



U.S. Fish and Wildlife Service

Mowich Lake Sculpin Survey (Sept. 2017)

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Report to Mount Rainier National Park

Introduction

The objective of this study was to obtain genetic samples and collect some basic ecological information on a population of sculpin (*Cottus* sp.) in Mowich Lake. We expected prickly sculpin (*C. asper*) would be present because they had been documented in five other mountain lakes near Mowich Lake including Lake George in Mt. Rainier National Park (Tabor et al. 2015). Prickly sculpin populations in mountain lakes are presumed to be introduced because most mountain lakes were historically fishless (Bahls 1992) and prickly sculpin are typically found at low elevations (Mongillo and Hallock 1997). Prickly sculpin are native to estuaries and lowland lakes and rivers of the Pacific Northwest. Because they can be abundant, have a diverse diet, and obtain a relatively large size, they may have important effects on lake food webs.

Recently we began a genetic study with the USFWS Abernathy Fish Technology Center to determine the population structure of prickly sculpin throughout the Puget Sound region and determine if populations in mid-elevation lakes represent introduced populations. On September 26-27, 2017, we collected sculpin in Mowich Lake to document their presence, obtain genetic samples, and collect baseline information that can be used to compare to other mountain lakes in the Nisqually River basin.

Study Site

Mowich Lake is a mountain lake located on the northwest side of Mount Rainier National Park (46.93872°N, 121.86149°W) within a glacial basin that drains into the Puyallup River watershed. It is the deepest (63.5 m maximum depth) and largest (0.42 km²) lake within the park boundary at an elevation of 1,502 m. The lake is clear with a depth of transparency of 17.6 m from a survey conducted in 2005 (Samora et al. 2011). The lake was historically stocked with kokanee (*Oncorhynchus nerka*) and rainbow trout (*O. mykiss*). Before the introductions of recreationally fishable salmonid species, the lake was assumed fishless.

