Sibara filifolia
(Santa Cruz Island Rockcress)

Five-Year Review:
Summary and Evaluation

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

FIVE-YEAR REVIEW

Species reviewed: *Sibara filifolia* (Santa Cruz Island rockcress)

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I. GENERAL INFORMATION

I.A. Methodology used to complete the review: This review was compiled by William B. Miller 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: Jim Bartel, Karen Goebel and William Miller, 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 five-year review for *S. filifolia* and asked for information from the public regarding the species' status (70 FR 39327). A second notice announcing the five-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 this species was described as "Stable," indicating that there had been no change to the species' numbers or threats since the last reporting period.

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 has been made.

I.C.4. Listing history

Original Listing

FR notice: 62 FR 42692

Date listed: The final rule was published on August 8, 1997, and became effective September 8, 1997.

Entity listed: Species. *Sibara filifolia* (E. Greene) E. Greene

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, *S. filifolia* was assigned a recovery priority of "2," meaning that this species has a high degree of threat but also a high potential for recovery.

I.C.8. Recovery Plan or Outline: To date, a recovery plan has not been prepared that is specific to the recovery of *S. filifolia*.

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 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. No recovery plan exists for this species.

II.C. Updated Information and Current Species Status

II.C.1. Biology and Habitat

II.C.1.a. Abundance, population trends (e.g. increasing, decreasing, stable), demographic features (e.g., age structure, sex ratio, family size, birth rate, age at mortality, mortality rate, etc.), or demographic trends: *Sibara filifolia* (Santa Cruz Island rockcress) is a slender annual herb in the mustard family (Brassicaceae) that flowers in April (Munz 1974). It is 13 to 38 cm (5 to 15 in.) tall. The flowers are bisexual and are borne in small terminal unbranched flower stalks. They are pink to purplish with spoon-shaped petals 3 to 6 mm. (⅛ to ¼ in.) in length. The leaves are 2.5 to 5 cm. (1 to 2 in.) long with a prominent midvein and narrow linear lobes arising along their length. The fruit is a slender pod (silique), 1.5 to 3 cm. (0.6 to 1 in.) long that contains many (*e.g.*, 20-30) wingless seeds (Junak and Wilken 1998, M. Wall pers. comm. 2006). Based on greenhouse observations it appears that, reproductively, *S.*

filifolia is capable of self-pollination and is self-compatible or, possibly, apomictic (capable of asexual reproduction) (M. Wall pers. comm. 2006, K. Helenurm pers. comm. 2006). Under natural conditions plants typically produce 2-10 fruits (K. Helenurm pers. comm. 2006). *Sibara filifolia* is the only species in its genus that occurs on the Channel Islands.

Historically known from Santa Cruz and Santa Catalina Islands, *S. filifolia* was thought to be extinct in the 1980's. Described as common by early collectors (Greene 1887, Trask 1901, S. Junak pers. comm. 2006), it appears to have been wide ranging based on historic records from the above two Channel Islands and recent records from San Clemente Island. At the time of listing in 1997, it was only known from San Clemente Island where fewer than 30 plants were found in one location during the 1996 season (62 FR 42692, Junak and Wilken 1998). Since that time, *S. filifolia* has been rediscovered on Santa Catalina Island and seven additional occurrences have been documented on San Clemente Island. It has yet to be re-observed during various, mostly untargeted, plant surveys on Santa Cruz Island, where the last record of the species is from 1936 (Helenurm 2003, 62 FR 42692, K. Chess pers. comm. 2006).

Contemporary surveys have recorded occurrences with a few to several hundred individual plants each (2 to 500 plants per occurrence) (Beauchamp 1987, D. Knapp pers. comm. 2006, Junak and Wilken 1998, Junak 2006). Monitoring reveals that, as is typical of annual plant species, populations fluctuate in response to seasonal rainfall, and during some years plants may not be evident (D. Knapp pers. comm. 2006, S. Junak pers. comm. 2006, K. Helenurm pers. comm. 2006). Some of the occurrences are comprised of scattered individuals and are not reliably observed on an annual basis (K. Helenurm pers. comm. 2006).

Of the eight documented occurrences on San Clemente Island, typically only three to five are observable on a regular basis (K. Helenurm pers. comm. 2006). One of those occurrences was visited in 1996 when 29 individuals were observed, and in 1997 when 208 individuals were observed. Four additional occurrences were documented in 1997. Those occurrences supported 500, 25, 12, and 11 plants, respectively, for a total of around 760 plants found in 1997 (Junak and Wilken 1998). Three additional occurrences ranging in number from 4 to 52 individuals were found in 2003 (Junak 2006). All of the San Clemente Island occurrences are found at the southern end of the Island within the boundaries of the Shore Bombardment Area (SHOBA), an area where the Navy conducts ship to shore bombing exercises (U. S. Department of the Navy 2001).

On Santa Catalina Island, the entirety of Wild Boar Gully (112 acres) was fenced in 1999 to protect the few remaining individuals of federally endangered Catalina mahogany (*Cercocarpus traskiae*) from non-native

mammalian herbivores (*i.e.* bison, deer, goats, pigs). Either due to erection of the exclosure or as a result of more intensive searching for rare plants within this area, *S. filifolia* was found in 2001 at two closely spaced locations within Wild Boar Gully (D. Knapp pers. comm. 2001., D. Knapp in litt. 2001). Monitoring of those occurrences has documented annual population fluctuations with the combined numbers of individuals for the two occurrences varying from a low of zero individuals in 2004 to a high of 253 plants in 2003 (D. Knapp pers. comm. 2005).

