

**LOUISIANA WILDLIFE AND FISHERIES COMMISSION**

**MEETING MINUTES**

**November 4, 2021**

**Jerri G. Smitko  
Chair**

**Baton Rouge, Louisiana**



A handwritten signature in blue ink, appearing to be 'J. Smitko', with the date '2 Dec 21' written below it.

The following constitute minutes of the Commission Meeting  
and are not verbatim transcripts of the proceedings.

Audio files of the meetings are kept at the  
Louisiana Department of Wildlife and Fisheries  
2000 Quail Drive  
Baton Rouge, Louisiana 70808

For more information, call (225) 763-5775

AGENDA  
Louisiana Wildlife and Fisheries Commission  
November 4, 2021 – 9:30 AM  
Baton Rouge, Louisiana

1. Call to Order
2. Pledge of Allegiance
3. Roll Call
4. Adoption of October 7, 2021 Commission Meeting Minutes
5. Approval of November 4, 2021 Agenda
6. Commission Special Announcements / Personal Privilege  
    Overview of Text-to-Tag and LA Wallet
7. Enforcement Report, October 2021
8. Receive a Summary of 2021 Spotted Seatrout Surveys
9. Receive and Consider an Updated Assessment of Spotted Seatrout in Louisiana Waters with  
    Basin Specific Trends and Updated Spotted Seatrout Management Measures
10. Discussion of Limits and Seasons for the Harvest of Sharks in Louisiana
11. Receive and Consider a Declaration of Emergency to Accept Oyster Lease Renewals by Mail
12. Announcement of 2022 Commission Meeting Dates (January 6, February 3, March 3, April 7,  
    May 5, June 2, July 7, August 4, September 1, October 6, November 3 and December 1)
13. Receive Public Comments
14. Adjournment

**MINUTES OF THE MEETING**  
**OF**  
**LOUISIANA WILDLIFE AND FISHERIES COMMISSION**

**Thursday, November 4, 2021**

The regular meeting of the Louisiana Wildlife and Fisheries Commission was **Called to Order** at 9:30 AM on November 4, 2021, in Baton Rouge, Louisiana at the Department of Wildlife and Fisheries Headquarters Building in the Joe L. Herring Louisiana Room by **Chair Smitko**.

**Commissioner Reynolds** led the **Pledge of Allegiance**.

**Chair Smitko** asked for the **Roll Call**. The following Commissioners were present:

Andrew Blanchard  
Dusty Guidry  
Joe McPherson  
Gene Reynolds  
Jerri Smitko  
Al Sunseri

Secretary Jack Montoucet was also present.

**Commissioner Bill Hogan** was absent from the meeting.

Next, **Chair Smitko** called for **Adoption of October 7, 2021 Commission Meeting Minutes**. **Commissioner Sunseri** made a motion to adopt the October 7, 2021 Commission Meeting minutes and it was seconded by **Commissioner Guidry**. The motion passed with no opposition.

**Chair Smitko** asked for **Approval of November 4, 2021 Agenda**. **Commissioner Sunseri** made a motion to approve the November 4, 2021 Agenda, seconded by **Commissioner Blanchard** and unanimously approved.

For **Commission Special Announcements/Personal Privilege**, **Chair Smitko** asked Mr. Alvin Henry, Statewide Program Manager to come forward for his item, **Overview of Text-to-Tag and LA Wallet**. Mr. Henry began stating he would talk on the recent recreational system enhancements, beginning with LA Wallet. LA Wallet is recognized as a legal driver's license and is completely free to download for android and iPhone users. The Department added their licenses to LA Wallet that went live on October 18 and as of November 4, over 70,000 people have joined and can now display their licenses. LA Wallet works offline and allows an Enforcement Agent to view your licenses. Another benefit to LA Wallet can show revocations a person may have as well. A video for LA Wallet was shown at this time. Next, Mr. Henry talked on Text-to-Tag that allows a hunter to tag their deer or turkey; however, a hunter can still

use the paper tags if he prefers. There are two ways to use Text-to-Tag – through text messaging only by responding with required information to validate your animal or request a link that will link a hunter to their validation tag page. A benefit to text only was using the system in an area with minimum service. A video of the text only version of Text-to-Tag was shown. If a hunter is in an area with no cell service, the only option would be use of the paper tags, but Mr. Henry stated there is a future project to close that gap. A future enhancement was a dedicated mobile app with the ability to tag a deer or turkey while in an offline mode. Another enhancement was adding deer and turkey tags in the LA Wallet app and Mr. Henry hoped this option would occur within the next several weeks. In the 2021 Legislative Session, Act 356 was passed which allows a license to be valid for 365 days from the day it was purchased and the option to auto renew your licenses each year. These changes go into effect June 1, 2022. **Chair Smitko** asked if adding the deer and turkey tags to the LA Wallet app would be done before the season begins and Mr. Henry answered yes. **Commissioner McPherson** asked if the auto renew would send a receipt to a person showing this option occurred; Mr. Henry said yes and added that there would be notifications sent at least one month in advance of a license expiring with the option to not renew or to allow to renew with a receipt being sent via email.

