Effects of the Two-Year Exempted Fishing Permit for the Gulf of Mexico Headboat Collaborative

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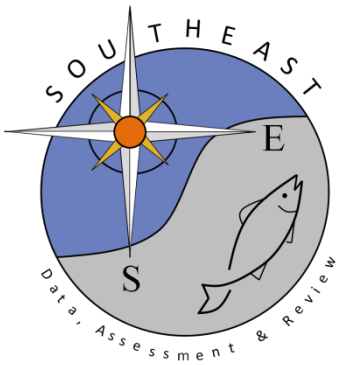

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Report to NOAA Fisheries

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1. Introduction

In 2014, a group of 17 headboat vessels owned by 13 companies, known as the Gulf Headboat Collaborative (GHC or Collaborative), began fishing under a unique exempted fishing permit (EFP)[1] to test an allocation-based approach to management of for-hire fisheries. Growing to 19 vessels and 15 businesses in 2015, the GHC received an annual allocation of red snapper and gag grouper – based upon their 2011 share of total landings of these species – and were allowed to land this allocation at any point within the calendar year, rather than being constrained by the increasingly short federal seasons for these species.[2] In exchange for this flexibility, GHC vessels agreed to install a Vessel Monitoring System (VMS), comply with hail in/hail out requirements, provide electronic reporting of landings at the conclusion of each trip, and abide by a more stringent regimen of dockside intercepts by enforcement authorities.

As part of the EFP, the GHC committed to commission a socioeconomic study by academic researchers "of the anticipated effects of the change in headboat cooperative management using currently available data sources. Simultaneously, the academic researchers and the Cooperative would develop additional survey instruments to gather economic data for a post-EFP analysis of the effects of the pilot project on Cooperative vessels after its first and second years (78 Fed. Reg. 19649, 19651 (Apr. 2, 2013))." This report is written to address these research requirements and provides an assessment of the effects of the temporary management changes under the EFP on vessel operations and economic outcomes for headboat owners, while summarizing the state of ongoing research to examine

[1] *See* 50 C.F.R. § 600.745(b). (the Regional Administrator of the National Marine Fisheries Service "may authorize, for limited testing, public display, data collection, exploratory fishing, compensation fishing, conservation engineering, health and safety surveys, environmental cleanup, and/or hazard removal purposes, the target or incidental harvest of species managed under an FMP or fishery regulations that would otherwise be prohibited.").

[2] *See* NMFS EFP No. 13-SERO-02 issued to the Gulf Headboat Collaborative, *available at* http://sero.nmfs.noaa.gov/sustainable_fisheries/gulf_fisheries/reef_fish/2013/headboat_efp/documents/pdfs/headboat_collaborative_efp.pdf. The EFP exempted GHC vessels from recreational season closures for red snapper and gag set by NOAA regulations. The EFP did not exempt GHC vessels from the statutory requirement applicable only to red snapper (MSA Section 407(d)) that NOAA must prohibit fishing when it determines that the total recreational quota has been met.

the effects of the EFP (or a similar permanent program) on the economic welfare of headboat customers.

2. Research activities and data sources

In order to provide a full accounting of how the management changes under the EFP led to changes in vessel operations, product offerings, economic returns to for-hire operators, and value to anglers we utilize a combination of primary and secondary data sources.

The first data source consists of the 2003-2015 catch records from the Southeast Region Headboat Survey (SRHS) administered by the Southeast Fisheries Science Center Beaufort Laboratory. These data were voluntarily released to us by GHC members, and provide trip level data on species-specific catch and discards, trip duration, location and number of customers. The data were provided in unmodified form for all vessels covered by the SRHS that were owned by GHC vessel owners in 2014-2015 – whether those vessels participated in the EFP fishery or not – for the entire historical period during which permit data indicated that the vessel was owned by the current owner. As a result, some vessels enter into the database at different points of time, although the majority of vessels had been owned by their current owners for several years prior to the EFP, providing a fairly stable dataset over time.

In addition to the data on vessels owned by GHC operators, we obtained SRHS data for all other vessels in the survey. Since these vessels were not covered by the data provision requirements of the EFP, a "rule of 3" was followed in all cases to protect vessel confidentiality.[3] We received these censored data at two primary scales. The first is at the level of the "region" and week. For a given year, vessels were assigned to one of five regions based upon their port of operation (Texas, Louisiana/Mississippi, Alabama, NW Florida, SW Florida), with summary statistics (totals and averages) reported by the week for these regions. These data offer the

[3] In essence the "rule of 3" meant that, given the spatial and temporal scaling of the data (i.e. state and week), no information was provided in a particular cell if the statistics from that cell would draw upon less than 3 vessels (with the exception that it was reported if the cell in question contained no fishing activity).

highest resolution perspective on vessel activity outside of the GHC, but are highly censored – particularly during the 'off-season' times of year and for regions with few headboat vessels (e.g., Louisiana/Mississippi). These week/region data are supplemented with annual statistics by region and contain virtually no censoring.

The SRHS data are the only available data that provide a longitudinal picture of the development of the GOM headboat fishery and are therefore invaluable. The data were developed and maintained over time with the primary rationale of providing data for effort and catch accounting for the headboat sector with supporting economic research as a secondary concern. While the data are of high quality for their intended purpose, they do contain some minor temporal inconsistencies that create challenges for economic analysis. For example, several changes were made to the survey in 2013, the year before the EFP, including 1) the consolidation of fishing and non-fishing passengers into a single variable; 2) the deletion of overlapping trip duration codes (which creates ambiguities in assigning trip types before and after 2013); and, the deletion of a variable tracking whether a vessel was paid "by the head" as opposed to being a charter trip.

The second major data source used in this report is the responses to surveys of GHC headboat owners.[4] These surveys[5] were administered through a combination of in-person interviews and mail in January-March 2014, at the very beginning of the EFP. They were repeated in the spring of 2015 and 2016 using the Qualtrics online survey platform. The 2014 surveys were administered to establish a pre-EFP baseline dataset about headboat operations (e.g., trip offerings, pricing, variable and fixed costs) for the 17 inaugural vessels as well as initial assessments about how the owners planned on altering their operations, if at all, in response to the new incentives under the program. The 2015 and 2016 surveys repeated the economic data questions – where each survey requested data about the season in the preceding calendar year – as well as more open-ended questions about how

[4] While it would have been ideal to gather similar data from non-GHC operations, it was determined that practical considerations would likely have led to low participation rates and significant selection effects for this population.

[5] The complete text of the survey is provided in an appendix to this report.

different aspects of the business had changed in reality. We combine these data with the SRHS trip data to provide estimates of revenues and net revenues for GHC vessels. We received completed surveys from 14 owners representing 18 vessels in 2015 (including all 17 2014 vessels and one of the two additional 2015 participants) and an identical response profile for 2016.

The third major data source for our analysis comes from survey data of anglers that took trips in 2014 or 2015 aboard vessels owned by GHC operators.[6] We provided each company with a 2 page paper survey of anglers and asked them to distribute this survey to all customers greater than 18 years of age – regardless of whether the trip was one in which EFP species were retained under the program.[7] This survey was typically administered either onboard while the vessel returned to port after fishing or onshore while the catch was filleted and distributed to passengers. The survey asked a number of basic demographic questions about anglers (e.g., age, gender, income, fishing experience and avidity, zip code) and trip-specific information (catch by species, trip duration, price paid, satisfaction, etc.). It also asked customers to provide an email address as a form of consent to be contacted for a follow-up Internet survey. Anglers were encouraged to provide their email through the opportunity of receiving a free fishing trip. Each company was provided with pre-paid envelopes to return their surveys to Dr. Abbott at ASU. In total 10,718 surveys were completed with 66% providing an email.

The emails from the 2 page survey were subsequently used to recruit participation in an online survey, deployed using the Qualtrics online survey platform. This survey took approximately 30-40 minutes to complete and could be completed in multiple sittings. The survey was deployed in 2 waves, once after the 2014 season, and again after the 2015 season, with anglers invited to participate by wave depending on whether they completed a 2 page survey in the previous year.

[6] The text of this survey is provided in an appendix to this report. Ideally we would have been able to survey passengers on both GHC and non-GHC vessels in a representative manner. However, the extent of cooperation and commitment required from owners and crew was not realistic to expect from non-GHC operators in the absence of "carrots" or "sticks" from government or more substantial incentives than we had the budget to offer.

[7] All surveys of anglers and vessel owners were reviewed and approved by the Arizona State University Office of Research Integrity.

The survey gathered recall data on recreational fishing trip-taking and associated economic costs in the previous year. In addition to these "revealed preference" data, the survey also presented anglers with "contingent behavior" choice exercises (Louviere, Hensher, and Swait 2000). The respondents were presented with two policy scenarios, A vs. B. In Policy A the season for either red snapper or gag grouper is restricted to June but with current bag limits and trip pricing – effectively a 'status quo' scenario. Under Policy B, anglers are presented with a scenario that allows anglers to fish for red snapper or gag at any time within the year they please; however, in exchange they must pay a higher trip fee or submit to a lower bag limit (or both). The respondents were then asked to provide the number and seasonal allocation of trips they would take under either scenario. Finally, they were asked to select their preferred policy.[8] These data will be used to estimate anglers' economic value for a permanent program that offers anglers the potential to catch red snapper, gag grouper, or other reef fish year round (Gulf of Mexico Fishery Management Council 2016). These data will offer an unprecedented view of the characteristics and preferences of GOM headboat anglers.

3. Effects on GHC vessel operations and trip characteristics

3.1 Some aggregate comparisons

Figures 1-7 provide useful context for understanding trends in the headboat fleet and understanding the GHC as a component of this fleet. Figure 1 shows the number of active headboat vessels[9] in the Gulf of Mexico by year. It also includes a tally of how many of the 19 2015 GHC vessels were active under GHC ownership in each year (a handful of vessels were purchased by GHC members in the early/mid-2000s). If a GHC vessel was fishing in a given year but was not fishing under a

[8] The survey also includes a selection of "choice experiment" questions that are similar in structure to (Carter and Liese 2012)– examining anglers' trip-level preferences for catch and landings of snapper or gag grouper vs. congestion and trip prices – as well as an examination of anglers' valuation of leisure time across the year. The latter is critically important to the proper valuation of the benefits of offering seasonal flexibility to anglers for retaining their preferred species.

[9] The definition of "headboat vessel" is defined by inclusion in the SRHS logbook program, which is essentially how the sector is defined for management purposes.

permit owned by a GHC operator, then it is included in the "all vessels" category but not counted for the GHC. The figure shows that by 2009 all GHC vessels were in the hands of GHC owners and active, while the number of headboats in the SRHS survey peaked at this time and stabilized at 68 vessels in 2013.

Figure 2 and 3 examine regional and overall patterns in total trips and the number of angler-days provided by GHC-owned vessels and all vessels in the SRHS survey. Aside from the effects of the 2010 Deepwater Horizon spill and hurricane activity in Texas in 2008, the most notable pattern in these figures is an overall upward trend in both measures; this growth is strongest in Florida, particularly in the southwest part of the state, and most muted in Texas. The gap between total trips/angler-days and the GHC in the graphs represents the trips/angler-days taken by non-GHC vessels.

While it is noteworthy that both the GHC and non-GHC vessels participated in the overall demand growth in the sector, the year-to-year movements of the GHC and non-GHC vessels often proceed at very different rates and are not always consistent in direction. Considering total trips, annual percentage growth from 2012-2013 and 2013-2014[10] was 5% and -0.3% for non-GHC vessels while GHC trips[11] grew at -1% and 4% in these same periods. In the two years of the EFP, total trips grew by 6% and 7% in 2014 and 2015 for non-GHC vessels, while total trips grew by 0% and 5% for GHC vessels. The picture for angler-days is similar, with annual percentage growth from 2012-2013 and 2013-2014 of 5% and 10.5% for non-GHC vessels while GHC vessels saw their angler days expand by 3% and 1%, respectively. During the EFP, angler-days grew by 4% (2014) and 5% (2015) for non-GHC vessels, while angler-days for GHC vessels grew by 6.5% in 2014 before declining by -0.4% in 2015. On the whole, non-GHC vessels saw more robust growth in both trips and angler-days than their GHC counterparts in the years immediately before the EFP. While both total trips and total angler-days expanded over the span

[10] We begin our comparison in these two years because 2010 to 2012 are heavily affected by the crash and recovery of the industry due to the Deepwater Horizon oil spill, and are thus highly atypical.

[11] These and all other calculations in this sub-section are calculated using the 2014 GHC membership in order to avoid confusion.

of the EFP (yielding an overall 2015-2013 change of 5.4% for trips and 6.1% for angler days), the higher rate of growth for the non-GHC vessels observed before the EFP continued in this period (an overall 2015-2013 change of 13.2% for trips and 9.5% for angler-days).

Figures 4-7 provide summaries of the annual number of trips retaining red snapper and gag, respectively, along with landings for these species. For GHC vessels, the number of red snapper trips fell by 13.4% and 11.1% in 2012 and 2013, while the number of trips retaining red snapper grew for non-GHC vessels by 3.6% and 4.4% in the same years. An unprecedented 9 day federal snapper season in 2014 led to a 27% reduction in trips retaining red snapper for non-GHC vessels compared to 2013, while GHC vessels operating in the first year of the EFP saw increases in trips retaining red snapper of 162% given a fixed allocation proportional to recent landings history. GHC vessels offered 1295 trips with some retention of red snapper in 2014 – eclipsing the previous record of 890 trips by those same vessels in 2009. In 2015, the passage of Reef Fish Amendment 40 (Gulf of Mexico Fishery Management Council 2014) created a separate red snapper quota allocation for federally permitted for-hire vessels (i.e. "sector separation"), which led to the establishment of a 45 day snapper season for non-GHC vessels (roughly the same season as in 2012). The number of red snapper trips for non-GHC vessels rebounded significantly as a result. Nevertheless, they remained 14% below their peak in 2013. In the same year, red snapper trips for GHC vessels fell by 1.1% relative to the previous year. This was likely driven by an initial 25% reduction in the red snapper allocation to the GHC as a part of NMFS's recalibration of historical recreational landings.[12]

[12] In 2014 NMFS re-calculated historical MRIP red snapper private recreational and charter landings estimates using a different methodology. These landings estimates were revised upward. Because headboat landings have been reported to SRHS for several years, historical headboat landings were unchanged, and thus the relative portion of total recreational landings by headboats decreased. Accordingly GHC allocations were decreased for the 2015 fishing year relative to 2014 allocations. For red snapper this was mostly offset by a June 2015 quota increase following an updated stock assessment and ACL increase; however the total recreational ACL and common pool season lengths increased as well.

Figure 5 shows the temporal evolution of red snapper landings. Non-GHC landings of red snapper fell by 57% in 2014 but recovered to levels not seen since 2011 the following year under the 45 day season. By contrast, GHC red snapper landings increased by 82% in 2014 relative to 2013. Importantly, due to an aggregate catch limit for the GHC, the EFP set an upper bound on total red snapper landings, with GHC vessels landing 98.9% of their allocation of fish in 2014 (Stephen 2016). In 2015, landings declined by 28% compared to 2014. This was driven to a large extent by the reduction in vessel allocations in this year, in addition to an increase in the share of allocations held in the Collaborative's uncertainty buffer from 5% to 10%. While this buffer was ultimately released to GHC members, it occurred quite late in the season (early November).

Figure 6 shows that trips retaining gag, coming mostly from Florida vessels, have experienced a great deal of interannual variability and with little similarity of trends between GHC and non-GHC vessels. Indeed, in the years immediately preceding the EFP, trips across the two groups move counter to one another. In 2014 the number of GHC gag trips increased 74% to 698, only to fall to 558 in 2015. This compares to a decrease of 35% in trips by non-GHC vessels in 2014 followed by a partial recovery of 17% in 2015. Gag landings (Figure 7) have been similarly erratic but with a clear downward decadal trend – this despite longer seasons in recent years and NMFS declaring that the stock was rebuilt in 2014. In 2014 landings for the GHC increased by over 56% compared to 2013, only to fall 42% from 2014 levels in the subsequent year. Simultaneously, non-GHC vessels experienced a 6% reduction in landings in 2014 followed by a 41% reduction in 2015.

3.2 Seasonal redistribution of EFP species

Figure 8 demonstrates that the overall seasonal timing of all trips for the GHC fleet did not change in 2014 and 2015. However, this stability masks the seasonal reallocation of catch across the season to better match the pattern of customer demand. We present the cumulative number of trips for 2014 GHC vessels retaining

red snapper and red snapper landings in Figure 9 and 10.[13] Overall, the seasonal distribution of red snapper landings closely tracks that of trips. These figures show that, despite the persistence of an uptick of red snapper fishing activity during the early-June red snapper season, on the whole both trips and red snapper landings are much more smoothed over the season. Less than 10% of red snapper trips occurred during the 9-day federal season in 2014, with nearly a third of trips occurring before the season opened in both years of the EFP. Less than a third of trips occurred during the 45-day federal season in 2015. Interestingly, the 2014-2015 pattern of red snapper trips in mid-June to July closely matches with that observed in the 2011-2012 seasons, which extended to mid-summer. However, the figures also show that GHC vessels utilized their allocations to accommodate an August red snapper fishery that had not existed since 2009. In general, the rate of red snapper trips and landings in the EFP has been far higher in the spring season than in the fall.[14]

Figure 11 and 12 present the same information for gag grouper. In both 2014 and 2015, roughly half of the trips retaining gag were taken before the beginning of the July 1 season – again showing considerable smoothing of trips and landings away from the traditional seasonal pattern. Indeed, gag trips in 2014-2015 are even more evenly distributed than those for red snapper, indicating a fairly even pattern across the year. On the whole, 2014 GHC member vessels were able to increase the number of customers on trips retaining either red snapper or gag by almost 33,646 in 2015 and 26,000 in 2014 (Figure 13). While not all of these customers may have been able to retain EFP species on their trip (logbook data only measures catch and

[13] We have limited these figures to 2014 GHC member vessels so that all vessels in 2014 are subject to the same regulation. Inclusion of the 2 vessels that joined in 2015 confuses the interpretation of 2014, but offers very similar qualitative conclusions.

[14] How much of this was driven by lack of demand vs. a lack of quota to pursue red snapper trips is uncertain. In 2014, uncertainty about whether there would be a summer/fall closure of the entire recreational fishery pursuant to 16 U.S.C. § 1883(d) triggered by private angling, charter vessels, and non-EFP headboats may have led some GHC vessels to fish more aggressively early in the season to avoid losing any unfished allocation in the fall. In 2015, the GHC also received significantly smaller initial allocations, which may have made it particularly challenging for vessels to preserve quota for the fall fishery.

landings at the trip level), this nevertheless reflects a considerable broadening of access.

An important aspect of the expansion and smoothing of trips retaining EFP species is that the increase in the number of these trips far exceeds the annual increases in landings of either species. In the case of red snapper, trips retaining that species increased by 161% in both 2014 and 2015 relative to 2013 while landings, being constrained by allocations, increased by only 82% (2014) and 31% (2015). In the case of gag, trips retaining that species increased by 74% (2014) and 39% (2015) relative to 2013, while gag landings on these trips increased by 56% in 2014 and actually *decreased* by 9% in 2015 relative to 2013. Together, this implies that the average number of red snapper and gag landed by the typical angler on these trips is likely to have declined.

While we lack the data to investigate this question at the level of individual anglers, we can observe average landings per customer at the trip level from the SRHS data. Figure 14 estimates the average landings per angler relative to the base year of 2013. These results are obtained by regressing trip-level landings data of red snapper per customer on annual dummy variables, weighting by the number of passengers per trip, so that the unit of analysis of the regression is shifted from the average trip to the average angler.[15] The estimates show that average landings of red snapper per angler fell by almost .4 fish and .66 fish in 2014 and 2015, respectively, from an average of 1.7 fish in 2013. This is consistent with statements from some GHC vessel operators indicating that they often limited retention, particularly on half-day trips outside of the federal season, to 1 red snapper per angler – this despite a legal limit of 2 fish/angler. Compared to red snapper, reductions in retention of gag per angler have been small (Figure 15); however,

[15] Vessel and month fixed effects are included so that the temporal dummies reflect changes in landings within individual vessels rather than reflecting changing distributions of fishing across vessels or seasons. To account for the fact that 2 vessels in the sample only joined the GHC starting in 2015, we include an interaction term between the 2014 year dummy and a dummy variable for this group of late joiners. This allows the un-interacted 2014 dummy variable to be interpreted for those vessels fishing under the EFP at that time.

these reductions are significant given that average gag retention in 2013 was only 0.2 fish/angler on trips where gag was retained.

Despite this evidence that some GHC vessels rationed their quotas for red snapper and gag through restricting landings of individual anglers, there is no evidence that anglers on GHC vessels in 2014-2015 experienced overall reductions in their total catch of all species. Figure 16 repeats the analysis of the previous two figures, using all landings as the regressor. 2014 landings per angler are statistically indistinguishable from 2013 levels and 2015 total retention actually increased by half a fish on average. This suggests that GHC vessels substituted toward non-EFP species to compensate for reduced EFP species per angler and ensure that customers went home with a "full bag" of fish.

3.3 Changing trip patterns

The seasonal shift of EFP species trips and landings across the season was paralleled by a reallocation of EFP species across different trip types. This is primarily reflected in an increase in daytrips (trips of at least 8 but less than 15 hours) retaining red snapper or gag grouper at the cost of partial-day trips.[16] Figure 17 shows estimates from a linear probability model regression of trip-level data for trips retaining red snapper or gag on annual dummy variables and month, vessel, and weekend fixed effects. It shows that the probability of a daytrip retaining EFP species increased by 12.4% in 2014 and 10.8% in 2015 compared to 2013. This increase in EFP species daytrips is strongly driven by red snapper, with gag showing a much more muted increase. The increase in EFP-retaining day trips could arise from one of two pathways – increasing the overall share of day trips or by shifting red snapper onto existing day trips. Figure 18, which repeats the regression from Figure 17 for *all* GHC trips, provides some insight into this question, showing that the overall probability of day trips increased by 6.7% (2014) and 1.7% (2015). This shows that almost half of the increase in EFP-retaining day trips in 2014 and the overwhelming majority of the increase in 2015 occurred from retention of red

[16] Trips longer than one day, while more important to some operations than others, are only 4% of overall trips and did not change markedly in EFP years.

snapper or gag grouper on *existing* trips, rather than an increase in the share of day trips overall. In other words, vessels disproportionately tended to shift conserved EFP landings toward their existing full-day trips, while also offering more full-day trips retaining EFP species in 2014.

