Sacramento Blackfish (*Orthodon microlepidotus*)
Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, November 2023
Revised, January 2024
Web Version, 8/12/2025

Organism Type: Fish
Overall Risk Assessment Category: Uncertain

Photo: René Reyes, U.S. Bureau of Reclamation. Public domain. Available: https://nas.er.usgs.gov/queries/FactSheet.aspx?SpeciesID=616 (November 2023).

1 Native Range and Status in the United States

Native Range

From Froese and Pauly (2023):

“North America: Sacramento-San Joaquin, Pajaro and Salinas River drainages [California]; Clear Lake in California, USA; […]”

Status in the United States

From Froese and Pauly (2023):

"North America: Sacramento-San Joaquin, Pajaro and Salinas River drainages; Clear Lake in California, USA; also Russian River, where possibly introduced; introduced to Santa Ana River in California and Humboldt River system in Nevada."

From Nico (2024):

"Native Range: Sacramento--San Joaquin, Pajaro, and Salinas River drainages; Clear Lake, California (Page and Burr 1991)."

"This species was eradicated from Lake Hughes, and (apparently) other Los Angeles County lakes in the early 1940s; it has been established in the lower Santa Ana River, California, since about 1986 (Swift et al. 1993). According to information given by Moyle (1976), the species apparently is established in the Russian River; however the status of the Carmel River population is questionable. La Rivers (1962) stated that all cyprinids in the Truckee Meadow Pond, Nevada, were "winterkilled" during 1948-1949 (the pond was subsequently drained). Even though it was suggested that the species may exist in drainage ditches east of Sparks, Nevada (La Rivers and Trelease 1952; La Rivers 1962); we are unaware of any reports verifying its occurrence in that area. Based on collections made in 1962, La Rivers (1962) concluded that the population was established in the area of the Lahontan Reservoir. Deacon and Williams (1984) also noted that it was established in Lahontan Reservoir."

From Byers and Vinyard (1990):

"Since first being detected in 1964, they have become the dominant fish species in Lahontan Reservoir, Churchill Co., NV (Sevon 1987)."

From Moyle (2002):

"They are present in a few central California reservoirs (e.g., Shasta, Hennessy, Lagoon Valley), but the extent of their distribution in these systems is poorly documented. […] They have been transported by the California Aqueduct to San Luis Reservoir (Merced County), where they are common, and they can be expected in any reservoir in southern California that contains water from the aqueduct."

This species is in trade in the United States, including the aquarium trade (e.g., Smart Fish Aquarium 2023), live food trade, and pond stocking.

From Nico (2024):

"A commercial fishery exists in California for this species, centered around the Chinese-American food trade (Moyle 1976; McGinnis 1984)."

From Byers and Vinyard (1990):

"They support commercial fisheries in Clear Lake, CA (Moyle 1976), San Luis Reservoir, CA (Moyle and Massingill 1980), Indian Lakes, NV, and Lahontan Reservoir, NV (Sevon 1984). In 1988, over 363 800 kg of blackfish were harvested from Lahontan Reservoir, NV (Sevon 1988). Because of their potentially high production rates, they have been proposed as possible candidates for aquaculture (Cech et al. 1979; Campagna and Cech 1981)."

From Cooper and Vigg (1985):

"Since 1981 a commercial fishing operation has been harvesting a monthly average of 16,900 Kg of Sacramento blackfish from the [Lahontan] reservoir."

A private hatchery in O'Neals, California, lists Sacramento Blackfish among the species it raises for pond and lake stocking (Willow Creek Fisheries 2024).

Regulations

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

Means of Introductions within the United States

From Nico (2024):

"The record from Truckee Valley Pond is based on a single specimen and several hybrids taken in the late 1940s (La Rivers and Trelease 1952); it was first discovered in the Lahontan Reservoir area in 1962 (downstream of the dam) (La Rivers 1962). R. R. Miller tentatively suggested that *Orthodon* may have gained access to the Truckee Meadow Pond through fish rescue material sent up from the Sacramento Valley (La Rivers and Trelease 1952; La Rivers 1962). The means [sic] introduction into other areas apparently is unknown (possibly unauthorized stockings by private individuals). According to Swift et al. (1993) this species was in Tweedy Lake, southern California in 1918 and subsequently spread into other Los Angeles County lakes."

From Moyle (2002):

"They have been transported by the California Aqueduct […]"

Remarks

From Nico (2024):

"There is some uncertainty concerning the native versus non-indigenous status of this species in the Russian River of California. Moyle (1976) stated that *Orthodon microlepidotus* was "apparently introduced into the Russian River." Based on their distribution map, Lee et al. (1980 et seq.) apparently considered it to be native to the Russian River. Minckley et al. (1986) listed it as native to the Sacramento River drainage; they made no mention of introductions. In its native range, hybrids have been reported with *Lavinia exilicauda* (Swift et al. 1993)."

Mention of commercial products in this Ecological Risk Screening Summary does not entail endorsement by the U.S. Federal Government.

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2023):

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 *Orthodon*
                            Species *Orthodon microlepidotus* (Ayres, 1854)

According to Fricke et al. (2023), *Orthodon microlepidotus* (Ayres 1854) is the current valid name for this species.

