# LAHONTAN MOUNTAIN SUCKER
## *Catostomus lahontan* (Rutter)

**Status: Moderate Concern.** The Lahontan mountain sucker does not appear to be at risk of extinction in California in the near future; however, many populations are declining and their range is fragmented.

**Description:** Mountain suckers are small (adults 12-20 cm TL), with subterminal mouths and full lips that are covered by many large papillae (Moyle 2002). Their lips are protrusible, have deep grooves where the upper and lower lips meet, and a cleft on the middle of the lower lip. The lower lip has two semicircular smooth areas along the inner margin next to a conspicuous cartilaginous plate that is used for scraping. The front of the upper lip is smooth. They have 75-92 scales along the lateral line and 23-37 gill rakers on the first gill arch. Fin rays typically number 10 (range 8-13) and nine for the dorsal and pelvic fins, respectively. An axillary process is easily visible at the base of the pelvic fins. Internally, their intestine is long (up to six times TL), and the lining of the abdominal cavity (peritoneum) is black. Their coloration is brown to olive green on the dorsal and lateral surfaces, white to yellow on their bellies, and dark brown in blotches in a lateral row or line. Mature males have two lateral bands, one red-orange on top of another that is black-green. Spawning males have tubercles covering their bodies and fins, with the exception of the dorsal fin. Tubercles on the enlarged anal fin become especially prominent. Spawning females also have tubercles but only on the top and sides of their heads and bodies. Larvae have relatively few dorsal-fin rays and a complete mid-ventral line of pigment from the heart to the vent (Snyder and Muth 2004).

**Taxonomic Relationships:** The Lahontan mountain sucker was originally described by Rutter (1903) as *Pantosteus lahontan*; the species was subsumed into *Catostomus platyrhynchus* by G.R. Smith (1966). The species was then revived by G.R. Smith et al. (2013), who described the complex taxonomic history of *Pantosteus* suckers as a distinct lineage within the genus *Catostomus*. The *Pantosteus* suckers are collectively referred to as mountain suckers, because they all tend to be small, occur mainly in mountain streams, and have a cartilaginous plate in their lower lip, used for scraping food organisms from rocks. Mountain suckers occur throughout western North America and G.R. Smith (1966) determined that there were six species within the group. Only one species, *C. platyrhynchus,* was recognized to encompass all mountain suckers in the Lahontan, Missouri, Snake, Bonneville, upper Green, and Columbia River drainages, which included California populations. However, based on combined morphometric, meristic, skeletal and mitochondrial DNA analyses, G. R. Smith et al. (2013) concluded that there were actually 11 modern species plus a number of fossil forms. *C. platyrhynchus* was re-divided into four species, including the Lahontan mountain sucker. This classification fits with the long isolation of Lahontan populations and the fact that a number of other Lahontan fishes are considered to be endemics (Moyle 2002).

**Life History:** Most studies on mountain suckers have been performed on other mountain sucker species outside of California; given the morphological similarity of the forms found throughout the west (Smith 1966, Smith et al. 2013), basic life history characteristics are also likely to be similar.

Mountain suckers (*C. jordani*) in Montana grow to 60-65 mm TL in their first year, 90-100 mm in their second year, and rarely exceed 17 cm TL as adults (Hauser 1969); growth rates in the first three years gradually decrease to a slow and constant rate. In Utah, *C. platyrhynchus* (as redefined by Smith et al. 2013) grow to 64 mm TL in their first year and reach 193 mm TL by the age of six years (Wydoski and Wydoski 2002). Growth is likely mediated by temperature and productivity of the stream in which they occur (Wydoski and Wydoski 2002). Lahontan mountain suckers likely have a similar growth pattern, based on length data (Moyle 2002). In populations that have been studied, males mature at 6-14 cm TL during their second or third year (Smith 1966, Marrin 1980). Females are larger, tend to mature later (second to fourth year at 9-17 cm TL), and live longer (7-9 years) than males (Smith 1966, Marrin 1980, Wydoski and Wydoski 2002). Fecundity can vary from 990 (at 13 cm TL) to 3,710 (at 18 cm TL) eggs per female (Marrin 1980) and is correlated to female total length but not age (Wydoski and Wydoski 2002). Mean egg diameter is also correlated to female total length.

