# Hidden Lake Bluecurls
(*Trichostema austromontanum* ssp. *compactum*)

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

**U.S. Fish and Wildlife Service**
**Carlsbad Fish and Wildlife Office**
**6010 Hidden Valley Road**
**Carlsbad, California 92011-4213**

**5-YEAR REVIEW**
**Species reviewed: Hidden Lake Bluecurls (*Trichostema austromontanum* ssp. *compactum*)**

## TABLE OF CONTENTS


| | | |
|---|---|---|
| I. | GENERAL INFORMATION | 3 |
| II. | REVIEW ANALYSIS | 4 |
| III. | RESULTS | 11 |
| IV. | RECOMMENDATIONS FOR FUTURE ACTIONS | 11 |
| V. | REFERENCES | 12 |

**5-YEAR REVIEW**
**Hidden Lake Bluecurls / *Trichostema austromontanum* ssp. *compactum***

# I. GENERAL INFORMATION

**I.A. Methodology used to complete the review:** The Carlsbad Fish and Wildlife Office of the U.S. Fish and Wildlife Service (Service) initiated a 5-year review of the Hidden Lake Bluecurls (*Trichostema austromontanum* ssp. *compactum*) in July 2005. The Service solicited information from the public through two Federal Register notices (70 FR 39327 and 70 FR 66842). To complete the review, we evaluated all information that has become available on the species since its listing in 1998.

## I.B. Reviewers

**Lead Region:** Diane Elam, California-Nevada Operations Office, 916-414-6464

**Lead Field Office:** Jim A. Bartel, Carlsbad Fish and Wildlife Service, 760-431-9440

**Cooperating Field Office(s):** Not applicable.

**Cooperating Office(s):** Not applicable.

## I.C. Background

**I.C.1. FR notice citation announcing initiation of this review:** The notice announcing the initiation of this 5-year review and opening of the first comment period for 60 days was published on July 7, 2005 (70 FR 39327). A notice reopening the comment period for 60 days was published on November 3, 2005 (70 FR 66842).

**I.C.2. Species status:** The status is "stable" according to the FY 2005 recovery data call.

**I.C.3. Recovery achieved:** Recovery achieved is a value of "1" or 0 to 25 percent according to the FY 2005 recovery data call.

**I.C.4. Listing history**

FR notice: 63 FR 49006
Date listed: September 14, 1998 (effective October 14, 1998)
Entity listed: subspecies
Classification: threatened

**I.C.5. Associated rulemakings:** No associated rulemakings.

**I.C.6. Review history:** No prior reviews.

**I.C.7. Species' Recovery Priority Number at start of review:** The Recovery Priority Number is 9 according the FY 2005 recovery data call. This number indicates that the taxon is a subspecies with a moderate degree of threat and a high potential for recovery.

**I.C.8. Recovery Plan or Outline**

Name of plan: Five Meadow Plants
Date issued: Under development
Dates of previous revisions: No previous plans.

## II. REVIEW ANALYSIS

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

**II.A.1. Is the species under review listed as a DPS?** No

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

**II.A.2. Was the DPS listed prior to 1996?** Not applicable

**II.A.2.a. Prior to this 5-year review, was the DPS classification reviewed to ensure it meets the 1996 policy standards?** Not applicable

**II.A.2.b. Does the original listed entity meet the discreteness and significance elements of the 1996 DPS policy?** Not applicable

**II.A.3. Is there relevant new information regarding application of the DPS policy to this DPS (i.e., is there new information since the original (either pre- or post-1996) DPS listing that indicates a need for splitting out, combining or otherwise re-configuring DPSs, or that the listed entity is no longer consistent with the DPS policy)?** Not applicable to plant listings.

**II.A.4. Is there relevant new information that would lead you to consider listing this species as a DPS in accordance with the 1996 policy?** Not applicable to plant listings.

## II.B. Recovery Criteria

**II.B.1. Does the species have a final, approved recovery plan containing objective, measurable criteria?** No

**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?** Not applicable.

**II.B.2.b. Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and there is no new information to consider regarding existing or new threats)?** Not applicable.