II.C.1.b. Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.): Genetic variation of three *S. filifolia* populations found on three adjoining ridges on San Clemente Island has been studied using two methods, allozyme analysis and Random Amplified Polymorphic DNA (RAPD) analysis (Helenurm 2003, Helenurm 1999). The allozyme study detected only two polymorphic loci out of 29 that were studied, indicating there is low genetic variation at both the species and population levels (Helenurm 2003). All of the polymorphism was detected within a single population indicating that most of the genetic variation is found within rather than among populations (Helenurm 2003). Populations that are as little as 150 meters apart from one another were also found to be genetically distinct, suggesting there is little gene flow among them (Helenurm 2003). Thus, this study concluded that the low level of genetic variation, differentiation of populations, and low level of gene flow could allow genetic drift to act as a potent force to further reduce genetic variation in the species (Helenurm 2003).

The RAPD study provided an independent method for corroborating the results of the allozyme analysis (Helenurm 1999). Using 11 RAPD primers, a total of 69 loci were detected of which 64 were polymorphic (92.8%). Thus, the RAPD study revealed more genetic variation than was detectable using allozymes. It also detected genetic variation within all of the populations studied, whereas the allozyme study only found one population that contained genetic variation. However, the RAPD analysis fully corroborated the conclusion of the allozyme study, that a high level of genetic differentiation exists among closely adjacent populations, and gene flow is extremely limited in the species. Interestingly, the large proportion of unique genotypes in each of the populations suggests the species reproduces primarily through outcrossing (Helenurm 1999). Still, extremely limited gene flow suggests that genetic variation can only be protected through the protection of all populations (Helenurm 1999). Loss of genetic variation could impair the ability of this species to adapt to a changing environment (Helenurm 1999).

II.C.1.c. Taxonomic classification or changes in nomenclature: No taxonomic classifications or changes in nomenclature have been published since the listing in 1997.

II.C.1.d. Spatial distribution, trends in spatial distribution (e.g. increasingly fragmented, increased numbers of corridors, etc.), or historic range (e.g. corrections to the historical range, change in distribution of the species' within its historic range, etc.): The only reliable recorded location for *S. filifolia* on Santa Catalina prior to its rediscovery was from a 1973 herbarium collection that indicates it was collected on a dry rocky slope with an eastern exposure at a 335-meter (1100-foot) elevation within Cape Canyon (S. Junak pers. comm. 2006). The newly discovered plants on Catalina were located some distance from that location within Wild Boar Gully. Two occurrences were found in Wild Boar Gully about 400 meters (¼ mile) from each other (D. Knapp pers. comm. 2001). Based on genetic studies on San Clemente Island, the two closely spaced occurrences on Catalina may be far enough apart to be genetically distinct (Helenurm 2003).

On San Clemente Island, *S. filifolia* is now known from several saddles on adjoining open ridgetops and on nearby flats towards the southern tip of the Island above Pyramid Head (Junak and Wilken 1998; Junak 2006). In total, eight occurrences of *S. filifolia* have been documented during targeted rare plant surveys conducted over the last 10 years. All of the these occurrences are found within around 195 hectares (¾ square mile) (S. Junak pers. comm. 2006.) but are genetically differentiated (Helenurm 2003), suggesting their mutual conservation is important to retention of genetic diversity.

During the course of this review, a possible herbarium record of *S. filifolia* from San Clemente Island was discovered (Benedict 1971). The location of this collection is recorded as Peak 1942, directly south of White Rock and near triangulation point "Alta." Although this collection resembles *Sibara*, its identity is difficult to verify because the herbarium specimen is dry and fragmentary (S. Junak pers. comm. 2006.). The area around Peak 1942 has been visited during survey efforts, but *S. filifolia* was not observed (S. Junak pers. comm. 2006). Presently, the habitat in this area does not resemble other extant locations for the species but may have once resembled the shadier conditions described for the type locality (S. Junak pers. comm. 2006).

II.C.1.e. Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):
Characterized as occurring in shady places on the "northward slope" at its type locality (Greene 1887), subsequent collectors have found *S. filifolia* in open areas along dry rocky ridgelines, in saddles or on nearby flats with

thin soils and little surrounding vegetation. Despite the lack of surrounding vegetation, the rockcress is often described as cryptic and difficult to detect because of its diminutive stature, short life and tendency to blend in with the surrounding substrate as it ages and dries (J. Dunn pers. comm. 2006, S. Junak pers. comm. 2006).

Historical and extant records suggest that *S. filifolia* can tolerate soils derived from a variety of parent materials including rocks of volcanic and metamorphic origin (S. Junak pers. comm. 2006). On Santa Catalina Island it is found in black sage (*Salvia mellifera*) dominated coastal sage scrub and is associated with foothill needlegrass (*Nassella lepida*), prickly-pear cactus (*Opuntia littoralis*), morning glory (*Calystegia macrostegia*), and dwarf flax (*Hesperolinon micranthum*) (D. Knapp in litt.2001). On San Clemente Island it is found on volcanic rock scree in association with cholla (*O. prolifera*), spike-moss (*Selaginella bigelovii*) and San Clemente Island birds-foot trefoil (*Lotus argophyllus* var. *adsurgens*) (Beauchamp 1987, Elvin in litt. 1996).

