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Awareness, Knowledge, and Perceptions of Barotrauma and Barotrauma Mitigation: A Survey of Florida Anglers[1]

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Introduction

Saltwater recreational fishing represents an important economic engine for many of Florida's coastal communities. The annual economic impact to the Florida economy associated with saltwater recreational fishing, which sustains 110,000 jobs, is estimated to be $13 billion (National Oceanic and Atmospheric Administration [NOAA] 2016). An important component of the saltwater recreational fishing effort in Florida targets reef fish, specifically snappers and groupers. Given the popularity and economic importance of reef fish, careful management of these fish stocks is imperative for the sustainability of the reef fish resource.

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The fisheries management process attempts to account for the recreational fishing mortality associated with a fish stock, including mortality associated with retention and release. Release, or discard, mortality occurs when fish that are to be returned to the water are injured during the process of being caught, handled improperly when landed, or released in an inappropriate manner. For reef fish, another unique source of release mortality exists, which is known as *barotrauma*. Barotrauma occurs when reef fish are brought up from depth and the resulting reduction in ambient barometric pressure causes gases within the fish to expand. These expanding gases can result in air embolisms (e.g., the blocking of a vein or artery by an air bubble) and rupture of gas-filled organs such as the swim bladder. Fish that are experiencing barotrauma may have difficulty returning to depth because the expanded gas within the body creates

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excessive buoyancy. As a result, these fish are often referred to in the vernacular as "floaters" and are more susceptible to predators and exposure from the elements.

Anglers can mitigate the effects of barotrauma through two key strategies. The first strategy is to allow the trapped, expanded gases to escape so that a fish can swim back down to depth upon release. This can be done using a hollow needle, or venting tool, that can be inserted into a fish's body to allow expanded gases to escape. In the absence of the expanded gases, the fish can overcome the excessive positive buoyancy and return to depth unaided. The second strategy is to forcibly return the fish to depth and to the ambient pressure from which it was removed. This can be done using a descending device/recompression tool, a weighted device that attaches to or encloses the fish and drops the fish back to depth where gases in the fish's body are recompressed, eliminating excessive positive buoyancy. Both of these barotrauma mitigation strategies provide a means to help reef fish return to depth, thereby reducing release mortality.

The popularity of reef fishing, coupled with more stringent fisheries regulations, has likely contributed to an increase in the numbers of reef fish being released by anglers. As the number of released fish increases, the aggregate release mortality will also likely increase. The management paradox is that this is counter-intuitive to the fisheries management goals of implementing bag limits, size limits, and seasonal closures. A strategy for reducing this discard mortality is to educate saltwater anglers about barotrauma and provide them with the necessary skills to mitigate its impact when fish are released.

The survey described here was conducted to measure Florida saltwater anglers' awareness, knowledge, and perceptions of barotrauma. The information will be useful in the development of outreach programs and strategies designed to motivate anglers to mitigate the effects of barotrauma on released fish when possible. The survey provided insight into the level of understanding Florida anglers have regarding the concept of barotrauma, their recognition of it, their experience and confidence in using existing barotrauma mitigation tools, and their preferred methods of learning about barotrauma. Information about basic fishing patterns and experience were also solicited. The findings of the survey will also be useful to state and federal fisheries managers as they seek to develop management strategies that will better ensure the sustainable use of reef fish stocks, as well as all other fish stocks targeted by the economically important saltwater recreational fishing industry.

Methods

Survey Implementation

A survey was administered via email to a sample of the 2013 Florida Saltwater Angler license holders on file, a list of which is maintained by the Florida Fish and Wildlife Conservation Commission. The parent file contained approximately 500,000 valid email addresses. The survey was conducted utilizing the University of Florida QUALTRICS system. Survey protocol and questions were approved by the University of Florida Internal Review Board for Social and Behavioral Research. The survey was field-tested for content clarity, validity, and readability. All recommendations were considered, and the survey was revised based on field-test feedback. The survey was sponsored by the Florida Sea Grant College Program, with assistance from the University of Florida Fisheries and Aquatic Sciences Program. An email message was sent to 10,000 unique, randomly selected email addresses every two weeks. The email message provided (1) a salutation that described the purpose of and motivation for the survey, although the salutation specifically avoided the use of the word barotrauma and (2) a link to the survey instrument. A reminder email was sent to each original recipient one week after the initial wave of messages was sent. A total of five waves of email messages (50,000) were sent out, with the initial wave being sent on July 14, 2014.

