Easygrants ID: 62137
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Electronic Monitoring and Reporting Grant Program 2018 - Submit Final Programmatic Report (New Metrics)
Grantee Organization: Texas A&M University - Corpus Christi
Project Title: Improving the iSnapper Mobile Application to Improve Recreational Red Snapper Fishery Reporting (TX)

Project Period	1/01/2019 - 12/31/2020
Project Location Description (from Proposal)	Gulf of Mexico
Project Summary (from Proposal)	Continue to develop and implement iSnapper, an electronic monitoring and reporting smart device application designed for private and for-hire recreational anglers to log catch and effort data in real-time, to improve the timeliness and quality of catch data in the red snapper fishery. Project will increase usage of the mobile application to 75 vessels and will monitor up to 218 trips.
Project Status and Accomplishments	Since 2015 iSnapper has collected catch and effort data from recreational anglers (private and charter for-hire) on a voluntary self-reported basis, with these data then being combined with creel information from our collaborator in the project, Texas Parks and Wildlife (TPWD), to calculate the annual total effort and harvest. The primary purpose of this grant was to continue to provide recreational anglers the ability to self-report Red Snapper landings using the iSnapper app and to use these data to calculate harvest and effort estimates for 2019 and 2020. During this timeframe, the Gulf states were operating under an Exempted Fishing Permit (EFP) allowing each individual state the ability to regulate and manage their jurisdictional federal Red Snapper season. During the 2018 and 2019 fishing seasons, under the EFP, Gulf states were required to report their estimated harvest to NOAA Fisheries on a biweekly basis. In an effort to assist the state, we chose to follow this timeline, with iSnapper landings also being calculated every two weeks and made available to TPWD when requested. In 2019, a total of 564 private Red Snapper boats were creeled with 2,294 anglers harvesting 4,129 Red Snapper. Using data collected from iSnapper and creel surveys, the estimated total annual harvest was 271,540 lbs (SE 90,112 lbs). In 2020, 784 boats were creeled with 3,381 private anglers harvesting 6,183 Red Snapper. Total harvest estimated using iSnapper was 479,074 lbs (SE 223,069 lbs).
Lessons Learned	Running iSnapper and specifically targeting private recreational anglers concurrently for 6 years has been a very insightful experience. Having retained the core data inputs and functionality of the app over that time, we were able to gauge angler's avidity and/or "burn out" from submitting trips using the app, as it is well-known that as the novelty of using a new app wanes, use can decrease. Based on our variable reporting rates, our results suggest that anglers are seeking the benefit of reporting their trips before buy-in. The reporting and management changes are on very different time steps. For example, the management process can take a long time (e.g., years) before any new data stream is realized in the fishery. Anglers often seem perplexed by this disconnect in terms of wanting a more immediate response from reporting their data. In addition, once anglers lose sight of the benefit of the app, they quickly lose interest and reporting rates decrease. While we attempted to overcome this lack of consistent use through a variety of promotional use and encouragement activities, it did not appear they were successful at creating long-term participation. Despite the trip submission taking only a few minutes, anglers were most influenced by the season length and their belief in if their trips would impact the management of the species. Early in the trials, when anglers were first learning about the app (i.e., collecting additional data regarding harvest), as well as the implications for management (more data = better data), they tended to be more receptive to using iSnapper.

These results show that having a web-based data entry option was also important due to some angler's preference to use a larger screen to enter their trips. Some individuals did not want to download the app but were willing to provide their data on a website. The website also provided researchers with the ability to download and compile data to allow for biweekly effort and harvest comparisons with TPWD. Thus, there was high value to maintaining a functional user-friendly web portal.

One of the benefits of running the app for so long was the ability to address any malfunctions or "bugs" found in previous versions as well as the chance every winter/spring to modify the app to improve user experience. For example, in the previous version the app would occasionally not record the number of Red Snapper harvested (providing the angler entered it to begin with) and/or not recording the vessel registration numbers. However, for this version, all submitted trips had a number harvested and only 3 trips in 2019 and 1 trip in 2020 did not have vessel registration numbers. In 2019, for the 3 missing vessels there were only a combined 8 creels conducted on those days and a total of 33 boats interviewed. While vessel registration numbers were required to validate trips, due to the low number of

boats that did not provide this information we do not believe it had significant impact on our results. However, aside from somehow coupling our registration with the TPWD boater's registration, there is no way to ensure that anglers provide their actual registration numbers. Similarly, we have encountered several vessels at creel surveys that do not have their vessel numbers displayed on the boat. These are likely Coast Guard registered vessels (and therefore do not have to display their numbers) but this means that there is no way to match a self-reported trip submitted by one of these vessels. Since we have encountered these types of vessels in the past, we have allowed them to create an account in iSnapper using specific preassigned vessel numbers. However, despite their ability to report with the app, users have to tell the creel agent their assigned vessel number when interviewed, and the agent would need to record that number for the trip to be validated. Vessel names (if visible) are written down if the boat does not have vessel numbers and could provide an opportunity to be validated because iSnapper registration does ask for vessel name. However, this requires an additional "matched" field (eg. boat ramp) to ensure the vessel reporting was also the vessel encountered at the ramp.

