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Brook Stickleback Established in Eastern Washington

Abstract

This note documents the first record of brook stickleback in Washington. Brook stickleback is established in the upper 36 km of Rock Creek, Spokane County, Washington. Rock Creek is a tributary of the Palouse River, which drains into the Snake River. Collections prior to 1999 yielded no brook stickleback in this drainage, leading us to believe that the species was recently introduced. This is the fifth record of occurrence west of the continental divide in the United States since 1995. Brook stickleback were previously collected in the Swan/Flathead River drainage, Montana, Green River drainage, Utah, Elk River drainage, Colorado and Klamath River drainage, California.

Introduction

The purpose of this study was to document the recent invasion and distribution of brook stickleback (*Culaea inconstans*) in eastern Washington. The natural distribution of brook stickleback in North America was centered east of the Rocky Mountains, primarily in the upper Missouri/Mississippi River, Peace/McKenzie River, Great Lakes, and Hudson Bay drainages (Nelson 1969, Wooten 1976, 1984, Lee et al. 1980). Brook stickleback historically occurred on the eastern slopes of the Rocky Mountains in British Columbia (Scott and Crossman 1973), Alberta (Nelson and Paetz 1992), Northwest Territories (McPhail and Lindsey 1970) and Montana (Brown 1971, Holton and Johnson 1996), but not Wyoming (Baxter and Stone 1995).

Historically, brook stickleback were not reported west of the continental divide in North America (Jordan and Gilbert 1883; Gilbert and Evermann 1895; Jordan and Evermann 1896-1900; Jordan et al. 1930; Schultz and DeLacy 1935, 1936; Schultz 1936; Brown 1971; Wydoski and Whitney 1979; Simpson and Wallace 1982). Additionally, the only fossil stickleback reported west of the continental divide is *Gasterosteus* (Miller 1958, 1965; Mural 1973).

Brook stickleback was first recorded west of the continental divide in 1991 in tributaries of the

Klamath River, California (Moyle 2002). Brook stickleback specimens were later reported (1995) from the Green River, Utah (Modde and Haines 1996), Elk River, Colorado (Modde and Haines 1996), and Swan River, Montana (Holton and Johnson 1996). The Montana specimens were thought to have originated from an illegal introduction prior to 1995 and, by 1997, had extended their distribution downstream to Flathead Lake (Jim Vashro, Montana Department of Fish, Wildlife and Parks, Kalispell, Montana, personal communication). This paper documents the first record of brook stickleback in Washington State and the fifth record of its occurrence west of the continental divide.

Methods

Brook stickleback were collected during routine electrofishing and dipnet surveys for fish and benthic invertebrates in the Rock Creek drainage, Spokane and Whitman Counties, Washington in 1999 and 2000 (Figure 1). Rock Creek arises on the Turnbull National Wildlife Refuge, 30 km southwest of Spokane and drains southwest into the Palouse River. The drainage is located in the channeled scablands geological province, formed by outburst floods from glacial Lake Missoula (Waite 1980). Study sites are presented in Figure 1. Latitude and longitude coordinates were obtained using a Garmin E-map Global Positioning System and confirmed using Terrain Navigator software. Brook stickleback were identified using

