyramid Cove contains only 9 percent of *Castilleja grisea* occurrences but 30 percent of the *Castilleja grisea* individuals. The INRMP describes the area around Pyramid Cove as having "...high military value for ship to shore bombardment and other activities" (p. 4-14, U. S. Department of the Navy, Southwest Division 2002). The Pyramid Cove Management Unit contains SHOBA and is, therefore, subjected to heavy military use. Approximately 62 percent of *Castilleja grisea* occurrences, however, occur in areas that have low military value (Table 1). These occurrences account for 26 percent of the *Castilleja grisea* individuals on the island.

Table 1. The military value for each of the 12 Management Units containing *Castilleja grisea* individuals on San Clemente Island. Management Units in bold contain the greatest number of *Castilleja grisea* individuals.

Management Unit	Military Value	Number of <i>Castilleja grisea</i> locations	Number of <i>Castilleja grisea</i> individuals
Pyramid Cove	Highest	20	1400+
China Cove	Highest	2	33
Seal Cove	High	1	12
Terrace Canyon	Medium	4	165
Cave Canyon	Medium	2	54
Mt. Thirst	Medium	16	810+
West Cove	Medium	2	507
Lemon Tank	Low	14	399
Mosquito Cove	Lowest	12	127
Lost Point	Lowest	27	234
Upper China Cove	Lowest	1	10
Eagle Canyon	Lowest	14	450+

In conclusion, although the INRMP is technically not a regulatory mechanism, it is an important guiding document that helps to integrate the military's mission with natural resource protection on San Clemente Island (U. S. Department of the Navy, Southwest Division 2002). The INRMP targets a number of objectives towards protection and restoration of *Castilleja grisea* habitats.

II.C.2.e. Other natural or manmade factors affecting its continued existence:

Because the entire distribution of *Castilleja grisea* occurs within a military installation, one manmade factor that may affect its continued existence is constrained access within a portion of its range for implementing active management and erosion control measures.

Access to SHOBA

Because SHOBA is used for ship-to-shore bombardment, access to this area is often restricted for non-military personnel. In the past, individuals conducting surveys or working on invasive species control projects have been granted access to SHOBA when military activities are not occurring. Because of the frequency of training, access to SHOBA can be restricted for long periods of time and there may only be brief intervals when biological work can be done (K. O'Connor pers. comm. 2006). This can undermine the effectiveness of invasive species control programs that often rely on treatments during a particular time in an organism's life cycle (e.g., spraying herbicide prior to seed set by invasive non-native grasses).

Safety concerns relative to the presence of unexploded ordinance within SHOBA have recently prompted the Navy to review access policies (K. O'Connor pers. comm. 2006). During the winter/spring of 2005 and 2006 all access for civilian personnel was withheld for one to two months. Currently, the Navy is considering adopting a new set of policies to address access to SHOBA. It is anticipated that access to the Impact Areas will be granted only when an explosive ordinance device escort can be present (K. O'Connor pers. comm. 2006). Restricted access to certain portions of SHOBA could impair the ability of biologists to detect and combat new invasive species prior to their becoming established and possibly a threat to this species.

- II.D. Synthesis** – The status of *Castilleja grisea* has improved since its listing as endangered in 1977. Although exact population numbers were unknown at that time, more recent surveys have documented that both the number of known locations and individuals have increased since the removal of non-native herbivores in 1992 (Junak and Wilken 1998; Junak 2006). Another measure that may help the recovery of *Castilleja grisea* is the 2002 adoption of the San Clemente Island INRMP by the Department of the Navy. The INRMP helps promote the conservation of *Castilleja grisea* by identifying a number of goals and objectives that are directed towards the protection and restoration of its habitats.

The documented increase in the number of *Castilleja grisea* occurrences and individuals and the complete removal of non-native mammalian herbivores from San Clemente Island have improved the status of the species, and we no longer consider it in danger of extinction (i.e., meeting the definition of endangered). However, 40 percent of the known occurrences of *Castilleja grisea* occur in the SHOBA, putting them at risk from

fire. In addition, erosion resulting from past grazing activities continues as does the threat from non-native invasive species. Because of these remaining threats, we find that the species meets the definition of threatened (likely to become endangered in the foreseeable future throughout all or a significant portion of its range), and therefore, recommend that it be reclassified. As the U.S. Navy continues to implement its INRMP, we expect that threats to the species will continue to decline.

