Arroyo Chub (*Gila orcuttii*)
Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, February 2024
Revised, December 2024
Web Version, 8/1/2025

Organism Type: Fish
Overall Risk Assessment Category: High

Photo: Paul Barrett, U.S. Fish and Wildlife Service. Public domain. Available: https://invasions.si.edu/nemesis/species_summary/553278 (February 2024).

1 Native Range and Status in the United States

Native Range

From Fuller (2024):

"**Native Range:** Malibu Creek, Santa Clara, San Luis Rey, and Santa Margarita River drainages, southern California (Page and Burr 1991)."

From Fofonoff et al. (2018):

"Arroyo Chub (*Gila orcuttii*) are small minnows native to Pacific streams from the Santa Monica Bay basin south to the Santa Margarita basin [in California] (Page and Burr 1991; Moyle 2002; USGS Nonindigenous Aquatic Species Program 2018)."

Status in the United States

From Fofonoff et al. (2018):

"[*G. orcuttii*] have been extirpated from some streams due to heavy development and disturbance, especially around Los Angeles, and introduced to others. As a result, there is some disagreement about their native range (Swift et al. 1993; Page and Burr 1991; Moyle 2002; UC Davis PISCES 2014). Swift et al. (1993) map [sic] treats populations south of the Santa Monica basin as native, and those to the north as introduced, with some extirpated populations in the Los Angeles area. The invaded Pacific Slope streams include the Santa Ynez, Santa Maria, Cuyama, Santa Clara, and other smaller coastal streams (Swift et al. 1993; UC Davis PISCES 2014; USGS Nonindigenous Aquatic Species Program 2014). The northernmost introduced population is in Chorro Creek, in the drainage of Morro Bay (UC Davis PISCES 2014). Arroyo Chubs have also been introduced into Mohave River basin, flowing down the dry eastern side of the coastal range ((Swift [sic] et al. 1993)."

From O'Brien and Barabe (2022):

"The Arroyo Chub (*Gila orcutti*) is a small cyprinid native to coastal drainages of Los Angeles, Orange, Riverside, and San Diego counties. We surveyed the seven drainages historically known to support the species in 2012-2014 and again in 2019 to determine current range and distribution. We compared our results to the most recent species account we could locate (1993). We detected Arroyo Chub in 18 of the 40 streams (45%) and within six of the seven native watersheds in our 2012–2014 surveys, while our 2019 surveys located fish in all of the seven native watersheds. This native species has retreated to the headwaters in most watersheds and the number of populations have declined since the most recent species account."

No records were found of *Gila orcuttii* in trade in the United States.

Regulations

No species-specific regulations on possession or trade were found within the United States.

Means of Introductions within the United States

From Fuller (2024):

"Bait bucket release, stock contamination with trout and mosquitofish in the 1930s and 1940s (Swift et al. 1993). Although originally thought to be native to the Mohave River, it was later discovered that the species' presence was the result of bait introductions about 1930 by trout anglers (Miller et al. 1991). The stocking of San Felipe Creek was part of a series of experiments to test the effects of changed environment on meristic and morphometric characters (Miller 1968)."

Remarks

From Fuller (2024):

"Species of special concern in California. There is some disagreement in the literature concerning the extent of this species' native distribution. Miller (1968) and Bell (1978) concluded that its occurrence in the Santa Clara River system probably represented an introduction. Lee et al. (1980 et seq.) indicated that *G. orcutti* was possibly introduced into Malibu Creek and that it was widely introduced north to Santa Inez River and Mojave River of Death Valley drainage. In contrast, Moyle (1976a) included the upper Santa Clara River system as part of this species' native distribution. Page and Burr (1991) also included the Santa Clara drainage in its native range. Hubbs and Miller (1943) provided a detailed description of *G. bicolor mohavensis* [*Siphateles bicolor mohavensis*] x *G. orcuttii hybrids*. They also found evidence of backcrossing."

From O'Brien and Barabe (2022):

"The decline of California's native fishes has been well documented (Moyle 1976[a]; Moyle et al. 1989; Moyle et al. 1995; Moyle et al. 2011; Moyle et al. 2015), and Arroyo Chub are no exception. Reasons for the decline are numerous and include habitat loss, urbanization, water development, flood control, and the introduction of invasive species. These factors have led to a reduction in the preferred habitat of Arroyo Chub within the coastal plain of southern California. Unfortunately, it is impossible to accurately quantify the magnitude of this decline, because comprehensive, range-wide studies of Arroyo Chub prior to these anthropogenic impacts are absent. Swift et al. (1993) published the only range-wide assessment, while other reports have only described the species distribution within specific drainages (see Haglund and Baskin 1995; Warburton et al. 2000; O'Brien et al. 2011; Packard 2012)."

"Moyle et al. (2015) reported Arroyo Chub as vulnerable to extinction in its native range within the next 100 years but considers the species more stable when non-native populations are included."

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2024):

Kingdom Animalia
  Subkingdom Bilateria
    Infrakingdom Deuterostomia
      Phylum Chordata
        Subphylum Vertebrata
          Infraphylum Gnathostomata
            Superclass Actinopterygii

Class Teleostei
Superorder Ostariophysi
Order Cypriniformes
Superfamily Cyprinoidea
Family Leuciscidae
Subfamily Laviniinae
Genus *Gila* Baird and Girard, 1853
Species *Gila orcuttii* (Eigenmann and Eigenmann, 1890)

According to Fricke et al. (2024), *Gila orcuttii* (Eigenmann & Eigenmann 1890) is the current valid name for this species.

