

ARTICLE

A Comparison of Private Recreational Fishing Harvest and Effort for Gulf of Mexico Red Snapper during Derby and Extended Federal Seasons and Implications for Future Management

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Abstract

Fisheries managers often use regulations such as bag, size, and season limits to manage recreational anglers and prevent overharvest, and this has been the case for the Gulf of Mexico Red Snapper *Lutjanus campechanus* fishery, which has been highly regulated for over 20 years. During this period, the federal season for private recreational anglers has decreased from year-round in 1996 to only 3 d in 2017. However, in 2017 the private recreational season was reopened for an additional 39 d. This scenario allowed us to examine a very short, derby-style initial season with an unexpected extended season and make comparisons with longer-term data sets from the Texas Parks and Wildlife Department's angler-intercept program, where we hypothesized that harvest and effort may not be directly related to season length. Our data indicated that there were higher harvest and effort rates during the initial season than during the extended season, and these differences were a function of extended season length (i.e., future access) and weather. The harvest and effort rates of the extended season were not proportional to the initial season, suggesting that recreational anglers compensated for reductions in season length by compressing their effort into the shortened season. While our results suggest that an extended season results in a reduction of daily harvest and effort rates, it is important to have programs in place to closely monitor the total harvest in a timely manner to prevent overharvest.

Fisheries managers face many challenges when attempting to set quotas for both recreational and commercial fleets in mixed-use fisheries. In the Gulf of Mexico, several commercial fisheries are managed with individual fishing quotas or catch share programs, where a limited number of commercial fishers are allowed to harvest a finite amount

of the total quota (e.g., pounds gutted weight) throughout the year. Recreational anglers, however, are managed based on modeled catch and effort data collected from previous years, which subsequently determines the season length for the current year (NMFS 2017). While this type of management has been suitable for many recreationally

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important species (e.g., Red Drum *Sciaenops ocellatus* and Spotted Seatrout *Cynoscion nebulosus*), the management of Red Snapper *Lutjanus campechanus* has proven to be more difficult.

Red Snapper are arguably the most important reef fish species in the Gulf of Mexico, supporting a multibillion dollar recreational and commercial fishing industry (NOAA 2017). Red Snapper harvest has been regulated since 1984, when a 13-in minimum size limit was imposed on the species (GMFMC 1981). In 1988, the stock was determined to be overfished and overfishing was occurring (Goodyear 1988). Recent assessments have concluded that the stock is no longer overfished or undergoing overfishing (SEDAR 52 2018). While the stock remains under a rebuilding plan and is recovering rapidly with more and larger fish, ironically, the private recreational season length has decreased in recent years despite an increasing quota, leaving recreational anglers only a few days each year to fish.

Management of Red Snapper is unique in that they are managed by both state and federal agencies. Contrary to most other recreationally harvested species, each Gulf State has their own separate “state waters” wherein state managers have the ability to determine size, bag, and season length of this area of water off their respective coastline. For example, based on catch estimates spanning 30 years, the Texas Parks and Wildlife Department (TPWD) has established and maintained a year-round state-water Red Snapper season with anglers permitted to harvest four fish per person at a 381-mm (15-in) minimum total length. National Oceanic and Atmospheric Administration (NOAA) Fisheries determines these same criteria in the federal waters. As federal recreational seasons have continued to be shortened in recent years, several Gulf States extended their state-water boundaries (Alabama, Louisiana, Mississippi) from 3 to 9 nautical miles (consistent with Texas and Florida boundaries; DOC 2016) and state-water fishing seasons to provide anglers more access to the state Red Snapper fishery. Despite this, most anglers, when given the option, prefer to fish in federal waters due to the larger size and greater abundance of Red Snapper that are available further offshore. Furthermore, the estimated harvest from state waters is then removed from the total federal quota, thereby shortening the season in federal waters.

National Oceanic and Atmospheric Administration Fisheries calculates the annual gulfwide Red Snapper quota using several data sources to determine the federal season length. Standard harvest and effort data is currently collected throughout the year through a system of individual state and federal surveys (Marine Recreational Information Program, Snapper Check [Alabama], Louisiana and Texas creel surveys, and the Southeast Region Headboat Survey), and the data are compiled, along with mean weights, to calculate total harvest (NMFS 2017). Season length for

federal waters is projected using these data from the previous years to predict the number of fishing days to reach the allocation. However, because catch data from these surveys are imprecise, managers apply additional buffers on the estimated quota as a precaution to minimize the chances of overfishing. Despite these precautions, the recreational sector (private anglers and charter for-hire boats) has exceeded their allocation in 16 of 20 years while fishing during the federally mandated seasons since recreational quota allocations were implemented in 1997 (GMFMC 2018). Furthermore, NOAA Fisheries approved Reef Fish Amendment 40 in 2015, which split the recreational sector into two groups: the private sector and the for-hire sector (U.S. Office of the Federal Register 2015). Collectively, sector separation, imprecise catch estimates, and longer state-water seasons all contribute to shortened federal seasons for private recreational anglers.

