INYO MOUNTAINS SALAMANDER

Batrachoseps campi Marlow, Brode, and Wake 1979

Status Summary

Batrachoseps campi is a Priority 3 Species of Special Concern, receiving a Total Score/Total Possible of 50% (55/110). During the previous evaluation, it was also considered a Species of Special Concern (Jennings and Hayes 1994a).

Identification

Batrachoseps campi is one of the largest and most robust members of the diverse plethodontid genus *Batrachoseps* (to 6.1 cm SVL) (Stebbins 2003). The head is relatively broad, and the tail is short compared to other *Batrachoseps* species. The body coloration is dark brown to blackish, with grayish or silvery dorsal spotting which ranges from very sparse to a continuous network. Individuals sometimes have a silvery or greenish cast overall (Stebbins 2003).

This species is the only salamander within its range and thus is unlikely to be confused with other species in the field. With the exception of the Kern Plateau salamander (*B. robustus*) and the largest individuals of the Tehachapi slender salamander (*B. stebbinsi*), other nearby *Batrachoseps* species are noticeably less robust and do not occur east of the Sierra crest. *Hydromantes* species may appear superficially similar

Inyo Mountains Salamander: Risk Factors

Ranking Criteria (Maximum Score)	Score
i. Range size (10)	10
ii. Distribution trend (25)	5
iii. Population concentration/ migration (10)	0
iv. Endemism (10)	10
v. Ecological tolerance (10)	10
vi. Population trend (25)	10
vii. Vulnerability to climate change (10)	0
viii. Projected impacts (10)	10
Total Score	55
Total Possible	110
Total Score/Total Possible	0.50

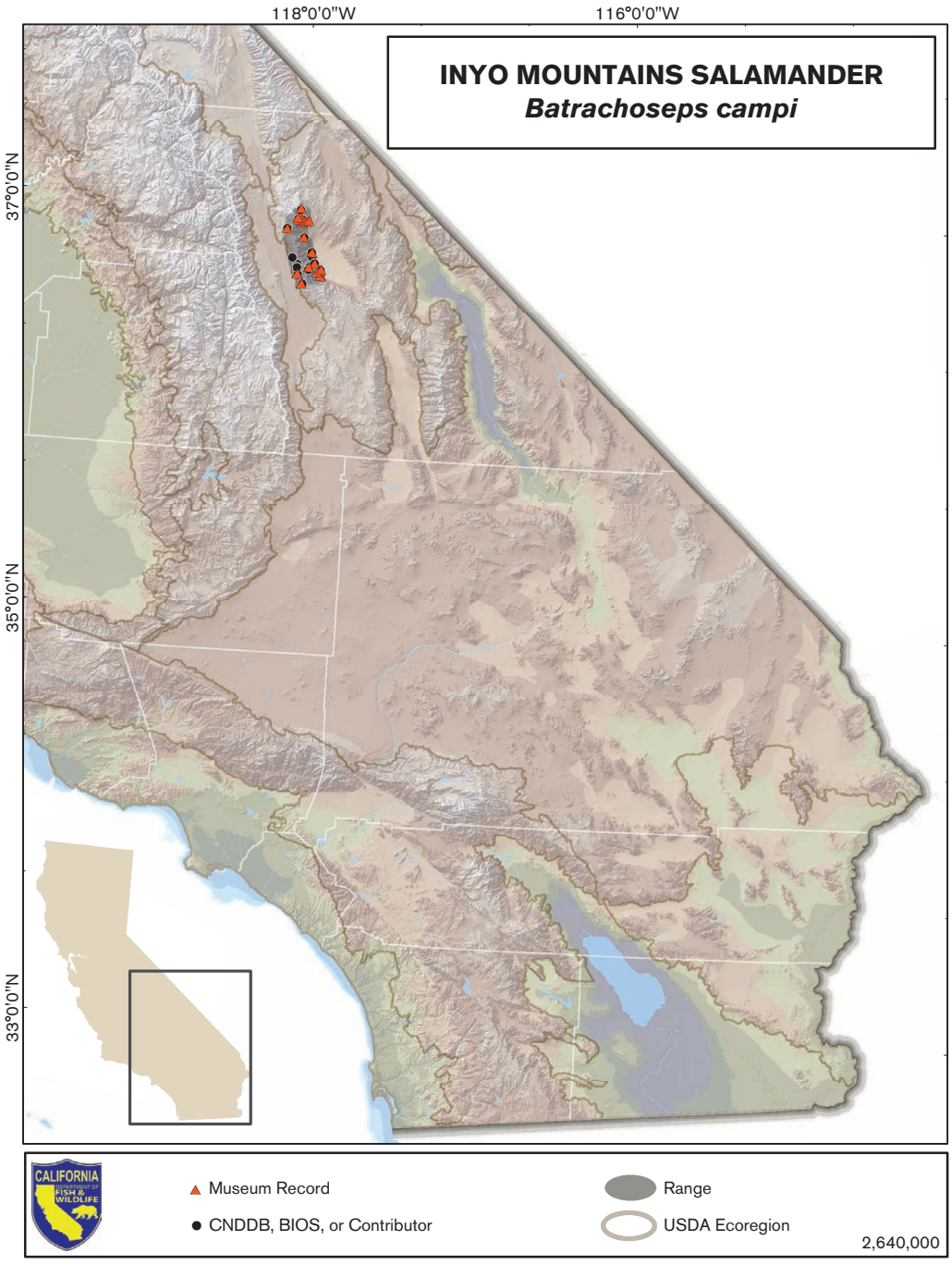

PHOTO ON PREVIOUS PAGE: Inyo Mountains salamander, Inyo County, California. Courtesy of Adam Clause.

but have five toes on the hind feet rather than four, as is the case in *Batrachoseps* (Stebbins 2003).

