

Delphinium variegatum ssp. *kinkiense*
(San Clemente Island Larkspur)

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

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

March 2008

5-YEAR REVIEW

Species reviewed: San Clemente Island Larkspur (*Delphinium variegatum* ssp. *kinkiense*)

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5-YEAR REVIEW

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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 and considered office files, available literature, new survey information, and interviews of individuals involved with surveying, research, and management of this subspecies.

I.B. Reviewers

Lead Region: Diane Elam and Jenness McBride, California-Nevada Operations Office, 916-414-6464

Lead Field Office: Karen Goebel and William B. Miller, Carlsbad Fish and Wildlife Office, 760-431-9440 ext. 206

Cooperating Field Office(s): Not applicable.

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 (Service) announced initiation of the 5-year review for *Delphinium variegatum* var. *kinkiense* and asked for information from the public regarding the species' status (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. 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: *Delphinium kinkiense* Munz (species; =subspecies San Clemente Island larkspur, *Delphinium variegatum* ssp. *kinkiense*)

Classification: Endangered.

I.C.3. Associated rulemakings: There are no associated rulemakings.

I.C.4. Review History: No status reviews have been completed since the time of listing.

I.C.5. Species' Recovery Priority Number at start of review: In the 2007 Recovery Data Call for the Carlsbad Fish and Wildlife Office, *Delphinium variegatum* ssp. *kinkiense* was assigned a recovery priority of "9," based on a 1-18 ranking system with "1" as the highest recovery priority and "18" as the lowest. This ranking indicates that the subspecies faces a moderate degree of threat but also has a high potential for recovery.

I.C.6. 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 (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 a 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 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 goals and objectives towards attaining recovery, one of the objectives of the plan (No. 4, pp. 111-112) is to develop delisting criteria for reclassifying or delisting the species (*e.g.* the size of populations and/or amount of suitable habitat needed).

II.B.2. Adequacy of recovery criteria.

II.B.2.a. Do the recovery criteria reflect the best available and most up-to-date information on the biology of the species and its habitat?

No. As discussed above, although there is a Recovery Plan, it does not contain criteria for reclassifying or delisting the species.

II.B.2.b. Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and is there no new information to consider regarding existing or new threats)?

No. As discussed above, although there is a Recovery Plan, it does not contain criteria for reclassifying or delisting the species.

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

II.C. Updated Information and Current Species Status

II.C.1. Biology and Habitat

II.C.1.a. Taxonomic classification or changes in nomenclature:

Delphinium kinkiense Munz was the name used for this taxon (a group that is sufficiently distinct to be considered a separate unit) when it was listed in 1977 (42 FR 40682). The type specimen for the species was collected by R.M. Beauchamp on San Clemente Island in 1967 (Munz 1969). Subsequent to the listing, Warnock (1990a) reduced *D. kinkiense* to the rank of subspecies as *Delphinium variegatum* Torrey & A. Gray subsp. [*i.e.* ssp.] *kinkiense* (Munz) Warnock in recognition of its alliance with another island endemic taxon, *D. variegatum* ssp. *thornei*. This nomenclatural change was further supported in his taxonomic review of California *Delphinium* (Warnock 1990b) and has been followed in the current floristic treatment (Jepson Manual) for California (Warnock 1993). *Delphinium variegatum* ssp. *kinkiense* will be followed in the upcoming revision of the Jepson Manual (Jason Koontz, pers. comm. 2008) and by the Service. The taxonomic realignment, published since listing, changes the listed entity's rank to subspecies but does not alter the definition, distribution, or range of the taxon from what it was at the time of listing. Thus, based on the most recent systematic (Warnock 1990a, 1990b) and floristic treatments for the genus (Warnock 1993, 1997), the listed taxon is now regarded as one of three subspecies of *Delphinium variegatum*.

As it is now considered, *Delphinium variegatum* ssp. *kinkiense* is an herbaceous perennial in the buttercup family (Ranunculaceae) that flowers from March to April (California Native Plant Society 2001). It grows 14 to 85 centimeters (cm) (6 to 33 inches (in)) in height, but generally is less than 50 cm (20 in) tall (Warnock 1993). The flowers are light blue to white in color and are bilaterally symmetrical with five petal-like sepals and four smaller petals. The uppermost sepal is a straight or downcurved spur that is characteristic for the genus. Flowers are borne along branched flower stalks typically bearing less than 12 flowers (Warnock 1993; Junak and Wilken 1998). Leaves are generally found along the lower one third of the stem and have few to many overlapping lobes that radiate from hairy petioles. The fruit is a follicle (dry, pod-like structure with a single suture), with up to three follicles possible per flower (Junak and Wilken

1998). Each follicle bears many winged seeds that are likely wind dispersed when the fruit passively splits open (Junak and Wilken 1998).

San Clemente Island larkspur is one of three subspecies of *Delphinium variegatum* (Warnock 1990a, 1990b, 1993, 1997). Two of the three subspecific taxa of *D. variegatum* (*D. v. ssp. kinkiense* and *D. v. ssp. thornei*) are endemic and restricted to San Clemente Island (Warnock 1993; Dodd and Helenurm 2002). The third subspecies, *D. v. ssp. variegatum* (Royal larkspur), is found exclusively on mainland California and ranges from the coast to the foothills in central and northern California (Dodd and Helenurm 2002). *Delphinium parryi* is the only other *Delphinium* known from the island, or any of the Channel Islands.

Three floral characters, sepal color, lateral sepal length, and lower petal blade length, are used to distinguish the subspecies (Dodd and Helenurm 2000). In general, Royal larkspur differs from the two island subspecies by having darker (deep versus bright or light blue) flowers and shorter lower petal blades (Dodd and Helenurm 2000). The island subspecies are distinguished by Thorne's larkspur having bright blue (*i.e.* darker), slightly larger flowers than San Clemente Island larkspur (Dodd and Helenurm 2000; Warnock 1993). Thorne's larkspur also generally occurs in the southern portion of San Clemente Island while San Clemente Island larkspur generally is found in the northern portion of the island (Dodd and Helenurm 2000).

Dodd and Helenurm (2000) found there is broad variation within populations and substantial overlap among the subspecies for the three floral characters, with the two metric characters, lateral sepal length and lower petal blade length, providing no clear distinction between taxa. Of the floral characters, sepal color appears to be the least ambiguous for differentiating the subspecies, but it may still be problematic for the island subspecies where central populations contain both light and dark individuals as well as individuals of intermediate color (Dodd and Helenurm 2000; Dodd and Helenurm 2002). Because natural hybridization has been documented to occur regularly among other taxa in the genus, the intermediate character of central populations suggests there may be hybridization among the subspecies in these populations (Dodd and Helenurm 2002).

II.C.1.b. Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.):

Dodd and Helenurm (2002) used enzyme electrophoresis to study genetic variability among the two subspecies on San Clemente Island (*Delphinium variegatum ssp. kinkiense* and *D. v. ssp. thornei*) and one mainland subspecies (*D. v. ssp. variegatum*). Their methods involved using starch-

gel electrophoresis to examine the frequency of expression of specific cellular enzymes (primary gene products known as “allozymes”) to obtain a measure of variation in the genes coding for those enzymes at 19 loci (each locus representing the position of alleles, which are different forms of a gene on the chromosome) (Helenurm 2002). Except in instances of small population size, about 40 individuals per population were sampled from 24 island populations, and 7 populations were sampled across the range of the mainland subspecies. Based on floral color, 10 of the island populations appeared to be San Clemente Island larkspur, 11 appeared to be Thorne’s larkspur, and the 3 remaining island populations appeared to support individuals of both subspecies.

For the island subspecies, 33 alleles were detected at 19 “readable” loci that had clear and consistent staining as identified from electrophoretic separation. Seven of these loci were polymorphic (exhibited variability).

Because there was little genetic differentiation detected among populations of the two insular subspecies, and earlier work had suggested there is little morphological evidence for separating them (Dodd and Helenurm 2000), populations of the two insular subspecies were combined for reporting of standard measures of genetic variability. In comparison with other plant species, *Delphinium variegatum* appears to be fairly typical in its pattern of genetic diversity relative to its geographic range at both the population and taxon levels (Dodd and Helenurm 2002). However, relative to other endemic species in the genus *Delphinium*, which exhibit levels of genetic diversity consistent with what is usually observed for regionally distributed species, the genetic variation observed for the insular taxa of *D. variegatum* appears to be low (Dodd and Helenurm 2002).