Despite our encouragement and similar to all other previous years, anglers were still reporting after they returned home from their trip. We recommend submitting the trip before arriving at the dock, to decrease recall bias as well as to ensure that encountering a creel agent does not change the angler behavior or impact their reporting accuracy. However, further review of validation data over the years does not indicate that anglers were intentionally misreporting their data and were in fact submitting accurate data. Due to this, we made the assumption that encountering a creel agent did not change the way the anglers reported their harvest. One of the important datums that iSnapper collects is the date and time the trip was submitted.

Activities and Outcomes

Funding Strategy: Planning, Research, Monitoring
Metric: FIF - Monitoring - # of trips monitored
Required: Optional
Description: Number of fishing trips monitored using EM/ER technology over the grant
period. In the notes, please specify total number of trips taken.

Starting Value	0.00	# of trips monitored
Value To Date	303.00	# of trips monitored
Target value	218.00	# of trips monitored

Note:

**Funding Strategy: Planning, Research, Monitoring**
Metric: FIF - Monitoring - # vessels in monitoring program
Required: Optional
Description: Number of vessels directly engaged/participating in monitoring program(s)

Starting Value	0.00	# vessels in monitoring program
Value To Date	139.00	# vessels in monitoring program
Target value	75.00	# vessels in monitoring program

Note:
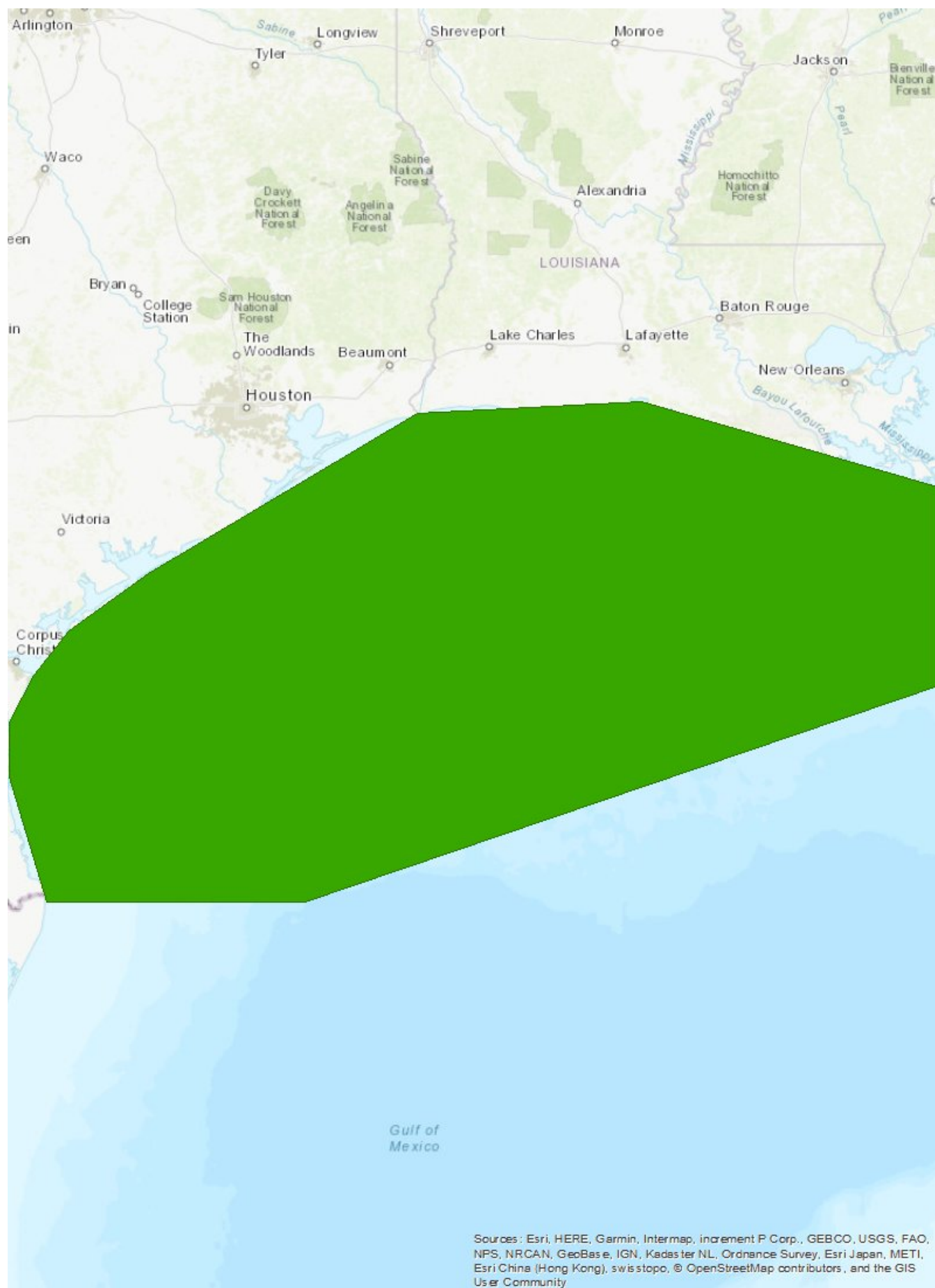
The following pages contain the uploaded documents, in the order shown below, as provided by the grantee:

Upload Type	File Name	Uploaded By	Uploaded Date
Final Report Narrative - Marine	NFWF Final Report iSnapper_20192020.doc	Stunz, Greg	04/02/2021
Photos - Jpeg	Isnapper 9x6 post card_Page_1.jpg	Stunz, Greg	03/31/2021
Photos - Jpeg	Isnapper 9x6 post card_Page_2.jpg	Stunz, Greg	03/31/2021
Photos - Jpeg	Creel survey_TPWD.png.jpg	Stunz, Greg	03/31/2021
Photos - Jpeg	HRI creeler.jpg	Stunz, Greg	03/31/2021

The following uploads do not have the same headers and footers as the previous sections of this document in order to preserve the integrity of the actual files uploaded.

Final Programmatic Report Narrative

Instructions: Save this document on your computer and complete the narrative in the format provided. The final narrative should not exceed ten (10) pages; do not delete the text provided below. Once complete, upload this document into the online final programmatic report task as instructed. **Please note** that this narrative will be made available on NFWF's Grants Library and therefore should provide brief context for the need of your project and should not contain unexplained terms or acronyms.

1. Summary of Accomplishments

Since 2015 *iSnapper* has collected catch and effort data from recreational anglers (private and charter for-hire) on a voluntary self-reported basis, with these data then being combined with creel information from our collaborator in the project, Texas Parks and Wildlife (TPWD), to calculate the annual total effort and harvest. The primary purpose of this grant was to continue to provide recreational anglers the ability to self-report Red Snapper landings using the *iSnapper* app and to use these data to calculate harvest and effort estimates for 2019 and 2020. During this timeframe, the Gulf states were operating under an Exempted Fishing Permit (EFP) allowing each individual state the ability to regulate and manage their jurisdictional federal Red Snapper season. During the 2018 and 2019 fishing seasons, under the EFP, Gulf states were required to report their estimated harvest to NOAA Fisheries on a biweekly basis. In an effort to assist the state, we chose to follow this timeline, with *iSnapper* landings also being calculated every two weeks and made available to TPWD when requested. In 2019, a total of 564 private Red Snapper boats were creeled with 2,294 anglers harvesting 4,129 Red Snapper. Using data collected from *iSnapper* and creel surveys, the estimated total annual harvest was 271,540 lbs (SE 90,112 lbs). In 2020, 784 boats were creeled with 3,381 private anglers harvesting 6,183 Red Snapper. Total harvest estimated using *iSnapper* was 479,074 lbs (SE 223,069 lbs).

2. Project Activities & Outcomes

Activities
Continue implementation of iSnapper as a data collection app for recreational anglers in the Gulf of Mexico.

The electronic reporting app, *iSnapper*, piloted in 2011, was revolutionary and one of the first methods to collect catch and harvest data using (at the time) relatively new iPhone applications. Specifically targeting Red Snapper anglers, *iSnapper* was created to allow citizen scientists the opportunity to self-report their catch using a smart device. Previously, all data collected from recreational fishers was done using dockside creel surveys. While the pilot was only for the charter-for-hire sector (CFH), the app was redesigned in 2015 to include both private and CFH anglers. Throughout the years, we have seen changes in user participation in line with the current management of the species. Following the first redesign in 2015, a moderate percentage of anglers were initially skeptical of the process and how the data would be used. However, when the season was reduced to 3 days in 2017, most anglers realized additional data

was needed and more anglers submitted trips during the 39-day season extension. Finally, in 2018 all five Gulf States were granted exempted fishing permits for two years, allowing the state agencies to determine their own seasons and ensuring Red Snapper landings did not exceed their quota. With this change in management to a state-based system, we saw the greatest number of *iSnapper* users in 2018, thanks largely to a push from TPWD to support electronic data collection. We continue to build a larger base of *iSnapper* users, but angler engagement leveled off and we did not see additional increases in the number of users. However, anglers using *iSnapper* typically submitted multiple trips, indicating that they saw utility in the app and that it was easy enough to use during subsequent fishing trips. While we have shown that a data collection app can be useful to provide supplemental data, we have also concluded that self-reported anglers need to see the utility in the app and understand that their data will be used in a productive way.