While the private recreational season was 9–10 d from 2014 to 2016, the 2017 season was the shortest on record at 3 d. These abbreviated seasons likely created a derby-style fishery, defined by NOAA as “a fishery of brief duration during which fishers race to take as much catch as they can before the fishery closes” (NOAA 2006). This type of fishery is more commonly seen in commercial fisheries prior to the utilization of individual fishing quotas (Gauvin et al. 1994; Casey et al. 1995). Similar to these derby-style fisheries, short seasons increase the likelihood of anglers engaging in unnecessarily risky fishing practices, such as fishing in less than desirable weather conditions to harvest the daily two fish per person bag limit in federal waters. In response to the 2017 3-d Red Snapper season (Thursday through Saturday), discussions developed among the Gulf State management agencies, Gulf State congressional offices, and the U.S. Department of Commerce, which resulted in NOAA Fisheries announcing a temporary reopening of federal waters to private recreational anglers on June 14, 2017 (U.S. Office of the Federal Register 2017). This order allowed private recreational anglers to fish in federal waters for an additional 39 d, making the entire 2017 federal season 42 d long.

During this unexpected extended season, anglers were allowed to harvest Red Snapper from state and federal waters from June 16th until September 4th (Labor Day) from Friday through Sunday, as well as the 4th of July holiday (June 30–July 4). State waters throughout the Gulf of Mexico were closed to the harvest of Red Snapper outside of the specified days of the extension, with only Texas reopening their waters once the extended federal season ended. The unique and unexpected occurrence of a short initial season followed by an unanticipated extended season allowed us to examine angler behavior in each scenario. Specifically, we used angler-intercept data to evaluate (1) whether daily catch and effort rates were similar between the initial and extended season and (2) if

environmental factors such as wind speed and wave height had an effect on when anglers fished under these varying scenarios. We also used long-term data sets from the TPWD's angler-intercept program to examine the relationship between estimates of harvest and harvest rate with changing recreational season lengths.

METHODS

Angler-intercept surveys.—Despite a lengthy Texas coastline, saltwater anglers have limited access to offshore waters, with only approximately 25 locations (including boat ramps and private and public marinas) allowing access to Red Snapper fishing in the Gulf of Mexico (Figure 1). While other Gulf States have modified both their sampling programs and state-water seasons, the management techniques (e.g., size and bag limits) of Red Snapper in Texas have remained relatively unchanged over the years. The TPWD has been conducting saltwater angler intercepts of both inshore and offshore private anglers since 1974 in each of the eight major bay systems throughout the state. Site selection is determined randomly following a weighting procedure based on mean roving counts of empty trailers and wet slips at inventoried boat access sites (in this case specifically those that have access to the Gulf of Mexico) adjusted by the percentage of target-area fishing activity. Survey data was collected at these boat ramps during the initial (June 1–3) and extended federal seasons to calculate rates of angler effort and harvest, which are then used to determine annual recreational landings (Osburn and Osborn 1991).

To collect harvest and effort data, creel agents interviewed anglers from 1000 to 1800 hours at selected boat access sites. Boats were intercepted after their fishing trip, and one angler per boat was asked the total number of anglers fishing, the total number of Red Snapper harvested, and if the fish were caught in state or federal waters, among various other questions. Creel agents counted the number of Red Snapper harvested, provided the angler gave consent. A daily effort rate was estimated using angler-trips per survey-day. An angler-trip was counted for each angler on a boat if the boat reported harvesting Red Snapper (NMFS 2012). A survey-day was counted for each boat access site that had angler-intercept surveys conducted on a given day.

Statistical analysis.—Data analysis was limited to private recreational anglers due to the fact that the initial 3-d season only applied to the private recreational anglers. This way a valid comparison of harvest and effort could be made between the derby-style initial season and the extended season. To ensure that comparisons of daily catch and effort rates between the initial and extended season were not biased by certain high-use ramps that could have been randomly selected for sampling more frequently in either the initial or extended season, the distribution of proportional sampling effort allocated to each ramp

during the initial season was compared against the observed distribution of sampling effort allocated to each ramp during the extended season using a *G*-test (Sokal and Rohlf 1995). If no difference between the distributions of sampling effort by ramp in the initial versus extended season was observed, we considered comparisons of daily catch and effort rates to be appropriate. Differences in harvest rate (fish/survey-day) and effort rate (angler-trips/survey-day) data between the initial and extended season were evaluated using Welch's *t*-test. Welch's *t*-test was also used to test if weekend harvest and effort rates were higher than weekday rates. Effort and harvest calculations excluded data after August 20, due to the impacts of Hurricane Harvey.

