

Status Review of Borax Lake Chub (*Gila boraxobius*)
Oregon Department of Fish and Wildlife
January 2017

Executive summary

The Borax Lake Chub are listed as an endangered species on the State List of Threatened and Endangered Species ("State List"; OAR 635-100-0125). The listing occurred because Borax Lake Chub were listed as threatened under the Federal Endangered Species Act (ESA) at the time the State List was created (consistent with 635-100-0105(2)(a)). The recovery of Borax Lake Chub was guided by the criteria in the Federal Recovery Plan (USFWS 1998). This review describes the current status of Borax Lake Chub relative to both the State and Federal delisting criteria (OAR 635-100-0112; USFWS 1998).

Removing a species from the State List requires a public rulemaking and determinations by the Commission (OAR 635-100-0112). These decisions require an evaluation of the biological status of the species to determine whether (OAR 635-100-0112(1)-(3) and 0105(6)):

1. The species is not, or is not likely to become within the foreseeable future, in danger of extinction throughout any significant portion of its range in this state, or is not at risk of becoming endangered throughout any significant portion of its range in this state;
2. That the natural reproductive potential of the species is not in danger of failure due to limited population numbers, disease, predation or other natural or human-related factors affecting its continued existence;
3. That most populations of the species are not undergoing imminent or active deterioration of their range or primary habitat;
4. That overutilization of the species or its habitat for commercial, recreational, scientific, or educational purposes is not occurring or is not likely to occur; and
5. That existing state or federal programs or regulations are adequate to protect the species and its habitat.

There are six criteria, identified in the Federal Recovery Plan necessary to federally delist Borax Lake Chub and consider them recovered under the federal ESA:

1. A viable, self-sustaining population of Borax Lake Chubs, which is herein defined as a naturally-sustaining population that is free of exotic species and fluctuates in size within the seasonal ranges observed in 1986 to 1987" (15,276 to 8,578);
2. Permanent protection for the 160-acre parcel of land to the north of Borax Lake (T37S, R33E, Sec. 11) by The Nature Conservancy or other appropriate public resource agency;
3. Withdrawal of Borax Lake waters from appropriations;
4. Establishment of a fence around the 259 hectare (640-acre) critical habitat area to prevent vehicle entry;
5. Establishment of monitoring programs to survey habitats and fish population status; and
6. Lack of any new threats to the species or ecosystem for five consecutive years.

Based upon a review of the recovery actions that have been conducted and the best available scientific data, Borax Lake Chub meet the biological and non-biological criteria for delisting. Of particular note,

recent land purchases and restrictions and existing regulations are sufficient to protect the habitat supporting Borax Lake Chub against direct and indirect recreational or commercial impacts.

Introduction

The Borax Lake Chub (*Gila boraxobius*) is a species of the genus *Gila* (a widespread desert minnow) that only exists in (i.e., is endemic to) Borax Lake and some adjacent wetlands in the Alvord Basin in Harney County, Oregon (Williams and Bond 1980). Adults are typically 33 to 50 millimeters (1.3 to 2 inches) standard length, with a maximum recorded size of 93 millimeters (3.6 inches) standard length. Spawning can occur year-round, but primarily takes place in the fall and spring (Williams & Bond 1983, Scopettone et al. 1995). Spawning occurs primarily in gravel, rock outcrop, and sand habitats, which comprise about 16% of the substrate in Borax Lake (Perkins et al. 1996). The Borax Lake Chub is an opportunistic omnivore (Williams & Williams 1980, Scopettone et al. 1995).

Borax Lake is a natural, 4.1 hectare, geothermally-heated alkaline lake, which is perched 10 meters above the desert floor on borosilicate deposits. Spring inputs near the bottom of a deep vent, 32 meters (100 feet) below the surface, vary from 40-148°C (104-300°F). Surface water temperatures typically vary from 16-38°C (61-100°F), but fluctuations occur and temperatures occasionally exceed 38°C (100°F), which may cause fish kills if water temperature exceeds the Borax Lake Chub's critical thermal maximum (Scopettone et al. 1995). Water flows from Borax Lake into surrounding marshes, small pools, and Lower Borax Lake.

