Delphinium bakeri
(Baker's larkspur)
5-Year Review:
Summary and Evaluation

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

June 2012

5-YEAR REVIEW
Delphinium bakeri (Baker's larkspur)

I. GENERAL INFORMATION

Purpose of 5-Year Reviews:

The U.S. Fish and Wildlife Service (Service) is required by section 4(c)(2) of the Endangered Species Act (Act) to conduct a status review of each listed species at least once every 5 years. The purpose of a 5-year review is to evaluate whether or not the species' status has changed since it was listed (or since the most recent 5-year review). Based on the 5-year review, we recommend whether the species should be removed from the list of endangered and threatened species, be changed in status from endangered to threatened, or be changed in status from threatened to endangered. Our original listing of a species as endangered or threatened is based on the existence of threats attributable to one or more of the five threat factors described in section 4(a)(1) of the Act, and we must consider these same five factors in any subsequent consideration of reclassification or delisting of a species. In the 5-year review, we consider the best available scientific and commercial data on the species, and focus on new information available since the species was listed or last reviewed. If we recommend a change in listing status based on the results of the 5-year review, we must propose to do so through a separate rule-making process defined in the Act that includes public review and comment.

Species Overview:

Delphinium bakeri is a perennial herb in the buttercup family (Ranunculaceae). The plant occurs in decomposed shale in the mixed woodland plant communities of Sonoma and Marin Counties, California. The only known remaining naturally occurring population of this species is found in Marin County on a steep roadside embankment subjected to road maintenance work and stochastic events such as landslides, fire, and vehicle accidents. Its range restriction and small population size, coupled with random events, make it extremely vulnerable to extirpation. To date, the species has been introduced to three additional sites in Sonoma and Marin Counties, with varying degrees of success. Though habitat conversion and road maintenance was historically responsible for decreasing numbers, those threats have been curtailed. Recovery efforts since listing focus on education of road crews at the road-cut site and identification of appropriate outplanting sites, *ex situ* seed regeneration and propagation to increase genetic diversity, and outplanting at identified sites.

Methodology Used to Complete This Review:

This review was prepared by the Sacramento Fish and Wildlife Office (SFWO), following the Region 8 guidance issued in March 2008. We used information from surveys conducted by experts who have been monitoring various localities of this species. Monitoring reports and communications with experts were our primary sources of information used to update the species' status and threats. We received no information from the public in response to our Federal Notice initiating this 5-year review. This 5-year review contains updated information on the species' biology and threats, and an assessment of that information compared to that known

at the time of listing or since the last 5-year review. We focus on current threats to the species that are attributable to the Act's five listing factors. The review synthesizes all this information to evaluate the listing status of the species and provide an indication of its progress towards recovery. Finally, based on this synthesis and the threats identified in the five-factor analysis, we recommend a prioritized list of conservation actions to be completed or initiated within the next 5 years.

Contact Information:

Lead Regional Office: Larry Rabin, Deputy Division Chief for Listing, Recovery, and Environmental Contaminants, Pacific Southwest Region; (916) 414-6464.

Lead Field Office: Josh Hull, Recovery Division Chief, Sacramento Fish and Wildlife Office; (916) 414-6600.

Federal Register (FR) Notice Citation Announcing Initiation of This Review: A notice announcing initiation of the 5-year review of this taxon and the opening of a 60-day period to receive information from the public was published in the Federal Register on May 21, 2010 [75 FR 28636]. No responses regarding *Delphinium bakeri* were received from the public.

Listing History:

Original Listing
FR Notice: 65 FR 4156
Date of Final Listing Rule: January 26, 2000
Entity Listed: *Delphinium bakeri*, a plant species
Classification: Endangered

State Listing: *Delphinium bakeri* was listed by the State of California as an endangered species in April 2007.

Associated Rulemakings: In 2003, two units in Sonoma and Marin Counties totaling approximately 740 hectares (1,828 acres) were designated as critical habitat for *Delphinium bakeri*. Both of these areas are on private land (68 FR 12834).

Review History: No formal status review has been conducted since the species was listed in 2000.

Species' Recovery Priority Number at Start of 5-Year Review: The recovery priority number for *Delphinium bakeri* is 5 according to the Service's 2011 Recovery Data Call for the SFWO, based on a 1 to 18 ranking system where 1 is the highest-ranked recovery priority and 18 is the lowest (Endangered and Threatened Species Listing and Recovery Priority Guidelines, 48 FR 43098, September 21, 1983). This number indicates that the taxon is a species that faces a high degree of threat and has a low potential for recovery.

Recovery Plan or Outline: No recovery plan or outline for this species has been completed.

