

Observer-based Estimates of Red Snapper Catch and Discard Rates During Open and Closed Recreational Seasons in the Northern Gulf of Mexico

Estimaciones de los Observadores a Base de Pescados del Filón de Capturas y de Descartes Durante Abierto y Cerrado Seasons Recreativos de Pargo Rojo en el Norte del Golfo de México

Les Estimations de Poissons de Récif Observateur à Base de Captures et les Taux de Rejets cours Ouverts et Fermés Seasons de Loisirs pour Red Snapper dans le Nord du Golfe du Mexique

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ABSTRACT

High discard rates combined with release mortality may impede stock recovery of the overfished red snapper stock in the US Gulf of Mexico (GOM). However, estimates of recreational fishery discards are based on self-reporting by fishermen. In this study, we estimated reef fish catch and discard rates through direct observation of charterboat operations in the for-hire recreational fishing sector during 2012-2013. Captured reef fish were identified, weighed, and measured to total length (TL). Gear description, fishing location, reef type, and fishing time also were recorded. The retained and discarded red snapper catch were sampled on each trip (n = 54) for sex determination and aging. Mean total and red snapper discards per trip declined significantly with depth but were not significantly different between open and closed seasons. During open seasons, smaller red snapper (mean TL = 475 mm, median age = 4 year) were discarded alive in favor of larger fish (mean TL = 633 mm, median age = 6). Overall, red snapper comprised nearly 80% of all discards, with 81.5% of red snapper discards occurring at depths < 40 m. Red snapper also constituted the largest percentage (65%) of regulatory discards when targeting other species during red snapper closed seasons. Open season red snapper discards were primarily due to fishermen targeting larger fish, with only 13% of discards attributable to the minimum length limit (406 mm TL) and only 2.1% due to reaching the daily bag limit. Captains fished significantly deeper waters and targeted a greater proportion of natural reef habitat during closed red snapper seasons resulting in a 61% decline in red snapper catch but only a 25% decline in red snapper discards. The specific factor(s) (e.g., depth, reef type, and gear type) driving differences in red snapper catches between open and closed seasons remains unclear.

KEY WORDS: Discard, red snapper, Gulf of Mexico, reef fish

INTRODUCTION

Discards are often a major contributor to overfishing and impede recovery of overfished stocks worldwide (Harrington et al. 2005, Kelleher 2005, NMFS 2011, NMFS 2012). High numbers of regulatory discards often typify fisheries in which traditional management measures, such as minimum length limits, seasonal closures, and annual quotas, are utilized to regulate fishing effort (Bochenek et al. 2010). All three of those measures are employed in the management of red snapper, *Lutjanus campechanus*, in US waters of the Gulf of Mexico (GOM), which is perhaps the most contentiously managed stock in the region. The GOM red snapper fishery is somewhat distinct in that it is impacted by multiple fishery sectors and gear types across a range of habitats and depths, thus effectively exposing the entire age structure of the population to fishing mortality (Porch 2007, SEDAR 2013). In addition, physoclistus fishes such as red snapper are particularly susceptible to acute and delayed release mortality associated with barotrauma resulting from rapid ascension to the surface during capture (Wilson and Burns 1996).

The recreational sector has produced the vast majority of sub-adult and adult red snapper discards since the introduction of seasonal closures in 1997 (SEDAR 2013). However, the estimate of recreational discards is uncertain as both live and dead discard numbers are self-reported by fishermen, and self-reporting in other fisheries has been shown to be inaccurate when compared to estimates from onboard observers (Bochenek et al. 2012). Furthermore, the length of the recreational red snapper season in US federal waters has steadily declined since 1997 (37 days in 2012 and 42 days in 2013), and it is unclear how the reduction in season length has affected fishing behavior and discarding practices in the recreational sector. The purpose of this study was to develop a protocol for observing and sampling charter boats within the for-hire recreational fishery, as well as to characterize variables of catch and effort between open and closed red snapper seasons. Descriptive statistics on fishing practices in this sector will inform fishery managers of current discarding practices and composition to better evaluate and develop alternative management strategies for mitigating bycatch and discards in the GOM reef fish fishery.

MATERIALS AND METHODS

Observer trips were conducted during May - October 2012 and May - July 2013. Trips were distributed among four for-hire charter vessels that ranged between 14 and 21 m in length and were licensed to carry between 6 and 22 fishermen; all captains had >10 years of experience in the northern GOM reef fish fishery. Boat captains were contacted approximately

one week in advance of proposed observer trips to check for availability of trips primarily targeting reef fishes. Charter boat captains were compensated \$250 per trip as an observer represented the loss of one potential customer, and that amount is reflective of the average daily trip rate per individual. Depth, GPS coordinates, reef type (artificial or natural), fishing time, and number of fishermen were recorded for each fishing site visited.