To determine if environmental factors, such as wind speed or wave height, influenced when anglers fished, climatic data for a centrally located buoy (buoy 42019; 60 nautical miles south of Freeport, Texas) was downloaded for the entire private recreational season from the NOAA National Data Buoy Center. Hourly wind speed and wave height were averaged for each day of the 2017 Red Snapper season. Daily angler-trips and harvest rate were plotted with wave height data to gauge changes in angler effort based on weather conditions. We qualitatively assessed which days were fishable using mean wave height and the Beaufort wind scale. Nonlinear regression was used to assess the relationship of harvest rate and effort with wind speed and wave height. Climatic data were not used for harvest rate and effort comparisons after August 20 due to the impacts of Hurricane Harvey.

To examine the relationship between season length and effort, TPWD angler-intercept data collected during the high-use season (May 15 through November 20) from 2008 to 2016 was compared with the federal season length using nonlinear regression. Due to variability in season length, data prior to 2008 was omitted since the federal season was greater than 100 d. Annual harvest and effort data provided by TPWD was used to examine changes in harvest rate and the proportion of harvest from federal waters by year, with anglers identifying if a majority of fish were caught in either state or federal waters. Data were analyzed using the JMP software package (version 13; SAS Institute), and hypothesis tests were conducted using $\alpha = 0.05$.

RESULTS

During the 2017 Gulf of Mexico Red Snapper federal seasons (initial and extended), a total of 134 angler-intercept creel surveys (27 initial, 107 extended) were completed, with an additional 14 canceled due to Hurricane Harvey. During the initial 3-d season, creel agents encountered anglers on 210 boats representing 865 angler-trips harvesting 1,696 Red Snapper (Table 1). For the extended

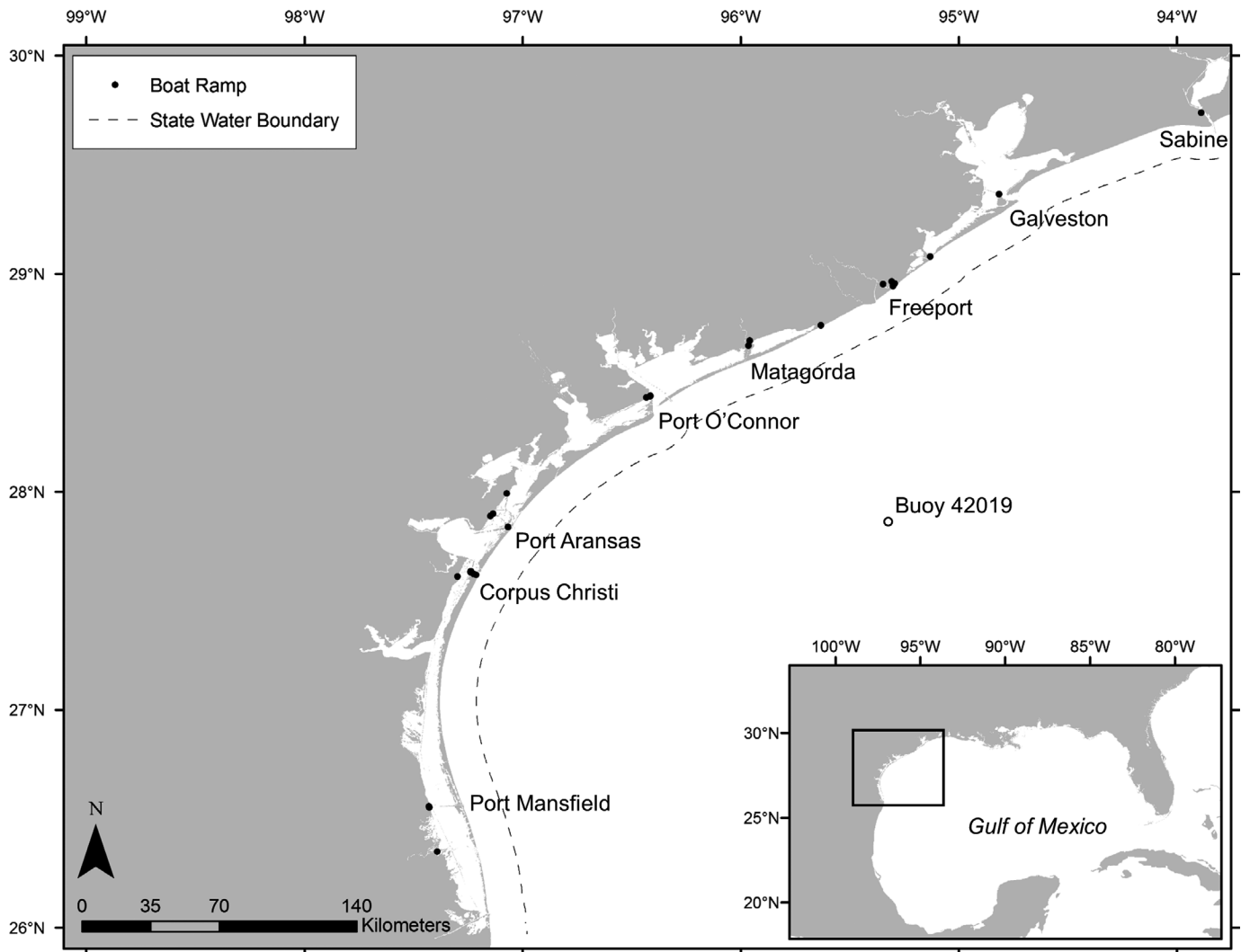


FIGURE 1. Map of the Texas coast, showing the locations of public boat ramps where angler-intercept surveys were conducted during the 2017 private recreational Red Snapper season. Labels on the map indicate major ports offering gulf access to anglers using public boat ramps and the location of the weather buoy (42019) used in analysis.

