DISTRIBUTION AND STATUS OF FISHES OF THE GENUS GILA (CYPRINIDAE) IN THE NORTHWESTERN GREAT BASIN

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ABSTRACT.

The distribution and status of fishes of the genus Gila were determined in 36 endorheic basins of the northwestern Great Basin. Seventeen (47%) of the 36 basins of the northwestern Great Basin. Seventeen (47%) of the 36 basins contain native populations of Gila; represented by G. bicolor, G. alvordensis, and G. boraxobius. All basins inhabited by Gila, except the Alvord, contain G. bicolor. Undescribed endemic subspecies of G. bicolor occur in the Silver Lake/Fort Rock, Summer, Alkali, Catlow, Guano, Goose Lake, and Dixie Basins. The large number of undescribed subspecies indicates the need for taxonomic surveys. Increased demand for water, associated with agricultural and energy developments, accents the need for ichthyological studies as several taxa are threatened with extinction. Gila boraxobius, G. bicolor subsp. (of Hutton Spring in Alkali Basin), G. bicolor subsp. (of Summer Basin), and G. b. vaccaceps are especially in need of protection.

INTRODUCTION

The Great Basin is in fact not a single magnificent basin, but instead is a compilation of approximately 90 western North American basins flanked by north-south orienting mountain ranges. The Great Basin is roughly bounded by the Columbia River system on the north, the Sierra Nevada on the west, the Wasatch Mountains on the east, and the Colorado River system on the south. For the purposes of this report, the boundaries of Snyder et al. (1964) are utilized.

The hydrographic history of the Great Basin has been dynamic, with great changes in water availability during the last 100,000+ years. Glaciers repeatedly advanced and retreated during the Pleistocene and Holocene, causing lakes to repeatedly form in many valleys of the Great Basin. During the past 40,000 years, the following pluvial lake level chronology for the Lahontan Basin of Nevada is presented by Benson (1978): a low level 40,000 to 25,000 years before present (YBP), an extreme high level, 25,000 to 22,000 YBP, a moderate high level 20,000 to 15,000 YBP, an extreme high level 13,500 to 11,000 YBP, and an extreme low level 9,000 to 5,000 YBP. Because the fluctuations in pluvial lakes were caused by regional changes in climate, similar changes in lake levels occurred throughout the Great Basin. Hubbs and Miller (1948), Mifflin and Wheat (1979), and Snyder et al. (1964), among others, have mapped pluvial lakes in the northwestern Great Basin.

Because of the above mentioned instability of aquatic habitats, the endorheic nature of

many of the basins, and few historical connections with outside river systems, the ichthyofauna of the Great Basin is depauperate. Also because of the isolation, most Great Basin fishes are endemic. Many basins have only one or two native fish species present, several basins are devoid of native fish, and only two basins, the Lahontan and Bonneville, are inhabited by a relatively large number of native fishes. Most Great Basin fishes are cyprinids, particularly of the genera Gila and Rhinichthys.

Until recently, many of the aquatic habitats in the Great Basin have remained somewhat undisturbed. However, with increasing demand for Great Basin water, due to energy, agricultural, military, and other developments; new pressures are being placed on the aquatic resources. The degree of these threats is difficult to quantify because most of the aquatic habitats have not been adequately studied. This report attempts to summarize the distribution and status of the most common fishes, the chubs (genus Gila), in the northwestern Great Basin. The northwestern Great Basin includes much of northern and western Nevada, northeastern California, and southeastern Oregon (Figure 1). Fishes especially in need of study and/or protection are discussed.