Size, Weight, and Age Range

From Fuller (2024):

"**Size:** 40 cm."

From Froese and Pauly (2024):

"Max length: 40.0 cm TL [total length] male/unsexed; [Page and Burr 2011]; max. reported age: 4 years [Hugg 1996]"

From Fofonoff et al. (2018):

"This fish can reach 400 mm, but it is usually less than 120 cm."

Environment

From Froese and Pauly (2024):

"Freshwater; benthopelagic."

From O'Brien and Barabe (2022):

"Typically, Arroyo Chub are found in slow-moving sections of cool to warm (10–26°C) streams dominated by sand and silt substrates (Wells and Diana 1975; Saiki et al. 2007; O'Brien et al. 2011), but Feeney and Swift (2008) found fish in pools with gravel, cobble, and boulder substrates, illustrating the diversity of habitat used by this species. These fish are adapted to survive the fluctuating conditions present in southern California streams, including warm, hypoxic conditions in summer (Castleberry and Cech 1986), and high flows and turbidity levels in winter."

From Fofonoff et al. (2018):

"Limnetic-Mesohaline. Salinities in the upper and middle sections of the Sant Clara estuary were 3-11 PSU (Laffety and Page 1997)."

From NatureServe (2024):

"Habitat for this species includes headwaters, creeks, and small to medium rivers, and often intermittent streams (Page and Burr 2011), permanent, small to moderate-sized, moderate to high gradient streams with more than 50% of the habitat as runs and pools < 10 cm deep and reaches of permanent water more than 2 km long and often spawns in stream pools. In natural habitat this species prefers slow moving sections of streams with sand or mud substrate. This species is physiologically adapted to hypoxic conditions and wide temperature fluctuations (Castleberry and Cech 1986, Moyle et al 2015)."

Climate

From Froese and Pauly (2024):

"Temperate; 35°N - 32°N"

Distribution Outside the United States

Native

The native range for this species is wholly within the United States. See section 1 for a complete description of the native range.

Introduced

According to FAO (2025), *G. orcuttii* was introduced to Mexico in 1955, but the species is not established in the wild in Mexico.

Means of Introduction Outside the United States

From FAO (2025):

"REASONS OF INTRODUCTION
off-site preservation"

Short Description

Froese and Pauly (2024):

"Dorsal soft rays (total): 8; Anal soft rays: 7. *Gila orcuttii* can be distinguised [sic] by the following characters: lateral line with 48-62 scales; dorsal fin with 8 rays; anal fin with 7 rays; pharyngeal teeth 2,5-4,2; small, slightly subterminal mouth; short, rounded snout; large eye; deep body; deep caudal peduncle; gray-olive above; often a dusky gray stripe along silver side [Page and Burr 2011]."

From Fofonoff et al. (2018):

"Arroyo Chub (*Gila orcutti*) are small to medium-sized freshwater fish belonging to Cyprinidae, the carp and minnow family. Fish of this family have a single dorsal fin, abdominal pelvic fins, a lateral line, and cycloid (circular) scales. They lack true spines in their fins. They lack teeth in their mouths but have 1-3 rows of pharyngeal teeth. Most fishes of this family have forked tails (Page and Burr 1991). The Arroyo Chub has a chunky body and a thick caudal peduncle. The mouth is small, the snout is rounded, and the eyes are relatively large. There are eight dorsal fin rays, seven anal fin rays, and 48 to 52 lateral line scales. The lateral line reaches the caudal peduncle. […] Males have larger fins than females and develop tubercles on the head during the breeding season. The body is olive dorsally, with silvery sides, and white ventrally. There is also a dusky-gray stripe along the side (Page and Burr 1991; Moyle 2002; UC Davis PICSES 2018)."

Biology

From Froese and Pauly (2024):

"Inhabits sandy and muddy bottoms of flowing pools and runs of headwaters creeks and small to medium rivers. Often found in intermittent streams [Page and Burr 2011]."

From Fofonoff et al. (2018):

"Spawning takes place in pools of streams from February through August but is most frequent in June and July. A group of males chases a female and rubs the female below the pelvic fins, stimulating release of the eggs. The males then fertilize the eggs, which adhere to vegetation, substrate and debris. Eggs are laid in small batches and hatch in about 4 days at 24 C. Larvae remain in the substrate or on the bottom for 3 or 4 days, and then swim to the surface to fill their swim bladders, and then swim in the water column. Fish reach the juvenile stage at about 21 mm and congregate in still or slow-flowing water with vegetation cover. They reach ~60 mm in their first year (Moyle 2002; Feeney and Swift 2008; [UC Davis PISCES 2018])."

From NatureServe (2024):

"Food Comments:
Aquatic insects, snails, and (mostly) algae. Feeds most abundantly on invertebrates in spring, least in winter (Moyle 1976[a]). Diet includes physids, pelecypods, Euparypus, Heliopsyche; apparently seeks mollusks associated with the bottom (Richards and Soltz 1986); also known to feed extensively on the roots of a floating water fern infested with nematodes (Moyle 1976[a])."

Human Uses

From Fofonoff et al. (2018):

"Arroyo Chubs are being studied for the biocontrol of mosquitos in southern California wetlands, as a substitute for the invasive Western Mosquitofish (*Gambusia affinis*). In experimental ponds, both fishes reduced mosquito larva abundance roughly equally, but Arroyo Chubs had less impact on non-target invertebrates (Van Dam and Walton 2007)."

