Is lake trout recruitment impacted by zebra mussels in Otsego Lake, NY?

David M. Lucykanish¹ & John R. Foster²

Abstract: Zebra mussels (Dreissena polymorpha) became established in Otsego Lake in 2008 and by 2010 carpeted the lake trout (Salvelinus namaycush) spawning shoal at Bissel Point. The literature suggests that the presence of zebra mussels would negatively impact lake trout recruitment, because of reduced attractiveness of the substrate and the degradation of interstitial water quality within the substrate. In this study current lake trout recruitment was examined and compared to recruitment levels observed in previous studies. Emergent fry traps were used to capture lake trout fry swimming up from the substrate at Bissel Point in April-May 2014. Twelve emergent fry traps with a diameter of 81 cm (.52 m²) were set on four linear transects in depths of 30, 60 and 90 cm, across the entire shoal. Both the highest (4.83 m²/day in 2014) and lowest (1.59 fry/m²/day in 2013) recruitment levels occurred in the presence of zebra mussels. Fry recruitment was 3.44-3.96 fry/m²/day in the absence of zebra mussels. Therefore, contrary to expectations from the literature, lake trout fry recruitment in the presence of zebra mussels did not differ significantly from recruitment levels in the absence of zebra mussels.

INTRODUCTION

Zebra mussel colonization of lake trout spawning shoals was shown to have negative impacts on their recruitment (Marsden et al 1995, Marsden & Chotkowski 2001). The occurrence of zebra mussels on the spawning shoals reduces their attractiveness to spawning adult lake trout, thus reducing egg deposition and recruitment (Marsden & Chotkowski 2001). Zebra mussels could also have negative impacts on recruitment by reducing the viability of lake trout eggs and fry. The presence of zebra mussels increases damage to lake trout eggs (Marsden & Chotkowski 2001), as well as vulnerability of eggs to predators (Claramunt et al. 2005, Marsden 1997). Zebra mussels can also degrade the interstitial water quality within the spawning substrate (Marsden et al 1995, Marsden & Chotkowski 2001).

Concerns have been raised about the negative impacts zebra mussels may have on lake trout recruitment in Otsego Lake (Sawick & Foster 2013). Initial studies conducted at Bissel Point (Sawick & Foster 2013), a historic lake trout spawning shoal, indicate reduced recruitment in 2013 following zebra mussel colonization in 2010 (Anonymous 2012). However, studies by Tibbits (2007) and Marsden and Chotkowski (2001) have also demonstrated significant variation in yearly lake trout recruitment. Further, the spawning shoals at Bissel Point are in very shallow water. This would make lake trout eggs particularly vulnerable to ice scour and wave action (Edwards et al. 1990). These physical factors are expected to vary from year to year, resulting in year to year variation in recruitment.

¹ Fisheries and Aquaculture student, SUNY Cobleskill.
² Professor and Chair, Fisheries, Wildlife and Environmental Science Department, SUNY Cobleskill.
The goal of this project was to continue the studies of Tibbits (2007) and Sawick & Foster (2013) and measure lake trout recruitment in Otsego Lake at Bissel Point. The objective is to provide data on the year-to-year variation in recruitment as well as the impact of zebra mussels on lake trout recruitment.

MATERIALS & METHODS

This study was conducted just off Bissel Point, Otsego Lake (W74° 54.141; N42° 45.550, Otsego Township, Otsego County, New York), following Tibbits (2007) and Sawick & Foster (2014). The study began on 9 April 2014 just as the ice was receding off Otsego Lake and was completed on 21 May 2014. The total time the traps were fished was 42 days.

Three emergent fry traps were set at depths of 30, 60 and 90 cm along four transect lines perpendicular to the shoreline (Figure 1). The twelve emergent fry traps used in this study had a diameter of 81 cm (area of .52 m\(^2\)) and were the same ones used by Tibbits (2007) and Sawick & Foster (2014). Emergent fry traps were checked every other day. Captured fry were counted and returned to the lake at the point of capture.

Figure 1. Emergent fry traps were set in depths of 30, 60 and 90 cm at 4 sites off Bissel Point, Otsego Lake, NY.
RESULTS

Most lake trout fry emerged close to shore. The majority (67%) of the 435 lake trout fry captured in the spring of 2014 swam up in the 30 cm deep traps (Figure 2). The 60cm deep trap captured 116 fry and only 27 fry were captured in the 90cm deep trap.

![Figure 2. The percent of 2014 emergent lake trout fry captured at three water depths.](image)

In 2014 lake trout fry emergence took place over 36 days. The first lake trout fry didn’t emerge until 17 April and the last fry emerged on 21 May (Figure 3). The peak fry emergence in 2014 was from 5-8 May.