All captured fish were identified to species, weighed to the nearest 0.01 kg, and measured to the nearest mm total length (TL) or fork length (TL). Depending on catch rate, every n^{th} red snapper (up to 20 per trip) from the discarded catch was identified with a tag and retained for scientific sampling. Red snapper from the discarded catch that were not retained for subsampling were measured, vented, and released at the surface. Up to 20 red snapper from the retained catch also were tagged and their carcasses retained for scientific sampling following fish cleaning. Samples were transported back to the laboratory for otolith removal and sex determination. Otoliths were embedded in epoxy, sectioned with a low-speed wafering saw, and aged following standard protocols (Patterson et al. 2001). Opaque zones were counted by two independent readers and average percent error was calculated between reader counts (Beamish and Fournier 1981).

Differences in catch and effort parameters measured on observed fishing trips were tested between open and closed season trips with single-factor ANOVAs computed in R. Differences in red snapper size and age among open season retained catch, open season discards, and closed season discards also were tested with ANOVA. Tukey's multiple comparison procedure was computed to test for differences among groups.

RESULTS

Observers collected data on 54 charter boat trips during which 279 reef sites were fished. Twenty-four trips occurred in 2012 and 30 trips occurred in 2013, with 32 trips made during red snapper open seasons and 22 during closed seasons. Differences in several catch and effort parameters were observed between open and closed season trips. Mean depth fished ($p < 0.01$), time fished ($p = 0.01$), percent natural reefs fished ($p < 0.01$), and number of species caught ($p < 0.01$) all were significantly greater during closed season trips, while the number of fishermen ($p < 0.01$), the number of red snapper caught ($p < 0.01$), and the percentage of the catch constituted by red snapper ($p < 0.01$) were significantly lower during closed season (Figure 1). Mean distance from port ($p = 0.19$) and the number of fish caught ($p = 0.11$) were greater during closed seasons but the difference between open and closed seasons was not statistically significant. Likewise, the number of red snapper discards ($p = 0.27$) was lower during closed season trips but the season effect was not significant.

Of the 893 red snapper discards, 34.6% occurred during closed seasons. Of the 584 red snapper discards that occurred during open seasons, 2.1% were due to fishermen having reached their daily bag limit ($n = 2$ fish per fisherman per day), 13.4% were due to fish being below the minimum size limit (406 mm TL), and 84.4% were due to fishermen live-discarding legal sized fish so they could target larger fish. Mean length (\pm SE) of retained red snapper (633 ± 4.0) was significantly different than that of discards during open (475 ± 3.4) or closed (443 ± 7.0)

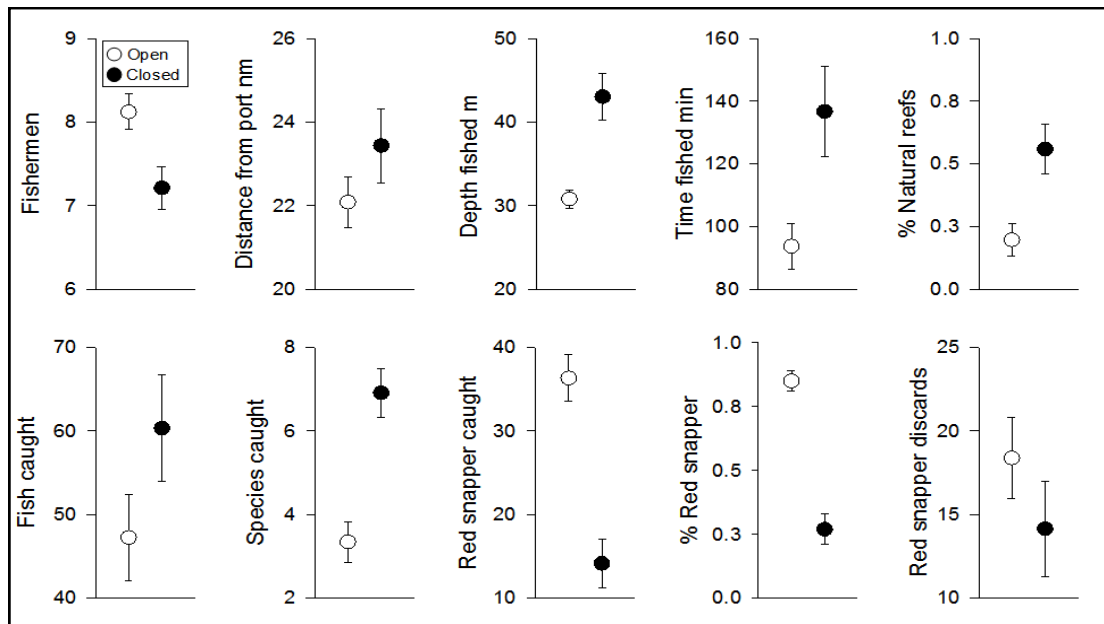


Figure 1. Mean (\pm SE) values catch and effort parameters used to characterize chartered reef fish trips during open and closed red snapper seasons.

