Northwest Science Notes

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An Oriental Weatherfish (*Misgurnus anguillicaudatus*) Population Established in Washington State

Abstract

The objective of this paper was to present some preliminary life history observations on a new exotic species, oriental weatherfish (*Misgurnus anguillicaudatus*), in the Lake Washington watershed of Washington State. During 1999 electrofishing surveys of Lake Washington Ship Canal (Portage Bay, Lake Union, Fremont Cut, and Salmon Bay), 21 oriental weatherfish were collected. An additional 15 specimens were observed but not captured. Two additional oriental weatherfish were found in the stomach of a largemouth bass (*Micropterus salmoides*). Oriental weatherfish were collected in areas that contained aquatic macrophytes and a mud/silt substrate. Most female oriental weatherfish were gravid. On average, females were considerably larger than males. Only 7 of 19 oriental weatherfish contained prey. Chironomid larvae and pupae, amphipods, and cladocerans made up 96% of the diet by wet weight. Cladocerans and chironomid larvae were the most frequently consumed prey. It is unclear what impact oriental weatherfish will have on the fish assemblage in the Lake Washington Ship Canal. Since oriental weatherfish can withstand a wide range of environmental conditions, they may expand to many areas of the Lake Washington basin.

Introduction

Exotic fish species are wide-spread throughout the Pacific Northwest. Many species have expanded their ranges (Wydoski and Whitney, in press); however, their impact on aquatic ecosystems is often unclear. Most recent research on introduced fishes in the Pacific Northwest has focused on predation of native salmonids by large, predatory fishes. Little work has been done on other potential impacts such as competition, indirect effects on the aquatic community structure, or introduction of fish parasites.

The oriental weatherfish (*Misgurnus anguillicaudatus*) is a member of the family Cobitidae (loaches) which are native to Eurasia and northern Africa. It is native to eastern Asia from Burma to Siberia (Berg 1948, Talwar and Jhingran 1992). Oriental weatherfish, as well as several other members of the family, are popular in the United States as aquarium fish. Introductions of the oriental weatherfish in the United States are believed to be either escapees from aquarium supply companies or discarded aquarium pets. The oriental weatherfish is a coolwater species that has become established in several states including: California, Florida, Hawaii, Illinois, Idaho, Michigan, Oregon, and Tennessee (Logan et al. 1996; Fuller et al. 1999). In the Pacific Northwest, oriental weatherfish were first reported from the Clackamas River, a tributary to the Willamette River (Bond 1994). More recently, this species was reported from the Owyhee, Malheur, and Snake Rivers in eastern Oregon and western Idaho (Logan et al. 1996). Until now, there has not been any evidence of a viable population in Washington State

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(Wydoski and Whitney, in press). This paper documents the collection of oriental weatherfish and summarizes some life history observations in the Lake Washington watershed of Washington State.

Methods

Fish surveys were conducted during April-July, 1999 in the Lake Washington Ship Canal (including Portage Bay, Lake Union, Fremont Cut, and Salmon Bay) in the Lake Washington watershed near Seattle, Washington (Figure 1). Fish were collected at night with boat electrofishing equipment along shoreline transects. Oriental weatherfish were preserved in 10% formalin. Total length (nearest millimeter; TL) and weights (nearest gram) were taken. The abdominal cavity was opened to determine the sex and remove the digestive tract for diet analysis. Prey items were identified to order or other broad taxonomic level. For each fish, prey groups were enumerated and weighed to the nearest 0.001 g.

Results and Discussion

Collection Locations

Twenty oriental weatherfish were collected from the south side of Portage Bay and one was collected from the Fremont Cut (Figure 1). An additional 15 specimens were observed in Portage Bay but escaped. Two other oriental weatherfish were reported earlier from the Lake Washington watershed (Figure 1). The first specimen was collected from the northeast shore of Union Bay in the summer of 1997 (T. Sibley, University of Washington, pers. comm.) and another was collected from Thornton Creek in June of 1998 (Resource Planning Associates 1998). We also found two oriental weatherfish in the stomach of a 438 mm fork length largemouth bass (*Micropterus salmoides*) collected in south Portage Bay on May 5, 1999, as part of another study (R. Tabor, unpublished data). One of the ingested oriental weatherfish was a 166 mm TL female. We were

