Consequences of Barotrauma on Post-Tournament Survival and Behaviour of Smallmouth Bass (*Micropterus dolomieu*) at a Fall Tournament on Rainy Lake

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Research Summary:

In North America, catch and release tournaments involving black bass (*Micropterus spp*) are becoming increasingly popular with recreational anglers. Much work has examined the biological effects of tournaments on black bass and has revealed that a number of factors including water temperature, livewell conditions, and weigh-in procedures can influence stress and mortality. However, by adopting simple strategies such as not holding tournaments during the warmest periods, providing fish with adequate water quality while in the livewell, and by improving weigh-in procedures, anglers and tournament anglers have been able to reduce stress and mortality potential.

Interestingly, there is evidence that smallmouth bass tend to be more sensitive to tournaments than largemouth bass as evidenced by higher levels of mortality and greater sensitivity to low oxygen conditions. Moreover, smallmouth bass tend to reside in deeper water than largemouth bass and may be more sensitive to barotraumas. Barotraumas result from a process called decompression where fish are brought from depth to the surface quickly leading to rapid changes in pressure. These rapid pressure changes can burst blood vessels (called hemorrhaging) or lead to expansion of the swim bladder (bloating). The bloated fish have difficulty returning to depth and may end up floundering on the surface where they could be hit by boats, wash up on shore, or be predated. To date, few studies have examined the extent and consequences of barotraumas on black bass or other fish models. Most research that does exist has been conducted in a laboratory setting and therefore lacks realism. To what extent are barotraumas evident in smallmouth bass tournaments? And what are the consequences of barotraumas on post-release behaviour and survival?

With support from the Rainy Lake Fisheries Charity Trust, the Canadian Fondation for Innovation, the Ontario Research Fund, and Carleton University, we conducted a study at the Fall Bass Classic on Rainy Lake in 2006. Our goal was to determine if barotraumas were an "issue" in northwestern Ontario tournaments with a longer term goal of testing strategies for recompressing fish if barotraumas are noted as a problem.

At the Fall Bass Classic on Rainy Lake, we examined these indicators in 86 smallmouth bass and also in a control group, fish that were quickly angled, sampled for blood and immediately released (n = 11).

Photo 1. Marie-Ange Gravel uses a vacutainer to collect a non-lethal blood sample while the fish is held in a water-filled trough

Water temperatures during the tournament were very moderate so the stress associated with capture, livewell retention, and weigh-in should have been relatively low providing an opportunity to focus on barotraumas. Of the randomly selected tournament fish 64 % showed signs of hemorrhaging (gums, body or fins) and 42 %

showed signs of bloating, both indicators of barotraumas.

The majority of fish exhibiting signs of barotrauma had difficulty maintaining equilibrium and were buoyant. The magnitude of the barotraumas ranged from minor to severe, with roughly 25% of the fish falling into the "severe" category.

To determine post-tournament behaviour and survival, a subset (n = 22) of these fish were released at a common site and radio-tracked for 5-6 days. Fish with one or no signs of barotrauma were considered to be in good condition (n = 12), while fish with more than one sign of barotrauma were considered to be in poor condition (n = 10). Fish in good and poor condition differed in the time they required to disperse 25 m from a common release site (Fig.1). After 15 hours, all good condition fish had left the release site (Fig.1), while it took 70 hours for all poor condition fish to leave the site of release (Fig.1).

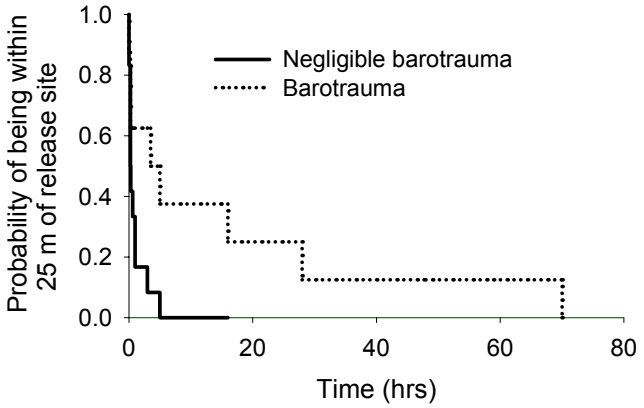

Figure 1. Probability of being within 25 meters of release site for fish in good condition (solid line) and poor condition (broken line), 80 hours post-release

The same trend was observed when we examined the time it took to travel more than 250 meters from release site (Fig.2). If the fish was in good condition, the probability of it being within 250 meters of release site 115 hours after it's release was 10 %, while if the fish was in poor condition, this probability was 50 % (Fig.2). After 5 days, 70 % of good condition fish were able to exit the bay where they were released (> 2 km), while only 28 % of the poor condition left the bay.