As noted above, one means by which some vessels rationed their scarce quota for EFP species was to proportionally scale down the maximum legal daily bag limit for their partial day trips. This seems to primarily have occurred for red snapper. To examine evidence for this practice in the SRHS data, we estimated the average wedge in red snapper retention per angler between full and partial day trips.[17] In 2013, the wedge in red snapper retention between full and partial day trips is 0.16 fish/angler. This corresponds with anecdotal evidence that, for many regions in recent years, many anglers are able to catch the 2-fish bag limit on a partial day trip. However, in 2014 we find that this wedge rose to 0.5 fish/angler (t statistic = 6.0) in 2014 and 0.44 fish/angler (t statistic = 4.79) in 2015. This is the largest gap in retention between trip types observed since 2007, when vessels operated under a 4 fish bag limit, which would tend to increase the wedge between full and partial day trip retention by lowering the share of partial day trips for which the bag limit binds. This provides supportive empirical evidence that the effective bag limit on partial day trips was voluntarily reduced, shifting retention toward full day trips.

3.4 Discards

The tendency of seasonal closures for red snapper and gag grouper to induce regulatory discards (mandatory discards outside of fishing seasons) of these species was a motivating factor for the EFP. It was hypothesized that an allocation-based system, by allowing fishermen to land their catch of EFP species year-round

[17] This was estimated from a regression of 2014 GHC members' trip-level red snapper retention per angler (for trips of a day or less) on annual dummy variables and their interaction with a dummy variable indicating a full day trip. These interactions provide the estimate of the retention "wedge" in any given year. The regression also includes controls for month, vessel, and weekends (to control for time-constant operational and spatial differences and seasonal trends), and is weighted by the number of anglers per trip.

(provided they surrendered the necessary quota and were compliant with individual bag limits), would allow individual vessel operators to better utilize their catch.

In measuring discard rates, we utilize two complementary measures, each varying in the denominator used to normalize the quantity of trip-level discards. The first measure utilizes total catch by trip of the species in question as the denominator. The discard rate in this case measures the share of total catch that is discarded, therefore functioning as a measure of how much of total catch is "wasted" as opposed to being retained by an angler. Figure 19 and 20 present estimates of these measures of discard rates relative to the baseline year of 2013. To create these estimates we estimate a regression of the discard rates (shares of species-specific catch) of red snapper or gag grouper for all 2015 GHC members, using annual dummy variables as regressors. For each regression we limit our sample to those trips with positive catch of the species. Finally, we include vessel fixed effects in the model so that our estimates reflect changes in discards due to changes within individual vessels over time rather than changes that occur simply because of variations in participation rates of vessels over time. The values reported in the figures are the mean discard rate in that year for vessels in the EFP relative to the average discard rate in 2013.

Figure 19 reveals that red snapper discard rates fell an average of 28% (2014) and 34% (2015) compared to 2013.[18] Similarly, Figure 20 shows that gag grouper discard rates fell 27% (2014) and 21% (2015) compared to 2013. These are the lowest discard rates experienced since 2008 for either species. They are overwhelmingly driven by reductions in mandatory regulatory discards during formerly out-of-season times of year; discard rates during the regular season in 2014-15 are comparable to previous years. For context, in 2013 6.8 of every 10 red snapper and 8.6 of every 10 gag that were caught were subsequently discarded.[19]

[18] To account for the fact that 2 vessels in the sample only joined the GHC starting in 2014, we include an interaction term between the 2014 year dummy and this group of late joiners. This allows the regular 2014 dummy variable to pertain only to those vessels fishing under the EFP at that time.

[19] Our approach treats the trip as the unit of observation, weighting discard rates for each trip equally regardless of the number of EFP species caught. Alternatively, one can weight trips in the

These consistent reductions in discard rates were limited to the GHC fleet; Figure 21 and 22 show that the discard rates among non-GHC vessels for red snapper were up 16% in 2014 and down by 4% in 2015 relative to 2013 levels, while 2014 and 2015 gag discard rates were statistically indistinguishable from 2013 levels.

As a second measure of discards we measure changes in discards per angler-day[20]. This provides a measure of the amount of "waste" per unit of service provided by GHC vessels. Figure 23 and 24 present estimates from Poisson regressions of the number of red snapper and gag discards per trip for trips with positive catch of these species. The regression contains vessel fixed effects and utilizes angler-days per trip as an exposure variable. We find that average red snapper discards per angler-day fell by 41% and 47% in 2014 and 2015 for GHC – showing that the rate of discards per angler-hour declined by more than the discard rate per catch. These are the lowest rates observed since 2006. Reductions were even more dramatic for gag, at 58% and 66% respectively. These are the lowest average discard rates per angler-day since discard data became available in 2004.

To resolve the gap between these two discard rate measures, the following formula is useful:

$$\frac{Discards}{AnglerXdays} = \frac{Discards}{Catch} \times \frac{Catch}{AnglerXdays}$$

Discards per customer-hour can be reduced via two pathways: increasing the fraction of catch that is landed, or by reductions in the catch rate through either natural factors or fishing practices. Figure 25 and 26 show that red snapper CPUE declined by 5% in 2014 and 20% in 2015, while gag CPUE saw far larger declines of 44 and 59% in 2014 and 2015, respectively. Therefore, reductions in discards per

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average proportionally to the number of the species caught per trip – estimating the mean discard risk experienced by a unit of catch. The latter approach yields smaller 2014 (2015) estimated reductions in discard rates of 19% (15%) for red snapper and 18% (2%) for gag. This attenuation is due to the lower weight given to the reductions in discard rates during out-of-season periods in which red snapper or gag catch is low.

[20] Angler-days are measured by coding the trip duration codes in the SRHS logbook into discrete durations (0.5, .75, 1, 1.5, 2 days,…) and then multiplying these values by the number of anglers on a trip.

angler were the joint product of increased average retention (in other words, reduced discard rates) and reduced CPUE for EFP species.[21]

4. Effects on Economic Returns

Economic returns to the EFP can be divided into benefits that accrue to vessel owners (i.e. producer surplus) and EFP headboat customers (i.e. consumer surplus).[22] We investigate each in turn.

4.1 Revenues and net revenues

4.1.1 Challenges of measurement

There are significant challenges associated with the measurement of the effects of the EFP on economic returns. Some of these challenges come from data limitations, while others are more conceptual.

As with most fisheries economic data – especially for-hire recreational fisheries – our data are limited in ways that constrain the interpretation of our results. On the revenue side, we have high-quality survey data (confirmed by the 2 page angler surveys over the same period) on the pricing of the overwhelming majority of trips that vessels offer on a "per head" basis (i.e. "headboat trips"). In many cases we also have prices for trips in which parties pay a flat trip rate for the vessel (i.e. "charter trips"). However, in 2013 the SRHS logbook form data dropped a question that allowed individual trips to be assigned to these categories. Examination of the pre-2013 data shows that there is no reliable method to utilize the other data in hand to assign trips to the charter or headboat categories, as the frequency, share, duration and seasonal timing of charter trips are often highly

[21] Despite the relationship between CPUE, discard rates and discards per angler-day, the product of the relative CPUE and discard rates in Figures 19-20 and 25-26 do not exactly equal the relative CPUE for discards per angler-day. This is due to the fact that the mean of a product is not the product of the means due to the correlation between discard rates and CPUE.

[22] It is also possible that hired captains and crew could benefit from negotiating higher wages in response to higher vessel profits; however, that possibility is likely excluded in a temporary program. One pathway for benefits to crew from the EFP is if increased customer satisfaction under the program induced customers to tip more highly. While we do solicit tip amounts in the 2 page angler survey, the data is noisy and data on tips in pre-EFP years do not exist, to our knowledge.

variable across vessels and years. Given this challenge, we elected to treat all trips by GHC vessels – including those before 2013 – as headboat trips.[23] While this almost certainly underestimates revenues in any given year[24], it does provide a stable basis for evaluating percentage *changes* in revenues across years, under the assumption that the share of revenue from charter trips is stable across years.[25] While this may result in biases if, for example, the EFP enlarges the share of charter trips (something no owner mentioned in their descriptions of how the EFP has shaped their operations), we adopt it as the most parsimonious and transparent way of handling this data limitation.

A second data challenge relates to the resolution and reliability of cost data. There is no tradition among GOM headboats of being surveyed concerning their operating costs, and our preliminary research found that the availability and reliability of cost accounting data varied widely across operations. Therefore cost data are gathered at a level of resolution and detail that seemed workable for all participants – average input use (fuel, bait, and ice) and unit prices for each trip type regularly offered by the vessel along with information on crew and captain compensation.[26] While these data are valuable for establishing the overall cost share of variable inputs for different trip types, the resolution of cost accounting for some operations is such that they are not likely to be up to the task of identifying variations in costs across years. Therefore, we do not attempt to use these data to perform a quantitative analysis of cost savings from the EFP. Furthermore, the strength of data is better for some inputs than others. Fuel use, as one of the largest

[23] The one exception to this rule was one AL vessel whose charter and headboat trips were almost always distinguishable by duration in a way that has been stable for many years.

[24] Charter trips are typically priced at a flat rate up to a maximum number of passengers (typically limited to the maximum number of passengers on a headboat trip, or in some cases a few passengers less). Charter prices are typically set such that trip revenues are at least equal to, or a bit more than, the revenue for an equivalent headboat trip at the same capacity.

[25] Alternatively, we could randomly assign trips to 2013-2015 on the basis of historical patterns for each vessel, but this also makes an assumption of temporal stability for these patterns. Furthermore, we lack reliable pricing data for charter trips for every operation given that the pricing of charter trips is often far more customized and idiosyncratic for some vessels compared to their headboat operations.

[26] We also gathered data on fixed costs, but these data vary widely in quality (in part due to the ability of operations to separate these costs from those of related vessels and businesses) and are not utilized given their irrelevance for the assessment of a short-run EFP.

expenditures, is most reliably estimated, while bait and ice use are more approximate. Crew compensation (not including compensation from tips) are generally reliable, while compensation of captains is made complex by the fact that many captains are owner-operators. Given that fuel savings are the primary pathway (at least in the short run) for cost reductions under the EFP – and the only pathway mentioned by vessel owners when surveyed about their changes in operations – we focus on this cost category in the subsequent analysis. Therefore, net revenues for this study are consistently measured as revenues net of fuel costs.

A more fundamental challenge than data limitations is the question of establishing the proper baseline for comparing GHC economic returns in the 2014-2015 period. This counterfactual scenario should answer the question of "what would have happened to GHC (net) revenues in 2014-2015 if the EFP had never occurred?" Of course, we do not observe this alternative history and therefore must impute it through theoretical or empirical assumptions (Timmins and Schlenker 2009). The most common empirical approach to providing this counterfactual in the program evaluation literature proceeds by comparing the changes in outcome variables before and after a major policy change between a "treated" group and a nearly identical "control" group that is subject to all the same factors as the treatment group, excepting the treatment itself (Figure 27). This "difference-in-differences" estimator (Angrist and Pischke 2008; Imbens and Wooldridge 2009) has been utilized successfully in fishery settings (Abbott and Wilen 2010; Cunningham, Bennear, and Smith 2016). It has the benefit of intuitive appeal and is often preferable to simply looking at before-after differences for a single treatment group since it controls for time-varying factors that may coincide with the policy change. However, this estimator relies upon two potentially strong assumptions: 1) that the treatment and control outcome variables would have pursued the same trend between the "before" and "after" measurements in the absence of the policy change (the "common trends" assumption); and 2) that the control group outcomes are not somehow indirectly affected by the treatment (the "no indirect treatment" assumption). Together these assumptions provide a basis for using the control

group trend to impute the outcome for the treated group in the absence of the treatment (Figure 27).

Applying this approach to the EFP, the natural control group would appear to be the vessels that fished outside the GHC in 2014-2015. However, this comparison is deeply flawed for reasons that extend well beyond our inability to measure revenues and costs for the non-GHC vessels. First, the "common trends" assumption is highly suspect in this case. This assumption cannot be tested directly for 2014-2015. However, it can be assessed indirectly by looking at whether or not critical outcome variables trend together in the years before 2014. In Appendix 1, we test this assumption using a technique known as a "placebo test" (Angrist and Pischke 2008). The results of this test indicate an alarming number of violations of the common trends assumption between the GHC and non-GHC groups in the years immediately preceding the EFP. This indicates that applying the difference-in-difference estimator in these years – years in which there was no treatment (i.e. a "placebo") – would nevertheless have found a significant effect for a nonexistent policy. This strongly undermines the validity of comparing the changes in trends between the GHC and non-GHC vessels before and after the EFP as a means to evaluate its impacts.[27]

Another problem with the difference-in-differences comparison lies less in its technical correctness but in whether it – even if perfectly valid by the previous assumptions – answers a meaningful policy question. The rationale for the EFP is to provide data-grounded guidance to policymakers concerning the likely economic consequences of a permanent headboat IFQ program. To be useful in this regard, the baseline scenario should reflect conditions that approximate those likely to occur in the future. Unfortunately, 2014-15 was marked by dramatic changes in management that undermine the value of extrapolating forward from the difference-in-differences scenario. 2014 saw an unprecedented 9 day season for recreational red snapper, followed by a new sector separation policy and a 45 day

[27] It is possible that careful matching of individual GHC vessels to their most comparable non-GHC counterpart could eliminate these sources of bias (Ferraro and Miranda 2014). However, such an analysis would require disaggregate data on non-GHC vessels, which were not available due to confidentiality concerns.

for-hire red snapper season in 2015. While 2015 may represent a reasonable "average" baseline going forward, 2014 certainly does not.

Given the aforementioned problems with the difference-in-difference comparison, we have chosen to primarily rely on before-after comparisons of 2014-2015 outcomes to outcomes in the years immediately preceding the EFP (2011-2013). While this comparison may be vulnerable to biases from underlying trends in the intervening period (although these appear fairly muted), it has the benefit of avoiding the dubious common trends extrapolation from non-GHC vessels while establishing a fairly realistic ensemble of "status quo" scenarios for the immediate future of 1-1.5 month red snapper seasons and a July-Nov/Dec gag season (all with bag limits of 2 snapper/gag per angler). We will, nonetheless, exercise caution in interpreting these temporal differences, accounting for underlying trends where appropriate to avoid spurious attribution of these trends to the effects of the EFP.

4.1.2 Changes in (net) revenues

Table 1 presents estimates of annual revenues and revenues net of fuel costs. These are limited to the 17 2014 GHC vessels so that comparisons between years are for a stable cohort of vessels. These annual estimates are formed through matching trip-level data from the SRHS logbook (which includes the number of passengers) to pricing and fuel cost data provided in the annual headboat owner survey. Well over 99% of trips were matched, with the remainder mostly consisting of very infrequently observed forms of multi-day trips. Note that, due to the lack of historical price/cost data and in order to isolate changes in revenues driven by changes in demand or trip operations as opposed to exogenous annual price increases, all revenues and net revenues are calculated using fixed 2014 values for trip-specific prices, fuel prices, and fuel usage per vessel and trip duration. Therefore, variations in reported revenues occur due to changes in trip offerings and the assortment of customers across these trips – not changes in pricing over time. The one exception to this is for cases where companies charged a price premium specifically for trips retaining EFP species – where we report revenues with these markups separately.

Table 1 shows that revenues, not including any increases in prices specifically for trips retaining EFP species, increased by 7.6% in 2014 and 6.1% in 2015 relative to 2013 levels. The inclusion of markup pricing for trips retaining EFP species leads to revenue increases of 8.9% and 7.2% in 2014 and 2015, respectively – therefore directly increasing overall revenues by an additional 1.3% and 1.1%.

Revenues minus fuel costs are reported due to the high reliability of fuel costs and the significant share it composes of revenues (13% on average). Revenues net of fuel costs increased by 7.4% in 2014 and 6.7% in 2015 relative to 2013. Including markup pricing leads to increases in revenues net of fuel costs of 8.9% and 7.9%.

Figure 28 shows the cumulative share of revenues within each season – the fraction of annual revenues amassed by a given week. A flatter, more linear curve indicates a more even distribution of revenues throughout the season. The figure shows that the distribution of revenues throughout the season evolved somewhat between 2014-15. In 2014, the overall pattern of revenues is similar to previous years, albeit with revenues shifted slightly earlier in the year. In 2015, this shift is more dramatic, with a significant smoothing of revenues across the year. 33% of revenues were earned by week 20 (late-May/early-June) in 2015 relative to approximately 26.5% in 2011-2013.

4.1.3 Mechanisms of revenue increases

There are three primary avenues by which revenues or net revenues can increase: 1) a quantity effect (either an increase in trips or an increase in customers per trip); 2) a product mix effect (shifting customers toward higher value or lower cost trips); or 3) charging a price premium.

The most obvious way for revenues to increase is through an increase in the quantity of customers, achieved either through taking more trips or adding customers to existing trips. Recall that the number of total trips in 2014 was essentially identical to in 2013; therefore, the only quantity effect in this year must work through the number of anglers per trip. Figure 29 shows that 2014 GHC vessels saw average increases in revenues per trip and trip revenues after fuel

expenditures of 9.5% and 10.3%. At the same time, anglers per trip increased by 6.3% (slightly less than 2 extra passengers per trip on average), indicating that roughly 2/3 of the increase in trip-level revenues came from booking more passengers on an identical number of trips in 2014.

In 2015, by contrast, revenues per trip and revenues-fuel per trip increased by a smaller 3.5% and 4.2% relative to 2013 levels. Anglers per trip increased by only 1.1% relative to 2013 on average (basically ½ an extra customer), so that less than 1/3 of the modest increase in revenues per trip was attributable to increased customers on trips. While the increase in anglers per trip in 2015 was quite modest, the overall quantity effect was more substantial due to the fact that the total number of trips increased by 5.4% compared to 2013. This largely explains how revenues – before any price premia for EFP trips – increased by 6.1% in 2015 relative to 2013.[28]

Turning attention to the revenue effects of changes in the product mix, Figure 30 investigates annual changes in the average revenue and the average revenue net of fuel costs per customer. The estimates are annual dummy variables from regressions of logged revenue per customer and revenue minus fuel costs per customer at the trip level, with vessel fixed effects included to avoid conflating annual changes resulting from changes across time for vessels with simple changes in the shares of trips taken by different vessels over time. Importantly, each regression is weighted by the number of passengers per trip, thereby up-weighting trips with more passengers so that the effective unit of the regression is the individual customer. The results show that the average customer paid 2.3% more in 2014 and 1.3% more in 2015 compared to 2013. Importantly, these average revenue increases occur purely due to changes in the mixture of trips and the allocation of customers across these trips, since all prices are fixed at their 2014

[28] It is tempting to add the 2014/2013 or 2015/2013 percentage changes in average revenues per trip and total trips to arrive at the total percentage change. However this is invalid (aside from errors induced by adding percentage changes, which are negligible for small percentages) for the reason that the trip-level regressions utilize vessel fixed effects to avoid conflating actual changes in average trip revenues with changes occurring purely because of changes in the shares of trips taken by vessels across years.

levels in the data. The percentage increase in average revenues net of fuel per customer are slightly higher than those for average revenues, at 2.6% and 1.4% respectively. While these increases in average revenues and net revenues may seem small, Figure 30 shows that these changes nevertheless reflect a clear departure from historical patterns. The upward shift in revenues and net revenues per customer is primarily linked to the aforementioned shift towards full-day trips at the expense of partial-day trips. We find that the average full-day trip yields a 35% greater average revenue per customer and 31% greater average revenue net of fuel costs per customer.[29] The shift of customers toward these full-day trips was enabled by the flexibility created under the EFP to allocate landings of EFP species toward trips yielding higher revenues and net revenues.

A total of 5 vessels in 2014 and 3 in 2015 – comprising 9.6% of all trips in the post-EFP period – charged an additional fee specifically for trips targeting EFP species, where the fee was levied before the vessel left port. These markups ranged from $5 to $20 and increased the price by 13% on average. As noted above, these markups increased overall revenues by slightly more than 1%. However, this calculation is based upon an assumption that the act of levying these markups did not reduce the number of customers on these vessels. To test this hypothesis, we regress the number of customers per trip on the premium charge ($/customer). To compare the trips charging a premium to a control group of trips that are as similar as possible, we restrict the sample to trips retaining EFP species on vessels in Texas and Northwest Florida (where the vessels charging the markup were based).[30] We found no negative effect (β =0.004, t statistic = 1.86) of the premium on the number of customers per trip. We then repeat the same regression but replace the number of customers with estimated trip revenues to examine the marginal effect of

[29] The importance of the shift toward full-day (and to a much lesser extent multi-day) trips for increases in average revenue per customer in 2014-15 is buttressed by the fact that removing full day trips from the sample underlying the estimates in Figure 30 leads to the finding of no statistically or economically significant changes in revenue per customer in the post-EFP years relative to 2013.

[30] Control variables include vessel dummies, controls for seasonality (week and day of week dummies), trip type (duration) fixed effects, and an indicator for whether the trip occurred during the red snapper season.

increasing the premium on trip revenues. We find that a $1 increase in premium for trips retaining EFP species will, on average, yield a $39 (t statistic = 5.4), or about 1.4%, increase in trip revenues. Given that the average trip typically carries approximately 32 passengers, this estimate is consistent with the notion that increasing the premium for a trip (at least in the range observed in the data) has no effect on angler demand for these trips, such that revenues increase proportionally.

4.1.4 Attribution of revenue effects to the EFP

In any real-world "policy experiment", the attribution of changes over time to the policy change itself, as opposed to the results of underlying trends or shocks to economic conditions or management, is a challenge. This section considers the evidence for whether the revenue-enhancing changes noted above can be linked in a direct way to the newfound incentives under the EFP.

It is clear from the previous analysis that a dominant effect of the EFP was to shift the distribution of red snapper and gag landings and trips from the summer months to the winter and spring and (to a lesser degree) the fall months. Therefore, a stronger case can be made for the revenue-enhancing effects of the program if the bulk of 2014-15 changes in revenues can be traced to the offseason times. Figure 31 repeats the analysis of Figure 29 while segmenting the data to the June-August period (encompassing both the traditional red snapper season and the summer portion of the gag season) and the remainder of the year. We find that June-August trip revenues and anglers per trip were basically unchanged in 2014-2015 while both measures saw large upward shifts during the non-summer months of these years. Figure 32 repeats the analysis of Figure 30 to examine whether the product mix effect was also seasonally driven. Figure 32 shows that the shift of customers toward higher-priced trips noted above was also a purely off-season phenomenon. While not conclusive, this is consistent with the changes in behavior captured in the logbook data of GHC members. Taken together, these results suggest that the increase in anglers per trip (quantity effect) and the shift of anglers toward higher-priced trips (product mix effect) was limited to non-summer months, and may

therefore be attributed to the enhanced ability of GHC vessels to provide higher quality trips retaining EFP species during this time.