II. REVIEW ANALYSIS

Application of the 1996 Distinct Population Segment (DPS) Policy

The Endangered Species Act defines "species" as including any subspecies of fish or wildlife or plants, and any distinct population segment (DPS) of any species of vertebrate wildlife. This definition of species under the Act limits listing as distinct population segments to species of vertebrate fish or wildlife. Because the species under review is a plant, the DPS policy is not applicable, and the application of the DPS policy to the species' listing is not addressed further in this review.

Information on the Species and its Status

Species Biology and Life History

Delphinium bakeri is a perennial herb in the buttercup family (Ranunculaceae) that grows in a variety of habitats, including mixed woodlands of coast live oak (*Quercus agrifolia*), California bay laurel (*Umbellularia californica*), and California buckeye (*Aesculus californica*) in Sonoma and Marin Counties, California. It grows from a thickened, tuber-like fleshy cluster of roots. The stems are hollow, erect, and grow to 65 centimeters (26 inches) tall. The leaves are five-parted, occur primarily along the upper third of the stem, and are green at the time the plant flowers. The whitish area in the center of the leaves is a distinctive feature. The flowers are irregularly shaped. The five sepals are conspicuous, bright dark blue or purplish, with the rear sepal elongated into a spur. The inconspicuous petals occur in two pairs. The lower pair is blue-purple; the upper pair is white. Seeds are produced in several dry, many-seeded fruits, called capsules, which split open at maturity on only one side. *D. bakeri* can be differentiated from other members of the genus by leaf margins that are notched or scalloped so as to form rounded teeth, leaves that do not wither at time of flowering, and flowers that are loosely arranged (Service 2000). *D. bakeri* flowers from April into May. Pollination is by bumblebees and hummingbirds. The species is self-compatible, but requires visitation by pollinators for good seed set (Center for Plant Conservation, 2008).

Spatial Distribution

Delphinium bakeri is endemic to Marin and Sonoma counties and was never widespread. It was considered rare when it was first described in the late 1930s (Ewan 1942). Historically, *D. bakeri* has only been known from three locations, one in Sonoma County and two in Marin County (CNDDB 2008). By the time of listing, however, the type locality in the Coleman Valley west of Occidental in Sonoma County had been converted to a dairy ranch (CNDDB Occurrence 4). The second known site, Tomales, Marin County, was based on a 1923 herbarium collection (CNDDB Occurrence 3) and by the time of listing was believed to be extirpated as well. The third locality is along a steep roadside embankment alongside Marshall-Petaluma Road in the Marin County road right-of-way (CNDDB Occurrence 1) and represents the only known naturally occurring population of the species. Besides this single remaining

naturally occurring population, the species is known from three additional locations where it has been introduced.

Since March 2009, UC Berkeley Botanical Garden (Garden) staff, under contract with the U.S. Fish and Wildlife Service, has introduced *D. bakeri* to three sites within its historic range: two are on private ranches, and the third site comprises three separate plantings on Marin Municipal Water District's land near Soulajoule Reservoir, all within three miles of the last remaining occurrence in Marin County. Success of each of the reintroductions is detailed below under Abundance.

Abundance

Historical Sites:

No information exists on the abundance of *Delphinium bakeri* at two of the three historic locations, and the species at both sites is presumed extirpated. The one remaining natural population of *D. bakeri* (Marshall-Petaluma Road population) has been regularly monitored by Garden staff since spring 2001, and at that time was comprised of 55 flowering individuals. By 2003, the population had grown to 97 individual plants but had ranged in previous years between 60 and 100 individual plants (Koontz and Forbes 2003). Numbers steadily decreased after severe damage to the site by road maintenance crews in 2002 and 2004 and a wildfire in 2004. In spring of 2006, seven plants appeared. Of the two that flowered, all but one flower aborted from one stem and the other stem was broken at its base before the inflorescence had fully expanded (Forbes, *in litt*. 2011*c*). Numbers increased slightly the following year, however, flowering individuals since 2007 have consistently numbered between two and four plants. Most recently, in 2011, four out of ten plants present reached flowering stage.

In summary, abundance at the single natural population has been extremely low, but fairly stable over recent years (**Table 1**).

Table 1. Last Remaining *Delphinium bakeri* Natural Population 2006-2011

Year	**# Individuals**	**# Flowering Individuals**	**# seeds present (# seeds collected)**
2006	7	2	N/A (none collected)
2007	11	2	N/A (395 collected)
2008	10	2	few (none collected)
2009	16	2	N/A (none collected)
2010	11	3	264 (all collected)
2011	10	4	1,329 (all collected)

In preparation for establishing new populations of *Delphinium bakeri*, the Service prepared a working draft of a *D. bakeri* introduction plan (*Baker's larkspur (Delphinium bakeri) Reintroduction Plan, Marin and Sonoma Counties, California)* (unpubl. 2008) for internal guidance, which was reviewed by California Department of Fish and Game (CDFG), the Garden, and Service botanists.

***Reintroduction Sites**:*
Abundance at the three reintroduction sites has varied since the reintroductions began in 2009.