Diseases

No information was found associating *Gila orcuttii* with any diseases listed by the World Organisation for Animal Health (2025).

From Archdeacon et al. (2010):

"The Asian fish tapeworm *Bothriocephalus acheilognathi* [now *Schyzocotyle acheilognathi*] (Cestoda: Bothriocephalidea) is an introduced fish parasite in the southwestern United States and is often considered a serious threat to native desert fishes. […] In California, […] arroyo chub have been reported as known hosts for the Asian fish tapeworm (Warburton et al. 2002). We confirmed […] arroyo chub as hosts for this parasite. Of all fish species examined, arroyo chub at Afton Canyon (an isolated pool in the Mojave River) exhibited the highest mean intensity, median intensity, and mean abundance of the Asian fish tapeworm."

From Murray (2022):

"A total of 214 *G. orcutti* […] were collected from the lower Santa Clara watershed. […] The internal parasite fauna consisted of 6 taxa, including 1 cestode (*S*[*chyzocotyle*] *acheilognathi*), 1 group of digenean diplostomid metacercariae comprised of *Ornithodiplostomum* sp. and *Posthodiplostomum sp*., 3 nematodes (*Rhabdochona* sp., *Contracaecum* sp., and larval acuariid cysts), and 1 acanthocephalan (unidentified cystacanth). The external parasite fauna consisted of 2 taxa, including 1 monogenean (*Gyrodactylus* sp.) and 1 copepod (*L*[*ernaea*] *cyprinacea*)."

Threat to Humans

No information was found on threats to humans from *Gila orcuttii*.

3 Impacts of Introductions

From Fuller (2024):

"Introduced *G. orcuttii* hybridized with endangered Mohave tui chub *G. bicolor mohavensis* [*Siphateles bicolor mohavensis*]; since its introduction in the 1930s the continued mass hybridization is believed to have replaced all, or most, pure stock of the tui chub in the Mohave River drainage (Hubbs and Miller 1943; Moyle 1976a, 1976b; Miller et al. 1991; Swift et al. 1993)."

From Chen et al. (2013):

"Mohave tui chubs [*Siphateles bicolor mohavensis*] have been eliminated from their natural range, following introduction of arroyo chubs (*Gila orcutti* Eigenmann and Eigenmann 1890). […] Presumably, arroyo chubs were introduced as fishing bait in tributary streams [of the Mojave River], where they remain established above dams and waterfalls, and from there spread downstream into the historic Mohave tui chub habitat. During the 1930s, Hubbs and Miller (1943) documented an increase in arroyo chubs, hybridization between arroyo chubs and Mohave tui chubs, and a rapid decline of the latter species in the Mojave River."

"Our results using microsatellites, larger sample sizes, and an additional collection locality at Afton Canyon increase the certainty and support the findings of May et al. (1997) that there is no evidence of Mohave tui chub ancestry within the extant Mojave River cyprinids. The abundant cyprinids in the Mojave River are arroyo chubs (*Gila orcutti*), notwithstanding Hubbs and Miller's 1943) observations of mass hybridization throughout the Mojave River. While hybridization may have occurred historically, the absence of hybrids today suggests reduced fitness, or infertility, may occur in F1 or subsequent introgressed progeny (e.g. F2 and backcross). In light of the fact that introgression was not responsible for the demise of the Mohave tui chub, we attribute their extirpation to competition with, and potential reproductive interference by, arroyo chubs—a species which is ironically better suited to contemporary conditions in the Mojave River."

From Fofonoff et al. (2018):

"They have had no reported ecological impact in estuaries, but they are being investigated as a less invasive mosquito biocontrol species in inland wetlands, and they have hybridized with native cyprinid species in inland watersheds."

"In the Cuyama River, Arroyo Chubs have hybridized extensively with the native California Roach (*Hesperoleucus symmetricus*) (Moyle 2002)."

No species-specific regulations on possession or trade were found within the United States.

4 History of Invasiveness

Gila orcuttii has been introduced and become established outside of its' native range. The introduction and establishment of *G. orcuttii* in the Mojave River has contributed to substantial declines or extirpation of populations of a native chub species through some combination of competition, hybridization, and reproductive interference. This species is not regulated and is not found in trade in the United States. Therefore, the History of Invasiveness for *Gila orcuttii* is classified as High.

5 Global Distribution

Figure 1. Reported global distribution of *Gila orcuttii*. Map from GBIF Secretariat (2023). Observations are reported from the United States. The observation in Kansas is a preserved specimen and does not represent an established population. Observations from Santa Rosa Island, Santa Catalina Island, San Felipe Creek (southern California), and the point off the coast of California do not represent established populations. Only observations representing established populations were included in the climate matching analysis.

