Testing Modified Self-Release Hooks for Use in Recreational Fishing

Prueba de Anzuelos de Auto-liberación Modificados Para su Uso en Pesca Recreativa

Test des Hameçons Modifiés à Libération Automatique Pour la Pêche Récréative

HOLDEN E. HARRIS[1*], ANDREW G. GUDE[2], and MICHEAL S. ALLEN[1]

[1]*Nature Coast Biological Station, Institute of Food and Agriculture Sciences, University of Florida, Cedar Key, FL, USA.*
**holdenharris@ufl.edu*
[2]*Lower Suwannee and Cedar Keys National Wildlife Refuges, National Wildlife Refuge System, U.S. Fish and Wildlife Service, Chiefland, FL, USA*

INTRODUCTION

Releasing fish can help conserve fishery resources by reducing harvest mortality but the process of capturing and handling fish can result in reduced fitness or death (Davis 2002). Stress, injuries, and mortalities in discarded fish are generally cryptic (Coggins et al. 2007), and, cumulatively, discard effects present a major conservation issue in recreational fisheries (Davis 2002; Cooke and Cowx 2004). The adoption of best fishing practices can considerably improve the outcome of released fish by minimizing injury with certain hooks, not contacting fish with dry surfaces, and limiting fish handling and air exposure (reviewed in Cooke and Suski 2005 and Brownscombe et al. 2017). Prescriptive use of hook types can reduce the severity of injury and likelihood of mortality in released fish (Muoneke and Childress 1994; Cooke and Suski 2005), and efficient dehooking can substantially reduce the physiological stress to fish that typically occurs during the landing and release process (Brownscombe et al. 2017). In this study, we examined the potential for hook modifications to allow in-water self-release (i.e., fish are released in-water without any handling by the angler) for a popular coastal sport fish, Spotted Seatrout (*Cynoscion nebulosus*) (Harris et al 2021). To our knowledge, this is the first assessment of a self-releasing hook designed to fully eliminate fish handling. Three candidate hook designs—standard, barbless, or bite-shorted hooks (Fig. 1)—were tested on their ability to successfully land the fish (i.e., the angler successfully retrieves the fish to the boatside), and then self-release it.

METHODS

Gear testing compared the use of a standard (i.e., unmodified) hook and two hook types that were modified to be barbless and bite-shortened (Fig. 1). Standard hooks were 3.5 g (1/8 oz) jigheads with a 15 mm bite distance (i.e., horizontal distance between the hook point and apex of the metal bend) and a backward facing barb. Barbless hooks were made from the standard hooks using a dermal grinder (i.e., a Dremel tool) to remove the barb. Bite-shortened hooks were made from standard hooks by cutting off the barbed portion of the hook with wire cutters to shorten the bite distance to 10 mm, then sharpening the end with a grinding stone bit at the cut-off point. A short video demonstrating this procedure is provided at https://youtu.be/VC23oNikyc8.

Catch data were recorded for success in landing boatside and self-release without handling, and the fish size category (if landed) was documented. Estimated fish size was visually categorized as small (<330 mm, <13 inches), medium (331–405 mm, 13–16 inches), or large (>406 mm, >16 inches). Data collection continued until >75 fish were hooked with each hook type. . A short video showing successful self-release is provided at https://youtu.be/WPZwM8x9iVQ and a short video of unsuccessful self-release at https://youtu.be/a-AFsi0G2Jo.

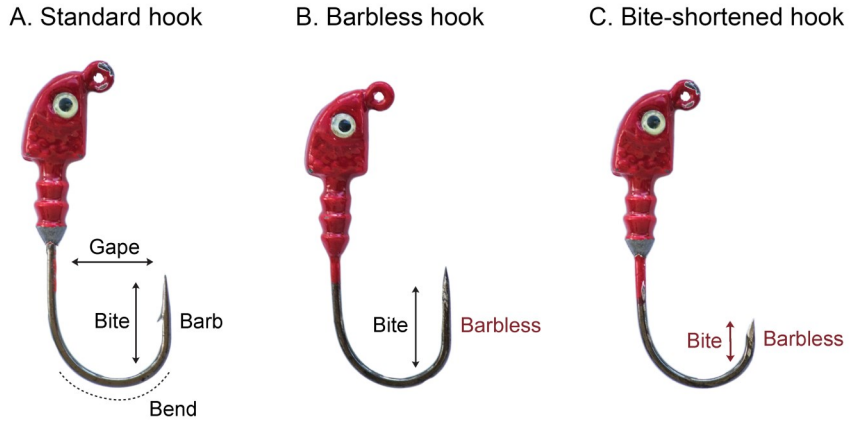

Figure 1. Photographs with labels for standard, barbless, and bite-shortened hook designs tested for their ability land and self-release fish.