Private Ranch on Marshall-Petaluma Road: Eleven plants were placed in March 2009 as a pilot planting, but no flowering plants remained as of spring 2011. In early 2011, a large oak tree fell on the site and sawdust from its removal essentially mulched the site, eliminating any seed germination and/or growth from 2010 seedlings. Of the five plants that emerged by spring 2011, three of them flowered, however seeds did not reach maturity, as the fruiting stems were destroyed, most likely from gopher activity (H. Forbes, *in litt*., 2011*a*) .

Private Ranch on Chileno Valley Rd.: 75 plants total placed at three sites between December 2009 and January 2011.

- Site 1: Fifteen plants were placed in December 2009 and ten additional plants were placed in January 2011. As of the March 30, 2011 monitoring visit, only five of the 25 plants remained with above ground growth, due to herbivory by banana slugs and possibly other herbivores. No flowers/seeds were produced in 2011.
- Site 2: Fifteen plants were placed in December 2009 and ten additional plants were placed in January 2011. As of the March 30, 2011 monitoring visit, only nine of the 25 plants remained with above ground growth, due to herbivory by banana slugs and possibly other herbivores. It is likely that only three produced flowers in 2011.
- Site 3: Fifteen plants were placed in December 2009 and though there was significant herbivory observed in spring 2010, 11 of the 15 plants still remained. Ten additional plants were placed in January 2011. As of the March 30, 2011 monitoring visit, 21 of the 25 plants remained with above ground growth. Of these, ten were expected to flower.

Soulajoule Reservoir: 110 plants total were placed at three sites between January 2010 and January 2011. All sites are successful to date.

- Site 1: Forty plants were placed in January 2010. As of March 2011, 26 remained and 730 seedlings were observed. As of May 2011, one plant had four capsules.
- Site 2: Thirty-five plants were placed in January 2011. As of March 2011, 33 plants remained. As of May 2011, nine out of the 35 plants had capsules, totaling 77 capsules. No seedlings were observed since it was the initial planting year.
- Site 3: Thirty-five plants were placed in January 2011. As of March 2011, 34 plants remained. As of March 2011, 14 out of the 35 plants had capsules, totaling 151 capsules. No seedlings were observed since it was the initial planting year.

Of the three reintroduction sites, lands around Soulajoule Reservoir, owned by Marin Municipal Water District, seem to hold the greatest promise for long-term establishment, though invertebrate and mammalian predation limits the population in some years, as described below under Factor C threats.

<u>Habitat or Ecosystem</u>
Ewan (1942) provided information about the site in Coleman Valley, Sonoma County from which the species was first described (*i.e*., the type locality) as "along fence rows and in heavy low brush." *Delphinium bakeri* occurs on decomposed shale within the coastal scrub plant community from 120 to 150 meters (400-500 feet) elevation (California Natural Diversity

Database (CNDDB) 1997). The population of *D. bakeri* along the Marshall- Petaluma Road occurs in moderately moist, shaded conditions on a shallow veneer of soil along an extensive north-facing slope. The primary constituent elements of its designated critical habitat (Service 2003) were determined to be: (1) soils that are derived from decomposed shale; (2) plant communities that support associated species, including, but not limited to *Umbellularia californica* (California Bay), *Aesculus californica* (California buckeye), and *Quercus agrifolia* (coastal live oak), *Baccharis pilularis* ssp. *consanguinea* (coyotebrush), *Symphorcarpos* cf. *rivularis* (snowberry), *Rubus ursinus* (California blackberry), *Pteridium aquilinum* (braken fern), *Polystichum munitum* (sword fern), *Pityrogramma triangularis* (goldback fern), *Dryopteris arguta* (coastal woodfern), *Adiantum jordanii* (maidenhair fern), *Polypodium glycyrrhiza* (licorice fern), *Toxicodendron diversilobum* (poison oak), *Ceanothus thyrsiflorus* (blueblossom ceanothus), *Lithophragma affine* (woodland star), and *Holodiscus discolor* (oceanspray) (CNDDB 2001); and (3) mesic conditions on extensive north-facing slopes (Service 2003).

Changes in Taxonomic Classification or Nomenclature: No change in either taxonomic classification or nomenclature has occurred since the listing.

Genetics: The Garden staff is collaborating with Dr. Jason Koontz to conduct ongoing analyses of genetic variability of *Delphinium bakeri*. Dr. Koontz has conducted a study of microsatellites on a related *Delphinium* species and will be conducting field research in spring 2012 on various other *Delphinium* species. This work will be in coordination with the Garden, who will provide tissue samples for his analysis.

Species-specific Research and/or Grant-supported Activities

Conservation efforts in recent years have focused on monitoring, seed collection for long-term storage, working with County Public Works officials to avoid future damage to the one remaining natural site, and propagation, at the Garden, of seeds collected from the wild. The Garden staff has been working closely with the U.S. Fish & Wildlife Service through a grant agreement on several of these activities. Also, an *ex situ* population of *Delphinium bakeri* has been growing at the Regional Parks Botanical Garden in Berkeley for many years.