Dodd and Helenurm (2002) did not find evidence for genetic differentiation between *Delphinium variegatum* ssp. *kinkiense* and *D. v.* ssp. *thornei*. They performed a statistical cluster analysis based on genetic similarity of populations and tested for a relationship between genetic distance and geographic distance on San Clemente Island. In general, most alleles are shared among all populations with differences among populations primarily found in allele frequencies. Of the genetic diversity found on San Clemente Island, 97 percent is found within populations and 3 percent is found among populations. The clustering of populations depicts “...a close relationship among all island populations with no obvious grouping of populations with respect to taxonomic identity (based on sepal color) or geography...” (p. 617, Dodd and Helenurm 2002).

While populations sometimes grouped statistically without respect to geographic distance, there still was an overall positive relationship between genetic and geographic distance for island populations of

Delphinium variegatum. This suggests there is a higher level of gene flow among adjacent populations (Dodd and Helenurm 2002). If estimates of historical gene flow are indicative of current patterns, then gene flow among the 24 island populations studied appears to be high enough to prevent genetic differentiation among them (Dodd and Helenurm 2002). This is consistent with the general low level of genetic differentiation that has been found among populations of other species in the genus *Delphinium* (Dodd and Helenurm 2002).

From their work on the genetics of *Delphinium variegatum* ssp. *kinkiense*, Dodd and Helenurm (2002) suggest that further taxonomic study should be performed to determine whether the insular taxa have been correctly designated as subspecies. However, as discussed in section II.C.1.a., the current floristic treatment (Jepson Manual) for California, and its upcoming revision, continue to recognize the two insular subspecies as distinct taxa. Dodd and Helenurm (2002) also state that the genetic data imply the following about conservation of the subspecies:

- The amount of genetic variation found among island populations suggests the long-term prospects for *D. v.* ssp. *kinkiense* and *D. v.* ssp. *thornei* may be favorable if populations are allowed to recover and expand further. As long as disturbances such as military activities do not reduce or further restrict populations, genetic drift (random changes in gene frequencies as a consequence of small population size) should not rapidly erode genetic diversity.
- Because of the high degree of genetic similarity among populations, the loss of any single population should not cause a significant loss of genetic variation for the San Clemente Island larkspur. However, because the high degree of similarity among populations is likely due to gene flow, an important management guideline will be to prevent the isolation of populations or groups of populations through the loss of intervening populations.
- If populations are lost due to disturbance, then conservation of the remaining populations should be prioritized according to both genetic and geographic criteria.
- The low level of genetic differentiation detected among populations suggests that successful reintroductions may be equally likely from any seed source (*i.e.* careful matching of seed source to reintroduction site may not be necessary).
- Seeds may not be needed from every population to capture genetic diversity in an *ex situ* conservation seed bank.

II.C.1.c. 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:

San Clemente Island larkspur was one of the first plant species to be listed pursuant to the Endangered Species Act. Its listing was initiated on the basis of its inclusion in a report to Congress on January 9, 1975, by the Secretary of the Smithsonian Institution (Ripley 1975). That report included a list of over 3,100 U. S. vascular plant taxa that were considered by scientists to be endangered, threatened, or possibly extinct. However, the 1976 Smithsonian report (41 FR 24523) and the 1977 proposed rule to list the larkspur (42 FR 40682) did not include specific information regarding the size, number, or trends of populations for this species.

The final listing rule for San Clemente Island larkspur (42 FR 40682) also failed to include specific information regarding the distribution and status of larkspur populations and only expanded on the information in the proposed rule by discussing which of the five factors listed in Section 4(a) of the Act applied to and led to its listing as endangered. Regarding the status of larkspur populations, the final rule merely summarized the comments of one individual who responded to the proposed rulemaking that San Clemente Island larkspur is "...uncommon in grasslands in Spring" (42 FR 40683).

The best information regarding population trends for this subspecies was compiled in association with the San Clemente Island Natural Resources Management Plan (INRMP) (U. S. Department of the Navy 2001), and during several sensitive plant survey efforts and a genetic study that have been performed since removal of feral goats and pigs from the island in the early 1990s (Junak and Wilken 1998; Junak 2006). The INRMP states that around 40 separate populations of the larkspur have been mapped since the 1960s (U. S. Department of the Navy 2001). However, it also describes a report made by Howard Ferguson in 1979, during the period of goat grazing, that stated only two isolated patches of the plant remained at that time (U. S. Department of the Navy 2001). One of those two patches was found to support just one lone individual. The Navy reportedly fenced those two occurrences to prevent their predation from feral pigs (U. S. Department of the Navy 2001; Kellogg and Kellogg 1994).

Five years later, the *California Channel Islands Species Recovery Plan* indicates that the number of known occurrences of the San Clemente Island larkspur had increased to at least seven grassland sites (Service 1984). However, there was no current information regarding the number of individuals at those occurrences (Service 1984).

During sensitive plant surveys performed in 1996 and 1997, Junak and Wilken (1998) documented 16 occurrences of San Clemente Island larkspur ranging in size from 7 to 1,450 individuals (median = 200, mean = 337). Fourteen of the sixteen occurrences were documented in 1996, totaling about 3,900 plants, and an additional two occurrences were found in 1997 where an additional 1,475 individuals brought the total number of documented plants for the two years to about 5,400. In 2003, Junak (2006) documented one additional population of San Clemente Island larkspur supporting about 200 individuals.

In a discussion of their 1996-1997 survey results, Junak and Wilken (1998) submit that they did not visit a number of historical sites for the subspecies. They therefore suggest that more San Clemente Island larkspur is likely to occur on the island than is reflected in their surveys. Appearing to support this conclusion, Dodd and Helenurm (2000, 2002), also performed fieldwork in 1996 and documented 10 occurrences of San Clemente Island larkspur (range of individuals = 16 to 2,500, median = 200, mean = 584) and three locations where they suspect there are mixed populations of San Clemente Island and Thorne's larkspur (range of individuals = 200 to 1,000, median = 350, mean = 517). Although Dodd and Helenurm (2002) suggest that Junak and Wilken's (1998) surveys detected the same populations as their own, a comparison of Figure 1 from Dodd and Helenurm (2002) with mapped locations from Junak and Wilken (1998) and Junak (2006) suggest that as few as three of the San Clemente Island populations may be held in common between the different survey efforts. Thus, while precise survey locations for Dodd and Helenurm (2000, 2002) are needed to accurately identify the unique occurrences that have been documented among the survey efforts, it appears that around 27 occurrences of San Clemente Island larkspur have been documented since feral animal removals, which includes three locations where mixed populations of the two subspecies are thought to occur. Dodd and Helenurm (2000) estimated about 3,920 individuals at their putatively unique locations containing just San Clemente Island Larkspur and an additional 1,550 individuals of potentially mixed genealogy occurred in the sympatric (occurring in the same geographic area) populations of the two subspecies.

Because survey efforts have focused on documenting new occurrences rather than re-visiting and tracking the dynamics of known populations (S. Junak pers. comm. 2006), there is little information for directly inferring population trends. The best trend information available is for one of the last two populations of *Delphinium variegatum* ssp. *kinkiense* that were thought to remain in 1979. As part of a long-term study of San Clemente Island vegetation condition and trend, a vegetation monitoring plot was overlain at a location north of Stone Station where Howard Ferguson reported a single individual occurring in 1979 (Kellogg and Kellogg 1994;

Tierra Data Inc. 2005). In 1992, though no direct population counts were made, 6-10 patches of 1-25 plants each were recorded at that location (Tierra Data Inc. 2005). “In 1995, a total of 564 plants were found, and 349 plants were present in 2000” (p. 80, Tierra Data Inc. 2005). Thus, the population north of Stone Station appears to have expanded from a single individual at the time of goat grazing to several hundred plants under fairly recent conditions. Elsewhere, the vegetation trend monitoring study has only captured San Clemente Island larkspur in one other monitoring plot where an individual plant was seen in 1994, but this plant has not been observed since (Tierra Data Inc. 2005).