Although Borax Lake Chub are relatively abundant, they are naturally at increased risk of extinction because they are represented by a single population that occupies limited habitat with potential for exposure to temperatures above their thermal tolerance limits. Additionally, the shallow nature of the lake, its elevated location, and the potential for seismic disturbance mean the lake is potentially vulnerable to draining.

In addition to natural risk factors, the thermal waters feeding Borax Lake face a potential threat from geothermal energy development. Proposals to drill wells near the lake prompted an emergency listing of this species as endangered in 1980. Other threats include modification of the fragile lake shoreline, which may easily be damaged by off-road vehicle use, and overgrazing by livestock.

Recovery Actions

A number of actions have been taken to safeguard the habitat for Borax Lake Chub following the federal listing action. These are outlined below.

- In 1982 the U.S. Fish and Wildlife Service (USFWS) designated critical habitat on 640 acres of land surrounding Borax Lake, including 320 acres of public lands and two 160 acre parcels of private land (USFWS 1982).
- In 1983, The Nature Conservancy (TNC) secured a 10-year lease to the two 160-acre parcels of private land surrounding and including Borax Lake and a “first right of refusal” for sale of the property and authority to manage the waters of Borax Lake. In 1993, TNC purchased the two 160-acre parcels of private land, bringing the entire critical habitat into public or conservation ownership. TNC ended water diversion from the lake for irrigation and livestock grazing within the critical habitat.

- In 1983, the U.S. Bureau of Land Management (BLM) designated 520 acres of public land surrounding Borax Lake as an Area of Critical Environmental Concern (ACEC) (BLM 2010). An ACEC is a conservation designation on certain lands managed by the BLM in the western United States, which requires protection of important riparian corridors, threatened and endangered species habitats, cultural and archeological resources, and unique scenic landscapes that the agency assesses as in need of special management attention.
- In 1991, Oregon Department of Fish and Wildlife (ODFW) acquired the water rights to Borax Lake for conservation purposes.
- In 2000, the US Congress passed the Steens Mountain Cooperative Management and Protection Act of 2000 (Steens Act) and BLM subsequently (2005) completed the Steens Mountain Cooperative Management and Protection Area (CMPA) Resource Management Plan (RMP). As a result, the BLM has withdrawn the public lands in the Alvord Known Geothermal Resource Area (AKGRA) from mineral and geothermal exploration and development, except for 332 acres in the southwest corner of the AKGRA (BLM 2005).
- The entire area within critical habitat was closed to livestock grazing (BLM 2005). Note that this area was subsequently fenced to create an enclosure fully encompassing the critical habitat (see next bullet).
- In 2011, BLM and TNC completed a perimeter fence surrounding the designated critical habitat to exclude vehicles from the lake and in 2013 installed locks on these gates.
- The RMP provides additional protection of Borax Lake Chub critical habitat by directing BLM to pursue the establishment of a conservation agreement or other cooperative agreement among BLM, TNC, USFWS, ODFW, or other private landowners to manage and protect the area for the conservation or recovery of the Borax Lake Chub, including closing the area to livestock grazing, off-road vehicle travel, and limiting or closing vehicle access.

In addition to these habitat actions, there has been significant coordination efforts among regulatory and land management parties, and intensive monitoring has occurred. The 'Borax Lake Chub (*Gila boraxobius*) Cooperative Management Plan' is currently in draft form. Numerous studies of the ecology and habitat of Borax Lake have been conducted (Salzer 1992; Scopettone et al. 1995; Furnish et al. 2004; Scheerer et al. 2016). TNC conducted abundance estimates from 1986 through 1997. ODFW conducted abundance estimates from 2005 through 2016 (excluding 2013 and 2014), developed a survey protocol, and recommended a long-term monitoring strategy (Scheerer and Jacob 2005; Scheerer et al. 2012; Peterson et al. 2015; Scheerer et al. 2016). ODFW also conducted surveys to monitor the condition of the lake's shoreline, outflow channels, and adjacent wetlands. Twelve photo points were established around the perimeter of the lake, temperatures were recorded, and disturbances were noted. To monitor the potential effects of future geothermal development that could occur within the aquifer that supplies water to Borax Lake, ODFW mapped the lake bathymetry and installed a water level logger in 2011. ODFW acquired data from 2011 through 2015, and will acquire additional baseline data in the upcoming years, which will be use to describe natural, seasonal variability in: 1) lake elevations, 2) the quantity and quality of habitat, and 3) the connectivity between the lake and adjacent wetlands.