Size, Weight, and Age Range

From Froese and Pauly (2023):

"Dorsal soft rays (total): 9-11. Dorsal fin with 9-11 rays; dorsal-fin origin in front of pelvic-fin origin; 90-105 scales on lateral line"

"Max length: 55.0 cm TL [total length] male/unsexed; [Page and Burr 1991]; common length: 35.0 cm TL male/unsexed; [Hugg 1996]; max. reported age: 5 years [Altman and Dittmer 1962]"

Environment

From Froese and Pauly (2023):

"Freshwater; brackish, benthopelagic, […]"

"Occurs in lakes, backwaters and sluggish pools of small to large rivers. Usually found in warm turbid water [Page and Burr 1991]."

From NatureServe (2023):

"Typically found in warm, shallow, turbid waters, where current slight or absent, including reservoirs and small to large rivers (Moyle 1976, Page and Burr 1991). […] High tolerance for low oxygen conditions."

From University of California (2023):

"Sacramento blackfish prefer water temperatures in the range of 22-28°C. They have shown a great ability to adapt to extreme environments including water temperatures exceeding 30°C and salinities in excess of 9 ppt [parts per thousand]."

Climate

From Froese and Pauly (2023):

"Temperate; 39°N - 35°N"

Distribution Outside the United States

Introduced

According to FAO (2023), *O. microlepidotus* was introduced from the United States into China in 1982. It is unclear whether the fish were released into the wild in China.

Means of Introduction Outside the United States

According to FAO (2023), the entity that introduced *O. microlepidotus* to China is unknown, but the reason for introduction was aquaculture.

Short Description

From Froese and Pauly (2023):

"Dorsal soft rays (total): 9-11. Dorsal fin with 9-11 rays; dorsal-fin origin in front of pelvic-fin origin; 90-105 scales on lateral line; wide head, flat above; slightly upturned mouth; slender, compressed body; long narrow caudal peduncle; pharyngeal teeth 0,6-6,0 or 0,6-5,0; light to dark gray above, often olive sheen; silver side [Page and Burr 2011]."

Biology

From University of California (2023):

"Blackfish are typically suspension feeders with a diet of planktonic algae and zooplankton, including copepods, insect larvae, rotifers, cladocerans, and detritus. Young fish tend to feed in the water column or stream bottom on zooplankton and insects. Juvenile fish may school along lake shores where prey is abundant. As Sacramento blackfish grow they become increasingly reliant upon pumping suspended material into their mouths, using their gill rakers as a filter, and trapping food in mucous in the roof of their mouth. Adults can live on a diet of primarily organic matter and algae. Pond and lake inhabitants can feed on diatoms, algae, and zooplankton, or may pick up organic matter and small invertebrates from the bottom. Sacramento blackfish may become sexually mature in their first, second, third, or fourth years, depending upon their growth rate. Males tend to reach sexual maturity before the females, and the production of eggs in females seems to be directly related to body size. A female of 171 mm FL [fork length] may produce 14,700 eggs, while a female of 466 mm FL can produce some 346,500 eggs. Spawning generally occurs in spring but may happen anytime between March and July when water temperatures are in the range of 12-24°C. Spawning beds are usually found in areas of thick vegetation and shallow water. The eggs will cling to the local substrate till the larvae emerge and begin foraging in the same region."

Human Uses

From Nico (2024):

"A commercial fishery exists in California for this species, centered around the Chinese-American food trade (Moyle 1976; McGinnis 1984)."

From Byers and Vinyard (1990):

"They support commercial fisheries in Clear Lake, CA (Moyle 1976), San Luis Reservoir, CA (Moyle and Massingill 1980), Indian Lakes, NV, and Lahontan Reservoir, NV (Sevon 1984). In 1988, over 363 800 kg of blackfish were harvested from Lahontan Reservoir, NV (Sevon 1988). Because of their potentially high production rates, they have been proposed as possible candidates for aquaculture (Cech et al. 1979; Campagna and Cech 1981)."

From Cooper and Vigg (1985):

"Since 1981 a commercial fishing operation has been harvesting a monthly average of 16,900 Kg of Sacramento blackfish from the [Lahontan] reservoir."

A private hatchery in O'Neals, California, lists Sacramento Blackfish among the species it raises for pond and lake stocking (Willow Creek Fisheries 2024).

O. microlepidotus is also present in the aquarium trade (e.g., Smart Fish Aquarium 2023).

Diseases

No information was found associating *Orthodon microlepidotus* with any diseases listed by the World Organisation for Animal Health (2023).

According to Poelen et al. (2014), *Orthodon microlepidotus* is a host species to the following parasites: *Dactylogyrus microlepidotus, Steringotrema corpulentum, Pseudotagia cupida,* and *Telosentis tenuicornis*.

Threat to Humans

From Froese and Pauly (2023):

"Harmless"

3 Impacts of Introductions

The following quotations detail **potential, anecdotal,** or **highly generalized** information on impacts of introduction from *Orthodon microlepidotus*.

From Nico (2024):

"According to Burns (1966), Sacramento Blackfish compete with young game fish for food and space. Specimens taken from the Truckee Meadow pond included hybrids, presumably between *Orthodon* and "*Siphateles bicolor obesus*" (La Rivers and Trelease 1952; La Rivers 1962) (the latter form now recognized as *Gila bicolor obesa*)."

