Spine punching: An effective way of marking spiny-rayed fish

Anthony Bruno¹, John R. Foster² and Joe C. Lydon³

Abstract: The effectiveness of spine punching as a technique for marking spiny rayed fish was examined using Otsego Lake walleye tagged with a variety of methods beginning in 2008. Spine punching proved to be cheap and easy to apply. Spine punches were retained extremely well and were easy to detect 4 years later. No negative impacts on survival and condition were found. Utilizing different spines to punch provided a system for unique identification. Spine punching appears to be one of the most effective techniques for marking spiny rayed fish.

INTRODUCTION

To be effective, fish tagging methods must be cheap, long lasting, easy to identify, easy to apply and have little negative effects on fish. One of the most common ways to mark fish is fin clipping. It has proven to be effective and cheap (Zerrenner et al. 1997, Thompson et. al. 2005), but has negative impacts on fish growth and survival (Bumgarner et al. 2009, Coble 1971, Shetter 1967). Numbered jaw tags have the advantage of allowing the fish to have a unique identification number, but they hinder the growth (Deroche 1963, Shetter 1967, Zerrenner et al. 1997), survival (Zerrenner et al 1997) and are frequently lost (Newman & Hoff 1998, Crawley 2009). Visual implant elastomer (VIE) tags have a low mortality rate (Close 2000, Zerrenner et al. 1997, Thompson et al. 2005) and a long retention time (Close 2000, FitzGerald et al. 2004). However, recently tagged fish can lose VIE tags at a high rate (Bailey et al. 1998) and while VIE tags can be quickly applied to fish (Close 2000), they are relatively expensive (Thompson et al 2005). Unfortunately all existing tagging and marking methods have problems that limit their usefulness.

The utilization of a hole punch to mark soft rayed fins has been used for short-term identification in studies determining population size (Guy et al. 1996). Hole punching is fast and cheap, but the limited number of fins provide limited opportunities to vary the punches. Further, while hole punches are easy to detect over the short term, fins must be closely examined for long term detection of this mark (Crawley 2009). A modification of the fin punching technique whereby the dorsal fin spines are punched has the potential of overcoming some of the limitations of soft fin punches. Spine punching is expected to retain the advantages of low cost and ease of application, but may have the distinct advantage of ease of long term detection. Additionally, fish can be given a unique identifying mark by punching different spines or spine combinations.

The goal of this study was to determine if spine punching is an effective way of marking spiny-rayed fish. The objective was to determine the ease of detection years after its application, and determine if spine punching reduces survival and condition.

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MATERIALS & METHODS

Walleye were collected and examined from Shadow Brook, Hayden Creek and Cripple Creek, Otsego County, New York (Figure 1). Fish were captured 12, 14, 15 April 2011, from 2100 to 2300 hours. Follow-up sampling was carried out in April 2012.

Figure 1. Otsego Lake and its main tributaries, with arrows showing the walleye collection sites utilized in this study.

Walleye were collected by night electrofishing, with a Haltech (HT-2000) electro-fisher. Stunned fish were placed in totes, individually measured, sexed, and checked for ripeness. Then they were examined for third and fifth dorsal spine punches, anal fin punches, fin clips, jaw tags, and VIE tags posterior to left eye and on the isthmus. Tagging locations examined corresponded to those utilized in previous studies (Table 1).
Table 1. Number of walleye marked each year with each marking technique.

<table>
<thead>
<tr>
<th>Marking</th>
<th>Number of Fish Marked</th>
<th>Marking Year</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anal Fin Hole Punch</td>
<td>320</td>
<td>2009</td>
<td>Peck et al. 2010</td>
</tr>
<tr>
<td>VIE Tag Isthmus</td>
<td>320</td>
<td>2009</td>
<td>Peck et al. 2010</td>
</tr>
<tr>
<td>5th Dorsal Spine Punch</td>
<td>588</td>
<td>2010</td>
<td>Crawley et al. 2010</td>
</tr>
</tbody>
</table>

A short term (81 day) study was conducted to determine the impact of spine punching on condition and survivability. In the aquaponics greenhouse at the State University of New York at Cobleskill, six, 500 gallon closed recirculation tanks were stocked with 235 tilapia ranging from 120-350 grams. A random sample of fifty fish from each tank was measured, weighed and then given a spine punch in their dorsal fin corresponding to their tank number. Fish from tank one were given a spine punch in the third dorsal spine, fish from tank two received a spine punch in the fourth dorsal spine and so on. Fish were again weighed and measured after 81 days and the condition and mortalities of marked and unmarked fish were recorded.