season, agents encountered anglers on an additional 304 boats representing 1,195 angler-trips harvesting 2,398 Red Snapper. The upper portion of the state, primarily centered off Freeport and Matagorda, had greater rates of fishing effort (i.e., angler-trips/survey-day) than the middle and lower coast (Figure 2). The sites with the greatest effort were Bridge Bait (Freeport) and Matagorda Harbor Public Ramp. Effort at these two sites was significantly greater than the coastwide average of 8.1 angler-trips/survey-day (255% and 186% greater, respectively). Similarly, harvest rates at these heavily used sites were also greater than the coastwide average of 15.9 fish/survey-day (196% and 224% greater, respectively). However, the distribution of sampling effort allocated to each ramp was not different between the initial versus extended season ($G = 15.2$, $df =$

25, $P = 0.936$), suggesting proportional (similar) sampling effort by ramp between the initial and extended seasons.

Harvest ($t = 4.41$, $df = 2.64$, $P = 0.028$) and effort ($t = 5.04$, $df = 2.92$, $P = 0.016$) rates were significantly greater during the initial season than the extended season, providing evidence for a Red Snapper “derby” fishery. Over the 3-d initial season, daily harvest rates averaged 60.9 fish/survey-day (SE = 10.7) and daily effort rates averaged 32.5 angler-trips/survey-day (SE = 5.7). During the 39-d extended season, there were 4 d when no angler-intercept surveys were scheduled due to the random nature of site selection. When omitting these days due to the uncertainty of whether anglers targeted or harvested Red Snapper, extended season daily harvest and effort rates averaged 18.5 fish/survey-day (SE = 3.5) and 9.8 angler-trips/survey-day (SE = 1.8),

respectively. Despite a greater than tenfold increase in the season length, a proportional increase in effort and harvest rate was not observed. Angler effort (angler-trips/

survey-day) was 232% higher during the initial season than during the extended season, while harvest rates (fish/survey-day) were 229% higher during the initial season. During the initial season, 44.1% of the observed Red Snapper harvest occurred. If the harvest rate of the initial season were applied to the extended season (a total of 29 d due to the omission of days after Hurricane Harvey and days without creel surveys), we would expect to have observed 6,029 Red Snapper harvested; however, our estimates suggest only 35.7% (2,153 Red Snapper) of the expected catch was harvested.

TABLE 1. Summary of angler-intercept survey sampling effort and observations during the 2017 private recreational Red Snapper season along the Texas coast. Data for angler-trips and harvest indicate observed totals for the initial and extended seasons.

Season	Season length (d)	Survey-days	Angler-trips	Harvest (number of fish)
Initial season	3	27	865	1,696
Extended season	36 ^a	107	1,195	2,398

^aWhile the extended season was 39 d for the entire gulf, 3 d were omitted due to Hurricane Harvey impacting the Texas coast on August 25.

Differences in angler effort and catch rates between weekdays and weekends were expected and evident during the extended season. Angler effort was significantly greater on weekends ($t = 1.85$, $df = 25$, $P = 0.038$), averaging 11.6 angler-trips/survey-day ($SE = 2.5$) compared with 5.7 angler-trips/survey-day ($SE = 2.0$) during weekdays.