Although no quantitative estimate exists of the amount of such habitat on each of the Channel Islands, potentially appropriate habitat is extensive and far exceeds the known distribution of the species on each of the islands where it persists. Given the cryptic habit of the species and the extensiveness of these conditions, *S. filifolia* may still exist on Santa Cruz Island and other populations may have gone undetected on Catalina and San Clemente Islands.

Defoliation from overgrazing by non-native mammalian herbivores has resulted in severe habitat destruction and alteration that likely curtailed the range of this species. Even following removal of most of the mammalian herbivores from the islands their legacy remains in the form of persistent and severe erosion. In the flat rocky areas and saddles where *S. filifolia* is known on San Clemente Island, erosion does not presently appear to be a problem (S. Junak pers. comm. 2006), but it may be a factor within suitable habitat elsewhere on the islands.

Contemporaneous with and likely aided by feral grazing animals, a large number of invasive alien species have naturalized on the islands and become a dominant component of many habitats. Possibly the greatest structural change to alter *Sibara* habitat has been the major invasion of the islands by non-native annual grasses. Presently, these species are not abundant within the known occurrences of *Sibara,* but they are capable of withstanding a large range of environmental conditions, and new invasions by previously undocumented grasses continue to be discovered (*e.g., Schismus arabicus*, *Brachypodium distachyon* on San Clemente Island)(S. Junak pers. comm. 2006, J. Dunn pers. comm. 2006).

II.C.1.f. Other: Greenhouse grown plants of *S. filifolia* are strikingly more robust than individuals observed in the wild (K. Helenurm pers. comm. 2006). At its type locality *S. filifolia* was described as occurring in shady places on the "northward slope" (Greene 1887). All other verified records and extant occurrences are from dry, open, rocky areas with thin soils and sparse vegetation. This suggests that although *S. filifolia* may have once been more broadly distributed among a range of habitats, it now persists in marginal conditions where it can escape competition from non-native exotic plants that have naturalized on the Channel Islands.

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

III.C.2.a. Present or threatened destruction, modification or curtailment of its habitat or range:

Grazing

The final rule for the listing of *Sibara filifolia* (62 FR 42692) details how defoliation from overgrazing by non-native mammalian herbivores introduced to the Channel Islands resulted in severe habitat destruction and alteration that likely curtailed the range of this species. Although its diminutive stature suggests that *S. filifolia* may not be a primary target of mammalian herbivores, overgrazing can lead to the direct loss of plants through herbivory and trampling. Grazing animals also alter habitat by creating trail networks with bare, compacted soil. Defoliation from overgrazing on the Channel Islands has caused increased erosion resulting in the loss of topsoil, loss of soil organic matter, and reduction of soil nutrient cycling and water holding capacity (Kellogg and Kellogg 1994, 62 FR 42697). Such losses may involve direct losses to the soil seed bank as well as the degradation or loss of suitable habitat. Finally, disturbances to the soil profile promote the invasion of non-native plants that act as competitors to native plant taxa. A large number of plant taxa have been introduced to the Channel Islands since the time of European contact, and several annual grasses, in particular, have potential to invade *S. filifolia* habitat (see below). Introduced grazing animals often act as vectors for the dispersal of non-native seed (Sweitzer *et al.* 2003).

While introduced large stature mammalian herbivores had already been removed from San Clemente Island at the time of listing, continuing efforts have been made to manage and remove the remaining introduced mammalian herbivores from Santa Cruz and Santa Catalina. The decline of the flora on Santa Cruz Island has largely been attributed to overgrazing by sheep (*Ovis aries*), which historically ranged in number from 20,000 to 50,000 or more (Brumbaugh 1980, Schuyler 1987). Efforts to eradicate sheep from Santa Cruz Island were done in stages, and sheep were restricted to the eastern end of the Island at the time of listing. Sheep were

completely removed from the island around 2004 (S. Junak pers. comm. 2006.). The only remaining large mammalian species of concern on Santa Cruz Island is the feral pig (*Sus scrofa*). A feral pig removal program was initiated by The Nature Conservancy in April 2005 and is estimated to be about 70 percent complete (L. Vermeer pers. comm. 2006). To date, pigs have been entirely removed from three of five fenced management units with an estimated 1,200 pigs remaining on the island (L. Vermeer pers. comm. 2006). Complete removal of pigs from the island is targeted for February to March 2007 (L. Vermeer pers. comm. 2006).

The flora of Santa Catalina Island has historically been altered by a number of introduced herbivores including sheep, black buck antelope (*Antelope cervicapra*), goat (*Capra hircus*), pigs, bison (*Bison bison*), and mule deer (*Odocoileus hemionus*). Sheep ranching was terminated in the late 1950's, but the latter five species remained on the island at the time of listing. A goat and pig management program was under way at the time of listing. Goat were completely removed from the island around 2001 (D. Knapp pers. comm. 2006). Pig removal efforts have been effectively completed with just a handful of lone animals thought to remain on the Island (J. Knapp pers. comm. 2006). Follow up monitoring is proposed to confirm that the remaining pigs do not reproduce, and they are eventually extirpated (J. Knapp pers. comm.).

