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Use of Floy Tags to Determine Angler Harvest of Brown Trout in Two Southern Michigan Streams

Michael P. Herman

Jackson District Office
301 Louis Glick Highway
Jackson, Michigan 49201

Abstract.–In late March 1991, fifty percent of yearling brown trout stocked into the St. Joseph-of-the-Maumee River and sixty-three percent of those stocked in the South Branch of the Kalamazoo River were marked with Floy tags in an effort to estimate angler harvest. St. Joseph River anglers returned a total of 31 tags representing an estimated minimum harvest of 1.8% and Kalamazoo River anglers returned a total of 38 tags, representing an estimated minimum harvest of 1.6%. Factors that could have contributed to the observed low number of tag returns include; tag loss (or shedding) after stocking, high hooking mortality of sublegal tagged fish, mortality due to tagging, natural mortality of tagged trout before they reached legal size, tags not returned by anglers and migration of fish out of the stocked areas. Tag loss and migration of stocked trout was probably very high throughout this study. Thus, angler returns of Floy tags did not yield reliable estimates of angler harvest. These estimates have limited value since they are based on a small number of returned tags and harvest was likely underestimated. Using larger trout may result in improved tag retention and is recommended for future tagging studies.

The St. Joseph-of-the-Maumee River in Hillsdale County and the South Branch of the Kalamazoo River in Jackson and Hillsdale Counties are representative of the marginal trout streams in south-central Michigan. The influence of urbanization, agriculture and other human activities have had significant negative effects on coldwater streams in this region. Even though these streams are often degraded and have somewhat poorer trout habitat than streams farther north, they are very important to trout anglers because of their proximity to urban centers in southern Michigan. These streams can support trout, at least seasonally, and are a fishery management challenge for biologists in this part of the state.

From 1986 through 1990, an average of nearly 65,000 brown trout have been stocked in District 13 (Jackson) streams each year. Electrofishing has been the main method used to evaluate stocking programs. These surveys sometimes yield good information about trout growth and survival, but indicate nothing about angler catch.

Angler surveys are one of the best available methods for measuring angler effort and relative success of fish stocking programs, but they are time consuming and costly. Therefore, fishery managers generally depend upon voluntary angler reports to assess the success of existing trout stocking programs. There is need for an inexpensive, yet effective, method for estimating trout harvest and angler effort in streams.

The main purpose of this study was to evaluate brown trout *Salmo trutta* stocking success. In this study, angler harvests of stocked trout in the St. Joseph-of-the-Maumee and the South Branch of the Kalamazoo River were estimated by voluntary tag returns. Minimum estimates of angler harvest were made by tagging a proportion of the total number of brown trout stocked in each stream and then expanding the return results.

Study Sites

St. Joseph-of-the-Maumee River

The portion of the St. Joseph-of-the-Maumee River managed for brown trout lies entirely within the boundaries of the Lost Nations State Game Area in central Hillsdale County (Figure 1). The area managed for trout includes approximately five river miles, beginning at the outlet of Loon Lake and ending at Pittsford Dam. The average width of this river reach is approximately 12 ft and the average depth is 10 in. On 24 July 1991, discharge at Way Road crossing was estimated at approximately 6 cfs and water surface temperature was 65ºF. This discharge appeared typical for mid-summer. Stream-bed substrates in the managed area consist mainly of sand (80%), gravel (10%), large rock (5%) and silt (5%). Other resident fishes include: white sucker *Catostomus commersoni*, creek chub *Semotilus atromaculatus*, northern hog sucker *Hypentelium nigricans*, central mudminnow *Umbra limi*, blacknose dace *Rhinichthys atratulus*, grass pickerel *Esox americanus vermiculatus*, green sunfish *Lepomis cyanellus*, pumpkinseed sunfish *Lepomis gibbosus*, carp *Cyprinus carpio*, largemouth bass *Micropterus salmoides* and various minnow and darter species. These species are not considered to be overly abundant.

South Branch of the Kalamazoo River

The section of the South Branch of the Kalamazoo managed for brown trout includes approximately six river miles. It begins at the Grover Road crossing in southwest Jackson County and ends at Mosherville Road just west of Mosherville (Figure 1). Average width of the river in this section is approximately 12 ft and average depth is 8 in. On 23 July 1991, discharge at Pope Road crossing was approximately 15 cfs and water surface temperatures averaged 61ºF. This discharge appeared typical for mid-summer. Stream-bed substrates in the managed area consist mainly of sand (80%), gravel (10%), large rock (5%) and silt (5%). Fish species present other than trout include: mottled sculpin *Cottus bairdi*, white sucker, creek chub, northern hog sucker, grass pickerel, green sunfish, rock bass *Ambloplites rupestris*, largemouth bass, bluegill *Lepomis macrochirus*, yellow perch *Perca flavescens*, bowfin *Amia calva* and various minnow and darter species. These species are not considered to be over-abundant.