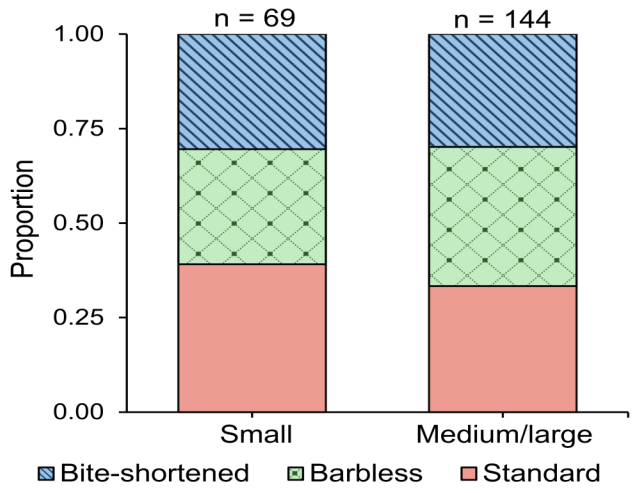

Figure 2. Proportion of Spotted Seatrout size-classes categorized as small (250–330 mm) or medium-and-large fish (331–485 mm) caught with the three hook types tested in this study (standard, barbless, or bite-shortened hooks).

Success rates that fish were landed boatside and self-released were assessed with logistic regressions computed with logit-linked generalized linear models (GLMs). These modelled the effect of hook type (categorical with three levels: standard, barbless, or bite-shortened) on the binomial outcome for landing success. Confidence intervals for each level for the logistic models were estimated by generating predicted probabilities with the GLMs and differences between levels were considered significant with type I error <0.05.The potential for size-selectivity was assessed with contingency tables and a Pearson's chi-squared ($\chi 2$) statistic and to test for significant differences (type I error $P < 0.05$) in the expected versus observed size-class frequencies, with the null hypothesis being that size categories did not differ between the three hook types.

RESULTS, DISCUSSION, AND RECOMMENDATIONS

At least seventy-five Spotted Seatrout were hooked using each of the three tested hook types (total = 226 fish). Size class bins included 69 small, 113 medium, and 13 large fish. Results from the $\chi 2$ test indicated that size-class frequencies were not significantly different between hook types regardless if fish were divided between three size classes ($\chi 2 = 2.836$, df = 4, $P = 0.586$) or two size classes whereby large fish were combined into a medium-and-large category (Fig. 2; $\chi 2 = 0.995$, df = 2, $P = 0.608$).

Bite-shortened hook exhibited marginally lower rates for successfully landing fish relative to the standard hook, although all three hooks allowed the majority of fish to be brought boatside (Fig. 3A). Seven of the seventy-five fish were unintentionally lost prior to landing with the bite-shortened hook. Results from the GLM estimated mean landing success with bite-shortened hooks was approximately 91%, compared to 99% and 96% landing success rates for the standard and barbless hooks, respectively. Estimated unintentional fish loss was predicted to be 7.5X more likely with the bite-shortened hook compared to the standard hook; however, the difference was not quite significant with a P-value of 0.06 at our predetermined level (type I error <0.05).

Bite-shortened hooks were demonstrably more effective in allowing anglers to self-release fish than the other two hook types (Fig. 3B). Sixty of the sixty-nine the fish landed with the bite-shortened hook were able self-release, with forty-eight of these self-releasing <5 seconds of being landed. Results from the self-release GLM estimated the mean probability of success for the bite-

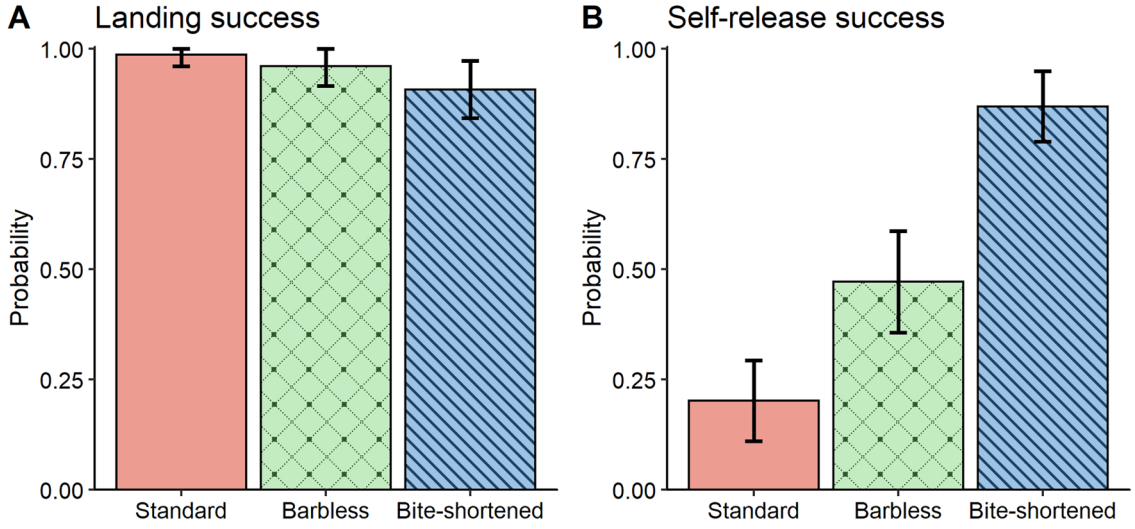

Figure 3. Mean probability for success (±95% CI) that Spotted Seatrout were (A) landed boatside and (B) self-released in the water without handling.

