

Delphinium luteum
(Yellow Larkspur)

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

**U.S. Fish and Wildlife Service
Sacramento Fish & Wildlife Office
Sacramento, CA**

September 2011

5-YEAR REVIEW

Delphinium luteum (Yellow 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 of 1973 (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 comments.

Species Overview:

As summarized from the Listing Rule for this species (65 FR 4156-4162), *Delphinium luteum* (yellow larkspur) is a perennial in the Ranunculaceae (buttercup family). This species grows in rocky areas within coastal scrub plant community, including areas with active rock slides, from sea level to 100 meters (300 feet) in elevation. The historic range is Marin and Sonoma counties.

Delphinium luteum is distinguished from other *Delphinium* species by its yellow flowers and its erect seed follicles. In contrast to typical pollinators for the genus *Delphinium*, (which are insects), potential pollinators for *D. luteum* are Allen's hummingbirds, which have been observed visiting *D. luteum* flowers.

At the time of the Listing Rule in 2000, there were 11 known occurrences of *Delphinium luteum* listed in the California Natural Diversity Database (CNDDDB; maintained by the California Department of Fish and Game (CDFG)), and only two of which were thought to be extinct (called Larkspur Rock and Larkspur Hill). At this time, there are now 12 total occurrences in the CNDDDB. After accounting for unreliable reports or locations that have not had plants for many years, of the 12 occurrences, there are possibly 1 to 5 extinct wild populations of *Delphinium luteum*, including the two populations described in the Listing Rule (Larkspur Rock and Larkspur Hill).

Methodology Used to Complete This Review:

This 5-year review contains updated information on the biology and threats to *Delphinium luteum*, and an assessment of that information compared to that known at the time of listing, and provides an indication of its progress towards recovery. This review was prepared by the Sacramento Fish and Wildlife Office, following the Region 8 guidance issued in March 2008. There is no final approved Recovery Plan. We used survey information from experts who have been monitoring various localities of this species, and the CNDDDB. Personal communications with experts were our primary sources of information used to update the species' status and threats. 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:

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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 March 21, 2010 (75 FR 28636 28642). We received no information from the public specific to *Delphinium luteum* in response to our Federal Notice initiating this 5-year review.

Listing History

Original Listing

FR Notice: Federal Register 65: 4156-4162

Date of Final Listing Rule: January 26, 2000

Entity Listed: *Delphinium luteum* (yellow larkspur); a plant species

Classification: Endangered

State Listing

Date of Final Listing Rule: September 1, 1979

Entity listed: *Delphinium luteum* (yellow larkspur)

Classification: Endangered

Associated Rulemakings: In 2003, four units in Sonoma and Marin counties totaling 1,046 hectares (2,584 acres) were designated as critical habitat for *Delphinium luteum*. All four of these areas are on private land (68 FR 12834-12863).

Review History: No 5-year status reviews have been conducted for *Delphinium luteum* since its listing in 2000.

Species' Recovery Priority Number at Start of 5-Year Review: The recovery priority number for *Delphinium luteum* is 8C according to the Service's 2010 Recovery Data Call for the Sacramento Fish and Wildlife Service office, based on a 1-18 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 moderate degree of threat and has a high potential for recovery. The "C" indicates conflict with construction or other development projects or other forms of economic activity.

Recovery Plan or Outline: There is no recovery plan or outline for *Delphinium luteum*.

II. REVIEW ANALYSIS

Application of the 1996 Distinct Population Segment (DPS) Policy:

The 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 luteum* (yellow larkspur) is a perennial in the Ranunculaceae (buttercup family). It grows from fibrous roots to 56 centimeters (22 inches) tall. The leaves are mostly basal, fleshy, and green at the time of flowering, which occurs from March to May. The flowers are cornucopia shaped with five conspicuous bright yellow sepals, with the posterior sepal elongated into a spur. The inconspicuous petals occur in two pairs: the upper petals are narrow and unlobed and the lower petals are oblong to ovate. The fruit is a follicle. It is not known how long plants live, but probably at least 10 years. Questions remain about the life history of *D. luteum*, including how long the seed bank stays viable, ideal germination conditions and effects of fire.