Since *iSnapper* had been running for a number of years and has been continually improved through the last several versions, no major updates to the app were required during this grant period. We ensured that the functionality to submit a trip remained the same so that active *iSnapper* users knew what to do upon opening the app. However, we used a different company to host and run the app, requiring all users to re-register since passwords were not transferred with the app development package. As in previous years, during the registration process users were required to provide their vessel identification information. The vessel numbers were used to match *iSnapper* trips with creel survey data for validation purposes, which were ultimately used to estimate the total effort and harvest of Red Snapper.

With data submission remaining unchanged, users navigated through three screens to submit their effort and catch information. For every trip the following data were collected: time and date, marina/dock launching from, number of anglers, species and number harvested, general fishing location, and depth were all required. When anglers caught Red Snapper, they were also required to provide the number released, and depth fished. However, these were not required for any other species. Supplemental information including the method of release (vent, descend, no vent, kept) and the release condition (excellent, good, poor, kept) could be provided on an additional screen if the angler chose to do so.

In knowing that not all individuals have access to a smartphone, catch and effort data collection was also done through the online website: *iSnapper*online.org. This site collected the exact same data but could be accessed from any computer, thereby allowing all anglers with internet access the ability to report their catch. The website was the primary portal to download data, with an administrative account that had access to all trip and catch/harvest data submitted. Since TPWD was still managing the Red Snapper fishery, we provided *iSnapper* effort and harvest estimates biweekly. While TPWD was a partner in this project, the state's landings were calculated using their long-term assessment methodologies, whereas the *iSnapper* harvest estimates were used as an independent comparison to examine multi-year trends.

Since this was a continuation of previous work, we did not vary our advertising strategies. The main goal was to remind current *iSnapper* users to report their trips, while still continuing to promote new angler participation. To directly target known Red Snapper anglers, postcards were mailed out to anglers' homes two weeks before the season opened. These postcards featured the 3-step process of submitting a trip and described the importance of providing their data. We also promoted the app through our Sportfish Center website (SportfishCenter.org), social media accounts, television and radio interviews, fishing magazines, online fishing forums, and on TPWD's website.

Catch estimates and validation of user-entered data collected via iSnapper

Catch estimates and validation of the *iSnapper* self-reported data followed the same process used in prior years. With the help of TPWD, additional creels were conducted at boat ramps with access to the Gulf of Mexico. Despite the extensive Texas coastline, there are only 25 boat ramps that routinely have anglers landing Red Snapper. In such, we selected from a list of these sites using TPWD's site pressure estimates in order to intercept private recreational anglers targeting Red Snapper along the TX coast. We once again used stratified proportional random sampling of creel locations after having success in lowering our overall standard error by following this procedure in 2018.

Upon initial encounter, all anglers intercepted at creel surveys were asked if they were fishing for Red Snapper. Any angler that said yes (or that indicated they do target the species) was asked if they were familiar with the *iSnapper* app, and given a wallet sized informational card following the creel interview and encouraged to report their trip. We also took the opportunity to educate any anglers who were unaware of the app about its importance and utility. These face-to-face interactions were highly valuable, as most anglers were familiar with the app but might not have remembered to report their trip had they not been interviewed. Being able to talk with these anglers, we believe we were able to address a majority of concerns regarding data collection and in doing so helped bolster our reporting rate.

The creel surveys occurred between 10 a.m. and 6 p.m., as this time span typically intercepts the greatest number of trips. During the survey itself, creel agents recorded at least the following information: the TX boat number for identification, number of anglers, number of harvested Red Snapper, and the time of the interview. Since *iSnapper* anglers were required to provide their vessel identification number during the registration process to use the app, we were able to cross-reference trips submitted by *iSnapper* participants with dock-side creel surveys/intercepts to validate data entries. Just like in previous years, TPWD tripled their creel surveys during the high use (spring/summer) season for a total of 108 surveys at these Gulf only sites for both years of this project. In addition, three creel agents from the Center for Sportfish Science and Conservation (CSSC) were assigned 21 sites to sample during the federal Red Snapper season, for a total of 63 additional creel surveys each year. However, in 2019 TPWD closed the season early (projected to be 97 days, shortened to 62 days) due to higher than expected harvest estimates for the first two months of the season. This being the case, the creel surveys that the CSSC was to conduct for the month of August (n = 8) were canceled and our group ultimately conducted 13 additional days of sampling (equating to 39 additional creels). In 2020, two days-worth of sampling (6 surveys) that were to be conducted by CSSC were cancelled due to Hurricane Hanna making landfall just south of Corpus Christi in late July.

As with previous years, the intention of having private recreational anglers submit trips using *iSnapper* was for us to continue to estimate annual effort and harvest of Red Snapper. By providing these anglers with a quick and easy way to self-report their catch and effort data, we were able to collect information from a much larger audience by not having to rely on physically encountering these anglers through creel surveys at boat ramps. *iSnapper* has never been designed to replace creel surveys, but to be used as a supplemental data source. The creel surveys are still essential to determine angler reporting rate and for data validation purposes. Calculation of these estimates were done using the methods set forth by Liu et al. (2017), where self-reported data was compared to the dock-side creel intercept data, in essentially a capture-recapture population estimate.