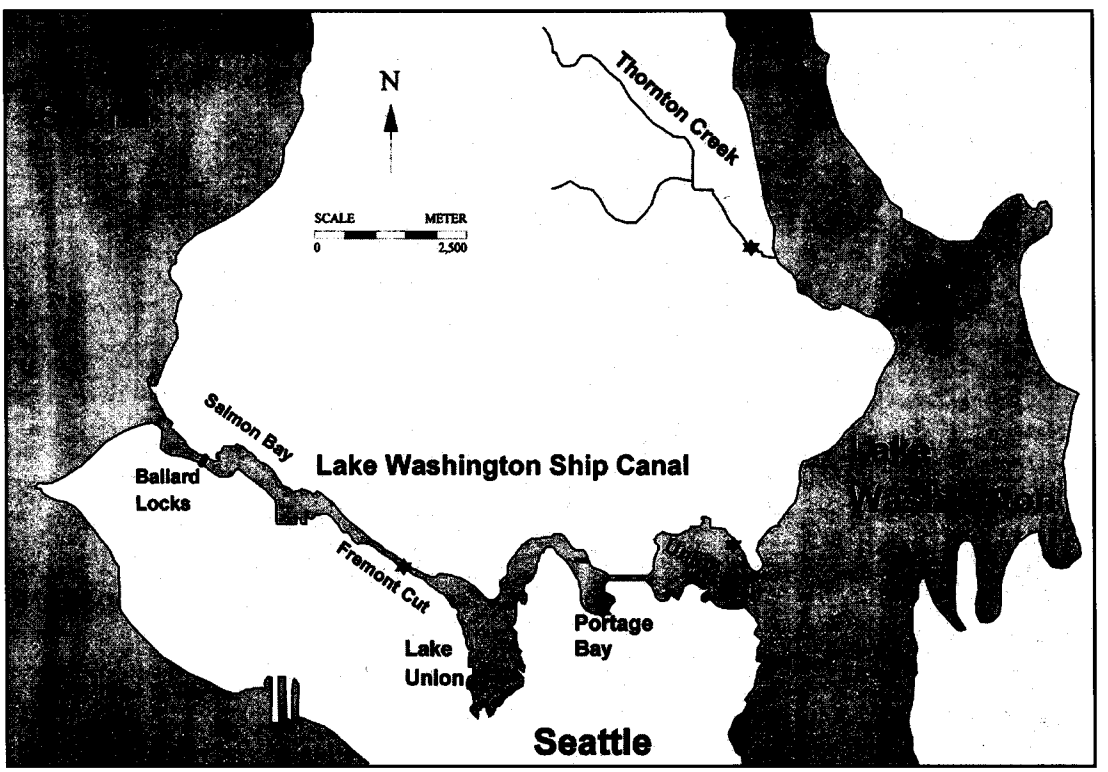

Figure 1. Locations (stars) that oriental weatherfish have been collected in the Lake Washington watershed.

unable to determine the size or sex of the other oriental weatherfish because of the advanced state of digestion.

Habitat

In south Portage Bay, oriental weatherfish were collected on the bottom in low-gradient, shallow water (0.2-0.5 m). Fish were over mud/silt substrate in aquatic marcophyte beds consisting of *Chara sp., Nitella sp., Zannichellia palustris*, and *Najas flexilis*. In the Fremont Cut, a single oriental weatherfish was collected in an area of mud/silt, cobble, and boulders. Few aquatic macrophytes were present. According to Walker (1974) and Talwar and Jhinger (1992), oriental weatherfish prefer a muddy substrate in which they can burrow until only their head protrudes. In Oregon, Logan et al. (1996) found that most oriental weatherfish inhabited muddy sediments among aquatic macrophytes. In contrast, Lintermans et al. (1990b) found oriental weatherfish in a range of substrates from fine silt to bedrock.

Size Range and Sexual Maturity

Oriental weatherfish collected in 1999 ranged in size from 85-200 mm TL. The maximum reported size of oriental weatherfish is 248 mm TL (Berg 1948). The average length of female oriental weatherfish (171 mm TL; Table 1) was considerably larger than that of males (143 mm TL). Males could easily be distinguished externally from females by their large pectoral fins and the presence of a round lamina circularis (Masuda et al. 1984; Lintermans and Burchmore 1996). Sixty-seven percent of the female oriental weatherfish we collected were gravid. In May and June, all (N = 5) females were gravid while only one (N = 4) was gravid in July. Some of the males had enlarged gonads, but we did not see any obvious signs that they were ripe.

