



FINAL Report
NOAA AWARD NA18NMF0080306

FishSmart South Atlantic Red Snapper and Red Drum Conservation Effort

Submitted by

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Executive Summary

During 2018-2020, 2,356 private recreational anglers and charterboat operators in the South Atlantic were engaged in a project designed to improve the survival of released red snapper (and other reef fish) and red drum. The objectives of the effort were to: 1) communicate with the recreational angling community the Best Practices for releasing fish and the appropriate use of descending devices and short leader circle hook rigs; 2) engage anglers in the application of these tools and techniques while participating in the South Atlantic reef fish and red drum fisheries, and; 3) gauge the level of success of implementation, conservation, and outreach. The methodology and assessment were patterned after a previous effort in the Gulf of Mexico (2015-2017) to provide comparability of results. For the red snapper/reef fish component, 66% of participants found Best Practices materials very helpful to improving the way that they release fish, 65% changed the way that they handled fish when releasing them into the water, 67% used a descending device for the first time due to this project, 72% believe descender devices would be helpful to reduce discard mortality of red snapper, and 74% are likely to use a descender device to release most fish when needed in the future. Ninety-three percent talked with, or involved other anglers in, the use of descending devices. There appeared to be a slightly greater prior awareness of the use of descending devices during the South Atlantic effort as compared to the earlier Gulf of Mexico effort. The results reinforce that maximum conservation benefits will be achieved by ensuring that anglers have access to Best Practices and other educational material when distributing descending devices. For the red drum component, anglers were provided with Best Practices and short leader circle hook rigs which have been demonstrated to reduce deep hooking and improve the chances of survival of released adult red drum. They are required gear for anglers in certain coastal waters of North Carolina during specific times of the year. The majority of anglers (61%) felt that the short leader circle hook rigs reduced the incidence of deep hooking indicating acceptance of their use. Angler adoption of these devices likely increased by replacing the barbless hook (as required in North Carolina) with barbed hooks (which improves retention of bait) while not reducing the conservation benefit. While barbless hooks may make hook removal easier, the scientific literature has not affirmed reduced mortality associated with their usage in this application whereas the short leader and circle hook attributes have been proven to improve survival. Full results are discussed in the report.

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FishSmart South Atlantic Red Snapper and Red Drum Conservation Effort

Introductory Note

This report covers both the red snapper/reef fish component of this project (the primary focus) as well as the red drum component of the project (secondary focus). However, NOAA award NA18NMF0080306 only supported aspects related to the red snapper/reef fish component.

Background

The red snapper fishery in federal waters of the South Atlantic region has been mostly closed since 2014 with only limited 4-6-day seasons allowed in 2017 -2020. The mortality of red snapper from heavy fishing pressure and high catch-and-release mortality has hindered the rebuilding of the fish stocks to a level that can sustain solid sport fisheries.

Additionally, the number of dead discards of red drum (one of the most recreationally sought-after fish throughout the South Atlantic) continues to increase. According to the Atlantic States Marine Fisheries Commission, southern stock harvest has shown a general increase, with Florida anglers landing the largest share of recreational harvest in numbers (53%), followed by North Carolina (25%). In 2016 (the year prior to initiation of this project), anglers took more than 2.3 million trips fishing for red drum, in the process releasing 2.5 million (over 200,000 of which died after release). Although southern red drum are not yet overfished, the popularity of this fishery and the sport fishing industry's dependence on it necessitates action to be taken to engage anglers in using tools and techniques to ensure that it remains healthy in the future. Studies have shown that using short leader rigs with circle hooks can reduce deep hooking¹ and improve the chances of survival for red drum that are released². This is especially true when fishing in slow or slack water. Short leader rigs are required in the internal coastal fishing waters of Pamlico Sound and its tributaries south of the Albemarle Sound of North Carolina at certain times of the year. The legal definition of short leader rig for these purposes in North Carolina describes an inline barbless circle hook no larger than 4/0 connected to a weight of at least two ounces with no more than six inches of leader between the attachment points of the hook and the weight.

History

FishSmart was initiated in 2011, with four workshops held around the coastal United States to 1) develop scientifically-based "Best Practices" for releasing fish, 2) identify research needs, 3) identify management actions to reduce the mortality of recreational caught-and-released fish and 4) Discuss communication mechanisms for reaching recreational anglers (see www.fishsmart.org for full details and results). During 2015-2017, the FishSmart Best Practices and Descender

¹ Aguilar, R. 2003. Short-term hooking mortality and movement of adult red drum (*Sciaenops ocellatus*) in the Neuse River, North Carolina. Theses in completion of Master of Science, degree, North Carolina State University. <http://www.lib.ncsu.edu/resolver/1840.16/2547>

² Beckwith, G.H., Jr. and P.S. Rand. 2004. Large circle hooks and short leaders with fixed weights reduce incidence of deep hooking in angled adult red drum. *Fisheries Research* 71 (2005) 115–120.