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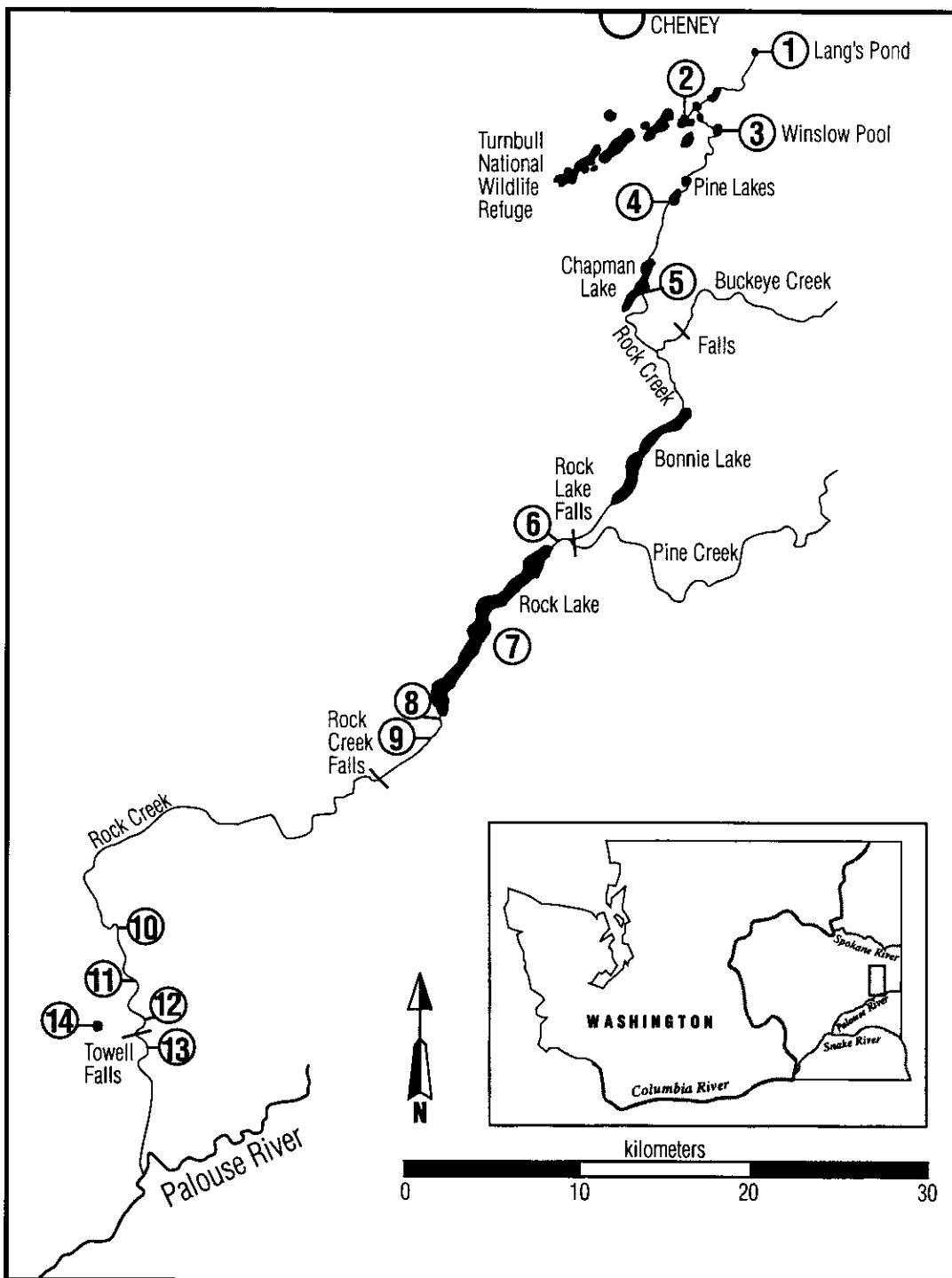


Figure 1. Locations of 14 sites sampled in the Rock Creek drainage, Spokane and Whitman Counties, WA in 1999 and 2000. Refer to Table 1 for latitude and longitude coordinates of each site. Brook sticklebacks were present at sites 1-6 and 14 and absent at sites 7-13.

the taxonomic keys of Scott and Crossman (1973), Becker (1983), and Nelson and Paetz (1992). Voucher specimens were stored in the Eastern Washington University fish collection (Catalog No. EWU 99-001).

In an attempt to discern their origin, pelvic spine length (base to tip) and standard body length (tip of snout to posterior end of caudal peduncle) of 101 brook stickleback were measured to the nearest 0.1 mm using a digital caliper. Previous investigators reported clinal variation in pelvic spine length (Nelson 1969, Andraso and Barron 2002). Specimens from the northwestern portion of their range (Alberta, British Columbia, Northwest Territories) had relatively shorter spines than those from the southeastern portion of their range (Ohio, Michigan, Wisconsin). Several populations from Alberta and the Northwest Territories lacked the pelvic skeleton altogether (Nelson 1969, 1977; Nelson and Atton 1971; Nelson and Paetz 1972; Reist 1981). We plotted pelvic spine length (dependent variable) against standard length (independent variable) of each individual in our sample and compared their distribution to those reported by Nelson (1969) and Andraso and Barron (2002) for brook stickleback populations throughout their natural range.