Presently black buck antelope, bison, or deer are not proposed for removal from Santa Catalina Island. Black buck antelope are not perceived as a problem on Catalina as fewer than a dozen animals are found in a single area, and their numbers do not seem to be increasing (D. Knapp pers. comm. 2006). Since their introduction in 1924, bison have acquired an important cultural and economic significance to island residents (Sweitzer *et al.* 2003). Therefore, the strategy of the principle landowner, the Catalina Island Conservancy, is to manage the size of the herd and their rangeland boundaries. Bison numbers are currently maintained around 150 animals, and they range through the two center quadrants of the island (excluding Wild Boar Gully, which is fenced) (D. Knapp pers. comm. 2006). This management prescription is based on recommendations from a study of the health and ecological effects of bison on Catalina and represents a moderate intensity of grazing within these quadrants (Sweitzer *et al.* 2003). Bison foraging, trampling, wallowing and dispersal of non-native seed will continue to alter ecological processes and the structure of plant communities in this portion of the island (Sweitzer *et al.* 2003). Cape Canyon, the location recorded for a historical collection of *S. filifolia,* falls within the area used by bison.

Mule deer are managed as a game species by the California Department of Fish and Game, and it has been suggested that new legislation would be required to entirely remove them from Santa Catalina Island (D. Knapp

pers. comm. 2006). Local and guided deer hunts are offered during the last 4 months of the year (D. Knapp pers. comm. 2006). Though no reliable estimate is available of the size of the deer herd, it may be increasing in response to management of bison and removal of goats and pigs (D. Knapp pers. comm. 2006). With the exception of Wild Boar Gully and a few experimental exclusion plots in burned areas, the exclusion fencing that has been used for feral animal removals on the island is ineffective at restricting deer movements, and deer can be found throughout the island (D. Knapp pers. comm. 2006). Fencing surrounding Wild Boar Gully is 2.7 meters (9 feet) tall and is generally effective at excluding deer from the *S. filifolia* occurrences, though deer have gained access to this area on occasion (D. Knapp pers. comm. 2006). The Catalina Island Conservancy has commissioned a study to determine the size and ecological effects of the deer herd. No management of deer other than the annual issuance of hunting permits is proposed until completion of that study (D. Knapp pers. comm. 2006).

San Clemente Island has a history of sheep ranching along with the introduction of goats and pigs. Sheep were removed from San Clemente in the 1930s, and the Navy completed removal of all feral goats and pigs from the island in the early 1990s (62 FR 42692). Since their removal, the vegetation on San Clemente has rebounded, and the health of populations of many rare plants has improved (S. Junak pers. comm. 2006). However, *S. filifolia* has not exhibited a dramatic increase in its range, possibly due to the small number of plants remaining at the time of animal removals.

In summary, the direct impact of grazing on *S. filifolia* has likely been much reduced through the removal of feral goats and pigs from Santa Catalina Island, and the complete removal of feral sheep and substantial removal of feral pigs from Santa Cruz Island. However, the effect that mammalian herbivores have had (such as destruction of habitat and introduction of non-natives) probably still affects this species, particularly due to the retention of bison and mule deer on Catalina Island.

Invasive Alien Plants

One of the chief threats to *S. filifolia* discussed in the listing rule is the spread of invasive alien (non-native) plants into its habitat. Alien species may compete with *S. filifolia* for space or other resources such as light, water, and nutrients. Alien invasives can also alter ecological processes such as nutrient cycling (Zink et. al. 1995) or the prevalence of fire (Brooks 1999) that otherwise could affect the persistence of this species.

Presently alien species are not abundant on the thin rocky soils where extant occurrences of *S. filifolia* are found, but they are dominant in areas that were likely part of its historic range (*e.g.* Peak 1942 on San Clemente

Island). Invasion of the Channel Islands by several species of annual non-native grasses is of particular concern due to the ability of these species to invade thin rocky soils and because, once established, they are unlikely to be eradicated. Vegetation trend monitoring along a long-term transect in *S. filifolia* habitat on San Clemente Island documented an increase in cover of slender wild oats (*Avena barbata*) from 5 percent in 1992 to 29 percent in 1994 (Tierra Data Systems, 2006). Thus, despite active alien invasive control programs implemented by the Navy on San Clemente, the Catalina Island Conservancy on Catalina, and the National Park Service and Nature Conservancy on Santa Cruz, it may not be practical or feasible to significantly reduce this threat.

Among the annual grasses of particular concern are Mediterranean grass (*Schismus arabicus)*, foxtail chess (*Bromus madritensis* ssp. *rubens*), wild oats (*Avena* spp.), veldt grass (*Erharta calycina*), and purple false brome (*Brachypodium distachyon*). The recent discovery of Mediterranean grass on the southern end of San Clemente Island along with the existing distribution of wild oats and foxtail chess have been highlighted as particularly important threats on that island (S. Junak pers. comm. 2006, L. Kellogg pers. comm. 2006, and K. O'Connor pers. comm. 2006). Purple false brome has been identified as an important threat to the rockcress on the other Channel Islands (S. Junak pers. comm. 2006).