Food Habits

Of 19 oriental weatherfish digestive tracts examined, only seven digestive tracts contained any prey. The diet was mostly small benthic invertebrates (Table 2). Small amounts of detritus were also present but were not measured. Chironomid larvae and pupae, amphipods, and cladocerans made up 96.3% of the diet by wet weight.

TABLE 1. Total lengths (mm) and sex of oriental weatherfish collected in the Lake Washington basin, May-July, 1999.

Number	Sex	Total length (mm)
1	Female	200
2	Female	197
3	Female	178
4	Female	175
5	Female	174
6	Female	173
7	Female	173
8	Female	145
9	Female	128
Average		171.4
10	Male	166
11	Male	162
12	Male	158
13	Male	148
14	Male	141
15	Male	131
16	Male	120
17	Male	120
Average		143.3
18	Immature	120
19	Immature	108
20	Immature	100
21	Immature	85
Average		103.3

TABLE 2. Pooled food items of seven oriental weatherfish from south Portage Bay, 1999 (FO = frequency of occurrence). The diet analysis does not include small amounts of detritus which were not measured.

Prey group	Total number	Percentage of Organisms	FO (%)	Wet Weight (%)
Crustacea	221	59.4	100	36.9
Cladocera	172	46.2	71.4	16.5
Copepoda	6	1.6	28.6	0.5
Ostracoda	10	2.7	57.1	0.8
Amphipoda	33	8.9	57.1	19.1
Insecta	151	40.6	85.7	61.4
Diptera				
Chironomidae	149	40.1	71.4	60.7
Ephemeroptera	1	0.3	14.3	0.3
Unidentified Insect	1	0.3	14.3	0.3
Plant material	—	—	14.3	1.7

Collectively, cladocerans and chironomids were the most frequently ingested prey items, representing 46% and 40%, respectively of the prey items. Little is known about the diet of oriental weatherfish in their natural habitat. However, Kim et al. (1994) found that they readily consume mosquito larvae and have been used successfully in South Korea to control mosquitoes in rice paddies. Some diet analyses have been done on fish collected from lotic systems in Australia, where oriental weatherfish are also an introduced fish. Burchmore et al. (1990) found their diet consisted of algae, detritus, ostracods, cladocerans, and gastropods. Lintermans et al. (1990b) noted several oriental weatherfish from Ginninderra Creek, Australia, had been feeding of zooplankton.

Range Expansion

Since oriental weatherfish can withstand a wide-range of environmental conditions (Schultz 1960; Baensch and Riehl 1993; Logan et al. 1996) and given the habitat preferences of oriental weatherfish, the taxon may be able to expand to many areas of the Lake Washington basin or may already be present. Because Union Bay (Figure 1) is large, has similar habitat, and is close by to Portage Bay, it may also contain a substantial population of oriental weatherfish. Because extensive marcophyte beds are common along the shoreline of Lake Washington, oriental weatherfish may be able to rapidly expand around the entire lake. Additionally, they could move into the Sammamish River drainage, which is a low-gradient system with abundant aquatic macrophytes and fine sediments. In some locations, oriental weatherfish appear to be able to quickly expand their range (Lintermans et al. 1990a). In an Australian drainage, oriental weatherfish were documented to have expanded their range over seven kilometers per year, which resulted in a six-fold range increase in 34 months (Lintermans et al. 1990b). However, in Shiawasse River, Michigan, oriental weatherfish only dispersed 2 km upstream and 14 km downstream in 19 years (Schultz 1960).

Impacts on Aquatic Ecosystems

The impact of oriental weatherfish introductions on aquatic ecosystems has received little attention. In Hawaii, they were categorized as having intermediate impacts to native stream fauna because of their preferred habitat, food habits, and abundance (Maciolek 1984). In some areas, oriental weatherfish introductions have been considered beneficial (Welcomme 1984), because they can be used as a food fish or used for mosquito control (Kim et al. 1994). Due to possible impacts to native fishes and other organisms in Australia, the government made the importation of oriental weatherfish illegal in 1986 (Lintermans et al. 1990a; Dove and Ernst 1998). Presently, fishery managers have speculated on possible impacts but little data is available. Possible interactions include introduction of fish parasites (Dove and Ernst 1998), competition for food or space, predation of fish eggs, or some type of indirect effect by restructuring the aquatic ecosystems. Further research is needed on the ecology of oriental weatherfish. Future efforts should also include a monitoring program to document the distribution and possible range expansion of oriental weatherfish.

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