An even more telling finding is presented in Figure 33, which reexamines the evidence for a product mix effect in the winter/spring and fall for only those trips that do not retain EFP species. There is no evidence of any increase in the average price or average revenue minus fuel costs per customer in 2014-2015. This demonstrates that the strong product mix effects shown in the left hand column of Figure 32 are completely driven by trips retaining EFP species. This corroborates anecdotal evidence from some headboat owners that they disproportionately utilized their quota allocation on their longer, more profitable trips in order to attract additional customers to these trips.[31] Overall, we find strong evidence linking enhanced revenues of the GHC vessels to trips retaining EFP species in non-summer months; given that these trips would not have been possible outside of participation in the GHC, it is justified to attribute these revenue increases to the EFP itself.

4.2 Angler (consumer) surplus – ongoing research

While the stated purpose of the socioeconomic assessment in the EFP was to examine its impacts on economic outcomes to headboat operations, there may also be substantial implications of the EFP (and, by extension, any similar permanent program) for customers' economic welfare. To assess the magnitude of changes to consumer surplus for Gulf of Mexico anglers, we developed a 2 part survey strategy.

In the first stage, we developed a short (2 page) paper survey (Appendix 2) that was administered to customers on GHC vessels.[32] While it would have been ideal to enroll customers of non-GHC operations in the survey, budgetary and logistical considerations – combined with the realities of political opposition to the

[31] It is possible that the causation was reversed – that quotas for EFP species were differentially used on higher value trips at times when consumer demand was inherently higher. However, controlling for patterns of seasonality in demand by adding monthly and day of week fixed effects has no effect on the results, supporting our interpretations.

[32] We encouraged each company to administer these surveys to all headboat customers, regardless of whether the vessel was enrolled in the GHC or if the trip involved the use of EFP quota. Coverage of non-GHC trips was substantial but somewhat inconsistent across operations. These variations in survey coverage will be controlled for in the weighting of our final welfare assessments.

EFP on the part of some non-GHC operations – made us choose to limit our survey to EFP participants. The surveys were typically distributed as vessels headed back into port at the end of a trip or while customers waited for their catch to be filleted. The surveys were provided free of charge to EFP participants, and they were furnished with pre-paid envelopes to return them to Dr. Abbott at Arizona State University.[33]

These intercept surveys gathered a number of demographic variables (summary stats in parentheses), including age (mean=34 years), fishing experience (15 years), gender (77.5% male), boat ownership (51%), GOM fishing avidity (median=1-2 times a year), mean trip duration (8.7 hours), and state of residence (where the largest share come from TX 37%, FL 14%, and AL 8%). Figure 34 shows the distribution of surveys by zip code. This map, aside from demonstrating the importance of demand from Gulf of Mexico states, shows the wide geographic reach of the GOM headboat industry, particularly in the Midwest and Eastern US. As a part of the survey we asked customers to provide their emails with the incentive that they would be entered into a drawing for a free fishing trip. We ultimately received 10,718 completed surveys with 66% providing an email.

To gather more focused data on the demand for headboat trips and how this demand is affected by policies on the seasonal availability of red snapper and gag, we developed a follow-up Internet survey of the anglers that provided their emails. We tested and refined this survey using two in-person focus groups of for-hire anglers held in Pensacola, FL. The survey was developed using Qualtrics web software, which allowed us to structure the survey in a more efficient fashion than would have been possible in a mail format – conditioning subsequent questions on respondents' previous answers within the survey and drawing upon this information at critical points to help remind customers of their previous answers. Customers were contacted using multiple emails and were incentivized to participate through the chance to win a $100 Amazon gift card. The survey was designed to take approximately 35 minutes to complete and was administered in two waves – once in mid-2015 (asking questions about the 2014 season) and again

[33] All survey activities for this research were pursued under the oversight and approval of the ASU Office of Research Integrity and Assurance.

in early 2016 (pertaining to the 2015 season). We ultimately received 813 completed online surveys. This somewhat low completion rate is partially a function of the Internet format and complexity of the survey but is also driven to some extent by the challenge of contacting respondents by email. Some emails were illegible or the survey recruitment emails were returned as undeliverable. Other emails ended up in some respondents' spam filters.[34] Despite these challenges, our data nevertheless constitutes a substantial sample of a fairly narrow and widespread angler population that would have been difficult to target effectively through other means.

The survey, in addition to gathering some additional socioeconomic characteristics of respondents, solicited two main sources of information. The first consisted of recall questions asking those surveyed to provide the seasonal timing, number, and duration of their Gulf of Mexico headboat fishing trips in the previous season, along with their catch on these trips. These data provide evidence of anglers' revealed preferences for fishing trips under the stock and management conditions that prevailed in 2014-2015. Importantly, these data were gathered for the entire season, so that they allow for the specification of a seasonal model of fishing demand (encompassing the choice not to go fishing at all), as opposed to some other surveys, which may only allow the analyst to model the decision of where/when to take the most recent trip.

The second substantial portion of the survey asks anglers to evaluate their prospective behavior under alternative scenarios of management and fishing conditions, while asking anglers to hold constant other aspects of their decision making process to their levels in the previous season. This "stated preference" or "contingent behavior" data allows us to evaluate how anglers value alternative management proposals – in the sense of their willingness to pay to obtain them – and how their demand, and its timing throughout the season, would vary in response to alternative management proposals. The core of this section of the survey asks fishermen to consider two alternative scenarios, denoted Policy A and

[34] To reduce the probability of this happening, the contact emails were sent from Dr. Abbott's university address.

Policy B, respectively. The comparison of these two policies begins by reminding the respondent of their trip behavior in the previous season – in order to help ground their response to the hypothetical scenarios in the reality of their past behavior. They are then presented with Policy A, which is designed to mimic the status quo for seasonal retention closures and bag limits for red snapper and gag in recent years, and with trip prices reflecting averages for the industry. Fishermen are then asked to say how many partial-day and full-day trips they would take during different times of year under this program. They are then asked to consider Policy B, which allows for year-round retention of red snapper or gag but raises the price of trips (or lowers the bag limit) so that Policy B is not necessarily superior for all respondents. They are then asked to provide their stated seasonal demands as they did for Policy A. Policy B mimics a situation like that experienced by anglers under the EFP or that could be experienced under a hypothetical permanent program. The alterations to the bag limit or increases in prices allow us to mimic the reality of extending the season under an allocation-based program given a constant total allowable catch; for a fixed number of fish, some form of increase in price or decline in bag limit will likely be necessary as headboat operations adjust their business practices to extend their individual allocations across the longer season.

The fundamental purpose of the survey is to utilize these stated and revealed preference data to develop a seasonal model of demand for headboat trips. This model will allow for heterogeneity in preferences across different groups of anglers (e.g., Gulf of Mexico residents vs. tourists and "snowbirds"). We will utilize our model to estimate the average willingness to pay of headboat anglers for a policy scenario in which fishermen have the ability to fish for and retain red snapper and gag year-round. When scaled to the population of all potential Gulf of Mexico anglers, this provides a measure of the annual consumer surplus that could be yielded from moving to a permanent allocation-based program for headboat vessels.[35] Work on these modeling activities is currently ongoing.

[35] We will utilize data on the regional distribution of trips from the SRHS survey, combined with our data from the 2 page intercept surveys, to re-weight our survey data so as to control for differences

5. Comments from EFP participants

In addition to questions soliciting data on trip prices and costs, the headboat owner surveys asked respondents several structured and open-ended questions concerning their experience over the previous year in the EFP.

5.1 Profitability and cost reductions

To assess GHC participants' perceptions of the effects of the program on their profitability, we asked the following question:

> *"On the whole, do you think that participating in the GHC enhanced the profitability of your headboat business in 2014 (2015) relative to 2013 and other recent years before the GHC?" (YES/NO/ABOUT THE SAME).*

For the 2014 season, 12 owners responded "yes", while 1 said "about the same." In the following year, 11 owners responded "yes", while 1 said "no" and 2 said "about the same."

To examine whether vessel owners thought their profitability under the EFP improved relative to the alternative of remaining outside the GHC in the same year, we asked the following question:

> *"On the whole, do you think your headboat business was more profitable in 2014 (2015) than it would have been if you had not participated in the Gulf Headboat Collaborative in 2014 (2015)?" (YES/NO/ABOUT THE SAME).*

For the 2014 season, 12 owners answered "yes", while 1 answered "no." For the 2015 season, 11 owners responded "yes", while 3 indicated that they thought their profitability would have been "about the same" if they had remained outside the GHC.

In order to explore headboat owners' perceptions of which factors were most important for increased profits, we asked owners to assess for the previous season the importance for increased profits under the GHC of each of these five factors on a

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in the spatial placement of GHC vessels relative to the overall industry and to control for non-response bias.

five point Likert scale (ranging from very unimportant to very important): 1) More customers per trip; 2) Charging a higher price for access to fish out of season; 3) Shifting customers to longer trips; 4) Running more trips; and, 5) Lower costs per trip. Figure 35 and 36 report the results of these questions for both seasons.

In both years, owners placed a strong priority on the role of the GHC in increasing the number of customers, both through increasing the number of trips and the number of anglers per trip. However, whereas in 2014, 9 out of 11 respondents said that increasing the number of customers per trip was very important, this number declined to 3 out of 13 in 2015. Interestingly, this pattern of responses is consistent with the shifting role of these two contributors to profits in 2014 vs. 2015.

Lower trip costs are considered at least somewhat important for at least half of respondents in both years, while shifting customers to longer trips is given less importance overall, with some small evidence of erosion in its importance in 2015. Charging a premium price for access to EFP species out of season is considered unimportant or of ambiguous importance by the majority of owners, with 3 fewer vessels in 2015 considering it to be "very important" than in 2014. This coincides fairly closely with the reduction in the number of vessels that charged a premium in 2015. Overall, the patterns revealed in the survey data coincide well with the overall importance of different mechanisms for increased profits – and their changes in importance between 2014 and 2015 – that we find in the SRHS data.

5.2 Trip-taking in poor weather

GHC headboat owners were asked "*how (if at all) participation in the Gulf Headboat Collaborative altered your decision making with respect to weather and rough seas."* In both survey years, 7 out of 14 companies indicated that participating in the EFP did not alter their choice of whether to go fishing vs. cancel a trip on a rough weather day. One respondent's comments are typical of this group: *"It did not alter any. We always use safety first so we would cancel a trip no matter what if the weather did not look safe."*

4 respondents in both 2014 and 2015 indicated that the increased security of red snapper or gag allocations offered in the program lead them to err more on the side of safety and customer comfort. One respondent said: *"When we are able to catch the fish later, we can afford to re-schedule the trip to another date with better weather conditions."* Another provided the following explanation: *"We would attempt to go in the past, if the weather forecast was marginal. If the actual sea conditions were better than the forecast, we would make the trip. If the sea conditions were too rough, we would turn around and return to the dock. In 2014 we cancelled the trip if the weather forecast was marginal. We could use the quota on a later trip. In previous years, we made some trips when the forecast was marginal, but the actual conditions were much better than the forecast. These days were not made in 2014 because we did not attempt to go on the marginal forecast days."* The remaining 4 respondents supplied ambiguous responses or left the question blank.

5.3 Transfers of quota between companies

Vessel owners were asked the following:

> *Did you transfer any of your red snapper or gag quota under the EFP in 2014/2015? If so, please describe the timing (date), species, and amounts transferred. Also, please specify the price paid (whether in $ or in terms of barter).*

In 2014, 5 companies reported no quota transfers. 3 companies reported cash purchases of red snapper (a total of 550 fish) for prices of between $20 and $25 a fish. A pair of companies reported swapping gag for red snapper on a 1-for-1 basis. 1 company borrowed red snapper allocation from another GHC vessel in 2014 and repaid these fish in kind in 2015. 1 other company gifted a small number of fish to another vessel in the GHC.

In 2015, 9 companies reported no transfers whatsoever. Only 1 vessel reported a cash purchase of quota (300 red snapper at $5.00/lb.). 1 company reported exchanging red snapper for gag with another GHC member on a 1-for-1 basis. 1 company gifted a small number of gag to another vessel in the GHC. 1 other

company reported engaging in some form of quota transfer but provided no further details.

5.4 Changes in business operations and overall assessment

In order to understand how vessel owners chose to allocate their scarce red snapper and gag allocation across the season we asked the following question:

> *"Did you limit customers to 1 red snapper or gag per customer on any of your headboat trips in 2014? If so, can you provide details on when you implemented this policy and when/if you discontinued it during the season? How was it received by your customers?"*

In 2014 (2015), 7 out of 14 (8 out of 14) respondents answered "no" to this question, while the rest indicated limiting customers to less than the legal bag limit on at least some trips. Representative responses were as follows:

- *"We had great success with limiting to 1 red snapper and/or 1 gag. We changed the limit in a variable nature to see if it had an impact on our booking and we found that trips with one snapper sold out as well as trips with two." (2014)*
- *"Yes. Several customers were of course unhappy." (2014)*
- *"We limited all customers to one red snapper per person per day, except for the 10 day federal season, in which we kept 2 snapper per person per day. Our customers were very pleased to be able to keep one snapper per person. This one fish per person made all the difference in their satisfaction with the trip. With so many other season / species closures, many customers would not have brought any fish back to the dock had it not been for these snapper tags." (2014)*
- *"It was well received by our customers on our 6-hour fishing trips. The one red snapper policy was implemented and used for all of 2014." (2014)*
- *"I limited customers to a one day bag limit on the 24 hour trips. This was received well by the majority. Only a couple customers complained." (2014)*
- *"On our 6-hour winter trips and our summer 6-hour trips, we did limit our customers to 1 red snapper per person. We would explain to our customers about the EFP and that we had an allocation of fish that we had to manage. It was a bit more difficult in 2015 since the charter-for-hire sector had a 44 day red snapper season. Those customers who wanted a limit of red snapper were offered our 8-hour trip. This policy was implemented at the beginning of 2015 and was in place for the entire year." (2015)*
- *"I limited a 1 fish bag limit on 14 hour trips. Trying to save quota to extend opportunities further into the year." (2015)*

- *"We limited all customers to 1 red snapper per day on headboat trips in 2015." (2015)*
- *"Yes, until June 1 when red snapper season opened up, then 2 per person afterward. people were okay with it. we did not do this in 2014 and ran out of quota. since the red snapper fishing was not as good in 2015, and we weren't catching as many, we left it at 2 per person the rest of the year. and we left quota un caught at the end of the year." (2015)*

To provide headboat owners with an open-ended opportunity to report how participation in the GHC altered participants' way of doing business, we asked the following question:

> *"Can you comment on how (if at all) participating in the Gulf Headboat Collaborative changed your way of doing business in 2014 (2015)? Specifically, how did your participation alter the types of trips you provide? How did these changes affect your revenues, costs and profitability?"*

There were several consistent themes in the responses. Several vessels reported that their participation allowed them to fish in a way that lowered their fuel costs. (Each response below is a unique response from a single vessel in a given year.)

- *"We fished closer to shore. We reduced costs. We increased profit. We gave customers more opportunity." (2014)*
- *"We were able to run more 6 hour trips with minimal fuel consumption because we knew the snapper would be there to catch and we didn't have to waste valuable time and fuel to try to locate other species." (2014)*
- *"We ran less trips with higher profits and the decrease in fuel consumption made us more profitable." (2014)*
- *"We offered the same types of trips as normal, but our expenses were reduced primarily because we did not have to use more fuel searching for other types of fish." (2015)*

Some vessels reported changes in their trip offerings or timing:

- *"We ran a lot more early spring trips…snowbirds don't fish if they can't keep." (2014)*
- *"We ran more extended trips. We charge more for these specialty trips and only ran them to target ARS (American red snapper) and Gag." (2014)*
- *"We booked more trips in the spring and fall." (2015)*
- *"It just changed the amount of Red Snapper & Gag Grouper trips we did in comparison to other trip types." (2015)*
- *"The GHC allowed us to run more customers and trips on both sides of the regular season, and it also allowed access to our spring and winter customers*

that had been excluded from the red snapper fishery for a very long time. We did offer less trips and more longer trips to conserve fishing quota. Profit per trip was up in 2015." (2015)

- *"I was able to offer trips targeting gag and ARS during off season to increase revenue." (2015)*

Some vessel owners indicated that the program led to increased demand.

- *"It did not change the way we did business. It did affect the rate of repeat customers which helped revenue." (2014)*
- *"We had more people wishing to fish for Red Snapper. The demand was greater and helped profits and more trips." (2015)*
- *"The ability to offer red snapper trips year around was the most important source of increased profit. Those who would not typically fish because they could not catch red snapper were now willing to spend the money to go out fishing." (2015)*

Only one owner specifically mentioned changes in trip pricing, albeit for their charter trips:

- *"We offered out of season special red snapper charters for $300 more per trip. This allowed us to increase our profit by $300 per trip when we were able to run these trips out of the normal season." (2015)*

6. Conclusion

Altogether, the data tell a consistent story. Participants in the headboat EFP clearly took advantage of the freedom to use their secure seasonal allocations of red snapper and gag in ways that best suited their business. While patterns of behavior varied between operations, most vessels chose to spread their allocations over a much larger number of trips over the course of the season, providing their customers with the opportunity to catch red snapper in the winter/spring and fall on either side of the traditional open season and catch gag before the late-summer/fall fishery. This unequivocally broadened access to gag and red snapper to a larger and more heterogeneous pool of fishermen than would have fished for these species in the traditional open seasons – including winter/Spring Break tourists, part-time (i.e. "snowbird" or "Winter Texan") Gulf residents, and full-time Gulf residents who prefer to avoid fishing in the summer season due to congestion or hot temperatures.

Increasing anglers' access to a fixed allocation of fish across the year inevitably requires that the average landings per angler with access to these species will decline. Indeed, this was the case for red snapper and gag under the EFP. Some companies (roughly half in our sample) primarily remained within their allocations by limiting the number of trips utilizing quota for EFP species while allowing fishermen to retain their full legal bag limit.[36] However, roughly half of the GHC companies did expand their offering of trips retaining EFP species by explicitly reducing the bag limit for these species on these special trips – reducing EFP species per angler but vastly increasing the number of anglers and trips enjoying some degree of access. While it has always been possible for companies to restrict their bag limit below the legal maximum, individual incentives to do so before the EFP were lacking. Importantly, the overall number of fish retained by fishermen on trips for trips offered under the GHC program remained constant. In essence customers that went fishing on GHC vessels that would otherwise have gone fishing without the opportunity to retain an EFP species found their experience enriched by the opportunity to retain at least one red snapper or gag, while those that were induced to fish by additional out-of-season retention opportunities saw their fishing experience improved. Furthermore, despite an overall decline in the rate of landings of EFP species per customer (an outcome that could have been achieved through increasing the rate of discards), we find that discards per angler-day have actually *declined*, both through an increase in retention rates and a reduction in CPUE for EFP species on trips that retain these species. These discard improvements are primarily due to reductions in regulatory discards in the off-season for EFP species.

Assessing the effects of the EFP on revenues and profitability is challenging given the task of defining a relevant counterfactual scenario for 2014-2015. It is possible that some revenue and profit growth from increased customer demand

[36] It is difficult to conclusively verify this from logbook data (which focus on overall landings and discards, rather than individual customer outcomes), but anecdotal evidence from our interviews suggests that vessels that allowed full bag limits may nevertheless have managed their catch rates during the trip to avoid consistent "limiting out" on the part of their customers. This is consistent with the overall pattern of lower CPUEs for red snapper and gag in 2014 and, especially, 2015 (a year where allocations under the EFP were comparatively scarce).

would likely have occurred in the absence of the EFP. However, there is evidence that at least some of the increase in anglers per trip in 2014 and increases in trips in 2015 were driven by more attractive fishing opportunities for customers – especially in the winter/spring fishery. Furthermore, there is robust evidence that the shift of customers toward mostly longer trips offered at higher prices and profit margins was driven by the ability to offer fishing for EFP species on these trips. Finally, a minority of vessels did charge a premium for trips retaining EFP species. Despite the fact that these premia applied to less than 10% of EFP trips, they raised overall revenues by more than 1% - with no evidence that these premia diverted customers away from these trips. Furthermore, these empirical assessments of increased profitability are independently affirmed by the survey responses of headboat owners, which also reveal consistent, if anecdotal, reports that fuel costs were reduced for those fishing under the EFP due to the ability to fish for red snapper rather than engaging in costly search for other legally retainable species.

Many of these findings are likely to persist under a permanent headboat catch share program. However, there are reasons to exercise a measure of caution in projecting these results into the future. Due to the temporary nature of the EFP, it is likely that there are many innovations in trip offerings, pricing and operations that are yet to emerge and that could provide additional benefits under a permanent program. This may be partially driven by the need for vessel owners and captains to have sufficient time to engage in "learning by doing." However, some innovations that may occur quickly under a permanent program were forestalled in a 2 year program due to the switching costs of the changes or concerns about alienating or confusing customers with changes in business practices that were inherently temporary.

One aspect of vessel operations under the pilot that seems unlikely to continue in a permanent program is the reticence to reflect the scarcity of red snapper and gag quota in the pricing of trips. If allocations of quota are allocated so that they are scarce then quota will have a value. Even owners that choose not to fish their full allocation or have more than they can profitably use will have to consider the opportunity cost of supplying this quota to others demanding it in a

transferable quota market. In such a context, the use of red snapper or gag quota is always a real cost to a company, and it is likely that this cost will ultimately be reflected in the pricing of trips – particularly when this cost is universally born by all vessels in the headboat sector. Conceivably, this could be reflected in uniform increases in trip prices; however, given that some customers care more about targeting and retaining certain species than others, we expect that headboat operators will instead develop differentiated trip offerings, with differentiated trip pricing, to appeal to anglers with higher values for retaining certain reef fish species while still catering to others without such values. For example, vessels may – if allowed to loosen individual bag limit restrictions or avoid them altogether – choose to market certain trips as "high bag limit" trips while maintaining lower bag limits on other trips targeting anglers with weak retention preferences for these species.[37]

While we found no evidence of a demand response to premium pricing for retention of EFP species, this may be driven by a combination of the uniqueness of the opportunity to retain red snapper or gag out of season – this was a novel and unfamiliar good to many customers, some of whom were not aware of it until after they booked the trip – and the lack of competitors offering similar trips in nearby ports in 2014-2015. Both of these factors will likely diminish somewhat under a permanent program. The novelty of the opportunity to retain red snapper and gag out of season will diminish if this opportunity becomes familiar and widespread. Furthermore, while headboats under a permanent catch share program will obtain durable privileges to take customers fishing for a public resource, these privileges potentially would be distributed over approximately 70 vessels in the Gulf of Mexico, such that customers will typically have several competing operations within a short drive to choose from. This will allow customers to "vote with their feet" to

[37] Alternatively, vessels could move toward an "a la carte" pricing approach whereby fishermen are charged individually for the fish they land. While seemingly more economically efficient (Abbott, Maharaj, and Wilen 2009; Abbott and Wilen 2009), this approach may be logistically difficult for crew to enforce on a vessel with many passengers. Furthermore, discussions with headboat owners and anglers suggests that customers may view paying *ex post* for retention of catch in a somewhat negative light compared to paying more for the *opportunity* to land up to a given number of fish before the catch has occurred.

select the operation with the best trips and pricing for them, while ensuring a healthy degree of competition for customers among headboat operators.