Education project, coordinated through the FishAmerica Foundation, engaged more than 1,100 anglers mostly in the Gulf of Mexico (with approximately 100 in the South Atlantic) in efforts to improve the survival of angler caught-and-released reef fish³. Participants in the project were provided with “Best Practices” materials for handling and releasing fish (developed through the workshop process) and with SeaQualizer descending devices. After approximately 6-12 months, project participants were asked to evaluate their extent of use of Best Practices and the descending device and provide feedback on their experiences. Applying known scientific information on the degree to which these devices improve survival of reef fish (including red snapper) in the Gulf of Mexico, 3,000 - 9,000 red snapper which would have died without the use of descending devices survived during this project period alone with conservation benefits continuing to accrue as anglers continue to use the devices and spread the word through the angling community (the “extension effect”)⁴. The survival of an unknown number of the additional 22,000 fish of other species that anglers reported releasing in this effort was also improved as part of this project. Based on the success of this 2015-2017 project, the 2017-2020 FishSmart Red Snapper and Red Drum Conservation Project was designed to expand the conservation benefits of Best Practices and specialized gear to the South Atlantic.

Objectives

The premise of this effort was that release mortality in recreational fisheries is the culmination of millions of individual encounters between anglers and fish and therefore recreational release mortality is most effectively reduced by empowering individual anglers with information, training, and tools to improve the survival of each individual fish that they return to the water.

The objectives of this project were:

- To communicate with the recreational angling community the *Best Practices* for releasing fish and the appropriate use of descending devices and short leader rigs.
- Engage anglers in the application of these tools and techniques while participating in the South Atlantic reef fish and red drum fisheries;
- Gauge the level of success of implementation, conservation, and outreach.

Methodology

Techniques similar to the 2015-2017 Gulf effort were implemented in the South Atlantic to engage anglers in the direct, hands-on conservation of red snapper (and other reef fish) and red drum by improving the survival of released fish. A key component of this approach was to directly engage *active* anglers (including charter captains) who are likely to take above-average number of fishing trips for these species and who may more likely be viewed as “opinion leaders” in the sport fishing community, thereby taking advantage of the extension effect that they have to convey information to the broader community.

³ Curtis, J.M., A.K. Tompkins, A.J. Loftus, and G.W. Stunz. 2019. Recreational angler attitudes and perceptions regarding the use of descending devices in southeast reef fish fisheries. *Marine and Coastal Fisheries: Dynamics, Management, and Ecosystem Science*. 11:506–518, 2019. American Fisheries Society, Bethesda, Maryland, USA.

⁴ Loftus, A.J. 2017. Initiating barotrauma and mortality reduction strategies with Gulf of Mexico recreational anglers. Final Report to the National Fish and Wildlife Foundation award 303.15.048009. 70 pages.

Direct Angler Engagement

State marine fisheries agencies (North Carolina, South Carolina, Georgia, and Florida) and The Nature Conservancy (working on a companion project focused on the Grays Reef National Marine Sanctuary) were engaged to reach out to their constituents with information on Best Practices and tools shown to improve the survival of released fish. In the case of red snapper, this tool was a descender device (primarily a SeaQualizer but also including Shelton Fish Descenders and Captain Roy's Fish Saver Descender) while in the case of red drum a "short-leader rig" (proven to reduce the incidence of deep hooking). Customized educational materials with individual (state or organization) logos were developed for the use of the partners. These partners received bulk shipments of devices based on their anticipated needs to distribute directly to anglers along with templates for producing Best Practices brochures/fact sheets and other media.

Website Registration

To reach anglers who were not directly contacted by personnel of partnering organizations, a website was developed and hosted by the Recreational Boating and Fishing Foundation where anglers could view Best Practices information and register to participate and receive a descending device (www.takemefishing.org/fishsmart). Yamaha Marine produced additional outreach materials (videos) which were available for viewing on this website. Anglers were driven to this website through various promotional avenues consisting mainly of a series of radio interviews conducted in 2018-2019 and through referrals from the partnering organizations and South Atlantic Fishery Management Council.⁵ Although the website contained educational materials for both red snapper/reef fish and red drum, enrollment in the project via the website was limited to those participating in the red snapper/reef fish aspect.