Lahontan mountain suckers, unlike most stream-dwelling fishes in western North America, spawn in summer (June to early August), rather than spring (Olson and Erman 1987, Decker 1989). In California, adults have been observed moving into small streams during later July to feed on algae and to spawn (Decker and Erman 1992). Spawning probably occurs at night, in riffles located immediately below pools, at temperatures ranging from 9-19 °C (Olson and Erman 1987, Decker 1989). However, spawning adults were noted in Sagehen Creek (Nevada and Sierra counties) at temperatures ranging from 9 to 12 °C (Decker 1989). In Utah, *C. platyrhynchus* adults preferred to spawn in flowing water of 6-20 cm/s, in riffles that were 11-30 cm deep (Wydoski and Wydoski 2002). Fertilized eggs adhere to stream substrates. Larvae and juveniles move into the stream margins, favoring areas with beds of aquatic algae associated with pools (*C. jordani*, Hauser 1969). Lahontan mountain suckers hybridize with Tahoe suckers in streams where they co-occur (Decker 1989; T. Taylor, ENTRIX, pers. comm. 2009).

Lahontan mountain suckers feed primarily on algae and diatoms but will also feed on aquatic invertebrates (Smith 1966, Marrin 1980). Juveniles (< 30 mm TL) have a higher proportion of aquatic insects in their diet than adults (Marrin 1980). Adults will move into areas of filamentous algal blooms to forage (Decker 1989).

Lahontan mountain suckers have been observed shoaling with Tahoe suckers (Decker 1989), with which their abundance is positively correlated (Olson and Erman 1987). They are also often associated with alien brown and rainbow trout, which may prey on them (Moyle 2002, Olsen and Belk 2005, Giddings et al. 2006).

**Habitat Requirements:** Lahontan mountain suckers are characteristically found in shallow (< 2 m), clear, low-gradient streams; they are associated with diverse substrates, from sand to boulders, in areas with dense cover (macrophytes, logs, undercut banks) (Moyle 2002). They have been found in streams at elevations up to 2800 m and at temperatures of 1-25°C (Smith 1966). Cool (<20°C), clear water seemed to be the common characteristic among sites. In eastern Sierra Nevada streams, their abundance is positively correlated with pools but not riffles (Olson and Erman 1987, Decker 1989). They may also be found in larger, more turbid rivers and in some smaller lakes and reservoirs. They have not been found in large lakes such as Tahoe, Eagle, or Pyramid lakes and they seem to be largely absent from California reservoirs. In streams, they typically use habitats with water velocities of 0.1-0.5 m/sec and depths of 0.5-1.8m, especially areas with abundant cover such as root wads and emergent vegetation (Decker 1989; T. Taylor, ENTRIX, pers. comm. 2009). In the East Fork Carson River (Alpine and Douglas/Lyon (NV) counties), mountain suckers are found primarily in mainstem reaches dominated by riffles and runs with cobble-boulder substrates at elevations of 1400-1770 m; these habitats had fish assemblages of 6-8 other species, including various salmonids (Dienstadt et al. 2004).

Habitat use may shift in the presence of piscivores such as brown trout (*Salmo trutta*). Juvenile mountain suckers (*C. platyrhynchus*) in central Utah occurred in main channel pools when brown trout were absent, but occurred exclusively in backwaters and off-channel habitats when brown trout were present (Olsen and Belk 2005). Adults, in contrast, did not exhibit a shift in habitat use, probably because they escaped predation once they reached larger sizes. However, in streams in Wyoming and South Dakota, high densities of large brown trout were found to have a negative influence on occurrence of mountain suckers, regardless of age (Dauwalter and Rahel 2008).