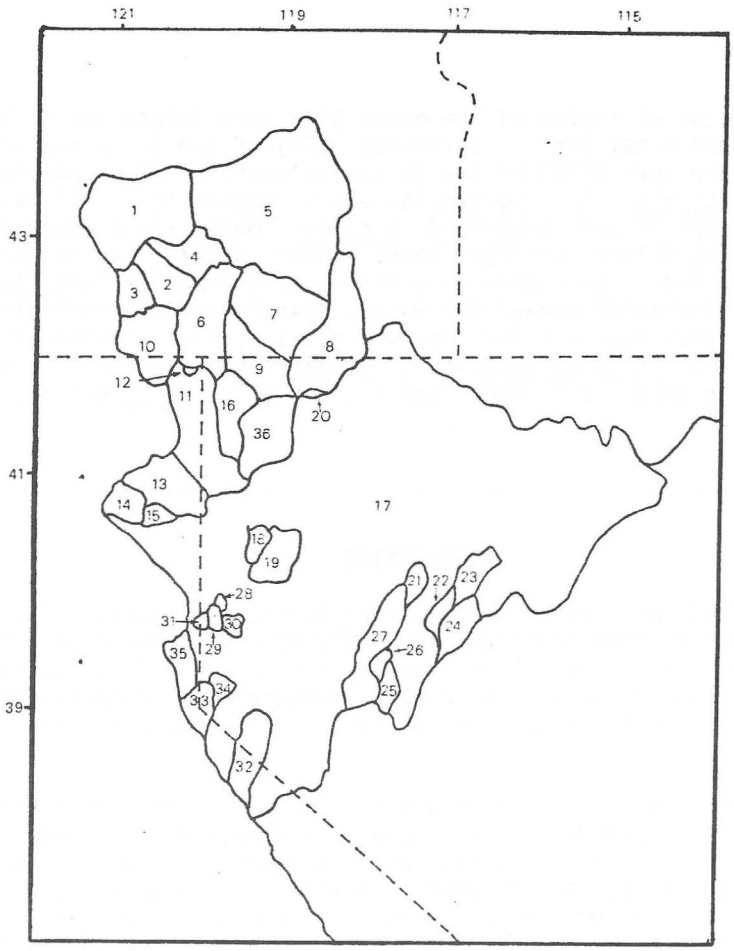

Figure 1. Map of the northwestern Great Basin, modified from Snyder et al. (1964) Basin numbers correspond to those given in Table 1.

DISTRIBUTION

Fishes of the genus Gila inhabit 17 (47%) of the 36 basins examined (Table 1). Three species of Gila: G. bicolor, G. alvordensis, and G. boraxobius; occur in the area. All basins inhabited by Gila, except the Alvord, contain G. bicolor. Gila alvordensis and G. boraxobius are restricted to the Alvord Basin. Of the basins not inhabited by Gila, 11 are devoid of native fishes, five contain only Rhinichthys osculus, the Horse Lake Basin contains R. osculus and Catostomus tahoensis, the Surprise Basin contains R. osculus and Catostomus sp., and the Summit Basin contains only Salmo clarki. Hubbs and Miller (1948) provide further information on the native fishes within each basin.

Table 1. The distribution of Gila in the northwestern Great Basin.

Basin Number	Drainage Basin	Location	Gila
1	Silver Lake/Fort Rock	Oregon	Gila bicolor subsp.
2	Abert	Oregon	Gila b. oregonensis
3	Summer	Oregon	Gila bicolor subsp.
4	Alkali	Oregon	Gila bicolor subsp.
5	Harney	Oregon	Gila b. columbianus
6	Warner	Oregon/Calif/ Nevada	Gila bicolor subsp.
7	Catlow	Oregon	Gila bicolor subsp.
8	Alvord	Oregon/Nevada	Gila alvordensis Gila boraxobius
9	Guano	Oregon/Nevada	Gila bicolor subsp.
10	Goose Lake	Calif/Oregon	Gila bicolor subsp.
11	Surprise	Calif/Nevada	none (?)
12	Cowhead Lake	California	Gila b. vaccaceps
13	Madeline Plain	Calif/Nevada	none
14	Eagle	California	Gila b. obesa Gila b. pectinifer
15	Horse Lake	California	none
16	Long	Nevada	none
17	Lahontan	Nevada/Calif Oregon	Gila b. obesa Gila b. pectinifer
18	Kumiva	Nevada	none

Table 1. (continued)

19	Granite Springs	Nevada	none
20	Summit	Nevada	none
21	Buffalo	Nevada	none
22	Carico	Nevada	none
23	Crescent	Nevada	none
24	Grass	Nevada	none
25	Smith Creek	Nevada	none
26	Edwards Creek	Nevada	none
27	Dixie	Nevada	*Gila bicolor* subsp.
28	unnamed	Nevada	none
29	Lemmon	Nevada	none
30	Spanish Spring	Nevada	none
31	Cold Spring	Nevada/Calif	none
32	Smith	Nevada/Calif	none
33	Tahoe	Nevada/Calif	*Gila b. obesa* *Gila b. pectinifer*
34	Washoe	Nevada	*Gila b. obesa* *Gila b. pectinifer*
35	Truckee	California	*Gila b. obesa* *Gila b. pectinifer*
36	High Rock	Nevada	none

The following basins contain endemic subspecies of *Gila bicolor*: Silver Lake/Fort Rock, Abert, Summer, Alkali, Catlow, Guano, Goose Lake, Cowhead Lake, and Dixie. The *G. bicolor* in the Warner Basin may be consubspecific with tui chubs in an adjacent basin (Bills 1977, and pers. comm.). *Gila b. columbianus* of the Harney Basin was derived from Columbia River stock (Bisson and Bond 1971). The Lahontan Basin tui chubs, *G. b. obesa* and *G. b. pectinifer*, also occur in the following basins that possessed, or currently maintain, a hydrographic connection with the Lahontan: Eagle, Tahoe, Washoe, and Truckee. A survey is needed to positively determine if any *Gila* exist in the Surprise Basin.

The Alvord Basin of southeastern Oregon and northwestern Nevada contains *G. alvordensis* and *G. boraxobius*. *Gila alvordensis* is found in 15 localities throughout the basin, whereas *G. boraxobius* is restricted to the Borax Lake area in the Oregon portion of the basin. The presence of *Gila* in the Alvord Basin that are distinct at the specific level is indicative of the long period of isolation and subsequent differentiation of these fishes from *Gila* in adjacent basins (Williams 1980).