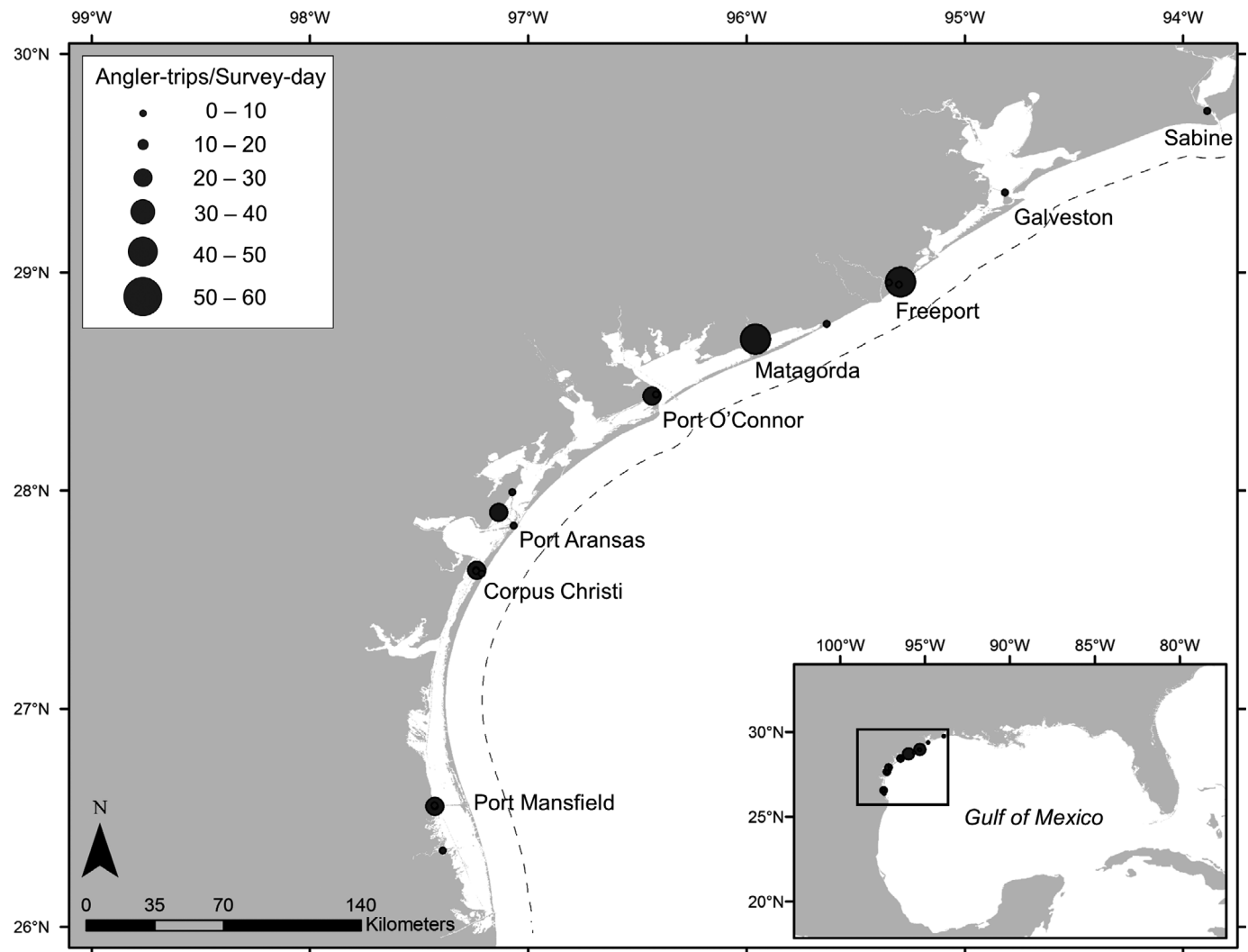


FIGURE 2. Map of 2017 extended-season angler effort (circle size represents angler-trips/survey-day) by ramp location along the Texas coast. The map includes only ramps with ≥ 2 survey-days during the extended season.

Harvest rate was also significantly higher on weekends ($t = 1.75$, $df = 25$, $P = 0.046$), averaging 22.2 fish/survey-day ($SE = 4.8$) compared with 11.3 fish/survey-day ($SE = 4.0$) on weekdays.

During the extended season, weather appeared to influence whether anglers fished for Red Snapper. Weather was considered “unfishable” when the Beaufort wind scale reached 5, consisting of mean wind speeds greater than 8.75 m/s (19.6 mph) or mean wave heights exceeding 1.2 m (4 ft). Using wave height as our proxy, a total of 10 d (25.6%) were considered unfishable, including three that were due to Hurricane Harvey. The best-fit model was an exponential model suggesting a significant negative relationship between angler effort (angler-trips/survey-day) and wave height ($R^2 = 0.693$, $P < 0.001$; Figure 3). These data suggest that anglers were conservative during the extended season, typically fishing on days when the wave height was 1 m or less. During the initial federal season, the seas were less than 1 m, allowing for a high number of angler-trips/survey-day (Figure 4). However, during the extended season, even when seas were of similar height, the number of angler-trips per survey-day were less than the initial season.

Surprisingly, the weekend following Hurricane Harvey (the last weekend of the federal Red Snapper season), a total of 21 private recreational boats fishing for Red Snapper were surveyed at four different sites. Hurricane Harvey affected Texas from August 25 to August 31, making landfall approximately 1.6 km northeast of Corpus Christi with winds estimated at 65 m/s (145 mph). Despite the proximity of landfall, between September 2 and 3, 12 boats were intercepted at sites within the Corpus Christi area. The additional boats were intercepted out of Port Mansfield (four boats) and Matagorda (five boats).