Methods

A total of 3,370 yearling brown trout (Plymouth Rock Strain) were divided among stocking sites on the St. Joseph River at Perrine Road, Tripp Road, Way Road and Reading Road on 27 March 1991. A total of 3,750 yearling brown trout (Plymouth Rock Strain) were divided among stocking sites in the South Branch of the Kalamazoo River at Grover Road, Pope Road, Rowe Road, Concord Road and Cranberry Lake Road on the same day. Stocked brown trout averaged 6.4 in.

Fifty-percent of trout stocked into the St. Joseph River and 63% of trout stocked into South Branch of the Kalamazoo River were tagged at the base of the dorsal fin. Floy anchor tags (FD-68BC, fine fabric) measuring 1.25 in were applied by personnel at the Harrietta State Fish Hatchery (near Cadillac, Michigan). Before tagging, all trout were anesthetized in a solution of water and MS-222. Trout were held in separate raceway sections for two days after tagging to observe tag retention, mortality and general fish vigor. Two news releases were sent to local newspapers prior to the trout season opener in late April to inform anglers of the tagging program. Plastic signs describing the project were mounted on wolmanized plywood boards, covered with plexiglass, and posted in the area. Both press releases and signs posted in the area asked anglers catching a tagged trout to deposit the tag into collection tubes at stream access sites or to send tags to the post office box address printed on the tag. Very few tags were sent to the post office box. Certificates of appreciation were offered to anglers as an incentive to return tags.

Minimum harvest estimates for brown trout were calculated from the number of returned tags. For each stream, an expansion factor was derived by dividing the total number of trout stocked by the number of tagged trout. This factor was multiplied by actual tag returns to estimate minimum total catch, assuming equal catch of tagged and untagged fish. Tags were collected once each week, beginning the last weekend in April and ending the last weekend in August. A population estimate was conducted using a DC stream shocker at three sites in each study area in July 1991 in an effort to estimate survival and movement of tagged trout.

Results

Floy tag returns indicated a minimum of 1.6 to 1.8 percent of stocked brown trout were harvested from the study rivers in 1991 (Table 1). Anglers returned a total of 31 and 38 tags from the St. Joseph-of-the-Maumee River and the South Branch of the Kalamazoo River, respectively. Tag returns peaked within two weeks of the season opener and few tags were returned after the month of June (Figure 2).An electrofishing survey of the St. Joseph River in July resulted in the capture of 104 brown trout ranging in size from 2-14 in. No tagged trout were caught, although eight trout in the 6-8 inch range appeared to have tag scars, indicating that these fish may have lost their tag.

Electrofishing collections on the South Branch of the Kalamazoo River in July captured 138 brown trout ranging in size from 2-20 in. Nine trout (6.5%) were tagged, and six other trout in the 6-8 inch range appeared to have tag scars. Approximately 8% and 11% of trout collected during July from the two study areas appeared to be from 1991 plants of tagged brown trout.

Discussion

Angler returns of Floy tags from brown trout tagged at a small size did not yield reliable estimates of angler harvest. Since tag loss was probably significant, harvest was undoubtedly underestimated. The calculated harvest estimates resulting from this study have limited value since the true tag return rate is unknown.

Several assumptions were necessary for this study to accurately estimate harvest from tagged fish. These include: (1) anglers would return tags from all harvested trout, (2) tagged and untagged trout have an equal chance of capture, (3) tagged and untagged trout experience similar mortality rates, and (4) all marked fish would retain their tags throughout the study. Harvest estimates were based on the assumption that all recovered tags were returned. Since the return of tags was voluntary and no financial incentive was offered, it is probable that some tags were not returned. A program using Floy tags at Lake Lanier, Georgia employed a monetary reward system ($0-$20) and resulted in the return of most tags from the $0 reward category, indicating reward level may be unimportant (Weaver and England 1986). However, Haas et al. (1988) noted that non-reporting rates for various fish species ranged from 15-75%. I contacted several trout anglers who fished the study streams and they indicated that most tags from harvested trout were returned to collection tubes.