In summary, although the precise survey locations of Dodd and Helenurm (2000, 2002) are needed to accurately quantify the number of known occurrences for the subspecies, it appears that since removal of feral mammalian herbivores, around 9,500 individuals have been documented from 24 locations supporting just San Clemente Island larkspur, and an additional 1,550 plants of mixed and possibly hybridizing genealogy occur in three locations where the two island subspecies are suspected to co-occur. Because survey efforts have focused on documenting new occurrences of *Delphinium variegatum* ssp. *kinkiense*, there is little information for directly inferring population trends. However, the one population that has been tracked has expanded from one plant to several hundred individuals. The discovery of 26 occurrences in 1996-1997 (Junak and Wilken 1998; Helenurm 2000) and a 27th occurrence in 2003 (Junak 2006) further suggests that San Clemente Island larkspur has made modest but appreciable gains since the removal of feral goats and pigs from the island in the early 1990s.

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.):

Although the Navy’s INRMP states that around 40 occurrences of San Clemente Island larkspur have been mapped since the 1960s, it also cites the observation of Howard Ferguson that the range of the species had become restricted from over-grazing by goats and pigs to two known patches by 1979 (U. S. Department of the Navy 2001). Therefore, the best information regarding the spatial distribution of San Clemente Island larkspur derives from recent studies (Dodd and Helenurm 2000, 2002) and surveys (Junak and Wilken 1998; Junak 2006) that have been performed since the removal of goats and pigs from the island in the early 1990s.

Based on mapped occurrences from these efforts, San Clemente Island larkspur is generally distributed on the eastern side of the northern and central parts of the island on open grassy terraces between the elevations

of 80 and 255 meters (m) (262 and 837 feet (ft)) (See Figure 1). About 26 occurrences are distributed within this portion of its range, which extends about 12 kilometers (km) (7.45 miles (mi)). There is also a single disjunct occurrence of San Clemente Island larkspur that occurs about 12.4 kms (7.7 mi) to the south, near the southern tip of the island above Pyramid Head.

Disregarding the southernmost, disjunct occurrence of San Clemente Island larkspur, populations are generally continuously scattered from north to south at varying distances along the high plateau above the eastern escarpment of the island; with the largest break among occurrences being about 3 km (1.9 mi) between the northern 17 occurrences and 9 occurrences that are focused towards the central portion of the island (see Figure 1). Among the northern occurrences, several are in proximity to one another (*e.g.* less than 400 m/0.25 mi), where pollinators and other population processes could be shared in common. Similarly, among the nine populations towards the central portion of the island several are in proximity to one another. If one uses the California Natural Diversity Database method for counting occurrences, which defines an occurrence as "...any population or group of nearby populations located more than 0.25 miles [400 meters] from any other population" (p. iii, California Department of Fish and Game, Natural Diversity Database, August 2006), then there are 11 distinct groupings or occurrences of the subspecies (see Figure 2). While this mapping standard disregards specific information about seed dispersal and pollinator movement distances, botanists occasionally use it for grouping occurrences mapped at a finer scale to obtain an indication of the number of functional populations there may be for a species. Based on this methodology, we have determined that there are less than half the number of functional populations than there are mapped occurrences of San Clemente Island larkspur.

Among the nine occurrences in the central portion of the island, three are suspected of supporting mixed populations and possible hybrids of *Delphinium variegatum* ssp. *kinkiense* and *D. v. ssp. thornei* (Dodd and Helenurm 2002). Because the latter subspecies is generally distributed towards the southern portion of San Clemente Island (Dodd and Helenurm 2000, 2002), the southernmost occurrence of *D. v. ssp. kinkiense* at Pyramid Head appears somewhat anomalous given the predominance of *D. v. ssp. thornei* toward this end of the island. However, historical records suggest *D. v. ssp. kinkiense* may also have once been found in another location towards the southern end of the island within Mosquito Canyon (U. S. Department of the Navy 2001). Whether this represents a natural portion of the subspecies' range or represents an area of possible introduction by animals or man is unknown.

Based on survey information, there do not appear to be any recent trends in the spatial distribution of the San Clemente Island larkspur subspecies since the apparent re-emergence of populations following the removal of goats from the island in 1992. While about 26 populations of the subspecies (including the three mixed populations) were identified during rare plant surveys and studies conducted in 1996 and 1997 (Junak and Wilken 1998, Dodd and Helenurm 2000), only a single new population of the subspecies was located during island-wide rare plant surveys conducted in 2003-2004 (Junak 2006). This new population was found towards the central portion of the island within the primary range delineated by 1996-1997 occurrences.

II.C.1.e. Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):

The original range and distribution of San Clemente Island larkspur is speculative because its decline began before a thorough botanical study of San Clemente Island was completed. The decline of the larkspur and the decline of all of San Clemente's endemic flora is primarily attributed to the introduction of non-native animal and plant species by Euro-Americans during the last 200 years, as summarized in our final listing rule of three other Channel Island plants in 1997 (62 FR 42692). Goats (*Capra hircus*) were present on San Clemente Island as early as 1827 (Dunkle 1950) and sheep (*Ovis aries*) were introduced around 1868 (Kellogg and Kellogg 1994). Other large-stature herbivores historically introduced to San Clemente Island include cattle (*Bos taurus*), pigs (*Sus scrofa*), and mule deer (*Odocoileus hemionus*) (62 FR 42692).

In particular, ranching of sheep and, following sheep removal, proliferation of goats led to severe over-grazing, trampling of vegetation and denudation of the island. Sheep likely numbered in the thousands at the turn of the 20th century, and records suggest that a herd of 11,000 to 12,000 sheep was maintained for about 20 years prior to their removal in 1934 (O'Malley 1994). Following sheep removal, goats proliferated without control from sheep ranchers, who had been keeping the goat population in check (Kellogg and Kellogg 1994). In the early 1970s, the goat population was estimated to be around 10,000 (Kellogg and Kellogg 1994).

With intensive grazing pressure leading to near complete consumption of grasses, sheep and goats fed on less palatable shrubs and trees, causing a tremendous loss of shrub and tree cover (Kellogg and Kellogg 1994; O'Malley 1994). Over-grazing also led to creation of bare trails, denuded areas and severe erosion. Severe erosion has likely been exacerbated by periods of drought and fire, leading to stripping of vegetation and soil, similar to that observed on the other Channel Islands (Johnson 1980).

Grazing animals also facilitated the spread of non-native plant taxa. By 1885, W. S. Lyon, the first botanist to visit the island, listed 85 plant species, 10 of which were non-native (Kellogg and Kellogg 1994). A 1992 flora compilation for San Clemente Island listed 380 species, 99 of which were non-native, 4 listed as endangered, and 2 believed to be extinct (Kellogg and Kellogg 1994).

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 from military training activities 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 (Map 3-3, p. 3-32, U. S. Department of the Navy 2001), and some areas have burned multiple times with very short intervals between fires (Map 3-4, p. 3-33, U. S. Department of the Navy 2001). The majority of these fires have been concentrated in the Shore Bombardment Area (SHOBA) covering the southern one-third of the island, where military training exercises employ live ordnance and incendiary devices, but fires are also occasionally ignited by activities north of SHOBA.

In an effort to preserve the endemic flora and fauna, all feral goats and pigs were removed from the island by the Navy in 1992 (Kellogg and Kellogg 1994). The Navy also initiated a long-term vegetation monitoring program in 1992 to track the status of sensitive plant species and to document vegetation changes on the island following animal removals (Tierra Data Inc. 2005).

Since removal of feral animals, San Clemente Island larkspur has increased in distribution and is primarily found on the east side of the northern and central portions of the island where it is described as occurring "...on cool slopes of the high plateau grasslands" (unpaginated, Appendix I, Kellogg and Kellogg 1994). More specifically, it occurs on gently sloping open grassy terraces with northwest, north and east exposures between elevations of 80 and 255 m (262 and 837 ft) (Junak and Wilken 1998). San Clemente Island larkspur is associated with both non-native annual grasses (*Avena* spp., *Bromus* spp.) and native perennial grasses (*Nasella pulchra*) and is described as occurring in a range of soils including clays, loams, and rocky soils (Kellogg and Kellogg 1994; Junak and Wilken 1998).