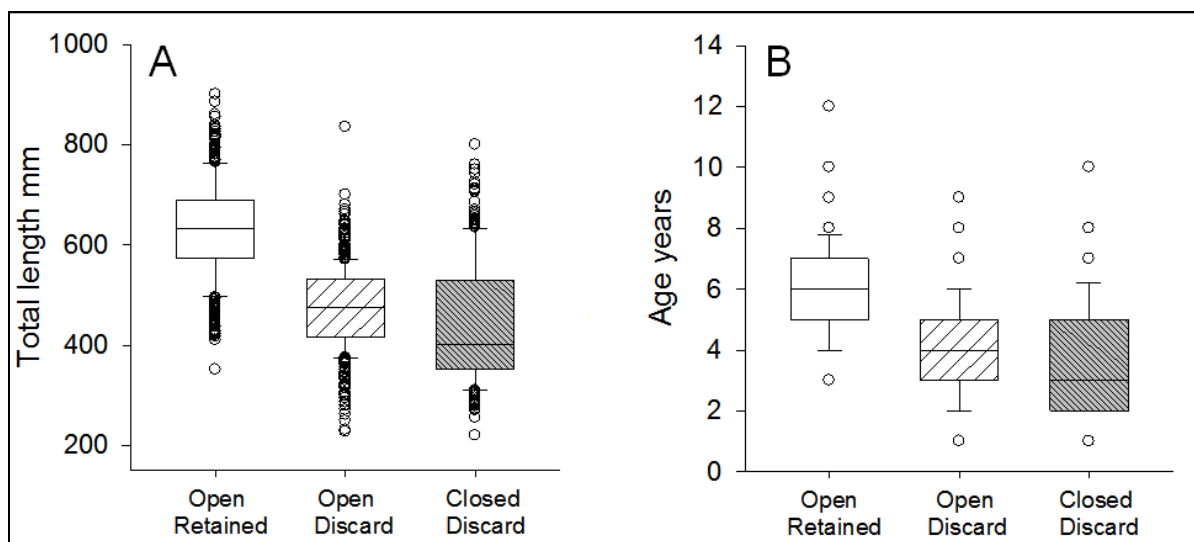


Figure 2. A) Boxplots of total length and B) age for red snapper sampled during open and closed seasons. Horizontal lines indicate median values, box ends represent the 25th and 75th percentiles, extended bars represent the 10th and 90th percentiles, and open circles represent outlying values.

seasons ($p < 0.01$; Figure 2), and TL was significantly different among all three groups. Median age of retained red snapper (age 6) was significantly different than that of open (age 4) or closed (age 3) season discards ($p < 0.01$; Figure 2), and age was significantly different among all three groups.

DISCUSSION

Charter boat captains were able to significantly reduce red snapper catch during closed season trips, with the red snapper catch rate being 2.6 times greater during open versus closed season trips. There also was a decline in the number of red snapper discards between open and closed trips, but that difference was not statistically significant. This disparity between a substantially lower red snapper catch rate but a non-significant decline in the number of red snapper discards is due to the fact that fishermen were able to retain approximately half of the red snapper they caught during open season trips.

The decline in the percentage of the reef fish catch constituted by red snapper during closed season trips was accomplished by charter boat captains changing their fishing behavior during closed seasons. They fished farther offshore in deep water and mostly at natural versus artificial reefs. There is a greater diversity of reef fishes at northern GOM natural reefs, but natural reefs tend to be found in deeper water closer to the shelf edge (Dance et al. 2011). Red snapper are among the more abundant reef fishes on northern GOM natural reefs, but they are the predominant fish on artificial reefs where they constitute approximately 40% of the fish biomass (Dance et al. 2011). Therefore, when targeting red snapper during open season trips, charter boat captains stayed closer to shore, fished shallower sites, and targeted artificial reef habitat.

While changes in charter boat captain fishing behavior clearly reduced the number of red snapper caught during closed season trips, the number of dead discards actually may have increased during closed season trips. Depth is a significant factor in red snapper barotrauma and release mortality (Rummer 2007, SEDAR 2013), and closed season trips occurred in significantly deeper water than open season trips. Furthermore, 25.5% of reefs targeted during closed seasons, versus 13.7% during open seasons, were in 40 m or greater, which Wilson and Burns (1996) identified as a threshold at which release mortality rapidly increases for physoclistus fishes.

Results from this study highlight the utility of onboard observers in characterizing catch and effort data for the GOM for-hire reef fish fishery. Boat captains were very willing to participate in this research but the four cooperating vessels represent a small percentage of the charter boat fleet currently operating in the northern GOM. In addition, trends in catch and effort must also be assessed for the private recreational sector, which has orders of magnitude greater fleet size than either the commercial and for-hire recreational sectors. Currently, discards in the recreational fishery are self reported, which has been shown to differ greatly from onboard observer estimates in other fisheries (Bochenek et al. 2012). While our study highlights the value of direct estimates of catch and discards, observer coverage would need to be greatly expanded to fully characterize discarding in the for-hire recreational fishery, and direct observations of some kind would need to occur for the private recreational sector as well. Gulf-wide estimates of recreational catch, effort, and discarding could then be used to evaluate alternative management strategies aimed at mitigating the issue of dead discards in the recreational red snapper fishery.

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