Accurate estimates of angler harvest required that tagged and untagged fish have equal probabilities of capture by anglers. Observations at the hatchery indicated that the presence of tags did not appear to interfere with the ability of trout to feed or swim. Tag color (dark brown and dark green) probably did not make the trout more visible to anglers or other predators, and Dexter (1991) determined that mortality of rainbow and brown trout was similar for fish tagged with different colors of Floy tags. The assumption that tagged and untagged trout have similar mortality rates could not be verified. However, no tagged trout died at the hatchery or immediately after they were stocked and all fish appeared healthy and vigorous upon release. Low tag returns could be attributed, at least in part, to trout migration after stocking. This hypothesis was tested in 1993. A total of 3,800 yearling brown trout were divided among stocking sites on the South Branch of the Kalamazoo River in 1993 and were fin-clipped to identify them as hatchery fish. The main objective of the study was to estimate the contribution of hatchery trout to the existing "wild" brown trout fishery. These wild trout are fish which have either survived as a result of a previous stocking or those which have been naturally produced in the stream. Survival and abundance of stocked and wild trout was monitored by electrofishing two sites of the South Branch of the Kalamazoo River in mid-March prior to stocking, at the end of March just after stocking, and again in late October. The survey conducted in late March resulted in the capture of only 10 fin-clipped trout and a total of 9 trout with fin clips were recovered during the late October survey. These data support the idea that significant migration may occur immediately after stocking, which may help to explain the observed low harvest estimates.

Tag loss was a major problem in this study. No trout lost their tags at the hatchery and none were lost at the access sites immediately after planting. However, a total of 14 brown trout examined during July electrofishing surveys showed evidence of tag loss (scars). Therefore, my harvest estimates are biased downward since all trout did not retain their tags. Similarly, 41% of brown trout stocked in a small spring-fed pond and 69% of brown trout stocked in Augusta Creek shed their Floy tags over a four-month period (Table 2; Dexter 1991). The brown trout used in the pond and stream experiments were similar in size to those used in my study. Tag loss may be significantly higher in streams than in ponds because of the potential for abrasion caused by continuous currents, undercut banks, tree roots and other objects in the stream.

Unfortunately, the tagged trout for this study did not have a distinguishing fin clip which would have made it easy to determine if they had lost their tag. Harvest estimates that adjust for tag loss were not made since rate of tag loss was unknown. Using only tag scars to evaluate tag loss would likely result in an underestimation of tag loss since scars may have completely healed by July when trout were first observed after stocking.

Besmear et al. (1992) attributed their low estimates for Atlantic salmon *Salmo salar* harvest from the St. Mary's River, Michigan mainly to high loss of Floy tags which appeared to result from inexperience in tagging, variability in tagging technique, and failure to lock the "T" bar of the Floy tag behind the interneural spines of the dorsal fin. Trout for my study were tagged by several DNR fisheries workers and variability in tagging techniques probably contributed to tag loss. However, even when tagging technique is good, the permanent penetration of skin layers can cause a variety of problems including infection and rejection (Bergman et al. 1992).

Hooking mortality of sublegal tagged trout may have contributed to low tag returns. Although anglers interviewed on the opening day of trout season in 1991 and 1992 on the St. Joseph and South Branch of the Kalamazoo Rivers reported catching some legal size trout, most also reported catching and releasing many sublegal trout. Interviewed anglers were certain that they had unintentionally killed a large percentage of these small trout which they caught and released.

The trout tagged for my study averaged only 6.4 in and the small size of these fish may have been a major reason for the suspected high tag losses. Several Floy tag studies using larger fish and tags similar to those used in my study have resulted in higher tag retention rates. A study to assess the relative merits of different types of tags for use on juvenile chinook salmon *Oncorhynchus tshawytscha* approximately 8 in long resulted in Floy tag loss estimates of only 10% (Eames & Hino 1983). Investigations of Floy tag loss from 13-31 inch lake whitefish *Coregonus clupeaformis* from Lake Michigan resulted in estimated retention rates of nearly 90% for fish at large for one year (Ebener & Copes 1982). In a study of white suckers, Floy anchor tags were found to be very suitable for fish over 8 in but generally were unsuitable for smaller fish (Franzin and McFarlane 1987).

Although Floy tags may be used successfully for short-term projects, their use in harvest estimate studies with small trout is not recommended. Future studies should emphasize quality control and uniformity in tagging technique to assure maximum tag retention. Additionally, it is recommended that only fish over 8 inches total length be used for Floy tag harvest estimate experiments.