Collect and assess socioeconomic data from reef fish fishery participants using iSnapper

The socioecomonic survey was provided to all *iSnapper* users in the form of a separate "button" on the home screen that they could select and submit. The questions remained unchanged from previous versions for annual comparisons, focusing on annual household and personal fishing effort, and costs of fuel, bait, and other more direct expense information. Data was submitted through the app or online through our website and could be accessed and downloaded by staff for analysis.

Survey questions were as follows:

- How many people in total, including yourself, live in your household? Please include those people who fish and who don't fish.
- How many people in your household, including children and adults, have been recreational saltwater fishing in the last 12 months anywhere in the Gulf of Mexico region including inshore and offshore?
- How many days did you spend saltwater fishing in the last 12 months?
- How many of these days were spent offshore?
- If this fishing trip is part of a longer trip in which you will spend at least one night away from your permanent residence, how many days will this trip last?
- What is your primary and secondary (if applicable) zip code?
- Gender
- What is the total distance traveled by boat during this trip? (Miles)
- Do you keep your boat at a marina or trailered?
- What is the estimated bait and tackle expenses for this trip?
- What is the horsepower of your boat?
- What is the estimated fuel consumption used for this trip? (Gallons)
- Which of the following best describes your household's annual income, before taxes? (US$)

Outcomes

Continue implementation of iSnapper as a data collection app (for Apple and Android platforms including a web portal) for recreational anglers in the Gulf of Mexico.

The *iSnapper* user base has fluctuated over the years, likely being influenced by management decisions and season lengths for Red Snapper. During our first year releasing the app to private anglers (2015) we had 65 users submit at least one trip during the 9-day season. Considering this was the first year we modified the app to include private recreational anglers, we were optimistic about the following years. However, the following 2 years did not show an increase in the user base as we had hoped with approximately the same number of users submitting trips. Interestingly, in 2018 when TPWD was first allowed by NOAA fisheries to manage the species, the number of users tripled to 151 individuals submitting at least one trip. We believe our partnership with TPWD was instrumental in this increase because with every announcement they made regarding the season length they continually pushed the use of *iSnapper* and the importance of using the app to report every trip. Finally, the last two years (this granting period) we saw what we considered complacency with usage, wherein anglers were satisfied with the season length and no longer felt as though they needed to report (because previously, they were submitting trips to get longer seasons). Unique users decreased to 92 in 2019 and then again to only 47 in 2020. In addition, 2020 saw the fewest number of trips submitted out of any year running the app, only 102.

Compare iSnapper data to TPWD creel survey data to validate the electronic data collection.

During the 2019 federal season for private recreational Red Snapper anglers, a total of 213 trips were reported using the *iSnapper* app. Those trips resulted in a total of 974 anglers and 1,885 Red Snapper harvested and a CPUE of 1.94 Red Snapper/angler. Due to the prolonged season, a total of 147 angler-intercept creel sites were surveyed. During these surveys a total of 481 boats targeting or harvesting Red Snapper were encountered. A total of 1,989 angler-trips harvested 3,558 Red Snapper during the federal season for private recreational anglers. Interestingly, the CPUE for those anglers encountered at creel locations was 1.79 Red Snapper/angler. The difference in CPUE for *iSnapper* and creel anglers provides evidence of more avid anglers submitting trips using the app. The reporting rate was 2.16% and the estimated total harvest of private anglers for 2019 was 50,464 (SE 23,420) Red Snapper, equating to a total harvest of 271,540 lbs (SE 90,112).

Red Snapper angler reports increased during the global pandemic, with the estimated fishing effort and harvest being higher in 2020 than any previous year since the app has been available. For 2020, *iSnapper* estimated a harvest of 479,074 lbs (SE 223,069) of Red Snapper harvested. A total of 90 trips were submitted using the app and 437 angler-trips harvested 874 Red Snapper, for a CPUE of 2.0 Red Snapper/angler. For the creel surveys a total of 687 boats were interviewed that were targeting Red Snapper and 3,081 angler-trips harvested 5,571 fish for a CPUE of 1.81 Red Snapper/angler. So, while the creel CPUE for the two years remained approximately the same, the *iSnapper* CPUE was higher in 2020. This is approximately 40% greater than the estimated pounds harvested in 2019. While this increase could be questioned, we also saw a 35% increase in the number of angler-trips (individuals fishing for Red Snapper) during this year. Considering many people were either temporarily unemployed or working from home during the Red Snapper season, this increased effort is not all that surprising. The biggest complaint we hear at the boat ramp through the years is that a majority of anglers are reduced to only being able to fish on the weekends. With the pandemic it stands to reason that anglers were more likely to go fishing whenever the weather cooperated, even if that turned out to be a weekday. Unfortunately, while it appears as though the effort increased substantially, the reporting rate was only 1.02%, which is the lowest rate since releasing the app.