In contrast to typical pollinators for the genus *Delphinium*, (which are insects), potential pollinators for *D. luteum* are Allen's hummingbirds, which have been observed visiting *D. luteum* flowers. In addition, the flower shape and sucrose-dominated nectar are consistent with characteristics of species that are typically pollinated by hummingbirds. However bumblebees have also been observed visiting *D. luteum* flowers in a nursery setting (H. Forbes, personal communication 2011). *D. luteum* is self-compatible, but visitation by pollinators improves seed set.

Spatial Distribution and Abundance: *Delphinium luteum* was probably never widely distributed. It occurred historically at elevations ranging from sea level to about 100 meters (300 feet) within northwestern Marin and southwestern Sonoma counties, California (CNDDDB 2011).

At the time of Listing Rule in 2000, there were 11 known occurrences of *Delphinium luteum* listed in the CNDDDB, and only two of which were thought to be extinct. Since the early 1980s, however, only six of these 11 occurrences were documented (reported in the CNDDDB or other reputable source). Of the other five occurrences in the CNDDDB, three have not been documented since 1935 or earlier (two of which were revisited in the 1980s with negative results), another is based entirely on unsupported and undated information found on a 1979 map, and the fifth is a questionable identification never confirmed by a second sighting (CNDDDB 2011). The six substantiated occurrences documented in the CNDDDB grow in three separate drainages, one in Sonoma County and two in Marin County. The largest number recorded by CNDDDB is 134 plants for the Marin County populations in 1993.

Of all of these occurrences, only two were mentioned in the Listing Rule, both on private property (Service, 2000). The first, Larkspur Rock, is located at an old rock quarry site near the city of Bodega in Sonoma County was partially destroyed and fragmented by historical quarry activities. The second location is known as Larkspur Hill, which may be extirpated. Larkspur Hill is located near Cheney Gulch, on the south side of Highway 1, about 2 miles west of Bodega Bay in Sonoma County.

At this time, there are now 12 total occurrences in the CNDDDB. After accounting for unreliable reports or locations that have not had plants for many years, of the 12 occurrences, there are possibly 1 to 5 extinct wild populations of *Delphinium luteum*, including the two populations described in the Listing Rule (Larkspur Rock and Larkspur Hill).

These five potential occurrences are described below:

1. Larkspur Rock corresponds with CNDDDB occurrence #5 and is the type location, southwest of a quarry site on a housing development property. It is on the south side of Cheney Gulch along Highway 1, 3 kilometers south of Bodega Bay. *Delphinium luteum* is on a north-facing slope growing with *Arabis blepharophylla* (coast rock cress), *Calochortus tolmiei* (Tolmiei star-tulip), *Mimulus aurantiacus* (sticky monkeyflower), a *Dudleya* species (probably *D. farinosa*), *Polypodium californicum* (California polypody), and a species of *Eriogonum* (probably either *E. latifolium* or *E. nudum*) (CNDDDB #5; P. Warner, personal communication, 2011). *Fritillaria affinis* (checker lily) was observed nearby. Part of the hill is a recent landslide, and some *D. luteum* plants are growing in the slide. According to Koontz *et al.* (2001), this population has high genetic diversity. This occurrence was last updated in 2000, when 55 plants were counted. A survey on May 19, 2011 counted 46 plants growing on the north side of the upper rock outcropping, and on May 23, 2011 about six plants were counted using binoculars on the lower outcropping (H. Forbes, personal communication, 2011).
2. Larkspur Hill corresponds to CNDDDB occurrence #11 and, according to the record, may be extirpated given that the management of the property was not compatible with

Delphinium luteum's continued existence. This property is currently managed as a sheep ranch, and plants are threatened with grazing. The landowner has not allowed access since 1987, when 12 plants were counted.

Three additional locations have been described in the CNDDDB since the 2000 Listing Rule, and one was described that is not in the CNDDDB.

3. A third location was observed by Smith (2010) along Highway 1. This corresponds to CNDDDB occurrence #14 (with which #12 was combined). This location is north of where Walker Creek drains into Tomales Bay in Marin County. This plant was growing with *Delphinium nudicaule* (red larkspur) and a hybrid between *D. luteum* and possibly *D. decorum* (coast larkspur). Only 1 plant was observed in 2000, and a survey in 2011 found *D. nudicaule* but no *D. luteum* (H. Forbes, personal communication, 2011).