Because of the repeated damage caused by County road maintenance crews, a critical component of the onsite conservation effort was for representatives from resource agencies, the Garden, and CNPS to work with Marin County road maintenance officials and crews to assure their future actions do not damage the *D. bakeri* or its immediate vicinity. The site has been free of human-related damage since the last incidence in 2004 and no contact with the road crews has been necessary since then.

As mentioned above, other onsite conservation efforts include monitoring and collecting seed from the Marshall-Petaluma Road population of *Delphinium bakeri* by staff of the Garden since spring 2001. The Garden has a research permit from the California Department of Fish and Game which allows for restricted seed collection to five capsules per year from the most robust individuals. Staff collected seeds at the site in May/June 2002 and 2003, and 2007. Members of the Marin chapter of the CNPS also occasionally visit the site to monitor for impacts and general population trends.

Since 2003, the Garden, with grant support from the Service, has been propagating *Delphinium bakeri* from seed collected from the Marshall- Petaluma Road population. As of fall of 2008, over 250 plants were in propagation that could provide founder stock to establish several new populations of *D. bakeri*. The plants ranged in age from seedlings up to three or more years and were outplanted during the cool season with a portion retained for continued seed-banking (stock-piling seeds for long-term storage). However, seed banking from greenhouse raised plants is not a recommended long-term strategy for rare plant conservation because it inadvertently selects for plants that thrive and set the most seed in artificial propagation, and may over time compromise the gene pool of wild-selected seeds.

With numerous mature plants in propagation, the Garden worked with staff from the Service's Partners for Fish & Wildlife Program to actively seek and work with willing landowners (private and public) to provide suitable reintroduction sites for establishment of self-sustaining populations. Sites were sought that required a minimal amount of management intervention. Also, in identifying appropriate reintroduction sites, specific sites with little or no public access were preferred, to reduce the risk of human-related disturbance. The reintroduction program works with landowners on an individual basis to develop mutually acceptable access agreements, under a Cooperative Agreement, to allow staff and trained volunteers to monitor the population and conduct site-specific management actions, if needed. Staff from the Partners for Fish and Wildlife Program worked with willing landowners to develop a mutually acceptable project through a Cooperative Agreement that provides for long-term access for plant monitoring, and the reimbursement of project-related expenses to the landowner, such as exclusionary fencing. The Cooperative Agreement includes landowner rights to terminate the project on their land, although it is highly preferred to work with landowners who are interested in the project indefinitely.

Working within the above sideboards, the reintroduction work was successfully conducted by the Garden and the Service between March 2009 and January 2011 and resulted in the three reintroduction sites described above. Under the existing contract with the Service, the Garden continues to work toward identifying additional sites for future reintroduction work.

The Service-developed Reintroduction Plan (Plan) (Service 2008) for *Delphinium bakeri* proposed the following short term reintroduction objectives (first five to ten years after Plan publication):

- Establish at least five new populations of *D. bakeri* distributed across its historic range;

- Establish a minimum breeding population size of 20 individuals, and preferably up to 40 at each reintroduction site over a five year period. The reproductive objective for the minimum breeding population may be met by a combination of surviving transplants and naturally recruited plants that mature and produce abundant seed annually (from Baye 2006). Because of the experimental nature of the reintroduction, consideration should be given to installing only a portion of the desired number of plants the first year or two at a given site to avoid the loss of up to 40 individuals if it the site is discovered to be inadequate;

- Monitor for seedling recruitment with a target objective of the population producing at least one seedling cohort within three years that contributes enough surviving individuals to ideally cause a net population increase at the site. Stable numbers would also be considered a short term success because natural recruitment would replace mortality. Failure to detect surviving seedlings that mature into reproductive individuals within three years would indicate that the reintroduction is not yet achieving dynamic population objectives (adapted from Baye 2006). However, if no seedlings survive in any one year, the causes of mortality should be assessed and management adapted presuming the cause is determined and can be influenced through active management.

Proposed long term reintroduction objectives (ten years to several decades):

- Maintain minimum viable population (MVP) numbers (or founder number if data on MVP are still lacking) of the reintroduced populations with an upward trend in number of mature, reproductive (viable seed-bearing) individuals. The survival of subsequent generations of seedlings to reproductive maturity to produce viable seed would demonstrate the population is completing its life-cycle in dynamic natural habitat conditions; and

- Establish additional populations within the historic range in the vicinity of previously reintroduced populations, as sites and resources become available.

To date, three of the proposed five reintroduction sites have been outplanted; however, it is too soon to determine if those sites will be self-sustaining in the long-term. Progress toward each of the other stated objectives, which involve demographic monitoring, continues to be measured at least annually at all sites. In addition, as mentioned above, the Garden continues to work with the Service toward identifying additional sites for future *Delphinium bakeri* reintroduction work.