Ultimately a for-hire catch share system would allow each operation to adapt its trip offerings, pricing and marketing approach to reflect its local context and customers. Some operations with strong summer demand may operate similarly to the way they operated in the past by utilizing their fish in a short summer season, while others may customize their trip offerings, bag limits and pricing to fit the ebb and flow of customers throughout the year. The result is likely to be a more differentiated headboat market than is presently allowed to exist under the current one-size-fits-all approach of season-based management. Headboat operators can improve their profitability through better differentiation of their products according to their perceptions of customer demand, and customers can benefit by selecting from among this richer choice set of trip types the trips that best suit their preferences. This product differentiation will likely enhance overall angler welfare (from the economic perspective of benefit-cost analysis) by allowing those who place the highest value on landing these species to obtain access to them through a differentiated and competitive marketplace that lets headboat operators and their customers utilize fish when *they* like, while ensuring accountability in the use of a public resource.

Acknowledgments

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Tables

	@2014 prices/costs (millions)			
	Revenue	%Chg.	Rev fuel	%Chg.
2009	6.91		5.98	
2010	5.87	-15.12%	5.08	-15.06%
2011	8.28	41.03%	7.27	43.23%
2012	8.35	0.84%	7.35	1.08%
2013	8.45	1.18%	7.32	-0.48%
2014	**9.09**	**7.60%**	**7.86**	**7.39%**
w/premium	**9.20**	**8.94%**	**7.97**	**8.93%**
2015	**8.96**	**-1.37%**	**7.81**	**-0.63%**
w/premium	**9.05**	**-1.63%**	**7.89**	**-0.95%**

Table 1: Estimated revenues for 2014 GHC vessels. Estimates are calculated at constant 2014 trip prices, input prices and input usage. Percentage changes are measured year-over-year. Percentage change for 2015 w/premium is calculated relative to 2014 levels w/premium.

Figures

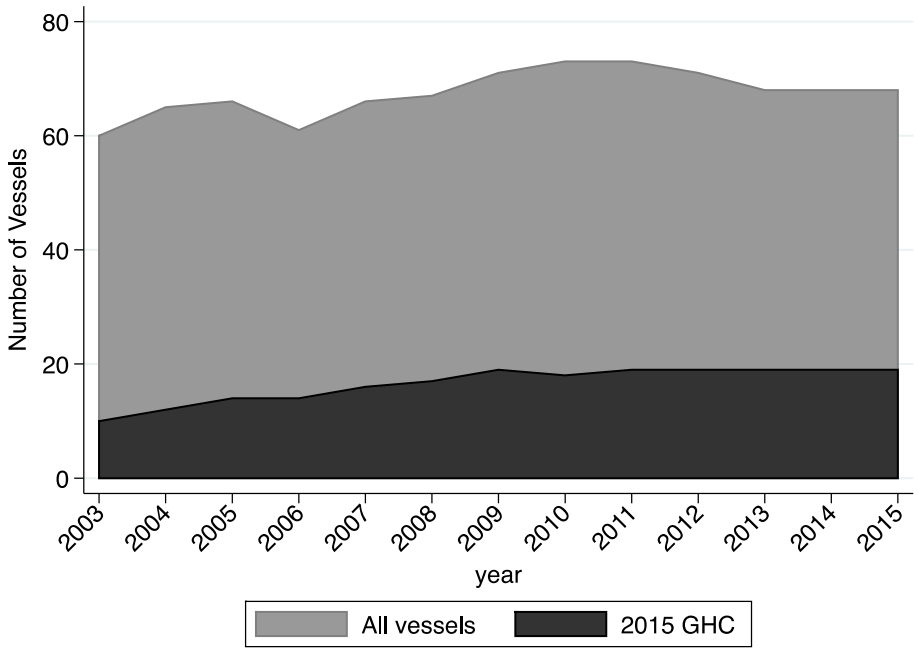

Figure 1: The number of headboat vessels active in the Gulf of Mexico by year. Activity in the fishery is defined by having trips in the SRHS logbook in a given year.

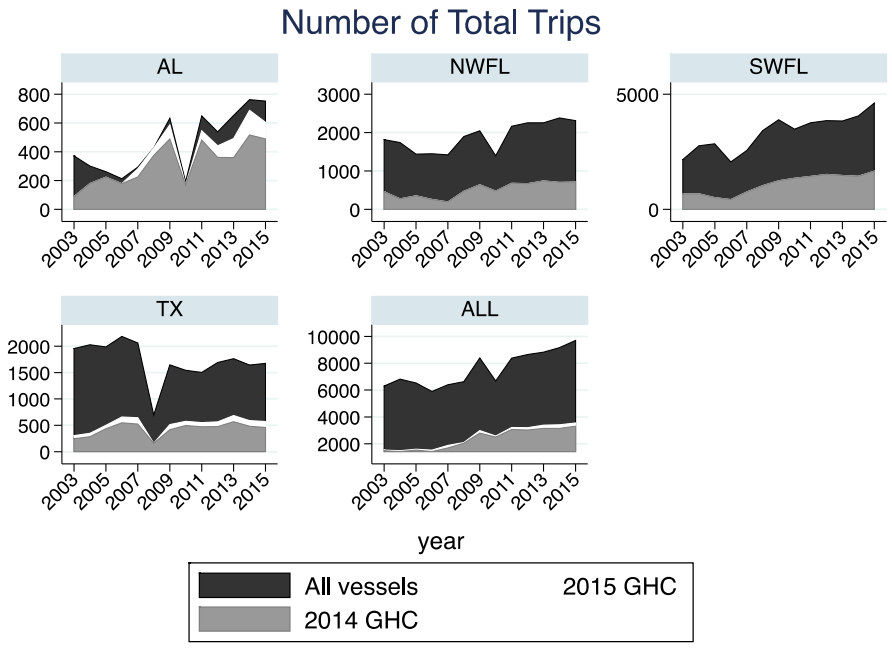

Figure 2: Total headboat trips in the Gulf of Mexico.

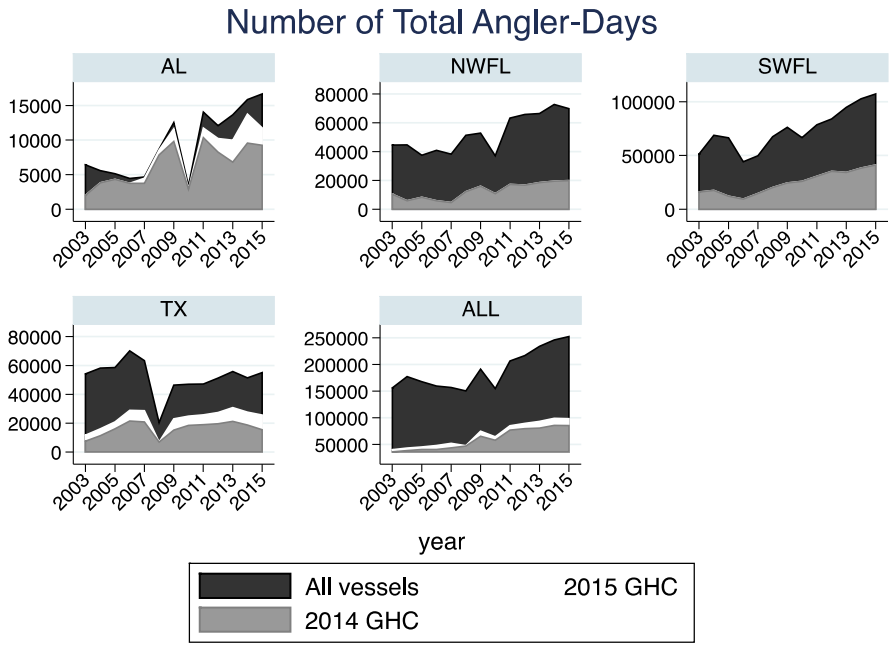

Figure 3: Total headboat angler-days in the Gulf of Mexico

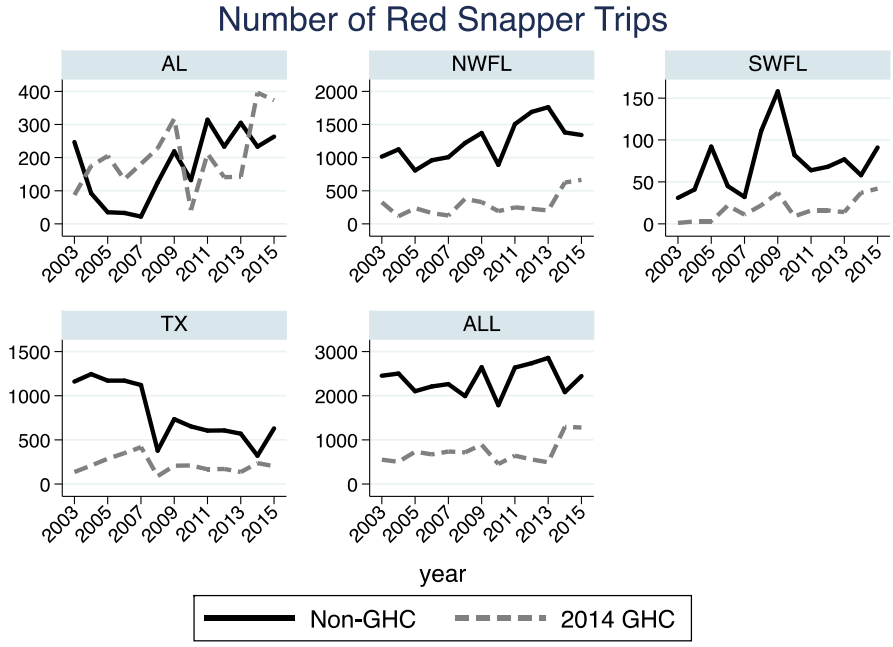

Figure 4: Number of headboat trips retaining red snapper.

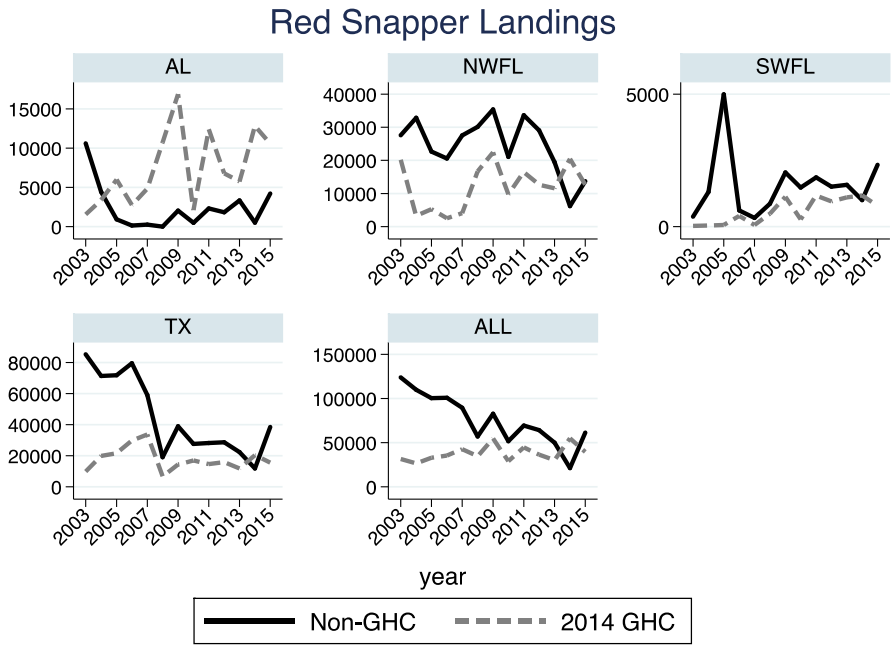

Figure 5: Total red snapper landings by headboat vessels.