4. The fourth location is located approximately 2.4 kilometers (1.5 miles) from the mouth of Estero de San Antonio. This population corresponds with CNDDDB occurrence #16, documented by Hickson in 1993. Plants were growing on and immediately below five rock outcrops above the creek. The habitat is Franciscan sandstone rock outcrops on a steep, north facing slope. Plants associated with this location included *Toxicodendron diversilobum* (poison oak), *Romanzoffia californica* (California Mistmaiden), *Arabis blepharophylla* (coast rock cress), *Hesperevax sparsiflora* (erect evax), *Pentagramma triangularis* (golden fern, gold back fern), *Sedum spathulifolium* (Pacific stonecrop). In 1993 134 plants were counted. No subsequent surveys are recorded.

5. The fifth location corresponds to CNDDDB occurrence #17 and was found by Amme (1993). This population is on private property in Marin County north of Dillon Beach on the north side of Estero San Antonio and South of the Estero Americano. At that time, this land was proposed for a golf course and monastery. This population was observed growing along a steep switchback sheep trail on the east side of a narrow "dog-leg" peninsula. The slope is north-facing, and is on the edge of the coastal sage scrub and grassland communities. Here *Delphinium luteum* grows with *Melica geyeri* (Geyer's onion grass). At that time sheep grazed the area, but the plants were out of reach of the sheep. Three plants were observed in 1993. These flowers were pale yellow and identification as pure *D. luteum* was not assured. Amme (1993) wrote that the plants could be a hybrid between *D. luteum*, *D. nudicaule* (red larkspur), *D. decorum* (coastal larkspur), and/or possibly, yellowish flowered form of *D. nudicaule*. No subsequent surveys are recorded.

Captive populations: There are two captive populations of *Delphinium luteum* in cultivation, one that came from Larkspur Hill, and is maintained by the California Native Plant Society (Betty Guggolz). There are about three plants at this location. There are additional *D. luteum* plants in private gardens. The second known *D. luteum* captive population is at the University of California Botanical Garden at Berkeley, which was started in 1983 from seed from Larkspur Rock. There are currently four plants in containers and 3-5 plants in the ground at this location. Seeds from cultivated plants are in storage here.

Habitat or Ecosystem: Heller (1903) described *Delphinium luteum* based on type material collected from “grassy slopes about rocks, near Bodega Bay, along the road leading to the village of Bodega” in Sonoma County. *Delphinium luteum* inhabits coastal prairie and coastal scrub, which typically have no overstory, at elevations ranging from sea level to about 100 meters (300 feet) within northwestern Marin and southwestern Sonoma counties, California (CNDDDB 2011). The species occurs on moderate to steep slopes with evidence of some level of disturbance, including landslides of various ages, in close proximity (CNDDDB 2011). Roots of *D. luteum* are tuberous, long and thin, an unusual combination in this genus which may provide an advantage in thin, unstable soils. Typical soil types supporting *D. luteum* include the Kneeland series in Sonoma County and the Yorkville series in Marin County. These soils derive from sandstone or shale, and share qualities of rapid runoff and high erosion potential. The most recently documented populations of *D. luteum* (those located in the 1980’s or later) tend to grow on north-facing slopes in canyon complexes with steep sides (CNDDDB 2011).

Presumably the more shaded north-facing slopes provide a moister microclimate, while the steep-sloped canyon walls increase the likelihood of erosion and landslides in the vicinity. Temperatures in the region inhabited by *Delphinium luteum* are moderated by fog, which keeps summers relatively cool and winters relatively warm compared to inland habitats. Much of the coastal prairie in this species’ range has been grazed for over a century, and is now characterized by a mixture of non-native annuals and forbs and native prairie plants. Native plants listed as occurring with *D. luteum* include *Arabis blepharophylla* (rose rockcress), *Calochortus tolmei* (Tolmei startulip), *Mimulus aurantiacus* (orange bush monkeyflower), *Dudleya caespitosa* (sea lettuce), *Polypodium californicum* (California polypody), and *Eriogonum parviflorum* (sea cliff buckwheat) (CNDDDB 2011).

Changes in Taxonomic Classification or Nomenclature: There have been no changes in taxonomic classification for *Delphinium luteum* since the Listing Rule in 2000.