Results

In 1999 and 2000, 541 brook stickleback were collected and 4,115 additional specimens were observed at six locations in about 36 km of the Rock Creek watershed in northeastern Washington (Sites 1-6 in Figure 1, Table 1). One additional specimen (at Site 14 in Figure 1, Table 1) was collected from an isolated pond about 24 km downstream from the outlet of Rock Lake in 2000 (Todd Thompson, USDI Bureau of Land Management, Spokane, Washington, personal communication). Brook stickleback were first observed at Sites 1, 5, and 6 in May 1999 and 2-4 in October 1999. They were also collected at Sites 1-5 during the summer of 2000. (Site 6 was not sampled in 2000.)

Mean left pelvic spine length of 101 specimens was 3.0 mm (range 2.1-4.0 mm) (Figure 2). The distribution of pelvic spine lengths in relation to standard body length was more similar to brook stickleback from the southeastern portion of their range than from the northwestern portion of their range (Figure 2).

Discussion

The present occurrence of brook stickleback in the Rock Creek drainage undoubtedly represents a recent introduction. Five of the 6 sites where stickleback were recovered in 1999 and 2000 (1, 3, 4, 5, 6 in Figure 1) were surveyed between 1980 and 1998, some on multiple occasions, but no stickleback were found. Ludwig and Leitch (1996) and Fuller et al. (1999) noted that stickleback are a common contaminant in bait buckets, which suggests a means of dispersal.

The mean left pelvic spine length in relation to standard body length of our specimens was closer to brook stickleback from the Ohio than those from Alberta (Nelson 1969, Andraso and Barron 2002). Therefore, it appears probable that the brook stickleback in eastern Washington originated from the Midwestern United States.

The point of introduction seems to be near the headwaters of Rock Creek as this was where we observed the greatest abundance. From there, brook stickleback could have rapidly dispersed downstream since six of the seven sites where their presence was recorded were interconnected and the elevation change between them totaled 282 m. A pronounced tendency to disperse downstream has been noted for this species (Lamsa 1963, Manion 1977). In the Rock Creek watershed, dams at Pine and Chapman Lakes and waterfalls act as barriers to block upstream dispersal.

Brook stickleback were found as far downstream as the inlet of Rock Lake. None was collected in the lake (McLellan 2000) or at six sites downstream from the lake. However, the BLM record (Site 14) is from an isolated pond adjacent to Rock Creek in the proximity of the most downstream site we sampled (Site 13). This pond is perched on a basalt terrace 62 m above Rock Creek and has no inlet or outlet, so that it would be impossible for sticklebacks to move from Rock Creek into the pond even during spring freshets.

Cow Creek, a tributary of the Palouse River, and Hangman Creek, a tributary of the Spokane River, were sampled in 1999-2000, but no brook stickleback were found. These were the closest drainages located respectively to the west and east of Rock Creek. These data provide a temporal snapshot for future comparisons.

Introduction of nonindigenous brook stickleback is a matter of concern because they are pugnacious

TABLE 1. Distribution records (1999 and 2000) of brook stickleback in Rock Creek, tributary to the Palouse River, Snake River drainage, Washington.

| Map Location | Location Name | Latitude (°N) Longitude (°W) | No. Collected | No. Observed |
|-----------------|-----------------------------------|---------------------------------|---------------|--------------|
| 1 | Lang's Pond | 047.4654 °N 117.4890 °W | 500 | 2,000 |
| 2 | Reeves Lake | 047.4300 °N 117.5651 °W | 2 | 3-4 |
| 3 | Winslow Pool | 047.4228 °N 117.5374 °W | 2 | 100 |
| 4 | Rock Creek (Pine L. outlet) | 047.4086 °N 117.5340 °W | 6 | 12 |
| 5 | Rock Creek (Chapman L. outlet) | 047.3545 °N 117.5661 °W | 30 | 2,000 |
| 6 | Rock Creek (Rock L. inlet) | 047.2223 °N 117.6331 °W | 1 | 0 |
| 7 | Rock Lake | 047.1866 °N 117.6832 °W | 0 | 0 |
| 8 | Rock Creek (Rock Lake outlet) | 047.1388 °N 117.7242 °W | 0 | 0 |
| 9 | Rock Creek (Hwy. 33) | 047.1240 °N 117.7493 °W | 0 | 0 |
| 10 ¹ | Rock Creek (BLM 1) | 047.0601 °N 117.9660 °W | 0 | 0 |
| 11 ¹ | Rock Creek (BLM 2) | 047.0538 °N 117.9713 °W | 0 | 0 |
| 12 ¹ | Rock Creek (BLM 3) | 046.9837 °N 117.9332 °W | 0 | 0 |
| 13 ¹ | Rock Creek (BLM 4) | 046.9824 °N 117.9283 °W | 0 | 0 |
| 14 ² | Isolated pond | 046.9942 °N 117.9451 °W | 1 | 0 |

¹ BLM 1-4 refer to four sites sampled on the Escure Ranch, managed by the Bureau of Land Management.