III. RESULTS

III.A. Recommended Classification: Downlist to Threatened

III.B. New Recovery Priority Number: 14

The trend for *Castilleja grisea* appears to be the documented increase in both the number of occurrences and individuals, suggesting that threats have diminished for the species from a moderate to a lower level. This also suggests that the recovery potential for this species remains high. Therefore, the recovery priority is recommended to be revised from 8 to 14.

III.C. If a reclassification is recommended, indicate the Listing and Reclassification Priority Number (FWS only): This species should be given a reclassification priority of “4,” which indicates an unpetitioned action with a moderate management impact.

IV. RECOMMENDATIONS FOR FUTURE ACTIONS – Because the California Channel Islands Species Recovery Plan (U. S. Fish and Wildlife Service 1984) does not include criteria for the reclassification and/or delisting of *Castilleja grisea*, a primary recommendation is to update the recovery plan to include such criteria. However, a number of actions can proceed in the interim that will promote recovery. These actions include the following:

1. Study the range (frequency and intensity) of fire conditions that *Castilleja grisea* can withstand. Determine whether there is a fire interval at which *Castilleja grisea* best survives and reproduces.
2. Conduct field studies to determine which species are pollinating *Castilleja grisea*. Protection of pollinator habitat, dispersal corridors, and other nectar sources may be necessary for the continued recovery of this species.
3. Identify which populations of *Castilleja grisea* are subjected to erosion from storm water run-off. Implement erosion control measures and other Best Management Practices in these areas.
4. Conduct greenhouse studies to determine the importance of host species on *Castilleja grisea* seedling recruitment and survival.

5. Establish a non-native annual grass removal program in *Castilleja grisea* habitats such that percent cover of these species decreases by at least 10 percent (a goal identified in the INRMP).

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Personal Communications:

The following people were contacted for information relevant to the status of *Castilleja grisea*. These people provided a range of expertise based on their involvement with specific survey efforts, scientific studies and/or management of San Clemente Island biological resources.

Junak, Steve. Santa Barbara Botanic Garden, Santa Barbara, California. April 11, 2006 telephone conversation with William Miller of the Carlsbad Fish and Wildlife Service Office.

Kellogg, Elizabeth. Tierra Data Systems, Escondido, California. July 5, 2006 telephone conversation with Christine Beck of the Carlsbad Fish and Wildlife Service Office.

O'Connor, Kim, Botanist, U. S. Department of the Navy, Southwest Division, San Diego, California. Multiple communications with William Miller of the Carlsbad Fish and Wildlife Service Office as follows: March 27, 2006 telephone conversation; April 10, 2006 telephone conversation; May 8, 2006 telephone conversation. July 7, 2006

telephone conversation with Christine Beck of the Carlsbad Fish and Wildlife Service Office.

U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Castilleja grisea*

Current Classification is Endangered
Recommendation resulting from the 5-Year Review

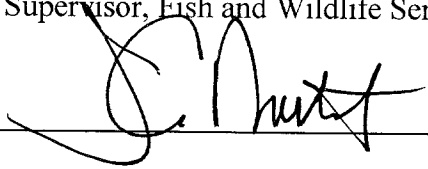
- Downlist to Threatened**
- Uplist to Endangered**
- Delist**
- No change is needed**

Appropriate Listing/Reclassification Priority Number, if applicable: 4

Review Conducted By: Christine Beck

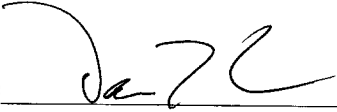
FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve  Date July 31, 2007

REGIONAL OFFICE APPROVAL:

^{Acting}
Lead Regional Director, Fish and Wildlife Service

Approve  Date 8/24/07