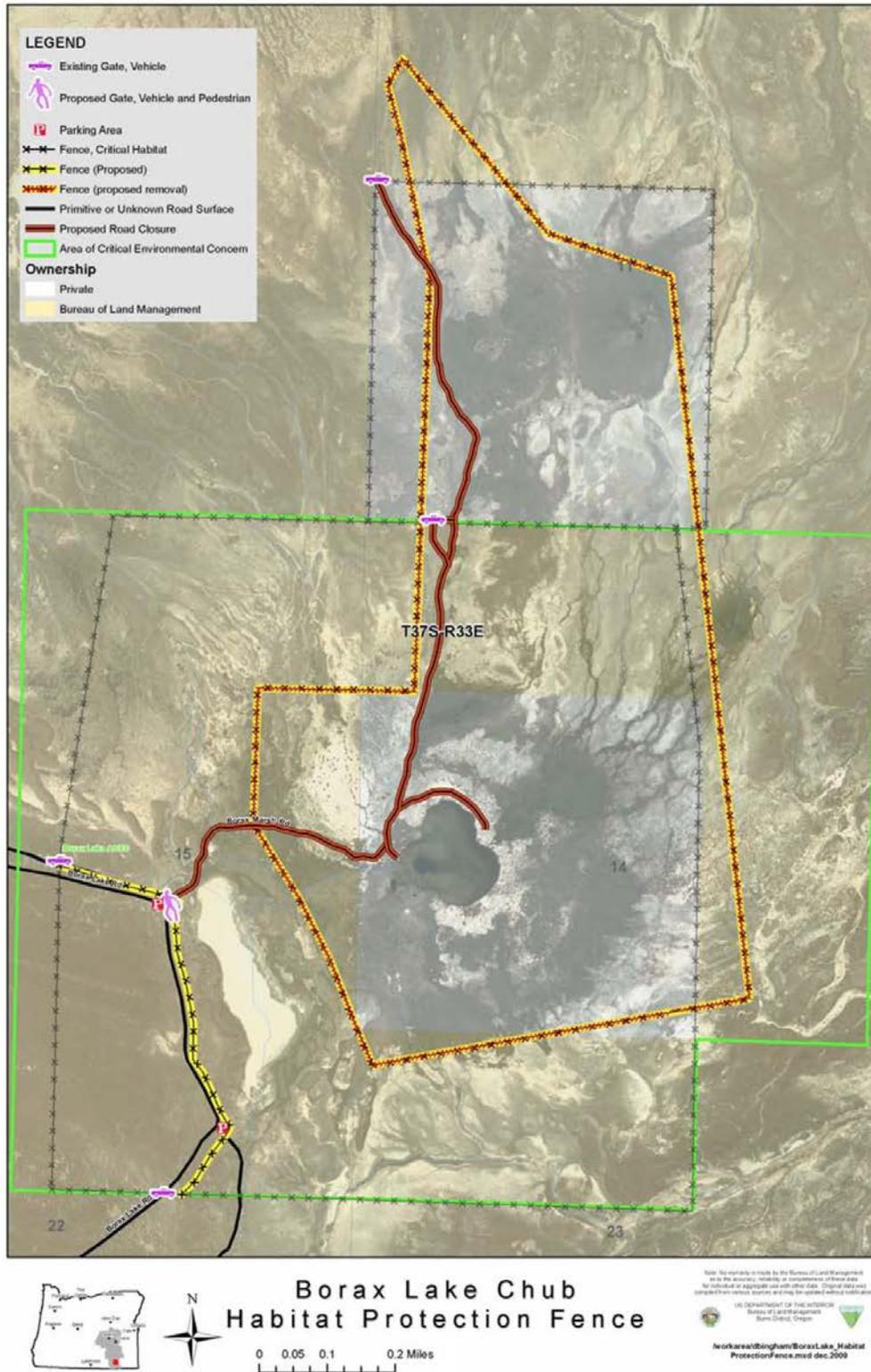


Figure 1. Critical habitat, Area of Critical Environmental Concern, and land ownership near and around Borax Lake. Map from BLM (2010).