6 Distribution Within the United States

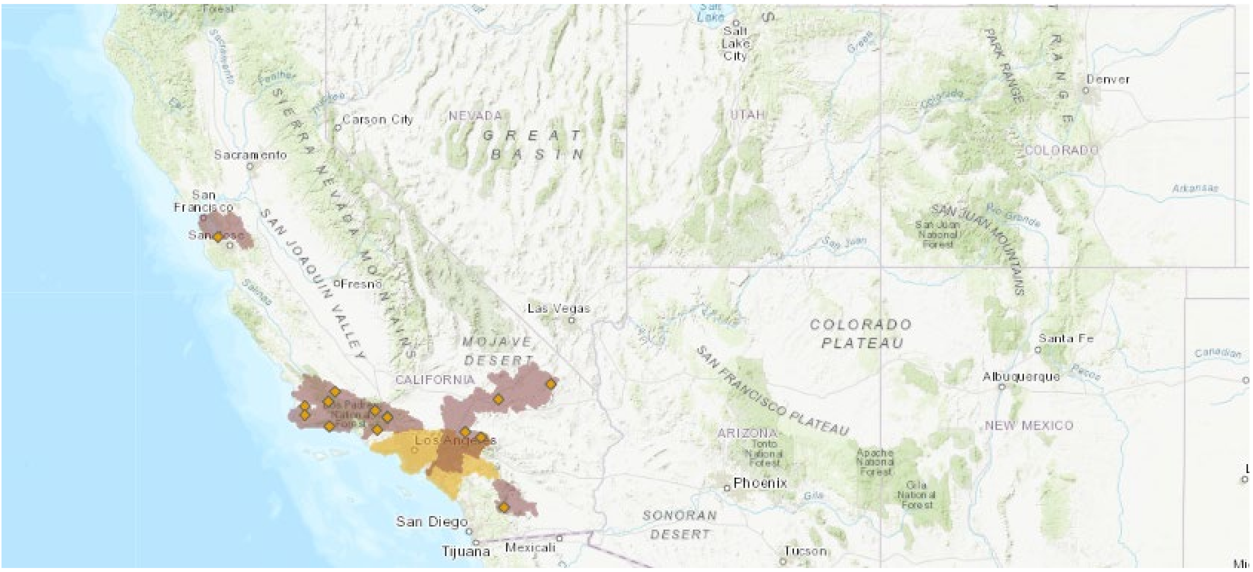

Figure 2. Reported distribution of *Gila orcuttii* in the United States. Map from Fuller (2024). Observations are reported from California. Native range (yellow) and nonnative range (brown) as shown. Orange points represent introductions of *G. orcuttii*. The introduction in San Felipe Creek (southern California) is reported to have failed and was not used as a source point in the climate matching analysis.

7 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Gila orcuttii* to the contiguous United States was high in southern and central California, western Arizona, and southern Nevada, with additional small areas of high match scattered in other areas west of the Rocky Mountains. Medium climate matches were present in portions of California, the Pacific Northwest, the Desert Southwest, the Great Basin, and in limited areas within the western Great Plains. Climate matches were low across the eastern contiguous United States to the Great Plains, as well as along the Rocky Mountains, Sierra Nevada, Cascade Range, and northern Pacific coastal areas. The overall Climate 6 score (Sanders et al. 2024; 16 climate variables; Euclidean distance) for the contiguous United States was 0.087, indicating that there is establishment concern for this species outside its native range. The Climate 6 score is calculated as: (count of target points with scores ≥ 6)/ (count of all target points). Establishment concern is warranted for Climate 6 scores greater than or equal to 0.002 based on an analysis of the establishment success of 356 nonnative aquatic species introduced to the United States (USFWS 2024).

Projected climate matches in the contiguous United States under future climate scenarios are available *Gila orcuttii* (see Appendix). These projected climate matches are provided as additional context for the reader; future climate scenarios are not factored into the Overall Risk Assessment Category.

