Descender devices or treat tethers: Does barotrauma mitigation increase opportunities for depredation?

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SEDAR74-RD102

March 2022

ESSAY

Descender Devices or Treat Tethers: Does Barotrauma Mitigation Increase Opportunities for Depredation?

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Increasing post-release survival of discarded fishes is a critical challenge to the development of effective conservation and management strategies for a multitude of commercial and recreational fisheries. Among reef fishes, this challenge is further complicated by pressure-related injuries collectively known as barotrauma. Left alone, these injuries are often fatal. Tactics to mitigate the adverse effects of barotrauma, including piercing an expanded swim bladder to release trapped gas (venting) and using a specially designed device to return a fish to the depth of capture (descending), have been well-described and readily adopted by regulatory agencies as best practices. Recently, the South Atlantic Fishery Management Council enacted a rule requiring anglers targeting species in the snapper grouper fishery management unit to be equipped with descender devices (SAFMC 2020), and similar regulations are anticipated for the Gulf of Mexico (GoM; AFS 2020). However, since enforcement is unfeasible, simply requiring possession of descender devices does not guarantee their use. Consequently, any potential benefits resulting from these rules rely completely on anglers embracing the use of descender devices, which will only happen if anglers truly believe that these devices increase post-release survival. A recent study suggests that anglers in the southern Atlantic who routinely use descender devices are willing to formally adopt them as a conservation strategy (Curtis et al. 2019); however, additional factors like predation influence the actual and perceived survival of descended fishes, yet remain poorly understood.

Depredation, defined as the partial or complete removal of a hooked species by a non-target species (Photo 1), is consistently discussed among anglers and regulatory agencies as an escalating problem in need of mitigation. In the western GoM, a recent study documented depredation on nearly 20% of vertical longline deployments; often the predator responsible was a shark (Streich et al. 2018). Moreover, in the eastern GoM, depredation from sharks has been identified as an obstacle preventing recreational stakeholder buy-in to shark conservation and management initiatives (Drymon and Scyphers 2017). Interestingly, angler concerns regarding depredation not only apply to fishes being caught (i.e. ascending), but to fishes being released with descenders (i.e. descending) as well. For example, during the August 2019 Gulf of Mexico Fishery Management Council meeting, several anglers expressed concern that if they are able to avoid rampant depredation prior to landing a fish, using a descender device to release the fish simply provides an additional chance for depredation. If resource managers are to promote descender devices as best practices, they must proactively address angler concerns about depredation of fishes during descent.

Photo 1: Image of a depredated Red Snapper *Lutjanus campechanus*. Photo courtesy of David Hay Jones.

Does barotrauma mitigation—specifically, the use of descender devices—increase opportunities for depredation? To examine this, we investigated two disparate fishery-independent Red Snapper *Lutjanus campechanus* camera datasets from the Alabama Artificial Reef Zone (AARZ) in the northern GoM (Figure 1). The AARZ is the largest artificial reef network in the United States and supports some of the highest removals of Red Snapper in the GoM (Karnauskas et al. 2017); in addition, depredation by sharks is common among hook-and-line fisheries in this region (Drymon et al. 2019). Consequently, the AARZ represents an ideal system for examining this question. The first dataset is from a vertical longline survey; briefly, three replicate vertical longlines (10 hooks each, 30 total) outfitted with 8/0, 11/0, and 15/0 circle hooks were soaked for 5 minutes. For complete details, see Powers et al. (2018). The second dataset is from a mark–recapture

