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Lifting the goliath grouper harvest ban: Angler perspectives and willingness to pay

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ABSTRACT

Despite uncertainties surrounding the protected Atlantic goliath grouper's stock size and resilience, fishery managers are under pressure to end the harvest moratorium in place since 1990. The present study sought to measure the proportion of anglers interested in reopening the goliath grouper fishery and to identify key reasons for this interest. We also present an estimate of the amount that anglers would be willing to pay for a goliath grouper harvest tag (the right sold to an angler to harvest one goliath grouper). A survey was mailed to a random sample of Florida (USA) residents with a recreational fishing license. Approximately half of the respondents agreed that the goliath grouper should now be open to recreational take. A probit analysis indicated that the best predictor for the opinion the fishery should be open is the belief that there are "too many goliath grouper." Also, more anglers agreed than disagreed that goliath grouper are eating "all the fish on the reef," a belief that was related to anglers personally viewing goliath grouper depredation. The mean willingness to pay for a goliath grouper harvest tag was estimated to be between $34 and $79. This information can be used to estimate the potential revenues available from a hypothetical tag system and can be compared with the economic value of goliath grouper in non-consumptive uses such as recreational diving.

1. Introduction

After decades of heavy fishing in US waters, the Atlantic goliath grouper spawning stock biomass declined to about 5% of virgin levels, which prompted a harvest moratorium in 1990 (Porch et al., 2006). A 2006 evaluation by the National Marine Fisheries Service (NMFS) suggested that the moratorium had successfully increased adult abundance to about 30% of virgin levels (but see McClenachan, 2009 for discussion about the appropriate baseline), which led to the grouper's removal from the NMFS species of concern list (NMFS, 2006). Nevertheless, high uncertainty remains among fishery managers as to the goliath grouper's stock size and age class structure (Cass-Calay and Schmidt, 2009) and the species is still considered critically endangered throughout its range (IUCN, 2014).

Despite the uncertainty surrounding stock size and resilience to fishing, fishery managers are revisiting the goliath grouper harvest moratorium. Some anglers have voiced concerns that goliath grouper are damaging the reef fish community, that there are too many of them, and that recreational take should be allowed (Frias-Torres, 2013; GS pers obs). Further, anglers report viewing depredation events (goliath grouper taking angler's hooked fish), which serves to increase angler annoyance and reinforces angler perceptions that goliath grouper are major consumers of other reef fishes. Koenig et al. (2011) contended that angler misconceptions about the goliath grouper reflect the "poor job" the scientific and management community has done communicating to the public. In general, the majority of information about angler perceptions regarding goliath grouper is anecdotal and empirical verification is lacking. A previous email-based survey of goliath grouper stakeholders found a majority of recreational Florida anglers have interest in harvesting the species, but suggested additional in-depth research of each stakeholder group to better understand their perceptions (Lorenzen et al., 2013). Without proper insight into Florida recreational angler perceptions, management is unable to place the demand for the reopening of the goliath grouper fishery into the appropriate context or to foresee the likely effects of future management decisions.

Though some anglers are pressuring for protection to be lifted, there is still uncertainty surrounding how representative these vocal anglers are of Florida recreational anglers, what influences their beliefs, or how much they are willing to pay to harvest a fish. The present study sought to answer two questions about Florida

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recreational anglers with respect to the goliath grouper using a 17-question mail survey distributed to a random sample of 1000 Florida residents with recreational fishing licenses: (1) What proportion of anglers favor reopening the fishery and why?; and (2) How much are anglers willing to pay to harvest a goliath grouper? To answer these questions, we used a modeling approach to examine which variables are the best indicators of angler beliefs about reopening the fishery, and used the contingent valuation methodology (CVM) to calculate measures of mean willingness to pay for the right to harvest goliath grouper. We also examined how willingness to pay for the harvest tag varies among subgroups of Florida anglers. Results from the present study may afford fishery managers a context in which to place the vocal Florida anglers pressuring policymakers to reopen the fishery. Further, results may allow for comparison with future estimates of non-consumptive use value of goliath grouper.

2. Methods

2.1. Survey

A survey to quantify angler perspectives was designed (for full survey and results, see Appendices) following the recommendations of the "tailored design method" outlined by Dillman (2007). Because the survey was intended for anglers who fish recreationally in Florida, the sample frame was based on individuals that were licensed saltwater anglers. State saltwater license-holder information (containing names, addresses, license types, demographics, etc.) was obtained from the Florida Fish and Wildlife Conservation Commission (FWC) in July 2012, which comprised 1,011,562 individual licenses and associated data. The sample frame was restricted to resident 1-y, 5-y, or lifetime saltwater fishing license types [omitted license types included snook and lobster endorsements (duplicative), non-resident licenses, charter licenses (as the survey questions were designed for individual anglers), and comprehensive license types less likely to be regular saltwater anglers (hunting/freshwater/saltwater combinations)]. Individuals younger than 18 y of age (minors) also were removed from the list. After this process, the sample frame was reduced down to 475,091 individuals, from which a random sample of 1000 individuals was drawn using a simple random selection.