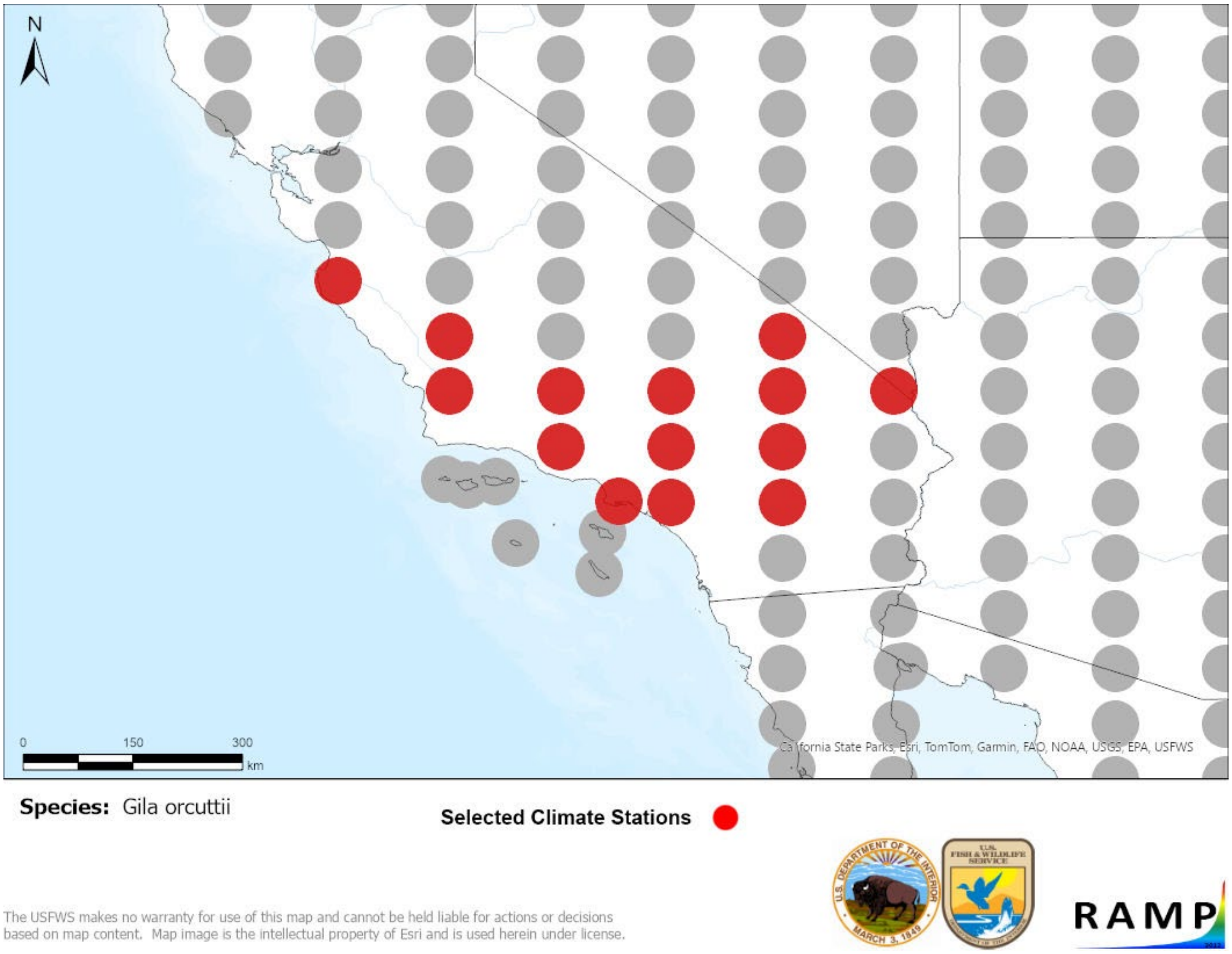

Figure 3. RAMP (Sanders et al. 2023) source map showing weather stations in the southwestern United States selected as source locations (red) and non-source locations (gray) for *Gila orcuttii* climate matching. Map from GBIF Secretariat (2023). Locations are within 100 km of one or more species occurrences, and do not necessarily represent the locations of occurrences themselves.