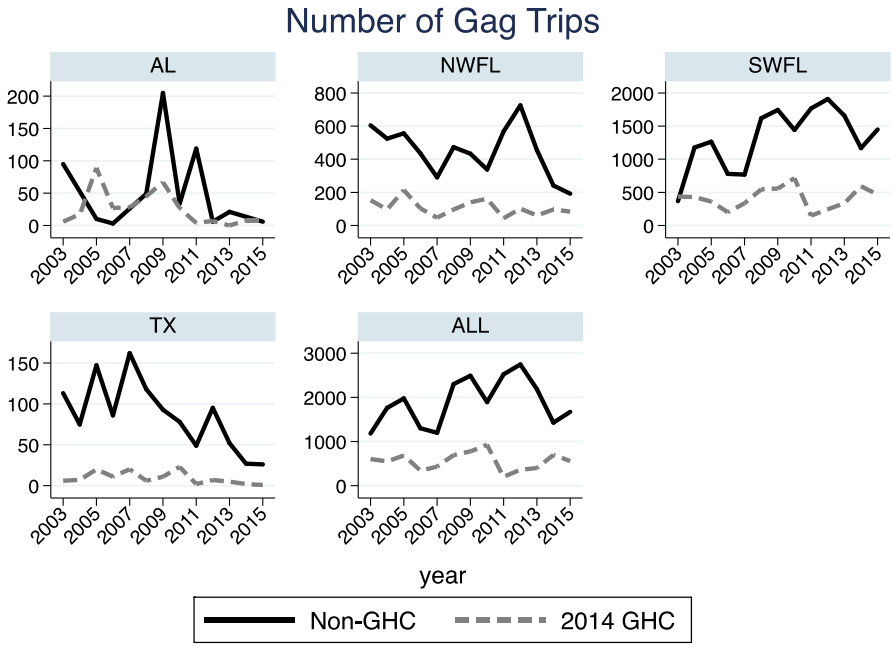

Figure 6: Number of headboat trips retaining gag

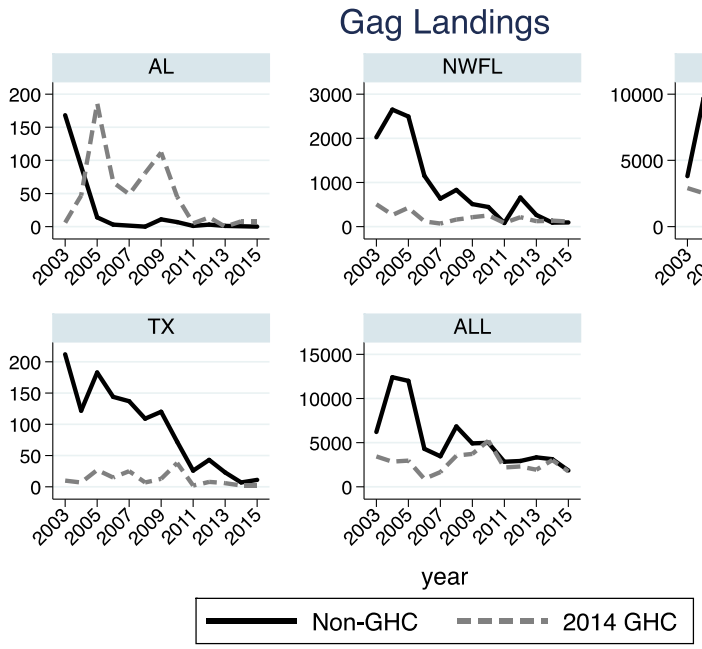

Figure 7: Total gag landings by headboat vessels

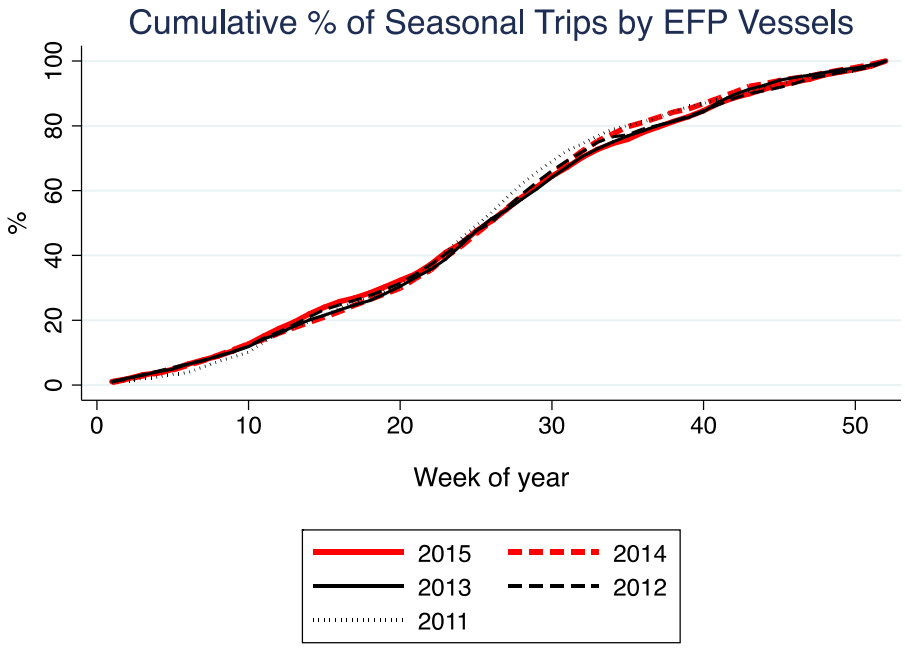

Figure 8: The cumulative share of trips for 2014 GHC vessels

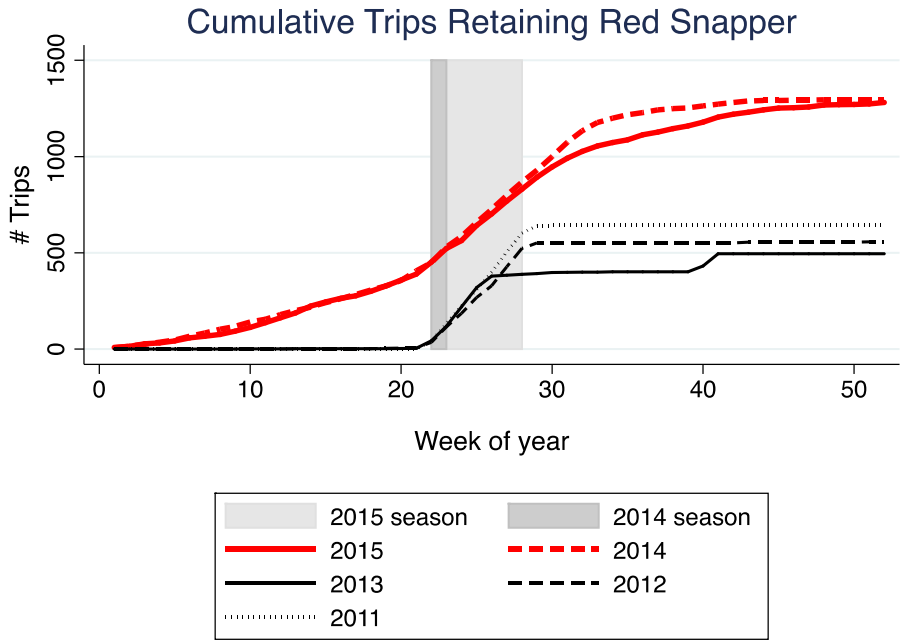

Figure 9: Number of red snapper trips for 2014 GHC vessels

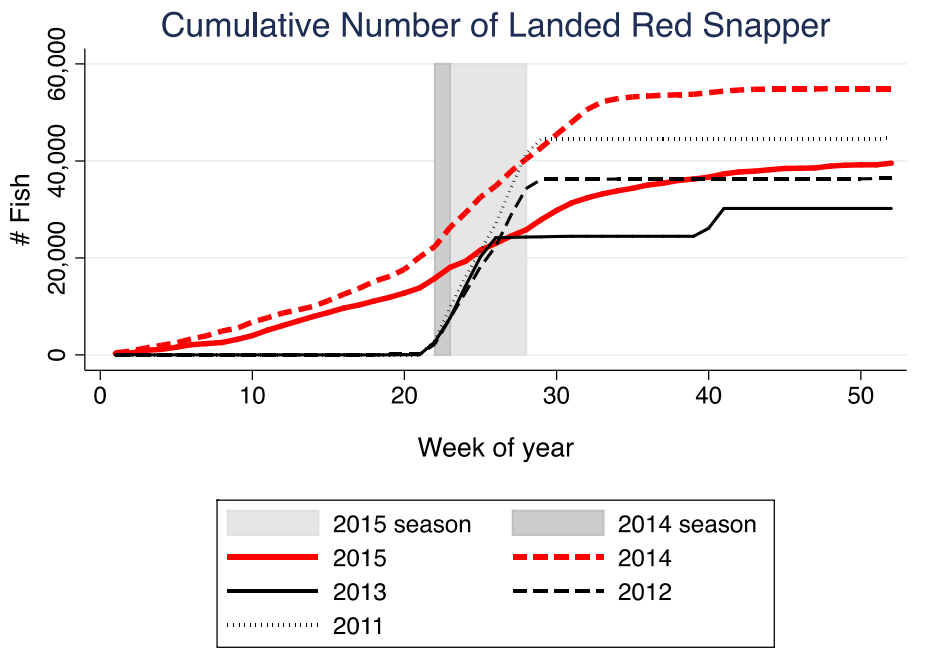

Figure 10: Number of landed red snapper by 2014 GHC vessels

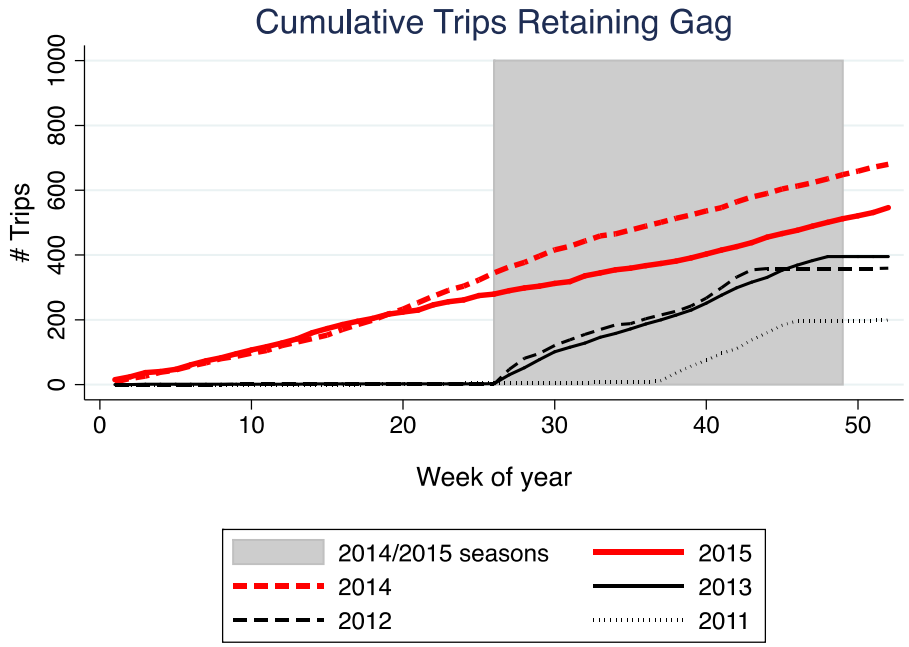

Figure 11: Number of gag grouper trips for 2014 GHC vessels

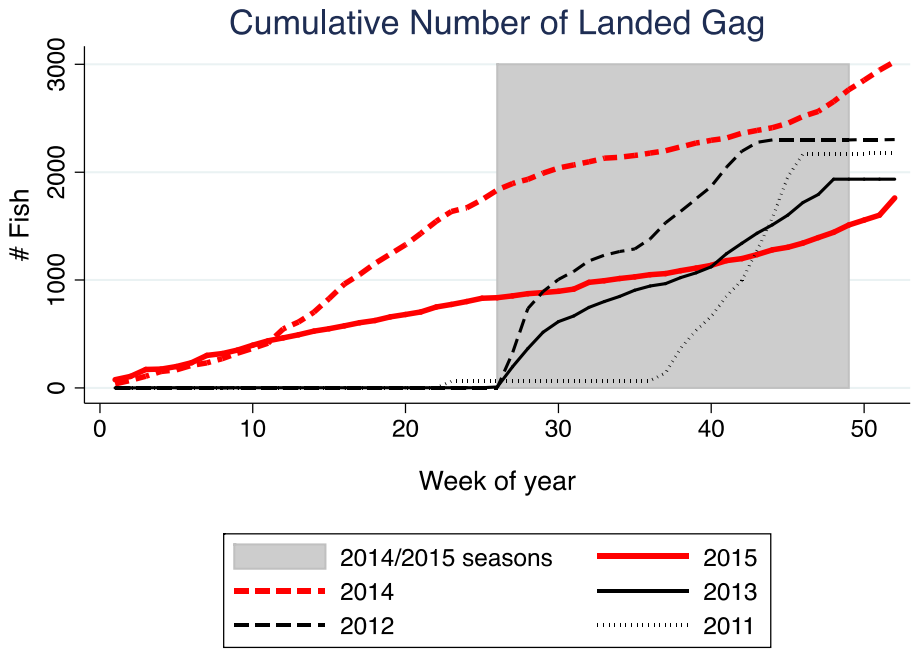

Figure 12: Number of landed gag grouper for 2014 GHC vessels

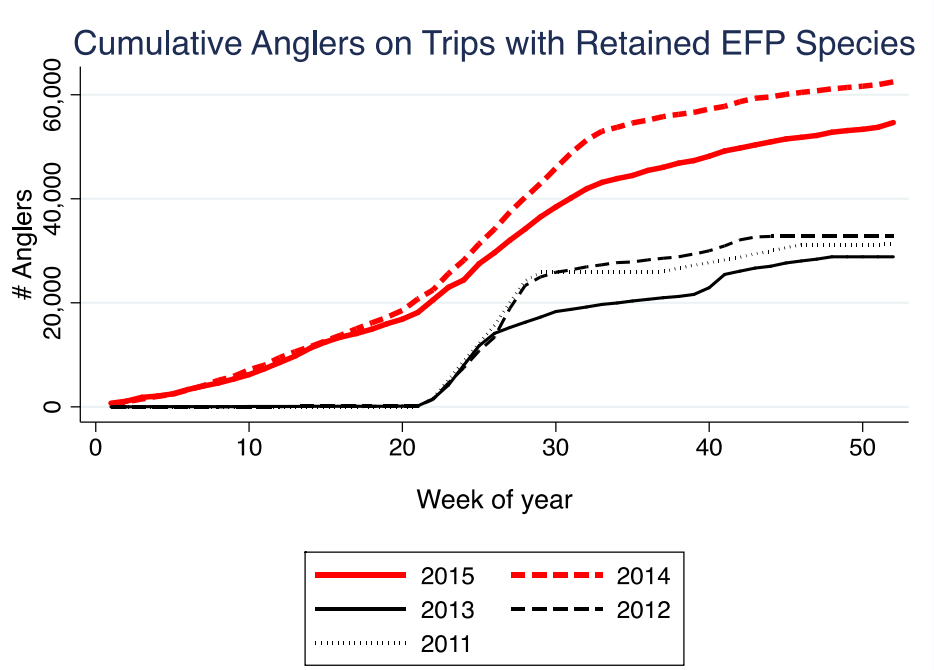

Figure 13: Number of anglers on trips retaining EFP species for 2014 GHC member vessels

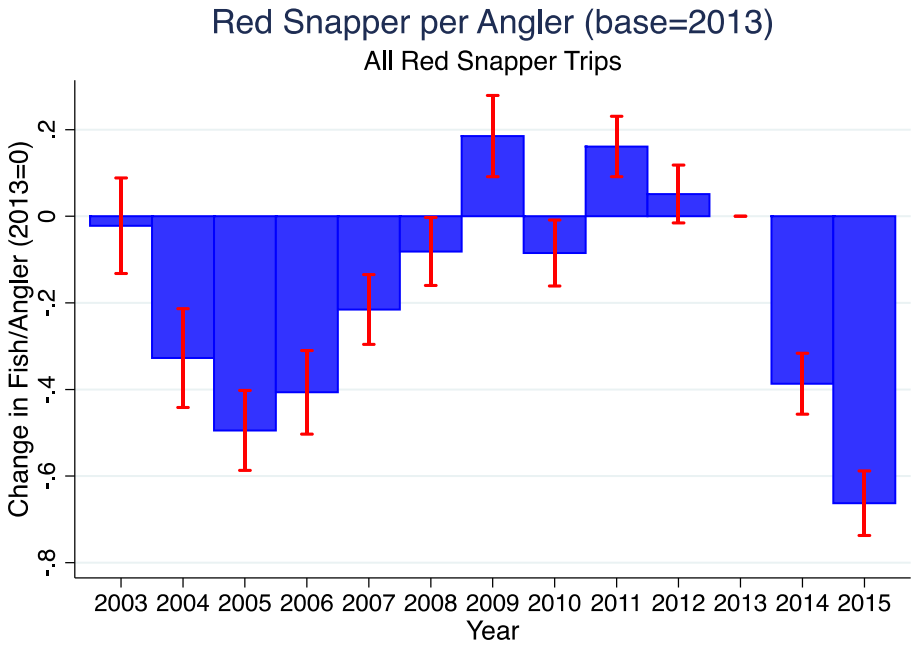

Figure 14: Change in red snapper per angler on trips retaining red snapper relative to 2013. Results are from a regression of trip-level per-capita red snapper landings on annual dummies, vessel fixed effects and month dummy variables. The regression is weighted by anglers per trip. The red whiskers indicate 95% confidence intervals using robust standard errors.

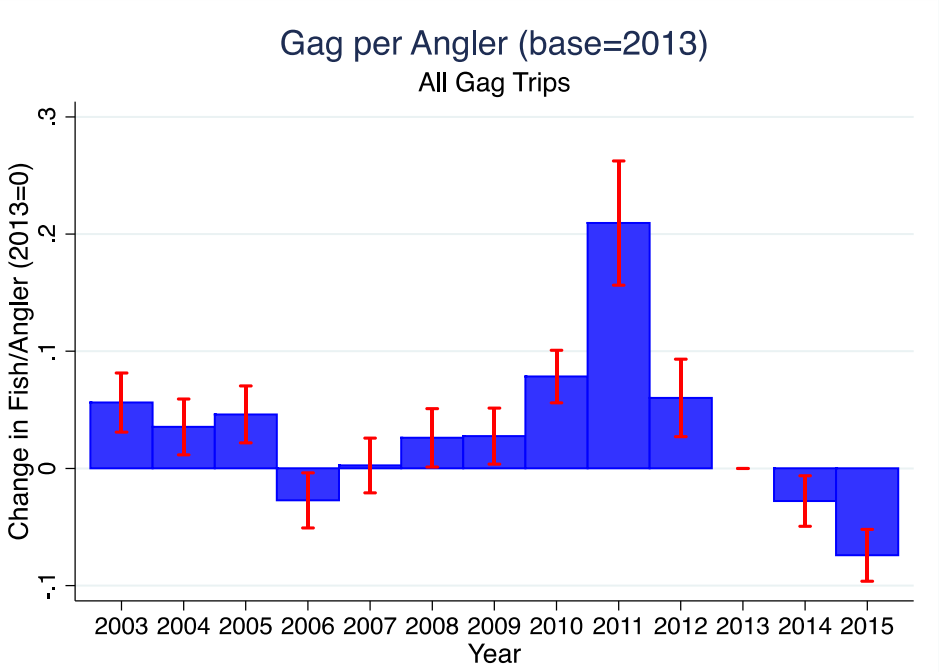

Figure 15: Change in gag per angler on trips retaining gag relative to 2013. Results are from a regression of trip-level per-capita gag landings on annual dummies, vessel fixed effects and month dummy variables. The regression is weighted by anglers per trip. The red whiskers indicate 95% confidence intervals using robust standard errors.

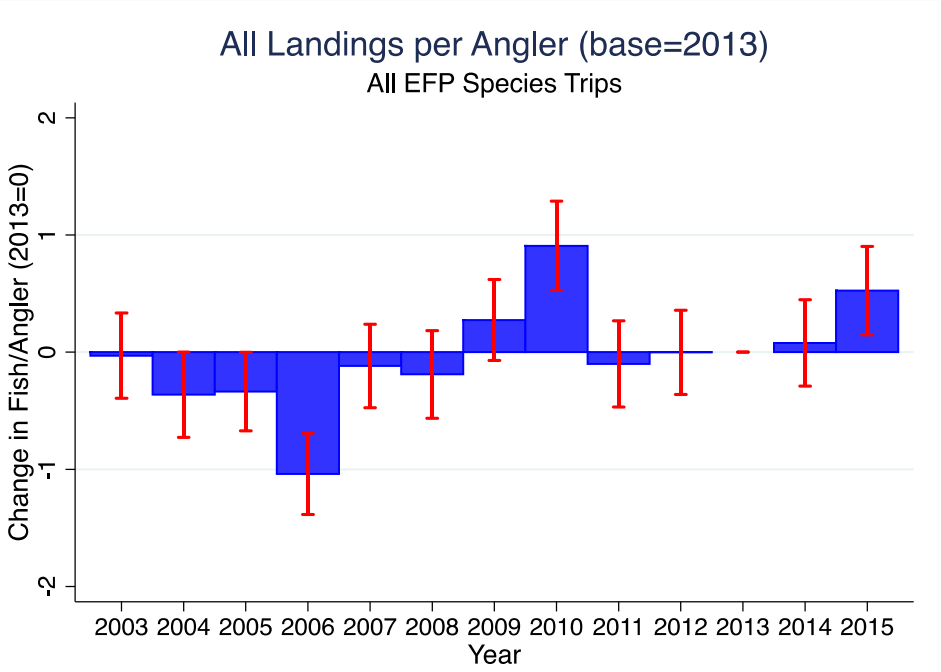

Figure 16: Change in all landings per angler on all trips retaining EFP species relative to 2013. Results are from a regression of trip-level per-capita landings on annual dummies, vessel fixed effects and month dummy variables. The

regression is weighted by anglers per trip. The red whiskers indicate 95% confidence intervals using robust standard errors.

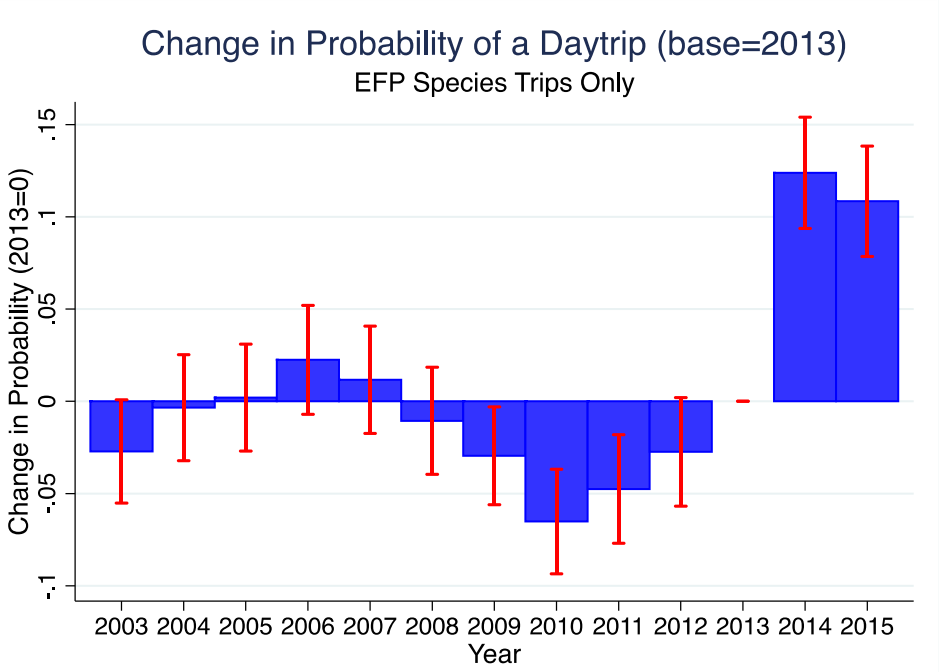

Figure 17: Change in probability of a daytrip for GHC vessels, relative to 2013, for all trips retaining EFP species. Results from a linear probability model on year, month, vessel, and weekend dummy variables. The red whiskers indicate 95% confidence intervals using robust standard errors.

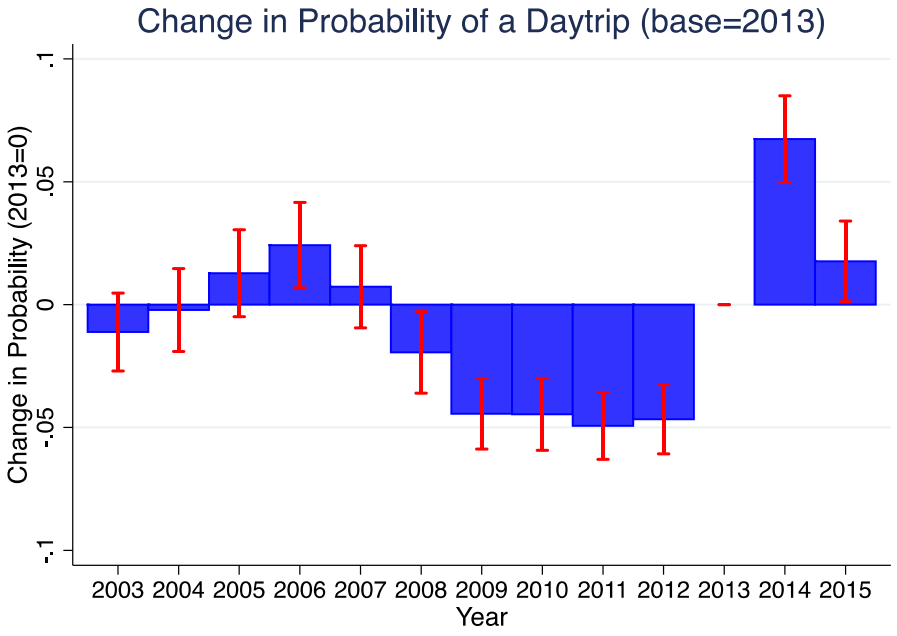

Figure 18: Change in probability of a daytrip for GHC vessels, relative to 2013, for all trips. Results from a linear probability model on year, month, vessel, and weekend dummy variables. The red whiskers indicate 95% confidence intervals using robust standard errors.

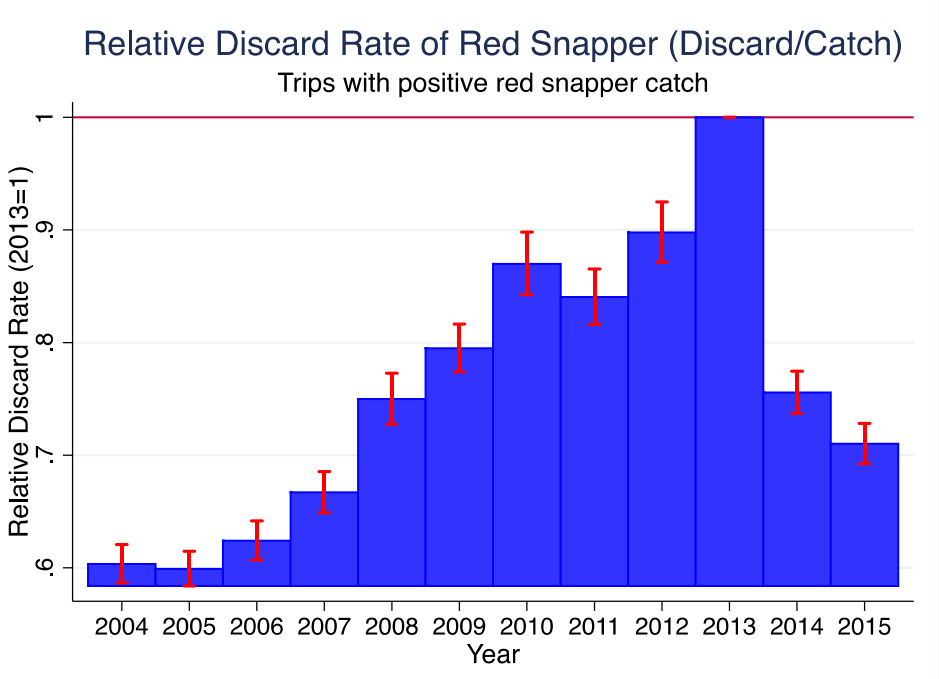

Figure 19: Relative red snapper discard rates for GHC vessels. Estimates are derived from annual dummy variables in a regression of trip-level shares of

discarded red snapper catch. Vessel fixed effects are included as controls. The red whiskers indicate 95% confidence intervals using robust standard errors

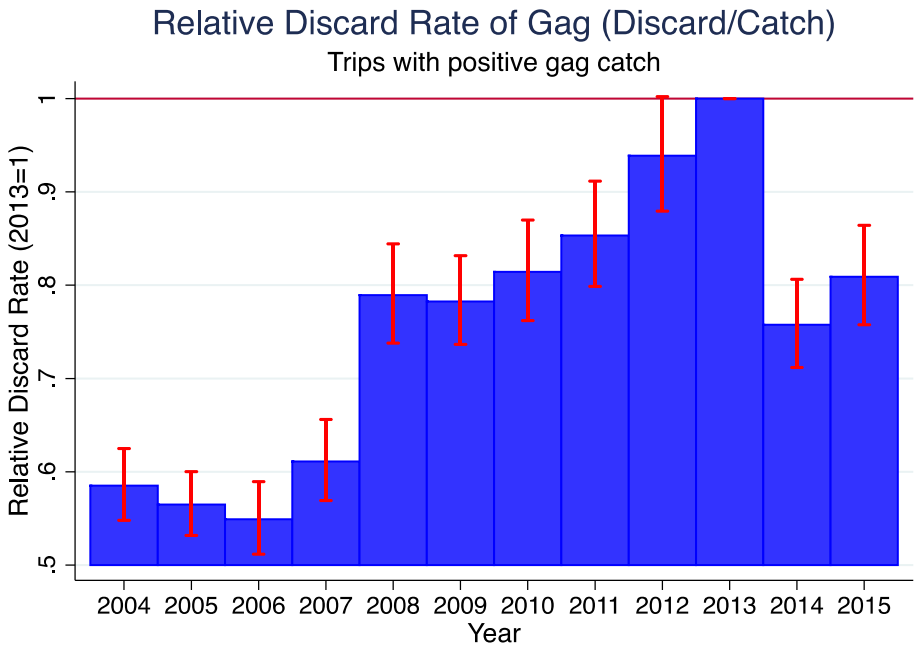

Figure 20: Relative gag discard rates for GHC vessels. Estimates are derived from annual dummy variables in a regression of trip-level shares of discarded gag catch. Vessel fixed effects are included as controls. The red whiskers indicate 95% confidence intervals using robust standard errors.

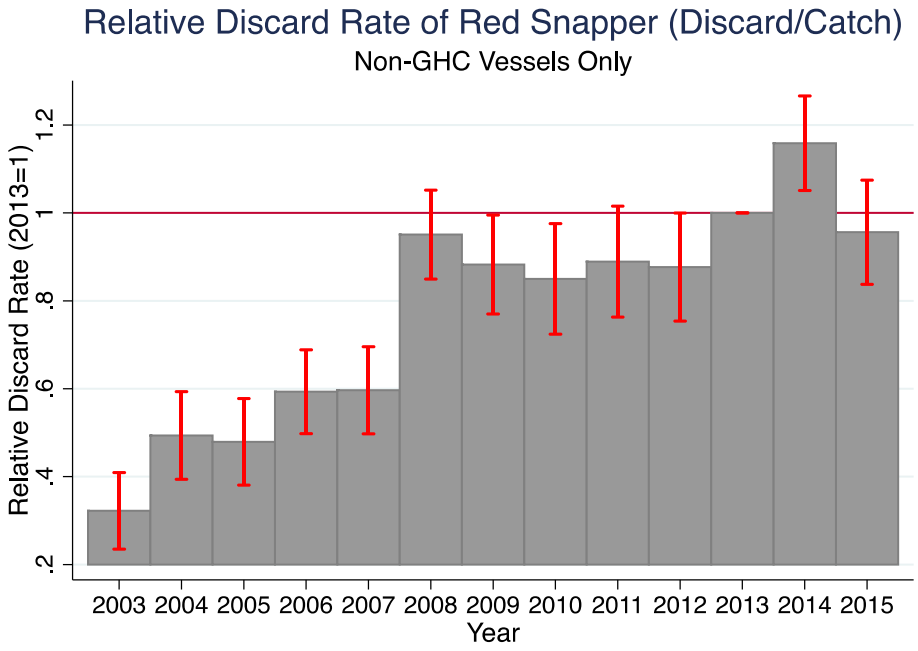

Figure 21: Relative red snapper discard rates for non-GHC vessels. This is from a regression using week/region data. The dependent variable is weekly red snapper discards divided by catch. Data are censored if there are less than two or fewer vessels operating with red snapper catch in that week. The regression is weighted by the number of trips by non-GHC vessels in that week/region.