STATUS

The ecology and taxonomy of the Great Basin ichthyofauna is poorly known. Many of the fishes have only recently been described or are yet to be named. Undescribed endemic subspecies of Gila bicolor occur in the Silver Lake/Fort Rock, Summer, Alkali, Catlow, Guano, Goose Lake, and Dixie Basins. Bills (1977) reported on the taxonomy of the Oregon tui chub complex, Gila bicolor oregonensis, of the Silver Lake/Fort Rock, Abert, Summer, Alkali, and Warner Basins. Although Bills demonstrated that the tui chubs in several of the basins are worthy of new subspecific status, no new subspecies have yet been described. A description of the Guano Basin tui chub has recently been prepared (Williams and Bond, in press). However, the tui chubs of Catlow, Goose Lake, and Dixie Basins remain relatively unstudied. As agriculture, energy, military, and other developments increase the demands on the sparse water supplies of the Great Basin, it is imperative that taxonomic determinations of these fishes be completed soon.

Several taxa of Gila in the northwestern Great Basin are threatened with extinction. Those forms especially deserving of protection include the Borax Lake chub, Gila boraxobius; Hutton Spring tui chub, G. bicolor subsp.; Summer Basin tui chub, G. b. subsp.; Summer Basin tui chub, G. b. subsp.; and Cowhead Lake tui chub, G. b. vaccaceps.

The Borax Lake chub,Gila boraxobius, is threatened by geothermal energy development and surface disturbance. This species was temporarily placed on the Department of the Interior's Endangered Species List by an emergency rulemaking in May 1980. While under the protection of the Endangered Species Act, a plan allowing for geothermal energy exploration as well as protection of G. boraxobius was developed and implemented. However, to insure consideration of this species in any future developments, the endangered status of this fish should be officially finalized.

The Hutton Spring tui chub, Gila bicolor subsp., of the Alkali Basin is threatened by chemical contamination of the aquifers that supply water to the spring, by contamination of the spring via surface flows, and by contamination of the spring by airborne evaporites. The contamination of surface and groundwater occurred during 1976 when 25,000 55-gallon drums of 2,4-dichlorophenoxyacetic acid (2,4-D) and methylchlorophenoxyacetic acid (MCPA) were improperly buried along the margin of Alkali Lake approximately 2.8 km south of Hutton Spring. During the burial process most of the barrels were damaged, leaking their contents into the ground and the nearby playa. Because of threats from chemical contamination, the Hutton Spring tui chub should be listed as threatened. The Hutton Spring tui chub and the Borax Lake chub receive protection from overcollecting by inclusion on the Oregon Department of Fish and Wildlife's Protected Species List.

Fish eradication projects and hybridization with introduced tui chubs, appear to have caused a decline in the native Gila bicolor of Summer Basin. The chubs examined by Bills (1977) from Ana Springs Reservoir in the Summer Basin appear introgressed or in other ways changed from earlier museum specimens. Research is needed to determine the extent of this problem and to provide possible solutions.

Gila bicolor vaccaceps inhabits a small outlet slough of Cowhead Lake in the northeastern corner of California (Bills and Bond 1980). Because of the restricted habitat and its susceptibility to alteration, G. b. vaccaceps should be listed as threatened.

LITERATURE CITED

Benson, L.V. 1978. Fluctuations in the level of pluvial Lake Lahontan during the last 40,000 years. Quaternary Res. 9:300-318.

Bills, F.T. 1977. Taxonomic status of the isolated populations of tui chub referred to Gila bicolor oregonensis (Snyder). M.S. Thesis. Oregon State Univ. 121 pp.

_____ and C.E. Bond 1980. A new subspecies of tui chub (Pisces: Cyprinidae) from Cowhead Lake, California. Copeia. 1980:329-322.

Bisson, P.A. and ____ 1971. Origin and distribution of the fishes of Harney Basin, Oregon. Copeia. 1971:268-281.

Hubbs, C.L. and R.R. Miller 1948. The zoological evidence: correlation between fish distribution and hydrographic history in the desert basins of western United States. Pages 17-166 in: The Great Basin with emphasis on glacial and postglacial times. Bull. Univ. Utah. Vol. 38.

Mifflin, M.D. and M.M. Wheat 1979. Pluvial lakes and estimated pluvial climates of Nevada. Nevada Bur. Mines Geology Bull. 94. 57 pp.

Snyder, C.T., G. Hardman, and F.F. Zdenek 1964. Pleistocene lakes in the Great Basin. U.S. Geol. Surv., Misc. Geol. Investigations, Map I-416.

Williams, J.E. 1980. Systematics and ecology of chubs (Gila: Cyprinidae) of the Alvord Basin, Oregon and Nevada. Ph.D. Dissertation, Oregon State Univ. 175 pp.

_____ and C.E. Bond. In press. A new subspecies of tui chub (Osteichthyes: Cyprinidae) from Guano Basin, Nevada and Oregon. Southwestern Nat. Vol. 26.