**Distribution:** In California, Lahontan mountain suckers occur in the Walker, Carson, Truckee and Susan river drainages of the Lahontan basin in the eastern Sierra Nevada, but not in the Eagle Lake basin. They are also found in the North Fork Feather River (Sacramento River) drainage, mainly in Red Clover Creek, into which they were likely carried by a water diversion from the Little Truckee River (Moyle 2002). Although there is at least one specimen known from the Sacramento River, they do not appear to have spread much beyond Red Clover Creek. Lahontan suckers are also widely distributed in streams of the Lahontan Basin (e.g. Humboldt River), in the northern half of Nevada.

**Trends in Abundance:** Lahontan Mountain suckers appear to be in decline in their native range in California (Erman 1986, Olson and Erman 1987, Decker 1989, Moyle 2002), although Deinstadt et al. (2004) noted that numbers can be highly variable from year to year, based on electrofishing samples. The evidence of decline is mostly anecdotal, where suckers are rare or absent from streams in which they have been abundant in the past. For example, they disappeared from Sagehen Creek following construction of Stampede Reservoir, into which the creek now flows (V. Boucher and P. Moyle, unpublished data). Mountain suckers, however, apparently remain abundant in some streams, such as the East Fork Carson River and its tributary, Hot Springs Creek (Erman 1986). In the East Fork Carson River, mountain sucker densities were estimated to range from 27 to 1,922 fish per mile in the 1980s and 1990s, depending on year of sampling and reach sampled, although estimates were not regarded as very reliable (Deinstadt et al. 2004). Mountain suckers rarely persist in reservoirs in California and smaller tributary streams upstream of reservoirs generally support only small populations, making them vulnerable to extirpation (e.g., Sagehen Creek). Once thought to occur in large numbers in the upper Truckee River (Moyle 2002), Lahontan mountain suckers are now infrequently found there (T. Taylor, ENTRIX, pers. comm. 2009).

**Nature and Degree of Threats:** Stream impoundment, sedimentation, passage barriers (dams, culverts), interactions with alien species, and hybridization with other sucker species have been noted as threats to various species of mountain suckers (Patton et al. 1998, Wydoski and Wydoski 2002, Belica and Nibbelink 2006). In California, impoundments, predation by brown trout, and habitat degradation due to grazing have been identified as significant limiting factors (Table 1; Decker 1989, Moyle et al. 2002). Because the mountain sucker is, at best, only moderately tolerant of environmental change, the synergistic effects of multiple limiting factors that degrade habitats are presumably the causes of decline.

*Major dams.* Habitat degradation associated with dams (e.g., alteration of flow and thermal regimes, interruption of sediment recruitment, habitat fragmentation) negatively affects Lahontan mountain sucker abundance and distribution. In Sagehen Creek, impoundment first resulted in a decrease (88%) of the historical longitudinal distribution of mountain suckers (Decker 1989) and then their eventual elimination from this stream (Moyle, unpublished data). Impoundments reduce the amount of stream habitat available and reduce connectivity between mountain sucker habitats because mountain suckers do not colonize most reservoirs. Hybridization between mountain and Tahoe suckers may result from reduced populations of mountain suckers combined with increased populations of Tahoe suckers (which do well in reservoirs), resulting in introgressive hybridization and loss of the species.

*Agriculture.* The effects of agriculture upon mountain suckers have not been documented and would occur only in the lowermost reaches of streams. In these areas, there are likely impacts to aquatic habitats from channel alteration, irrigation diversions, polluted return water and similar consequences of farming along streams.

*Grazing.* Grazing can alter the quality of stream habitats for Lahontan mountain suckers by increasing turbidity (decreasing the quality of spawning gravel) and decreasing cover, especially undercut banks (Decker 1989, Moyle 2002). Past grazing pressure incised stream reaches in the upper Truckee River, resulting in siltation of stream substrates and loss of riparian vegetation that provided cover (T. Taylor, pers. comm. 2009).

*Rural residential and urbanization.* The streams in which mountain suckers occur are affected by rapidly expanding urban and suburban areas (e.g.,Truckee), or areas pressured with development of recreational homes and ski, golf and other types of resorts. The effects of increasing development on suckers has not been documented but negative effects from stream alteration, siltation from run-off, septic pollution, fertilizers and other pollutants from landscape runoff and similar stressors are likely reducing the amount of suitable mountain sucker habitat within their range.