Beyond personal contact with state agencies, anglers were engaged in a variety of other ways. Videos (existing or produced by partners in this project) were available for distribution on the internet or closed-loop television at sporting shows or other locations where the selected target audience (reef-fish and red drum anglers in the South Atlantic) could be accessed. Upon registering to participate and receive a device as part of this project (whether directly contacted by agencies/dealers or web registration), anglers were asked to provide basic information including their email address, name, mailing address (if not receiving a device directly from a partner), primary port of fishing, and whether they are a private angler or charter captain.

Additionally, the South Atlantic Fishery Management Council conducted outreach to South Atlantic anglers in preparation of the requirement in 2020 that those anglers carry a descending device on board and use it when necessary to release red snapper. This outreach included development of their web page based on FishSmart Best Practices and links to the FishSmart project page.

⁵ On July 15, 2020, new regulations requiring descending devices and modifying hook requirements went into effect for offshore fishermen in the South Atlantic targeting or possessing species in the snapper grouper management complex along with an outreach effort to promote Best Practices for handling and releasing fish.

Partners

A large number of partners provided financial, material, and/or programmatic support to carry out this project:

- Yamaha Motor Corporation (financial and programmatic)
- NOAA Fisheries (financial support)
- Grizzly Smokeless Tobacco (funding only)
- FishAmerica Foundation (administrative support)
- American Sportfishing Association (administrative/logistical support)
- Recreational Boating and Fishing Foundation (website development and hosting)
- SeaQualizer LLC (product development and provision)
- Shelton Fish Descenders (product)
- Shimano (product)
- South Atlantic Fishery Management Council (communications support)
- Georgia Department of Natural Resources (programmatic and communications)
- Florida Fish & Wildlife Conservation Commission (programmatic and communications)
- South Carolina Department of Natural Resources (programmatic and communications)
- North Carolina Department Environment & Natural Resources (Marine Fisheries (programmatic and communications)
- The Nature Conservancy/Grays Reef National Marine Sanctuary (programmatic and communications)

Coordination Activities

Coordination Meetings

Two in-person coordination meetings were held, one on July 12, 2018 and one on July 10, 2019 to address coordination and outreach activities. Meeting participants included representatives from the state and federal partnering agencies including South Carolina Department of Natural Resources, Florida Fish and Wildlife Conservation Commission, Georgia Department of Natural Resources, North Carolina Department Environment & Natural Resources (Marine Fisheries (via teleconference), South Atlantic Fishery Management Council, Gray's Reef National Marine Sanctuary, NOAA National Marine Sanctuaries program, and NOAA Fisheries as well as private partners Yamaha Marine, and American Sportfishing Association. These meetings helped to coordinate the types of outreach that each partner was to undertake to reach their recreational fishing constituencies and to effectively register those participants for this project. Additionally, periodic conference calls and multiple email exchanges were used to facilitate coordination during intervening periods.

Development of Educational Materials and Project Registration

The Recreational Boating and Fishing Foundation developed and hosted the web-based education and registration portal (portal (www.takemefishing.org/fishsmart)). This involved uploading various materials to instruct anglers on the Best Practices for handling and releasing fish (developed through earlier phases of the FishSmart project) including videos produced by Yamaha Marine, a main project supporter for the South Atlantic FishSmart project. Although the

primary means to engage and register anglers during the project was through direct interaction with state partners, anglers had the option of registering through this online portal.

As a result of the 2015-2017 project, several communication assets were already available that were applied to this effort, including:

- FishSmart Best Practices Video focusing on deepwater release (www.fishsmart.org).
- FishSmart Best Practices brochure template which was customized for each partner and modified to reflect either deepwater release (reef-fish) or use of the short leader rig (red drum).
- FishSmart Best Practices fact sheet (single side) template customized for each partner and modified to reflect either deepwater release (reef-fish) or use of the short leader rig (red drum).
- How to Use a SeaQualizer video – specific to SeaQualizer descending device.

Additionally, two videos were developed specifically for this project by Yamaha Marine and used as a training resource via the web portal:

- Capt 'n Spud video on use of short leader rig for red drum.
- Capt 'n Spud Red Snapper Down video for application to the reef fish/descender component of this project.

Once anglers viewed and/or downloaded these materials, they proceeded to a registration page to provide their contact information and asked if they had previously used a descender device. Email addresses were validated prior to shipping a SeaQualizer; registrants without valid emails or outside of the primary project area (coastal South Atlantic) were screened out prior to shipping.

Modify and Customize Outreach Materials

A standard template for outreach materials centered on the communication of Best Practices to project participants was customized for each state partner depending on their use and needs, but, at a minimum, the materials are customized with each partner's logo to reflect their participation in the project.

Additionally, the FishSmart Best Practices have been integrated into the South Atlantic Fishery Management Council's MyFishCount app, an electronic reporting app and web-portal for recreational anglers in the South Atlantic. Data from anglers who report on this app that they are using descending devices will be utilized to refine depth-based calculations of potential conservation benefits from the use of these devices as part of the FishSmart project.