Analysis of State List delisting requirements

State Criterion 1: The species is not, or is not likely to become within the foreseeable future, in danger of extinction throughout any significant portion of its range in this state, or is not at risk of becoming endangered throughout any significant portion of its range in this state

This Criterion has been met. The historical and current range of Borax Lake Chub is limited to Borax Lake (4.1 ha) and some adjacent wetlands. The population size of Borax Lake Chub varies substantially among years. The abundance estimates vary from a low of 1,242 to a high of 35,650 fish (Figure 2) (Scheerer et al. 2016). Because Borax Lake Chub experience water temperatures that are at or near their thermal critical maximum (Williams and Bond 1983), Borax Lake Chub survival and recruitment are likely higher during years when lake temperatures are cooler (Scheerer et al. 2015). However, Borax Lake Chub may seek refuge from the warmest temperatures by moving to cooler available habitats in Borax Lake and the adjacent wetlands, which are variably connected by surface water. This behavioral thermoregulation was noted in July 1987 by Williams et al. (1989), when presumed high temperature induced mortality was observed and Borax Lake Chub congregated in cooler portions of the lake.

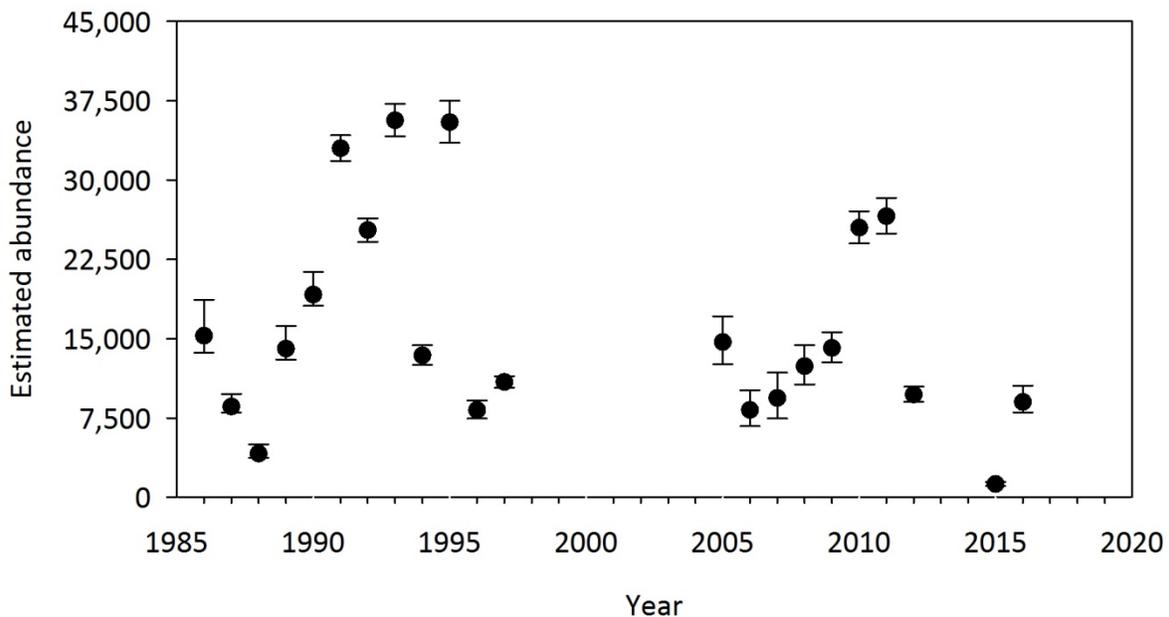


Figure 2. Borax Lake Chub estimated abundance (number of individual fish) from 1986 through 2016. Vertical bars represent 95% confidence intervals. From 1986 through 1990 only the perimeter of the lake was sampled. After 1990 the entire lake, wetland, wetland channel, and outflow channel were sampled. Different sampling methods were used during different time periods so estimates are not directly comparable across these time periods.