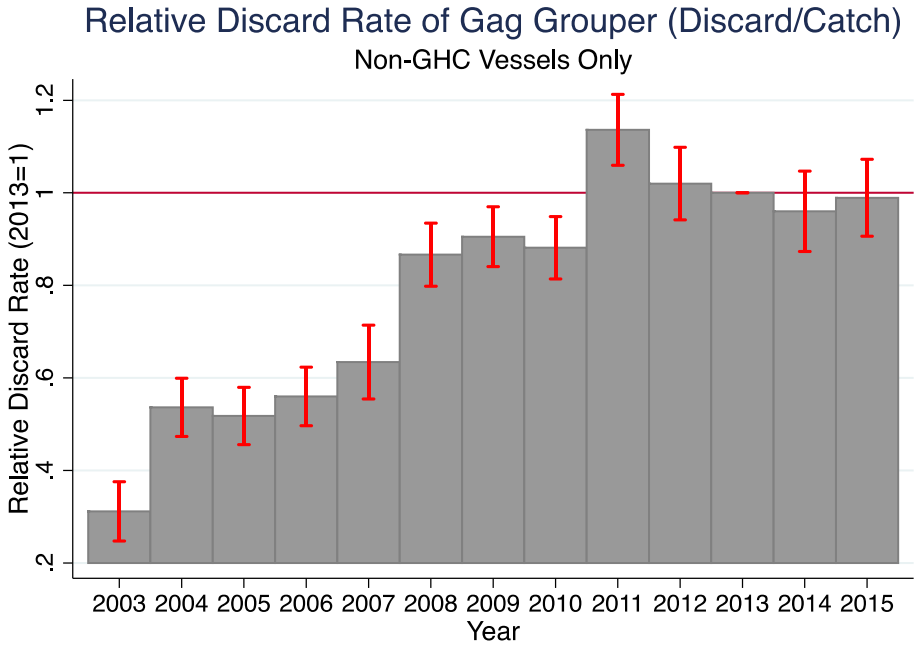

Figure 22: Relative gag grouper discard rates for non-GHC vessels. This is from a regression using week/region data. The dependent variable is weekly gag

discards divided by catch. Data are censored if there are less than two or fewer vessels operating with gag catch in that week. The regression is weighted by the number of trips by non-GHC vessels in that week/region.

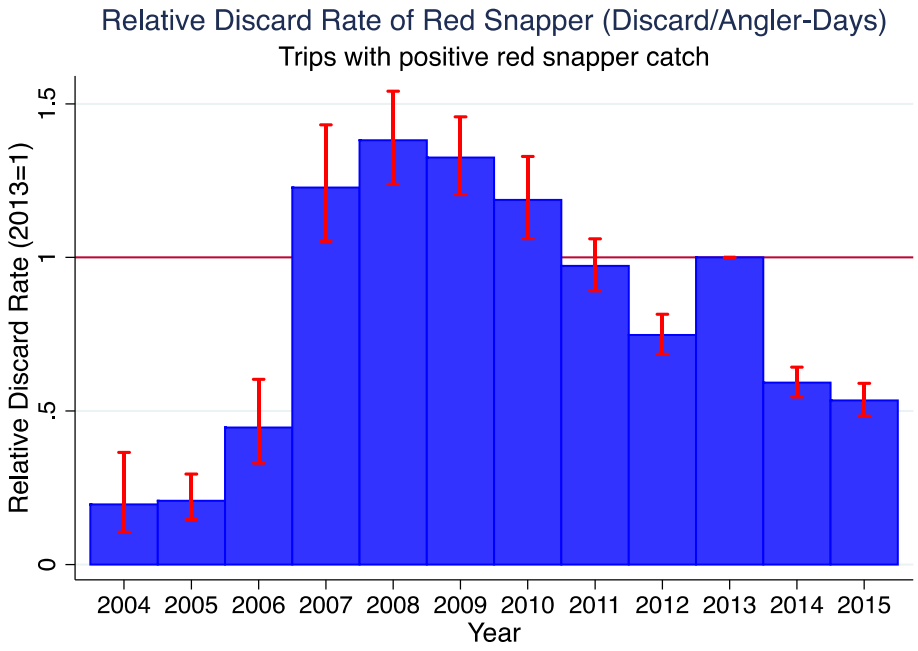

Figure 23: Relative red snapper discard rates for GHC vessels. Estimates are incidence rates derived from annual dummy variables in a Poisson regression of trip-level total red snapper discards, using trip angler-days as an exposure variable. Vessel fixed effects are included as controls. The red whiskers indicate 95% confidence intervals using robust standard errors.

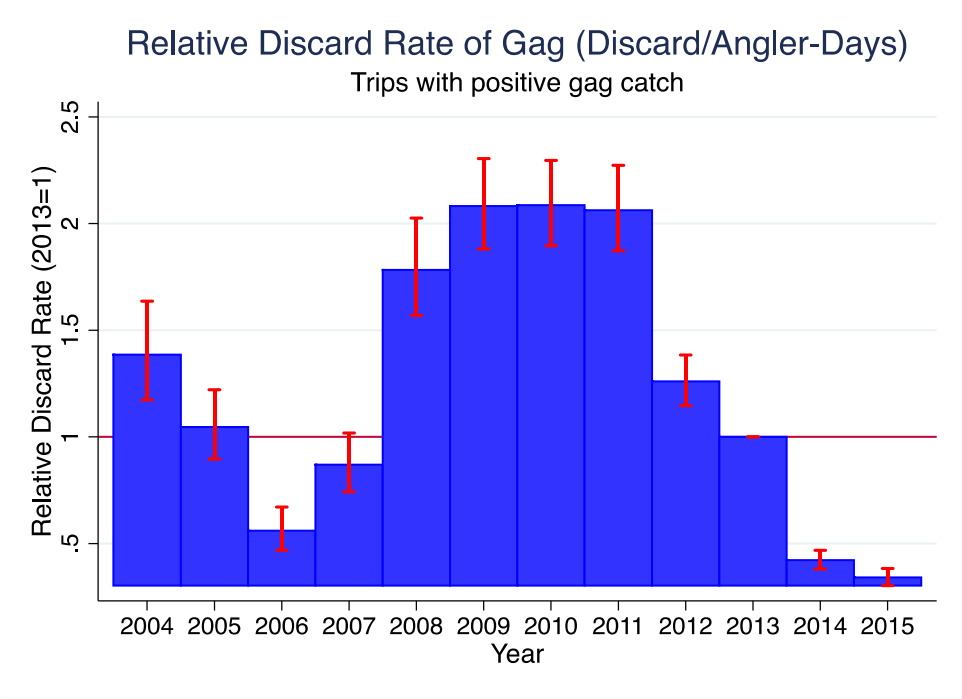

Figure 24: Relative gag grouper discard rates for GHC vessels. Estimates are incidence rates derived from annual dummy variables in a Poisson regression of trip-level total red snapper discards, using trip angler-days as an exposure variable. Vessel fixed effects are included as controls. The red whiskers indicate 95% confidence intervals using robust standard errors.

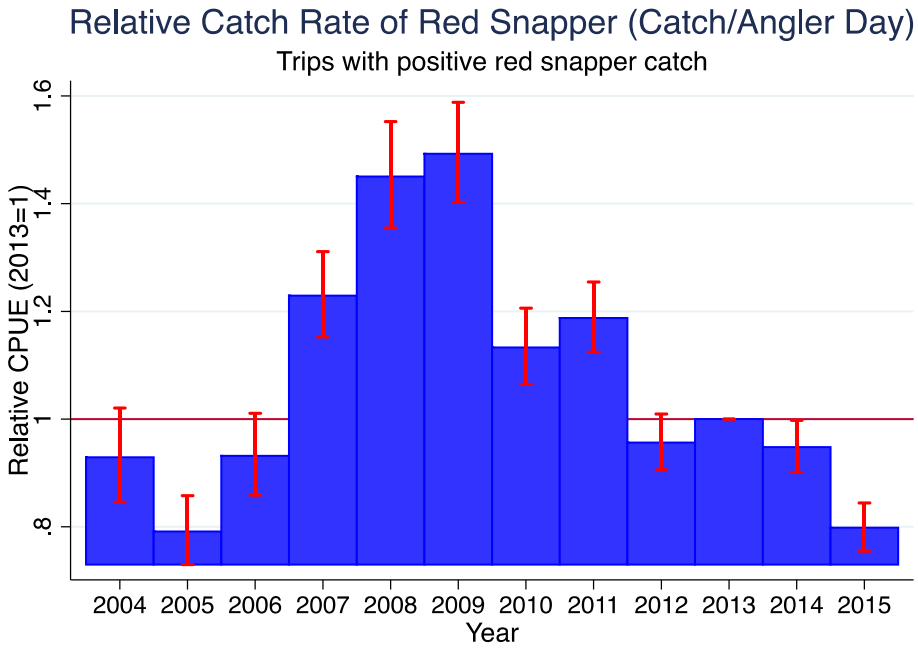

Figure 25: Relative red snapper catch rates per angler for GHC vessels. Estimates are incidence rates derived from annual dummy variables in a truncated Poisson regression of trip-level total red snapper catch, using trip angler-days as an exposure variable. Vessel fixed effects are included as controls. The red whiskers indicate 95% confidence intervals using robust standard errors.

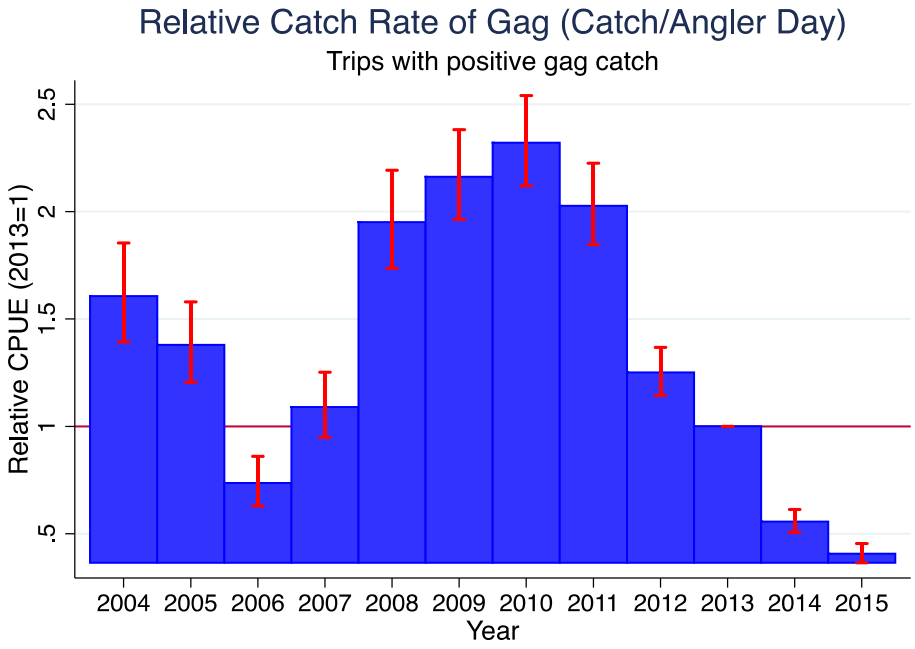

Figure 26: Relative gag catch rates per angler for GHC vessels. Estimates are incidence rates derived from annual dummy variables in a truncated Poisson regression of trip-level total gag catch, using trip angler-days as an exposure variable. Vessel fixed effects are included as controls. The red whiskers indicate 95% confidence intervals using robust standard errors.

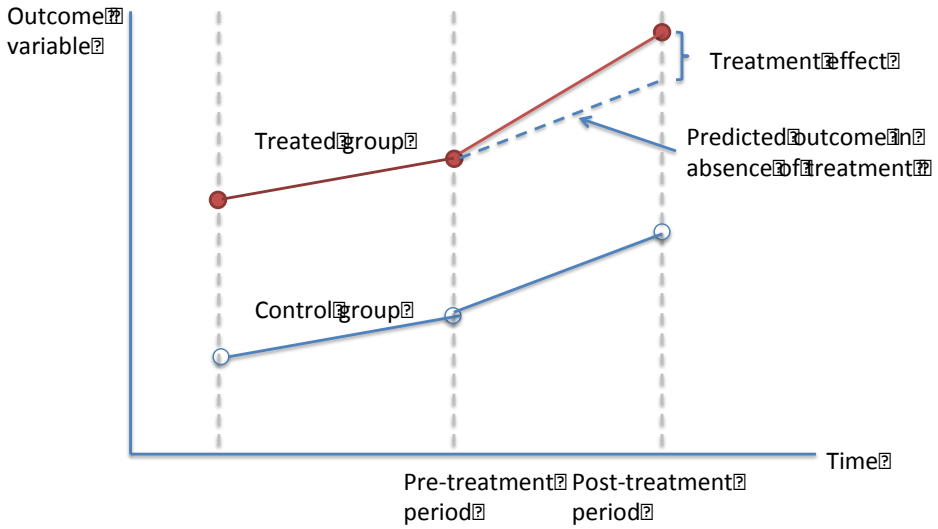

Figure 27: Illustration of the logic of the difference-in-difference estimator for estimating the treatment effect of a policy intervention. Note that the estimation of the treatment effect is predicated on the assumption that the treatment and control groups would have experienced the same trend in the

absence of the treatment (blue dashed line). In this hypothetical case this assumption is supported by evidence from the initial period.

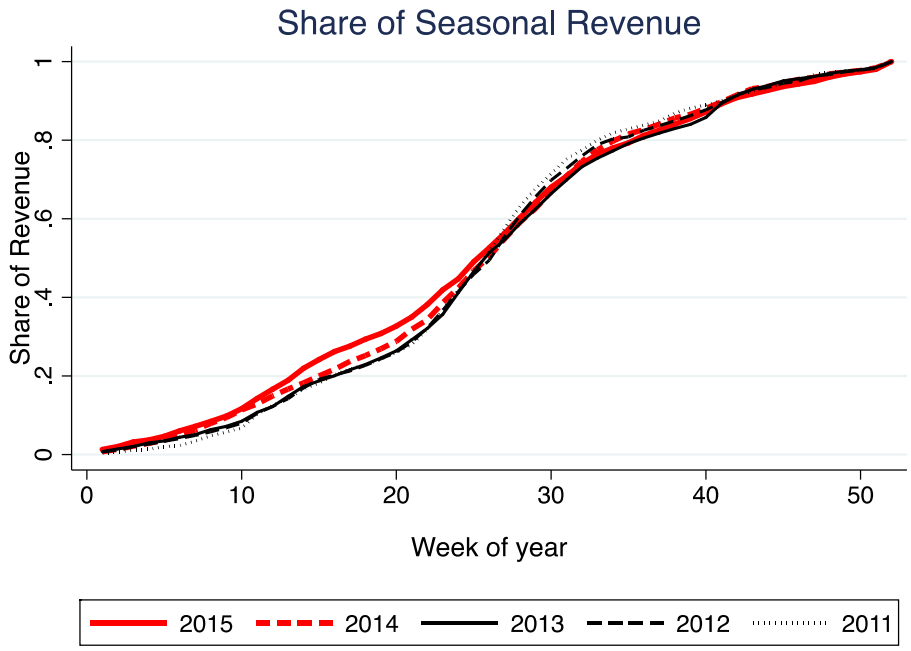

Figure 28: Cumulative share of seasonal revenues for 2014 GHC vessels.

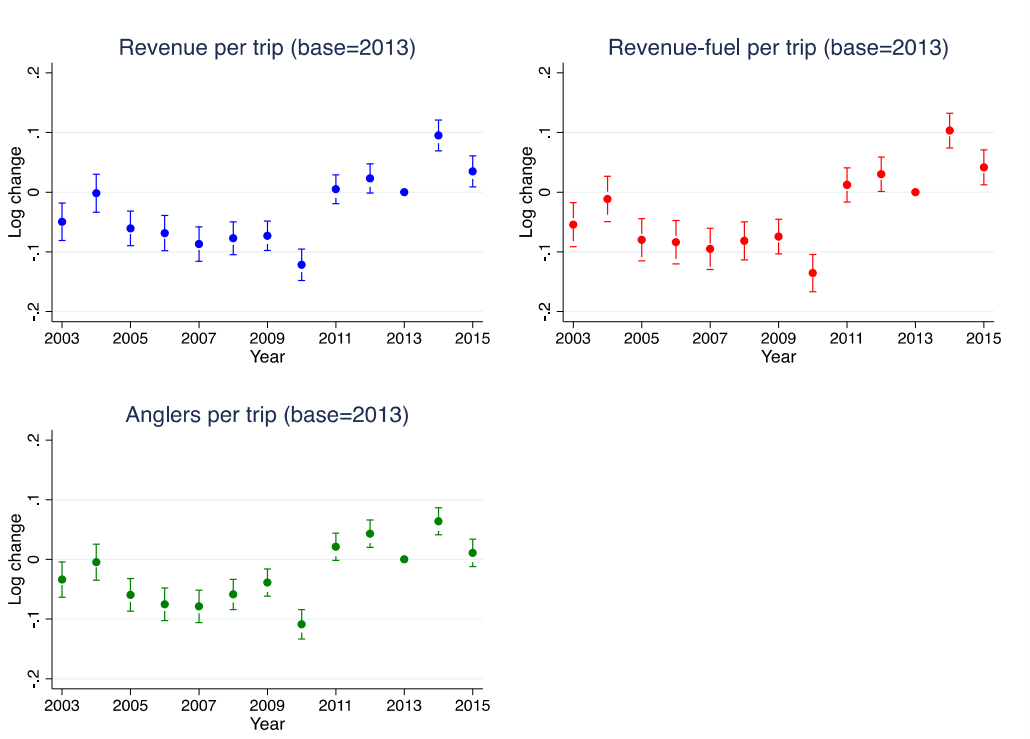

Figure 29: Estimates of annual dummy variables from regressions of trip-level revenues, revenues minus fuel, and anglers per trip on vessel fixed effects. The sample is for 2014 GHC vessels only. The fixed effects control for time constant differences (i.e. capacity) to examine if vessels, on average, see increases or decreases in revenues and anglers per trip. The whiskers indicate 95% confidence intervals using robust standard errors.

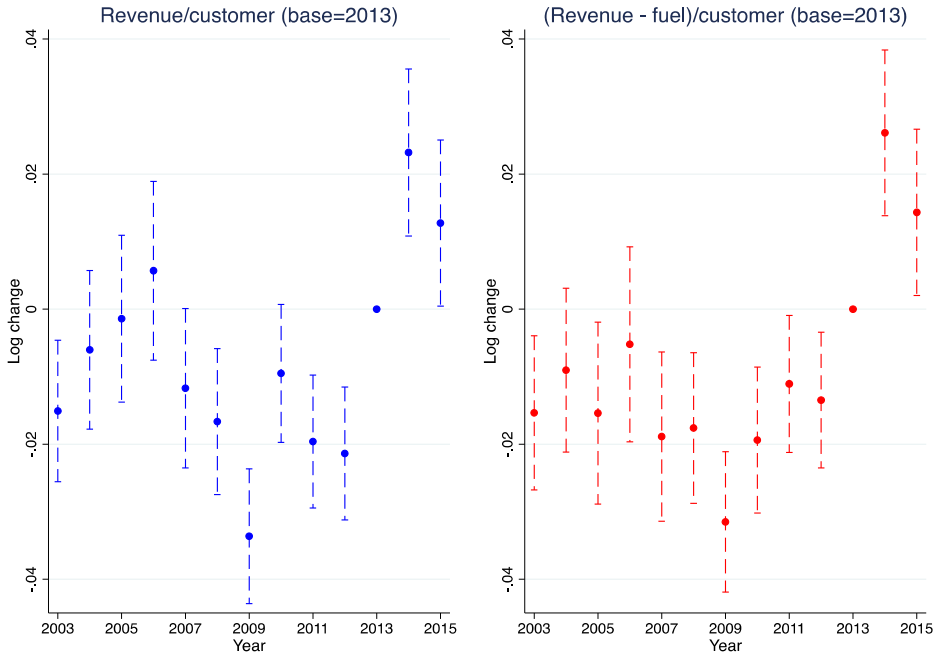

Figure 30: Change in average revenue per customer and average revenue minus fuel costs per customer (relative to a base year of 2013). Results are from regressions of logged revenue per customer and revenue minus fuel costs per customer at the trip level. The regression includes vessel fixed effects. Each regression is weighted by the number of passengers per trip. The whiskers indicate 95% confidence intervals using robust standard errors.