Five-Factor Analysis

The following five-factor analysis describes and evaluates the threats attributable to one or more of the five listing factors outlined in section 4(a)(1) of the Act.

FACTOR A: Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range.

The final listing rule states agricultural conversion to hayfields as the primary reason for habitat destruction (Ewan 1942, Service 2000). Also, sheep grazing was stated as at one time threatening a now extirpated population, though it was not known if grazing was the primary cause of its demise (Service 2000). Grazing activities may result in trampling of individual plants, soil compaction, consumption, and impacts which may influence presence of invasive species.

As mentioned earlier, the Marshall-Petaluma Road natural population exists on a steep roadside embankment subjected to road maintenance work and stochastic events such as landslides, fire,

and vehicle accidents. The site has sustained significant damage to the habitat since 2002. In May of that year, as part of Marin County road maintenance, work crews gouged the slope removing the largest plants before seed set was completed despite repeated discussions between the Garden staff and others with the County agency responsible for roadside maintenance. In September 2004, fire-fighting crews set backfires on the slope above the *Delphinium bakeri* in efforts to control a wildfire that started nearby. The plants are shallowly rooted, and the only individuals that survived were those that were protected by the roots of woody plants or were growing low on the slope and escaped being burned. In October 2004, County road crews, during road maintenance, removed most of the remaining individuals from the slope while clearing out the culvert located below the population, although the slope above the culvert had not eroded to block the culvert (Forbes, *in litt*. 2011*c*).

The fire of 2004 resulted in changes in the vegetation and microsite conditions. The increased sun penetration from the fire-damaged canopy appears to have changed the microclimate at the site from generally moist and shady to generally drier and sunnier which may affect the ability of seedlings to become established (Forbes, *in litt*. 2011*c*). Increased sunlight has also encouraged the growth of invasive vegetation such as *Conium maculatum* (poison hemlock), *Avena fatua* (wild oats) and *Genista monspessulana* (French broom), which are now more common on the slope. Prior to the fire, *Conium maculatum* was only observed in the roadside ditch. The local *Rubus ursinus* (California blackberry) appears denser and has the potential, as do the nonnative species, to displace *Delphinium bakeri*.

Populations at the reintroduction sites at the two private ranches and Soulajoule Reservoir are, by design, generally free from threats to habitat destruction currently, though may be subject to threats described below. The three introduction sites were specifically selected to avoid any current and anticipated land use conflicts, and require minimal stewardship activities.

FACTOR B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Overutilization is a significant threat to this species, as stated in the listing rule (Service 2000). In 1992, all the capsules were collected from the plants at the only known site of *Delphinium bakeri* (CDFG *in litt.* 1993). Because these capsules contained the plants' seeds, all sexual reproduction for 1992 was lost. Were this collection to occur regularly or in conjunction with unrelated natural events (*e.g.*, fire) the species may be lost. Table 1 illustrates the low number of seeds produced by the natural population, emphasizing the conservation, whether in place or *ex situ* of the capsules for retention of genetic diversity.

Whether, and the degree to which, collection of *Delphinium bakeri* has occurred since the time of listing is unknown at this time.

FACTOR C: Disease or Predation

The listing rule describes that most *Delphinium* species are toxic to cattle. The toxicity of *Delphinium bakeri* has not been tested, however, Ewan (1942) noted that *D. bakeri* did not appear to be poisonous to livestock. Sheep grazing was also described in the listing rule as a

possible threat to the species at a now extirpated location. Currently, sheep grazing is not known to threaten any populations of *D. bakeri*.

Since the time of listing, it has become apparent that herbivory by slugs, snails, gophers and other species can significantly damage vegetative growth of *Delphinium bakeri*. Slugs were observed to negatively impact *D. bakeri* at the Chileno Valley Road reintroduction site and slug bait was found to be ineffective in reducing the number of banana slugs present (H. Forbes, *in litt*. 2011*b*).

In 2011, herbivory was not noted at the Marshall-Petaluma Road natural population. At the Stubbs Vineyard site, however, the plants observed to be flowering earlier in the year were missing by mid-May 2011. Though signs of gophers had not been detected earlier in the year, fresh gopher activity was detected very close (0.6 meter) to the plants during the later site visit (H. Forbes *in litt*, 2011*a*).

FACTOR D: Inadequacy of Existing Regulatory Mechanisms

At the time of listing, regulatory mechanisms thought to provide some degree of protection for *Delphinium bakeri* included: (1) the California Native Plant Protection Act and (2) the California Environmental Quality Act (CEQA). The listing rule (Service 2000) provides an analysis of the level of protection that was anticipated from those regulatory mechanisms. This analysis appears to remain currently valid. In addition, as discussed below, in 2007, the species was listed as endangered by the State of California which provide some additional protection.