Fire

Another threat to *S. filifolia*, discussed in the listing rule, is the threat of fire to small populations with an unknown tolerance to fire (62 FR 42692). Likely exacerbating this threat, but not explicitly addressed in the final rule, is the invasion of annual grasses and other alien species into *S. filifolia* habitat due to the increased fuel load they provide for fire. Invasion and proliferation of various brome grasses and Mediterranean grass in the Mojave Desert has been implicated as a major factor responsible for reduced fire intervals and increased fire intensity in this formerly sparsely vegetated biome (Brooks 1999, USGS Website http://www.werc.usgs.gov/invasivespecies/mojavegrassfire.html). Grasses exploit many different microhabitats and create a continuous and persistent fuel bed by filling in what was once plant free space with living plants and thatch (Brooks 1999). Because annual grasses vary in density with rainfall they have potential to significantly alter the fuel condition in wet years. Grasses also provide a "flashy" fuel that is easily ignitable due to the short time needed for fuel moisture to drop to low levels, even during a diurnal cycle.

Fire may not have previously been an important evolutionary force for this species, so a change in fire regime may have adverse effects to *S. filiflora*. While it is anticipated that some proportion of *S. filifolia* populations

could persist as dormant seed in the soil following a fire, the small, thin coated seeds of this species do not appear to be well adapted to withstand fire. Recent, small scale germination trials at the Rancho Santa Ana Botanic Garden obtained about 33 percent germination success for untreated seeds, 26 percent germination success for seeds exposed to cool smoke treatment and zero percent success for seeds exposed to heat and smoke treatment (C. Ames pers. comm.. 2006). In the absence of insulation by soil, investigators found that the thin coated seeds were killed by five minutes of exposure to hot smoke in a chamber that reached about 200 degrees Fahrenheit (M. Wall pers. comm.. 2006). Further suggesting the species may be poorly adapted to fire, a fire in 1995 is reported to have impacted a known occurrence of *S. filifolia,* with subsequent surveys in 1996 unable to detect plants at this location (FWS 1997, M. Elvin pers. comm. 1996). Certainly, any loss of plants from fire prior to setting seed would be a threat to the small populations of this species. A change to an increased fire regime associated with the invasion of non-native grasses would likely exacerbate this threat.

Land Use

The threat of fire is not severe on Santa Cruz and Santa Catalina Islands where conservation organizations manage each of the islands for the benefit of natural resources and human access is regulated; however, there is an elevated risk of recurrent fire on San Clemente Island. San Clemente 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, Navy Sea, Air and Land (SEALS), and it supports training by the U.S. Marine Corps, the U.S. Air Force and others. 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. The Navy has adopted an Integrated Natural Resource Management Plan (INRMP) to help integrate its mission with resource protection on the island. The entire distribution of *S. filifolia* occurs at the southern end of the island in an intensively used area known as the Shore Bombardment Area (SHOBA).

SHOBA encompasses approximately the southern one-third of San Clemente Island and supports a variety of training operations involving 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 involves 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 ordinance 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 (FWS 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. However, because of the risk of explosion from unexploded ordinance, 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. Therefore, the most appropriate method of attack is often to back-burn and hold the wildland fire along a road, fuel break or other fuel treated area (U.S. Department of the Navy 2001).

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 *S. filifolia*. 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 (FWS 1997, FWS 2002). These factors help to minimize, but do not eliminate the threat of fire and fire suppression activities on *S. filifolia*, which is mostly distributed uphill and downwind from the target areas.

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 *S. filifolia*.by increasing the logistical complexity of fire hazard reduction and strategic response.

Another potential threat to *S. filifolia* is human movement through its habitat. Although human access is regulated on each of the Channel Islands, due to the extremely small size of the populations, there is some

risk to this species from human trampling. Ironically, due to its cryptic appearance, this threat arises partly from biologists that may be surveying or managing sensitive resources on the islands (E. Kellogg pers. comm. 2006). On Santa Catalina Island, such workers may pose the primary threat, as the area where the plant occurs is fenced and public access is not allowed. On San Clemente, the threat of trampling arises from biologists as well as any military training activities that could involve troop movements through the area where the plant is distributed. Although we presently are not aware of specific training activities that involve troop movements in the vicinity of *S. filifolia*, any human movement through the area presents a threat because the plant is distributed on ridgetops and flat areas where humans are drawn to avoid surrounding steep terrain (E. Kellogg pers. comm. 2006).

On San Clemente Island, road expansion or trail development to accommodate military training activities may threaten the rockcress. Two of the occurrences of *S. filifolia* are located in proximity to where the major north-south road on the Island terminates. Although the Navy has not identified a specific project, there is concern that an extension of the road or alignment of trails to connect to the road could significantly impact these occurrences (S. Junak pers. comm. 2006, E. Kellogg pers. comm. 2006). Any such development likely would involve section 7 consultation with the Navy.

Access to SHOBA

Because SHOBA on San Clemente Island is used for ship to shore bombardment as well as other munitions training exercises, access to this area is often restricted for non-military personnel. These restrictions can influence both the timing and locations where access is granted.

Historically, biologists doing surveys and other individuals doing invasive species control have been granted access to SHOBA during times that do not conflict with military exercises. Because sensitive resources are known to occur within the impact areas, biologists have also generally been granted access to the impact areas. However, because of the frequency of training, access can be restricted for several weeks at a time or more, and there may only be brief intervals when biological work can be done (K. O'Connor pers. comm. 2006). This access limitation and the lead time needed for scheduling can undermine the effectiveness of surveys and invasive species control efforts by limiting the ability to time these activities during optimal times in the life cycle (*e.g.* spraying herbicide prior to an invasive plant setting seed).