**II.B.4. 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**

Hidden lake bluecurls was listed as threatened in 1998. In 1999, Bauder produced a report for California Department of Parks and Recreation detailing environmental factors and small-scale distribution (microdistribution) of the species. This report is the primary source of new information relevant to this 5-year review.

**II.C.1.a. Abundance, population trends (e.g. increasing, decreasing, stable), demographic features (e.g., age structure, sex ratio, family size, birth rate, age at mortality, mortality rate, etc.), or demographic trends:**

Hidden Lake bluecurls was known at the time of listing and is only known today from a single location, Hidden Lake. Located in a "shallow [granitic] depression or basin surrounded by slopes rising to 2682 m

(8,800 feet) on three sides," the outlet and overflow dropping down an escarpment to the east and desert below. Hidden Lake is a small (less than 0.97 hectares or 2.4 acres), shallow (1.3 m or 4.3 feet), seasonal lake at an elevation of about 2,650 meters (8,700 feet) in the Mount San Jacinto State Park Wilderness in the southeastern portion of the San Jacinto Mountains in Riverside County, California. It is the only naturally occurring body of water in this isolated mountain range. To the best of our knowledge, the habitat or ecosystem conditions remain unchanged since listing.

We noted in the final rule that the population sizes fluctuated from less than 50 to 10,000 individuals between 1979 and 1991. Though the Service reported in the final rule that the population size "declines during periods of either above or below normal precipitation because of its position along the perimeter of the vernal pool habitat," Bauder (1999) noted that:

> "[t]he size of the Hidden Lake blue curls population varies greatly from year to year, depending on the availability of suitable habitat, the presence of conditions suitable for germination and the amount of seed stored in the soil. The species appears to germinate and grow only on open soil that is exposed during the summer months when there is a drawdown of Hidden Lake and summer temperatures prevail. The extent of the drawdown, hence the area exposed, depends on the amount of precipitation during the prior wet season."

Despite these annual changes in size, the population is best characterized as stable because the variations are natural and tied primarily to the summer level of the lake. This conclusion is in keeping with the paper by Bauder and McMillan (1996) who concluded that "sub-regional climatic variables may be controlling [the] distribution" of the bluecurls and another montane vernal pool species from San Diego County. This apparent stability is enhanced by the observation that the subspecies is self-compatible (capable of producing viable seed by self-fertilization) and individual plants are not dependant on pollinators to produce seed (Spira 1980).

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

No papers have been published since listing dealing with the genetics of the species.

### II.C.1.c. Taxonomic classification or changes in nomenclature:

No taxonomic classifications or changes in nomenclature involving the species have been published since listing in 1998. In the latest treatment of *Trichostema* (Lewis 1993), the two subspecies of *Trichostema austromontanum* are distinguished by the length of the leaves at ascending nodes, with those of ssp. *compactum* smaller at succeedingly higher nodes and those of ssp. *austromontanum* equal to or greater than leaves at the preceding node. Lewis (1993) described the leaves of ssp. *compactum* as less than 30 mm long, while the leaves of ssp. *austromontanum* range up to 50 mm in length. Both subspecies are tetraploids with $2n = 28$ (Lewis 1945, 1960).

### 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.):

As discussed above, the Hidden Lake bluecurls is endemic to a single alpine lake. It is also restricted to a subset of the lake. In a study of the "microdistribution"(distribution over small-scales) of the subspecies, Bauder (1999) stated that:

> "Hidden Lake blue curls was found in a band from the edge of the lake basin (maximum high water line) across exposed, gravelly/sandy soils down into the basin, stopping short of inundated soil. Generally it occurred in the open, frequently in small clumps, and sometimes more or less hidden in stands of the native wetlands grass, *Deschampsia danthonioides* (hairgrass). Hidden Lake blue curls plants were often found at the base of the occasional rocks that stud the sandy soil surface. Plants were not found in areas of deep pine duff near the lake edge or dense stands of the perennial *Eleocharis macrostachys*, usually at lower elevations or in deeper water. Except for a few scattered plants found in August, 1991, Hidden Lake blue curls was absent from the south and west sides of the lake basin where the slope is steeper and less soil becomes exposed as water levels drop. These shores are also in deep shade during the afternoons and much cooler."

Despite the annual fluctuations in population size (less than 100 in 1993 to no more than 10,000 in 1992), no trends in spatial distribution have been detected ever for the Hidden Lake bluecurls.

