

# Expansion of the invasive Round Goby (*Neogobius melanostomus*) into Allegheny River tributaries: LeBoeuf and French Creeks in Pennsylvania

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*Abstract:* The Round Goby (*Neogobius melanostomus*) is an invasive fish species currently found in all five of the Laurentian Great Lakes of the United States. Round gobies have previously been restricted to the Lake Erie watershed of Pennsylvania, however, in fall of 2014, they were discovered in portions of the upper Allegheny River watershed, specifically Lake LeBoeuf and LeBoeuf Creek. This introduction was likely via bait bucket transfer. This paper confirms additional records of Round Gobies, including age zero fish and males in breeding colors, in LeBoeuf Creek as well as in the main stem of French Creek, tributaries to the Allegheny River.

*Keywords:* invasive species, Round Goby, Allegheny, French Creek, LeBoeuf Creek,

The Round Goby (*Neogobius melanostomus* Pallas) is an invasive fish species found in all five of the Laurentian Great Lakes and associated tributaries and was likely initially introduced from ballast waters of oceanic vessels traveling from the Black and Baltic Seas (Jude et al. 1992; Sapota and Skora 2005; Brown and Stepien 2008, 2009). Kornis et al. (2012) published an extensive literature review and should be consulted for additional specific life history traits. Stauffer et al. (2016) summarized the status of both the Round Goby and Tubenose Goby (*Proterorhinus semilunaris*) in Pennsylvania.

In August 2014, the Pennsylvania Fish and Boat Commission released a statement confirming that a Pennsylvania Department of Environmental Protection biologist had found Round Gobies in Lake LeBoeuf (PFBC 2014).

Since then, the U.S. Geological Survey nonindigenous aquatic species database has added entries that confirmed young of year and adult collection of Round Gobies in Lake LeBoeuf and LeBoeuf Creek (USGS 2014).

Both Lake LeBoeuf and LeBoeuf Creek are located in Erie County near Waterford, Pennsylvania (figure 1). Lake LeBoeuf is a natural lake, approximately 28 hectares in size, and serves as a refuge for popular game fish species such as Black Crappie (*Pomoxis nigromaculatus*), Yellow Perch (*Perca flavescens*), and Largemouth Bass (*Micropterus salmoides*) (PFBC 2015). The outflow of Lake LeBoeuf is LeBoeuf Creek, which is fed not only by Lake LeBoeuf but also by additional headwaters approximately 10 km upstream of the lake. LeBoeuf Creek is a tributary to French Creek, which flows from southwestern New York to the Allegheny River in Franklin, Pennsylvania. French Creek is rich in biodiversity, providing a habitat for 80 species of fish, 397 species of birds, many species of salamanders, including the threatened Eastern Hellbender (*Cryptobranchus alleganiensis*), and 27 species of freshwater mussels, four of which are listed as federally endangered and ten as endangered within Pennsylvania (WPC 2002). The purpose of this paper is to report on the migration and colonization of

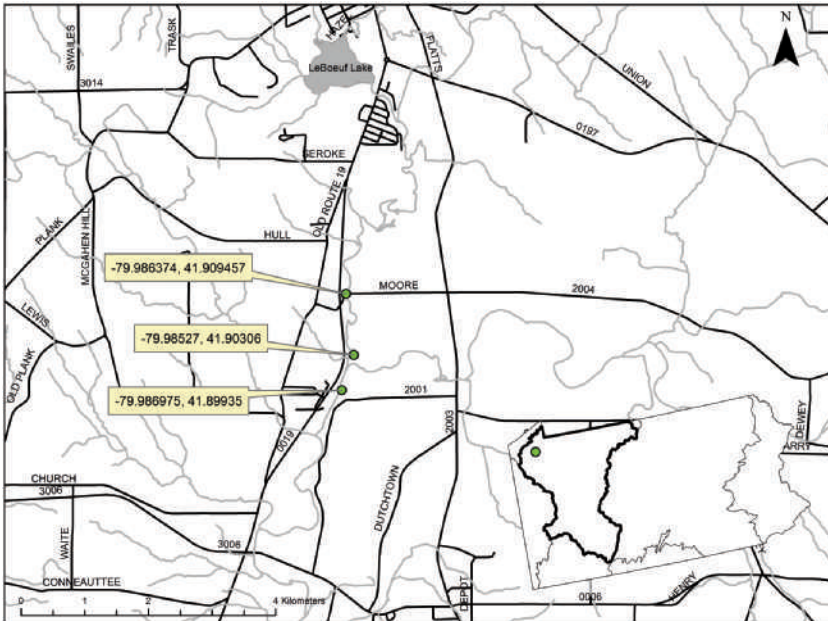


Figure 1. Collection sites for Round Gobies in LeBoeuf and French Creeks in 2015.