Running *iSnapper* during the 2019 and 2020 turned out to be much more important than in previous years due to the granting of the EFP. For these years, *iSnapper* landings could be provided to TPWD whenever requested as an additional harvest estimate. While ultimately the harvest was based on TPWD effort and harvest estimates, *iSnapper* estimates were useful in comparing trends with state estimates. Interestingly, in 2019 TPWD estimated number and total pounds of Red Snapper harvested were higher than *iSnapper*. TPWD reported approximately 17,000 more fish harvested equating to approximately 70,000 more pounds than *iSnapper*. This was the first and presumably (2020 annual landings are not yet available from TPWD) only year that an estimate from TPWD was greater than *iSnapper*. For 2019, the number of angler-trips reported for TPWD was almost twice as many as in previous years, 27,112 angler-trips versus a previous high of 17,652 in 2017 with a mean of 13,861 angler-trips for 2015-2018.

Comparing data from validated trips, wherein the boat was interviewed by creel agents and submitted a trip using the app, we were encouraged to see that self-reported data had relatively low reporting error considering data provided was strictly voluntary. In 2019, there were 10 private recreational trips validated through creel surveys, with the number of fish harvested equaling the number observed during creel surveys. In addition, the marina or the boat ramp listed for their launch location was also correct, whereas in previous years only about half

the locations were correct. However, the boat ramps where anglers were intercepted (e.g., Bridge Bait, South Conn Brown, Froggies) were also some of the most well-known launch locations. For example, Froggies is one of two boat ramps in Port O'Connor that typically have Red Snapper anglers. Therefore, it would be unlikely for anglers to have incorrectly identified their launch location at one of these sites. For 2020, 7 trips (7.8%) were validated. Anglers reported 5 additional Red Snapper using *iSnapper* than were reported at the boat ramp. This resulted in an error rate of 9.4%, with the *iSnapper* harvest being greater than the creel. This could help explain the high CPUE, with all of the trips reporting at least 2 fish per angler (anglers are allowed to possess a maximum of 4 fish per angler- 2 from federal waters and 2 from state waters).

Despite all the effort to try and encourage anglers to report their Red Snapper trips prior to returning to the dock, 43 trips in 2019 and 16 trips in 2020 reported their trip on the same day (18.4 and 15.7%, respectively). This included all trips submitted during the calendar year, not just for the federal season. Of the trips that were recorded as day trips (less than 24 hrs, which is most common for a Red Snapper trip) 15.8% reported an arrival time in which they could have been creeled (from 10am-6pm) and 81.8% reported a time after 6pm. However, based on previous years, we assume that at least some (if not most) anglers are returning at an earlier time but not reporting their trips until the evening. This same pattern held in 2020, with 34.2% of day trips having arrival time within creel hours and 57.5% reported after 6pm. In general, the mean number of days between departure day and reporting day was 4 or 6 (2019 and 2020, respectively), with a median of 2 for both years, and maximum of 54 for 2019 and 44 for 2020. Omitting trips where the arrival date was more than one day and those that occurred for a duration less than 10 minutes, the average trip length was approximately 8.5 hrs in 2019 and approximately 8 hours in 2020.

Collect and assess socioeconomic data from reef fish fishery participants using iSnapper.

The socioeconomic survey responses were highly variable between the two years. In 2019, a total of 99 surveys were completed by private recreational anglers. However, some anglers submitted more than one survey, so the total number of unique respondents was 77. Overall, in the last 12 months respondents spent an average of 31 days saltwater fishing, with an average of 13 days spent offshore. If anglers spent more than one day away from their residence to fish, the average trip length was 1.9 days. A majority of boats were trailered (68%) and all but two respondents (97%) were males. The average total distance traveled for the trip was 98 miles, indicating that anglers were likely fishing about 50 miles offshore. The average fuel consumption was 80 gallons. With premium fuel prices averaging $2.85/gallon, respondents spent an estimated $225 in fuel costs per trip. Interestingly, when asked the cost of bait and tackle expenses, every response was at least $1,000, with some claiming as much as $250,000. While we do not believe these are an accurate depiction of the cost of those items for the *trip,* it is possible that all the items used such as rods, reels, lures, and in some cases the cost of the boat, were included in this estimate. Finally, a total of 67 respondents provided their annual household income. A majority (32%) of respondents had an income of $100,000–$150,000. Approximately 70% of respondents indicated a household income of at least $100,000. Somewhat surprisingly, 7 respondents (9%) indicated a household income of less than $75,000 which is the greatest number we have seen in that category since we re-released the app in 2015. On the other side of the income bracket, 23% of respondents indicated their household income was greater than $200,000. Considering the costs for owning a boat as well as the maintenance and other expenses (fuel, insurance, bait, tackle) it is logical that most Red Snapper fisherman would likely be in the

upper income brackets. Based on these surveys that appears to be the case, as median household income in Texas is approximately $76,000 and the "upper class" starts at around $125,000 (USA Today report). So at least 40% of our respondents are in this higher income bracket.