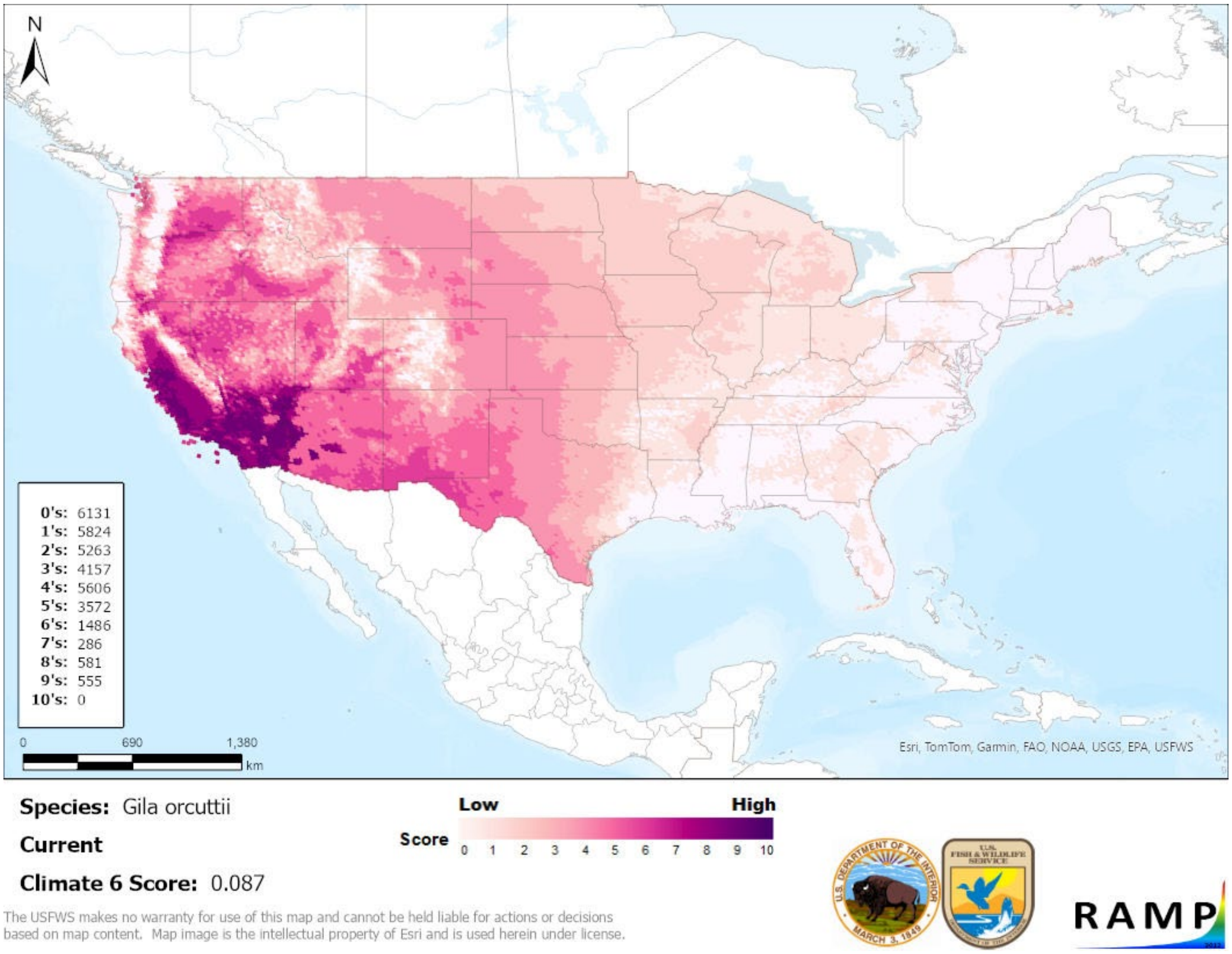

Figure 4. Map of RAMP (Sanders et al. 2023) climate matches for *Gila orcuttii* in the contiguous United States based on source locations reported by GBIF Secretariat (2023). Counts of climate match scores are tabulated on the left. 0/Pale Pink = Lowest match, 10/Dark Purple = Highest match.

8 Certainty of Assessment

The Certainty of Assessment for *Gila orcuttii* is classified as Medium. There is uncertainty regarding the native range of this species. However, there is clear and convincing information on the History of Invasiveness of *G. orcuttii* from nonnative established populations where the status of the population as established and nonnative is not in question.

9 Risk Assessment

Summary of Risk to the Contiguous United States

Gila orcuttii, Arroyo Chub, is a fish that is native to Pacific drainages along the southern California coast. *G. orcuttii* has been released in California outside its native range by means of bait bucket introductions and stock contamination, resulting in established populations throughout southern California. *Gila orcuttii* is not known to be in trade within the United States, and no species-specific regulations are known pertaining to its possession or transport as a nonnative species. The History of Invasiveness for *Gila orcuttii* is classified as High due to its successful establishment in nonnative aquatic habitats within southern California. These established populations have been linked to declines in the endangered Mohave tui chub (*Siphateles bicolor mohavensis*), and hybridization of nonnative *G. orcuttii* with multiple native species has been reported. The climate matching analysis for the contiguous United States indicates establishment concern for *Gila orcuttii* outside its native range. The highest climate matches were found in central and southern California, southern Nevada, and western Arizona. The Certainty of Assessment for this ERSS is classified as medium due to adequate evidence on history of invasiveness but uncertainty regarding parts of the native distribution of this species. The Overall Risk Assessment Category for *Gila orcuttii* in the contiguous United States is High.

Assessment Elements

- **History of Invasiveness (see Section 4): High**
- **Establishment Concern (see Section 7): Yes**
- **Certainty of Assessment (see Section 8): Medium**
- **Remarks, Important additional information: Declining within the native range and listed as a species of special concern in California.**
- **Overall Risk Assessment Category: High**

10 Literature Cited

Note: The following references were accessed for this ERSS. References cited within quoted text but not accessed are included below in section 11.

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11 Literature Cited in Quoted Material

Note: The following references are cited within quoted text within this ERSS, but were not accessed for its preparation. They are included here to provide the reader with more information.

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Appendix

Summary of Future Climate Matching Analysis

Future climate projections represent two Shared Socioeconomic Pathways (SSP) developed by the Intergovernmental Panel on Climate Change (IPCC 2021): SSP5, in which emissions triple by the end of the century; and SSP3, in which emissions double by the end of the century. Future climate matches were based on source locations reported by GBIF Secretariat (2023).

Under the future climate scenarios (figure A1), high climate match was seen for *Gila orcuttii* in the southwestern contiguous United States, specifically central and southern California, southern Nevada, and western and central Arizona. Areas of low climate match were projected to occur in all regions east of the Great Plains, as well as in coastal and mountainous parts of the Northern Pacific Coast region. The climate match was higher in the Great Plains under SSP5 than under SSP3. The Climate 6 scores for the individual future scenario models (figure A2) ranged from a low of 0.104 (model: UKESM1-0-LL, SSP5, 2085) to a high of 0.127 (model: MPI-ESM1-2-HR, SSP3, 2085). All future scenario Climate 6 scores were above the Establishment Concern threshold, indicating that Yes, there is establishment concern for this species under future scenarios. The Climate 6 score for the current climate match (0.087, figure 4) falls below the range of scores for future projections. The time step and climate scenario with the most change relative to current conditions was SSP5, 2085, the most extreme climate change scenario (figure A3). Under all time step and climate scenarios, areas within the Southwest saw a large increase in the climate match relative to current conditions. Western and central Arizona increased in climate match dramatically under all future scenarios relative to current conditions, especially under the more moderate scenarios. Additionally, primarily under time step 2085, areas within the Colorado Plateau, Great Basin, Northern Plains, and Western Mountains saw a moderate increase in the climate match relative to current conditions. Under one or more time step and climate scenarios, areas within California, the Northern Pacific Coast, Southwest, and Western Mountains saw a moderate decrease in the climate match relative to current conditions. No large decreases were observed regardless of time step and climate scenarios.