Survey Design

The survey was designed to solicit a wide range of information from the respondents, including

1. Basic fishing patterns (depth, fishing experience, avidity, location, fishing mode [e.g., private/rental vessel, party/charter vessel, or shore])
2. Ability to recognize symptoms of barotrauma
3. Use and confidence associated with venting tools
4. Use and confidence associated with descending gear
5. Reasons for not using barotrauma mitigation tools
6. The need for additional training on the use of barotrauma mitigation tools
7. Preferred methods to learn more about barotrauma mitigation and catch/release practices

The survey instrument was designed to solicit information in a logical sequence, with options for the respondents to skip questions that did not apply while ensuring all respondents provided basic information on key topics.

Survey Findings

A total of 825 completed surveys were obtained from the 50,000 email messages that were sent out over the ten-week sampling period, which suggests an overall response rate of 1.65%. However, this seemingly low response rate could be due to a variety of non-response issues associated with email surveys (e.g., incorrect email addresses, SPAM and junk mail filters, unopened email messages, failure of the recipient to click through to the survey page landing, etc.) (Kaplowitz et al. 2015). Samples of the survey responses and respective tabulated data are provided below (a complete discussion of the survey questions and subsequent findings can be found at https://www.flseagrant.org/wp-content/uploads/TP_224_web.pdf [TP 224]).

Depth Zone Fished

Key Finding: Almost two-thirds of the trips taken by respondents were in depths greater than 30 feet, which are depths for which barotrauma signs (or effects) can be more pronounced.

Familiarity with Floaters and Use of Venting Tools/Descending Gear

The percentage of "yes" responses to survey questions about this subject are illustrated in Table 1. The key findings on this subject are as follows:

- Almost three-fourths of survey respondents who fished at depths greater than 30 feet had observed fish having difficulty returning to depth. Thus, the key problem with barotrauma was familiar to respondents, regardless of their level of exposure to the barotrauma concept or their avidity to fishing in deeper water.
- Virtually all of the respondents who indicated they use some method to assist floaters used venting tools.
- The number of Florida saltwater respondents who use descending/recompression gear is dramatically lower than the number of respondents who use venting tools.
- Of the 92% of respondents who use venting tools, approximately 63% indicated a need for additional training.

Reasons for Lack of Use of Venting Tools/Descending Gear

The key findings on this subject are as follows:

- Most respondents who attempted to assist floaters use venting tools. However, 29% of those who chose not to use a venting tool instead used a descending/recompression tool. Those who chose not to use a venting tool provided numerous reasons for not using a venting tool, including lack of understanding or knowledge, difficulty of use, ineffectiveness, cost, and safety.
- The most frequent reasons for not using descending/recompression gear were lack of knowledge about the gear and already using venting tools. This finding suggests a need for additional outreach regarding the use of descending/recompression gear as a viable option for barotrauma mitigation.

Preferred Methods to Learn More about Venting/Descending Gear

The preferred learning methods were ranked on a scale of 1 to 3 in Table 2. The key findings on this subject are as follows:

- High-tech methods of finding information, such as websites and online videos, as well as television and print media, ranked highest in preferred methods.
- Traditional methods, such as fishing event presentations, social media, webinars, and online forums, ranked lowest in preferred methods.

Florida Fishing Experience and Avidity

The distribution of fishing experience in years fished by survey respondents is illustrated in Figure 1. The key findings on this subject are as follows:

- Respondents who fish in Florida's coastal/marine waters often have many years of overall experience.
- Most respondents report 30 or fewer years of fishing experience. Relatively fewer report more than 30 years of experience, and the number reporting more than 50 years of fishing experience is dramatically lower.