² Information from Todd Thompson, USDI, Bureau of Land Management, Spokane, WA. The specimen was collected in an unnamed depressional wetland isolated on a bench above Rock Creek on the Escure Ranch.

and carnivorous. They eat a variety of aquatic invertebrates, especially *Chironomus* larvae and cladocerans (Becker 1983), and fish eggs (Woodling 1985). Therefore, they may compete with or prey upon native species. They are abundant on Turnbull National Wildlife Refuge and could potentially restructure the aquatic communities in refuge ponds and streams.

Given their propensity for downstream displacement, we anticipate that brook stickleback in Rock Creek will eventually spread into the Palouse, Snake, and lower Columbia Rivers. We also predict the imminent spread of Swan River/Flathead Lake populations into the Clark Fork, Pend Oreille and upper Columbia Rivers.

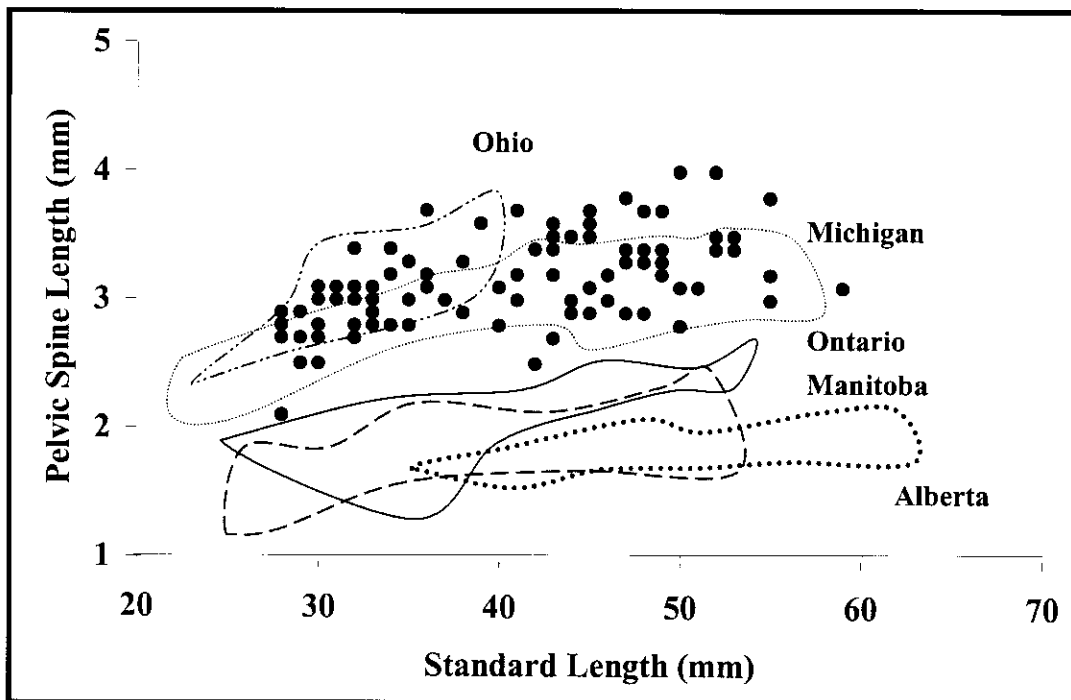


Figure 2. Left pelvic spine length versus standard length of brook stickleback ($n = 101$) collected from the Rock Creek drainage, Spokane and Whitman Counties, Washington (individual black dots). Shaded areas and enclosed lines indicate the range in variation of pelvic spine length to standard length of brook stickleback collected at five different locations, from southeastern to northwestern portions of their natural range (after Nelson 1969). Pelvic spine lengths of the sticklebacks from eastern Washington were comparable to those found in the Midwest.

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