State Criterion 2: The natural reproductive potential of the species is not in danger of failure due to limited population numbers, disease, predation or other natural or human-related factors affecting its continued existence

State Criterion 2 has been met as discussed for State Criterion 1 and Federal Recovery Plan Criterion 1 (see below). Additionally, age-0 fish have been observed during surveys conducted by ODFW annually from 2005 through 2016 (Scheerer et al. 2016), which is further conclusive evidence that reproduction is occurring.

State Criterion 3: Most populations of the species are not undergoing imminent or active deterioration of their range or primary habitat

This Criterion has been met. Borax Lake Chub consist of a single known population in Borax Lake and some adjacent wetlands, and there has been no reduction in the range or habitat in the past 35 years since the species has been monitored. In contrast, the primary habitat has been protected and restored as outlined above.

State Criterion 4: Overutilization of the species or its habitat for commercial, recreational, scientific or educational purposes is not occurring or is not likely to occur.

This Criterion has been met. The habitat for Borax Lake Chub is protected from commercial use (see discussion of Federal Recovery Criteria 2, 3, and 4). Access to Borax Lake is restricted to foot traffic. The population abundance of Borax Lake Chub is typically monitored periodically (1-3 years) and no other scientific or educational utilization occurs. Also, Borax Lake Chub are a non-game species and there is no commercial or recreational harvest allowed on them.

State Criterion 5: Existing state or federal programs or regulations are adequate to protect the species and its habitat.

This Criterion has been met. Protections and mechanisms are in place for the species and habitat. The primary future threat for Borax Lake Chub is related to potential off-site geothermal energy development that may have a hydraulic connection to the lake through the aquifer. Development of the habitat and surrounding geothermal resource is adequately protected. With acquisition of Borax Lake by TNC, surface waters on their land cannot be appropriated. Additionally, ODFW obtained the water rights to Borax Lake in 1991 for conservation purposes.

Although surface water appropriations have been protected, there is a possibility that additional groundwater use on private land outside of the critical habitat area may affect Borax Lake. The primary potential groundwater use in this area would be for geothermal energy development, which initially triggered federal ESA listing of Borax Lake Chub in 1980 and 1982. There are no current or known efforts to develop geothermal energy in this area. There are approximately 2,000 acres of private lands within a 3-mile radius of Borax Lake. The relationship between groundwater extraction and the Borax Lake ecosystem has not been thoroughly assessed because groundwater connections are complex and variable in this dynamic fault-controlled geothermal system (Fairley and Hinds 2004). Detailed studies would be needed to provide a better understanding of the relationship between fault mechanics and groundwater hydrology. If a geothermal energy project were initiated, there are regulatory mechanisms in place that allow for consideration of the unique nature of Borax Lake Chub. Protections under these regulatory mechanisms are not dependent on designation under the State List (and likely not dependent on their presence on the federal ESA list as well), especially given that Borax Lake Chub will be placed on

the Sensitive Species List (OAR 635-100-0040) if they are removed from the State List of Threatened and Endangered Species. The potential threat of geothermal energy development on private lands within the AKGRA and the adequacy of existing regulatory protections are discussed more fully in Attachment 7.

Analysis of federal recovery criteria

Federal Recovery Plan Criterion 1: A viable, self-sustaining population of Borax Lake chubs, which is herein defined as a naturally-sustaining population that is free of exotic species and fluctuates in size within the seasonal ranges observed in 1986 to 1987 (15,276 to 8,578).