From Moyle (2002):

"They have been spread (and are still spreading) through introductions and aqueducts to a number of reservoirs, and their impacts on other fishes in these reservoirs and associated streams are not known. However, in Lahontan Reservoir, Nevada, blackfish apparently replaced native tui chub [*Gila bicolor*] as the most abundant species."

From Byers and Vinyard (1990):

"A series of mesocosm experiments was performed to assess the effects on the plankton community of filter-feeding Sacramento blackfish (Cyprinidae; *Orthodon microlepidotus*). Phytoplankton size-frequency distribution, zooplankton abundance, primary production, potential secondary production, and nutrient concentrations were measured. Blackfish reduce numbers of both evasive and non-evasive zooplankton and large phytoplankton while enhancing nanoplankton densities. Blackfish also significantly increase primary production and potential secondary community production. Levels of dissolved inorganic phosphorus and ammonia-nitrogen also increase. The effects of blackfish are generally similar to those reported for other filter-feeding fish."

"Blackfish affect the plankton community at several levels. When they are present, densities of most zooplankton taxa are lower, total algal biomass is higher, and small-particle densities are significantly higher. These changes in the plankton community are produced both directly and indirectly. Blackfish predation directly affects the plankton by selective filtration of particles ≥ 20 µm ESD (Johnson and Vinyard 1988), which includes virtually all larger algae and zooplankton. Indirect effects result from changes in community structure and perhaps from alteration of nutrient relationships within the plankton."

4 History of Invasiveness

The History of Invasiveness for *Orthodon microlepidotus* is classified as Data Deficient. *O. microlepidotus* has been introduced into the wild and become established outside its native range. However, there is limited information on the current status of nonnative introductions and on impacts of these introductions. *O. microlepidotus* has purportedly hybridized with or replaced a formerly common native species in Nevada, but no detailed information could be found to confirm the role of *O. microlepidotus* in the native species decline. Additionally, observed effects of *O. microlepidotus* on the plankton community in a mesocosm experiment may or may not translate to impacts in a natural setting.

5 Global Distribution

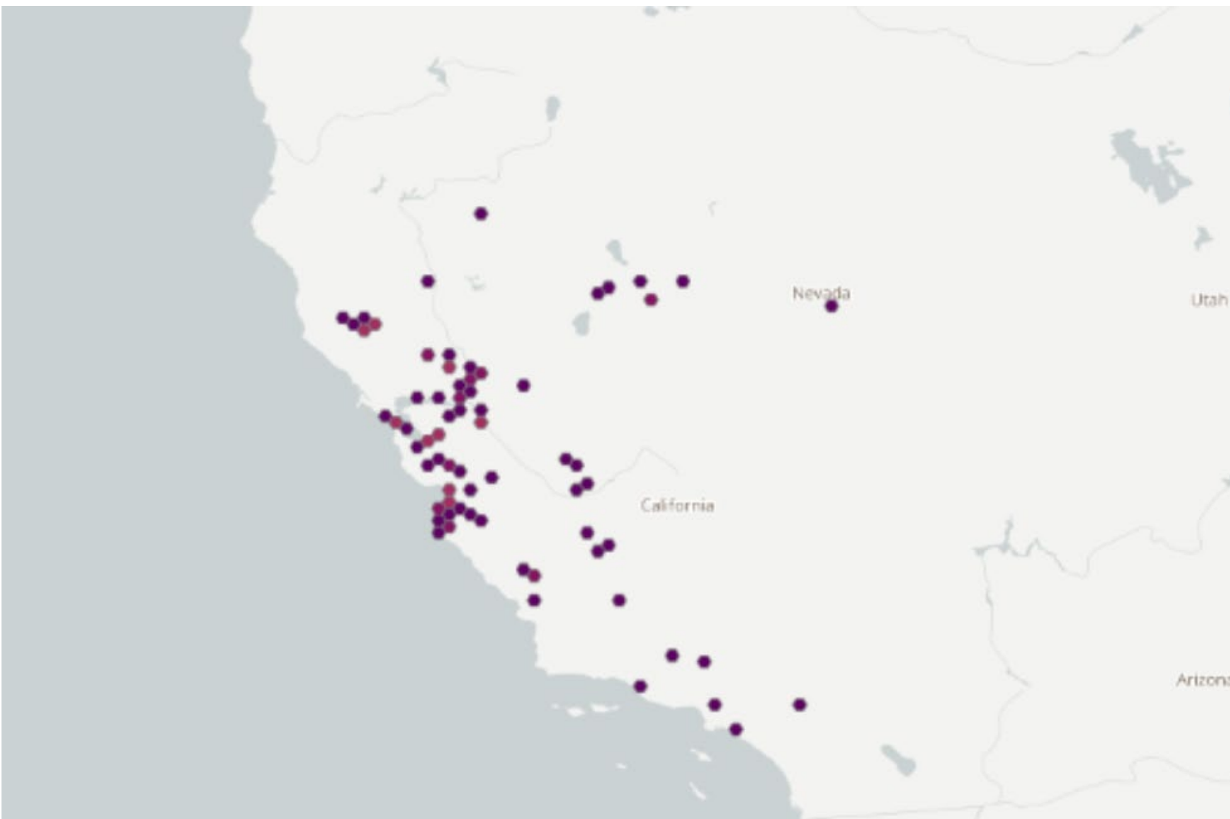

Figure 1. Reported global distribution of *Orthodon microlepidotus*. Map from GBIF Secretariat (2023). Observations are reported from California and Nevada. The point in central Nevada represents a state centroid and was not used to select source points for the climate matching analysis.