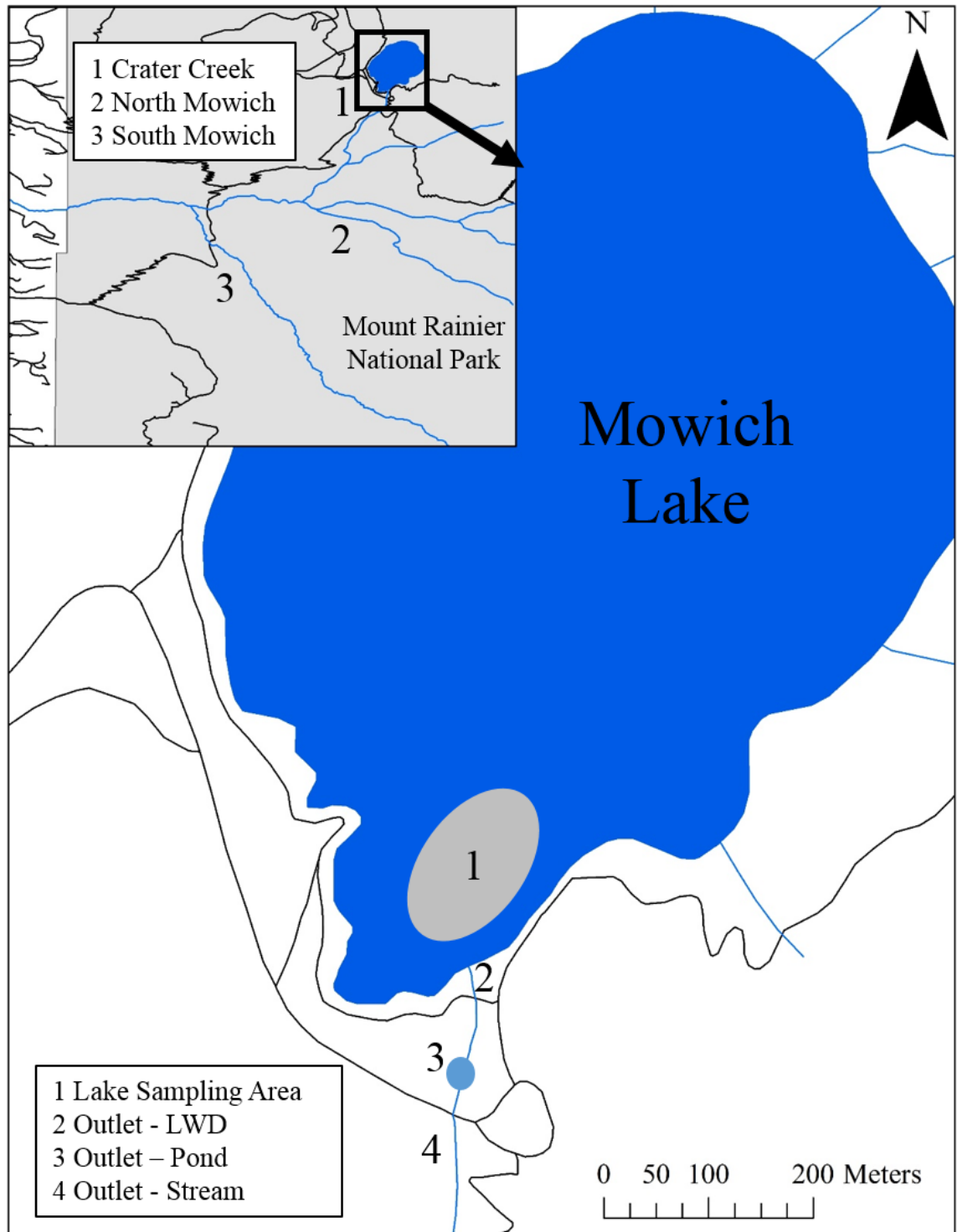


FIGURE 1. – Map of Mowich Lake within Mouth Rainier National Park displaying the general area where minnow traps were set in the lake (1) and in the outlet area (2-4), September 26-27, 2017.

Methods

Our primary collection method was baited “Gee-type” minnow traps. Each trap was baited with 20 g of canned sardines that was placed in a mesh bag. We followed the same procedures used at other mountain lakes including Lake George in Mt. Rainier National Park (Tabor et al. 2015). Total effort in Mowich Lake consisted of 12 traps with four traps (separated by ≥ 15 m) set at each of three depths: 1, 5, and 10 m. Three additional traps were set near the lake’s outlet. Two of these additional traps were set within a small pond located just upstream of the lakes’ outlet stream. The other trap was first placed in a logjam at the outlet but was later moved to the outlet stream for the overnight set to avoid a large crayfish bycatch. The additional traps used in the lake outlet area were set in water that was approximately 0.5 m deep.

Traps were first set during the day for three hours (approximately 14:30 to 17:30). A small inflatable raft was used to set the traps along with a snorkeler to assure proper trap placement. After minnow traps were retrieved, all fish and crayfish were identified and enumerated. Traps were immediately reset for an overnight set (approximately 17:30 to 8:00). For both day and overnight traps, all crayfish and most sculpin were released shortly after the traps were retrieved. A few sculpin were sacrificed to be later examined in our laboratory for species identification. We also did some day and night snorkeling to get some preliminary observations on sculpin diel behavior and take photographs.