RESULTS

Of the 462 walleye examined in 2011, 154 had one or more tags (Table 2). All walleye receiving a 3rd spine hole punch retained the mark. Since the fish receiving a 5th spine punch had not received a second mark there was no way of determining if this punch was missed or lost. Spine punch retention was higher than VIE, jaw tagging and soft fin punching (Table 2).

Spine punched tilapia did not have a higher mortality (.005% N=600) over 81 days than did tilapia that did not receive a spine punch (.009% N= 1110). The condition of tilapia receiving a spine punch (K = 1.99) did not differ from tilapia that did not receive a spine punch (K = 1.96).

Walleye marked with an anal fin punch were difficult to detect visually. Often the anal fin had to be felt to find the scar from the healed hole. VIE tags also require a fairly extensive search with a black light, since the VIE tag had a tendency to fragment, fade or become lost. Jaw tags were easily detected.

Spine punches were remarkably easy to detect even after two (Figure 2) and four (Figure 3) years. Spines either reconnected at an oblique angle, or there was a gap in the spine where the
punch had occurred. The dorsal fin had to be erected during the examination, but the time of detection occurred faster than with the VIE tags and the anal fin punch (Figure 3).

Table 2. The 2011 recapture data showing mark retention in walleye marked during a particular year.

<table>
<thead>
<tr>
<th>Marking</th>
<th># Recaptured With Marks</th>
<th>Per Cent Retained</th>
<th>Marking Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>3rd Dorsal Spine Punch</td>
<td>27</td>
<td>100%</td>
<td>2008</td>
</tr>
<tr>
<td>Jaw Tag</td>
<td>14</td>
<td>93%</td>
<td>2008</td>
</tr>
<tr>
<td>VIE Tag Posterior Left Eye</td>
<td>24</td>
<td>88%</td>
<td>2008</td>
</tr>
<tr>
<td>Anal Fin Hole Punch</td>
<td>46</td>
<td>98%</td>
<td>2009</td>
</tr>
<tr>
<td>VIE Tag Isthmus</td>
<td>32</td>
<td>56%</td>
<td>2009</td>
</tr>
<tr>
<td>5th Dorsal Spine Punch</td>
<td>102</td>
<td>-</td>
<td>2010</td>
</tr>
</tbody>
</table>

Figure 2. Two years after the 5th dorsal spine was punched it was easy to detect.
DISCUSSION

An effective method of marking and tagging fish is critical for fisheries research and management (Hilborn et al. 1990). Fish marking is used to determine population abundance, year class strength, harvest rates, growth, survival, homing and migrations (Hilborn et al. 1990, Guy et al. 1996). Tag retention, impact on growth and survival and the ease and cost of application and detection are critical considerations in evaluating marking and tagging methods.

One hundred percent of the walleye retained the 3rd spine dorsal punch after three years. Even after four years the spine punch in the 3rd dorsal spine was easily visible. In contrast, the three-year retention of the VIE tag posterior to the left eye was retained only 88% of the time. Further, there was some difficulty distinguishing between the green and yellow VIE tags under the ultraviolet light. The VIE tag on the isthmus was even harder to detect and it’s retention after two years was only 56%. Inexperience in tagging fish with VIE tags may have explain these lower rates of tag detention (FitzGerald et al. 2004, Olsen et al. 2001, Close 2000). Similarly, after two years the anal ray punch needed to be viewed more closely than the spine punches in order to detect it, even though it was retained 98% of the time. Like VIE tags, jaw tags took a
long time to apply, but had a 93% retention rate over 3 years. These three year retention rates were higher than reported for the same fish after one year (Crawley et al. 2009).

In this first study to test spine punching as marking technique for spiny rayed fish, spine punching proved to be cheap and easy to apply. Further, after four years spine punches were retained extremely well, and had no negative impact on condition or survival. The choice of spines to punch also provided a system for unique identification. For these reasons, spine punching appears to be one of the most effective techniques for marking spiny rayed fish.

**ACKNOWLEDGEMENTS**

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**LITERATURE CITED**