6 Distribution Within the United States

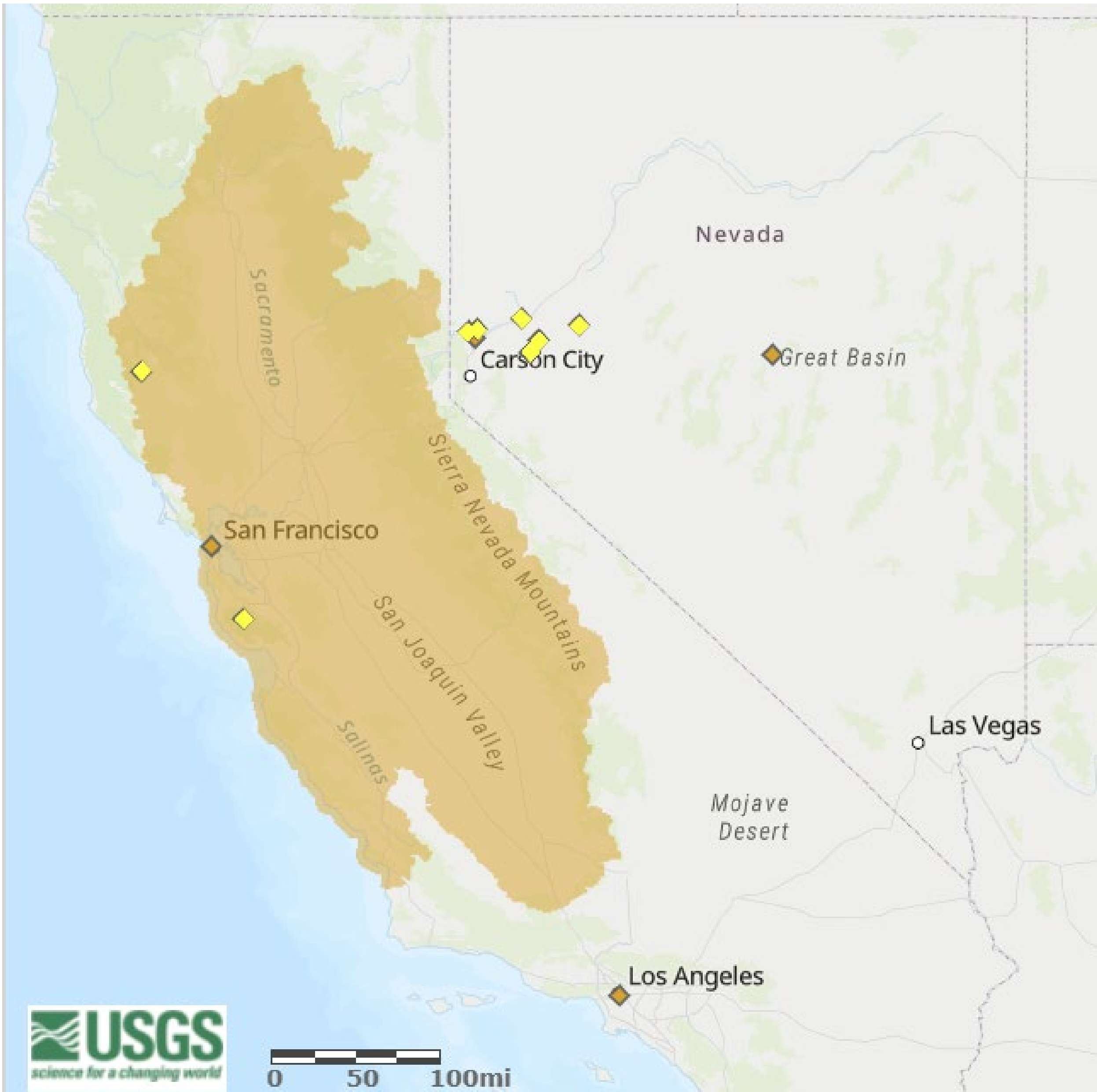

Figure 2. Reported distribution of *Orthodon microlepidotus* in the United States. Map from USGS (2025). Observations are reported from California and Nevada. Yellow diamonds represent established populations. Orange diamonds represent failed populations and other introductions that are not known to have resulted in establishment. The shaded orange polygon represents the native range of *O. microlepidotus*. Only established nonnative populations and occurrences within the native range were used to select source points for the climate matching analysis.

7 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Orthodon microlepidotus* to the contiguous United States was high west of the Rocky Mountains, especially in California, where the species is native. Areas of medium match were located just east of the Rockies and scattered through the Great Lakes. The rest of the eastern contiguous United States had a low climate match. The overall Climate 6 score (Sanders et al. 2023; 16 climate variables; Euclidean distance) for the contiguous United States was 0.218, indicating that Yes, 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 non-native aquatic species introduced to the United States (USFWS 2024).

Projected climate matches in the contiguous United States under future climate scenarios are available for *Orthodon microlepidotus* (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.