In 2020, a total of 14 surveys were completed with one survey taken by an individual in Florida. Respondents spent an average of 30 days out of the last 12-month saltwater fishing, with an average of 12 days offshore. If the trip included an overnight stay, the average number of days for the trip was 2.4 days. Once again, the vast majority (92%) of respondents trailered their boats. In addition, this year all surveys were submitted by male respondents. The average total distance traveled for the trip was 93 miles, virtually the same as 2019. Along the same lines, the average fuel consumption was 74 gallons. The cost of premium fuel in 2020 was a little less expensive than the previous year at $2.46/gallon, an estimated $180 in fuel costs per trip. Finally, all 13 respondents provided their annual household income. Interestingly, most (46%) reported a household income of $200,000 and above and only one respondent reported an income less than $100,000. This difference from previous years could simply be due to having a small respondent pool.

3. Lessons Learned

Running *iSnapper* and specifically targeting private recreational anglers concurrently for 6 years has been a very insightful experience. Having retained the core data inputs and functionality of the app over that time, we were able to gauge angler's avidity and/or "burn out" from submitting trips using the app, as it is well-known that as the novelty of using a new app wanes, use can decrease. Based on our variable reporting rates, our results suggest that anglers are seeking the benefit of reporting their trips before buy-in. The reporting and management changes are on very different time steps. For example, the management process can take a long time (e.g., years) before any new data stream is realized in the fishery. Anglers often seem perplexed by this disconnect in terms of wanting a more immediate response from reporting their data. In addition, once anglers lose sight of the benefit of the app, they quickly lose interest and reporting rates decrease. While we attempted to overcome this lack of consistent use through a variety of promotional use and encouragement activities, it did not appear they were successful at creating long-term participation. Despite the trip submission taking only a few minutes, anglers were most influenced by the season length and their belief in if their trips would impact the management of the species. Early in the trials, when anglers were first learning about the app (i.e., collecting additional data regarding harvest), as well as the implications for management (more data = better data), they tended to be more receptive to using *iSnapper*.

These results show that having a web-based data entry option was also important due to some angler's preference to use a larger screen to enter their trips. Some individuals did not want to download the app but were willing to provide their data on a website. The website also provided researchers with the ability to download and compile data to allow for biweekly effort and harvest comparisons with TPWD. Thus, there was high value to maintaining a functional user-friendly web portal.

One of the benefits of running the app for so long was the ability to address any malfunctions or "bugs" found in previous versions as well as the chance every winter/spring to modify the app to improve user experience. For example, in the previous version the app would occasionally not record the number of Red Snapper harvested (providing the angler entered it to begin with) and/or not recording the vessel registration numbers. However, for this version, all submitted trips had a number harvested and only 3 trips in 2019 and 1 trip in 2020 did not have

vessel registration numbers. In 2019, for the 3 missing vessels there were only a combined 8 creels conducted on those days and a total of 33 boats interviewed. While vessel registration numbers were required to validate trips, due to the low number of boats that did not provide this information we do not believe it had significant impact on our results. However, aside from somehow coupling our registration with the TPWD boater's registration, there is no way to ensure that anglers provide their actual registration numbers. Similarly, we have encountered several vessels at creel surveys that do not have their vessel numbers displayed on the boat. These are likely Coast Guard registered vessels (and therefore do not have to display their numbers) but this means that there is no way to match a self-reported trip submitted by one of these vessels. Since we have encountered these types of vessels in the past, we have allowed them to create an account in *iSnapper* using specific preassigned vessel numbers. However, despite their ability to report with the app, users have to tell the creel agent their assigned vessel number when interviewed, and the agent would need to record that number for the trip to be validated. Vessel names (if visible) are written down if the boat does not have vessel numbers and could provide an opportunity to be validated because *iSnapper* registration does ask for vessel name. However, this requires an additional "matched" field (eg. boat ramp) to ensure the vessel reporting was also the vessel encountered at the ramp.

Despite our encouragement and similar to all other previous years, anglers were still reporting after they returned home from their trip. We recommend submitting the trip before arriving at the dock, to decrease recall bias as well as to ensure that encountering a creel agent does not change the angler behavior or impact their reporting accuracy. However, further review of validation data over the years does not indicate that anglers were intentionally misreporting their data and were in fact submitting accurate data. Due to this, we made the assumption that encountering a creel agent did not change the way the anglers reported their harvest. One of the important datums that *iSnapper* collects is the date and time the trip was submitted. Without knowing when the trip was actually submitted, we would have incorrectly assumed that all the self-reported data was submitted prior to creeling, which is the ideal scenario. However, since this did not happen, it was beneficial to see how much time anglers waited to submit their trips, which helped us gauge our confidence in our harvest estimates. We do not have a solution to this problem without requiring a trip ticket or similar mechanism for reporting before allowing the user to begin another trip. Implementing a program such as this would certainly require regulations, increased enforcement and cost, and other implementation obstacles that were beyond this study. However, even then these concerns have the potential to persist and will need to be overcome.