State Laws and Regulations

California Environmental Quality Act (CEQA): The CEQA requires review of any project that is undertaken, funded, or permitted by the State or a local governmental agency. If significant effects are identified, the lead agency has the option of requiring mitigation through changes in the project or to decide that overriding considerations make mitigation infeasible (CEQA section 21002). Protection of listed species through CEQA is, therefore, dependent upon the discretion of the lead agency involved.

California Endangered Species Act (CESA): In 2007, *Delphinium bakeri* was listed as endangered under California Endangered Species Act (CESA) (California Fish and Game Code, section 2080 *et seq*.). The CESA requires State agencies to consult with CDFG on activities that may affect a State-listed species and mitigate for any adverse impacts to the species or its habitat. Pursuant to CESA, it is unlawful to import or export, take, possess, purchase, or sell any species or part or product of any species listed as endangered or threatened. The State may authorize permits for scientific, educational, or management purposes, and to allow take that is incidental to otherwise lawful activities.

Native Plant Protection Act (NPPA): The NPPA (Division 2, Chapter 10, section 1908) prohibits the unauthorized take of State-listed threatened or endangered plant species. With regard to prohibitions of unauthorized take under NPPA, landowners are exempt from this prohibition for plants to be taken in the process of habitat modification. Where landowners have

been notified by the State that a rare or endangered plant is growing on their land, the landowners are required to notify the California Department of Fish and Game 10 days in advance of changing land use in order to allow salvage of listed plants.

Federal Laws and Regulations

Endangered Species Act of 1973, as amended (Act): The Act is the primary Federal law providing protection for this species. The Service's responsibilities include administering the Act, including sections 7, 9, and 10 that address take. Since listing, the Service has analyzed the potential effects of Federal projects under section 7(a)(2), which requires Federal agencies to consult with the Service prior to authorizing, funding, or carrying out activities that may affect listed species. A jeopardy determination is made for a project that is reasonably expected, either directly or indirectly, to appreciably reduce the likelihood of both the survival and recovery of a listed species in the wild by reducing its reproduction, numbers, or distribution (50 CFR 402.02). A non-jeopardy opinion may include reasonable and prudent measures that minimize the amount or extent of incidental take of listed species associated with a project.

Section 9 prohibits the taking of any federally listed endangered or threatened species. Section 3(18) defines "take" to mean "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." Service regulations (50 CFR 17.3) define "harm" to include significant habitat modification or degradation which actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering. Harassment is defined by the Service as an intentional or negligent action that creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. The Act provides for civil and criminal penalties for the unlawful taking of listed species. Incidental take refers to taking of listed species that result from, but is not the purpose of, carrying out an otherwise lawful activity by a Federal agency or applicant (50 CFR 402.02). For projects without a Federal nexus that would likely result in incidental take of listed species, the Service may issue incidental take permits to non-Federal applicants pursuant to section 10(a)(1)(B). To qualify for an incidental take permit, applicants must develop, fund, and implement a Service-approved Habitat Conservation Plan (HCP) that details measures to minimize and mitigate the project's adverse impacts to listed species. Regional HCPs in some areas now provide an additional layer of regulatory protection for covered species, and many of these HCPs are coordinated with California's related Natural Community Conservation Planning program.

With regard to federally listed plant species, section 7(a)(2) requires Federal agencies to consult with the Service to ensure any project they fund, authorize, or carry out does not jeopardize a listed plant species. Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the "take" of federally endangered wildlife; however, the take prohibition does not apply to plants. Instead, plants are protected from harm in two particular circumstances. Section 9 prohibits (1) the removal and reduction to possession (i.e., collection) of endangered plants from lands under Federal jurisdiction, and (2) the removal, cutting, digging, damage, or destruction of endangered plants on any other area in knowing violation of a state law or

regulation or in the course of any violation of a state criminal trespass law. Federally listed plants may be incidentally protected if they co-occur with federally listed wildlife species.

National Environmental Policy Act (NEPA): NEPA (42 U.S.C. 4371 *et seq*.) provides some protection for listed species that may be affected by activities undertaken, authorized, or funded by Federal agencies. Prior to implementation of such projects with a Federal nexus, NEPA requires the agency to analyze the project for potential impacts to the human environment, including natural resources. In cases where that analysis reveals significant environmental effects, the Federal agency must propose mitigation alternatives that would offset those effects (40 C.F.R. 1502.16). These mitigations usually provide some protection for listed species. However, NEPA does not require that adverse impacts be fully mitigated, only that impacts be assessed and the analysis disclosed to the public.

FACTOR E: Other Natural or Manmade Factors Affecting Its Continued Existence

At the time of listing, threats to *Delphinium bakeri* under Factor E were risk of extinction due to small populations that are subject to random events and genetic drift. By the time of listing, *D. bakeri* had been reduced to one population (Marshall-Petaluma Road) of 35 individuals.