The sample was randomly ordered, numbered, and individuals were assigned to bins of 100 (e.g., 1–100, 101–200, etc.) for assignment to 10 versions of the survey with 10 unique dollar amounts for the willingness-to-pay dichotomous choice component of the study (see willingness to pay section below). Each individual's survey was printed with a unique identifying number, and individual surveys were matched with the corresponding mailing address label to ensure that each survey was sent to the appropriate individual, but also to ensure that the survey results were kept anonymous to anyone without access to the secured database.

The survey was accompanied by a letter of explanation and informed consent, and with contact information for questions. Funding limitations precluded the use of a pre-paid cash incentive with each mailing to increase response rate. Although research has shown that a lottery prize has minimal effects compared to no prize (control) or pre-paid cash incentives (Dillman, 2007), the letter of explanation communicated that all participants would be included in a raffle for a prize at the end of the study period, per previous angler studies (e.g., Larkin et al., 2010 and references therein).

The first wave of mailings was sent in May 2013. As responses were received, the sample list was adjusted to account for individuals who had responded or letters that were returned as undeliverable. If an expired forwarded address was listed on a returned envelope, the address for the individual was updated for future mailings. A second wave of mailings was prepared and sent (July 2013) to those who had not yet responded.

2.2. Survey error and analysis

Sampling error was derived following Dillman (2007). A mail survey was chosen over an email survey because less than half of licensed anglers in Florida provided an email address. Also, using standard mail avoids the potential bias in the subsample of individuals willing to disclose an email address to a government agency. One of us (GSS) conducted a survey pilot study in February 2013 at a local fishing club located in Hollywood, Florida. The results of the pilot study were used to improve the survey design.

We used a Lagrange Multipiler test to evaluate nonresponse error (Whitehead et al., 1993; Fisher, 1996; Marra and Radice, 2011) using the R package "SemiParBIVProbit" (Marra et al., 2013). The Lagrange Multiplier test is used to test the null hypothesis that there is no sample selection error present (Marra et al., 2013). Demographic data provided as part of the Florida saltwater fishing license database outlined above were used in the model, including age, sex, ethnicity, license type, and Florida region. We supplemented these data with the political affiliation of each angler as listed in public records (using http://www.politicalstrategies.com/VoterSearch.aspx).

All categorical and ordinal responses were coded to numerical values, and were coded as binomial values for models. If an angler provided a range (e.g., for number of fishing trips per month), the midpoint for that range was used. Response refusals for income and education were replaced with the mean values of the valid observations so that other survey responses were not lost in analyses (Whitehead et al., 1993). All means are reported with standard errors, and statistical significance was declared at $P < 0.05$. Statistical analyses were conducted using the R Environment for Statistical Computing (R Core Team, 2012).

2.3. Survey questions

2.3.1. Perceptions of goliath grouper abundance changes over time

To gauge the perceptions of goliath grouper abundance changes over time, anglers were asked to estimate encounter rates for three points in time: 2012 (survey read "last year"), 2008 (survey read "five years ago"), and when an angler first started fishing (calculated as 2013 minus reported number of years fishing). We binned these reported encounter rates into six groups: pre-1980 (pre-heavy exploitation), 1980–1989 (the years of heavy exploitation leading up to the moratorium), 1990–1999 (the first decade of the moratorium), 2000–2007 (the second decade of the moratorium), 2008–2009 (five years ago binned with individuals who began fishing within this time), and 2010–2012 (last year binned with individuals who began fishing within this time). For each of these time periods, we calculated the probability per trip that anglers would encounter a goliath grouper. This was accomplished by summing the medians of the frequency ranges anglers reported to have encountered goliath grouper (e.g., 10–25% of trips = 17.5%), which was divided by the sum of the total number of fishing trips anglers in that time period indicated they took per month. We then truncated the data at 1993 to aid in comparison to the Reef Environmental Education Foundation (REEF) database (which was also calculated as percent of total dive trips), a citizen-science diving survey effort that has been cited as the best available index of abundance for the goliath grouper in Florida (see Koenig et al., 2011).

2.3.2. Belief about reopening the fishery

We used a probit model to estimate the probability that an angler would agree that the fishery should be reopened to harvest.