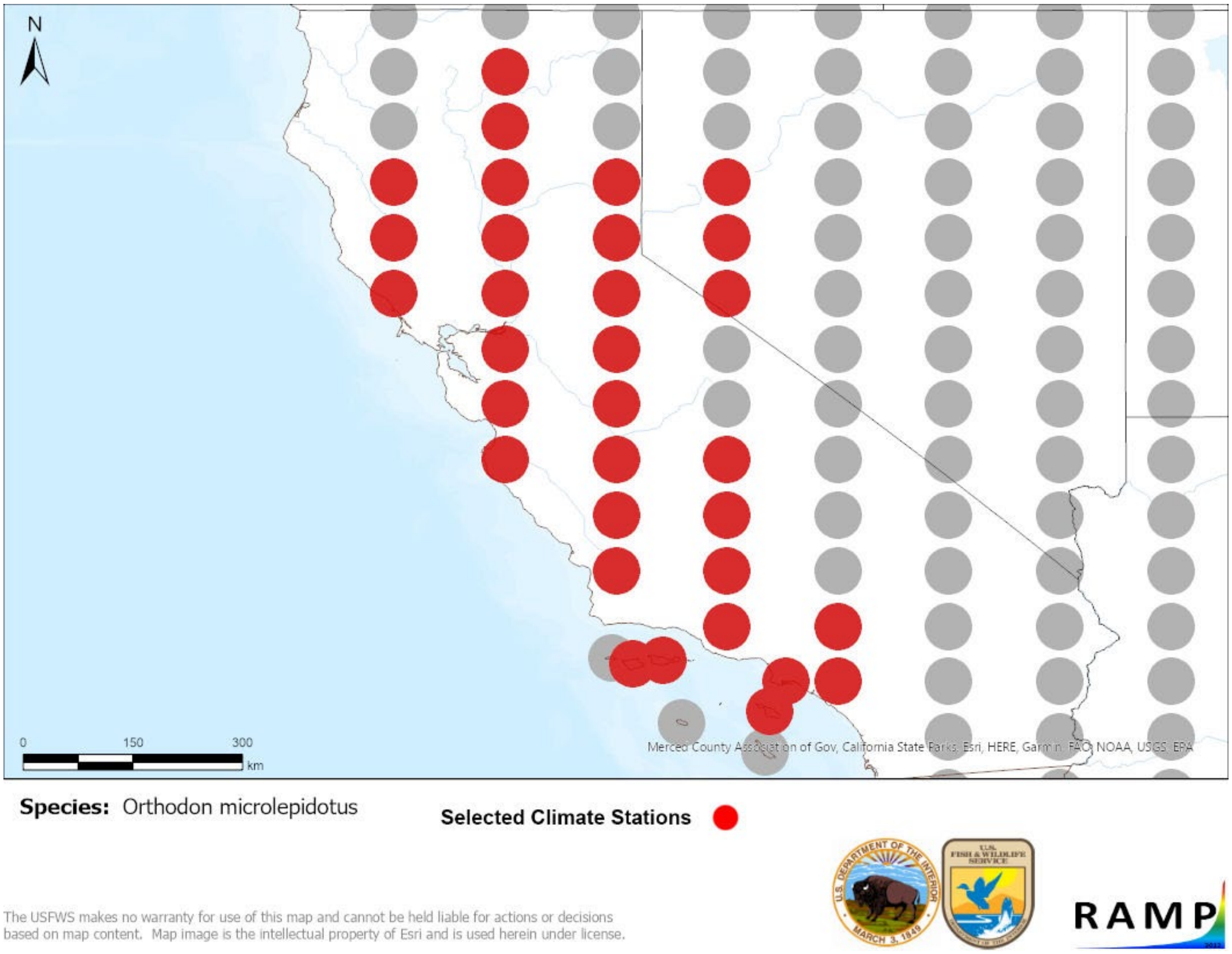

Figure 3. RAMP (Sanders et al. 2023) source map showing weather stations in Southwest United States selected as source locations (red; California and Nevada in the United States) and non-source locations (gray) for *Orthodon microlepidotus* climate matching. Source locations from GBIF Secretariat (2023). Selected source locations are within 100 km of one or more species occurrences, and do not necessarily represent the locations of occurrences themselves.