Although it is unclear how much of the island was formerly grassland, about one-third of the island or 4,856 hectares (ha) (12,000 acres (ac)) was reported to be covered by grasslands in 1994 (Kellogg and Kellogg 1994).

Within this area, the high-elevation plateau supports grasslands dominated by native perennial grasses, with annual forbs in the interspaces (Kellogg and Kellogg 1994). The mid- and low-elevation grasslands tend to be less diverse and are dominated by introduced annual grasses (Kellogg and Kellogg 1994).

Within the known range of San Clemente Island larkspur, some occupied slopes show signs of rapid overland runoff of water during rains with severe piping and gulying nearby presenting a threat from erosion (Kellogg and Kellogg 1994). Competition within grasslands dominated by non-native annual grasses and other introduced plant species may also be a factor limiting the distribution of the subspecies (U. S. Department of the Navy 2001). A number of non-native plant taxa have been found in association with San Clemente Island larkspur, including: *Atriplex semibaccata*, *Avena fatua*, *Bromus diandrus*, *Bromus madritensis rubens*, *Erodium moschatum*, *Hypochaeris glabra*, *Silene gallica*, *Sonchus oleraceus*, and *Spigularia villosa* (Junak and Wilken 1998). Many of these species, particularly including the non-native annual grasses such as *Avena* and *Bromus*, are likely to be permanently established within island grasslands (Kellogg and Kellogg 1994). A number of fires have been recorded since 1979 within the range of San Clemente Island larkspur.

A 1994 geographic information system (GIS) exercise to model potential habitat for San Clemente Island larkspur used grassland vegetation and estimated solar insolation as primary variables for identifying potentially suitable habitat for the subspecies (Kellogg and Kellogg 1994). That effort suggests that suitable habitat for San Clemente Island larkspur could exist within much of the mid- and high-elevation eastern grasslands on the island (Map 7, p. 71, Kellogg and Kellogg 1994). This closely reflects what was previously identified as essential habitat for the larkspur in the *Channel Islands Species Recovery Plan* (Figure 10, p. 56, Service 1984). Excepting the single disjunct southern occurrence of San Clemente Island larkspur towards Pyramid Head, this habitat model appreciably extends the range of the subspecies southwards from its current known distribution, and is representative of the combined range for *Delphinium variegatum* ssp. *kinkiense* and *D. v.* ssp. *thornei*.

Long-term vegetation monitoring from 1992-2003 suggests that, although the composition of vegetation on grassland plots has fluctuated, it is difficult to discern significant long-term trends in this community since feral animal removals because the amplitude of cover values has largely been influenced by precipitation patterns (*e.g.* drought) (Tierra Data Inc. 2005). Baseline cover values collected in 1992-1993 followed a year of heavy rainfall, while recent data collected in 2003 followed a relatively normal rainy season that came after drought conditions in 2002. The change in cover values from 1992-1993 to 2003, based on 12 vegetation

plots, was a reduction from 46 to 44.8 percent for annual forbs, 58 to 37.7 percent for annual grasses, and 21 to 18.8 percent for perennial grasses (Tierra Data Inc. 2005). Thus, although both native and non-native plant cover were significantly lower in 2003 than during 1992-1993, this is probably due to the plots achieving only partial recovery following the drought conditions of 2002 compared to the heavy rainfall and total vegetation cover of 80 to 100 percent at the time of baseline sampling (Tierra Data Inc. 2005).

Less vulnerable to annual fluctuations, the percent cover of cactuses, subshrubs and shrubs is typically low on most grassland plots and has remained essentially unchanged during this period (Tierra Data Inc. 2005). One exception has been the trend for coyote brush (*Baccharis pilularis*), which has shown a stable or increasing number of plants within the clay grassland plots where it is located (Tierra Data Inc. 2005). In one plot, this species exhibited a dramatic increase from 18 shrubs in 1992 to 149 shrubs in 2000. Several other plots have shown notable but less dramatic increases of between 10 to 18 individuals (Tierra Data Inc. 2005). Continued increases in the cover of coyote brush in clay grasslands could eventually lead to the conversion of these areas into shrublands (Tierra Data Inc. 2005). Shrubs also appear to be emerging into grassland areas near the brows of canyons where they are more densely concentrated (U. S. Department of the Navy 2001). Such increases in shrubland cover could eventually reduce available grassland habitat for San Clemente Island larkspur.

In summary, San Clemente Island larkspur is found within mid- to high-elevation grasslands on the east side of the northern and central portions of the island where it occurs in clay, loam, and rocky soils. This vegetation community is recovering following a long period of over-grazing by introduced mammalian herbivores but continues to exhibit the legacy of over-grazing in the form of accelerated erosion and the dominance in many areas of naturalized invasive alien species, particularly non-native annual grasses. Although currently not widespread, the colonization of clay grasslands by coyote brush may alter habitat suitability over the long term in some areas.

II.C.1.f. Research on reproductive ecology:

Some species of *Delphinium* are self-incompatible (Waser and Price 1983 from Junak and Wilken 1998), but the mating system for *D. variegatum* ssp. *kinkiense* is poorly understood. Dodd and Helenurm (2002) conclude from their study of genetic variability among populations of *D. variegatum* that the two insular subspecies (*D. v.* ssp. *kinkiense* and *D. v.* ssp. *thornei*) are largely outcrossing with a pattern of near random mating. Outcrossing rates for the mainland subspecies (*D. v.* ssp. *variegatum*)

indicate that it sustains higher levels of inbreeding (Dodd and Helenurm 2002). Pollinators that have been observed on San Clemente Island larkspur include a large black and white solitary bee (Evans and Bohn 1987) and a bumblebee (*Bombus*) (Junak and Wilken 1998).

Junak and Wilken (1998) estimated the number of flowers and fruits per inflorescence in three populations of San Clemente Island larkspur and studied the viability and germination of seeds collected from a single population. They found on average from 64.5 to 78.5 percent of flowers produce fruits, and there was a significantly greater number of flowers than fruits. This is consistent with self-incompatibility and/or a requirement for insect-mediated pollination (Junak and Wilken 1998). They also found that that seed germination (43 percent) was not significantly less than seed viability (53 percent) when analyzed around 20 weeks following collection. They concluded that recruitment does not appear to be limited by fruit production.

During efforts to collect seed for the purposes of plant propagation, Evans and Bohn (1987) found seed predation to be heavy in one population of San Clemente Island larkspur. They found holes chewed through the bottom portion of seed capsules, but they were unable to ascertain the identity of the seed eater. During their survey efforts, Junak and Wilken (1998) have not seen evidence of seed predation.

In contrast with the results of Junak and Wilken (1998), Evans and Bohn (1987) were unsuccessful getting freshly collected seeds to germinate. This may be due to a requirement for seeds to go through a period of dormancy prior to germination (Evans and Bohn 1987; Junak and Wilken 1998).

The Rancho Santa Ana Botanic Garden currently has a collection of about 7,780 seeds of San Clemente Island larkspur in their conservation seed bank (Michael Wall pers. comm. 2006). However, based on their experience with this subspecies they believe their ability to propagate San Clemente Island larkspur "...is poor at this point" (Michael Wall pers. comm. 2006).

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:

As discussed above, San Clemente Island has a history of over-grazing by domestic and feral herbivores that led to severe erosion and dramatic alteration of the island's vegetation communities. The effects of over-

grazing are likely associated with the restriction of the range of San Clemente Island larkspur to two known populations around the time of listing. The 1977 final rule thus highlighted three principle threats to the species associated with domestic and feral herbivores on the island: habitat alteration and destruction, facilitation of invasion by non-native plant species, and direct predation on plants by grazing animals (42 FR 40682)

By 1992, the Navy removed the last of the feral goats and pigs in an effort to preserve the island's endemic vegetation (Kellogg and Kellogg 1994). Since that time, many of the island's sensitive plant species have been recovering, including an expansion in the distribution of San Clemente Island larkspur. This suggests that feral goats and pigs were a chief threat to the distribution of this subspecies. However, competition with non-native invasive plant species and erosion likely remain ongoing threats. Other remaining threats that were not addressed in the final rule include alteration of San Clemente Island habitats by military activities, increased fire frequencies associated with military training activities, and possibly constrained access within the one location in the southern portion of its range, which could interfere with the ability to effectively manage for this subspecies.

