# Stress Response of Largemouth and Smallmouth Bass: Barbless Hooks Verses Barbed Hooks C & R

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Largemouth Bass *Micropterus salmoides* and Smallmouth Bass *Micropterus dolomieu* are two of the most popular species of fish for anglers to target in Minnesota. In this study, Largemouth Bass and Smallmouth Bass stress was characterized by handling time and recovery time. This study compares handling time and recovery time between barbed and barbless hooks. For Largemouth Bass, there was a significant relationship between recovery time and time out of the water for barbed ($P = 0.02$, $R^2 = 0.86$) and barbless hooks ($P < 0.01$, $R^2 = 0.74$). For Smallmouth Bass, there was no significant relationship between recovery time and time out of the water for barbed ($P = 0.29$, $R^2 = 0.37$) and barbless hooks ($P = 0.68$, $R^2 = 0.50$). The slope of the regression lines showed a positive trend for both barbed and barbless hooks. Barbless hooks were found to have a major impact on Largemouth Bass stress. This study is meant to help make the sport of bass fishing better and will hopefully help create healthier Largemouth and Smallmouth Bass populations.

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## Introduction

Today, many anglers are using the practice of catch and release angling with the thought that those fish are going to survive after the release of the fish. Catch and release is a technique used in recreational angling where fish are caught and released back in the water after the removal of the hook. Largemouth Bass *Micropterus salmoides* and Smallmouth Bass *Micropterus dolomieu* are two of the most popular catch and release fish species in Minnesota and receive a great deal of fishing pressure by many anglers. The popularity of bass fishing, especially in a tournament setting, has been drastically on the rise over the last few years and it is not slowing down. One major concern with this increased interest in bass fishing is the health of the fish. One idea is to use barbless hooks to better promote the health of the fish by limiting the stress each fish goes through while being caught, which would ultimately help maintain good populations of both species. Some research has been done but the majority of it has been on trout species.

The controversy of whether barbless hooks are beneficial to fish species has been around for some time now. In a previous study on Rainbow Trout *Oncorhynchus mykiss*, Brown Trout *Salmo trutta*, and Brook Trout *Salvelinus fontinalis*, it was determined that the difference between barbed and barbless hooks is minute in terms of fish mortality (DuBois and Dubielzig 2004). It was also concluded that there was no significant evidence of one hook type causing more trauma to the fish than the other. To counter that however, many people suggest barbless hooks do have a substantial positive effect on fish survival after the release because of the shorter unhooking time. In one study, it was determined that there is a much shorter unhooking time with barbless hooks compared to barbed hooks (Schaeffer and Hoffman 2002). Also, with the hook being easier and faster to remove, the time the fish spends out of the water decreases. The longer the fish is out of the water the stress levels increase. A study done by Cook et al. (2015) on Coho Salmon *Oncorhynchus kisutch*, Rainbow Trout, and Comon Carp *Cyprinus carpio* demonstrated that increased air exposer led to higher stress levels.

The objective of this experiment is to compare the different stress levels of catch and release Largemouth and Smallmouth Bass based on the use of barbed and barbless hooks with artificial baits. The importance of this study is to see if barbed hooks cause more stress to the two species of fish than barbless hooks. Also, to see if the difference in handling times between the different types of hooks used is significant to the stress levels of both species. The findings of the study will hopefully result in making the sport of bass fishing better and will help create more healthy bass populations.

## Methods

There were two different study areas for this experiment. The first was located about 16.1 km north of Bemidji, Minnesota on Movil Lake where

Largemouth Bass were targeted. The second study area was located about 14.5 km northeast of Bemidji, Minnesota on Beltrami Lake where Smallmouth Bass were the target species. The data was taken from September and October of 2019 for Largemouth Bass and September and October of 2020 for Smallmouth Bass. Movil lake has an area of 345.4 ha with a littoral area of 207.6 ha. Movil at its deepest point is 15.2 m deep with a water clarity of 2.7 m. Movil Lake is only accessible by a channel through Big Turtle Lake. The areas fished were 0.6-1.2 m Bulrushes *Schoenoplectus tabernaemontani* and 1.2-3.1 m weed lines consisting of Clasping Leaf Pondweed *Potamogeton richardsonii*. Beltrami Lake has an area of 293.4 ha with a littoral area of 121.4 ha. Beltrami Lake at its deepest point is 15.2 m deep with a water clarity of 3.2 m. The areas fished were rock points and humps around the lake in depths of 3-9 m.