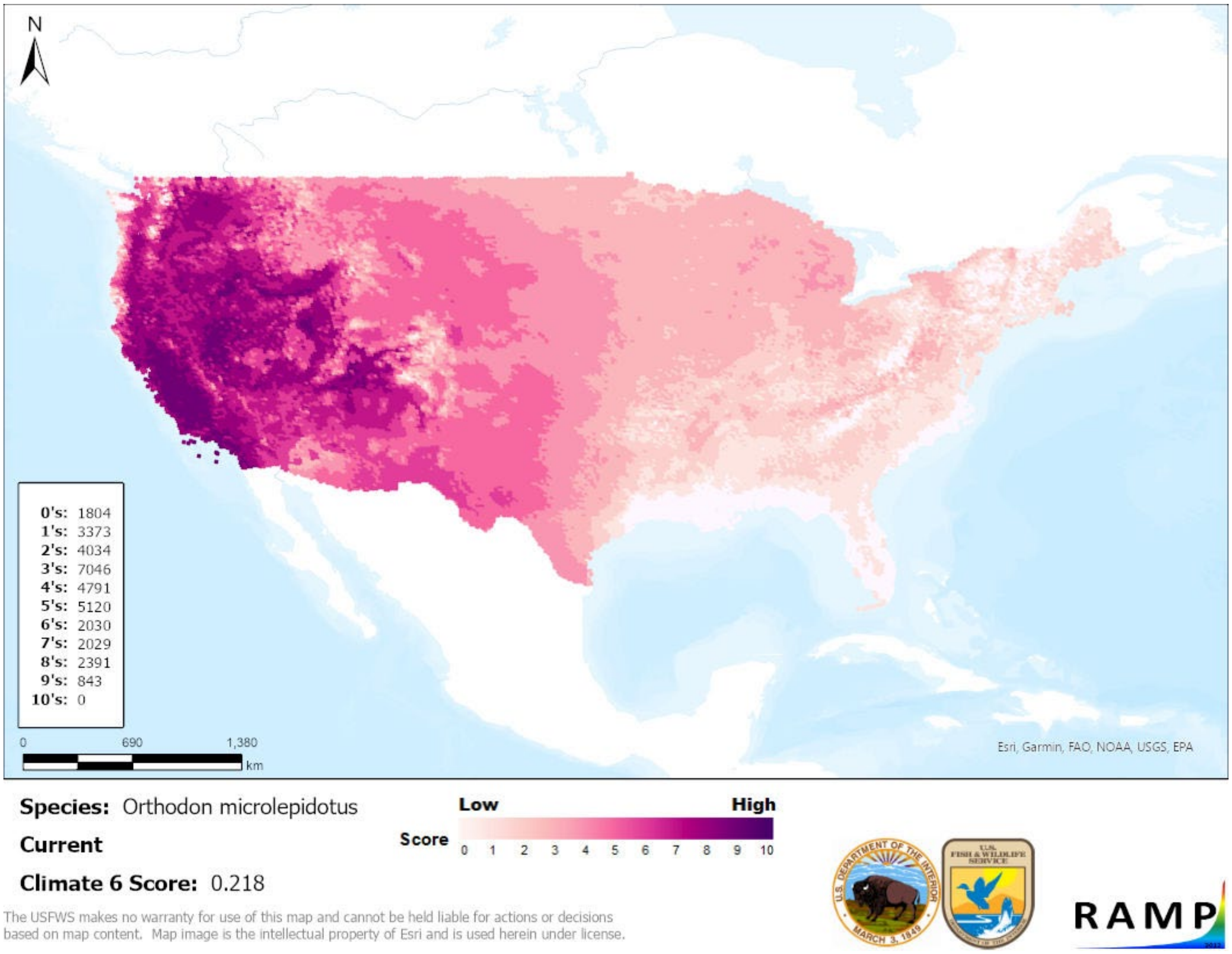

Figure 4. Map of RAMP (Sanders et al. 2023) climate matches for *Orthodon microlepidotus* in the contiguous United States based on source locations reported by GBIF Secretariat (2023). Counts of climate match scores are tabulated on the left. 0/Pale Pink = Lowest match, 10/Dark Purple = Highest match.

8 Certainty of Assessment

The Certainty of Assessment for *Orthodon microlepidotus* is classified as Low. There is reasonably complete information on the biology and ecology of *O. microlepidotus*. However, there is a lack of information on current status of some introductions and on impacts of introduction on which to base an assessment of risk.

9 Risk Assessment

Summary of Risk to the Contiguous United States

Orthodon microlepidotus, Sacramento Blackfish, is a freshwater fish that is native to the state of California in the United States. This species prefers a temperate climate with warm and turbid waters. It has been introduced in Nevada and outside its native range in California, both accidentally and deliberately. There are records of this species being harvested commercially, but no recent information was found on the size of the commercial fishery. The History of

Invasiveness for *Orthodon microlepidotus* is classified as Data Deficient due to knowledge of nonnative introductions resulting in established populations, but with a lack of data on impacts of these introductions. Effects on native fish and the plankton community have been suggested but no clear documentation of these impacts in wild populations was found. The climate matching analysis for the contiguous United States indicates Establishment Concern for this species outside its native range. The locations with the highest climate match extended west of the Rocky Mountains to the Pacific coast and included the native range of *O. microlepidotus*. The eastern United States had a generally low climate match. The Certainty of Assessment for this ERSS is classified as Low due a lack of information about negative impacts of this species. The Overall Risk Assessment Category for *Orthodon microlepidotus* in the contiguous United States is Uncertain.

Assessment Elements

- **History of Invasiveness (see Section 4): Data Deficient**
- **Establishment Concern (see Section 7): Yes**
- **Certainty of Assessment (see Section 8): Low**
- **Remarks, Important additional information: None**
- **Overall Risk Assessment Category: Uncertain**

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), on average, high climate match for *Orthodon microlepidotus* was projected to occur in California and the Great Basin of the contiguous United States. Areas of low climate match were projected to occur in the Appalachian Range, Great Lakes, Gulf Coast, Mid-Atlantic, Northeast, Southeast, Southern Atlantic Coast, and Southern Florida regions. At time step 2085, medium match extended further into the Great Lakes region than at time step 2055. The Climate 6 scores for the individual future scenario models (figure A2) ranged from a low of 0.118 (model: UKESM1-0-LL, SSP5, 2085) to a high of 0.240 (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 (0.218, figure 4) falls within 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. Under one or more time step and climate scenarios, areas within the Colorado Plateau, Northern Plains, Southwest, and Western Mountains saw a moderate increase in the climate match relative to current conditions. No large increases were observed regardless of time step and climate scenarios. Under one or more time step and climate scenarios, areas within California, the Colorado Plateau, and Great Basin saw a large decrease in the climate match relative to current conditions. Additionally, areas within the Appalachian Range, Gulf Coast, Mid-Atlantic, Northern Pacific Coast, Southeast, Southern Plains, Southwest, and Western Mountains saw a moderate decrease in the climate match relative to current conditions. Additional, very small areas of large or moderate change may be visible on the maps (figure A3). The magnitude and extent of the change in climate match was generally greater at time step 2085 than at time step 2055 and under SSP5 than under SSP3. In contrast, for the Southwest region, the moderate increase in climate match was least prominent under scenario SSP5, 2085.