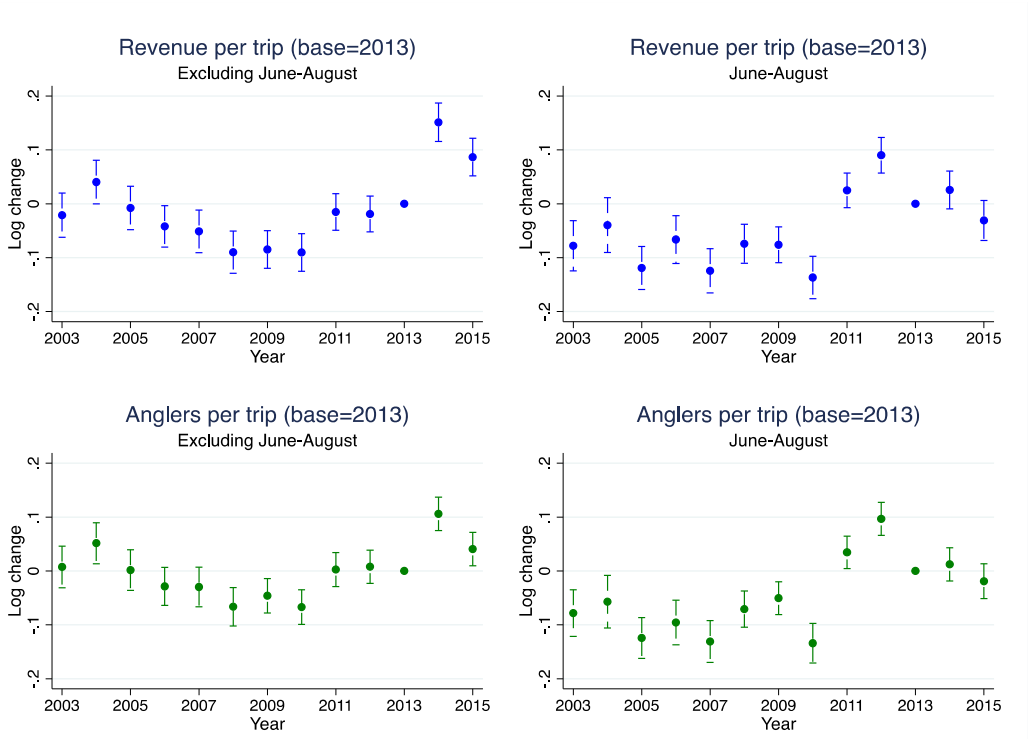

Figure 31: Changes in average revenues per trip and anglers per trip on 2014 GHC vessels for the peak summer season (right column) vs. the rest of the season (left column). Estimation is done as in Figure 29

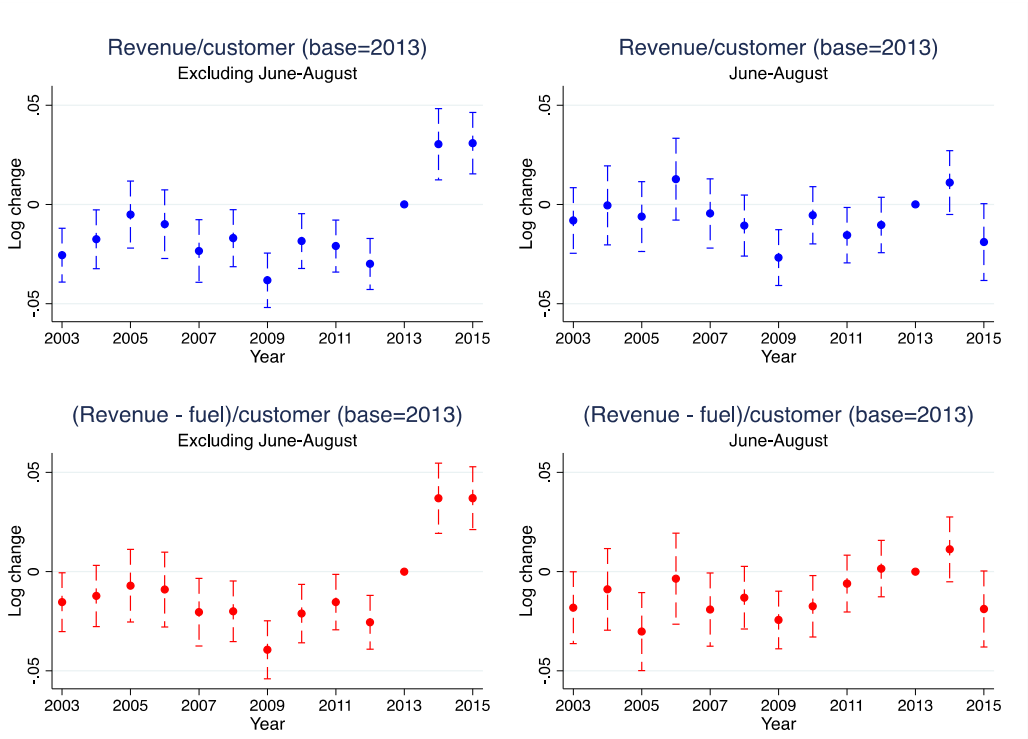

Figure 32: Change in average revenue and average revenue minus fuel costs per customer (relative to a base year of 2013) for the peak summer season (right column) vs. the rest of the season (left column). Estimates are derived as in Figure 30.

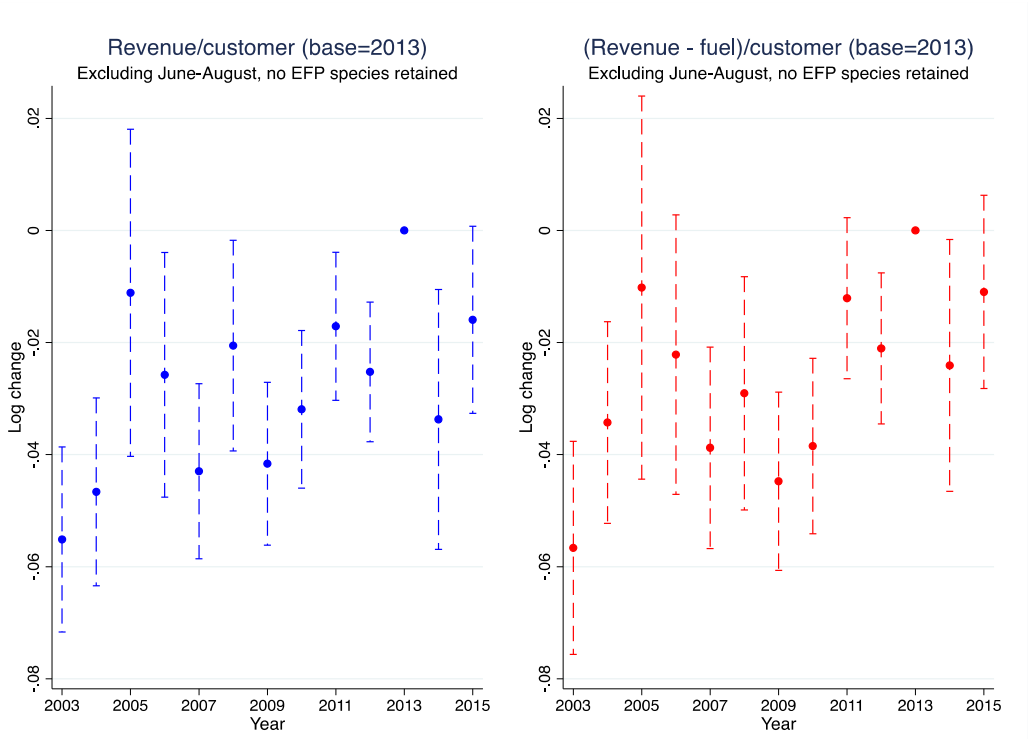

Figure 33: Change in average revenue (left) and average revenue minus fuel costs (right) per customer (relative to a base year of 2013) for non-summer trips in which EFP species are not retained. Estimates are derived as in Figure 30.

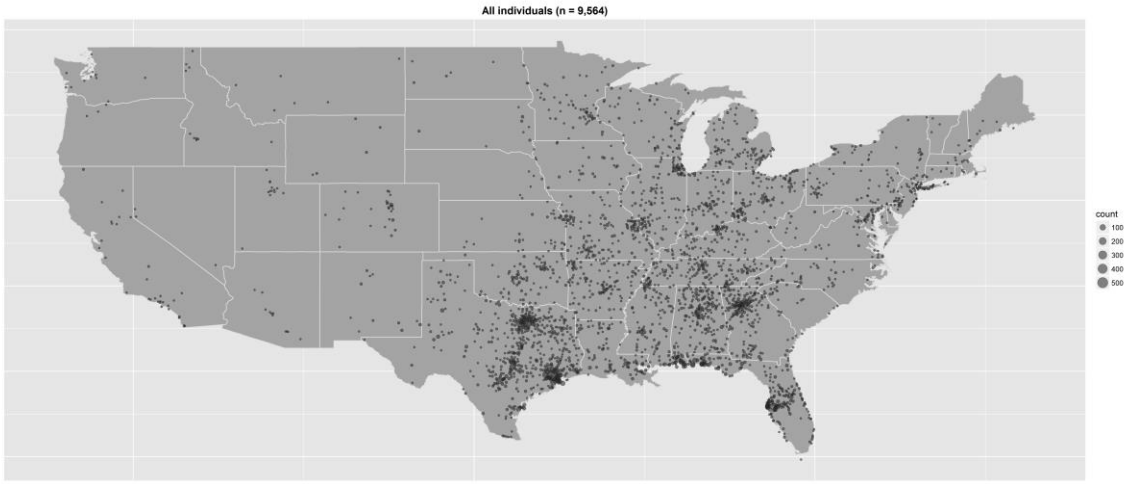

Figure 34: Spatial distribution of respondents to the headboat angler intercept survey.

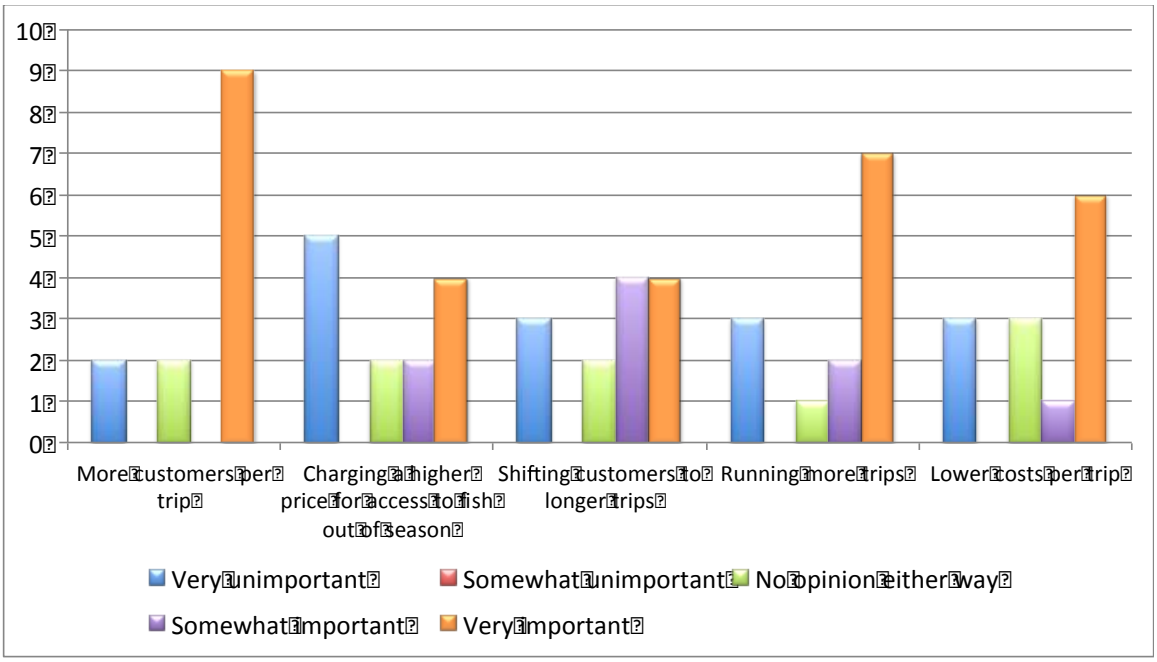

Figure 35: Headboat owner's assessment of the importance of different potential contributors to increased 2014 profits under the GHC.

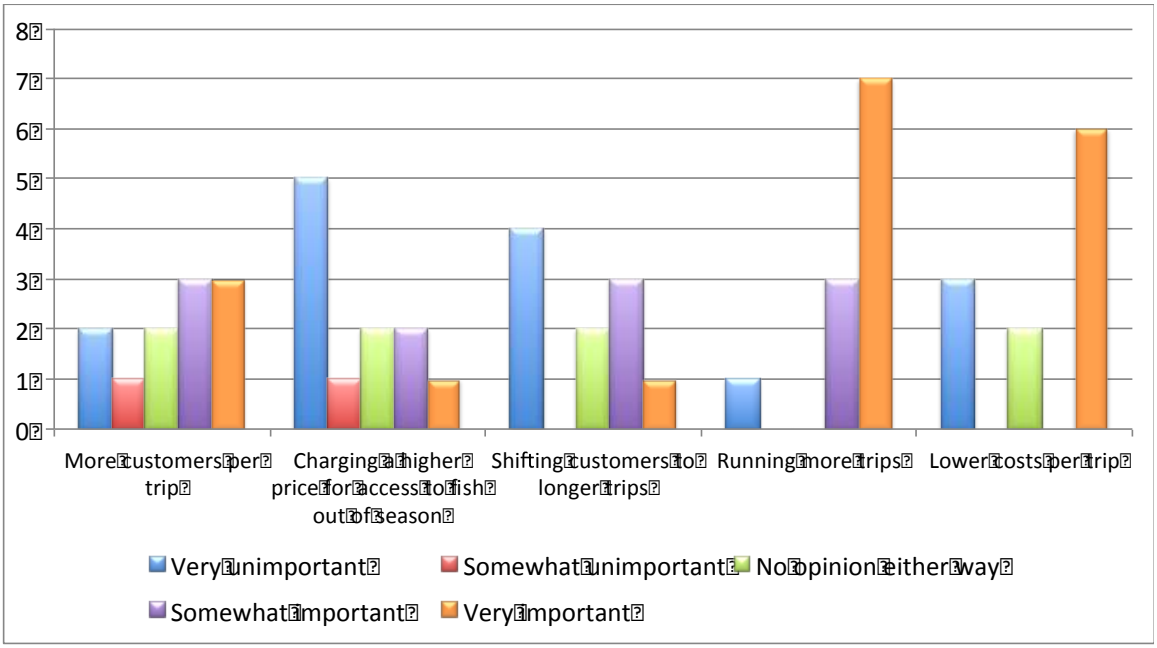

Figure 36: Headboat owner's assessment of the importance of different potential contributors to increased 2015 profits under the GHC.

Appendix 1: Placebo Tests of non-GHC vs. GHC vessels

In order to test the assumption of common trends that is required to utilize a difference-in-differences approach, we exploit the fact that we have several years of data available for both the treatment (GHC) and potential control (non-GHC) groups. We aggregate the trip-level data for GHC vessels by the week and region to make it comparable to the aggregate data for the non-GHC. Then we pool these data and estimate the following regression:

$$q_{ywi} = \alpha_0 + \alpha_1 EFP_i + \beta_w + \gamma_w EFP_i + \delta_y + \theta_y EFP_i + \epsilon_{ywi}$$

where y indicates year, w indicates week of the year, and $i = 0,1$ is an indicator for whether an observation represents non-GHC or GHC vessels. $EFP_i = 1$ if the data belongs to the GHC group. We therefore regress our outcome variables on an indicator for the GHC group, weekly dummy variables, an interaction between weekly dummy variables and the GHC indicator, annual dummy variables, and a series of interactions between yearly dummy variables and the EFP indicator.

We estimate these regressions separately for each region. This estimation approach, combined with the interactions between weekly indicators and the EFP dummy creates a very flexible specification that allows for different annual and weekly trends by region and distinct within-season trends between GHC and non-GHC vessels. We estimate the regression using 2013, the last year before the EFP was implemented, as the omitted baseline year. This implies that the mean difference in outcome between the two groups in 2013 is captured by α_1. In order for the assumption of parallel trends to be validated by historical data, we would like to see estimates for the θ_y in pre-2013 be small and statistically insignificant – indicating that the gap between the treatment and control groups captured by α_1 remains consistent over time.

Figures A1 to A3 plot the estimates of θ_y for regressions of the logarithm of weekly trips, average anglers per trip, and average angler-days per trip.[38] The regressions utilize cluster-robust standard errors (Cameron and Miller 2015), with clusters defined at the year-by-month level. This accounts for potential serial correlation between weeks (Bertrand, Duflo, and Mullainathan 2004) as well as contemporaneous correlation between GHC and non-GHC vessels in the same region.

The results show that there are many cases where there are alarming instabilities in the temporal trends of GHC and non-GHC vessels, with many cases of large and statistically significant gaps in their trends relative to 2013 levels. While instabilities in the first few years of the sample might be less indicative of current relationships (and may perhaps be prone to changes in the composition of the GHC and non-GHC groups before 2008), there are many cases of significant violations of the parallel trends assumption in the 2010-2012 period. Overall, these results suggest that there is little evidence in recent history to support the common trends

[38] Regressions estimated on non-logged data yielded similar results.

assumption – and therefore no basis in fact for comparing outcome variables between the GHC and non-GHC vessels immediately before and after the EFP.

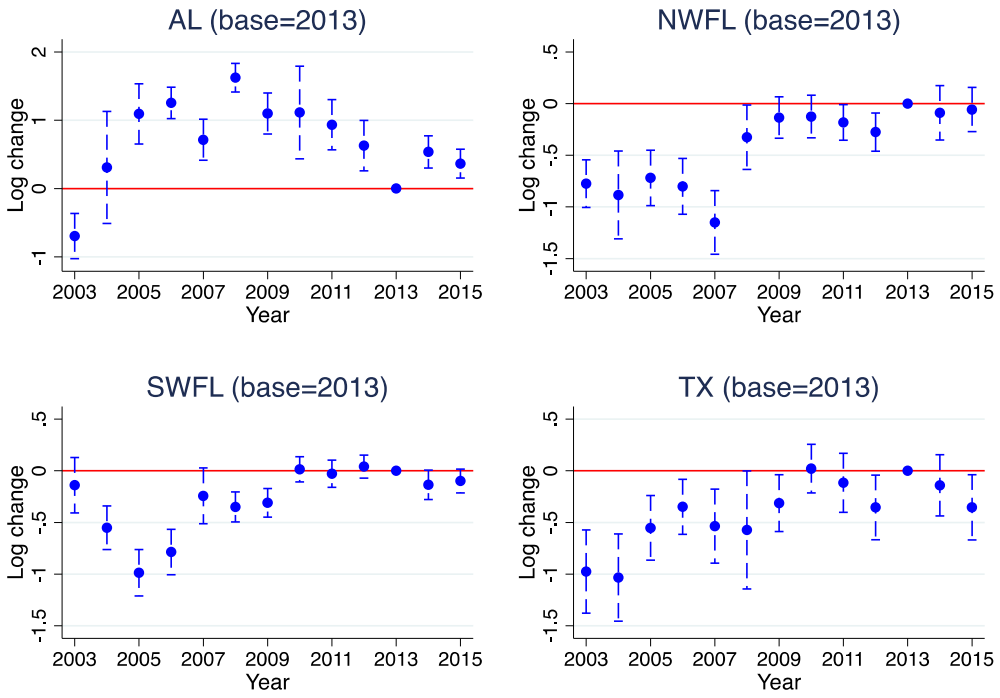

Figure A1: Estimation of the difference in annual trends in the logarithm of trips per week between GHC and non-GHC vessels (base=2013). 95% confidence intervals use cluster-robust standard errors with clustering at the year-month level.

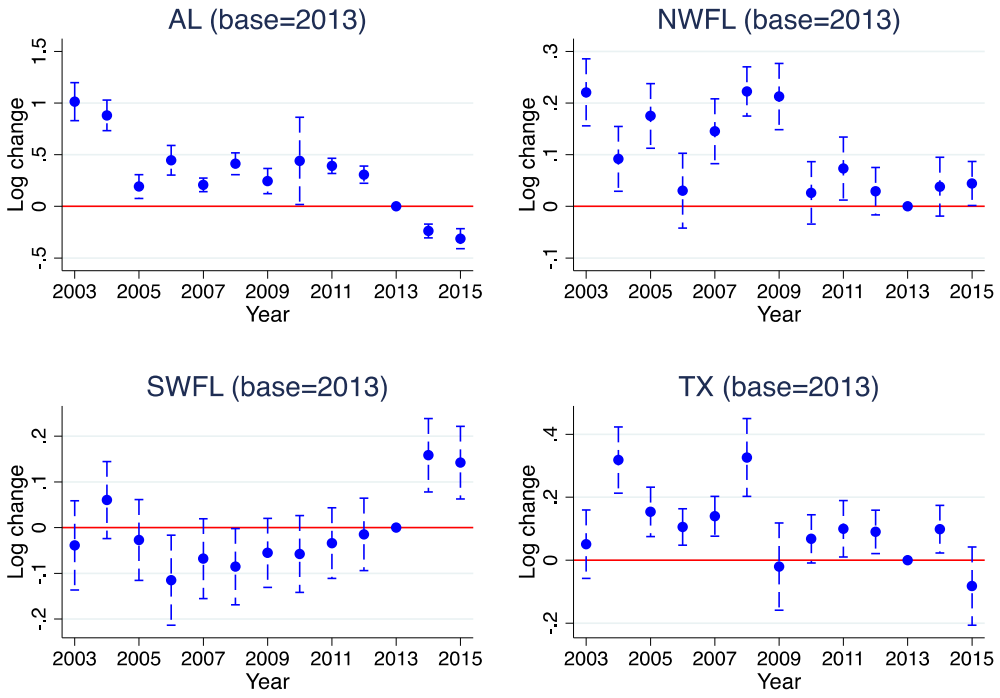

Figure A2: Estimation of the difference in annual trends in the logarithm of anglers per trip between GHC and non-GHC vessels (base=2013). 95% confidence intervals use cluster-robust standard errors with clustering at the year-month level. The regression is weighted by the number of trips for that particular group/week.

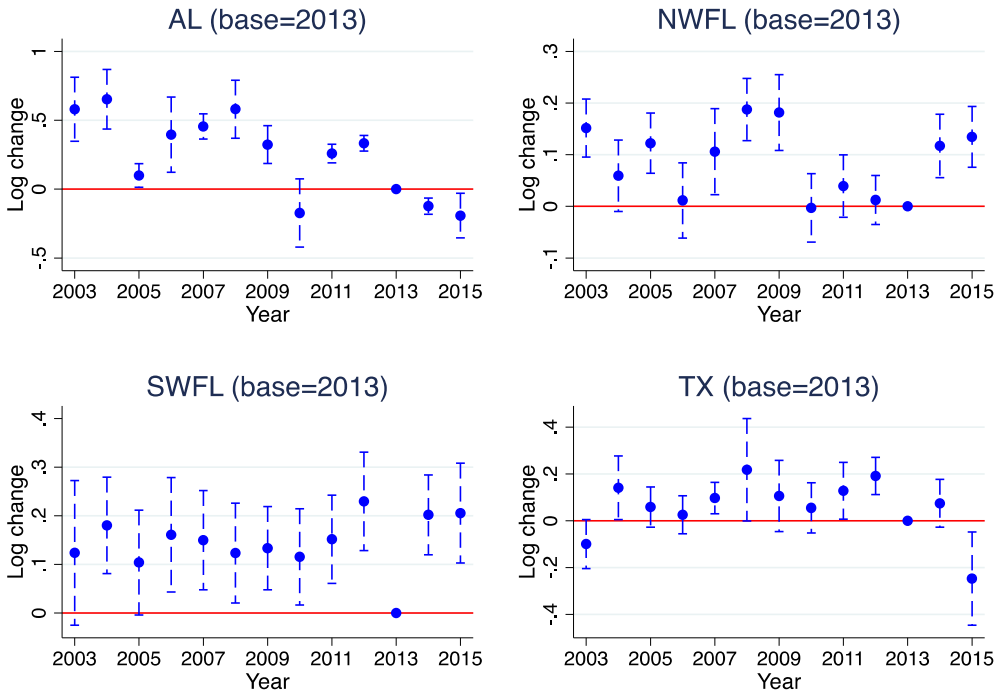

Figure A3: Estimation of the difference in annual trends in the logarithm of angler-days per trip between GHC and non-GHC vessels (base=2013). 95% confidence intervals use cluster-robust standard errors with clustering at the year-month level. The regression is weighted by the number of trips for that particular group/week.

Appendix 2: Intercept Survey of Headboat Anglers

GULF OF MEXICO HEADBOAT ANGLER SURVEY

Please take 3 to 5 minutes to answer the following questions. This survey is being conducted to understand angler experiences in the Gulf of Mexico. Your participation is completely voluntary. If you prefer not to answer a question, feel free to skip it and go on to the next question. The information you provide will only be used for research purposes. All responses are confidential. No one will be identified in any reports coming out of the survey.