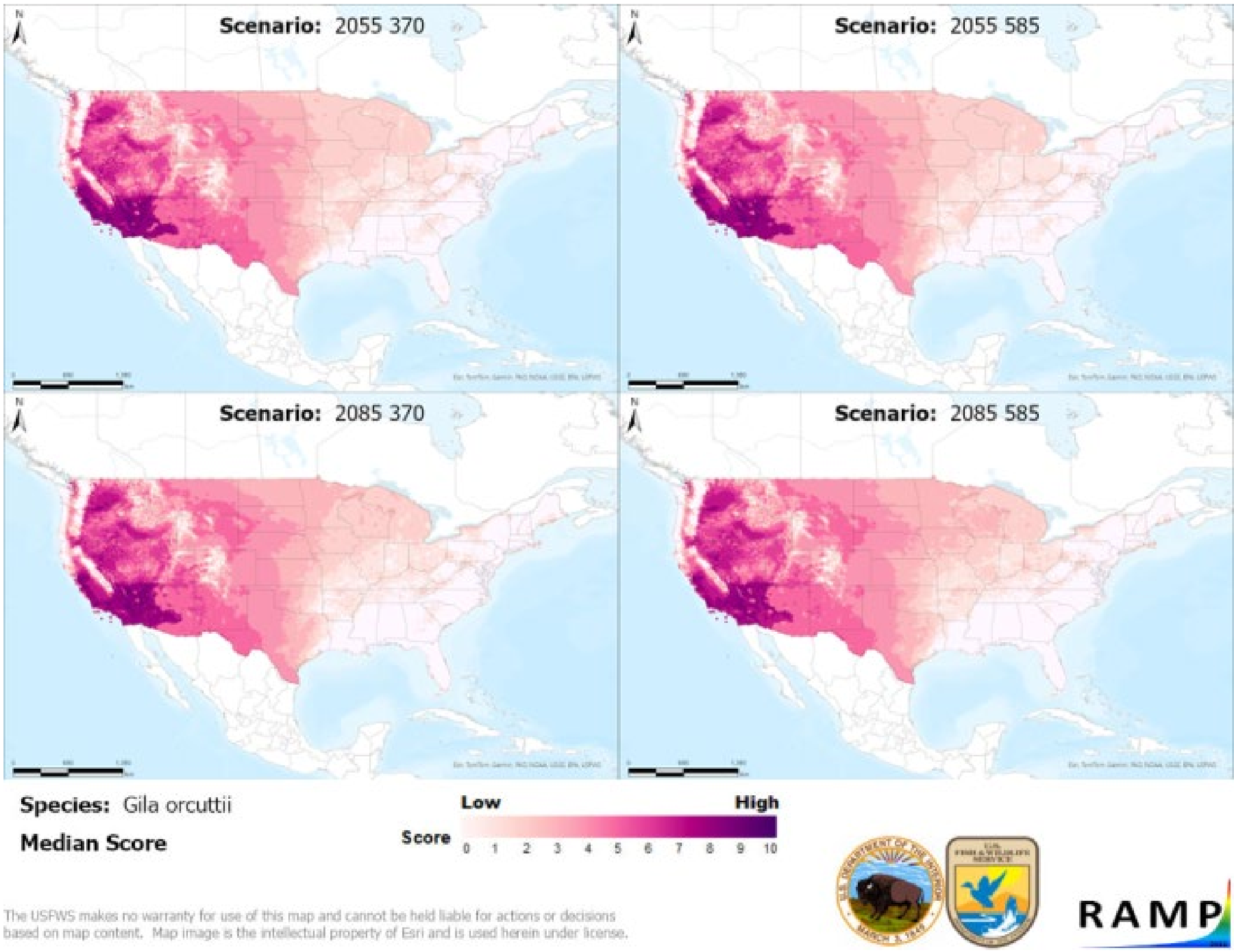

Figure A1. Maps of median RAMP (Sanders et al. 2023) climate matches projected under potential future climate conditions using five global climate models for *Gila orcuttii* in the contiguous United States. Climate matching is based on source locations reported by GBIF Secretariat (2023). Shared Socioeconomic Pathways (SSPs) used (from left to right): SSP3, SSP5 (IPCC 2021). Time steps: 2055 (top row) and 2085 (bottom row). Climate source data from CHELSA (Karger et al. 2017, 2018); global climate models used: GFDL-ESM4, UKESM1-0-LL, MPI-ESM1-2-HR, IPSL-CM6A-LR, and MRI-ESM2-0. 0/Pale Pink = Lowest match, 10/Dark Purple = Highest match.

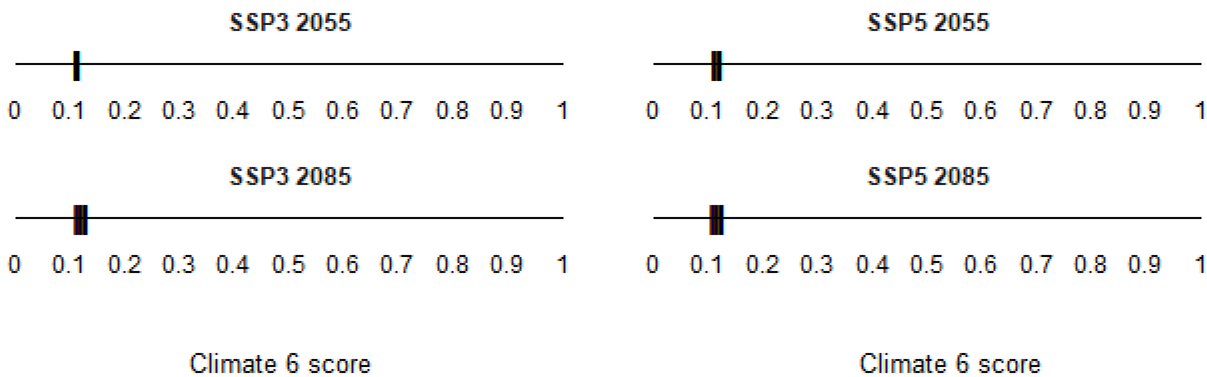

Figure A2. Comparison of projected future Climate 6 scores for *Gila orcuttii* in the contiguous United States for each of five global climate models under four combinations of Shared Socioeconomic Pathway (SSP) and time step. SSPs used (from left to right): SSP3, SSP5 (Karger et al. 2017, 2018; IPCC 2021). Time steps: 2055 (top row) and 2085 (bottom row). Climate source data from CHELSA (Karger et al. 2017, 2018); global climate models used: GFDL-ESM4, UKESM1-0-LL, MPI-ESM1-2-HR, IPSL-CM6A-LR, and MRI-ESM2-0.