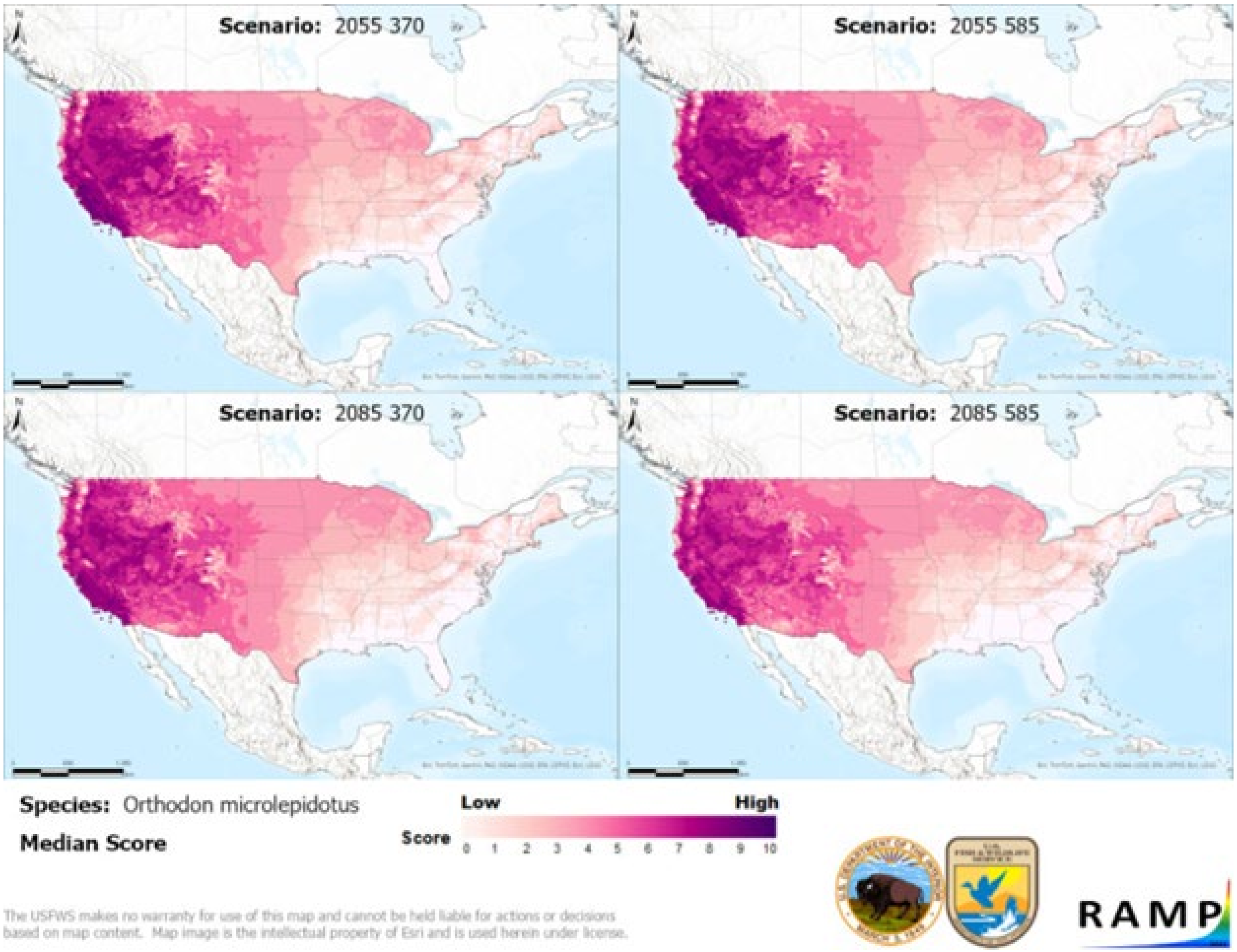

Figure A1. Maps of median RAMP (Sanders et al. 2023) climate matches projected under potential future climate conditions using five global climate models for *Orthodon microlepidotus* in the contiguous United States. Climate matching is based on source locations reported by GBIF Secretariat (2023). Shared 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.