Land Use

San Clemente is owned by the U. S. Department of the Navy. With its associated offshore range complex, it is the primary maritime training area for the Navy Pacific Fleet and 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. To help integrate its mission with resource protection, the Navy has adopted an Integrated Natural Resource Management Plan (INRMP) to help govern land uses on the island (U. S. Department of the Navy 2001, discussed below).

The distribution of San Clemente Island larkspur includes a scattering of occurrences that span a distance of about 12 km (7.45 mi) on the east side of the northern and central portions of the island within mid- to high-elevation grasslands, and a single occurrence near the southern tip of the island above Pyramid Head (U. S. Department of the Navy 2001).

The northern and central occurrences of San Clemente Island larkspur span several management units identified by the INRMP, with most of the known occurrences falling within the Terrace Canyon, Mount Thirst, Lemon Tank, and Nots Pier management units (U. S. Department of the Navy 2001). Each of these management units are overlain by an infantry

operations area that coincides with the plateau grasslands and follows and adjoins the major Ridge Road that runs from north to south down the length of the island. Parallel with and adjoining Ridge Road from the airport at the northern end of the island and extending south to the SHOBA is an Assault Vehicle Maneuver Road (AVMR) that is both existing and under development along the southern 8 miles of its alignment (Service 2004). The infantry operations area, Ridge Road, and AVMR support movement of troops and equipment during training exercises that can involve small SEAL teams to large scale integrated exercises involving battalion sized deployments (*e.g.* 1,500 soldiers). Also overlaying portions of these management units are Special Warfare Training Areas (SWAT). SWATs are generally large areas (40.5-1,781 ha/100-4,400 ac) that have been specifically designated for scheduling of SEAL training activities, Marine expeditionary units, and other special operations. SEAL training includes practicing onshore and nearshore activities such as clandestine landings, minimum disturbance patrolling, and clandestine extraction of troops. Included within the SWATs are various Training Area and Ranges (TARs), which are smaller areas (0.4-324 ha/1-800 ac.) that include targets or objectives where troops may use intensive firepower that can include the use of demolitions, flares, tracers, pistols, rifles, and shotguns. Included within the management units are also an ordnance land use area and a Missile Impact Range. Human activities within the management units that have been identified by the INRMP with potential to impact San Clemente Island larkspur include foot traffic from various training activities and infantry battalion landings, operational camping, off-road vehicle traffic, and land demolitions within SWATs and TARs.

The southern occurrence of the larkspur falls within the intensively used area known as SHOBA (U. S. Department of the Navy 2001). SHOBA encompasses approximately the southern one-third of San Clemente Island and supports a variety of training activities including infantry operations and 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 Airforce 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 training activities in SHOBA, live and non-live munitions fire is targeted towards two delineated impact areas in the southern portion of 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. The southern occurrence above Pyramid Head lies east of these impact areas near an artillery firing point and an area identified for infantry operations. Although no fire has been recorded for this location since 1979, this population likely faces a risk from short fire return intervals (discussed below) as well as similar risks from human activities within the infantry operations areas and SWATs described above (U. S. Department of the Navy 2001).

The Navy has recently proposed a dramatic expansion in the number of annual training operations that are supported on an annual basis within the San Clemente Island Range Complex (SCIRC 2005). This will likely lead to an increase in the level of ground disturbance within San Clemente Island larkspur habitat and could lead to an increase in the area burned and frequency of fire within grasslands.

Erosion

San Clemente Island larkspur is associated with loamy grasslands where erosion from past land use and existing roads (including those currently under development, *e.g.* AVMR) continues to degrade the productive potential of soils and remove water before it can be utilized by plants (U. S. Department of the Navy 2001). Some slopes occupied by San Clemente Island larkspur appear sheetwashed with severe piping and gullyng presenting a threat to specific populations (Kellogg and Kellogg 1994; U. S. Department of the Navy 2001). Erosion occurring down drainages south of Stone Station adjoining the recently approved San Clemente Island Road Improvement Project (Service 2004) may be a particular threat to *Delphinium* occurrences in those locations (E. Kellogg pers. comm. 2006).

Non-Native Species

Although the level of competition between San Clemente Island larkspur and introduced non-native species is not known, one of the potential threats to larkspur is the spread and proliferation of invasive non-native plants in its habitat. San Clemente Island larkspur occurs in grassland areas that have become dominated by non-native annual grasses. Non-native species have potential to compete with larkspur for space or other resources such as light, water, and nutrients. Non-native invasives can also alter habitat structure, ecological processes such as nutrient cycling (Zink *et al.* 1995), and the prevalence of fire (Brooks 1999).

By 1992, 99 non-native species were documented as occurring on San Clemente Island (Kellogg and Kellogg 1994), with many of them having become naturalized to become a significant component of island habitats. New non-natives also continue to be discovered, which may represent new introductions from military personnel, vehicles and/or equipment (*e.g.*, *Schismus* sp., *Brassicae tournefortii*) (J. Dunn pers. comm. 2006; E. Kellogg pers comm. 2006; S. Junak pers. comm. 2006). The main Ridge Road and Assault Vehicle Maneuver Road cut through the plateau grasslands where San Clemente Island larkspur occurs, providing a path for the continued invasion of its habitat by non-natives (*e.g.* *Oryzopsis miliacea*) (U. S. Department of the Navy 2001).

Possibly the greatest structural change to alter habitats on San Clemente Island has been the naturalization and proliferation of non-native annual grasses that now dominate in many areas. Due to their prevalence, many of these species have likely become permanently established within larkspur habitat (Kellogg and Kellogg 1994). Alien grasses and forbs are often capable of rapidly expanding into areas that have been exposed to disturbance (D'Antonio and Vitousek 1992), such as from military training exercises and/or fire. Because the Navy's infantry operations area coincides with the plateau grasslands, even in the absence of new non-native arrivals, movement of troops, vehicles, and equipment through plateau areas likely affects the distribution and density of resident non-native species, which may lead to increased competition with San Clemente Island larkspur.

Fire

The California Channel Island Species Recovery Plan (Service 1984) states that “[F]ield observation following fire suggests that this species is adapted to fire during its dormant period” (p. 53). However, not much else is known regarding the tolerance of this species to fire, such as what the mechanism is for regrowth (*e.g.* from resprouts or seed) and what minimum fire return interval the species can tolerate.

Another *Delphinium* (*D. viridescens*) from the eastern Cascades of Washington State is reported to be adapted to fire (Center for Plant Conservation 2008). That species is associated with mesic habitats and responds to fire by resprouting from underground rhizomes. Plants in burned plots also appear to be more robust than those in unburned plots, possibly due to reduced competition for light following fire (Harrod *et al.* 2000). Because San Clemente Island larkspur is exposed to a different climate and is associated with different habitat conditions, further study is needed to determine if it shares similar adaptations to fire.

A comparison of extant occurrences of *Delphinium variegatum* ssp. *kinkiense* and *D. v. ssp. thornei* with fire history maps for the island between the years of 1979-2000 indicates there is no fire history for a number of occurrences, quite a few occurrences burned once, a number of occurrences burned twice, and several occurrences of *D. v. thornei* appear to have burned three times during that interval (U. S. Department of the Navy 2001). This appears consistent with the observation that San Clemente Island larkspur populations are tolerant of and may benefit from at least occasional fire.

If San Clemente Island larkspur responds to fire by regrowth from seeds, burns prior to seed set could impair seed recruitment and regeneration following fire (U. S. Department of the Navy 2001). If the larkspur resprouts from root structures, burns prior to the period of dormancy could impair the ability of plants to resprout following fire. High fire frequency, such as is found in particular within the southern portion of the subspecies' range in and adjacent to SHOBA, could also be a potential threat that could limit the distribution of the larkspur by overwhelming its tolerance threshold to fire. However, we currently have no information regarding the ecological response of San Clemente Island larkspur to different combinations of fire intensity and frequency.