DOI: 10.1002/fsh.10476

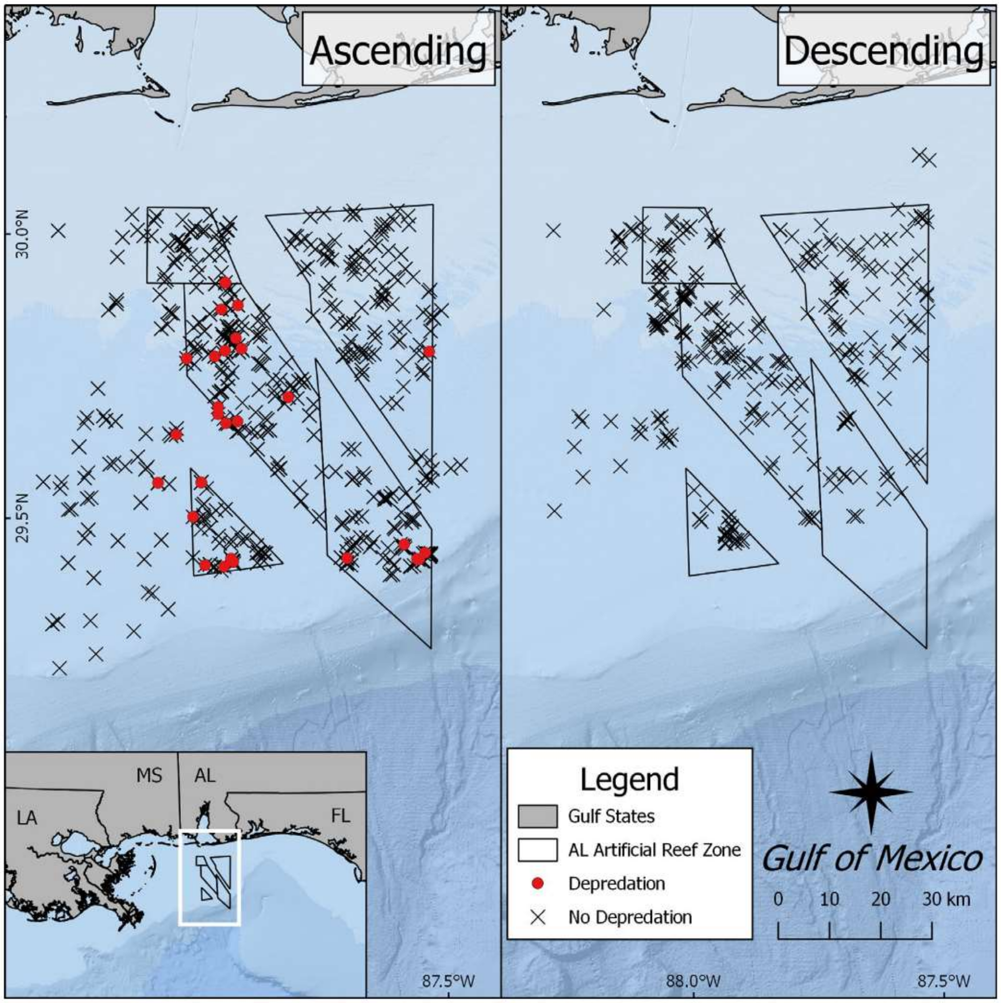

FIGURE 1. Locations (x) where downward-facing video footage was collected for vertical longline (left panel, Ascending) and descender releases (right panel, Descending). Camera-documented depredation events are shown in red.

study, during which hook-and-line sampling was conducted with 8/0 and 10/0 circle hooks. Complete details are provided in Sackett et al. (2018). Both gear types were equipped with downward-facing GoPro cameras, yet recorded different events; the vertical longline only recorded ascents, while the hook-and-line only recorded descents. Only videos where water quality permitted assessment of fate were used (i.e. videos recorded in poor water quality were excluded).

Between 2016 and 2018, GoPro video footage with sufficient water clarity was collected from 1,483 vertical longline sets and 1,096 descender releases. During vertical longline sampling, 69 depredation events were recorded on GoPro. Depredation was most frequently caused by sharks (n = 54). Depredation by dolphins was much less common (n = 15), and highly concentrated; nearly 75% (11 of 15) of dolphin-related depredation took place during two sampling days. No depredation by sharks or dolphins was recorded during descender releases. In other words, during a 3-year period when depredation was documented in the AARZ, it was only recorded on ascending hooks, and never on descending hooks.

Why was vertical longline depredation so much more prevalent than depredation on descenders? One likely explanation may be due to differences in fish behavior between the two gear types. Immediately upon capture by vertical longline, Red Snapper resist the hook and swim erratically. This behavior attracts sharks, whose highly specialized sensory systems (e.g. mechanoreception) are particularly attuned to these atypical, agitated swimming behaviors. Conversely, Red Snapper attached to descenders are nearly motionless, and thus avoid attracting additional, unwanted attention from predators. Alternatively, differences in gear may explain why depredation was observed on vertical longline, but not descenders. First, the vertical longline has several hooks, and hence can concentrate multiple struggling fishes in a small area. Second, once deployed, the vertical longline remains in the water column for several minutes (5 minutes in this study). Even fishes that are hooked immediately will remain hooked for 5 minutes, thereby increasing the temporal window for depredation. Alternatively, with a descender, a single fish is attached for a very brief period, typically less than 1 minute, before reaching its benthic destination.

Although our investigation was never intended to be a direct comparison, it illustrates a powerful truth: *depredation is a problem for ascending fishes, but less so for fishes attached to descenders*. This acknowledgment is an imperative first step toward engaging the angling community and thus increasing buy-in of descender devices across the GoM region. Recent studies in this area have shown that descender device awareness is generally relatively low, but once anglers are provided with clear instructions and access to descenders, willingness to adopt the use of these devices increases substantially (Curtis et al. 2019). Ideally, these instructions are shared through in-person descender device demonstrations and face-to-face conversations in casual settings, particularly where devices are distributed free of charge as an attendance incentive (Runde 2019). For broader dissemination, digital media can easily reach a large and geographically diffuse audience; however, careful consideration must be given to the style of these outreach materials to ensure optimal comprehension and reception of the content. For example, simple infographics and brief, informational "whiteboard-style" videos can effectively depict proper usage of descender devices; additionally, short GoPro scenes are inexpensive, yet powerful for documenting and sharing the fate of descended fishes once they reach the seafloor. An example of GoPro descender device footage is available at the Gulf of Mexico Fishery Management Council's Fishing for our Future website (https://bit.ly/2AznSXa), a new platform designed to raise awareness about release mortality throughout the GoM.

Developing appropriate messaging for stakeholders will undoubtedly require region-specific approaches. While depredation in the AARZ is primarily the result of interactions with sharks (Drymon et al. 2019; this study), other regions within the GoM experience different depredation dynamics. For example, depredation by Greater Amberjack *Seriola dumerili* is as prevalent as depredation by Sandbar Shark *Carcharhinus plumbeus* in the western GoM (Streich et al. 2018). In the eastern GoM, depredation is often the result of interactions with Goliath Grouper *Epinephelus itajara* (Schideler et al. 2015). Our conclusions, therefore, do not apply to areas outside the AARZ. We encourage other researchers who are presently using camera gear to examine the prevalence of depredation during both ascent and descent; more importantly, we encourage them to share their findings broadly with anglers in the region.

The success of any fishery regulation ultimately relies on adoption by end-users, but this is especially true in instances where equipment is simply required, not required to be used. Our comparison suggests that barotrauma mitigation—specifically the use of descender devices—does not increase opportunities for depredation in the AARZ. Short and simple messaging should emphasize that in the northern GoM, descender devices appear to work as intended, rather than simply functioning as treat tethers for hungry predators.

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