The analysis of TPWD long-term data (2008–2016) showed that the harvest rate was greatest when the Red Snapper season length was short; however, it decreased and appeared to approach an asymptote around 80 d (Figure 5). Power functions with R^2 values of mean daily harvest rate and federal season harvest by federal season length are included in Figure 5. During the 10-d season in 2015, the harvest rate peaked to 1,247 Red Snapper per day. In addition, the effort began to shift from a predominantly federal-water fishery to more of a state-water fishery by 2012 when federal season lengths began to be drastically reduced, forcing anglers targeting Red Snapper to fish the open state-water areas.

DISCUSSION

The 2017 Red Snapper season in the Gulf of Mexico provided a unique opportunity to compare harvest and effort data between an abbreviated and extended fishing season. Anglers interviewed during intercept surveys off the coast of Texas expended more effort and had higher

harvest rates during the abbreviated season than during the extended season. Harvest and effort data were not proportional between these two fishing seasons, which reveals the “derby” style nature and “perceived scarcity” response that the abbreviated federal season creates. As such, this management style allows the quota to be reached faster than during longer extended seasons.

The likely explanation for the lower harvest and effort rates during the extended season was weather. For the extended season, the seas were above the 1.2-m wave threshold 7 out of 36 d (omitting Hurricane Harvey weekend), with 5 of those days occurring in June. Of those days, only one June trip was encountered harvesting Red Snapper. During the remaining days, no Red Snapper boats were intercepted. Thus, it appears as though most anglers were selectively fishing on the calmer days when given access to the fishery for an extended period of time. For the 3-d initial season, the seas were marginal for offshore fishing (wave height was approximately 1 m), and while it is difficult to draw direct comparisons between the two seasons because the weather was so variable, effort rates appeared to be lower during the extended season on days with similar wave height as those of the initial season. As described in Powers and Anson (2018), it is logical that anglers would not go out in poor and potentially dangerous conditions to harvest fish when sufficient access to the fishery is available. However, when the season is only a few days long, a scenario is inevitably created where anglers are forced to fish in undesirable conditions in order to participate in this recreational opportunity. Interestingly, there were several trips interviewed only days following a direct impact from Hurricane Harvey. While we do not have direct information regarding the rationale of the fishermen, it is possible that fish are relatively unaffected by the hurricane or that anglers may catch larger fish after a hurricane (Bell and Hall 1994; Turpin and Bortone 2002).

During the 39-d extension, the average effort was three times less than that of the initial season. Similarly, a study by Powers and Anson (2016) using boat ramp cameras found that reductions in season length did not result in proportional decreases in effort and catch. However, our findings are somewhat surprising because aside from June, the extended season had good weather for a majority of the days. Furthermore, the effort during the extended season was also limited to days typically characterized by the highest fishing pressure (e.g., Friday through Sunday and holidays). Thus, we expected to see greater effort rates over the extended season as compared with the initial season. With these relatively low rates of daily effort, it is likely that if the extended season included the typically low-effort days during midweek, the season could have been even longer before it reached the same overall harvest as the compressed derby season.

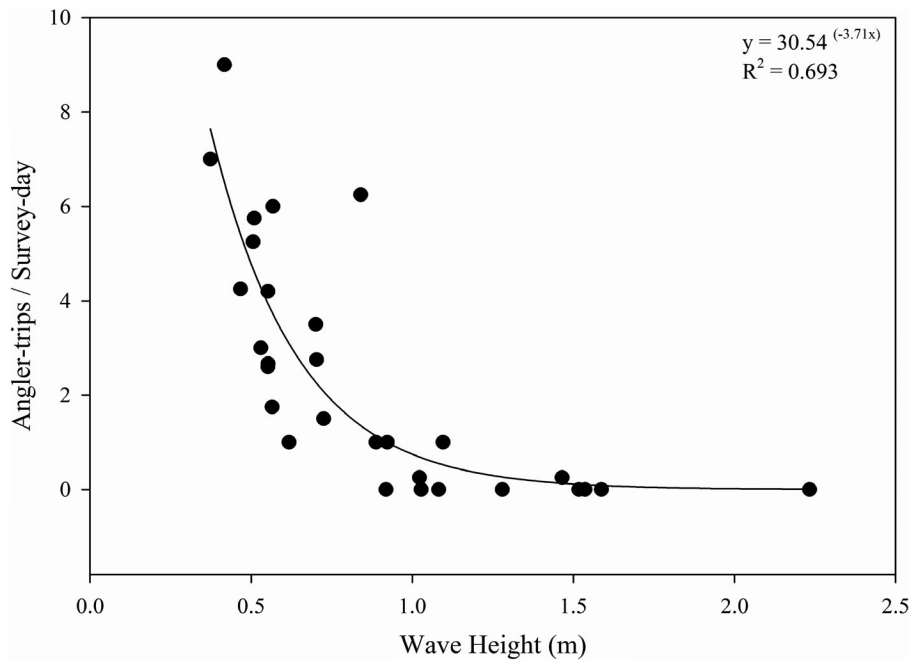


FIGURE 3. Scatterplot depicting the significant relationship between angler effort (angler-trips/survey-day) and wave height (m) during the extended 2017 season.