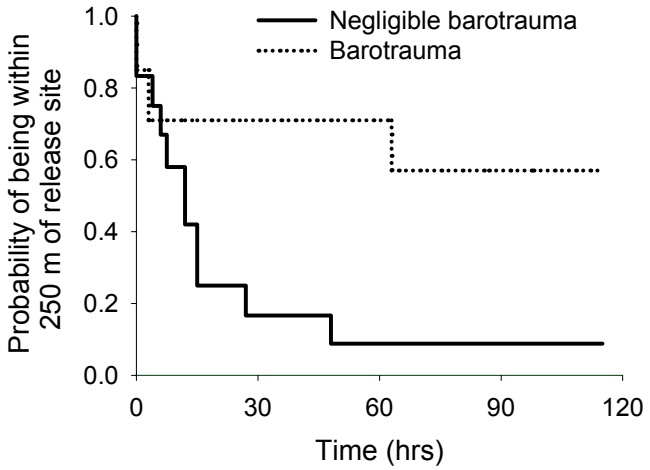

Figure 2. Probability of being within 250 meters of release site for fish in good condition (solid line) and poor condition (broken line), 115 hours post-release

Of the radio-tagged fish that we categorized to be in poor condition, we observed 20 % mortality, whereas no mortality was observed in the fish categorized to be in good condition. In addition, at the end of the monitoring period (5 or 6 days post tournament), two fish were still at the release site and failed to respond to diver stimuli (i.e. they sat on the bottom in a moribund state) and were deemed to be very close to death. Thus, mortality rates for fish in poor condition were likely closer to 40%. Interestingly, one of the fish that died was apparently still floating and was hit by a boat propeller. Although there was minimal external damage (some scale loss and fin severing), a post-mortem revealed that the stomach and liver were no longer in tact.

Photo 2. Bass that was hit by a propeller while on the surface because of barotraumas

The physiological indicators (plasma lactate and glucose) revealed that the fish in poor condition were more stressed than those in other groups (Fig.3). In fact, the glucose levels for fish in poor condition were some of the highest ever recorded in a freshwater fish. Glucose is mobilized in response to stress and may indicate prolonged attempts to regain equilibrium during retention.

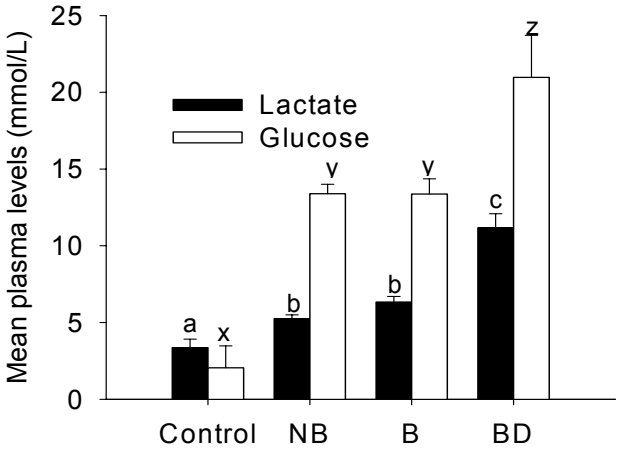

Figure 3. Plasma lactate and glucose of smallmouth bass that were simply angled and blood sampled (control)(n = 11), showed no signs of barotraumas after the tournament (NB) (n = 54), showed signs of decompression and survived (B) (n = 25) and showed signs of decompression and died (BD) (n = 4). Dissimilar letters indicate significant differences for a stress indicator across different treatments.

Our work shows that post-tournament behaviour and survival of smallmouth bass are affected by the incidence of barotrauma. Fish exhibiting severe barotraumas take longer to leave the release site, show physiological signs of stress (high lactate and glucose), and are more likely to expire than fish in good condition (including minimal barotrauma). Assuming that 25% of all tournament caught smallmouth bass exhibited severe signs of barotrauma, and that 30 to 50% of fish with severe signs of barotrauma died post release, then between 7.5 and 15% of all fish released from the tournament could have suffered mortality. Thus, of the 586 fish weighed in at the tournament, between 44 and 88 of the individual fish may have died. Simply documenting mortality rates in recreational fisheries is not as important as the opportunities that this can reveal. Data derived from this study points to opportunities for additional research focused on reducing mortality. Specifically, for the first time we have revealed that a portion of fish released with barotraumas do not survive. Therefore, there is opportunity to develop, refine, and test various methods for recompressing fish.

Photo 3. Experimental smallmouth bass equipped with a radio transmitter

Given that environmental conditions were relatively benign (i.e., low water temperatures which reduce stress of capture, enhance livewell quality, and minimize weigh-in stress), it is likely that the mortality that we observed is almost entirely due to the barotrauma. If fish depth distributions and angler behaviour are similar throughout the angling season, it is possible that tournaments held during warmer periods may experience even higher barotrauma-related mortality. Suggesting that anglers only target fish in shallow waters is unrealistic. Furthermore, even when fishing shallow (e.g., dragging a fluke in 10 feet of water), smallmouth bass in clear water may come from a depth of 30 feet to attack the lure. Therefore, work on recompression methods (e.g. venting or fizzing: i.e., puncturing air bladder with hypodermic needle to release expanded gases) is needed to examine if post-tournament behaviour and survival can be improved. This provides clear direction for additional research on Rainy Lake to ensure that all fish that are released have the greatest chance of surviving to reproduce and be captured again.

Acknowledgements:

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