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

The extent and distribution of habitat for the Hidden Lake bluecurls is fixed by the microtopography of a single alpine lake. In Bauder's (1999) microtopographic (topography over small-scales) mapping analysis of the Hidden Lake basin, she concluded that Hidden Lake at capacity "fits within a 130 m x 90 m (425 feet x 295 feet) rectangle with one corner cut off." Based on her map, Bauder (1999) estimated the maximum surface area of the lake was of 9668 $m^2$ (104,027 $feet^2$) or 0.97 hectares (2.4 acres). At the maximum depth of the lake of 1.3 m (4.3 feet), the low spot of the lake occupies a circular area approximately 76 $m^2$ (818 $feet^2$), somewhat west of the center of the lake basin. Bauder (1999) estimated the shoreline at high water to be 375 m (1,230 feet) long. Depending on the season and drawdown of the lake, the habitat of the Hidden Lake bluecurls would always be a subset of the lake basin.

**II.C.1.f. Other:**

Regarding other natural factors affecting the species, Bauder (1999) noted that "*Trichostema austromontanum* ssp. *compactum* appears to be a taxon that is rare for biological and geographical reasons and may be restricted to this one habitat by lack of other suitable habitats or scarcity of such habitats combined with a very low rate of dispersal and low probability of arriving at a time when temperatures and moisture needed for germination are present.

**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:** Consistent with the final rule, this factor is not applicable.

**III.C.2.b. Overutilization for commercial, recreational, scientific, or educational purposes:** Consistent with the final rule, this factor is not applicable.

**III.C.2.c. Disease or predation:** Consistent with the final rule, this factor is not applicable.

**III.C.2.d. Inadequacy of existing regulatory mechanisms:** As discussed in the final rule, the only existing regulatory mechanisms are 1) the conservation provisions under section 404 of the Federal Clean Water Act, and 2) the land management of the California Department of Parks And Recreation (State or State Parks). As concluded in the final rule regarding the former regulatory mechanism, "though *Trichostema austromontanum* ssp. *compactum* is associated with a single vernal pool, it would not be affected by the Clean Water Act because its entire distribution lies within Mount San Jacinto State Wilderness." This conclusion remains appropriate for the species. Regarding the latter existing regulatory mechanism, no management inadequacies were attributed to State Parks in the final rule. This conclusion remains appropriate for the species.

In fact, State Parks has worked toward protection of Hidden Lake bluecurls. The main focus of the protection and recovery for this species has been minimizing the threat of trampling from hikers and horseback riders. State Parks has taken several measures to reduce visitation to this area. Prior to listing, State Parks removed references to "Hidden Lake" from trail maps, and signs in the park. Since listing, they have continued to obscure user trails to the lake. In 2000, State Parks installed an additional barrier to exclude equestrian use (E. Guaracha, pers. comm. 2006). In 2002, as a part of their general plan, State Parks designated the Hidden Lake area, including the entire known population of Hidden Lake bluecurls, as the Hidden Divide Natural Preserve (CDPR 2002). This designation provides additional protection beyond that afforded to the surrounding San Jacinto State Park. Within the natural preserve, management goals are focused on protecting the sensitive resources. For example, within this area hikers must stay on official paths and cannot camp or picnic.

**III.C.2.e. Other natural or manmade factors affecting its continued existence:** The Service summarized in the 1998 final rule that only trampling and low numbers threatened *Trichostema austromontanum* ssp. *compactum*. Concluding that "[t]rampling by hikers and visitors has been noted at some sites" for most of the species included in the final rule, the Service further elaborated that

> "Due to its accessibility, and localized habitat, the *Trichostema austromontanum* ssp. *compactum* population at Mount San Jacinto State Wilderness is particularly vulnerable to trampling by recreational users. This site has

> been popular since the development of the Palm Springs tramway in 1964 and the Desert Divide Trail from 1979 to 1981 (Hamilton, pers. comm. 1996). Several measures were initiated by the State during the past decade to protect the vernal pool ecosystem and the *Trichostema* population, including removing references to the site from park interpretive materials and the elimination of marked trails to the lake. These measures, however, have not prevented on-going impacts from trampling by hikers and horses. Trampling by horses crushes plants and creates depressions that retain water where seeds and adult plants of *T. austromontanum* ssp. *compactum* drown (Hamilton 1991; Hamilton, pers. comm. 1996). Livestock concentrate their activities around ponds and vernal wetlands. As a result, impacts to mountain meadows may persist for decades."