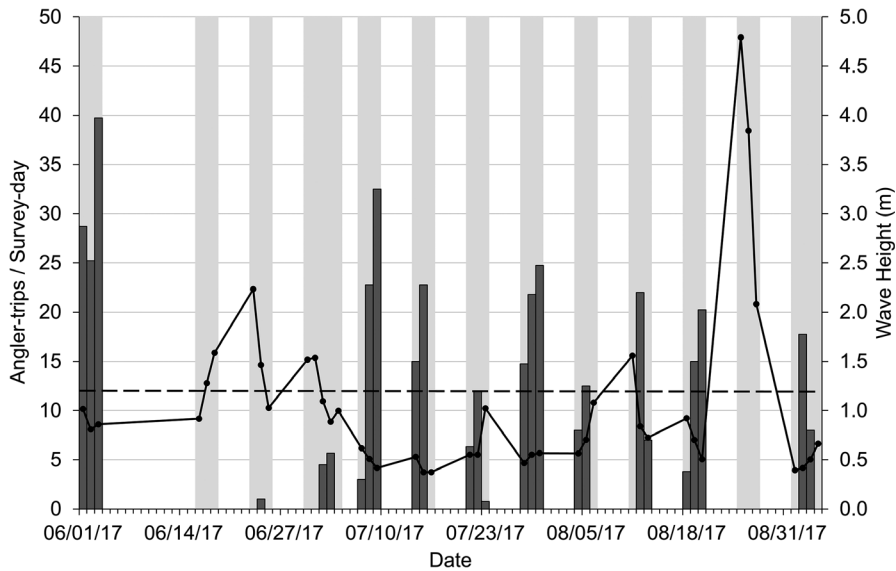


FIGURE 4. Estimated daily angler effort (angler-trips/survey-day; dark gray bars) and mean daily wave height (m; solid black line; secondary y-axis) during the 2017 private recreational Red Snapper season. The light gray vertical shading indicates open season days. The dashed line indicates a 1.2-m wave height, conditions that were considered unfishable.

Long-term angler-intercept survey data provided by TPWD showed that as the federal season decreased, private anglers began harvesting more fish from state rather than federal waters. Thus, an abbreviated federal season might disproportionately affect Red Snapper distributed on suitable habitat closer to shore. Tewfik and Béné (2004)

found that commercial lobstermen in Turks and Caicos targeted lobsters in shallow waters during the beginning of the season, then moved further offshore as the supply waned. Similarly, Frank et al. (2018) found that movement of larger Atlantic Cod *Gadus morhua* into deeper waters could be explained by size-selective exploitation. The

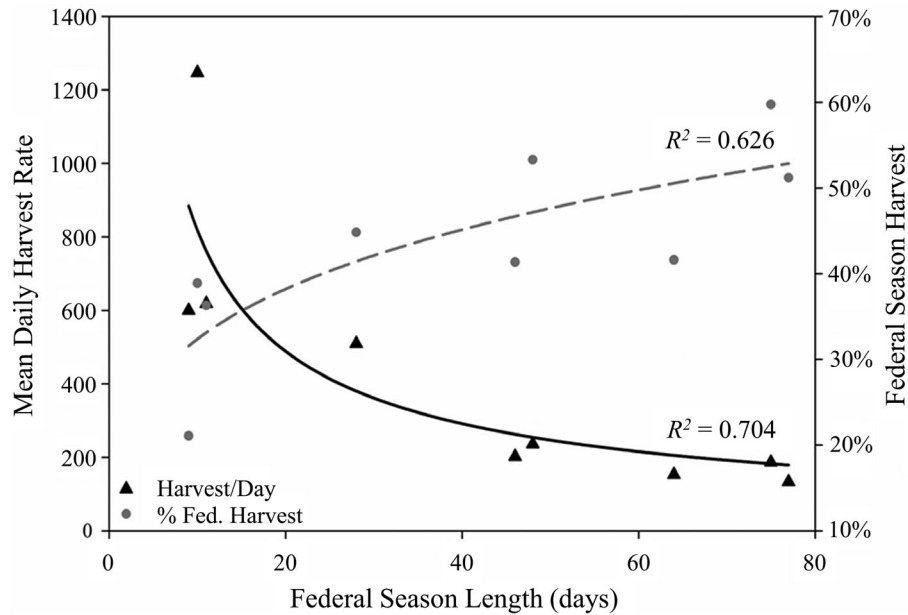


FIGURE 5. Daily harvest rate (number of fish; black triangles and black line) and percent of harvest estimated to occur in federal waters during the federal season (secondary y-axis; gray dots and gray dashed line) by federal season length, 2008–2016. For both data sets, the best-fitting power function and the R^2 values are shown.

potential exists for Texas Red Snapper anglers to overfish these state-water sites that are open year-round. Anglers might also selectively fish sites close to the state and federal water border further offshore (in deeper waters) to target larger fish typically found in deeper waters while remaining in state waters. Stelzenmüller et al. (2008) found that the distance to port was highly significant in their spatial model of artisanal fishing fleets around five European marine protected areas. Considering the cost of fuel and a two fish per person bag limit, it becomes a cost-benefit of distance traveled versus size of catch. While anglers interviewed in our study did not provide detailed locations of where they were fishing, a size and age analysis of Red Snapper from nearshore to offshore waters might provide further insight as to whether this type of selective fishing is occurring off the Texas coast.