This Criterion has been met. Population abundance estimates conducted from 1991 through 1996 indicated a fluctuating population varying from 8,259 fish to 35,650 fish (see Scheerer et al. 2012). Population abundance estimates conducted by ODFW from 2005 through 2012 varied from 8,246 to 26,571 individuals, and the population contained multiple size/age classes (Scheerer et al. 2012). Borax Lake Chub abundance was estimated at 1,242 individuals in 2015 (Scheerer et al. 2015) and in 2016 Borax Lake Chub abundance was estimated at 9,003 individuals (Scheerer et al. 2016). Scheerer et al. (2015) speculate that the low Borax Lake Chub abundance observed in 2015 was a result of a warmer than average summer temperatures in 2015 resulting in greater than average Borax Lake Chub mortality. Although Borax Lake Chub abundance in 2015 fluctuated below ‘the seasonal ranges observe in 1986 to 1987’, at least to caveats should be considered. First, this criterion is based on two years of available data (i.e., data available in 1986 and 1987) as opposed to a formal analysis indicating that Borax Lake Chub abundance in 1986 and 1987 represents the natural range of variation in Borax Lake Chub abundance. Second, methodological differences in the way that Borax Lake Chub abundance has been estimated over time may preclude direct comparisons. It is clear that Borax Lake Chub abundance varies considerably among years; however, there is no apparent trend in abundance over the time period that abundance has been monitored. In 2013, ODFW staff observed the presence of an exotic species (one individual fish observed from the lake shoreline), presumably a largemouth bass. Extensive sampling with minnow traps in 2013, 2014, 2015, and 2016 showed no evidence of exotic fishes or obvious impact to the Borax Lake Chub. The harsh environment in the lake (i.e., high levels of heavy metals and high temperatures) may preclude establishment of many fishes.

Federal Recovery Plan Criterion 2: Permanent protection for the 160-acre parcel of land to the north of Borax Lake (T37S, R33E, Sec. 11) by The Nature Conservancy or other appropriate public resource agency.

This Criterion has been met. Land has been secured through public (i.e., BLM) and private (i.e., TNC) entities and is currently managed to protect Borax Lake Chub. See ‘Recovery Actions’ (this document) for more details.

Federal Recovery Plan Criterion 3: Withdrawal of Borax Lake waters from appropriations.

This Criterion has been met. Protections and mechanisms are in place for the species and habitat. The primary future threat for Borax Lake Chub is related to potential off-site geothermal energy development that may have a hydraulic connection to the lake through the aquifer. There is currently no geothermal development in the area. See ‘Analysis of State List delisting requirements – State Criterion 5’ (this document) for more details.

Federal Recovery Plan Criterion 4: Establishment of a fence around the 259 hectare (640-acre) critical habitat area to prevent vehicle entry.

This Criterion has been met. The designated critical habitat is fenced, gated, and locked to restrict vehicular and other unauthorized access such as livestock grazing. Foot travel by the public is permitted.

Federal Recovery Plan Criterion 5: Establishment of monitoring programs to survey habitats and fish population status.

This Criterion has been met. Numerous studies of the ecology and habitat of Borax Lake have been conducted (Salzer 1992; Scoppettone et al. 1995; Furnish et al. 2004; Peterson et al. 2015; Scheerer et al. 2016). See 'Recovery Actions' (this document) for more details.

Federal Recovery Plan Criterion 6: Lack of any new threats to the species or ecosystem for five consecutive years.

This Criterion has been met. No new threats have been identified since federal ESA listing of Borax Lake Chub in 1980 and 1982.

Conclusion

Borax Lake Chub were emergency listed as endangered under the federal ESA in 1980 because of a potential threat from geothermal energy development. Since listing, a number of recovery actions have been implemented to protect and enhance the habitat across the range of Borax Lake Chub. The historical range of Borax Lake Chub is currently intact and owned and managed by TNC in cooperation with ODFW, BLM, and USFWS. The land surrounding the range of Borax Lake Chub is owned and managed by BLM in cooperation with TNC, ODFW, and USFWS; this land is also designated as an Area of Critical Environmental Concern. Borax Lake Chub abundance is variable among years, natural reproduction is occurring, and the species and its habitat are not subject to overuse for commercial, recreational, or scientific, or educational purposes. State delisting criteria all appear to be met.

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