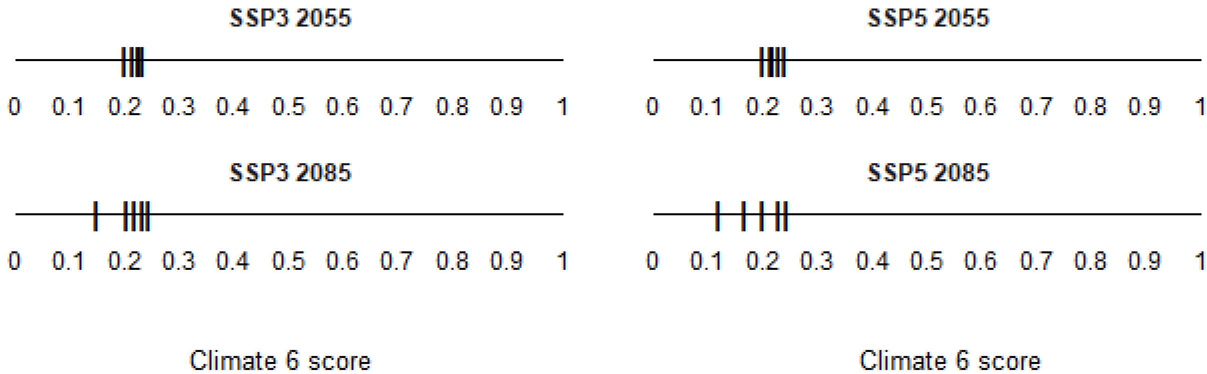

Figure A2. Comparison of projected future Climate 6 scores for *Orthodon microlepidotus* in the contiguous United States for each of five global climate models under four combinations of Shared Socioeconomic Pathway (SSP) and time step. SSPs used (from left to right): SSP3, SSP5 (Karger et al. 2017, 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.

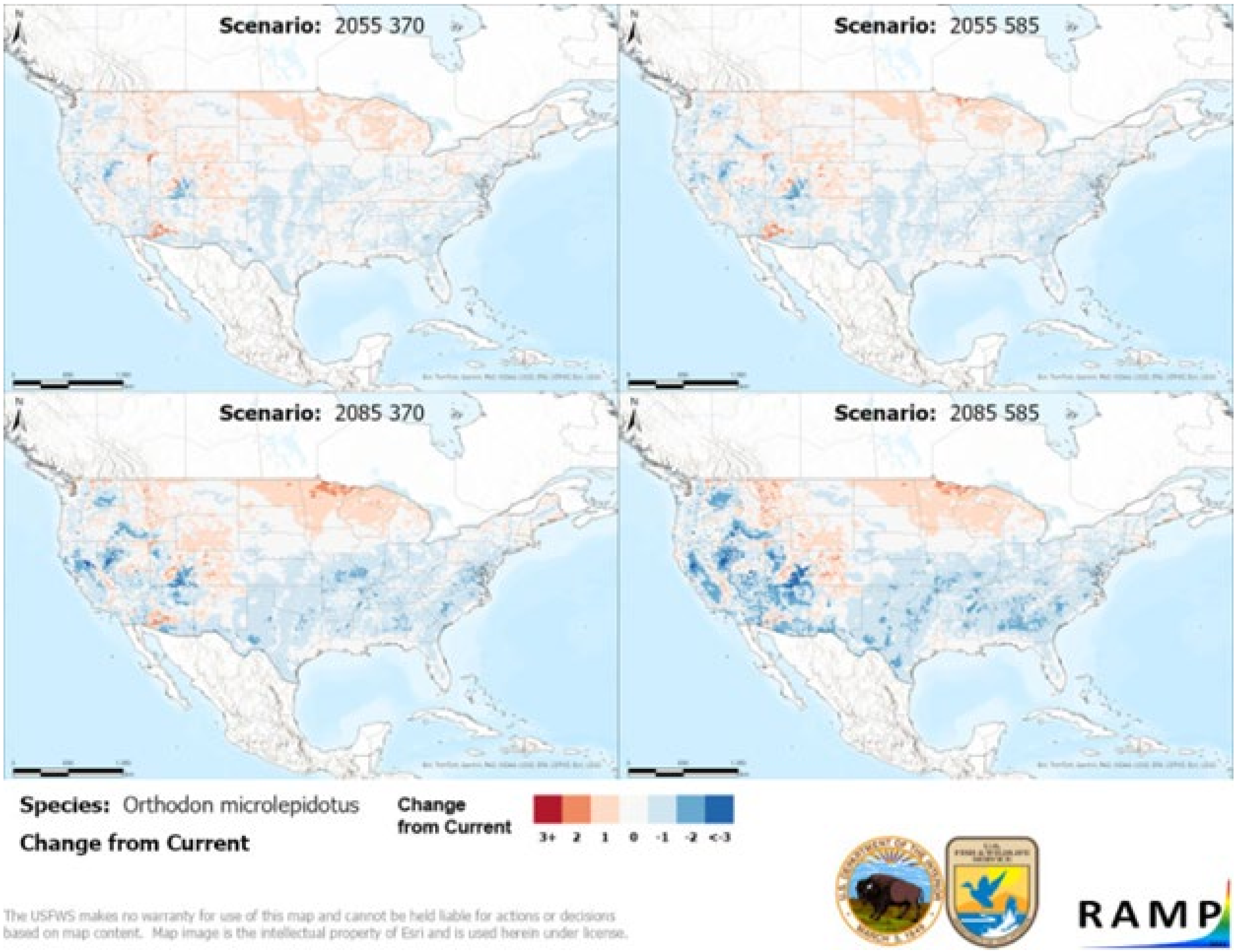

Figure A3. RAMP (Sanders et al. 2023) maps of the contiguous United States showing the difference between the current climate match target point score (figure 4) and the median target point score for future climate scenarios (figure A1) for *Orthodon microlepidotus* based on source locations reported 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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