Results

Only one sculpin was collected from the day minnow trap sets, whereas 10 were collected from overnight sets. A total of five sculpin were collected in both the 1-m and 5-m traps and one sculpin was collected in the 10-m traps. No sculpin were collected in the lake outlet area. All sculpin collected in the minnow traps were identified as torrent sculpin (*C. rhotheus*). Numerous sculpin were also observed during night snorkeling and they all appeared to be torrent sculpin (Figure 2). There was no evidence that prickly sculpin are present in Mowich Lake. Laboratory examination of the sculpin also indicated they are torrent sculpin based on the following characteristics:

- 1) Two prominent, forward-slanting saddles under second dorsal fin
- 2) Two chin pores
- 3) Palatine teeth present
- 4) Lateral line complete
- 5) Skin on eyes nubbled
- 6) Two fainter saddles joined under first dorsal fin
- 7) Mouth relatively large

However, some characteristics (shape of saddle bars and spacing between vomerine and palatine teeth) were different than what we typically see in Puget Sound drainages suggesting a possibility they may have originated from a different location or they are mottled sculpin (*C. bairdi*), which can be confused with torrent sculpin (Markle et al. 1996).

Besides torrent sculpin, the only thing caught in the minnow traps were signal crayfish (*Pacifastacus leniusculus*). Daytime traps captured 44 signal crayfish while 69 signal crayfish were captured from the overnight traps (Figures 3 and 4). However, of the 44 signal crayfish collected in the daytime sets, 21 were collected in one trap near a large woody debris pile at the lake outlet and this location was not used overnight to avoid collecting a large number of crayfish. Signal crayfish were captured in 73% of the daytime traps and 93% of the overnight traps.



FIGURE 2. – Photographs of torrent sculpin in Mowich Lake, September 26, 2017. All photographs were taken at night by Roger Tabor, USFWS.