Summary

A survey designed to assess the current level of angler awareness, knowledge, and perceptions regarding barotrauma and the use of barotrauma mitigation devices was conducted as part of a statewide Florida Sea Grant barotrauma outreach program. The purpose of the survey was to aid in the development of outreach programs and strategies designed to motivate anglers to mitigate the effects of barotrauma on released fish when possible, and to provide state and federal fisheries managers with information useful toward developing management strategies that will better ensure the sustainable use of reef fish stocks. A total of 825 completed surveys were obtained from 50,000 email messages sent to license holders via five waves over a ten-week period. The survey solicited information concerning basic fishing patterns, experience, and avidity;

ability to recognize barotrauma symptoms; use and confidence associated with venting tools and descending devices; reasons for not using such mitigation tools; the need for additional training; preferred methods to receive training; and other information. Approximately two-thirds of survey respondents fished at depths greater than 30 feet, with three-fourths of those respondents having observed fish having difficulty returning to depth. Most respondents attempted to assist "floaters," and those who did not were constrained by a lack of knowledge of methods and gear. Of those who did assist fish to return to depth, the majority used a venting tool, while a much smaller number of respondents used descending devices. The survey findings suggest that additional outreach is needed to help anglers better understand the proper techniques in the use of venting tools and descending devices. Such outreach would help increase the confidence of anglers in the use of such barotrauma mitigation devices. Although traditional sources of information are still in high demand by anglers, the survey indicated a strong preference for training through more "high-tech" methods, such as websites and online videos.

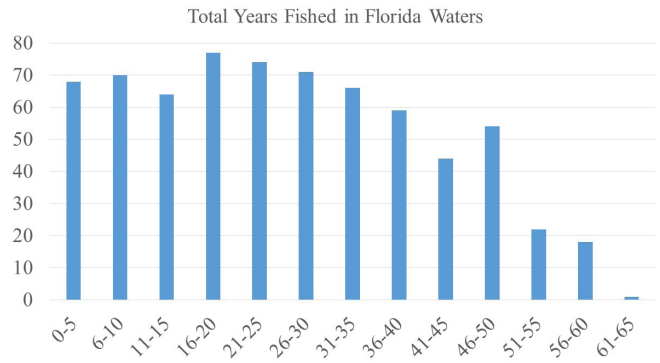

Figure 1. Distribution of fishing experience (years fished) by survey respondents

Barotrauma is recognized by fishery managers as a key source of release mortality associated with the recreational reef fish fishery. With the popularity of recreational fishing for reef fish in deeper water environments remaining strong, the need to better understand mortality associated with released fish persists. As the number of fishing trips increases while more stringent management imposes regional/seasonal closures, larger minimum sizes, and stricter bag limits, the number of released fish will likely increase. As a result, the developing management strategies that encourage the use of barotrauma mitigation devices may be warranted. If so, the findings of this survey may be useful in better understanding the incentives and constraints that play a role in the use of barotrauma mitigation devices by the saltwater anglers of Florida.

References

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Table 1. Percentage of "yes" responses to survey questions

Question	Yes
While releasing reef fish (for example, snapper, grouper, etc.) caught from deep water have you ever noticed that some were physically unable to return to the bottom on their own? Such fish are often referred to as "floaters." (n = 729)	71%
Do you use a venting tool to help floaters return to depth? (n=458)	92%
Do you feel you need more information/training on the proper use of venting tools? (n=424)	63%
Do you use descending/recompression gear to help floaters return to depth? (n=425)	9%
Do you feel you need more information/training on the proper use of descending/recompression gear? (n=423)	70%
Note: All respondents fished at depths greater than 30 feet.	

Table 2. Ranking of the top three preferred learning methods

Please rank your top three preferred methods to learn about venting, fish descending/recompression gear, or handling of floaters. Enter a 1, 2, or 3 next to your three responses.				
Answer		**1**	**2**	**3**
Magazines and newspaper articles (n=195)		79	62	54
TV shows about fishing (n=189)		69	74	46
Talking with bait and tackle shops (n=69)		18	24	27
Agency brochures and other educational print materials (n=106)		32	35	39
Websites (n=199)		84	63	52
Online forums (n=51)		13	17	21
Social media (e.g., Facebook, Twitter, Pinterest) (n=21)		4	5	12
YouTube videos (n=168)		56	56	56
Word of mouth from other anglers (n=88)		18	33	37
Presentations/displays at community fishing events or club meetings (n=42)		5	17	20
Fishing workshops or classes (n=49)		17	13	19
Webinars (online presentations) (n=35)		12	6	17
Other (n=13)		8	1	4