Round Gobies from their initial discovery in LeBoeuf Creek downstream to the main channel French Creek.

## MATERIALS AND METHODS

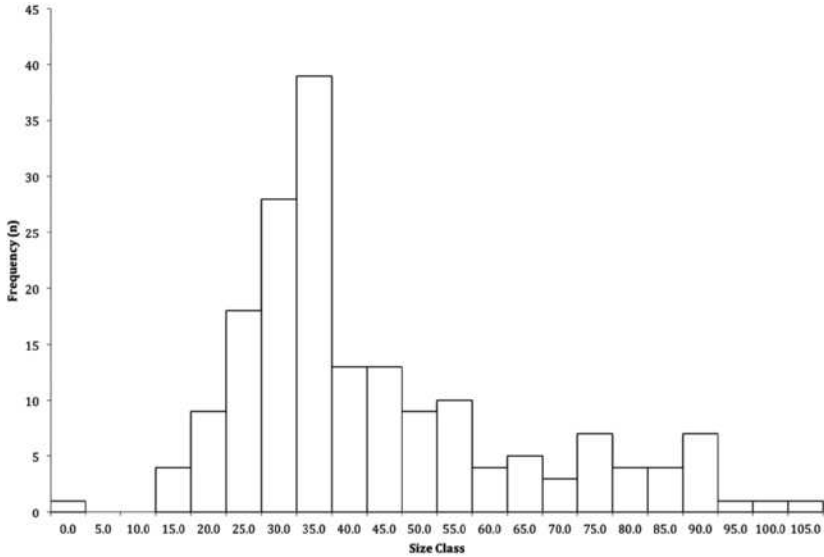
Three sites were sampled in the summer of 2015 (figure 1). The first site was located on Moore Road at the bridge that crosses LeBoeuf Creek (41.909457°, -79.986374°). This location was chosen based on previous surveys that found this site to be devoid of Round Gobies, despite being less than 5 km from Lake LeBoeuf (Bradshaw, personal communication). The second and third sites were near the confluence of LeBoeuf and French Creeks (41.90306°, -79.98527°). The third site was downstream of the confluence and the reach of stream surveyed began at 41.80201°, -79.98699°.

Samples at the Moore Road bridge site were collected in July and September 2015 using a 3-m seine with 0.64-cm mesh. At this site, a macroinvertebrate sample was also collected using a D-frame kicknet. In August 2015, samples at the mouths of LeBoeuf Creek and French Creek were collected with an Aqua Shock Solution backpack electrofishing unit. All of the fishes collected were inventoried. Round Gobies were anesthetized with a buffered MS222 solution and preserved in 10% formalin. After preservation, the total length of each Round Goby was measured using calipers. Total lengths were plotted in a histogram, and mean length at age was determined from data collected by Kornis et al. (2012) for Round Gobies in the central Lake Erie basin. Fish were permanently stored in 70% ethanol in the Pennsylvania State University Fish Museum. These methods are in accordance with the Pennsylvania State University Institutional Animal Care and Use Committee (IACUC 43866).

Additional Round Gobies were collected in September 2015 for genetic analysis using the Aqua Shock Solution backpack electrofishing unit. Fin clips were taken in the field and preserved in 100% ethanol. The results of genetic analysis will not be included in this paper, but these Round Gobies are included in the length histogram.

## RESULTS AND DISCUSSION

At the Moore Road Bridge site in July and September 2015, samples of 57 and 82 Round Gobies were captured, respectively. The mouth of LeBoeuf Creek was only sampled in August and September 2015 and yielded 14 and 6 Round Gobies, respectively. Only one Round Goby was collected in French Creek in August 2015. In late September 2015, 21 Round Gobies were collected at the Moore Road Bridge site, with an additional 6 Round Gobies collected at the



**Figure 2.** Total length (mm) for Round Gobies ( $N = 181$ ) collected in LeBoeuf Creek in 2015. Male /female mean lengths at age for 0+, 1+, 2+, 3+ are 51.75, 72.4, 97.15, and 138.9 mm, respectively.

mouth of LeBoeuf Creek. A total of 181 Round Gobies was collected among the three sites in 2015 and are included in the length histogram (figure 2).