While in the field, two anglers fished until the target quota of 60 fish was met for both species. A total of 30 fish were caught using barbed hooks and a total of 30 were caught using barbless hooks for each species. The size and brand of both types of hooks remained constant, which were size 3/0 Trokar flippin hooks. The same was done for Smallmouth Bass except the tackle used changed. The tackle used for Smallmouth Bass was #2 dropshot hooks and 3/8oz ned rigs. During this study, each angler switched off using barbless hooks and barbed hooks everyday data was recorded. For each fish captured; the hook location, time out of the water, recovery time, and if the fish was bleeding or not was recorded. When a fish was captured, the other angler dropped their rod and prepared to record the data while the fish was being reeled in. Once the fish was out of the water the other angler started recording how long it took to unhook the fish. Each time a fish was caught, it was also recorded where the hook was located and if the fish was bleeding or not. Lastly, once the fish was unhooked and ready to be released, it was recorded how long the fish needed to recover while in the water before it swam off.

Largemouth Bass and Smallmouth Bass stress was determined by taking into consideration all three variables that were measured while in the field while using barbed and barbless hooks. The three variables measured were if the fish was bleeding or not, the time each fish spent out of the water, and recovery time. These three factors are what were used to determine fish stress. Increased air exposer time for example handling and recovery time are related to fish stress. A regression analysis was used to compare the relationship between recovery time and time out of water for both species.

**Results**

For Largemouth Bass, time out of the water ranged from 6.88 to 25.7 s while using barbed hooks, with an average was 10.84 (SD = 3.86). Recovery time for barbed hooks ranged from 0.81 to 6.34 s with an average of 2.11 (SD = 1.02). While using barbless hooks, the time spent out of the water ranged from 5.19 to 13.73 s with an average of 8.4 (SD = 1.96). Recovery time ranged from 0.29 to 3.12 s with an average of 1.12 (SD = 0.64). There was a significant relationship between recovery time and time out of the water for barbed ($P = 0.02$, $R^2 = 0.86$) and barbless hooks ($P < 0.01$, $R^2 = 0.74$; Figure 1).

For Smallmouth Bass, time out of the water ranged from 6.59 to 18.62 s while using barbed hooks, with an average was 10.17 (SD = 2.29). Recovery time for barbed hooks ranged from 1.01 to 4.03 s with an average of 1.65 (SD = 0.67). While using barbless hooks, the time spent out of the water ranged from 5.68 to 12.36 s with an average of 7.97 (SD = 1.81). Recovery time ranged from 0.64 to 2.18 s with an average of 1.18 (SD = 0.50). There was no significant relationship between recovery time and time out of the water for barbed ($P = 0.29$, $R^2 = 0.37$) or barbless hooks ($P = 0.68$, $R^2 = 0.50$; Figure 2). The slope of the regression lines showed a positive trend for both barbed and barbless hooks. Only three Largemouth Bass and two Smallmouth Bass bled in the study with all those fish being caught on barbed hooks.

**Discussion**

The data collected in the study provided evidence to suggest a significant relationship between recovery time and time out of the water for Largemouth Bass while using both barbed hooks and barbless hooks. This finding is supported by Meka (2004) in a study done on Rainbow Trout. The study looked at injury rates and duration of capture while fishing with different hook types. Hook removal time was significantly longer when barbed J hooks were used compared to barbless J hooks. There was also a lower incidence of injury while using barbless J hooks compared to barbed J hooks. Rainbow Trout caught while using barbless showed signs of injury 56% of the time compared to 71.5% for barbed J hooks. J hooks are the same style of hook we used in our study which reflected comparable results for longer hook removal while using barbed hooks.

While using barbless hooks there was a significant difference in handling time compared to using barbed hooks. For Largemouth Bass, the average time out of water was 10.84 for barbed hooks compared to 8.40 s when using barbless hooks. While recovery time for barbed hooks was 2.11 and barbless hooks was 1.12 s. For

Smallmouth Bass, the average time out of water was 10.17 for barbed hooks compared to 7.97 s when using barbless hooks. The average recovery time for barbed hooks was 1.65 and barbless hooks was 1.18 s. A study done by Cooke et al. (2001) found air exposure time affected recovery time of the Rock Bass *Ambloplites rupestris*. Fish exposed to air for 30 seconds took 2 hours of recovery time while fish exposed to 180 seconds of airtime required 4 hours of recovery time.