This survey research is being conducted by Joshua Abbott (Arizona State University). If you have any questions about this research, please contact me at joshua.k.abbott@asu.edu. If you have any questions about your rights as a participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU Office of Research Integrity and Assurance, at (480) 965-6788.

By continuing to the survey, I acknowledge that I am at least 18 years old, have read the above information, and provide my consent to participate under the terms above.

---

1. Today's date: month_____/day_____/year_____

2. Current time: _____:_____ am/pm

3. Name of the company/boat: _____ /_____

4. Duration of fishing trip (to nearest hour): _____ hours

5. Counting yourself, how many people were in your personal fishing group today?

		people

6. How many years have you been saltwater fishing?

		years

7. How often do you go offshore saltwater fishing in a typical year?
□ Less than once □ 1-2 times □ 3-6 times □ More than 6 times a year

8. Do you own a boat that is capable of fishing in the Gulf of Mexico (including nearshore fishing)?
□ Yes □ No

9. How many nights away from home (if any) are you spending on this trip?

		nights

10. Are you a repeat customer of this company? □ Yes □ No □ Don't know

11. What is the primary purpose of your trip?
□ This fishing trip □ Beach recreation □ Visiting family □ Other (specify)_____

12. How far in advance did you book today's fishing trip?
□ A week or less □ More than a week but less than a month □ More than a month

13. How much did you pay per person in fees and tips for today's trip?
Fee_____ Tips_____

14. Did you pay an additional surcharge for red snapper or gag grouper that you landed (Y/N)? If so, how much did you pay per fish? _____

15. By species (if possible) how many fish did you personally catch and keep on today's trip?

Species	# caught	# kept
Red snapper		
Gag grouper		
All other catch		

16. How satisfied are you with today's fishing experience?
□ Very satisfied □ Satisfied □ Neutral □ Dissatisfied □Very dissatisfied

Comments_____

_____

17. What is your gender? □ Male □ Female

18. What year were you born? 1 9 | | |

19. What is the 5 digit US zip code (or country) of your place of residence? | | | | | |

20. What was your household's total income before taxes in 2013?
□ Less than $24,999 □ $75,000 - $99,999 □ $150,000 - $199,999
□ $25,000 - $49,999 □ $100,000 - $124,999 □ $200,000 - $249,999
□ $50,000 - $74,999 □ $125,000 - $149,999 □ Greater than $250,000

Thank you for your participation! If possible, we would like to contact you via email to complete a brief internet questionnaire about your opinions on today's fishing experience. Please provide an email below where we can contact you. Your email will be kept confidential, will not be given

away or sold to anyone, and will not be used for marketing by any company. *By providing an email, you are providing your consent for us to contact you for this follow-up internet survey.*

Email (please print): _____@_____

Appendix 3: Survey of Headboat Owners

The following is a PDF printout of the web survey taken by GHC vessel owners in 2015 and 2016 for the 2014 and 2015 seasons. Given that the survey was developed as an online survey in Qualtrics software, this printout differs somewhat in its formatting from the online version and also includes programming field codes where information previously supplied by the respondent would be "piped" into the survey.

Introduction

Gulf Headboat Collaborative: Owner Survey for 2015 Season

The following questions will ask you about your experience in the 2015 fishing season, with a focus on the pricing of trips and your business costs. Before you respond to this survey, you should make sure you have the necessary financial information on the following topics. The survey will include questions on:

Trip characteristics and pricing
Fuel use and costs
Bait use and costs
Ice use and costs
Captain and crew costs
Fixed costs

The survey may take 45 minutes to an hour to complete.
If you prefer not to answer a particular question, feel free to skip it and go on to the next question. The information you provide will only be used for research purposes. The data, arising from this interview will be kept confidential. This survey research is being conducted by Joshua Abbott of Arizona State University. If you have any questions about this research, please contact me at joshua.k.abbott@asu.edu.

If you have any questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU Office of Research Integrity and Assurance, at (480) 965-6788.

ASU Arizona State University

This survey will ask you questions about vessels that you operated as headboats in federal waters fisheries in the Gulf of Mexico in 2015. This will include questions about vessels that are participating in the Gulf Headboat Collaborative, as well as headboat vessels that are not participating. In the case of your business we will be asking you questions about the following vessels:

Boat 1: ${e://Field/Vessel%201}
Boat 2: ${e://Field/Vessel%202}
Boat 3: ${e://Field/Vessel%203}

Please note that if you operated fewer than 3 vessels as headboats, then one or more vessels above will be listed as "N/A". Throughout the survey please leave data fields corresponding with "N/A" vessels blank.

If you did not operate these vessels as headboats in 2015 then please terminate the survey and contact me at joshua.k.abbott@asu.edu so that I can fix the problem before you complete the survey.

Trip Characteristics

In the table below, please provide a length (in hours) and brief description (species, season, etc.) of the different types of trips you provided using these vessels in 2015:

Boat 1: ${e://Field/Vessel%201}
Boat 2: ${e://Field/Vessel%202}
Boat 3: ${e://Field/Vessel%203}

Please consider a unique trip "type" as the combination of a trip duration (average length in hours) and the price paid by a fishing customer. Therefore, if you offered your customers two different trips of the same length but for different prices (due to seasonality, species targeted, etc.) then please consider these as separate trip types below.

For each trip type, please indicate the price per head you charged for fishing customers, children and non-fishing customers in 2015 (leave a field blank if you did not charge a different price for non-fishing passengers or children).

Note: Please only include the base fee. If there were additional add-on charges or different prices for trips retaining red snapper or gag then you will be asked about these in subsequent questions.

	Length (hours)	Description (Unlimited length)	Price: Fishing passengers	Price:Non-fishing passengers	Price:Children
Trip type 1					
Trip type 2					
Trip type 3					
Trip type 4					
Trip type 5					
Trip type 6					
Trip type 7					

For each trip type defined above, which vessel(s) did you use to conduct each trip in 2015?

	Headboat Vessels		
	${e://Field/Vessel%201}	${e://Field/Vessel%202}	${e://Field/Vessel%203}
Trip type 1, ${q://QID3/ChoiceTextEntryValue/8/1}hrs, ${q://QID3/ChoiceTextEntryValue/8/2}	☐	☐	☐

Trip type 2. ${q://QID3/ChoiceTextEntryValue/26/1}hrs, ${q://QID3/ChoiceTextEntryValue/26/2}	☐	☐	☐
Trip type 3. ${q://QID3/ChoiceTextEntryValue/27/1}hrs, ${q://QID3/ChoiceTextEntryValue/27/2}	☐	☐	☐
Trip type 4. ${q://QID3/ChoiceTextEntryValue/22/1}hrs, ${q://QID3/ChoiceTextEntryValue/22/2}	☐	☐	☐
Trip type 5. ${q://QID3/ChoiceTextEntryValue/28/1}hrs, ${q://QID3/ChoiceTextEntryValue/28/2}	☐	☐	☐
Trip type 6. ${q://QID3/ChoiceTextEntryValue/29/1}hrs, ${q://QID3/ChoiceTextEntryValue/29/2}	☐	☐	☐
Trip type 7. ${q://QID3/ChoiceTextEntryValue/30/1}hrs, ${q://QID3/ChoiceTextEntryValue/30/2}	☐	☐	☐

At any point in the 2015 season did you charge customers a different price *per trip* for trips targeting red snapper or gag outside of the regular open season compared to trips not retaining these species?

Note: Answer "yes" only if *all* fishing passengers on these trips paid the different charge. Do not answer yes if you allowed specific anglers on a trip to pay extra in order to retain red snapper or have an enhanced bag limit.

- ○ Yes
- ○ No

If so please describe the pricing below, including:

1) Specific $ amounts	
2) The time of season in which you used this pricing	
3) Whether you continued the pricing throughout the year or discontinued it (and why)	
4) How your customers reacted to it.	

At any point in the 2015 season did you charge individual customers on trips an additional fee in order to retain red snapper or gag?

Note: Do not answer "yes" if *all* adult fishing customers on a trip paid the same price (i.e. a "red snapper trip"). Answer "yes" only if you allowed *individual* anglers to effectively purchase the right to retain red snapper over and above the baseline bag limit you set for the trip.

- ○ Yes
- ○ No

If so please describe the pricing below:

1) Specific $ amounts	
2) The time of season in which you used this pricing	
3) Whether you continued the pricing through the year or discontinued it (and why)	
4) How your customers reacted to it	

Can you provide some insight into your decision not to raise prices for trips retaining red snapper or gag out of season? What specific reasons did you have for not altering your trip pricing?

Fuel use & costs

The following questions will ask you about your usage of inputs (i.e. fuel, bait, etc.) and the associated costs for each trip type in the 2015 season.

Fuel use & costs

Please report your average fuel use per trip type and vessel in 2015

	Fuel use (gallons per trip) ${e://Field/Vessel%201}	Fuel use (gallons per trip) ${e://Field/Vessel%202}	Fuel use (gallons per trip) ${e://Field/Vessel%203}
Trip type 1, ${q://QID3/ChoiceTextEntryValue/8/1}hrs, ${q://QID3/ChoiceTextEntryValue/8/2}			
Trip type 2, ${q://QID3/ChoiceTextEntryValue/26/1}hrs, ${q://QID3/ChoiceTextEntryValue/26/2}			
Trip type 3, ${q://QID3/ChoiceTextEntryValue/27/1}hrs, ${q://QID3/ChoiceTextEntryValue/27/2}			
Trip type 4, ${q://QID3/ChoiceTextEntryValue/22/1}hrs, ${q://QID3/ChoiceTextEntryValue/22/2}			
Trip type 5, ${q://QID3/ChoiceTextEntryValue/28/1}hrs, ${q://QID3/ChoiceTextEntryValue/28/2}			
Trip type 6, ${q://QID3/ChoiceTextEntryValue/29/1}hrs, ${q://QID3/ChoiceTextEntryValue/29/2}			
Trip type 7, ${q://QID3/ChoiceTextEntryValue/30/1}hrs, ${q://QID3/ChoiceTextEntryValue/30/2}			

How, if at all, did your fuel usage per trip change in 2015 compared to in 2014?

- Increased
- No change
- Decreased

To what factors do you attribute these changes in fuel usage? Has participation in the Gulf Headboat Collaborative influenced your fuel usage in a noticeable way? How?

Please provide the average price per gallon of fuel you paid ($/gal, tax included) in your busiest winter/spring (Jan-Apr), summer (May-Aug), and fall (Sept-Dec) month in 2015

	$/gallon
Winter/Spring	
Summer	
Fall	

Please describe any challenges or difficulties you faced in answering the preceding questions about fuel usage and costs

Bait usage and costs

Bait usage and costs

Please list the most important types of bait you used in 2015 along with their average price per pound.

	Click to write Column 3	Fresh/Frozen		Click to write Column 2
	Type/Species	Fresh	Frozen	Price per pound
Bait type 1				
Bait type 2				
Bait type 3				
Bait type 4				
Bait type 5				
Bait type 6				
Bait type 7				

Please include any comments in the box below

When you are loading the vessel with bait, do you vary the amount of bait based upon the number of customers, or do you use the same amount of bait regardless of the number of customers?

- I scale bait usage with the number of customers
- I use the same amount of bait regardless of the number of customers

For each trip type defined above, how much (in pounds) of each kind of bait do you use (on average) per customer? [Leave boxes that are not applicable blank]

	Bait type 1 ${q://QID23%231/ChoiceTextEntryValue/1/1}	Bait type 2 ${q://QID23%231/ChoiceTextEntryValue/2/1}	Bait type 3 ${q://QID23%231/ChoiceTextEntryValue/3/1}	Bait type 4 ${q://QID23%231/ChoiceTextEntryValue/4/1}	Bait type 5 ${q://QID23%231/ChoiceTextEntryValue/5/1}	Bait type 6 ${q://QID23%231/ChoiceTextEntryValue/6/1}	Bait type 7 ${q://QID23%231/ChoiceTextEntryValue/7/1}
Trip type 1, ${q://QID3/ChoiceTextEntryValue/8/1}hrs, ${q://QID3/ChoiceTextEntryValue/8/2}							
Trip type 2, ${q://QID3/ChoiceTextEntryValue/26/1}hrs, ${q://QID3/ChoiceTextEntryValue/26/2}							
Trip type 3, ${q://QID3/ChoiceTextEntryValue/27/1}hrs, ${q://QID3/ChoiceTextEntryValue/27/2}							
Trip type 4, ${q://QID3/ChoiceTextEntryValue/22/1}hrs, ${q://QID3/ChoiceTextEntryValue/22/2}							
Trip type 5, ${q://QID3/ChoiceTextEntryValue/28/1}hrs, ${q://QID3/ChoiceTextEntryValue/28/2}							
Trip type 6, ${q://QID3/ChoiceTextEntryValue/29/1}hrs, ${q://QID3/ChoiceTextEntryValue/29/2}							
Trip type 7, ${q://QID3/ChoiceTextEntryValue/30/1}hrs, ${q://QID3/ChoiceTextEntryValue/30/2}							

How, if at all, did your bait use per trip change in 2015 compared to in 2014?

- Increased
- No change
- Decreased

To what factors do you attribute these changes in bait use? Has participation in the Gulf Headboat Collaborative influenced this in a noticeable way? How?

Please describe any challenges or difficulties you faced in answering the preceding questions about bait usage and costs

Ice usage & costs

Ice usage & costs

Please describe the units of measurement for ice (i.e., How are you charged for it? By the pound?)

Given the units you described above, please provide the average unit price of ice that you paid in 2015.

Average unit price

Using the units indicated above, please indicate the average amount of ice you used for each trip type in 2015

	Ice quantity
Trip type 1, ${q://QID3/ChoiceTextEntryValue/8/1}hrs, ${q://QID3/ChoiceTextEntryValue/8/2}	
Trip type 2, ${q://QID3/ChoiceTextEntryValue/26/1}hrs, ${q://QID3/ChoiceTextEntryValue/26/2}	
Trip type 3, ${q://QID3/ChoiceTextEntryValue/27/1}hrs, ${q://QID3/ChoiceTextEntryValue/27/2}	
Trip type 4, ${q://QID3/ChoiceTextEntryValue/22/1}hrs, ${q://QID3/ChoiceTextEntryValue/22/2}	
Trip type 5, ${q://QID3/ChoiceTextEntryValue/28/1}hrs, ${q://QID3/ChoiceTextEntryValue/28/2}	
Trip type 6, ${q://QID3/ChoiceTextEntryValue/29/1}hrs, ${q://QID3/ChoiceTextEntryValue/29/2}	
Trip type 7, ${q://QID3/ChoiceTextEntryValue/30/1}hrs, ${q://QID3/ChoiceTextEntryValue/30/2}	

Please describe any challenges or difficulties you faced in answering the preceding questions about ice usage and costs

Captain Costs

Captain Costs

How many crewmembers and captains (not double-counting for turnover) have you employed on all the headboats in this survey in 2015?

0 Captains

0 Crew

Captain Costs

How are captains compensated on your headboat vessels?

	Compensation				If other is selected, please explain
	Salary	Payment per trip	Neither (captain is owner operator)	Other (please explain in next column)	Explanation
${e://Field/Vessel%201}					
${e://Field/Vessel%202}					
${e://Field/Vessel%203}					

Please provide the captain's compensation per trip ($) below (please only report this for vessels with per-trip compensation)

	${e://Field/Vessel%201}	${e://Field/Vessel%202}	${e://Field/Vessel%203}
» **Trip type 1**, ${q://QID3/ChoiceTextEntryValue/8/1}hrs, ${q://QID3/ChoiceTextEntryValue/8/2}			
» **Trip type 2**, ${q://QID3/ChoiceTextEntryValue/26/1}hrs, ${q://QID3/ChoiceTextEntryValue/26/2}			
» **Trip type 3**, ${q://QID3/ChoiceTextEntryValue/27/1}hrs, ${q://QID3/ChoiceTextEntryValue/27/2}			
» **Trip type 4**, ${q://QID3/ChoiceTextEntryValue/22/1}hrs, ${q://QID3/ChoiceTextEntryValue/22/2}			
» **Trip type 5**, ${q://QID3/ChoiceTextEntryValue/28/1}hrs, ${q://QID3/ChoiceTextEntryValue/28/2}			
» **Trip type 6**, ${q://QID3/ChoiceTextEntryValue/29/1}hrs, ${q://QID3/ChoiceTextEntryValue/29/2}			
» **Trip type 7**, ${q://QID3/ChoiceTextEntryValue/30/1}hrs, ${q://QID3/ChoiceTextEntryValue/30/2}			

Please report the total salary payments to captains operating the headboats covered in this survey in 2015

0 dollars

Please describe any challenges or difficulties you faced in answering the preceding questions about captain pay

Crew Costs

Crew costs

How many crew (excluding the captain) do you typically employ on each vessel?

	# crew
${e://Field/Vessel%201}	
${e://Field/Vessel%202}	
${e://Field/Vessel%203}	

How are crew (excluding the captain) compensated on your vessels?

	Salary + tips	Payment per trip + tips	Tips only
${e://Field/Vessel%201}			
${e://Field/Vessel%202}			
${e://Field/Vessel%203}			

Roughly, what percentage of the crew's total pay from headboat fishing for your company comes from tips?

Roughly, what is the typical tip to crew members, measured as a percentage of the trip price?

Report the average per-trip payments to crew in 2015.

	Crew compensation per trip ($)
Trip type 1, ${q://QID3/ChoiceTextEntryValue/8/1}hrs, ${q://QID3/ChoiceTextEntryValue/8/2}	
Trip type 2, ${q://QID3/ChoiceTextEntryValue/26/1}hrs, ${q://QID3/ChoiceTextEntryValue/26/2}	
Trip type 3, ${q://QID3/ChoiceTextEntryValue/27/1}hrs, ${q://QID3/ChoiceTextEntryValue/27/2}	
Trip type 4, ${q://QID3/ChoiceTextEntryValue/22/1}hrs, ${q://QID3/ChoiceTextEntryValue/22/2}	
Trip type 5, ${q://QID3/ChoiceTextEntryValue/28/1}hrs, ${q://QID3/ChoiceTextEntryValue/28/2}	
Trip type 6, ${q://QID3/ChoiceTextEntryValue/29/1}hrs, ${q://QID3/ChoiceTextEntryValue/29/2}	
Trip type 7, ${q://QID3/ChoiceTextEntryValue/30/1}hrs, ${q://QID3/ChoiceTextEntryValue/30/2}	

Please report the total payments (not counting tips) to crew onboard the headboats covered by this survey in 2015

0 total payments

Please describe any challenges or difficulties you faced in answering the preceding questions about crew pay

Fixed costs

For each trip type/vessel, provide your best estimate of the average variable costs of taking this trip in 2015. Variable costs are any costs you incur by taking a trip that you could avoid by not taking it. They should include the costs of inputs like fuel, bait and ice as well as any additional costs of compensating the captain or crew that you bear by taking the trip.

	${e://Field/Vessel%201} -Variable Costs per trip ($)	${e://Field/Vessel%202} - Variable Costs per trip ($)	${e://Field/Vessel%203} - Variable Costs per trip ($)
Trip type 1, ${q://QID3/ChoiceTextEntryValue/8/1}hrs, ${q://QID3/ChoiceTextEntryValue/8/2}			
Trip type 2, ${q://QID3/ChoiceTextEntryValue/26/1}hrs, ${q://QID3/ChoiceTextEntryValue/26/2}			
Trip type 3, ${q://QID3/ChoiceTextEntryValue/27/1}hrs, ${q://QID3/ChoiceTextEntryValue/27/2}			
Trip type 4, ${q://QID3/ChoiceTextEntryValue/22/1}hrs, ${q://QID3/ChoiceTextEntryValue/22/2}			
Trip type 5, ${q://QID3/ChoiceTextEntryValue/28/1}hrs, ${q://QID3/ChoiceTextEntryValue/28/2}			
Trip type 6, ${q://QID3/ChoiceTextEntryValue/29/1}hrs, ${q://QID3/ChoiceTextEntryValue/29/2}			
Trip type 7, ${q://QID3/ChoiceTextEntryValue/30/1}hrs, ${q://QID3/ChoiceTextEntryValue/30/2}			

How, if at all, have these costs changed relative to 2014?

Fixed costs

Please record your annual expenses for the following categories of costs in 2015. To the extent possible, only record the costs that are attributable to your headboat business. [sum across all headboats]

	Cost in 2015
Boat payments	
Repair/maintenance	
Fishing supplies	
Tackle	
Utilities	
Slip rent	

Booking commissions	
Wages & salary for office personnel	
Insurance	
License and permit fees (state & federal)	
US Coast Guard inspections	
Office rent/ mortgage	

Please specify any difficulties associated with the calculation or documentation of these costs. Specifically, please document whether certain costs are for your overall business or for only the headboat portion of your business.

EFP Questions

Questions about fishing under the EFP in 2015

One trend we've noticed is that some Gulf Headboat Collaborative vessels have taken more full-day trips relative to half-day trips in 2015 when retaining red snapper or gag as compared to years before the EFP. Has this been an intentional shift for your operation? If so, can you explain the reasons for this change?

Did you limit customers to 1 red snapper or gag per customer on any of your headboat trips in 2015? If so, can you provide details on when you implemented this policy and when/if you discontinued it during the season? How was it received by your customers?

Did you transfer any of your red snapper or gag quota under the EFP in 2015? If so, please describe the timing (date), species, and amounts transferred. Also, please specify the price paid (whether in $ or in terms of barter).

On the whole, do you think that participating in the Gulf Headboat Collaborative enhanced the profitability of your headboat business in 2015 *relative to your profitability in 2013 and other recent years before the GHC?*

- Yes
- No
- About the same

On the whole, do you think your headboat business was more profitable in 2015 than it would have been *if you had not participated in the Gulf Headboat Collaborative in 2015*?

- Yes
- No
- About the same

Please rank the importance of the following potential sources of increased profits from fishing in the Gulf Headboat Collaborative for your business in 2015

	Very unimportant	Somewhat unimportant	No opinion either way	Somewhat important	Very important
More customers per trip					
Charging a higher price for access to fish out of season					

Shifting customers to longer trips	○	○	○	○	○
Running more trips	○	○	○	○	○
Lower costs per trip	○	○	○	○	○

Can you comment on how (if at all) participating in the Gulf Headboat Collaborative changed your way of doing business in 2015? Specifically, how did your participation alter the types of trips you provide? How did these changes affect your revenues, costs and profitability?

In 2015, were there occasions where you canceled trips due to poor weather/sea conditions?

- ○ Yes
- ○ No

For what percentage of these cancellations, would you have gone ahead with the trip in previous years?

Please provide any comments about how (if at all) participation in the Gulf Headboat Collaborative altered your decision making with respect to weather and rough seas.

Thank you for taking the time to complete this survey. Please use the following space to provide us with any other comments you have, either about the survey or your fishing experience in the Gulf Headboat Collaborative.

This concludes the survey. Thank you for your time.