Safety concerns relative to the presence of unexploded ordinance within SHOBA have recently prompted the Navy to re-assess access policies (K.

O'Connor pers. comm. 2006). During the winter and spring of 2006, all access for non-military personnel was withheld for a 1- to 2-month period, and the Navy is now considering adopting a new set of policies to address access (K. O'Connor pers. comm. 2006). These policies are anticipated to restrict access to the impact areas to times when an explosive ordinance device escort can be present, but could eliminate all access to the Impact Areas by biologists and restoration personnel (K. O'Connor pers. comm. 2006). Restricted access to certain portions of the range could impair the ability of biologists to detect and combat new invasive species prior to their becoming established and presenting a significant threat to *S. filifolia*. As discussed above, invasive species are one of the primary threats to *S. filifolia* due to their potential to directly compete with individual plants for light and space and/or their ability to indirectly increase the frequency and intensity of fire within *S. filifolia* habitat.

II.C.2.b. Overutilization for commercial, recreational, scientific, or educational purposes: The final rule to list *S. filifolia* notes that due to the extreme rarity of the species and the focus of many evolutionary biologists on the biology of islands, any unauthorized collection or even unintentional use could result in the extirpation of the species from Santa Catalina Island (62 FR 42692). Because public access is restricted by the Navy on San Clemente Island, overutilization was not considered an appreciable threat at this location.

Since that time, voucher herbarium specimens and seed have been collected from populations on each of the islands for genetic research and conservation banking purposes (D. Knapp pers. comm. 2005, M. Wall pers. comm. 2006, and Helenurm 2003). Although these collections were authorized and were made for legitimate scientific purposes, they affirm a scientific interest in the species, and there likely remains some small risk of overutilization on both islands. The availability of banked seed helps to diminish this limited threat.

II.C.2.c. Disease or predation: The final rule stated that because severe browsing can kill plants directly and prevent successful reproduction by surviving individuals the remaining feral herbivores on Santa Cruz and Santa Catalina Islands threatened the possible reappearance of *S. filifolia* on those islands (62 FR 42692). As described above, significant progress has been made at removing almost all of the large stature feral mammalian herbivores from both islands, with just mule deer and bison likely to remain on Santa Catalina Island into the foreseeable future.

However, *S. filifolia* was recently rediscovered on Santa Catalina Island in association with a fence that was erected to exclude deer and bison. Elsewhere on this island, a study of post-fire vegetation recovery has documented dramatic differences in the response of the plant community

to fire within the bounds of mule deer and bison exclusion plots. Five years following fire, exclusion plots supported far greater recruitment and cover of native shrubs relative to burned areas that were not protected from these herbivores (D. Knapp pers. comm. 2006.). The occurrence of *S. filifolia* within an area where mule deer and bison are excluded, and the apparent profound effect that these species have on the structure of plant communities suggests that, while progress has been achieved at removing feral herbivores from the islands, retention of bison and mule deer on Catalina may present a continued threat to this species.

Additionally, despite a close familiarity with San Clemente Island occurrences and the use of Global Positioning System devices to track them, two biologists that have tried to follow the phenology of *S. filifolia* populations on San Clemente during the flowering season have been unable to relocate populations that they visited just a short while earlier (K. Helenurm pers. comm. 2006, J. Dunn pers. comm. 2006). Given their familiarity with the populations and the terrain, this has led the biologists to speculate that something may be eating plants in the absence of large mammalian herbivores (K. Helenurm pers. comm. 2006, J. Dunn pers. comm. 2006).

Although unrecognized at the time of listing, several introduced and possibly native avian species on the Channel Islands have potential to prey upon *S. filifolia*. These include but are not limited to California quail (*Callipepla californica*) and wild turkey (*Meleagris gallopavo*) on Santa Cruz Island, wild turkey on Santa Catalina Island, and California quail, Gambles quail (*Callipepla gambelii*) and chukar (*Alectoris chukar*) on San Clemente Island. Due to their proliferation following introduction to San Clemente Island, the foraging habits of chukar, in particular, may be of consequence to the survival of *S. filifolia* (J. Dunn pers. comm. 2006).

All of these species are ground foragers with an opportunistic diet that incorporates vegetation including forb seeds and leaves. Analyses of crop contents of chukar in Nevada found that plant food makes up the bulk of its diet, with seeds of tansy mustard (*Descurainia pinnata*), another species in the mustard family, comprising an appreciable component of its diet in Nevada (Christensen 1996). Because tansy mustard and the listed rockcress have a similar stature, *S. filifolia* could be an analogous food item for chukar on San Clemente Island.