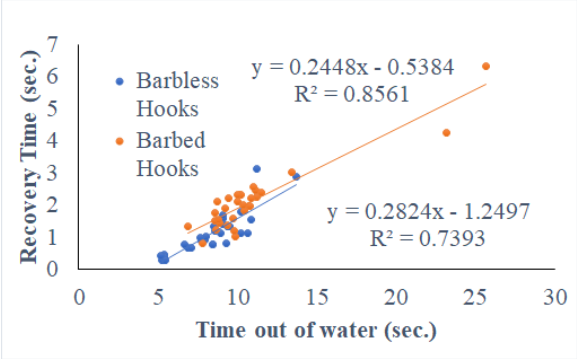


**Figure 1.** Relationship between the time spent out of the water per catch and recovery time per catch while fishing for Largemouth Bass on Movil Lake, MN.

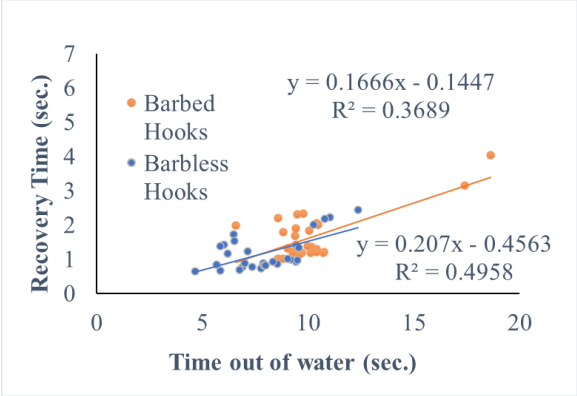


**Figure 2.** Relationship between the time spent out of the water per catch and recovery time per catch while fishing for Smallmouth Bass on Beltrami Lake, MN.

The relationships between barbed and barbless hooks recovery time had a direct influence on time out of water for Largemouth Bass but not Smallmouth Bass. Overall, it took longer to unhook Largemouth Bass than Smallmouth Bass. It also took more time for the anglers to unhook the fish while using the barbed hook compared to the barbless hook. This relationship remained the same for barbed and barbless hooks. Barbed hooked Largemouth and Smallmouth Bass took longer to recover because of the longer air exposure during the unhooking process.

While in the field, many more fish were also lost during the fight while using barbless hooks compared to barbed hooks, especially Largemouth Bass. Similar results were shown in a study done by Schaeffer et al. (2002) found the loss number of hooked fish was significantly higher with barbless hooks. When using barbed hooks 22% more fish were landed during the study. While we did not record how many fish we lost using barbed hooks, we can estimate losing about 50% of hooked fish while using barbless hooks.

Contrasting fish species may show different responses to barbed and barbless hooks which could influence the results. Trout species may respond to barbed and barbless hooks differently than Largemouth and Smallmouth Bass. In a study done by Lamansky et al. (2016) on air exposure times of trout release by anglers during catch and release it was determined that trout exposed to air for 0, 30, and 60 s experienced mortality rates of 12, 38, and 72%. Also, handling time and recovery time may not be the only two factors that relate to fish stress. Other factors such as injury rates and strength of hooks may be useful to monitor.

Another factor that could be conducive to stress response is using different equipment and tackle while targeting the fish. Larger or smaller hook sizes could greatly influence stress response to the fish (Meka 2004). In this study different hook sizes were used for Largemouth and Smallmouth Bass. Different rod types could also play a significant role in contributing to stress response of Largemouth and Smallmouth Bass. Using a different action could greatly influence the results. While Smallmouth Bass fishing we used lighter action rods compared to the heavy action rods used to catch Largemouth Bass. Angler experience is another factor that could lead to longer handling times and more efficient hook removal (Meka 2004). Lastly, line type could also affect stress response. Using mono or braid could result in vast differences between stress exerted upon the fish.

The objective of the study was to determine if barbed or barbless hooks have different effects on Largemouth and Smallmouth Bass stress responses. The results showed clear statistical evidence that there was a significant difference between recovery time and time out of the water for Largemouth Bass but not Smallmouth Bass while using barbed and barbless hooks. Time out of the water and recovery time was overall much lower for barbless hooks. One thing that stands out in this study is that while using barbless hooks, Smallmouth Bass recovery times were higher than Largemouth Bass. However, while using barbed hooks Smallmouth Bass recovered faster than Largemouth Bass even though they were caught

in colder temperatures and in deeper water. Our results show all the factors that can cause stress on Largemouth and Smallmouth Bass, a future study could be done to focus on these outside factors.

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