The combination of few populations, small number of individuals found within each population, narrow range, and restricted habitat make this species susceptible to destruction of all or a significant part of any population from random natural events, such as herbivory, insect outbreaks, fire, drought, disease, or other natural occurrences (Schaffer 1981, Primack 1993). Random events causing population fluctuations or even population extirpations are not usually a concern until the number of individuals or geographic distribution become as limited as they have for *Delphinium bakeri*. Once a plant population becomes significantly reduced due to habitat destruction and fragmentation, the remnant population has a greater probability of extinction from random events. Small populations may also be subject to increased genetic drift and inbreeding (Menges 1991; Ellstrand and Elam 1993).

In addition, this species is noted in the taxonomic keys for the ease in which the main stem separates from its roots. Its current location on a road-cut makes it vulnerable to wind blasts by passing busses and trucks. Breakage of *D. bakeri* inflorescences has been observed from swinging stems of California blackberry catching on and breaking *D. bakeri* inflorescences (Forbes, *in litt*. 2011*c*).

Its extreme range restriction and small population size (in spring of 2008, only two plants out of ten flowered and they produced only small inflorescences and few seedlings were found) (Forbes, *in litt*. 2011*c*), coupled with random events, make it extremely vulnerable to extinction in the immediate future. Quantity and viability of seed in the naturally occurring seedbank is unknown. All the threats to the only known natural population of this species cannot be completely reduced or eliminated at this time due to the extreme restriction of the species' range, its proximity to the roadway, and continued access by the public.

An additional threat to the species noted since the listing is climate change. Climate is predicted to change in California during the 21st century (Field *et al*. 1999; Cayan *et al*. 2009). Even

modest changes in warming could result in a reduction of the spring snowpack, earlier snowmelt, and more runoff in winter with less runoff in spring and summer, more winter flooding, and drier summer soils (Field *et al*. 1999; Cayan *et al*. 2009). The predicted impacts on California's ecosystems projected with a high certainty include higher sea level; decreased suitable habitat for many terrestrial species as climate change intensifies human impacts; and increased competition among urban, agricultural, and natural ecosystem uses (Field *et al*. 1999). Although the specific effects of climate change on *Delphinium bakeri* are unknown, the effects of increased winter flooding and drought conditions in the spring have the potential to adversely affect this species.

In summary, the most overriding and significant Factor E threat to *Delphinium bakeri* is extirpation of small populations with extreme range restriction resulting from random events. Additionally, *D. bakeri* is likely threatened by global climate change throughout its range.

III. RECOVERY CRITERIA

No approved final or draft recovery plan for *Delphinium bakeri* has been completed or is in preparation.

IV. SYNTHESIS

At the time of listing in 2000, only one population of *Delphinium bakeri* was known to exist on County land at Marshall-Petaluma Road, Marin County. Since that time, three additional populations have been reintroduced on private and public lands within three miles of the last remaining occurrence; however, it is too soon to know if any will be successful in the long-term. At the time of listing the species was threatened by agricultural conversion, road maintenance crews, and stochastic events such as landslides, fire, and vehicle accidents as well as over-collection, possible sheep grazing, inadequate regulatory mechanisms, and genetic drift due to small population size. Currently, there are four known extant populations – one natural and three introduced – that, though primarily in conservation ownership, remain highly threatened by road maintenance effects, predation, stochastic events, and genetic drift. Therefore, we believe *D. bakeri* still meets the definition of endangered, and recommend no status change at this time.

V. RESULTS

Recommended Listing Action:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist (indicate reason for delisting according to 50 CFR 424.11):
  ____ *Extinction*
  ____ *Recovery*
  ____ *Original data for classification in error*
__X_ No Change

New Recovery Priority Number and Brief Rationale: No change in recovery priority number.

VI. RECOMMENDATIONS FOR ACTIONS OVER THE NEXT 5 YEARS

1. Continue monitoring of the Marshall-Petaluma Road naturally occurring population and the three existing reintroduction sites at private ranches on Marshall-Petaluma and Chileno Valley Roads, and Marin Municipal Water District's Soulajoule Reservoir.

2. Continue seed multiplication and propagation efforts at the Garden.

3. Identify additional reintroduction sites and reintroduce *Delphinium bakeri* to at least two additional locations within its historic range.

   The Garden and the Service are actively working with and seeking additional willing landowners (private and public) to provide suitable reintroduction sites for establishment of self-sustaining populations of *Delphinium bakeri* that ideally require a minimal amount of management intervention. The species introduction and follow up activities would be conducted by the Garden and the Service or its contractors, and/or skilled volunteers and under a written agreement with landowner rights to terminate the project on their land with conditions regarding the disposition of the plants. However, it is strongly preferred to work with landowners who are interested in the project indefinitely. Specific sites with little or no public access, at least unrestricted access, are preferred to reduce the risk of vandalism and unintentional impacts at the site. The reintroduction program will work with landowners on an individual basis to develop mutually acceptable access agreements to allow monitoring of the population and stewardship activities to sustain the population.