*Mining*. The legacy effects of hard rock mining in the region include acid mine drainage and stream alteration but effects on mountain suckers are not well documented. Silver and gold mining during the Comstock Lode era likely contributed substantially to degradation of stream and forest habitats, with the widespread development of 'boom and bust' mining towns and their demand for natural resources, but the legacy effects on mountain suckers and other native Lahontan fishes is unknown.

*Transportation.* Roads are generally associated with declines in fish abundance and diversity in the Sierra Nevada (Moyle and Randall 1998). In the eastern Sierra Nevada, major highways follow the courses of large rivers (e.g. Truckee, Carson rivers) and alter habitats by confining streams, reducing riparian trees and cover, and allowing for increasing development of the region, which impacts streams through habitat alteration, pollution, and diversions. Logging, mining, and agriculture are also associated with increased densities of secondary roads, which directly impact streams through channel alteration and indirectly affect them through increased siltation, removal of riparian cover, and other environmental changes.

*Logging*. Logging is pervasive throughout the Lahontan mountain sucker's range and, while practices are now much more stream and fish 'friendly' than in the past, logging may still negatively impact streams in which mountain suckers occur. Of greater concern are the legacy effects of intensive logging during the $19^{th}$ and 20th centuries (much of which supported Comstock Lode mines and mining towns), which dramatically altered streams, with lasting impacts that continue to impair aquatic ecosystem functions. Large rivers in the eastern Sierra Nevada (e.g., Truckee, East Fork Carson) were used as natural sluices to extract millions of board feet of timber from headwater basins during the latter part of the $19^{th}$ century, causing extensive and, in some cases, lasting environmental damage. For example, large woody debris remains generally absent in many streams that would otherwise provide cover and feeding areas for mountain suckers.

*Fire*. Fire is a natural and ongoing occurrence in the Lahontan region but the effects of fire upon mountain suckers are unknown. Because fire has been suppressed for many decades, catastrophic fires, with the potential to greatly alter stream habitats, are now more frequent and intense. The future impacts of fire may be exacerbated by predicted climate change outcomes, which may especially affect small, isolated populations in headwater stream reaches.

*Recreation.* Heavy recreational use, including ski and golf resorts, has altered some streams, especially through sedimentation, pollution input, or perhaps changed behavior of fishes (e.g. through rafting, swimming, or angling). Effects on mountain suckers are not known but are likely minimal.

*Alien species.* The presence of alien species (e.g. brown trout) can relegate mountain suckers to suboptimal habitats and subject them to increased predation and physiological costs (Olsen and Belk 2005, Belica and Nibbelink 2006, Giddings et al. 2006). Habitat use shifts by juvenile mountain suckers can reduce growth and decrease energy available for reproduction (Olsen and Belk 2005). Nonlethal effects, due to increased physiological costs, may result in additional population declines. In the Truckee River, one of the larger mainstem rivers within their range in California, mountain suckers face threats from interactions with non-native fishes including largemouth bass, bluegill, and brown bullhead, as well as brown, brook and rainbow trouts (T. Taylor, pers. comm. 2009). A more recent threat is the rapid spread of smallmouth bass in the Truckee River watershed, apparently introduced by anglers (Moyle, personal observations).

