Spawning site fidelity of walleye (*Sander vitreus*) in Otsego Lake, NY

John. R. Foster¹, Joseph C. Lydon², Rian C. Hilsdorf³, and Cory J. Tizzio³

**Abstract:** This study was conducted to determine if walleye populations in Otsego Lake demonstrated spawning site fidelity. In 2008 and 2009 walleye were trap netted and/or electrofished on their spawning grounds and marked with elastomer and/or jaw tags. Within the 2008 spawning run, 21% of the recaptured walleye visited at least two spawning streams. In the following years, 2009 and 2010, 54% of the walleye recaptured did not home back to the stream where they were initially captured. Spawning site fidelity by walleye in Otsego Lake was found to be much weaker than reported for this species in their native Oneida Lake.

**INTRODUCTION**

Natal homing behavior is considered typical of walleye (Regier et al. 1969). Numerous studies have shown that stream-spawning walleyes tagged on specific spawning grounds returned to the same spawning grounds year after year (Stoudt 1939, Rawson 1957, Crowe 1962, Forney 1963, Jennings et al. 1996). However, there is growing evidence that in at least some walleye populations homing behavior is weak or inconsistent (Smith et al. 1952, Olson & Scidmore 1962, Todd & Haas 1993, Bigrigg 2006).

Oneida Lake walleye are reported to have strong spawning site fidelity. Stream and lake-spawning Oneida Lake walleyes tagged and recaptured during successive years showed little tendency to move from one spawning area to another during the same or in successive spawning years (Forney 1963). After Otsego Lake’s native walleye population was extirpated in the 1980’s (Lehman et al. 1991), Oneida Lake walleye fingerlings have been stocked since 2000 (Cornwell & McBride 2008). However, hatchery incubated and pond reared Oneida Lake walleye will not have the same early life history or opportunities to imprint on spawning sites, as would a natural population.

The question examined in this study was: Will Oneida Lake walleye stocked into Otsego Lake show the same spawning site fidelity as observed in Oneida Lake by Forney (1963)? In order to answer this question, Otsego Lake walleye were tagged on their spawning run and then recaptured in subsequent years to determine the extent of spawning site fidelity. The examination of spawning site fidelity in stocked walleye may give some insight into the underlying mechanism for the development of homing behavior in this species.

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MATERIALS AND METHODS

The study was conducted at the four primary tributaries (Cripple Creek, Hayden Creek, Shadow Brook, and Leatherstocking Creek; Figure 1). These four tributaries were the primary walleye spawning locations for walleye on Otsego Lake, Otsego County, N.Y. (42.40° N latitude, 74.55° W longitude).

Walleye were captured in six foot Oneida trap nets set on Sunken Island, and in the mouths of Shadow Brook, and Hayden, Cripple, and Leatherstocking Creeks from 9-25 April 2008 (Figure 1). Walleye were removed from the nets daily, measured, marked and returned to the opposite side of the net from which they were captured.
In 2008 a total of 628 walleye were marked with a hole-punch at the base of the third dorsal fin spine and injected with a visible implant elastomer (VIE) behind the left eye. VIE marks were color coded to indicate capture site. Within this group of 628 marked walleye, 490 fish also received a NYSDEC numerically coded jaw-tag. In 2009 a total of 499 walleye received a VIE tag implanted in the isthmus of the fish and a hole was punched in the anal fin.

During the spawning run in 2009, walleye were recaptured using backpack electrofishers and trap nets. Trap nets were used from 7 April to 2 May at the stream mouths. On 16, 17, 18 April 2009 Smith-Root and Haltech backpack electro-shockers were also used in Cripple Creek (below Clarke Pond), Shadow Brook (at Mill Road) and Hayden Creek (County Road-53) to recapture walleye. In 2010 Smith Root and Haltech backpack shockers were again used in each of the four streams. Electrofishing surveys for recaptured fish occurred from 7:00 pm until 12:00 am, 4-7 April and on 9 April 2010.

All walleye captured were examined for VIE tags, (using an ultraviolet handheld light), jaw tags, fin clips, dorsal hole punches and anal hole punches. Once a walleye was examined for marks, each fish was sexed, and returned to its capture site.

RESULTS

Site Fidelity During the Spawning Run

Of the 628 walleye tagged in 2008, 109 were recaptured during the 2008 spawning run. Most (58%) walleye were recaptured the day after they were initially tagged and 78% were recaptured within two days of being marked (Figure 2).

![Figure 2. Days to recapture for 2008 walleye tagged during the spawning run.](image-url)
The majority of the recaptures occurred in the same stream as the fish were tagged, however 21% were recaptured in a different stream. Of the fish that changed streams during the spawning run, some did so very quickly, within one day after their initial capture, while others were recaptured in a different stream as much as 10-11 days later (Figure 2).

None of the fish tagged in Shadow Brook moved to another stream (Table 1). None of the fish tagged in other locations moved to Leatherstocking Creek during the 2008 spawning run. Walleye tagged in Cripple Creek moved to Hayden Creek and Shadow Brook. Walleye tagged in the south end of the lake in Leatherstocking Creek moved to the northern streams.

Table 1. Walleye that changed spawning streams during the 2008 spawning run.

<table>
<thead>
<tr>
<th>Stream of Origin</th>
<th>Recapture Stream</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Leatherstocking</td>
</tr>
<tr>
<td>Leatherstocking Cr.</td>
<td>5</td>
</tr>
<tr>
<td>Cripple Creek</td>
<td></td>
</tr>
<tr>
<td>Hayden Creek</td>
<td>5</td>
</tr>
<tr>
<td>Shadow Brook</td>
<td></td>
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</tbody>
</table>

**Spawning Site Fidelity From Year to Year**

During the 2009 and 2010 spawning runs, 136 tagged walleye were recaptured. The percent of walleye that were captured in the same spawning stream in subsequent years was 46%. In other words, 54% of the walleye did not home.