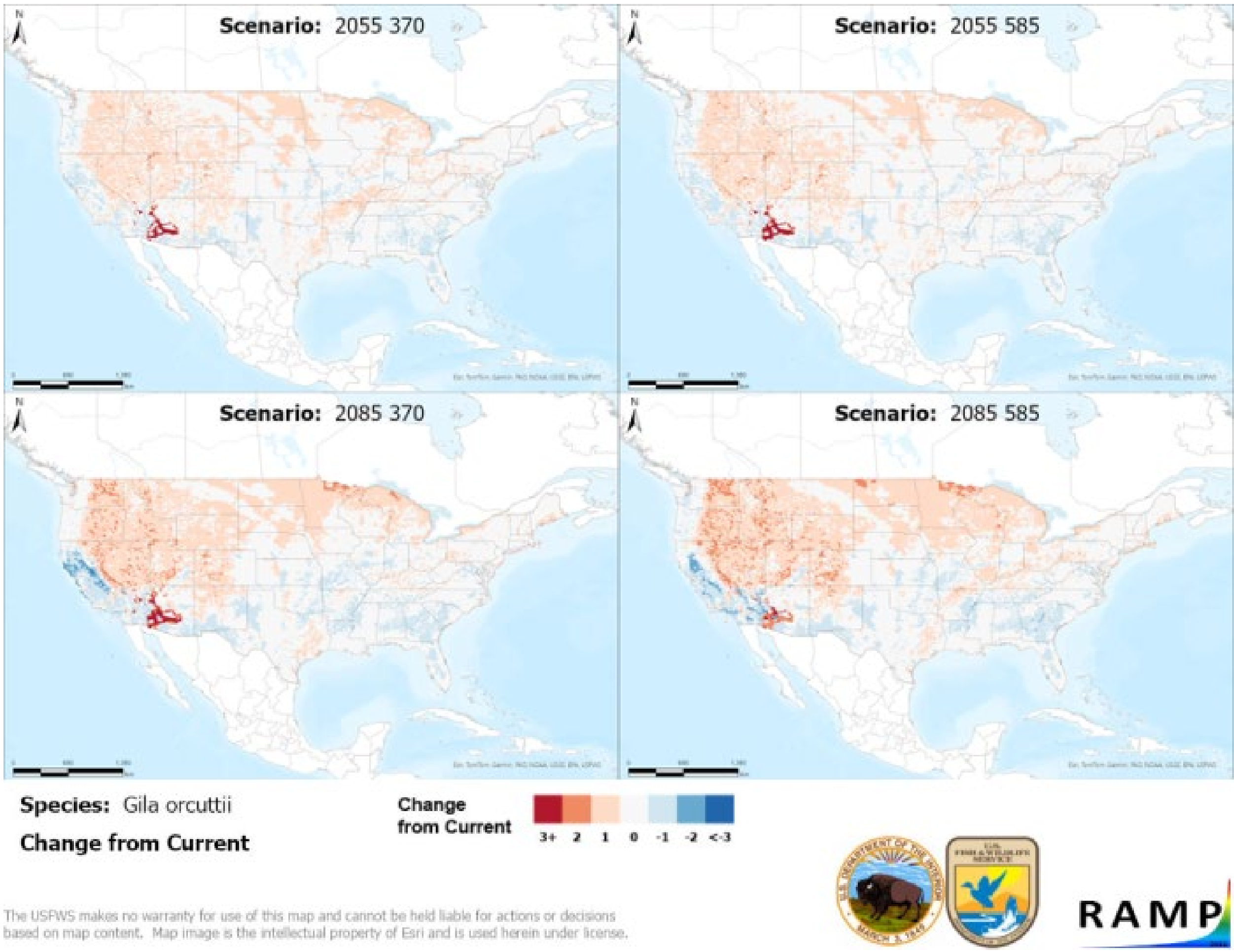

Figure A3. RAMP (Sanders et al. 2023) maps of the contiguous United States showing the difference between the current climate match target point score (figure 4) and the median target point score for future climate scenarios (figure A1) for *Gila orcuttii* based on source locations reported by GBIF Secretariat (2023). Shared Socioeconomic Pathways (SSPs) used (from left to right): SSP3, SSP5 (IPCC 2021). Time steps: 2055 (top row) and 2085 (bottom row). Climate source data from CHELSA (Karger et al. 2017, 2018); global models used: GFDL-ESM4, UKESM1-0-LL, MPI-ESM1-2-HR, IPSL-CM6A-LR, and MRI-ESM2-0. Shades of blue indicate a lower target point score under future scenarios than under current conditions. Shades of red indicate a higher target point score under future scenarios than under current conditions. Darker shades indicate greater change.

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