Red Snapper has proven difficult to manage using season day-based regulations, especially due to their rapid recovery. Anglers are catching more and larger fish, causing the quota to be met sooner and often resulting in quota overruns, which may lead to reductions in subsequent season length as accountability measures are triggered. One of the conundrums fisheries managers face is how conservative to be when variables such as weather and harvest from state waters can greatly effect the length of the federal season. However, based on these historical data, it appears that the harvest rate stabilizes somewhere above 80 d. By extending the season, the harvest rate that is artificially inflated due to effort compensation would be reduced, allowing anglers additional fishing days.

One consideration regarding extended seasons is the potential to overharvest the quota due to allowing anglers greater access to the fishery. While harvest and effort rates were significantly less during the extended season, it is important to be able to monitor the harvest with more real-time monitoring programs. There is certainly the potential for anglers to harvest at higher than expected rates due to factors such as calm weather or holidays providing anglers additional opportunities to fish (e.g., days off from work). Each Gulf State has created novel monitoring programs (Gulf Reef Fish Survey, Florida; Snapper Check,* Alabama; Tails n' Scales,* Mississippi; LA Creel, Louisiana; iSnapper,* Texas)¹ specifically aimed at collecting data from recreational anglers to calculate more accurate harvest and effort estimates. It is important to have these monitoring programs in place to provide timely harvest estimates to ensure that the fishery can be closed in the event anglers are close to overharvesting their respective quota. This being the case, providing anglers with an extended season has certain caveats that must be considered before any permanent seasonal adjustments are made.

The future management of the Gulf of Mexico recreational Red Snapper fishery remains unclear. Based on our findings and similar studies (Powers and Anson 2016, 2018), harvest and effort rates of Red Snapper are drastically influenced by season length. Fewer days compress

¹Surveys denoted with an asterisk indicate programs that were specifically designed for Red Snapper data collection.

the effort and force anglers to derby-style fish, while longer extended seasons allow expansion of effort and provide more access the fishery but add the risk of significantly overharvesting the quota, especially if weather is favorable. Season length is also influenced by the current “one-size-fits-all” management of the fishery gulfwide. In spring 2019, the Gulf Council took final action and approved state-based regional management starting in 2020, whereby each state will be provided a predetermined portion of the total quota. In this system, management is based on specific regional needs, and state resource agencies will have the flexibility to manage the fishery based on the nuanced needs in their region. State agencies will be responsible for ensuring that anglers in their state do not overharvest their portion of the quota through pay-back provisions the following year as well as other emergency measures to prevent overfishing. This management framework is currently being successfully tested through exempted fishing permits (permit numbers 18-SERO-01 through 18-SERO-05, state dependent), whereby preliminary analyses suggest that the regionalized management is largely curbing much of the derby characteristics observed during the shortened seasons in this study. As required by these exempted fishing permits, all state agencies (excluding Florida) must report their state's total Red Snapper harvest biweekly to ensure each state is staying within their annual catch limit. In 2018, despite a year-round state-water season and having federal waters open for 82 d, Texas' landings were approximately 40,000 lb under the annual catch limit. However, in 2019 catch estimates indicated that anglers had harvested more fish than projected during the month of June, and as a result, TPWD closed the federal season early (August 2, 2019; a 35-d reduction of the originally projected season length). This early closure was necessary to ensure anglers still have access to state-water Red Snapper for the remainder of 2019. While it is possible that TPWD may have to close state waters prior to the end of the year if anglers harvest significantly more Red Snapper in state waters during fall and winter, long-term state-water landings data suggests such a closure is unlikely. Finally, concern regarding Texas' year-round state-water season should be minimal as long as state-water landings data is incorporated into federal season projections and updated in a timely fashion for the remainder of the year.

The regional management strategies taking hold in the Gulf of Mexico Red Snapper fishery will allow for fishing behaviors (what conditions and days anglers fish) to be tailored to distinct regional differences that exist when determining the season length. This more region-based management would ideally allow for seasons based on regional harvest rates while optimizing access to the fishery. Based on these data here, any strategies that could lengthen the season would likely reduce the short-term

highly concentrated effort while still maintaining an equivalent harvest and likely allay some of the conflict in the management of this fishery. Regardless of who ultimately manages the Red Snapper fishery, these data indicate that season length can greatly influence harvest and effort and, in some cases, even create a derby-style fishery. These differences in effort resulting from variable season lengths and weather conditions must be considered to develop the most effective future management plans for Gulf of Mexico Red Snapper.

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