Species-specific Research and/or Grant-supported Activities:

1. Koontz *et al.* (2001) examined the genetic variability of *Delphinium luteum* and the potential hybrid contamination of the captive populations. Their data suggest that *D. luteum* is probably not of recent hybrid origin. In addition, Koontz *et al.* (2001) found high genetic diversity in *D. luteum* despite reduction in population sizes and restricted range. They suggest that several factors may be maintaining this high genetic diversity, including a long-lived seed or rootstock bank, outcrossing over dominance (where heterozygous individuals have higher fitness), or that *Delphinium* species have high genetic diversity in general. In addition the authors found that the two cultivated populations have somewhat reduced genetic variability in comparison to one of the natural populations.

2. Koontz *et al.* (2004) used phylogenetic analysis to examine the possible hybrid origin of *Delphinium luteum* from *D. nudicaule* and *D. Decorum*. The origin of *D. luteum* was not well-resolved, but the authors suggest that if *D. luteum* has its origin in a hybridization event, it was probably not recent, or that *D. luteum* may be a species group that diverged through a

bifurcating, rather than a reticulating (hybrid) process. The population-level study from Koontz *et al.* (2001) supports the latter scenario.

3. In 2010, Holly Forbes, Garden Curator at the University of California Botanical Garden at Berkeley, was contracted to continue propagation and reintroduction of four native plants, including *Delphinium luteum*.

Actions under this proposal are as follows:

- a. Seed regeneration. Garden propagator will sow currently stored seed for seed regeneration in the Garden's nursery. Seed from existing mature plants will be collected, cleaned, and stored for future restoration work.
- b. A subset of the above seed will be sown to produce plants for introduction projects when those sites are identified. Those plants will be available at a minimum of three years old.
- c. Partnerships on future recovery actions. Garden Curator Holly Forbes will consult with species stakeholders in a workshop to discuss future actions to be taken in support of *Delphinium luteum*. These actions may include monitoring extinct populations via census, identification and management of threats at extinct locations, or identification of potential introduction sites within the historic range. Ms. Forbes will include experts, as available, such as Mrs. Betty Guggolz, Dr. Jason Koontz, and representatives from the Service, CDFG, other California Native Plant Society members, etc. Findings of the workshop will be documented by Holly Forbes and reported to USFWS for further action.

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

Habitat destruction was a threat in the 2000 Listing Rule and is still considered the greatest immediate threat for *Delphinium luteum*. At the time of Listing Rule in 2000, there were two remaining wild populations of *D. luteum*, both on private property (Larkspur Rock and Larkspur Hill). No surveys have been done on Larkspur Hill since 2000. The landowner at Larkspur Hill, as of the 2000 Listing Rule, has not allowed surveys. This population may be extirpated.

Larkspur Rock is located at an old rock quarry site near Bodega and has been partially destroyed and fragmented by historical quarry activities. In 2011 46 plants were counted at Larkspur Rock.

Observations have been made of potentially three additional populations, but none of these locations have been systematically surveyed, and evidence is somewhat anecdotal. These

populations are ostensibly threatened by habitat destruction or alteration. Location 3 is threatened by increasing erosion and disturbance due to its roadside location.

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

At the time of Listing Rule in 2000, unrestricted collecting for scientific or horticultural purposes or excessive visits by individuals interested in seeing rare plants was said to be a threat (65 FR 4156). Overcollecting may still be a threat. *Delphinium luteum* is the only known yellow-flowered larkspur. Due to this distinctive morphology, it has been and continues to be of horticultural interest, and some of the historical decline to *D. luteum* can be attributed to overcollecting (Forbes 2001). Seeds were seen for sale in horticultural trade journals in the 1940s and 50s, and are still available today. Collecting is thought to have resulted in the extirpation at least one occurrence of *D. luteum* located southwest of Tomales (CNDDDB 2011).

FACTOR C: Disease or Predation

This factor was included in the Listing Rule and is still a threat for populations located on sheep grazing land. Most *Delphinium* species are toxic to cattle but not sheep. Several populations may be threatened by sheep grazing, including Larkspur Hill, Location 4 (where inflorescences were observed to be chewed and damaged, Hickson, 1993) and possibly Location 5 (though these plants were observed to be out of reach of sheep). In 2011, several of the *Delphinium luteum* plants surveyed at Larkspur Rock were observed to have inflorescences chewed, but not by sheep (sheep are not grazed in the Bodega Harbor property). These may have instead been chewed by deer or lagomorphs.