| | Rating | Explanation |
|---|---|---|
| Major dams | Medium | Impoundments fragment populations |
| Agriculture | Low | Increased turbidity and water temperatures may affect some populations |
| Grazing | Medium | Grazing decreases water quality, reduces riparian cover, and incises streams |
| Rural residential | Medium | Suburbanization is a growing problem in their range, which can reduce water and habitat quality |
| Urbanization | Medium | Urban areas tend to concentrate along streams that support mountain suckers |
| Instream mining | n/a | |
| Mining | Low | Present in region with toxic effluents, but effects not documented |
| Transportation | Medium | Highways and railroads parallel many streams, reducing edge habitat and potentially increasing sediment and pollutant input |
| Logging | Medium | Logging is a principal land use around mountain sucker streams and may increase sedimentation, etc. |
| Fire | Low | Fire is a natural and recurrent phenomenon in the region but effects on suckers are unknown; fire suppression, coupled with predicted climate change outcomes, may increase future impacts |
| Estuary alteration | n/a | |
| Recreation | Low | Heavy recreational use, including ski and golf resorts, has altered some streams, especially through sedimentation |
| Harvest | n/a | |
| Hatcheries | n/a | |
| Alien species | Medium | Interactions with alien species (e.g. brown trout) may interfere with mountain sucker utilization of preferred habitats and reduce populations through predation |

**Table 1.** Major anthropogenic factors limiting, or potentially limiting, viability of populations of Lahontan mountain sucker in California. Factors were rated on a five-level ordinal scale where a factor rated "critical" could push a species to extinction in 3 generations or 10 years, whichever is less; a factor rated "high" could push the species to extinction in 10 generations or 50 years whichever is less; a factor rated "medium" is unlikely to drive a species to extinction by itself but contributes to increased extinction risk; a factor rated "low" may reduce populations but extinction is unlikely as a result. A factor rated "n/a" has no known negative impact. Certainty of these judgments is moderate. See methods section for descriptions of the factors and explanation of the rating protocol.

**Effects of Climate Change:** Predicted climate change impacts on Lahontan mountain sucker populations and their habitats in California will vary by location. In general, water temperatures are expected to increase and the flow regime of streams will become more variable as the result of more frequent and extreme droughts and floods. Water temperatures are predicted to increase, on average, by at least 0.7°C by 2099, based on conversion factors developed by Eaton and Scheller (1996). Lahontan mountain suckers are generally found in water <20°C (Decker 1989, Moyle 2002). Higher stream temperatures may reduce individual fitness by increasing physiological maintenance costs (Moyle and Cech 2004) and changes to hydrographs may change the spawning ecology of fishes (Parmenter 2008).

Elevated air temperatures associated with climate change will change the periodicity and magnitude of peak and base flows in streams due to a reduction in snow pack levels and seasonal retention. Predictions are that stream flow will increase in the winter and early spring and decrease in the fall and summer (Knox and Scheuring 1991, Field et al. 1999, CDWR 2006). Because mountain suckers spawn in the summer, spawning success may be especially impacted by lower base flows. Moyle et al. (2013) consider Lahontan mountain suckers to be "highly vulnerable" to eventual extinction in California as the result of climate change, reflecting both their apparent on-going decline and the high degree of uncertainty about the their status.

**Status Determination Score = 3.1 - Moderate Concern** (see Methods section, Table 2). Lahontan mountain suckers are a declining species in California (Decker 1989, Moyle 2002) and probably in Nevada as well; although many populations still persist, they are fragmented and subject to localized extinction (Table 2).

| Metric | Score | Justification |
|---|---|---|
| Area occupied | 3 | Found in three major watersheds |
| Estimated adult abundance | 4 | Populations in some rivers are assumed to be large |
| Intervention dependence | 4 | Persistence will require habitat improvements for most, if not all, streams |
| Tolerance | 3 | Moderately tolerant of low water quality |
| Genetic risk | 3 | Low numbers, isolation, habitat degradation and hybridization (with Tahoe suckers) threaten genetic integrity of most populations |
| Climate change | 2 | Dramatic changes to stream flows likely |
| Anthropogenic threats | 3 | See Table 1 |
| Average | 3.1 | 22/7 |
| Certainty (1-4) | 2 | Abundance and trend data generally not available |

**Table 2.** Metrics for determining the status of Lahontan mountain sucker in California, where 1 is a major negative factor contributing to status, 5 is factor with no or positive effects on status, and 2-4 are intermediate values. See methods section for further explanation.