shortened hooks was 87%. In contrast, standard hooks were 20% successful (fifteen of seventy-four fish landed) and barbless hooks were 47% successful (thirty-four of seventy -two fish landed). The self-release model indicated that, compared to the standard hook, the odds of self-releasing was 3.5X higher with the barbless hook ($z = 3.371$, $P = 0.001$) and 26X higher with the bite-shortened hook ($z = 7.105$, $P < 0.001$).

Further research appears warranted to examine if similar success rates for self-releasing hooks would be achieved with different fish species, lure types, and anglers. We expect landing success to vary in different species due to differences in fish mouth morphology and their behavior after being hooked. Fighting behaviors that release tension on the hook, e.g., by swimming towards the angler or by jumping, would likely cause a bite-shortened hook to release from a fish before it is landed. Prescriptive use of different hook sizes may also allow for increased contact selectivity for target fish sizes and decreased bycatch of non-target species and undersized individuals (Cooke et al. 2005; Garner et al. 2014). Arguably the most important question determining the adoption of self-releasing hooks will concern the degree to which their use could provide a quality recreational experience. Widescale adoption of self-releasing hooks may be encouraged by the fact that the bite-shortened modification can easily be made using simple tools and basic supplies, as well as this study's results indicated no difference in size-selectivity between hook types. However, catch-and-self-release fishing may offer lower utility for anglers given that this invariably precludes the opportunity for anglers photograph their catch. Moreover, adoption may be limited if self-releasing hooks result in conspicuous changes in an angler's landing success. Unintended fish loss with the bite -shortened hooks was notably higher—9% compared to 1% for standard hooks—although the logistic model indicated that this difference was not statistically strong. Angler skill also appeared critically important for successful use of with the bite-shortened hooks: for both keeping tension on the line in order to land the fish, as wells as letting go that tension to self-release it. Understanding angler motivations from the fisheries where self-releasing hooks could be used will be critical as any potential benefits will ultimately depend on user adoption and behavior.

LITERATURE CITED

Brownscombe, J. W., A. J. Danylchuk, J. M. Chapman, L. F. G. Gutowsky, and S. J. Cooke. 2017. Best practices for catch-and-release recreational fisheries – angling tools and tactics. Fisheries Research 186:693–705. Elsevier B.V.

Coggins, L. G., M. J. Catalano, M. S. Allen, W. E. Pine, and C. J. Walters. 2007. Effects of cryptic mortality and the hidden costs of using length limits in fishery management. Fish and Fisheries 8(3):196–210.

Cooke, S. J., B. L. Barthel, C. D. Suski, M. J. Siepker, and D. P. Philipp. 2005. Influence of circle hook size on hooking efficiency, injury, and size selectivity of bluegill with comments on circle hook conservation benefits in recreational fisheries. North American Journal of Fisheries Management 25(1):211–219. Wiley.

Cooke, S. J., and I. G. Cowx. 2004. The role of recreational fishing in global fish crises. BioScience 54(9):857. Oxford University Press.

Cooke, S. J., and C. D. Suski. 2005. Do we need species-specific guidelines for catch-and-release recreational angling to effectively conserve diverse fishery resources? Biodiversity and Conservation 14(5):1195–1209. Springer.

Davis, M. W. 2002. Key principles for understanding fish bycatch discard mortality. Canadian Journal of Fisheries and Aquatic Sciences 59 (11):1834–1843. Canadian Science Publishing.

Garner, S. B., W. F. Patterson III, C. E. Porch, and J. H. Tarnecki. 2014. Experimental assessment of circle hook performance and selectivity in the northern Gulf of Mexico recreational reef fish fishery. Marine and Coastal Fisheries 6(1):235–246. Taylor and Francis.

Harris HE, BK Whalen, AG Gude, and MS Allen (2021) Testing a Bite-Shortened Hook to Minimize Fish Handling in a Recreational Fishery. Fisheries 46 (7) 321-328. doi.org/10.1002/fsh.10608

Muoneke, M. I., and W. M. Childress. 1994. Hooking mortality: a review for recreational fisheries. Reviews in Fisheries Science 2(2):123–156.