Descending Devices

Based on the success of the use of SeaQualizer descending devices during the 2015-2017 Gulf project and angler surveys which showed this to be the preferred device⁶, agreements were reached and orders placed directly with the manufacturer at a discounted price. Additionally, state partners expressed an interest in Shelton Fish Descenders which some anglers prefer for

⁶ Crouch, M. 2017. 2017 Citizen science descending device study final report: An evaluation of anglers' barriers to using descending devices. Florida Fish and Wildlife Conservation Commission Division of Marine Fisheries Management, Tallahassee, FL. 57 pages.

releasing fish, particularly at shallower depths (e.g., ~30 feet) when needed. The manufacturer of this device was contacted and an agreement reached to ship supplies directly to the state agencies for distribution to anglers. The Shelton Fish Descender was only distributed by states (not through the online registration option). SeaQualizers were distributed by partners as well as through the online web registration. Additionally, Georgia DNR had some Captain Roy's Fish Saver Descending Devices remaining from a previous project which they utilized in this effort, but these constituted a small percentage of the devices distributed.

Short Leader Rigs

(Not funded by NOAA)

North Carolina, Georgia, and South Carolina elected to participate in the short leader rig aspect of this project. The product development team at SeaQualizer, LLC designed and supplied the short leader rigs utilized in this project. As described earlier, studies have shown that short leader rigs reduce the deep hooking of adult red drum and North Carolina has developed a legal definition of this terminal tackle. During the initial year of this project (2018-2019) all short leader rigs provided to anglers were designed to meet this legal definition. However, angler feedback indicated that adoption of this equipment was being hindered due to a higher incidence of lost bait with barbless hooks. In a review of the scientific literature, barbless hooks had not been proven to reduce mortality (although it may reduce handling time) while the other aspects of short leader rigs (e.g., leader length and circle hooks) have been demonstrated (through the literature) to reduce mortality. Given that angler adoption of this gear (and subsequent conservation benefits) was being hindered by an aspect not supported in the literature (barbless hooks), a decision was made to offer state partners (except North Carolina) short leader rigs with barbed hooks and a three-way swivel in place of the fixed weight to allow anglers to attach heavier weights to meet specific fishing conditions. These were termed adjustable or variable weight short leader rigs. Orders of all short leader rigs were shipped directly from the manufacturer to individual state agencies.

Media Engagement

Targeted outreach through to anglers through radio and print media was conducted during December 2018-January 2019; the following radio shows were engaged:

- Radio Interview with The Outdoors Show
- Radio Interview with Fishing Headquarters
- Still Just Fishing Radio Show Interview
- Catch a Memory Outdoors Radio Show

Additionally, the following engagement of print media was accomplished:

- Press release focused on North Carolina markets.
- Article in *Soundings* magazine
- Information provided to *Florida Sportsman* for upcoming issue

Agency partners conducted additional outreach to media through their local avenues as well as through social media platforms.

Presentations were provided to the South Atlantic Fishery Management Council's "Workshop on Improving Survival of Released Fish" in Ponte Vedra Beach, FL June 12, 2017 and the South Atlantic Fishery Management Council's Recreational Advisory Panel meeting, April 14, 2020.

Cooperation with The Nature Conservancy/Grays Reef National Marine Sanctuary

FishSmart partners were approached by The Nature Conservancy (TNC) regarding an education and outreach effort that they were launching in the Grays Reef National Marine Sanctuary. This effort was designed to engage recreational anglers fishing in Grays Reef in a series of focus panels exploring various issues and perceptions of fishing in the sanctuary. A component of these focus panels included questions related to release of deep caught reef fish and the use of descending devices. Participants were provided with Best Practices information and a descending device (SeaQualizer provided through this project). Additionally, questions were added to the FishSmart evaluation questionnaire to ascertain the use and application of these materials and devices in Grays Reef.

Assessment Methodology

To assess the degree of implementation, effectiveness, and adoption of *Best Practices* techniques and descender (or short leader rig) tools, four rounds of assessment were completed: May, 2019, January 2020, October, 2020, and December 2020. This was based on the assessment conducted in the initial 2015-2017 Gulf of Mexico effort with only minor modification for purposes of comparison, but customized where needed for the specific conditions in this South Atlantic effort (particularly related to red drum and Grays Reef National Marine Sanctuary participants which were not part of the 2015-2017 effort). An additional question was added to assess the types of behavior change if anglers indicated that Best Practices changed the way that they handled or released fish in order to delve deeper into questions that remained from the 2015-2017 Gulf of Mexico effort. Ultimately, the goal was to evaluate the effectiveness of implementation of this program, the extent of adoption of Best Practices and specialized release gear/tackle, and a rough approximation of conservation benefit resulting from the project.