II.C.2.d. Inadequacy of existing regulatory mechanisms: At the time of listing, regulatory mechanisms that were thought to have some potential to protect *S. filifolia* included: (1) the California Environmental Quality Act (CEQA); (2) the National Environmental Policy Act (NEPA); and (3) the Federal Endangered Species Act ("Act") in those cases where *S. filifolia* occurs in habitat occupied by other listed species. The final rule

(62 FR 42692) provides a discussion of the level of protection that was anticipated from those regulatory mechanisms and that analysis appears to remain valid. However, since that time, *S. filifolia* was discovered on Santa Catalina Island in close proximity to the Catalina Island mountain-mahogany (*Cercocarpus traskiae*), a State and federally listed plant species. Additionally, in 2002, pursuant to the Sikes Act Improvement Act of 1997, the Navy adopted an INRMP for San Clemente Island. These factors could provide some additional protection to *S. filifolia.*

The discovery of the Santa Cruz Island rockcress in proximity to the Catalina Island mountain-mahogany on Catalina Island may afford some additional protection. The California Fish and Game Commission listed the mountain-mahogany as endangered under the Native Plant Protection Act (Division 2, Chapter 10, Section 1900 *et seq.* of the California Fish and Game (CFG) Code) and the California Endangered Species Act (Division 3, Chapter 1.5, Section 2050 *et seq.*). After the California Department of Fish and Game notifies a landowner that a State-listed plant grows on his or her property, the CFG Code requires the landowner to notify the agency "...at least 10 days in advance of changing the land use to allow salvage of such plant" (Chapter 10, Section 1913). Any such notification for the mountain-mahogany would likely mean the rockcress will suffer similar impacts and could provide an opportunity for plant salvage provided the landowner provides his/her consent.

The Catalina Island mountain-mahogany was federally listed as endangered concurrent with the listing of the rockcress (62 FR 42692). The Act requires all Federal action 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 species (section 7(a)(2)). Because *C. traskiae* is on privately held land on Catalina, where there is little Federal involvement, there does not appear to be a high potential that these provisions will be invoked, except for Federal grant opportunities that would likely be of benefit to this species (*e.g.* Partners for Fish and Wildlife Conservation Grants).

Although the newly discovered adjacency of the Santa Cruz Island rockcress to a state and federally endangered plant species could confer a slight degree of additional regulatory protection, we do not anticipate future project proposals that would adversely affect either of these species on Catalina because the landowner, the Catalina Island Conservancy, has dedicated its land for conservation purposes. As discussed above, Catalina Island Conservancy erected feral mammal exclusion fencing around *C. traskiae* that appears to be associated with the rediscovery of *S. filifolia* and is a likely benefit to this species. We anticipate that Catalina Island Conservancy management of the area where both species occur will continue to benefit *S. filifolia.*

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..." The San Clemente Island INRMP describes the area around Pyramid Cove, where the rockcress is located, as having "...high military value for ship to shore bombardment and other activities" (p. 4-14, U. S. Department of the Navy 2001). Therefore, the INRMP includes as an objective protecting military access to the Pyramid Cove firing ranges in a manner consistent with protecting habitat conditions that support *S. filifolia*.

Specific INRMP objectives targeted towards habitat protection include: control of invasive alien grasses using appropriate wildland fire management protocols; reduction of aliens, mostly red brome, from the 1992-93 baseline condition of 40 percent by maintaining the pace of shrub recovery; controlling escape of fire from Impact Area 1; protecting rare species while allowing light fire; evaluating the fire tolerance of *S. filifolia* seed; and, comparing rockcress habitat on San Clemente with that on Santa Catalina Island to gain insight into habitat preferences for the species and to help define a desired future condition for its habitat. To date, concerted efforts have been made to control escape of fire from the Impact Areas, but other objectives have not been implemented such as reduction of red brome from 1992-1993 conditions, or studying the tolerance of *S. filifolia* to fire (K. O'Connor pers. comm. 2006).

The INRMP also includes a set of Fire Management Guiding Principles that reference a Fire Management Plan that has yet to be proposed or adopted (E. Kellogg pers. comm. 2006). The guiding principles emphasize the allocation of fire protection resources for human life and firefighter safety first, with high value, vulnerable facilities, structures, habitats and natural and cultural resources ranked second. The guiding principles also call for the use of pre-suppression management to reduce the risk of ignitions and adverse ecological effects of wildland fire. When pre-suppression management strategies are needed to protect natural resource assets, highest priority is given to those assets that fall under regulatory compliance (*e.g.* listed species).

In conclusion, although the INRMP is technically not a regulatory mechanism because its implementation is subject to funding availability, it is an important guiding document that helps to integrate the military's mission with natural resource protection on San Clemente Island. An important objective of the INRMP is to protect military access to SHOBA firing ranges that present a threat to the survival of the Santa Cruz Island rockcress. However, the INRMP also targets a number of objectives towards protection of rockcress habitat and includes a set of fire

management guiding principles that help to reduce the threat of fire ignitions escaping into its habitat.

II.C.2.e. Other natural or manmade factors affecting its continued existence: Because the Santa Cruz Island rockcress is an insular endemic species known from only 10 small, narrowly distributed occurrences, the species is vulnerable to extirpation from systematic pressures, such as habitat loss (*e.g.* due to erosion) and a number of stochastic factors such as demographic stochasticity, environmental stochasticity, genetic stochasticity, and natural catastrophes (Shaffer 1981).

Demographic stochasticity arises from variability in probabilities (rates) of survival or reproduction among individuals within a population (Lande 1988). Assuming these rates vary independently among individuals, sampling variance in vital rates can play a large role in the extirpation of finite populations, such as are found for *S. filifolia*.