Regarding the threat posed by low numbers, the Service concluded in the final rule that "[t]he limited numbers and extremely localized range of *Trichostema austromontana* [sic.] ssp. *compactum* make this taxon more susceptible to single disturbance events such as trampling during the flowering season or alteration of the local water table from soil compression." No supporting references for this statement were cited in the final rule. However, the conservation biology literature commonly notes the vulnerability of taxa known from one or very few locations and/or from small populations (e.g., Shaffer 1981, 1987; Meffe and Carroll 1997, Primack 1998; see also below).

As discussed above, changes in population size of Hidden Lake bluecurls (i.e., periodic low population numbers), especially absent evidence of trampling or other anthropogenic (i.e., human caused) impact, may be best characterized as natural variations or fluctuations tied to the annual level of the lake (cf. Bauder and McMillan 1996, Bauder 1999). As such, we cannot conclude at this time that these observed changes in numbers of this annual herb reflect an adverse change or trend in the seed bank of the species after flowering and seed dispersal each fall. More study is needed to determine whether population size significantly threatens *Trichostema austromontanum* ssp. *compactum*.

Paraphrasing the general principles of species conservation and reserve design used by Noss, O'Connell, and Murphy (1997), a species distributed across multiple sites within its native range is less susceptible to extinction than another similar species confined to far fewer sites. As a result, being restricted to a single small, seasonal lake clearly makes the species more vulnerable to stochastic (i.e., random, less predictable) threats. Using the

three categories described by Noss, O'Connell, and Murphy (1997), these threats would be 1) genetic (primarily loss of genetic variation), 2) demographic (principally extremely small population size), and 3) environmental threats (lake level changes and perhaps unknown events). The general conservation consequences regarding genetics and small population size were described by Barrett and Kohn (1991). However, given that *Trichostema austromontanum* ssp. *compactum* has doubtlessly only occupied this highly isolated, small site for an extremely long time and that no stochastic threats have been documented to date, non-anthropogenic threats remain largely theoretical at this time and in need of further study.

## II.D. Synthesis:

According to the final rule, the Service listed the Hidden Lake bluecurls as threatened instead of as endangered because "the State has taken measures to protect *Trichostema austromontanum*." The Service clarified in the rule that "[m]easures implemented by the State to obscure access routes to the only known locality of, and delete references to *Trichostema austromontanum* ssp. *compactum* in recreational literature afford this plant some measure of protection." Withdrawing the proposal to list the Hidden Lake bluecurls and other plants was "considered but not preferred because not listing these species would not provide adequate protection and would not be consistent with the Act." Given the lack of status information or field work for more a decade (since Bauder 1999), we cannot determine today whether State Parks, as we expect, has effectively managed the Hidden Lake area via signage and changes to their interpretive materials and trail system such that they have dealt with whatever threat is posed by trampling humans and horses. Further studies of the effectiveness of State Parks management likely would answer the question whether continued listing under the Endangered Species Act is appropriate.

The Service determined in the final rule that "the limited numbers and extremely localized range of . . . [Hidden Lake bluecurls] make this taxon more susceptible to single disturbance events such as trampling during the flowering season or alteration of the local water table from soil compression." As with the threat posed by trampling humans and horses, we cannot determine the significance of the stochastic threats potentially affecting the single population of the listed plant confined to a portion of a small vernal lake. As discussed by Bauder (1999) in detailing management recommendations for the plant, the germplasm storage of a small amount of seed at a botanic garden would provide "a modest form of insurance" for the Hidden Lake bluecurls from adverse stochastic events. In conclusion, if it can be demonstrated that 1) management by State Parks has been effective, 2) stochastic threats are not significant, and 3) sufficient seed has been banked for reintroduction after an adverse stochastic event, delisting would be

appropriate. Nonetheless, delisting may never be acceptable to some scientists given the largely irremediable threat posed by stochastic events to a single small population.