Total length of all Round Gobies collected ranged from 0.35 to 106 mm. The smallest Round Goby was captured at the Moore Road bridge site, and the largest Round Goby was captured at the mouth of LeBoeuf Creek. The median total length was 38.7 mm. Based on the average of male and female mean lengths at ages from Kornis et al. (2012), 71.82% of Round Gobies we collected were age class 0+, 12.71% age class 1+, 13.81% age class 2+, and 1.66% age class 3+.

Other fishes collected simultaneously in July and August 2015 are summarized in table 1. At the Moore Road Bridge site, 7 species of darters and 2 species of madtoms were collected. At the mouth of Leboeuf Creek, 9 species of darters and a single species of madtom were collected. Last, 10 species of darters and 2 species of madtoms were collected in French Creek below the confluence with LeBoeuf Creek. Additionally, several Ohio Lamprey (*Ichthyomyzon bdellium*) were collected at the French Creek site.

This study confirms the presence of Round Gobies throughout LeBoeuf Creek with an additional record of Round Gobies in the main channel of French Creek. Additionally, the range of size classes collected indicates that this population is established and breeding. Wilson has since found a breeding

**Table 1.** Presence and absence of fishes in LeBoeuf and French Creeks in July and August 2015.

	<i>LeBoeuf Creek at Moore Road (July 30)</i>	<i>LeBoeuf Creek at mouth (Aug. 4)</i>	<i>French Creek below confl. (Aug. 4)</i>	<i>French Creek below confl. (Aug. 7)</i>
Petromyzontidae				
<i>Ichthyomyzon bdellium</i>			X	X
Amiidae				
<i>Amia calva</i>	X			
Cyprinidae				
<i>Campostoma anomalum</i>	X		X	
<i>Cyprinella spiloptera</i>	X		X	X
<i>Notropis atherinoides</i>				X
<i>N. volucellus</i>				X
<i>Pimephales notatus</i>		X	X	
<i>Rhinichthys obtusus</i>		X		
<i>Semotilus atromaculatus</i>			X	
Esocidae				
<i>Esox americanus</i>		X		
Catostomidae				
<i>Hypentelium nigricans</i>		X	X	X
<i>Moxostoma erythrurum</i>		X		
Ictaluridae				
<i>Ameiurus natalis</i>		X	X	
<i>Noturus flavus</i>				X
<i>Not. miurus</i>	X	X	X	X
Percopsidae				
<i>Percopsis omiscomaycus</i>	X			
Centrarchidae				
<i>Ambloplites rupestris</i>				X
<i>Lepomis</i> spp	X			
<i>L. gibbosus</i>		X		

(Continued)

**Table 1.** Presence and absence of fishes in LeBoeuf and French Creeks in July and August 2015. (Continued)

	<i>LeBoeuf Creek at Moore Road (July 30)</i>	<i>LeBoeuf Creek at mouth (Aug. 4)</i>	<i>French Creek below confl. (Aug. 4)</i>	<i>French Creek below confl. (Aug. 7)</i>
<i>Micropterus</i> spp	X			
<i>Micr. dolomieu</i>		X		X
<i>Micr. salmoides</i>		X		
Percidae				
<i>Etheostoma blennioides</i>	X	X	X	X
<i>Eth. caeruleum</i>	X	X		X
<i>Eth. camurum</i>	X	X	X	X
<i>Eth. flabellare</i>		X		X
<i>Eth. maculatum</i>			X	X
<i>Eth. nigrum</i>	X	X		
<i>Eth. variatum</i>			X	X
<i>Eth. zonale</i>	X	X	X	X
<i>Perca flavescens</i>		X		X
<i>Percina caprodes</i>	X	X		
<i>P. macrocephala</i>		X		X
<i>P. maculata</i>	X	X		X
Gobiidae				
<i>Neogobius melanostomus</i>	X	X		X

male Round Goby guarding eggs at the Moore Road bridge site. Further studies will examine the dispersal and microhabitat partitioning of Round Gobies throughout the French Creek drainage. At that time, sites will be monitored for other benthic species of fishes as well.

## NOTE

We appreciate the assistance of Kyle Clark, Benjamin Plohr, and Danielle Pierone in the field.

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