Interactions between the Alien Oriental Weatherfish (*Misgurnus anguillicaudatus*) and Native Fishes in the Klyne Esopus Kill, a Hudson River Tributary

A Final Report of the Tibor T. Polgar Fellowship Program

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ABSTRACT

The alien loach, Oriental weatherfish [*Misgurnus anguillicaudatus* (Cantor)] was sampled from the Klyne Esopus Kill, a small Hudson River tributary south of Kingston, New York. American eel (*Anguilla rostrata*) and Creek chub (*Semotilus atromaculatus*) were the only other common species in the area. Comparisons of food habits and habitat among the three species suggested that Oriental weatherfish have little effect on the native fishes in this stream. Oriental weatherfish preferred silty habitat or areas in rocky streams with a detritus substrate. American eel preferred rocky habitat and were absent from extensive silty areas. Creek chub were found in all habitats but were an order of magnitude less dense than American eel (0.14-0.17 individuals/m^2 and 1.16 individuals/m^2, respectively). In rocky habitats, Oriental weatherfish fed exclusively on algae and therefore had little to no overlap with sympatric American eel or Creek chub. In silty habitats, Oriental weatherfish supplemented their algal diet with animal foods, but did not overlap at all with sympatric Creek chubs. Because of habitat and diet segregation among Oriental weatherfish and the two native stream species, there does not appear to be any negative effect of this alien species in this Hudson River tributary. Localities that have abundant silty substrate could, however, support a large population of Oriental weatherfish and thus could have negative effects on native species.

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INTRODUCTION

The Oriental weatherfish (*Misgurnus anguillicaudatus*) is an Asian loach, family Cobitidae, which has been known from North America for about 50 years (Schultz 1960). The first known population in the Northeastern United States was discovered in Connecticut in mid-November, 2014 (Robert Jacobs, personal communication). There has been a proliferation of newly discovered populations of this species in the last two decades, including four in the Hudson River watershed.

Whereas there is general concern about the effects that alien aquatic organisms may have on ecosystems, little information exists on how this species may be altering local systems. Schmidt and Schmidt (2014) provided information on habitat, distribution, and food habits of this species in a Hudson River tributary but they did not address the issue of interactions between Oriental weatherfish and native fishes.

In 2013, R.E. Schmidt and C.H. Bowser discovered a new Hudson River population in the Klyne Esopus Kill, a tiny Hudson River tributary. At that time, Oriental weatherfish were easily collected and subjectively were the most abundant fish in that part of the stream running through a wet meadow. Given the abundance of the weatherfish at this site, and ease of access, a study on the ecology of Oriental weatherfish in this stream seemed warranted. The purposes of this study were to sample all the common fishes in the Klyne Esopus Kill to determine their distribution, habitat, and food habits and compare these data to the Oriental weatherfish. These comparisons may help determine what interactions may be occurring between native fishes and the Oriental weatherfish.

METHODS

Study Area

The Klyne Esopus Kill is a very small Hudson River tributary located in Ulster Park, Ulster County, New York. The study area extended from the tidal mouth in Esopus Meadows upstream about 1.1 km. Sampling was done at four locations (Figure 1). One location was in a wet meadow characterized by relatively low gradient and clay substrate. A silty backwater located on the north edge of the meadow was identified as likely habitat for Oriental weatherfish (Schmidt and Schmidt 2014). The other three sampling sites (Figure 1) were higher gradient rocky stream segments characterized by overhanging forest and gravel and cobble substrate.

Field Methods

Fishes were collected with a backpack electroshocker. Fishes were identified and counted in the field. At two sites, the backwater in the Wet Meadow and Rocky Stream #1, fish population size was estimated by a three-pass depletion technique (Carle and Strub 1978). Block nets were put in place (3/16 inch knotless nylon mesh seines). A team of field workers moved upstream with the shocker and as many fishes as possible were removed and placed in a large container. These fishes were then counted and identified. This process was repeated three times. The length and several widths of the stream were measured with a tape.