Environmental stochasticity arises from temporal variation in habitat parameters or populations of competitors, predators, parasites and disease (Shaffer 1981). These factors commonly affect vital rates independent of population size and can affect all individuals similarly (Lande 1988). Because most populations undergo fluctuations due to weather or abundances of interacting species, changes to vital rates from these factors can result in extinction rates greater than would be predicted by sampling variance in vital rates alone (Lande 1988).

Genetic stochasticity results from changes in gene frequencies due to founder effects, random fixation (*e.g.* genetic drift) or inbreeding (Shaffer 1981). Because not much is known about the mating system for *S. filifolia,* it is unknown whether inbreeding of populations has or could lead to inbreeding depression (*i.e.* loss of reproductive fitness or vigor). However, low levels of gene flow detected among occurrences suggest that genetic drift may further reduce the already low level of genetic variation detected within rockcress populations (Helenurm 2003). Loss of genetic variation could impair the ability of this species to adapt to a changing environment (Helenurm 1999).

Finally, given the extremely restricted distribution of this species, any natural catastrophe such as a fire, landslide, or prolonged drought on either Island could lead to the extirpation of the species from that island. On San Clemente Island all of the known occurrences are within 1,200 meters (¾ of a mile) of one another suggesting that all populations experience similar patterns of rainfall and could be affected by a single fire. The two Santa Catalina Island occurrences are also closely spaced and likely to be similarly affected by a catastrophe. However, the presence of *S. filifolia*

on two geographically separate islands improves the prospects for continued survival of the species in the event of a natural catastrophe.

Another factor that helps to diminish the risk of extinction of *S. filifolia* from these factors is the conservation banking of seeds that has been achieved at the Rancho Santa Ana Botanic Garden since the listing (M. Wall pers. comm. 2006). While seed banking, in itself, does nothing to ameliorate the systematic or stochastic threats facing natural populations of *S. filifolia*, it does provide source material to re-establish populations in the wild should they become extirpated.

II.D. Synthesis

At the time of listing, there was only one known population of Santa Cruz Island rockcress on San Clemente Island. Since that time, seven additional occurrences have been found on San Clemente Island and two small occurrences have been found within Wild Boar Gully on Santa Catalina Island. Removal of pigs and goats, and erection of fencing to exclude bison and mule deer from Wild Boar Gully have also helped the species on Catalina Island. Despite these improvements to its status, the distribution of *S. filifolia* remains sufficiently restricted and the size of populations small enough that it remains vulnerable to environmental catastrophe and stochastic factors alone. As discussed above, it also continues to face a number of threats. Chief among these is the apparent low tolerance of the species to fire, as evidenced by the poor survivorship of seeds following heat and smoke treatment, and its restricted distribution on San Clemente Island entirely within the shore bombardment area; an area where there is a high risk of fire ignitions from military training exercises. Another principal threat remains from the invasion of San Clemente and Santa Catalina by exotic plant species, particularly invasive grasses, which may act synergistically with high fire frequencies to competitively displace *S. filifolia*. When considered in combination with other threats such as the potential exploitation of rockcress populations by unknown animals, and the retention of bison and mule deer on Catalina Island, it is apparent that the species remains in danger of extinction throughout all or a significant portion of its range. Therefore, we recommend that the status of Santa Cruz Island rockcress remain unchanged as endangered.

III. RESULTS

III.A. Recommended Classification: No change is needed.

III.B. New Recovery Priority Number: No change to the recovery priority is proposed at this time. *Sibara filifolia* continues to face a high degree of threat but also continues to have a high recovery potential. Recovery Priority No. 2 remains appropriate for the species.

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

- Because no recovery plan for *S. filifolia* exists, a primary recommendation is to prepare such a plan. However, a number of actions can proceed in the interim that will promote recovery. These actions include the following:

(1) Because Mediterranean grass is thought to be restricted to a few locations at the southern end of San Clemente Island, take prompt action to eradicate this alien plant from the island.

(2) Work with the military to adopt a set of access policies for the shore bombardment area on San Clemente Island to facilitate effective management and monitoring of rockcress. These policies should include adoption of early warning mechanisms for the detection and eradication of new invasive species as well as allow for greater flexibility in the timing of surveys and invasive species control measures.

(3) Use information from genetic research and existing or new seed collections to propagate and establish additional populations of Santa Cruz Island rockcress on San Clemente and Santa Catalina Islands. Because there remains potential to rediscover rockcress on Santa Cruz Island, reintroduction efforts should await the results of directed surveys for the species within appropriate habitat on that island.

(4) Study the distribution and feeding habits of chukar on San Clemente Island to help determine whether it poses a threat to rockcress populations.

(5) Study the reproductive ecology of the Santa Cruz Island rockcress on San Clemente and Catalina Islands to determine the processes that may be responsible for the low rate of gene flow apparent on San Clemente.

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U. S. FISH AND WILDLIFE SERVICE
FIVE-YEAR REVIEW of *Sibara filifolia*

Current Classification __Endangered_____

Recommendation resulting from the 5-Year Review

____ **Downlist to Threatened**
____ **Uplist to Endangered**
____ **Delist**
_X__ **No change is needed**

Appropriate Listing/Reclassification Priority Number, if applicable _NA_

Review Conducted By __William B. Miller_____

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve _____ Date 8/16/06
Scott A. Sobiech, Acting Field Supervisor

REGIONAL OFFICE APPROVAL:

Lead Regional Director, Fish and Wildlife Service

Approve_____ Date_____