Access to SHOBA

Because SHOBA 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.

Until recently, biologists doing surveys and other personnel 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 and the lead time needed to do range-scheduling can undermine the effectiveness of surveys and invasive species control efforts by limiting the ability to time these activities during optimal times in an organism's 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-appraise 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 one- to two-month

period, and the Navy is presently 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 during times when an explosive ordinance device escort can be present, but they 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 colonists prior to their becoming established and presenting a significant threat to this subspecies. As discussed above, invasive species are one of the threats to San Clemente Island larkspur due to their potential to directly compete with individual plants for light and space.

II.C.2.b. Overutilization for commercial, recreational, scientific, or educational purposes:

This factor was not determined applicable in the final rule (42 FR 40682). As a military installation, public access to San Clemente Island is restricted by the Navy. Known collections of this subspecies since its listing have been performed to promote its recovery through creation of an *ex situ* seed bank and collection of information on the subspecies population genetics.

II.C.2.c. Disease or predation:

At the time of listing, grazing of feral goats and rooting of feral pigs were viewed as serious threats to the continued existence of San Clemente Island larkspur (42 FR 40682). In 1992, feral goats and pigs were entirely removed from the island, thus removing these threats. This appears to have significantly improved the prospects of survival for this subspecies.

Subsequent to the listing, Evans and Bohn (1987) found seed predation to be heavy in one population of San Clemente Island larkspur. They found holes chewed through the bottom portion of seed capsules, but were unable to ascertain the identity of the seed eater. More recent surveys have not found evidence of seed predation (Junak and Wilken 1998). Thus, it is not clear whether this is a significant and consistent factor limiting recruitment within the subspecies.

Presently, there are no diseases on San Clemente Island that are known to pose a significant threat to the larkspur.

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

This factor was not determined applicable in the final rule (42 FR 40682). At that time, the primary regulatory mechanism with potential to protect

San Clemente Island larkspur was the National Environmental Policy Act (NEPA) due to the occurrence of the subspecies on federally owned land. This law continues to apply and requires Federal action 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.

Since the time of the listing, additional regulatory mechanisms have been put in place that have potential to provide some added protection to San Clemente Island larkspur. These include: (1) the listing of San Clemente Island larkspur as endangered under the Native Plant Protection Act (NPPA) and California Endangered Species Act (CESA); (2) the listing under the Federal Endangered Species Act of eight other plant and animal species on San Clemente Island; and (3) the 2002 adoption by the Navy of an Integrated Natural Resources Management Plan (INRMP) for San Clemente Island. However, none of these regulatory mechanisms achieve the same level of protection to San Clemente Island Larkspur that is provided by the Act. Protections afforded by these mechanisms are described below.

Native Plant Protection Act and California Endangered Species Act: In 1979, the California Fish and Game Commission listed *Delphinium variegatum* ssp. *kinkiense* as endangered under the NPPA (Division 2, chapter 10, section 1900 *et seq.* of the California Fish and Game Code (CFG)) and CESA (Division 3, chapter 1.5, section 2050 *et seq.* of the CFG). Both the NPPA and CESA include prohibitions forbidding the “take” of San Clemente Island larkspur (Chapter 10, Section 1908 and Chapter 1.5, Section 2080, CFG code). However, the NPPA, which is referenced as an exception to the “take” prohibitions of CESA, exempts a number of activities from regulation under the NPPA including: clearing of land for agricultural practices or fire control measures; removal of endangered or rare plants when done in association with an approved timber harvesting plan, or mining work performed pursuant to Federal or State mining laws, or by a public utility providing service to the public; and/or when a landowner proceeds with changing the use on their land in a manner that could result in “take,” provided the landowner notifies the California Department of Fish and Game at least 10 days in advance of the change. These exemptions indicate that CESA and NPPA may be inadequate to protect against the taking of larkspur associated with a range of activities, if the subspecies were not federally listed as endangered. In practice, listing under NPPA and CESA may only meaningfully protect San Clemente Island larkspur in those instances when a private project is proposed on San Clemente Island or when proposed activities fall under other State laws (*e.g.*, timber harvest or mining activities).

Federal Endangered Species Act: The Act requires all Federal agencies to insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any threatened or endangered species (section 7(a)(2)). In 1977, concurrent with the listing of San Clemente Island larkspur, six additional San Clemente Island plant and animal species were federally listed (42 FR 40682). Additionally, in 1997, two other San Clemente Island plants were listed as endangered (62 FR 42692). If San Clemente Island larkspur were removed from the Federal list of threatened and endangered species, in those cases where the larkspur occurs in habitat occupied by other listed species, some regulatory protection would be incidentally afforded to the larkspur through the obligation of the Navy to consult with the U. S. Fish and Wildlife Service regarding any anticipated adverse impacts they may have to those listed species. Through the consultation process, the Service often works with the Navy to identify measures that will avoid, minimize, and promote the conservation of the listed species. If delisted, San Clemente Island larkspur could thus benefit from the consultation process to the extent that avoidance, minimization, and conservation measures for other listed species would similarly benefit its distribution.

Integrated Natural Resource Management Plan: Pursuant to the Sikes Act Improvement Act of 1997, the Navy adopted an Integrated Natural Resource 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" (p. 1-1, U. S. Department of the Navy 2001). To achieve this, the San Clemente Island INRMP proposes an array of management strategies to address identified goals and objectives for specified management units and their natural resources.

The INRMP identifies goals and objectives for management units based on each unit's ranking for both military and natural resource value. Of 18 management units identified on the island, San Clemente Island larkspur is identified as occurring within 8 of them. Military value rankings for these management units include the "highest" ranking for one unit (Pyramid Cove), a "high" ranking for two units (Nots Pier and Seal Cove), a "medium" ranking for two units (Terrace Canyon and Mount Thirst), a "low" ranking for one unit (Lemon Tank), and a "lowest" ranking for two units (Lost Point and Eagle Canyon). Approximately, 72 percent of San Clemente Island larkspur populations fall within the Lemon Tank management unit, which has been assigned a "low" military value ranking (U. S. Department of the Navy 2001). A special management emphasis for this management unit is "...aimed at maintaining those military values to the extent possible and with greatest flexibility for maintaining natural

resource values as an integral part of day to day operations”(p. 5-49, U. S. Department of the Navy 2001).

Natural resource management objectives for the management units are stepped down from broader natural resource objectives identified for species and habitats. Of relevance to the protection of San Clemente Island larkspur, the 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. 4-39, U. S. Department of the Navy 2001). Associated with this objective are a number of proposed management strategies that include: consideration of San Clemente Island larkspur as a “management focus plant” such that it is considered independently from its associated plant community for management; conducting status surveys for this subspecies; ensuring that management focus plants have a network of suitable sites; performing pollination studies on *Delphinium variegatum* ssp. *kinkiense*; and continuing to apply genetic research and management approaches to its management.

Other INRMP strategies targeted towards loam and clay grasslands, in which *Delphinium variegatum* ssp. *kinkiense* occurs, include: control erosion, with priority given to locations where erosion may be lowering the water table and affecting listed species such as the San Clemente Island larkspur; improve the dominance of needlegrass and other native herbaceous species; reduce non-native plant cover from 1992-1993 baseline levels; manage fire intervals and patch size with a preliminary target of a 5-year minimum return interval and 300-acre patch size; allow patches of coyote brush to fluctuate naturally; and experiment with fire management to improve native plant dominance while protecting sensitive plant populations.

To date, a number of the INRMP management strategies, or aspects of them, have been implemented. The Navy has implemented rare plant surveys that have documented new occurrences of San Clemente Island larkspur. Genetic research and natural history studies have also been performed. Concerted efforts have been made to control escape of fire from military training activities. However, other objectives have not yet been achieved, such as reducing the percent cover of invasive plants from 1992-93 baseline conditions (K. O’Connor pers. comm. 2006).

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. The INRMP targets multiple objectives towards protection of San Clemente Island larkspur and its habitat, which help reduce threats to this subspecies.