All Oriental weatherfish collected were preserved (in 50% isopropanol or 10% formalin) for laboratory analysis. Additionally some specimens of other species were also preserved and returned to the laboratory.

Laboratory Methods

Preserved fishes were dissected to remove the anterior third of the gut. Food items were teased out from the gut and identified as far as practical with a dissecting microscope. Food habits for each species were summarized as the percent of individuals with a particular food out of the total number of individuals with food in the stomach. Since several types of food items could be present in a given stomach, these percentages can sum to more than 100.

RESULTS

Three collections were done in this study. Frequent rains made the visibility in the Klyne Esopus Kill so poor that electroshocker was ineffective. Rocky Stream #1 was sampled on June 16, 2014; the Wet Meadow on June 26; and Rocky Stream #2 on August 12, 2014.

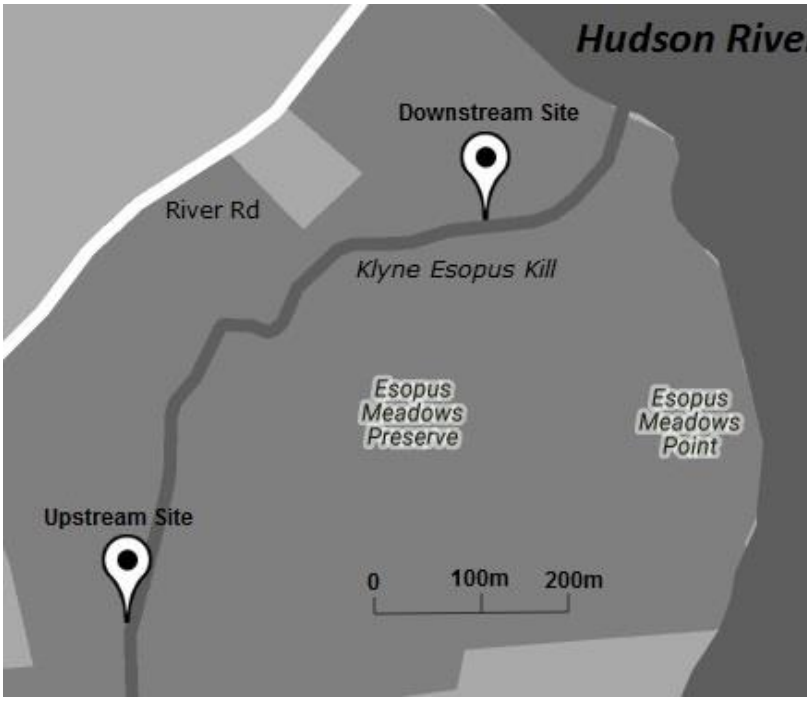

Figure 1. Map of sampling sites on the Klyne Esopus Kill, Ulster Park, NY. The distance between the stream mouth and the most upstream site (Rocky Stream 3) is about 1.1 km.

Habitat

There was relatively clear habitat segregation between American eel and Oriental weatherfish (Table 2). Eels preferred the rocky stream habitat whereas Oriental weatherfish were most abundant in the silty wet meadow location. Even when collected in the rocky stream areas, Oriental weatherfish were found under undercut banks or among tangled branches where dead leaves and silt accumulated. The Rocky Stream #3 sample was not included in this analysis since no Oriental weatherfish were captured in that location. Creek chub are more evenly distributed in the samples, overlapping with both American eels and Oriental weatherfish (Table 2).

Triple pass depletion estimates were done during the Rocky Stream #1 and Wet Meadow samples. The area of the former sample was 43.8 m^2 and the latter was 147.8 m^2. Confidence intervals (95%) could only be calculated for the American eel in Rocky Stream #1. For all other observations, the estimated population size equaled the observed number of fish caught (Table 3). American eel had a density one or two orders of magnitude greater than the other species.