FACTOR D: Inadequacy of existing regulatory mechanisms

At the time of the Listing Rule, regulatory mechanisms thought to provide protection to *Delphinium luteum* included: 1) listing under the Endangered Species Act; 2) the National Environmental Policy Act (NEPA); 3) listing under the California Endangered Species Act (CESA); 4) the California Environmental Quality Act (CEQA); 5) the California Native Plant Protection Act (NPPA); and 6) The California Coastal Act (CCA).

Federal Laws and Regulations:

Endangered Species Act (Act): The Act of 1973, as amended, is the primary Federal law that provides protection for *Delphinium luteum*. 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 species. Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit “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. Section 9 also makes illegal the

international and interstate transport, import export and sale or offer for sale of endangered plants and animals. The protection of Section 9 afforded to endangered species is extended to threatened wildlife and plants by regulation. Federally listed plants are included as covered species in Habitat Conservation Plans (HCPs) prepared by non-Federal applicants as part of the terms and conditions for the issuance of an incidental take permit for Federally listed wildlife under section 10(a)(1)(B). *D. luteum* is not within any HCP boundaries.

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.

State Laws and Regulations:

California Endangered Species Act (CESA): The CESA (CESA; California Fish and Game Code, section 2080 *et seq.*) prohibits the unauthorized take of State-listed threatened or endangered species. The California Native Plant Protection Act (Division 2, Chapter 10, section 1908) prohibits the unauthorized take of State-listed rare or endangered plant species. 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 allow to take that is incidental to otherwise lawful activities. *Delphinium luteum* was listed by the State of California as endangered in 1979.

California Native Plant Protection Act (NPPA): 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 CDFG 10 days in advance of changing land use in order to allow salvage of listed plants. Salvaging may be possible for the *Delphinium luteum* because it is a perennial species.

California Environmental Quality Act (CEQA): CEQA requires review of any project that is undertaken, funded, or permitted by the State or a local government agency. If significant effects are identified, the lead agency has the option of requiring mitigation through changes in the project. Protection of a listed species through CEQA is dependent on the discretion of the agency involved.

California Coastal Act (CCA): The CCA considers the presence of listed species in determining environmentally sensitive habitat lands subject to Section 30240 of the California Coastal Act of 1976, which requires their protection. Certain local jurisdictions have developed their own

Coastal Programs or Land Use Plans that have been approved by the Coastal Commission. Some of the major accomplishments of this act include reduction in overall development, the acquisition of prime habitat along the coast, restoration of coastal streams and rivers, and a reduction in the rate of wetland loss. The CCA provides additional minimal protections in association with the previous State regulatory mechanisms.

In summary, the Federal Endangered Species Act is the primary Federal law that provides protection for *Delphinium luteum* since it was considered endangered with the Listing Rule of 2000. Other Federal and State regulatory mechanisms provide discretionary protections for the species based on current management direction, but do not guarantee protection for the species absent its status under the Act. Therefore, we continue to believe other laws and regulations have limited ability to protect the species in absence of the Act.

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

Risk of extirpation due to small population sizes: Small populations are typically at greater risk of extinction than larger ones (Terborgh and Winter 1980; Diamond 1984; Pimm *et al.* 1988; Morris and Doak 2003). Extinction risk can increase through several factors, such as stochasticity in birth and death rates. A few years of poor germination could result in extinction. Catastrophic events such as fire, floods or droughts, diseases or invasive species can also cause extinction of a species if the single population is wiped out. In addition, small populations have a higher risk of inbreeding due to reduced numbers of individuals available for reproduction. Inbreeding can reduce fitness, making populations less able to adapt to a variable environment (Shaffer, M. L. 1981; Ellstrand and Elam 1993). Though Koontz *et al.* (2001) found relatively high genetic diversity in *Delphinium luteum* populations, decreasing numbers of individuals still indicates the possibility of inbreeding.

Risk of extinction through random events was listed as a threat in the 2000 Listing Rule. The small number of individuals in the single *Delphinium luteum* population increases the threat of extinction of the species as a whole through stochastic demographic and environmental events. *Delphinium* has been reduced to a few unprotected populations with fluctuating numbers of individuals.