Unfortunately, only 14 tagged females were recaptured. Four of the six females tagged in Hayden Creek returned to Hayden Creek and one of the three tagged females captured in Shadow Brook was originally captured there. Walleye females tagged in Cripple Creek and Leatherstocking Creek went to other streams in subsequent years. In total only 5 of the recaptured females had returned to their original site of capture, and 9 went elsewhere.

A total of 122 tagged males were recaptured, 56 of which returned to their original site of capture, and 66 went elsewhere. While a slightly higher percent of males returned to their original site of capture (46% males versus 36% of the females) the difference was not statistically significant (Chi square test, $P = .07$). Therefore, male and female data were combined in subsequent analysis.

Tagged walleye in each spawning stream were divided into those that spawned there the previous year and those that spawned elsewhere (Figure 3). The percent of walleye in a
particular stream that returned from the previous year varied significantly from stream to stream (Chi square test, P < .001). While Shadow Brook contained the most tagged walleye, the per cent that spawned there the previous year was the lowest of all streams. On the other hand, Leatherstocking Creek was the least popular walleye spawning site, but it contained the highest per cent of tagged walleye that returned to it.

Another way of looking at the data is to ask the question: If a walleye was tagged in a particular spawning stream one year would it return to that stream the following year? The answer varies significantly among the spawning sites (Table 2). Walleye tagged in Shadow Brook were most likely to return to Shadow Brook in the following years, although some strayed to Cripple Creek and Hayden Creek. Hayden Creek walleye returned in about equal numbers to Hayden Creek or went to Shadow Brook. Walleye tagged in Cripple Creek were equally likely to show up in Cripple Creek, Hayden Creek and Shadow Brook during the next spawning run.

Figure 3. The number of tagged walleye present in each stream that homed or did not home to that location.
The plasticity of walleye homing behavior was demonstrated by fish tagged in Leatherstocking Creek. Movement into Leatherstocking Creek was completely obstructed in 2010 by a beaver dam, forcing walleye to spawn elsewhere. Of the 19 recaptured walleye originally tagged in Leatherstocking Creek, 15 went elsewhere the following year.

Table 2. A comparison of the stream of origin for walleye tagged in 2008 and where they were recaptured in the 2009 spawning run.

<table>
<thead>
<tr>
<th>Marked Stream 2008</th>
<th>Recapture Stream</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Leatherstocking</td>
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<tr>
<td>Leatherstocking Cr.</td>
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</tr>
<tr>
<td>Cripple Creek</td>
<td>0</td>
</tr>
<tr>
<td>Hayden Creek</td>
<td>1</td>
</tr>
<tr>
<td>Shadow Brook</td>
<td>0</td>
</tr>
</tbody>
</table>

Sunken Island is believed to be an offshore spawning area for walleye in Otsego Lake. In 2008, 30 walleye were tagged on Sunken Island during the spawning run. In 2010, three walleye originally tagged in 2008 on Sunken Island were captured in Hayden Brook and two were captured in Cripple Creek during the spawning run.

DISCUSSION

In Oneida Lake, stream and lake-spawning walleyes tagged and recaptured during successive years showed little tendency to move from one spawning area to another during the same or in successive spawning seasons (Forney 1963). However, when this same strain of fish was stocked into Otsego Lake substantially different behaviors were observed. In this study, over 21% of the recaptured walleye changed spawning areas within the same spawning season. Further, the majority (54%) of walleye did not return to the same spawning stream on successive years.

Natal homing behavior is considered typical of walleyes and reproductively active adults are expected to return to their natal spawning grounds in the following spring (Regier et al. 1969). Studies have indicated that natal homing in spawning walleye is governed by a genetically based response to environmental cues (Stepien and Faber 1998). Mitochondrial DNA analyses show genetic divergence between spawning populations within Lake Erie with natal homing hypothesized to be the responsible mechanism (Stepien and Faber 1998).
Other studies (Smith et al. 1952, Olson & Scidmore 1962, Todd & Haas 1993, Bigrigg 2006) have indicated that walleye possess weak homing behavior and straying from the home spawning site is common (Todd and Haas 1993). In some populations individual walleye have been shown to move intermittently between spawning streams or display an irregular pattern of return (Smith et al. 1952, Olson & Scidmore 1962, Bigrigg 2006). Mitochondrial differences have been identified among some spawning stocks but not others, suggesting that fidelity may be stock-specific (Merker and Woodruff 1996).

The fact that walleye in Otsego Lake do not demonstrate the strong homing behavior described by Forney (1963) may have a number of causes. The genetic basis for spawning site fidelity (Jennings et al. 1996) may have been reduced or lost over the intervening 48 years by hatchery techniques of capturing migrating brood-stock out in Oneida Lake. Trapping migrating walleye in the lake would mix brood-stock with a genetic pre-deposition for spawning in lake and stream locations. Hatchery incubation and pond rearing of fry may result in the olfactory imprinting of spawning grounds that are not found in Otsego Lake, further reducing homing abilities and spawning site fidelity.

ACKNOWLEDGEMENTS

SUNY Cobleskill students volunteered many hours electro-fishing and trap netting, especially William Crawley, David Johns, Doug Peck and Justin Potter. SUNY Cobleskill’s fisheries technician Kevin Poole also assisted with the field work. All of the equipment used in this study was supplied by SUNY Cobleskill, SUNY Oneonta Biological Field Station, and Cornell Biological Field Station. Assistance with the equipment and advice on the fieldwork was provided by Tom Brooking from Cornell Biological Field Station, and Matt Albright and Dr. Willard Harman from SUNY Oneonta Biological Field Station.

LITERATURE CITED