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

The two island subspecies of *Delphinium variegatum* (*D. v. ssp. kinkiense* and *D. v. ssp. thornei*) are suspected to co-occur in several locations (Service 1984; Dodd and Helenurm 2000, 2002). It is not known if their co-occurrence is natural or if it results from historic or current land use practices. Plants with flowers of intermediate color in these populations suggest that genetic exchange could be occurring among the subspecies (Dodd and Helenurm 2000, 2002). Genetic exchange between the two island delphiniums could threaten the genetic integrity of the taxa.

II.D. Synthesis:

Historically restricted to two occurrences on San Clemente Island around the time of its listing, the status of San Clemente Island larkspur has improved appreciably since the removal of feral goats and pigs from the island in the early 1990s. Although precise locations for occurrences studied by Dodd and Helenurm (2000, 2002) are needed to accurately quantify the number of extant occurrences on the island, it appears that as many as 27 occurrences from 11 areas are now known (See Figures 1 and 2). Associated with these occurrences, around 9,500 individuals have been documented from 24 locations supporting just San Clemente Island larkspur, and an additional 1,550 plants of mixed and possibly hybridizing genealogy occur in three locations where San Clemente Island larkspur and Thorne's larkspur are suspected to co-occur.

Expansion of its distribution and the overall recovery of San Clemente Island vegetation since complete removal of feral goats and pigs in 1992 suggest that these animals were a principle threat limiting the distribution of this subspecies. However, a number of threats remain for San Clemente Island larkspur, including erosion, competition with non-native invasive plant species, alteration of San Clemente Island habitats by military activities, unnaturally high fire frequencies in the southern portion of its range, and constrained access to its habitat for conducting active management. Principle among these threats is the occurrence of the larkspur in the high plateau grasslands used by the military for infantry operations training, which involves ground disturbances, can cause fires, and likely facilitates erosion and invasion of its habitat by non-native plant species. Although countered to some extent by the Navy's adoption of an INRMP, the Navy's proposal to expand the amount and intensity of training within the San Clemente Island Range Complex (U. S. Department of the Navy 2005) further suggests the level of disturbance within larkspur habitat will likely increase in the future.

Despite these threats, San Clemente Island larkspur populations have emerged across a range of about 12 km (7.45 mi) on the east side of the northern and central portions of the island, with another disjunct occurrence that is found about 12.4 km (7.7 mi) to the south, near the southern tip of the island. The one population for which there is long-term monitoring information has expanded from one to several hundred individuals (Kellogg and Kellogg 1994; U. S. Department of the Navy 2001; Tierra Data Inc. 2005). Although it is conceivable that a catastrophe such as a drought or fire could still cover the entire distribution of the subspecies, it now occurs across a broad enough area and in sufficient numbers that some populations would likely survive such an event. Occurrence locations further indicate that the subspecies is capable of withstanding occasional fire. Thus, we conclude that San Clemente Island larkspur is no longer in danger of extinction throughout all or a significant portion of its range and warrants reclassification to threatened status.

As noted above, Dodd and Helenurm (2000) in a morphological study noted that “[f]urther taxonomic study using additional characters should be conducted to decide whether the island taxa have been appropriately designated as separate subspecies.” Subsequently, based on the expression of plant proteins that have an underlying genetic basis Dodd and Helenurm (2002) did not find evidence that *Delphinium variegatum* ssp. *kinkiense* and *D. v.* ssp. *thornei* are genetically distinct, and they reiterated the need for further taxonomic study to determine whether the insular taxa have been correctly designated as subspecies. However, the current floristic treatment (Jepson Manual) for California (Warnock 1993), and its upcoming revision (Jason Koontz, pers. comm. 2008), continue to recognize the two insular subspecies as distinct taxa. Should taxonomic study determine that the two island subspecies are not taxonomically distinct, our recommendation for classification likely will need reconsideration.

III. RESULTS

III.A. Recommended Classification:

- Downlist to Threatened**
- Uplist to Endangered**
- Delist** (*Indicate reasons for delisting per 50 CFR 424.11*):
 - Extinction*
 - Recovery*
 - Original data for classification in error*
- No change is needed**

III.B. New Recovery Priority Number

No change to the recovery priority number is proposed at this time. While the status of San Clemente Island larkspur has improved, it continues to face a

moderate degree of threat from military activities, erosion, non-native species, and unnatural fire frequencies. It also continues to have high recovery potential as evidenced by the increase in its distribution following removal of goats and pigs from San Clemente Island. Therefore, recovery priority No. 9 remains appropriate for the subspecies .

III.C. If a reclassification is recommended, indicate the Listing and Reclassification Priority Number:

According to the Service's 1983 priority guidelines for ranking delisting actions (48 FR 43098), downlisting of San Clemente Island larkspur has a priority ranking of 6 as an unpetitioned action with low management impact.

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

Because the *California Channel Islands Species Recovery Plan* (Service 1984) does not include criteria for delisting San Clemente Island larkspur, 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) Perform additional systematic studies to determine the evolutionary relationships of *Delphinium variegatum* ssp. *kinkiense* to the two taxa with which it co-occurs on San Clemente Island (*D. variegatum* ssp. *thornei* and *D. parryi*) and to mainland *D. variegatum*.
- (2) Develop and implement a species reintroduction program in coordination with San Clemente Island restoration actions to accelerate the recovery of this subspecies. Such a plan should use genetic and geographic information to prevent the loss of genetic integrity, if warranted, between the two island subspecies.
- (3) Control erosion within island grasslands, with priority given to locations where erosion may be threatening specific occurrences of San Clemente Island larkspur.
- (4) Perform additional ecological studies to determine what species may be eating seeds of San Clemente Island larkspur and whether seed predation is a significant threat to the recovery of this subspecies.
- (5) Work with the Navy to develop a program to monitor the status of San Clemente Island larkspur populations to better understand population dynamics and track the recovery of the subspecies. Directed sensitive plant surveys should also continue to be implemented every several years to document new occurrences and further range expansions.
- (6) Study the affect of fire on San Clemente Island larkspur and establish appropriate fire management goals for island grasslands that are sensitive to this subspecies.

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Personal Communications: The following people were contacted for information relevant to the status of *Delphinium variegatum* ssp. *kinkiense*. These people provided a range of expertise based on their involvement with specific survey efforts, scientific studies, and/or management of Channel Island biological resources:

- Dunn, Jonathan. Botanical Conservation Manager at the San Diego Zoological Society Conservation and Research for Endangered Species, Applied Conservation Division, Escondido, California. Telephone conversation with William Miller of the Carlsbad Fish and Wildlife Office on April 11, 2006.
- Junak, Steve. Santa Barbara Botanic Garden, Santa Barbara, California. Telephone conversations with William Miller of the Carlsbad Fish and Wildlife Office on April 11, 2006, June 19, 2006, and June 30, 2006.
- Kellogg, Elizabeth. Tierra Data Systems, Escondido, California. Consultant to the Department of the Navy. Telephone conversations with William B. Miller of the Carlsbad Fish and Wildlife Office on July 5, 2006.
- Koontz, Jason. Assistant Professor of Biology, Augustana College, Rock Island, Illinois. Electronic mail communication to William B. Miller of the Carlsbad Fish and Wildlife Office on March 11, 2008.
- O'Connor, Kim. Botanist, U. S. Department of the Navy, Southwest, San Diego, California. Multiple communications with William Miller of the Carlsbad Fish and Wildlife Office as follows: Telephone conversation on March 27, 2006; telephone conversation on April 10, 2006; telephone conversation on May 8, 2006.
- Showers, Mary Ann. Staff Environmental Scientist, Lead Botanist, California Department of Fish and Game, Sacramento, California. Electronic mail communication to William B. Miller of the Carlsbad Fish and Wildlife Office on August 8, 2006.
- Wall, Michael. Curator/Manager Seed Program, Rancho Santa Ana Botanic Garden, Claremont, California. Email communication with William Miller of the Carlsbad Fish and Wildlife Office on August 15, 2006.