Participants were chosen if they had the devices for six months or more and had not received a previous request for their input. Incentives (provided by private partners) were offered to encourage their participation. For all registrants except those enrolled by the South Carolina DNR, initial emails were sent using Survey Monkey, with follow ups to non-respondents using Constant Contact and finally direct email. South Carolina managed their registrants and directed all participants to the survey via direct email.

Results

Project Enrollment and Device Distribution

Project partners distributed 673 SeaQualizers and 596 Shelton fish descending devices. Additionally, 297 devices were distributed via the online registration portal (see table 1). A total of 1,054 participants were enrolled in the red snapper/reef fish conservation component. Note that in some cases, participants were supplied with two of the lower cost Shelton Fish Descenders along with one SeaQualizer.

Table 1. Distribution of descending devices and Best Practices material as part of the South Atlantic Red Snapper/Reef Fish Conservation Project.

Partnering Organization	Partner Distribution SeaQualizer	Partner Distribution Shelton's	# Partner-Registered Participants	# Web-Registered Participants SeaQualizers	Total Participants
North Carolina DENR	39	23	53	20	73
South Carolina DNR ¹	212	96	251	54	305
Georgia DNR ¹	323	445	322	92	414
Florida FWC	33	32	65	131	196
TNC/Grays Reef	66	N/A	66	N/A	66
Total	673	596	757	297	1,054

¹ In addition to those numbers reported in this table, South Carolina has 49 other participants signed up during the 2015-17 Gulf/South Atlantic project. Georgia had 45 participants signed up during the 2015-2017 project, some of whom may have re-registered to participate in this effort and would be reflected in the numbers in the table.

Red Drum Conservation Participants – state agencies were provided with approximately 5,276 short leader rigs. In most cases, anglers were provided with more than one short leader rig since they are relatively low cost and easily lost, so progress is best measured as the number of anglers. Across the three states participating (Florida elected not to participate in this component), Georgia reported 763 individuals, North Carolina 543 individuals, and South Carolina 212 individuals participating. Of the total 1,518 participants, only 216 overlap with the red snapper conservation component of this project and 1,302 are unique to participating only in the red drum conservation aspect (See Table 2 for details).

Table 2. Distribution of short leader rigs and Best Practices material as part of the South Atlantic Red Drum Conservation Project.

Partnering Organization	Unique Participants	Overlapping Participants with Descending Component	Total Number of Participants
North Carolina DENR	541	2	543
South Carolina DNR	31	181	212
Georgia DNR	730	33	763
Total	1,302	216	1,518

Assessment of Angler Engagement

General Assessment Results

Approximately 1,756 requests were sent to participate in the four rounds of the assessment with 1,567 successful deliveries. A total of 625 responses were received for a minimum response rate of 40%. The response rate is based on the number of emails that did not bounce back; however,

previous testing has revealed that a certain (unknown) number of emails may reach the ISP server but do not appear in the intended recipient’s mailbox (and do not bounce back). Therefore, the actual response rate as a percentage of those who had a choice to participate in the survey or not by virtue of reading the invitational email is likely higher but cannot be calculated.

Overall, 25% of the respondents received both a short leader rig and a descending device. The results will be discussed individually for each of the project segments.

Red Snapper/Reef Fish Conservation

Characteristics

Of the responses received, 375 indicated that they had received a descending device; 351 had used it on one or more trips and 24 did not have the opportunity to use it. Responses discussed from here on reflect those who had used it on at least one trip. Devices were used for an average of 9 months and on 14 fishing trips. The majority (88%) were private recreational anglers with the remaining 12% charterboat operators (one respondent was a headboat operator). The overwhelming number of respondents were male (95%) and 60% had an undergraduate college degree or higher education. Sixty-eight percent were over the age of 41. As expected, the respondents tended to be more avid anglers with 65% indicating that they had fished for reef fish for 20 years or more (table 3) and 50% fishing for reef fish more than 11 days in the past year (table 4).

Table 3. Number of years fishing for reef fish (n=330).

	Less Than 1 Year	1-4 Years	5-10 Years	11-20 Years	More Than 20 Years
	5%	12%	18%	20%	45%

Table 4. Number of days fishing for reef fish in the last year (n=323).

	0 Days	1-5 Days	6-10 Days	11-20 Days	More Than 20 Days
	3%	21%	26%	19%	31%

Approximately 32% indicated that they most often fished out of Florida, 32% out of Georgia, 10% from North Carolina and 25% from South Carolina. Of these, 27% had fished in Grays Reef National Marine Sanctuary during the past 3 years with 63% of those targeting snapper/grouper and 74% actually catching and releasing snapper/grouper).