Climate Change: Global climate change was not included in the 2000 Listing Rule, but is a potential threat to *Delphinium luteum*. Current climate change predictions for terrestrial areas in the northern hemisphere indicate warmer air temperatures, more intense precipitation events, and increased summer continental drying (Field *et al.* 1999; Cayan *et al.* 2005; IPCC 2007). However, predictions of climatic conditions for smaller sub-regions such as California remain uncertain. It is unknown at this time if climate change in California will result in a warmer trend with localized drying, higher precipitation events, or other effects.

Delphinium luteum is endemic to a region with abundant coastal fog, which increases plant, soil, and atmospheric moisture. This increased moisture decreases fire hazard, which may negatively affect *D. luteum*. It is unknown at this time if climate change in California will result in a warmer trend with localized drying, higher precipitation events, or other effects in coastal Sonoma and Marin counties. Some trends have been observed in fog data in coastal California,

but at present there is no consensus. For example, Johnstone and Dawson (2010) found direct evidence for moderate fog reductions since 1951, but Bakun (1990) and Lebassi (2009) and some modeling studies (Diffenbaugh *et al.* 2004, Snyder *et al.* 2003) suggest increases in northern California coastal fog in response to increased carbon emissions.

In summary, we recognize that climate change is an important issue with potential effects to listed species and their habitats; we lack adequate information to make accurate predictions regarding its effects to particular species at this time. *Delphinium luteum* may be at risk with global climate change if it cannot disperse to favorable climate and conditions.

III. RECOVERY CRITERIA

At present there is no approved draft or final Recovery Plan for *Delphinium luteum* and therefore no recovery criteria.

IV. SYNTHESIS

At the time of Listing Rule in 2000, *Delphinium luteum* was thought to be restricted to two populations. As of 2011, 46 plants at Larkspur Rock were counted. No formal surveys have been conducted on the other populations since the designation of critical habitat in 2003, and the status of Larkspur Hill described in the Listing Rule is unknown.

Delphinium luteum continues to meet the definition of endangered, in part because none of the five possible extinct populations are formally protected and all five populations have very few individuals. Road widening, uncontrolled sheep grazing, fire suppression, rock quarrying activities, residential development, and sheep grazing have resulted in further restriction of the species' distribution. It is likely that several of these populations have been extirpated, are threatened with extirpation or are hybridized with other *Delphinium* species. Therefore we recommend no change in status 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*
- No Change

New Recovery Priority Number and Brief Rationale: We recommend maintaining the current Recovery Priority Number.

VI. RECOMMENDATIONS FOR ACTIONS OVER THE NEXT 5 YEARS

1. Write a Recovery Plan. The Act requires that all listed species have recovery plans. *Delphinium luteum* has been listed since 2000, development of a recovery plan would provide guidance to conservation efforts already in progress and provide criteria for successful recovery of the species.
2. Yearly surveys of plants. Currently there is little knowledge about the numbers of plants and populations of *Delphinium luteum*. We recommend yearly surveys of sites listed in the CNDDDB in addition to sites on north-facing rocky slopes that may have unknown populations of *D. luteum*. With yearly surveys we can establish basic knowledge of the population numbers and range of the species, in addition to more information about any changes in habitat, a more comprehensive threats analysis and an estimation of the population trends of the species (declining, stable, or increasing).
3. Pursue communication with landowners for access to survey plants. Some of the CNDDDB occurrences are on private property and have not been observed in many years. We recommend communicating with landowners to negotiate access to their properties to survey for plants.
4. Find appropriate reintroduction sites. Survey for reintroduction sites on protected property and pursue landowner agreements.
5. Gather information on habitat needs and requirements. Little is known about the habitat needs and requirements for *Delphinium luteum*. All wild populations grow on north-facing rocky slopes in Sonoma or Marin counties, but the plant is grown easily in horticulture. We recommend research to gather information about soil and moisture requirements, pollination and germination requirements and viability of the seed bank.
6. Continue captive propagation. Continue captive propagation efforts for *Delphinium luteum* at the University of California Botanical Garden at Berkeley.

VII. REFERENCES CITED

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

Delphinium luteum (yellow larkspur)

Current Classification: endangered

Recommendation Resulting from the 5-Year Review:

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

Review Conducted By: Mandi Finger, Sacramento Fish and Wildlife Office

FIELD OFFICE APPROVAL:

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

Approve JW Carrington Date 8 Sept 2011