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[Management Brief]

Does Pectoral Spine Extraction Cause Mortality to Channel Catfish?

PAUL H. MICHALETZ*

*Missouri Department of Conservation,
1110 South College Avenue, Columbia, Missouri 65201, USA*

Abstract.—Pectoral spines have been commonly used to age channel catfish *Ictalurus punctatus*. Recently, use of otoliths has increased because they may provide more accurate and precise estimates of age. A presumed advantage of using pectoral spines instead of otoliths is that fish can be released alive and experience little mortality. However, little information is available to test this presumption. I used mark and recapture of channel catfish in two impoundments to assess whether recapture rates differed between fish that had their left pectoral spine removed and those that did not. Channel catfish were marked in June and recaptured in October. There was no difference in the proportion of channel catfish recaptured that had their spine removed versus those that did not in either impoundment. My findings suggest that pectoral spine extraction causes little if any mortality to channel catfish.

Pectoral spines have historically been used to age channel catfish *Ictalurus punctatus* (Marzolf 1955; Prentice and Whiteside 1975; Crumpton et al. 1987). Recently, however, Buckmeier et al. (2002) recommended that otoliths be used to age channel catfish because these structures provided more accurate and precise estimates of age than pectoral spines. A disadvantage of using otoliths to age channel catfish is that fish are necessarily sacrificed. In contrast, pectoral spines can be removed from live fish and fish can then be released. In this regard, the relative advantage of pectoral spines over otoliths depends on the survival of fish after spine extraction. If mortality of channel catfish is high following spine extraction, then there may be no advantage in using pectoral spines instead of otoliths. I am aware of only one study that assessed the mortality of channel catfish after spine extraction. Stevenson and Day (1987) found no mortality of channel catfish in hatchery ponds following spine extraction. Because this study was conducted in hatchery ponds where channel catfish were fed and no other fish species were present, it is unknown if these results can be extended to more ''natural'' environments such as impoundments and streams. I used marked channel catfish collected from and returned to two impoundments to determine if the mortality of fish with pectoral spines removed was higher than for fish with pectoral spines intact.

Methods

The study was conducted in Edwin A. Pape (99 ha) and Maple Leaf (57 ha) lakes located in central Missouri. These impoundments are typical of many Midwestern impoundments in that natural recruitment of channel catfish is negligible and their populations are maintained by annual stockings of large fingerlings (mean total length [TL] = 230–250 mm) in October. In addition to channel catfish, largemouth bass *Micropterus salmoides*, bluegill *Lepomis macrochirus*, and white crappie *Pomoxis annularis* provide popular sport fisheries. These shallow (mean depth, <5 m), eutrophic impoundments thermally stratify from late June to mid-September, and their hypolimnia become anoxic.

Cheese-baited hoop nets set in tandem (three nets tied in series; Michaletz and Sullivan 2002) and fished for 3 d were used to sample channel catfish for mark and recapture. Channel catfish were sampled in early and late June and again in mid-October 2000 (Table 1). Eight tandem hoop net sets (each set consisted of three nets) were used to collect channel catfish at randomly selected sites for each sampling date. Surface water temperatures were 23, 25, and 16°C, respectively, for the three sampling dates for Edwin A. Pape Lake, and 23.5, 25, and 15.5°C for Maple Leaf Lake. All channel catfish that were captured during early June sampling were measured (TL, nearest mm) and their adipose fin was clipped. Additionally, the left pectoral spine was removed from a sample of fish (up to five fish per 10-mm-TL group). Fish were immediately released after processing for all sampling dates. All captured channel catfish during the late June sampling were measured and adipose fins were clipped on all nonmarked fish, but pectoral spines were not removed from any fish.

* Corresponding author: Paul.Michaletz@mdc.mo.gov

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TABLE 1.—Number and mean total length (TL, mm) for channel catfish (''intact'' = pectoral spine not removed; ''extracted'' = pectoral spine removed) marked in June and recaptured in October in Edwin A. Pape and Maple Leaf lakes during 2000.