## III. RESULTS

### III.A. Recommended Classification:

At this point, no change is need. However, if it can be demonstrated that 1) management by State Parks has been effective, 2) stochastic threats are not significant, and 3) sufficient seed has been banked for reintroduction after an adverse stochastic event, delisting would be appropriate.

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

### III.B. New Recovery Priority Number: _15_

This number indicates that the taxon is a subspecies with a low degree of threat and a high potential for recovery. The change from 9 to 15 indicates that the degree of threat has decreased from moderate to low.

### II.C. If applicable, indicate the Listing and Reclassification Priority Number (FWS only):

**Reclassification (from Threatened to Endangered) Priority Number: ____**

**Reclassification (from Endangered to Threatened) Priority Number: ____**

**Delisting (Removal from list regardless of current classification) Priority Number: ____**

## IV. RECOMMENDATIONS FOR FUTURE ACTIONS –

We should visit the population and undertake any necessary studies to determine whether State Parks management, as expected, has been effective. To determine whether non-anthropogenic or stochastic threats are significant, we should work with State Parks and

California Department of Fish and Game (State Fish and Game) to assess demographic and ecological trends and potential stochastic threats (i.e., genetic, demographic, and environmental threats). To this end, we have secured funding to conduct a follow-up study to a report done by Bauder 1999 to determine the condition of the population and the effectiveness of the management by State Parks; to survey and sign the legal boundaries of the established natural preserve so the regulations designed to protect the Hidden Lake bluecurls can be enforced; and to establish a seed banking program that includes collection of seeds, a conservation strategy, and monitoring. We will work with State Parks, State Fish and Game, the California Native Plant Society and Rancho Santa Ana Botanic Garden (RSABG) to establish a seed or germplasm collection of *Trichostema austromontanum* ssp. *compactum*. Through a Memorandum of Understanding with the CDFG and Service, the RSABG is authorized and regularly utilized as the principle repository for germplasm collections of rare, threatened, and endangered California native plant species. This action will provide additional protection should stochastic events impact the lone population.

## V. REFERENCES -


Barrett, S.C.H., and J.R. Kohn. 1991. Genetic and evolutionary consequences of small population size in plants: Implications for conservation. *In*: Genetics and conservation of rare plants, eds. D.F. Falk and K.E. Holsinger, pages 3-30. Center for Plant Conservation, Oxford University Press, New York.

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Meffe, G.K. and C.R. Carroll. 1997. Principles of conservation biology. Sinauer Associates, Sunderland, Massachusettes.

Noss, R.F., M.A. O'Connell, and D.D. Murphy. 1997. The science of conservation planning. Island Press, Covelo, California.

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U.S. Fish and Wildlife Service. 1998. Endangered and threatened wildlife and plants; Final rule to determine endangered or threatened status for six plants from the mountains of southern California. *Federal Register* 63:49006-49022.

**Personal Communications**

Guaracha, Eduardo. 2006. Phone call from Eduardo Guaracho (Mount San Jacinto State Park) to Jonathan Snapp-Cook (Carlsbad Fish and Wildlife Office) on February 7, 2006.

**U.S. FISH AND WILDLIFE SERVICE**
**5-YEAR REVIEW of Hidden Lake bluecurls**
**(*Trichostema austromontanum* ssp. *compactum*)**

Current Classification Threatened
Recommendation resulting from the 5-Year Review

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

Appropriate Listing/Reclassification Priority Number 15

Review Conducted By Jim A. Bartel

**FIELD OFFICE APPROVAL:**

Field Supervisor, Fish and Wildlife Service

Approve _____ Date July 24, 2006

The lead Field Office must ensure that other offices within the range of the species have been provided adequate opportunity to review and comment prior to the review's completion. If a change in classification is recommended, written concurrence from other field offices is required.

**REGIONAL OFFICE APPROVAL:**

The Regional Director must sign all 5-year reviews, unless the authority has been delegated by the Regional Director to the Assistant Regional Director of Ecological Services.

Regional Director, Fish and Wildlife Service

Approve _____ Date JUL 28 2006

The Lead Region must ensure that other regions within the range of the species have been provided adequate opportunity to review and comment prior to the review's completion. If a change in classification is recommended, written concurrence from other regions is required.