Rising water temperatures above 8 °C seem to trigger fry emergence. From 27 April to 5 May water temperature was consistent at 8 °C. When water temperature increased to 9 °C, on 8 May, 138 emergent fry swam up into the traps. However, as the water temperature continued to increase above 11°C, the number of fry captured decreased until 21 May, when just 7 fry were captured.
In 2014, all measures of fry emergence were substantially higher than in 2013 or in 2003-2004 prior to the invasion of zebra mussels (Table 1). In 2014, the average number of fry per trap per day was 1.01, higher than .73 in 2003 and .96 in 2004 prior to the introduction of zebra mussels.
mussels. In 2014 the average number of fry per m²/day was 4.83 which was higher than the 3.96 fry/m²/day captured in 2004, and higher than the 3.44 fry/m²/day captured in 2003. In fact the total amount of fry captured in this study (435) was almost twice the combined number of fry captured in the three previous studies combined (chi square test, P < .001)!

Table 1. Various measures of fry emergence in 2014 compared to previous studies.

<table>
<thead>
<tr>
<th>Year</th>
<th>Emergence Period (Days)</th>
<th>Total Fry Captured</th>
<th>Average Fry per Trap per Day</th>
<th>Average Fry per m²/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>21</td>
<td>172</td>
<td>.73</td>
<td>3.44</td>
</tr>
<tr>
<td>2004</td>
<td>28</td>
<td>43</td>
<td>.96</td>
<td>3.96</td>
</tr>
<tr>
<td>2013</td>
<td>28</td>
<td>13</td>
<td>.07</td>
<td>1.59</td>
</tr>
<tr>
<td>2014</td>
<td>36</td>
<td>435</td>
<td>1.01</td>
<td>4.83</td>
</tr>
</tbody>
</table>

DISCUSSION

Natural recruitment is critically important to maintain the lake trout fishery in Otsego Lake. Seventy five percent of the lake trout in Otsego Lake are from natural recruitment and only 25% come from stocked fish according to New York State Department of Environment Conservation gill net surveys (Tibbits 2007). Concerns about lake trout recruitment came soon after zebra mussels were first documented in Otsego Lake in 2007 (Waterfield 2009). Adult zebra mussels were well established throughout the Lake by 2010 including the lake trout spawning shoal at Bissel Point (Anonymous 2010).

The literature suggests that the presence of zebra mussels on the spawning shoals would negatively impact lake trout recruitment because of reduced attractiveness of the substrate to spawning lake trout. In spite of the presence of zebra mussels, natural spawning of lake trout did occur at the Bissel point shoal in 2013 as evidenced by the emergent fry captured during the spring of 2014.

The degradation of interstitial water quality within the substrate and increased predation have also been suggested as possible negative impacts of zebra mussels on lake trout recruitment (Marsden et al 1995, Marsden 1997, Marsden & Chotkowski 2001 Claramunt et al. 2005). However, in this study the highest level of recruitment (4.83 m²/day) ever recorded occurred in the presence of zebra mussels. The total number of emergent fry captured (435) was significantly higher than the maximum captured (172) before zebra mussels became established in Otsego Lake (Tibbits 2007).

Therefore, contrary to expectations from the literature, lake trout fry recruitment in the presence of zebra mussels may not differ significantly from recruitment levels in the absence of zebra mussels in Otsego Lake. Similarly, Marsden & Chotkowski (2001) showed that lake trout emergence was similar on substrates fouled and not fouled by zebra mussels. Further, Marsden et
al. (2005) showed that lake trout fry hatch per egg had some of the highest rates on sites in Lake Champlain that were densely covered with zebra mussels.

There are a multitude of other factors besides zebra mussels that could negatively impact lake trout fry recruitment and increase the variation in fry recruitment from year to year. Wave action, ice scour, and predation all impact lake trout recruitment and are expected to vary from year to year (Edwards et al. 1990, Krueger et. al 1995, Marsden et. al 1995).

The presence of zebra mussels themselves may have a positive impact on measures of lake trout recruitment. Lake trout fry are mobile before swimming up, and they move within and above the substrate (Baird & Krueger 2000). Possibly, zebra mussels may clog interstitial spaces in the substrate reducing fry movement making them more vulnerable to capture by emergence traps (Marsden & Chotkowski 2001). This may result in increased capture rates by emergence traps.

Both the highest (4.83 m²/day) and lowest (1.59 fry/m²/day; Sawick & Foster 2013) recruitment levels occurred in the presence of zebra mussels. Fry recruitment was 3.44-3.96 fry/m²/day in the absence of zebra mussels. More studies are necessary to determine year-to-year variation in recruitment, as well as the impact of zebra mussels on lake trout recruitment.

ACKNOWLEDGEMENTS

The SUNY Oneonta Biological Field Station provided the fry emergent traps and facilities. Matthew Albright of the BFS provided guidance and assistance to this project. Land owners Bevin & Aaron Hall allowed access and use of their property at Bissel Point. SUNY Cobleskill students Matthew Best, Eric Malone, Nick Sawick, Jeff Thompson, Quinn Buckley, Matt Miners, Nick Winter and Brandon Winter helped set, check and repair traps. Research grants to the senior author from the Clear Water Chapter of Trout Unlimited and Schoharie County Conservation Association helped fund this study.

LITERATURE CITED

Anonymous. 2010. Otsego Lake zebra mussel update. SUNY Oneonta Biological Field Station Reporter, summer/fall 2010, p.3. SUNY Oneonta Biological Field Station, Oneonta, NY.