Water temperatures, flow stability and trout growth are generally considered marginal in most trout streams in the Jackson Fisheries District. Past electrofishing surveys of these streams have shown that relatively few brown trout stocked in the spring survive the following winter. Although trout grow slowly in these marginal streams, spring and early summer water temperatures are favorable for trout survival. Tag returns from both study streams in 1991 show that most tags were returned during the first 30 days after the trout season opened. These data suggest that the angling effort during this period is significant and that stocked trout make some contribution to the fishery. I believe that stocking larger trout would result in an increase in angler effort as well as an increase in harvest of legal fish in an area where few trout fishing opportunities currently exist. Although the present Fisheries Division policy prohibits stocking legal-size trout in public waters, southern Michigan anglers could greatly benefit from minor modifications to this policy. Because of the increased cost of larger brown trout, managers would need to request fewer trout for stocking marginal streams.

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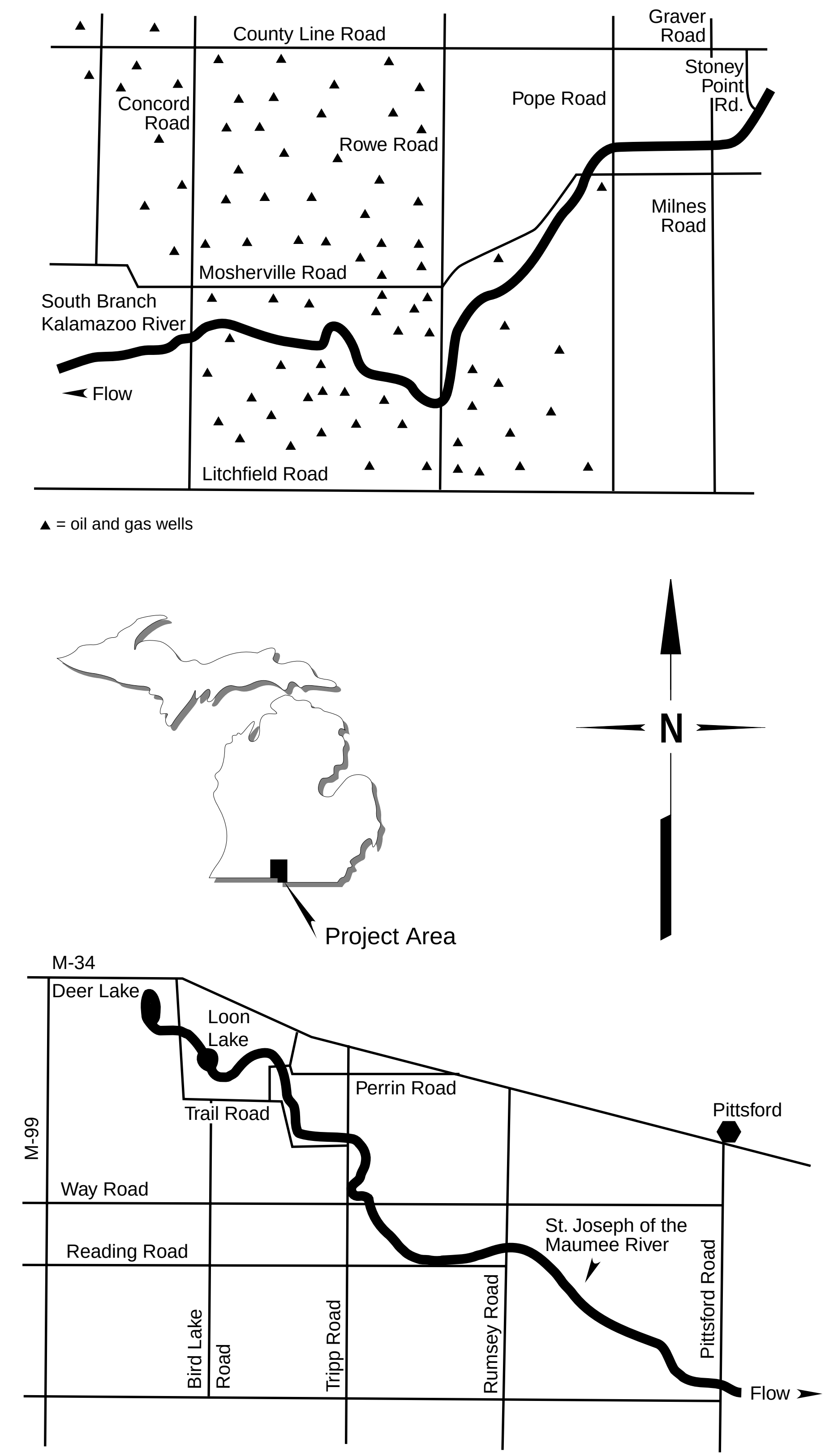

Figure 1.—Map showing the study sections of the South Branch of the Kalamazoo River and the St. Joseph of the Maumee River.