Species	RS 1	RS 2	Wet Meadow
American eel	40	6	0
Creek chub	6	4	10
Oriental weatherfish	4	8	10

Table 1. Numbers of individuals collected by electroshocking in the Klyne Esopus Kill, 2014. RS indicates "Rocky Stream", see Figure 1.

Population	Confidence	Density		
Sample	*Species*	*Estimate*	*Interval*	*#/m^2*
Rocky Stream #1	American eel	51	42-69	1.16
	Creek chub	6		0.14
	Oriental weatherfish	4		0.09
Wet Meadow	Creek chub	25		0.17
	Oriental weatherfish	10		0.07

Table 2. Estimates of population size, 96% confidence interval (for American eel), and density (#/m^2) from triple pass depletion sampling in the Klyne Esopus Kill, 2014.

Diet

The food habit analysis indicated that there was very little overlap between Oriental weatherfish and American eel in the rocky stream habitat (Table 1). Overlap that was visible was due to plant material (algae) seen in both species. American eel is not known to consume algae (Machut 2006) and the presence of this material in eel guts is probably incidental. Nothing but algae was found in the Oriental weatherfish, which suggests that this material is important in the diet. Schmidt and Schmidt (2014) also reported algae in the Oriental weatherfish diet.

	Rocky Habitat			**Silty Habitat**	
Food	*Ow*	*Ae*	*Cc*	*Ow*	*Cc*
Algae	100	17	0	50	0
Annelids	0	67	0		
Insects	0	33	100	0	100
Beetles				17	0
Salamander				0	17
"Eggs"	0	0	17	17	0

Table 3. Summary of food habit data from fishes occupying two habitats in the Klyne Esopus Kill. Abbreviations are: Ow = Oriental weatherfish, Ae = American eel, and Cc = Creek chub. Numbers are percent of individuals having that item out of all individuals with food in their gut.

In the rocky stream habitat there was overlap between Oriental weatherfish and the native Creek chub in that both consumed insects. However, Creek chub are sight feeders and take insects from the surface or the water column (Hartel et al. 2002) whereas the burrowing habit and presence of substantial barbels indicate a benthic feeding strategy for Oriental weatherfish (Schmidt and Schmidt 2014). In the silty backwater habitat, Oriental weatherfish showed no overlap in food items with Creek chub (and no eel were collected). Again, the predominant food item in Oriental weatherfish was algae. Creek chub is known to be the top predator in small streams and feeds opportunistically on aquatic insects, mollusks (Hartel et al. 2002), or other fishes in the case of large individuals (Etnier and Starnes 1993). Overlap indices were going to

be calculated to compare diets among the three species found in the Klyne Esopus Kill, however, the minimum amount of overlap observed in this study made calculation of overlap indices superfluous.

DISCUSSION

In 2014, Oriental weatherfish was the least common species in the Klyne Esopus Kill (ignoring single individuals of White sucker and Blacknose dace collected). This was unexpected since previous observations (in 2013) indicated a high abundance for this species. Cause(s) of this change are not known.

Oriental weatherfish were found in habitats containing cover and silt. This is similar to the habitats reported by Schmidt and Schmidt (2014). Therefore there was very little overlap with American eel that preferred a rocky stream environment. In fact, American eel density in the Klyne Esopus Kill is close to the highest density reported for this species (1.2-1.4 eels/m^2, Schmidt et al. 2006). In either habitat, creek chub was more abundant that Oriental weatherfish (Table 3).

There was almost no overlap between Oriental weatherfish diet and the other two native species. Certainly, Oriental weatherfish are not interacting with American eel in terms of competing for habitat or food items. There is more overlap in habitat and food items between Oriental weatherfish and creek chub, but creek chub outnumber the alien species and feed differently; picking organisms from the water column or substrate surface whereas Oriental weatherfish are mostly feeding beneath the substrate surface.

Despite concerns about the spread of Oriental weatherfish locally and nationally, this species does not seem to be negatively affecting the native fishes in the Klyne Esopus Kill. This

assessment may change under conditions of high population density or in environments where the substrate is mostly silt.

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