Project Materials and Perceptions

The majority of respondents (92%) received a SeaQualizer, 17% a Shelton Fish Descender, and 11% a Captain Roy’s Fish Saver Descender (30% received more than 1 device with 75% of those receiving a Shelton/SeaQualizer combination) with 48% receiving it as a result of the online web registration portal, 45% directly from agency personnel, and 7% from a workshop or other event.

Of those receiving more than one device, 72% indicated a preference to a SeaQualizer, 11% preferring Shelton’s, and 7% preferring Captain Roy’s Fish Saver.

Most (72%) recalled reviewing materials on Best Practices for handling and releasing fish at the time that they received (or registered) for their device. The most often reviewed material was the FishSmart Best Practices flyer/brochure (table 5).

Table 5. What material do you remember receiving or viewing when you registered for or received your device (n=351, multiple selections allowed).

FishSmart Best Practices flyer/brochure	41%
FishSmart Video	9%
How to Use a SeaQualizer" video	29%
Cap’n Spud: Red Snapper Down” Video	5%
I didn't receive or view any materials	28%

Changes in Behavior

Two-thirds (66%) of those recalling the materials found them “very helpful” to help improve the way that they release fish or recognize the signs of barotrauma with 30% indicating that they were “slightly helpful.”

For those responding that they found the information very or slightly helpful, approximately 2/3 indicated that they used a descending device for the first time and changed the way that they handled or released fish when releasing them. Others changed various aspects of their planning for their trip or handling the fish (table 6).

Table 6. How did Best Practices materials influence you (n=251, multiple selections allowed).

Changed the way that I plan for a trip.	16%
I changed the gear that I used to catch fish.	17%
I changed how I brought fish to the boat or landed fish.	21%
I changed the way that I handled fish on the boat.	36%
I changed the way that I handled fish when releasing them into the water.	65%
I used a descending device (of any type) for the first time.	67%
Other	4%

Barotrauma Cues and Descending Device Usage

Anglers were asked to identify which cues they used most often when deciding to use a descending device or venting tool to release a fish. Most physical attributes of barotrauma provide important cues for the anglers (table 7).

Table 7. Which of these cues do you use when deciding to use a descending device or venting tool to release a fish (n=351, multiple selections allowed).

Fish appears bloated (inflated with air), but otherwise normal	69%
Stomach is protruding from mouth	71%
Eyes are bulging	54%
Fish appears sluggish or unresponsive when brought to the boat	41%
Fish is floating and unable to submerge	62%
I use a venting or descending tool on every fish, even if they exhibit none of the symptoms above	21%
I never use a venting tool or descending tool	4%
Other	5%

Approximately 2/3 (67%) of respondents indicated that they had little or no knowledge about descending devices prior to participating in this project with only 8% indicating high or very high knowledge. When asked about their future usage of a descending device when needed, 3/4 indicated that they would likely use it on most or all fish (table 8).

Table 8. How likely are you to use a descending device to release fish when needed (n=351).

I would likely use it on all fish	33%
I would likely use it on most fish	42%
I would likely use it about half the time	15%
I would likely use it on very few fish	8%
I would not likely use it at all	2%

Finally, anglers were asked how helpful they believed that descending devices would be in reducing discard mortality in the red snapper fishery, with nearly 3/4 (73%) indicating helpful or very helpful and only 7% perceiving them to be of little or no help. On average, respondents indicated that they believed that 71% of fish survive after being released using a descending device

Fishing Attributes

Approximately 60% of anglers in this project fished 0-30 miles from shore (table 9) and tended to target reef fish at moderate fishing depths, with 82% indicating less than 125 feet (table 10).

Table 9. Distance from shore most often fished when fishing for reef fish.

0-10 miles	18%
11-20 miles	20%
21-30 miles	21%
31-40 miles	16%
41-50 miles	15%
51-60 miles	7%
61-80 miles	2%

Table 10. When fishing for red snapper, grouper, or other reef fish, what is your most common targeted range of fishing depth (n=351)

75 feet or less	18%
76-125 feet	64%
126-175 feet	13%
176-225 feet	4%
226-275 feet	<1%
Greater than 275 feet	<1%

In terms of number of fish released using a descender, the most common species was red snapper (table 11).

Table 11. Approximately how many fish have you released using the descending device (n=156).