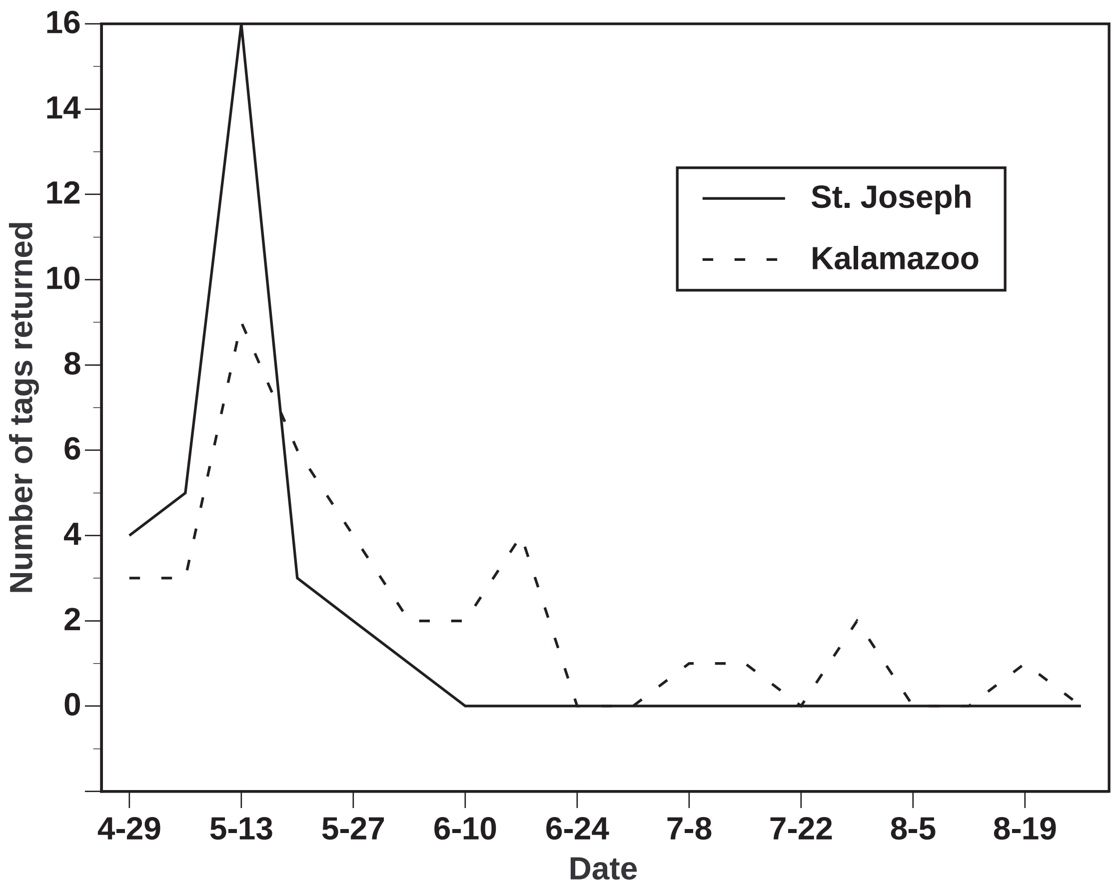

Figure 2.—Number of floy tags returned by anglers during the survey period (27 April - 26 August 1991).

Table 1.–Tag returns and estimated minimum brown trout harvest for two southern Michigan streams during 1991.

River	Total Number Stocked	Number of Fish Tagged	Tags Returned	Minimum Number Harvested	Minimum Percent Harvested
South Branch Kalamazoo	3,750	2,370	38	60	1.6
St. Joseph-of- the-Maumee	3,370	1,685	31	62	1.8

Table 2.–Floy tag loss from brown trout over a 200-day period in 1990 (Dexter 1991).

Day	Tags Lost	Total Number of Fish Examined	Percent Tag Loss
13	3	19	15.8
30[1]	32	250	12.8
60[1]	31	112	27.7
79	4	18	22.2
120[1]	20	49	40.8
123	11	16	68.8
200	14	18	77.8

[1]Samples collected from a pond experiment at Wolf Lake State Fish Hatchery.

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James S. Diana, Editor
Alan D. Sutton, Graphics
Barbara A. Diana, Word Processor