	Edwin A. Pape			Maple Leaf		
Variable	Jun 5	Jun 26	Oct 16	Jun 6	Jun 27	Oct 17
Intact fish						
Number	888	595	135	147	161	76
Mean TL	418	387	421	379	382	425
Extracted fish						
Number	225		28	176		34
Mean TL	463		523	413		475

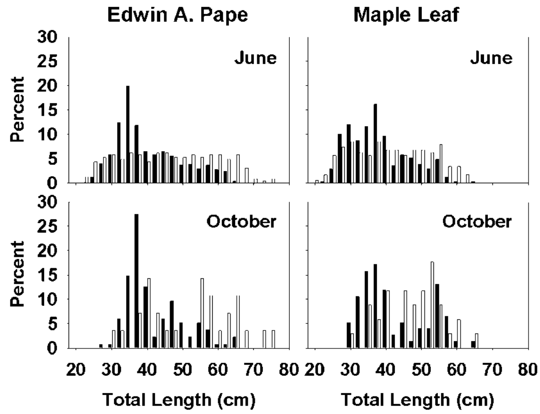

FIGURE 1.—Length frequency distributions (cm) of marked channel catfish with spines extracted (open bars) and with spines intact (solid bars) from Edwin A. Pape and Maple Leaf lakes in June and October 2000. Data from the two June samples were pooled. Sample sizes are listed in Table 1.

Unfortunately, marked channel catfish were not all checked for the presence or absence of the left pectoral spine so the two groups could not be distinguished. All channel catfish collected during the October sampling were measured and checked for fin clips and the presence of the left pectoral spine. To assess if pectoral spine extraction increased mortality of released channel catfish, I compared the ratio of marked fish with the left pectoral spines removed to marked fish with pectoral spines intact in June (both sampling dates combined) to the same ratio in October with chi-square tests. If these ratios differed it may indicate that channel catfish with their pectoral spines removed experienced different mortality rates than those fish that did not have their pectoral spines removed.

To determine if recapture rates of channel catfish may be size related, I compared length distributions of channel catfish marked in June with those recaptured in October for fish with and without left pectoral spines using Kolmogorov–Smirnov (K–S) tests. I pooled lengths for the two June samples for the fish with left pectoral spines intact. This was deemed appropriate because little growth of channel catfish occurred between the two June samples. Length distributions for the two June samples were not significantly different (K–S test: $P = 0.87$) for Maple Leaf Lake. The two June length distributions differed ($P < 0.0001$) for Edwin A. Pape Lake because a larger proportion of smaller fish (<400 mm TL) were captured in the late June sample. Before comparing June and October length distributions with K–S tests, I accounted for differences in length distributions due to somatic growth by subtracting the mean growth increment (mm) from the length of each fish recaptured in October. The mean growth increment was computed by subtracting the mean TL of marked fish in June from the mean TL of marked fish in October for fish with and without left pectoral spines. After accounting for growth, differences in length distributions from June to October may indicate size-related differences in mortality or catchability.

Results and Discussion

A total of 1,483 channel catfish with pectoral spines intact and 225 with pectoral spines extracted were marked in June in Edwin A. Pape Lake (Table 1). In October, 135 marked channel catfish with left pectoral spines intact and 28 with pectoral spines extracted were recaptured. A total of 308 fish with left pectoral spines intact and 176 with pectoral spines extracted were marked in June in Maple Leaf Lake. In October, 76 marked fish with left pectoral spines intact and 34 with pectoral spines extracted were recaptured. Recapture rates for the two groups did not differ for either Edwin A. Pape Lake ($\chi^2 = 2.04$; $P = 0.15$) or Maple Leaf Lake ($\chi^2 = 1.17$; $P = 0.28$), suggesting that mortality rates for the two groups were similar.

Fish size may be a confounding factor in my analysis because the average size of channel catfish with pectoral spines extracted was larger than that of those with pectoral spines intact (Table 1; Figure 1). This size differential occurred because channel catfish were selected for spine extraction based on a fixed number per length-group, which is a common method for population sampling (Bettoli and Miranda 2001). Perhaps spine extraction did cause additional mortality, but this mortality was offset by the generally higher survival of large fish. While I cannot discount this possibility, recaptured fish in both groups represented a wide range of sizes (Figure 1) and, after accounting for growth, June and October length distributions for both groups of fish (with and without left pectoral spines) and lakes did not differ (all $P > 0.16$), suggesting that mortality was not size related.

My results and those of Stevenson and Day (1987) confirm that the removal of a pectoral spine from channel catfish causes little if any mortality. Thus, use of pectoral spines for aging channel catfish is a viable option when sacrificing fish for aging purposes is undesirable. However, potential difficulties and biases in using pectoral spines for aging (Buckmeier et al. 002) should still receive consideration.

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