	None	1-5 Fish	6-15 Fish	16-30 Fish	31-50 Fish	51-75 Fish	more than 75 Fish	I have no idea
Red Snapper	13%	33%	23%	15%	5%	4%	6%	1%
Gag Grouper	62%	22%	11%	3%	<1%	0%	0%	1%
Black Sea Bass	56%	22%	8%	6%	4%	2%	1%	1%
Other Fish	33%	32%	14%	10%	4%	0%	3%	4%

Communication

To assess the extent of peer-to-peer communication and exchange of information related to Best Practices and descending devices, participants were asked to estimate the number of anglers and non-anglers with whom they discussed these issues. Approximately 93% discussed the issues

with one or more other anglers with nearly 1/3 indicating that they had spoken with more than six other anglers about these issues (table 12).

Table 12. With how many other people have you discussed the use of the devices and/or involved in the use of the devices provided through the FishSmart program (n=351).

	None	1-5	6-10	11-15	More than 15	Weighted Average
Other Anglers	7%	59%	20%	4%	10%	2.63
Customers (charter or head boat)	71%	10%	5%	2%	12%	1.84
Non-Anglers	62%	29%	5%	1%	3%	1.57

Red Drum Conservation

An error in skip logic while programming the survey precludes us from accurately utilizing some of the questions characterizing anglers who received short leader rigs but who had indicated that they did not recall receiving educational materials. However, questions related directly to the usage of short leader rigs are usable but only reflect anglers who did recall receiving educational materials.

Characteristics

Approximately 273 respondents participated in the red drum conservation/short leader rig aspect of this project. Of those, 211 were able to provide information directly related to their usage. Ninety-one percent of SLR recipients were private recreational anglers and 9% were charter captains.

Use of Devices

Project participants used the short leader circle hook rigs supplied as part of this project for an average of eight months on approximately nine fishing trips. Sixty-seven percent used fixed weight rigs, and 47% variable weight (some participants used more than one type). Of those who had used more than one type, 26% preferred the fixed weight, 37% the variable weight, 35% felt that both are equally preferred and 2% didn't like fishing with either style.

Fishing Activity

When using these short leader circle hook rigs, 78% were fishing from a boat the majority of the time, 8% from a pier or other man-made structure, and 14% from the beach or other natural shoreline. On average, they released approximately nine adult red drum (over 27 inches in length) using these short leader circle hook rigs. The majority of anglers (61%) felt that the short leader circle hook rig reduced the incidence of deep hooking (hook location other than jaw or lip) in the adult (over 27") red drum that they caught while 32% were unsure whether they did or not.

Discussion

The questionnaire that was used to evaluate the effectiveness and impact of this project was purposely designed from that used in the 2015-2017 Gulf of Mexico effort in order to provide comparability with the results. The striking feature in this comparison is the similarity in results

to key questions (table 13). However, one major difference was observed. There appeared to be a slightly greater awareness of the use of descending devices during the South Atlantic effort as compared to the earlier Gulf of Mexico effort. This is likely due to the increasing attention being directed to these devices as a conservation and management tool. Toward the end of this project (on July 15, 2020), NOAA Fisheries implemented a requirement that recreational and commercial fishermen have a descending device on board and readily available for use when fishing for or possessing snapper and grouper species in federal waters of the South Atlantic. Descending devices must be attached to at least 16 ounces of weight and at least 60 feet of line. This requirement, and the publicity leading up to it, may have generated an increased awareness of, and interest in, descending devices although the regulation was implemented late in the project period (and the increased awareness was evident from the first round of the survey in May 2019).

Another significant finding of this project (as was also seen in the Gulf of Mexico effort) is the conservation benefit of the *Best Practices* and instructional material. Approximately 2/3 of project participants changed their fishing and handling practices based on these materials which are based on the best available scientific advice for improving the survival of released fish. These changes include modifying the way that they handled fish when releasing them into the water, changing fishing gear used to catch fish, and changing techniques for bringing fish to the boat and handling them while onboard. *This reinforces that maximum conservation benefits will be achieved by ensuring that anglers have access to Best Practices and other educational material when distributing descending devices.*

Table 13, Comparison of results between the FishSmart Best Practices and Conservation effort focusing on the Gulf of Mexico (2015-2017) to of the South Atlantic Red Snapper/Reef Fish Conservation Project (2018-2020).