**Management Recommendations:** The apparent decline of Lahontan mountain sucker populations in California may be indicative of the reduced capacity of northeastern Sierra

Nevada streams to support large and diverse populations of native fishes (Moyle 2002), especially since associated declines have also occurred in Lahontan speckled dace and mountain whitefish populations (Olson 1988). Consequently, a number of streams should be targeted for management for native fish communities, as part of a long-term conservation strategy to maintain the biotic integrity of Lahontan basin streams (Moyle 2002). Matrix demographic models suggested that most species of mountain suckers are particularly vulnerable to mortality when they are young of year, so the habitat needs and life history requirements of early stages need special attention (Belica and Nibbelink 2006).

Lahontan mountain suckers are a poorly understood species; basic research on their life history, physiology, and ecology is needed to provide guidance for their protection and for reversing apparent declines. It would be particularly beneficial to conduct a joint research program involving the state of Nevada, given that Nevada encompasses a large portion of the Lahontan mountain sucker's range. Such a program could potentially include NDOW, CDFW, universities, and/or federal agencies performing fisheries monitoring and recovery actions in both states (e.g., USFWS, USGS, USFS). Genetic studies to compare relatedness between California populations and those in the Humboldt River and other areas in Nevada would be of value in terms of developing management strategies to protect genetic and ecological diversity within the species. Specific management recommendations include:

*Dams and diversions.* Management measures to mitigate impacts of impoundments and diversion should include the removal of dams wherever possible and construction of structures that provide fish passage for non-game species. Where dam removal is not feasible, flows should be managed to enhance spawning by providing colder, higher flows in the summer. Water quality in tributaries to impoundments and reservoirs can be improved by management actions that reduce erosion and sustain riparian vegetation (e.g., through establishment of wide riparian buffer strips, improvements to secondary roads, or closure and restoration of under or non-utilized roads).

*Interactions with alien species.* Although Lahontan mountain sucker habitat use can presumably shift in response to the presence of alien predator species, refuges from predation are often only available in channels that have not been degraded (Olsen and Belk 2005). Strategies should be developed to reduce impacts from alien species, especially brown trout, which are highly piscivorous at larger sizes. Protection for mountain suckers and other native fishes can be enhanced by increasing instream cover complexity. Restoration actions that increase riparian vegetation and channel complexity should, thus, be developed and implemented. However, restoration plans need to be carefully designed and their potential impacts closely monitored, as a reduction (65-85%) in mountain sucker abundance has been tied to restoration activities aimed at increasing trout habitat (Glover and Ford 1990 in Quinn 1994).

*Loss of structural complexity.* As noted, mountain suckers can benefit from stream restoration projects that increase habitat complexity and improve water quality. In California, measures to restore heavily altered streams include the creation of new channels in areas with heavy incision (T. Taylor, pers. comm. 2009). In areas where cattle grazing still occurs, benefits can accrue from cattle exclusion fencing to protect stream channels, reduced allotment sizes and quicker rotation of cattle, closure of riparian areas to grazing for experimental impact and recovery studies, and establishment of drinking water sources outside the stream channel.  In other areas, roads may need to be moved away from stream banks, crossings reduced, and other measures taken to reduce their impacts.

Overall, management actions to benefit Lahontan mountain suckers will require two interrelated efforts: (1) a status survey; and (2) restoration and management of selected streams to favor native fish assemblages.  A status survey should be conducted at least once every five years, as part of a general survey of the status of native Lahontan basin fishes in California.  An initial survey should be set up to: (1) identify key sites for a monitoring program; (2) identify streams to manage specifically for native fishes; and (3) quantify the habitat requirements of mountain sucker.  Once key native fish restoration streams are identified, efforts should be made to protect habitats in order to enhance their ability to support native fishes.  For example, Martis Creek contains a nearly complete assemblage of native fishes but would benefit from restoration efforts (Kiernan and Moyle 2012).  Removal of Martis Creek Dam (listed as unsafe by the Army Corps of Engineers) would provide the opportunity for natural flow regimes to be re-established in the lower creek and to eliminate Martis Creek reservoir as a source of alien fishes such as green sunfish.