Taxonomic Relationships

This species is a member of the *Plethopsis* subgenus of *Batrachoseps*, which also includes the Oregon salamander (*B. wright*) from north central Oregon, and *B. robustus* from the Kern Plateau and western margins of Owens Valley in eastern California (Wake et al. 2002). *Plethopsis* can generally be characterized as a stout, robust group of *Batrachoseps* with relatively broad heads. *Batrachoseps campi* is morphologically distinguishable from other *Plethopsis* based on the presence of silvery iridophores, lack of dorsal stripe, and lack of white flecks ventrally (Marlow et al. 1979, Wake et al. 2002, Stebbins 2003). In addition, the species is genetically distinct at allozyme and mitochondrial loci (Yanev 1978, Yanev and Wake 1981, Jockusch and Wake 2002).

Life History

The life history of *Batrachoseps campi* is in need of further study. Its habitat differs somewhat from other closely related *Batrachoseps* species (e.g., *B. robustus*, *B. wrighti*), but information from these taxa is still likely to apply to *B. campi* in several respects. Surface activity occurs at night (Macey and Papenfuss 1991a) during which time the species presumably feeds on a variety of small insects. A life history study of the species is likely to provide important information for future management.

Habitat Requirements

Batrachoseps campi appears to be largely restricted to small patches of riparian habitat associated with perennial springs and limestone fissures in canyons of the Inyo Mountains. Localities where this species has been found contain wet rocks and fissures in close proximity to perennial water (Hansen and Wake 2005a). Salamanders are usually found under wet rocks or in clumps of moist ferns or other cover (Hansen and Wake 2005a). The species retreats into fissures and rock crevices when surface conditions are not favorable. Habitat surrounding these localized springs consists of Mojave Desert and Great Basin vegetational associations, which are unsuitable for the species. Individuals have only been found away from immediate proximity to flowing water at high-elevation sites in areas of pinyon–juniper woodland (Giuliani 1996, Hansen and Wake 2005a).

Distribution (Past and Present)

Batrachoseps campi is known from a small number of localities on the eastern and western slopes of the Inyo Mountains (Jennings and Hayes 1994a), although additional populations (presumably few) may be discovered in currently unsurveyed sites (Hansen and Wake 2005a). The known elevational range of the species extends from 490 to 2600 m (Macey and Papenfuss 1991a, Hansen and Wake 2005a).

Trends in Abundance

Populations may have declined or been extirpated at a few sites due to habitat modification, though population abundance data are essentially lacking (Papenfuss and Macey 1986). Although data are scarce, most known populations appear to be stable.

Nature and Degree of Threat

The primary threat to this taxon is habitat modification. The overall species range is very small (<20 ha total occupied habitat) and within that range consists of very small, isolated patches of suitable habitat (Hansen and Wake 2005a). The populations in each of these patches are isolated, so recolonization following extirpation is unlikely (Yanev and Wake 1981). Flash floods have scoured the canyon bottoms at some localities, destroying the riparian habitat, though salamander populations appear to persist and slowly recover (Giuliani 1996, Hansen and Wake 2005a). Damage to the sensitive riparian microhabitat from the capture and containment of springs (spring capping), mining, water diversion, and feral burro activity has

occurred at other localities (Papenfuss and Macey 1986). Much of the species' range is unprotected and is vulnerable to further modification.

Status Determination

Due to its small range size and isolated populations, this species is inherently vulnerable to decline. The springs that are essential to its existence are scarce within the species' range and are vulnerable to impacts from water diversion and habitat degradation from humans, livestock, and feral mammals. There are few data on the habitat requirements of this species and the extent to which the isolated population can withstand these impacts. For all of these reasons, a Priority 3 status is justified.

Management Recommendations

The primary management priority for *Batrachoseps campi* is to protect existing habitat. Restoration of degraded habitat would be helpful. However, given the dearth of information on habitat requirements, it is very difficult to know what kinds of restoration would most benefit the species. Thus, restoration efforts need to be informed by the research and monitoring efforts outlined below. Until that time, the riparian areas around desert springs should be protected from modification, specifically with respect to changes in hydrology and vegetation. Some populations, such as the one at Barrel Spring, Inyo County, California, are likely to be sensitive to relatively minor changes in hydrology (D. Wake, pers. comm.).

Monitoring, Research, and Survey Needs

While the key management priority for this species is simply to protect habitat and minimize disturbances, restoration efforts would require basic research on the size, habitat requirements, and occupancy of sites throughout the species' limited geographic range. In the course of this work, surveyors would need to undertake basic life history research to gather information on population sizes (both census and genetically determined effective population sizes), yearly activity cycles, habitat occupancy, and basic ecological data. Because habitat protection alone is likely to be sufficient to safeguard this species, it may be best to carry out this work only in areas where disturbance to the habitat can be minimized.

Additional desert spring habitat near the known distribution needs to be searched during times when surface moisture is high enough to bring salamanders to the surface, although minimizing damage to these rare habitats is a critical priority. Higher-elevation populations may be more dispersed across the landscape, and surveys should take this into account. Monitoring efforts need to be initiated at localities that have experienced habitat degradation to quantify the ability of *Batrachoseps campi* to tolerate habitat changes that occur as springs are managed for human or livestock needs.