   The vast majority, if not all, of the land within the historic range of *Delphinium bakeri* is privately owned. The long-term survival and recovery of *D. bakeri* will depend on the willingness of private landowners to voluntarily participate in the reintroduction program by allowing the establishment of a self-sustaining population of *D. bakeri*. Landowners with large acreages, such as ranchland, with relatively undisturbed, moist, north-facing slopes are sought to participate in the reintroduction program.

VII. REFERENCES CITED

Baye, P.R. 2006. California sea-blite (*Suaeda californica*) Reintroduction Plan, San Francisco Bay, California. Prepared for U.S. Fish and Wildlife Service, Sacramento, California. 59 pages + figures.

California Natural Diversity Database (CNDDB). 1997. Rarefind: A database application for the California Department of Fish and Game Natural Heritage Division Data.

California Natural Diversity Data Base (CNDDB). 2008. Occurrences of *Delphinium bakeri*. 3 pp.

California Natural Diversity Data Base (CNDDB). 2001. Occurrences of *Delphinium bakeri*. 3 pp.

Cayan, D., M. Tyree, M. Dettinger, H. Hidalgo, T. Das, E. Maurer, P. Bromirski, N. Graham, and R. Flick. 2009. Climate change scenarios and sea level rise estimates for California 2008 Climate Change Scenarios Assessment. California Climate Change Center. *In prep.*

Center for Plant Conservation (CPC). 2008. CPC National Plant Collection Plant Profile, Delphinium bakeri. http://www.centerforplantconservation.org/ASP/CPC_ViewProfile.asp?CPCNum=1375#

Ellstrand N.C. and D.R. Elam. 1993. Population genetic consequences of small population size: implications for plant conservation. Annual Review of Ecology and Systematics 24: 217-242.

Ewan, J. 1942. The genus Delphinium in North America: series Echinatae of subsection Subscaposa, and miscellaneous noteworthy species. Bulletin of the Torrey Botanical Club 69:137-150.

Field, C.B., G.C. Daily, F.W. Davis, S. Gaines, P.A. Matson, J. Melack, and N.L. Miller. 1999. Confronting climate change in California. Ecological impacts on the Golden State. A report of the Union of Concerned Scientists, Cambridge, Massachusetts, and the Ecological Society of America, Washington DC.

Koontz, J.A. and H. Forbes. 2003. Demography and conservation genetics of the endangered Baker's Larkspur (Delphinium bakeri, Ranunculaceae). Prepared for the Species Conservation and Recovery Program, Habitat Conservation Planning Branch, California Department of Fish and Game. Research Permit 01-01. 20pp.

Menges, E.S. 1991. The application of minimum viable population theory to plants. Pages 45-61 in D.A. Falk and K.E. Holsinger (editors). Genetics and conservation of rare plants. Oxford University Press, New York, New York.

Primack, R. 1993. Essentials of Conservation Biology. Sinauer and Associates. Pp. 253-276.

Schaffer, M.L. 1981. Minimum population sizes for species conservation. Bioscience 31: 131-134.

[Service] U.S. Fish and Wildlife Service. 2000. Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for Two Larkspurs from Coastal Northern California. Federal Register 65: 4156-4162.

[Service] U.S. Fish and Wildlife Service. 2003. Final Designation of Critical Habitat for Two Larkspurs from Coastal Northern California. Federal Register 68: 12834-12863.

In Litt

California Department of Fish and Game. 1993. EPP Telecon report. Telephone conversation record. 2 pp.

Forbes, Holly. 2011*a*. Curator, UC Berkeley Botanical Garden. Electronic mail from Holly Forbes to Valary Bloom in regards to Baker's larkspur reintroduction success monitoring. May 20, 2011.

Forbes, Holly. 2011*b*. Curator, UC Berkeley Botanical Garden. Electronic mail from Holly Forbes to Valary Bloom in regards to slug deterrent measures at Baker's larkspur reintroduction sites. September 7, 2011.

Forbes, Holly. 2011*c*. Curator, U.C. Berkeley Botanical Garden. Electronic mail from Holly Forbes to Valary Bloom in regards to success of seed set, threats to Baker's larkspur, and genetic introgression. September 23, 2011.

U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW

***Delphinium bakeri* (Baker's larkspur)**

Current Classification: Endangered

Recommendation Resulting from the 5-Year Review:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
__X__ No change needed

Review Conducted By: Valary Bloom, Sacramento Fish and Wildlife Office

FIELD OFFICE APPROVAL:

Lead Field Supervisor, U.S. Fish and Wildlife Service

for

Approve _____ Date 20 June 2012