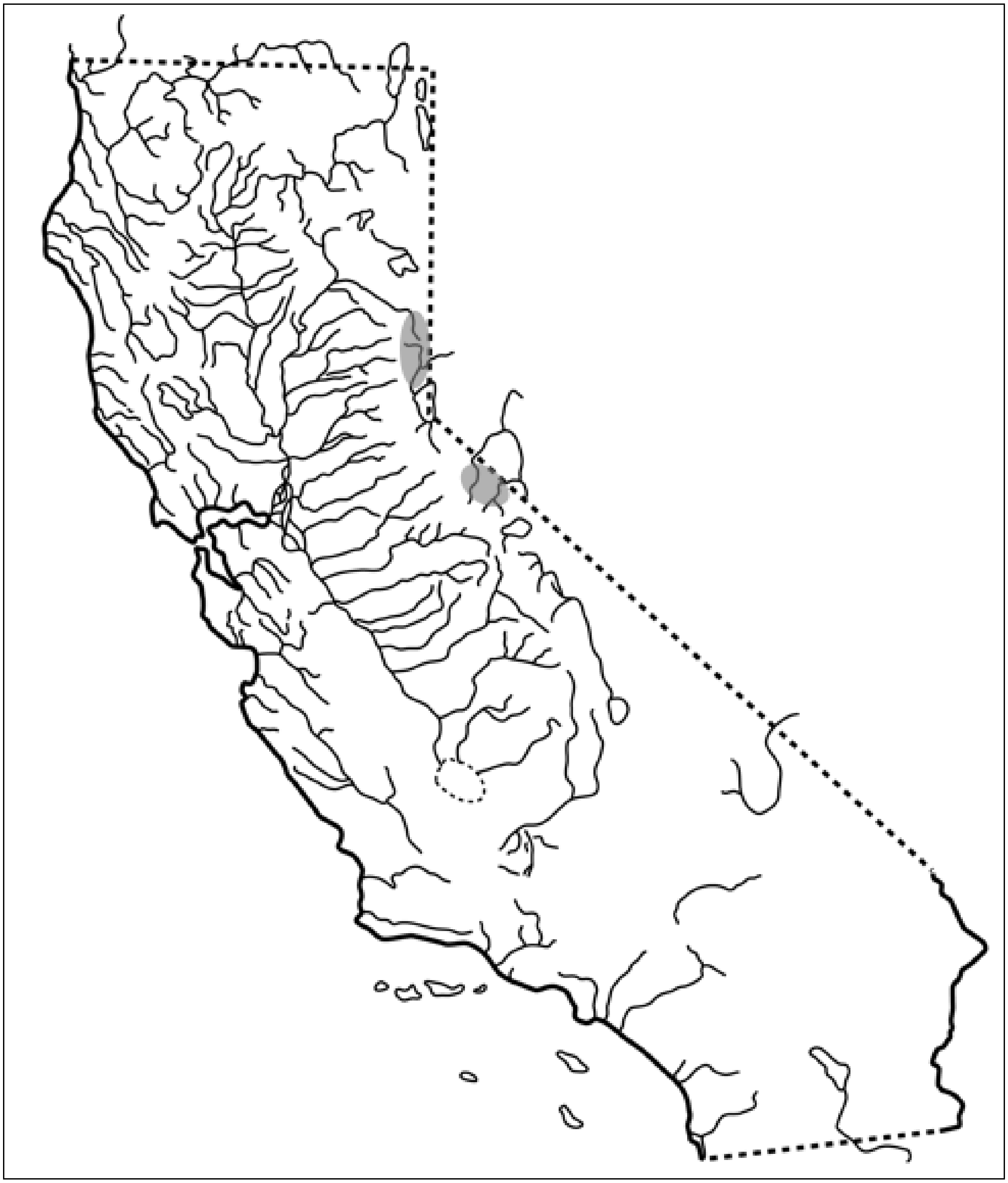

**Figure 1.** Generalized distribution of Lahontan mountain sucker, *Catostomus lahontan* (Rutter), in the Susan, Truckee, Carson, and Walker River basins in California. Presumed introduced population in Red Clover Creek (Sacramento River drainage) not shown.