One interesting finding that occurred during this period was that TPWD estimated a higher effort and harvest in 2019 as compared to *iSnapper*. This is the only year that this has occurred, and we are not sure what could have caused this change. We have always assumed that the *iSnapper* harvest would be greater than TPWD since anglers are provided the opportunity to report their catch any time of day and from any launch location, even private docks and marinas that creel procedures may miss. However, both methods of effort estimation had almost the same number of trips in 2019 (~27,000). For previous years *iSnapper* estimated angler-trips to be at least twice as many as TPWD, so this convergence of angler-trips is something to examine further. As mentioned above, for 2015-2018 the average angler-trip estimated by TPWD was almost 14,000 versus 31,000 for *iSnapper*. It is possible that the roving trailer counts provided more accurate effort estimates for this year, or simply that the effort substantially increased. In addition, TPWD estimated a CPUE of 2.5 compared to 1.8 for *iSnapper*, obviously the

contributing factor to the higher harvest estimate. Typically, the CPUEs in previous years were very similar (mean CPUE difference = 0.19 fish/angler), so a difference of 0.64 fish/angler indicates that anglers encountered by TPWD were harvesting a greater number of Red Snapper than those entering trips using *iSnapper*. There is the potential that anglers reporting with *iSnapper* only reported Red Snapper harvested in federal waters, but we do not believe this is likely as we ask the "quantity harvested" and do not require the user to separate their harvest into the number caught in state or federal waters. Finally, for this year the average weight per fish was greater for *iSnapper* (5.38 lbs) as compared to TPWD (5.01 lbs). Had the harvest from *iSnapper* been equivalent to TPWD's estimate, *iSnapper* harvest would have been approximately 25,000 lbs greater than TPWD. It will be interesting to see what the 2020 final estimates are from TPWD to see if this increased effort and harvest continued, or if 2019 was only an outlier.

4. Dissemination

In recent years, electronic data collection has become an integral part of data collection and in such, has garnered much support from the general fishing community. When creeling anglers at boat ramps, we typically are informally gauging interest and asking *iSnapper* users if they have suggestions for making the app more user-friendly. Aside from that, due to the collaborative nature of the project, TPWD is always briefed and informed with the landings and effort estimates calculated using *iSnapper*. Finally, we have been asked by several anglers to make the *iSnapper* results readily available, so we will work to provide this final report on the *iSnapper* webpage.

In addition, PI Stunz serves on the Gulf of Mexico Fishery Management Council. Thus, he is actively involved in the current management of Red Snapper and these affiliations will facilitate that these results are conveyed to the managers in the most efficient manner. PI Stunz has attended and given presentations to the Council, as well as participated in numerous workshops.

5. Project Documents
Include in your final programmatic report, via the Uploads section of this task, the following:

- 2-10 representative photos from the project. Photos need to have a minimum resolution of 300 dpi. For each uploaded photo, provide a photo credit and brief description below;
- Report publications, Power Point (or other) presentations, GIS data, brochures, videos, outreach tools, press releases, media coverage;
- Any project deliverables per the terms of your grant agreement.

POSTING OF FINAL REPORT: This report and attached project documents may be shared by the Foundation and any Funding Source for the Project via their respective websites. In the event that the Recipient intends to claim that its final report or project documents contains material that does not have to be posted on such websites because it is protected from disclosure by statutory or regulatory provisions, the Recipient shall clearly mark all such potentially protected materials as "PROTECTED" and provide an explanation and complete citation to the statutory or regulatory source for such protection.
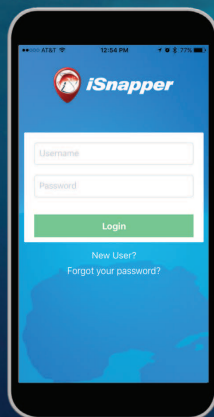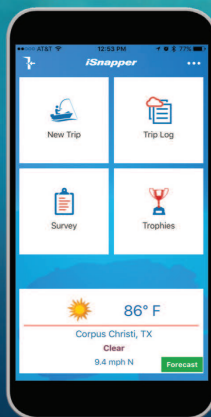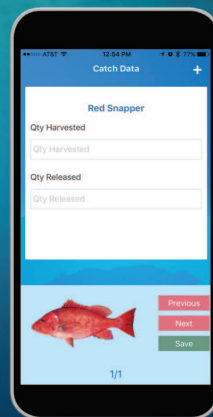
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iSnapper
Your Catch Counts!

Continue Using iSnapper!

For the next two years, the Texas Parks and Wildlife Department will be managing the Red Snapper fishery in both state and federal waters off Texas' coast, so it is essential that we collect the most accurate data possible to maximize angler access to the resource. Submit a trip using iSnapper each time you go fishing, before you get back to the boat ramp. Your contribution will help ensure quality access to the Red Snapper fishery.

Doing your part is fun and as easy as 1-2-3:

1 Login to iSnapper   **2** Start a Trip   **3** Enter a Catch

Download now and use iSnapper on every trip!

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