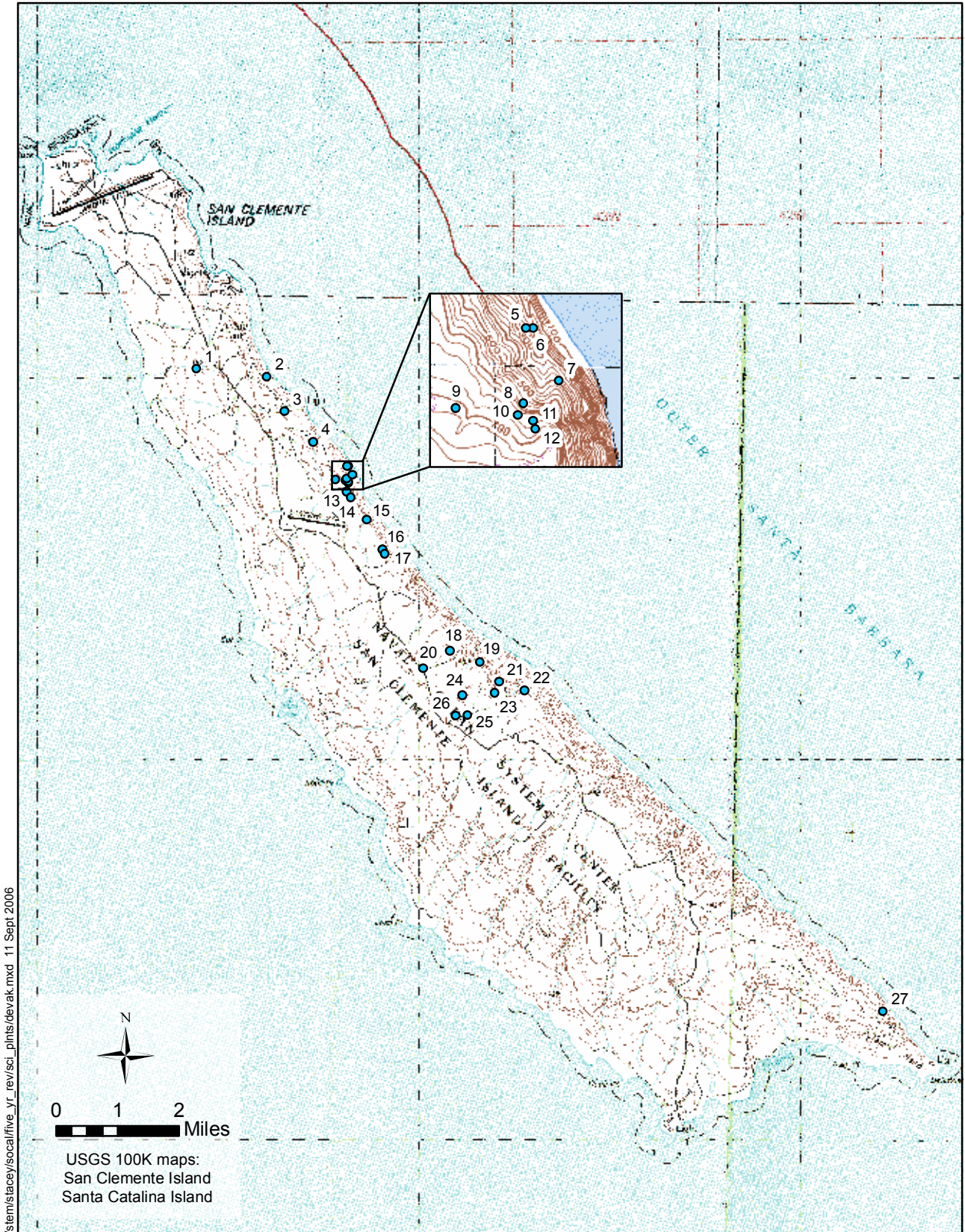


Figure 1. Locations of Records for *Delphinium variegatum* ssp. *kinkiense*

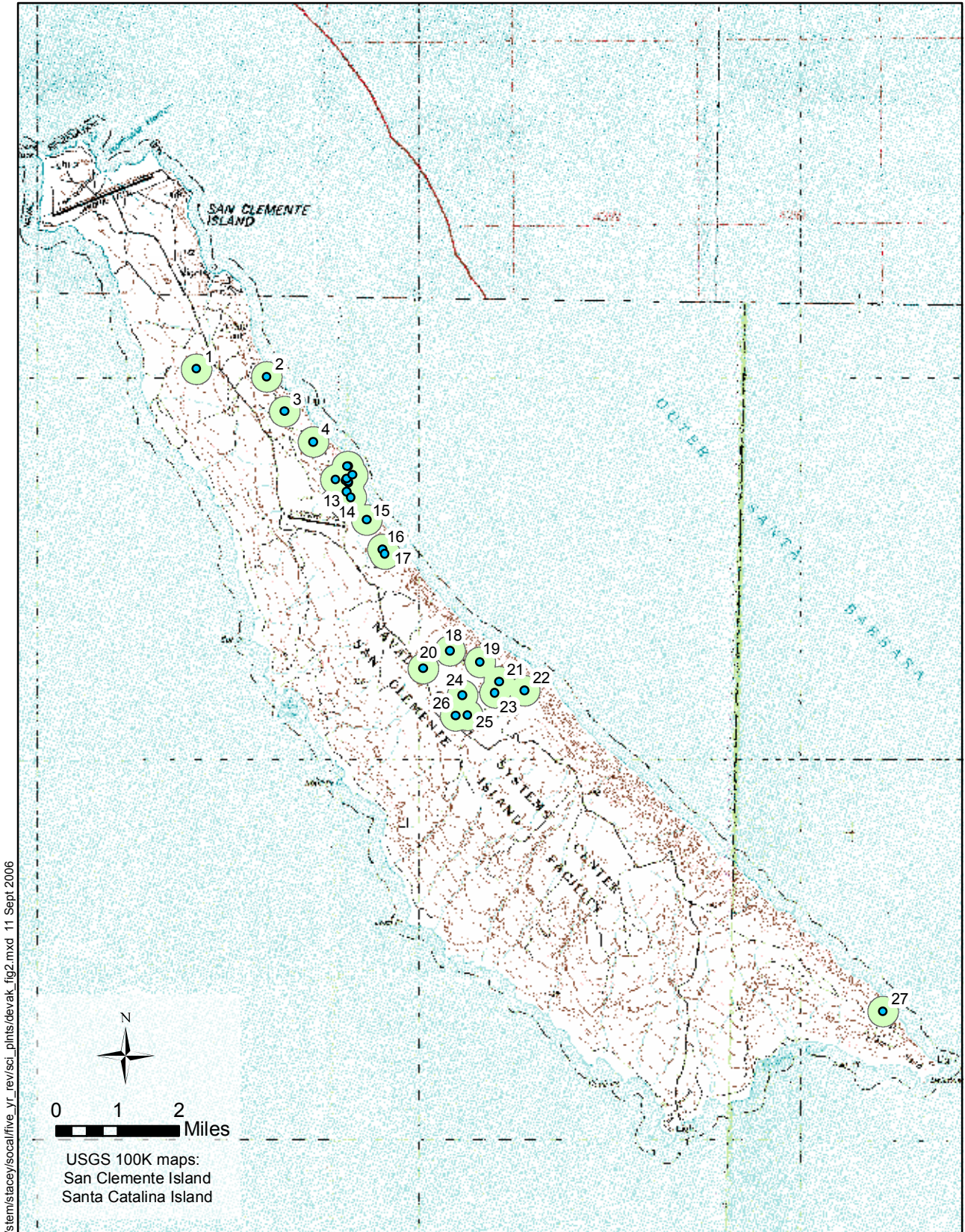


Figure 2. Grouping of *Delphinium variegatum* ssp. *kinkiense* occurrences within 400 meters (0.25 mile) of one another

U. S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Delphinium variegatum* ssp. *kinkiense*
(San Clemente Island Larkspur)

Current Classification: Endangered

Recommendation resulting from the 5-Year Review:


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

Appropriate Listing/Reclassification Priority Number, if applicable 6

Review Conducted By Carlsbad Fish and Wildlife Office

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve  Date 3-27-08

REGIONAL OFFICE APPROVAL:

Lead Regional Director, Fish and Wildlife Service

Approve  Date 3/31/08