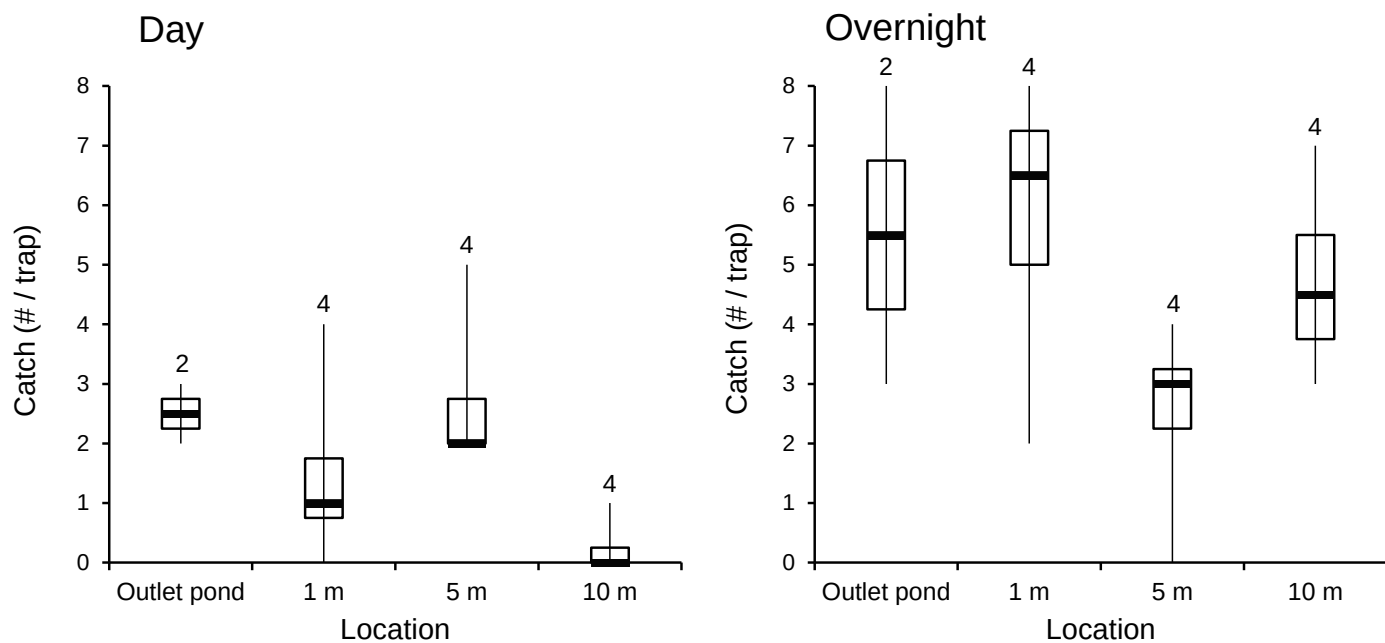


FIGURE 3.-- Catch rate box plots (whiskers show the ranges, box dimensions show the 25% and 75% quartiles, and lines within the boxes shows the medians) of signal crayfish collected in minnow traps, Mowich Lake, September 26-27, 2017. The number above each box plot is the number of traps used. Figure does not include the results of one additional trap that was set during the day in a large woody debris pile at the lake outlet (catch = 21 crayfish) and then set overnight in the outlet stream (catch = 6 crayfish).



FIGURE 4. – Photographs of signal crayfish in Mowich Lake, September 26, 2017. Photographs were all taken at night by Roger Tabor, USFWS.

Discussion

Our sampling results indicated that the only sculpin species present in Mowich Lake is torrent sculpin. We believe torrent sculpin in Mowich Lake represents an introduced population because the vast majority of mountain lakes in western United States were historically fishless (Bahls 1992). The stream gradient downstream of Mowich Lake in Crater Creek is approximately 25% and there is an impassible fish barrier upstream of the confluence of Crater Creek and the Mowich River (Williams et al. 1975), thus preventing fish colonization from downstream. Mowich Lake is located 1,506 m above sea level, which is three times greater than the highest elevation observed for torrent sculpin in Olympic Peninsula streams (Mongillo and Hallock 1997; Wydoski and Whitney 2003).

Documentation of other introduced populations of torrent sculpin is not well known and torrent sculpin is not listed among the nonindigenous fishes introduced into the inland waters of the United States (Fuller et al. 1999; Fuller 2018). The only other introduced population of torrent sculpin we are aware of is in Fish Lake (elevation, 2,248 m) in Harney Basin, a closed basin in southern Oregon (Bisson and Bond 1971). However, introductions of freshwater sculpins in the Pacific Northwest are likely underappreciated because they are represented by several species, can be difficult to identify to species, and their native distribution may not be precisely known.

Torrent Sculpin typically inhabit a wide range of habitat types in medium to large streams (Bond 1963; Wydoski and Whitney 2003; Tabor et al. 2007). In more northerly locations, they also inhabit nearshore areas of lakes (Northcote 1954; McPhail 2007). In the Puget Sound region, they are typically not found in lakes but this is likely due in part to competitive interactions with other sculpin species such as prickly sculpin and coastrange sculpin (*C. aleuticus*). In Mowich Lake, torrent sculpin appear to be the only sculpin species present.

In addition to torrent sculpin, signal crayfish appeared to be an important component of the Mowich Lake benthic community. Whether or not the population of signal crayfish in Mowich Lake is introduced or a native population is unknown. Many populations of signal crayfish in the Pacific Northwest appear to be introduced from other Pacific Northwest locations (Larson et al. 2012). Light (2003) found introduced signal crayfish did not move upstream and expand their range in streams with a gradient of more than 3%. Bubb et al. (2004) also found that upstream of signal crayfish was limited by stream gradient. Because the stream gradient downstream of Mowich Lake is approximately 25%, it would seem likely that the Mowich Lake crayfish population is introduced.

Mountain lakes such as Mowich Lake can be particularly sensitive to introductions (Knapp et al. 2001). Native amphibian and invertebrate populations appear to be particularly sensitive. Introduced salmonids have been shown to often have strong impacts on mountain lake ecosystems (Dunham et al. 2004). Little is known about the impacts of introduced torrent

sculpin and signal crayfish in mountain lakes. Both torrent sculpin and signal crayfish appear to be abundant in Mowich Lake and thus could have significant impacts on the native fauna. Impacts of torrent sculpin introductions are not known. Signal crayfish have been introduced in several places in Europe and have had strong impacts on freshwater communities (Holdich et al. 2014).

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