	Gulf of Mexico 2015-2017	South Atlantic 2018-2019
Exposure:	Used devices on average 8 months, on 15 fishing trips.	Used devices on average 9 months, on 14 fishing trips.
Increased Awareness	72% had little or no knowledge of descender devices prior to participating in this project.	66% had little or no knowledge of descender devices prior to participating in this project.
Effective Education	67% found Best Practices materials very helpful to improving the way that they release fish/ recognize signs of barotrauma	66% found Best Practices materials very helpful to improving the way that they release fish/ recognize signs of barotrauma
Changed Behavior	76% are now likely to use a descender device to release most or all fish when needed.	<ul style="list-style-type: none"> •74% are likely to use a descender device to release most/ all fish when needed. •65% changed the way that they handled fish when releasing them into the water. •67% used a descending for the first time. •17% hanged the gear used to catch fish. •21% I changed how they brought fish to the boat or landed fish.
Improved Perceptions	78% believe descender devices would be helpful or very to reduce discard mortality of Red Snapper.	72% believe descender devices would be helpful/ very helpful to reduce discard mortality of Red Snapper
Extended Communication	95% talked with, or involved other anglers in, the use of descending devices.	93% talked with, or involved other anglers in, the use of descending devices.
Red Snapper Conservation	3,000 - 9,000 red snapper “saved” directly during this project period only.	See Discussion
Additional Conservation	Unknown number of the 13,000 - 22,000 other fish released benefitted from improved handling techniques and use of descending devices.	

Developing a quantitative estimate of the number of red snapper that survived as a result of this project would involve a high degree of uncertainty. During the earlier Gulf of Mexico effort, several studies had been published around the time of the project completion that demonstrated the comparative survival of fish that had been released with and without the application of descending devices. No such definitive studies exist for the South Atlantic and given the disparate environmental conditions between the Gulf of Mexico and South Atlantic, applying the results of the Gulf studies to the South Atlantic would not be appropriate. As scientific studies are completed estimating the relative improvement in survival when using descending devices in South Atlantic waters, these calculations may become possible.

The short leader rig aspect of this project was added at the request of state agencies and after a literature search had confirmed that these devices did provide a conservation benefit based on best available science (a core tenet of the FishSmart program). In general, anglers had a favorable impression of this gear. However, as discussed earlier, anglers conveyed that the ‘barbless hook’ attribute of this gear was resulting in lost bait and therefore many were not continuing to use them (where the usage was voluntary). After a review of the literature it was determined that the demonstrated conservation benefit was derived from the circle hook and short leader aspects and, while barbless hooks may make hook removal easier, the scientific literature had not affirmed reduced mortality associated with their usage. Modifying the gear to allow barbed circle hooks and a replacing the fixed weight with a three-way swivel for attaching weights of various sizes (to match fishing conditions) may have increased acceptance of the gear although angler preference was nearly equally split between fixed, variable, and both equally preferred. Importantly, the majority of anglers (61%) felt that the short leader circle hook rig reduced the incidence of deep hooking indicating acceptance of their use once they had an opportunity to try them out.

Obstacles Encountered

The later-than-anticipated implementation in July, 2018 meant that state agency partners were just beginning the Best Practices and descending device distribution as the first weekend of a 6-day red snapper season was beginning. While some participants were enrolled during this period, having additional lead time prior to the opening would have allowed opportunities for greater publicity and increased awareness before anglers began targeting red snapper. However, since anglers still catch and release red snapper (and other reef fish) outside of the season, application of Best Practices all year round is just as important as during the open season to maximize the survival of caught and released fish. Distribution continued during 2019 and 2020 although the 2020 activities were hindered by the global coronavirus pandemic (discussed later).

By far, the largest impediment impacting the South Atlantic Red Snapper and Red Drum Conservation Project in 2018 was Hurricane Florence which hit in September and impacted the majority of the project area but most heavily North Carolina and South Carolina. Beyond the destruction caused by the storm itself (and extensive flooding), state agencies were diverted to duties related to pre-storm preparedness and post-storm recovery. Outreach activities related to this project by agencies were substantially impacted for the remainder of that year.

As with all other aspects of society worldwide, the dominant event during 2020 was the continuing global pandemic of coronavirus and the substantial disruption to all activities. Several in-person events that project partners were planning to distribute Best Practices materials

and descending devices were cancelled causing project partners to focus more on using social media and other electronic communication tools to reach anglers, and shipping materials to them instead of personal delivery. Fortunately, the online portal hosted by the Recreational Boating and Fishing Foundation for this purpose filled in some of the needs, and project partners began developing new ways with which to reach anglers while adhering to social distancing advisories for reducing the spread of Covid-19.

As with the earlier Gulf of Mexico project, engaging headboat operators (and some charterboat operators) in the use of descending devices was challenging. Taking the time to descend fish one-at-a-time can be daunting, or practically impossible, when large numbers of anglers are onboard and a large number of fish are coming onboard at one time. Developing a system which can be utilized on vessels carrying a large number of anglers, and which meets the requirements of law enforcement (particularly related to the “retention of fish”) remains a challenge.

Some agency partners communicated that many anglers do not feel that they fish in deep water often enough to warrant participation in the project. However, if this is the case, these individuals could still be candidates for receiving information on Best Practices even though descending fish may not be necessary for the majority of their fishing trips.

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