Major Edward Skena began the **Enforcement Reports for October 2021** stating there were 4 boating incidents with no injuries and 2 fatalities in October. A total of 498 written citations and 196 written warnings were issued and agents responded to 26 public assists in October. News releases discussed included agents cited two subjects and issued an arrest warrant for a third for deer violations with the subjects facing Civil Restitution totaling \$1,624.61; a Marksville man was cited for taking over the limit of squirrels (15); and agents cited 5 individuals for several Migratory Game Bird hunting violations in Jefferson Davis Parish during the special Teal Season.

Dr. Jack Isaacs, Economist began his agenda item, **Receive a Summary of 2021 Spotted Seatrout Surveys** stating this was an update to a survey the Department did last year on a series of potential management options for spotted seatrout. He added that staff tried to parallel this survey with that done last year by following the same basic approach in terms of questions that were asked. The goal, to obtain a 20% reduction in harvest and a 5-year recovery effort, was the same for both surveys as well as surveying the same type of population. The survey was sent to two groups of people, a random selection of Louisiana residents 18 years of age or older with saltwater privileges and a web survey that was accessible to anyone on the Department's website. Of the 10,000 emails sent, about 10% responded (lower than last year), but there were over 4,000 respondents to the web survey. Dr. Isaacs then showed the respondents for both surveys with charts on percentage who held specific types of licenses (over-represented were those from the Sportsman's Paradise and Lifetime categories); the reported number of coastal fishing trips and the percentage who reported targeting spotted seatrout (95.5% from the web survey compared to 83.2% from email survey); and percentage who reported catching a specific number of seatrout on a typical coastal fishing trip. The presentation then centered on the respondents' views of change in spotted seatrout stocks. From the first chart in change in spotted seatrout, many fishermen felt the seatrout stock has grown worse in recent years; then a chart on level of concern showed a majority from both surveys indicated they were moderately to extremely concerned for the spotted seatrout stock. On the question of percent of released seatrout died because of being caught, Dr. Isaacs stated research points to 8-10% while about

60% of both surveys felt that percentage was 10% or less. At this point, Dr. Isaacs took the opportunity to credit Dr. Rex Caffey with Louisiana Sea Grant and Dr. Steve Midway from LSU for their help with these surveys. A chart on Net Preferences for General Management Options (lowering creel, increasing minimum size, slot limits or seasonal closures) was shown with the net preference equaling the percent of strongly supporting or slightly supporting minus those strongly opposed or slightly opposed. Generally, the respondents were receptive to lowering the creel limits or increasing minimum size limits but season closures were not popular at all. A different way of looking at the five options was showing their weighted score with 1-strongly opposed to 5-strongly supported. Louisiana has two sets of regulations with one for Calcasieu/Cameron Parishes and the other set for the rest of the State and a question was asked about having different regulations for the State or having a consistent statewide set of regulations. The majority of respondents preferred one set of regulations for the entire state to separate regulations. Next presented were questions about specific management scenarios (current seatrout regulations and the five alternatives) based on a 5-point scale. The first chart on current regulations (12" minimum size with 25-fish creel limit) showed approximately 37-38% strongly support or slightly support the current regulations. Next option, to lower creel limit to 9 fish with 12" minimum size proved to not be a popular option with the majority of respondents strongly oppose. Results from the size change only option (14" minimum size with 25-fish creel limit) was somewhat supported by the respondents. The creel and size limit change option (13" minimum with 11-fish creel limit) had higher levels of opposition than support. The next two charts received the highest level of support; creel and size change option (13.5" minimum size with 15-fish creel limit) was one of the better received options. The slot option (13" minimum with 20" maximum size and 13 fish creel limit) was different from last year's survey in that a fisherman gets to keep an extra fish including one over 20". In summary, Dr. Isaacs showed that respondents were opposed to four of the six options (current regulations, creel change only, size change only, creel and size change of 13" minimum size with 11-fish creel) whereas the other two options (creel and size change of 13.5" minimum size with 15-fish creel and slot limit) received the highest ratings. He added that of the respondents that answered the questions on alternative options, 83% of the email survey and 85% of the web survey agreed with having something other than current regulations. Dr. Isaacs stated that all percentages from these surveys apply only to the time when the survey was conducted; public opinion may change in the future. A list of people that assisted with the surveys was shown to which Dr. Isaacs expressed his thanks. (A copy of Dr. Isaac's presentation is included in the Appendices Section of the Minutes.)

**Commissioner McPherson** asked what Texas contributed to the survey to which Dr. Isaacs stated Mr. David Smith was a graduate student under Dr. Midway who has since graduated and was now working in Texas. **Commissioner Reynolds** asked if the 10% response to the survey was average or below average; Dr. Isaacs felt it was a matter of concern adding that past surveys have received higher responses (response rate was 14-15% last year). He stated that the low response might be related to survey fatigue or even the possibility that the public may not think these surveys are not actually from whom it states it is. Dr. Isaacs commented that there was a need to explore other means to interview people (average age of respondents was 51 years old). The **Commissioner** then asked if the sample size was enough to give a trend and Dr. Isaacs answered yes. **Commissioner Sunseri** asked if the survey was sent by itself or was there language in the survey that notified the fishermen there was a problem with overfishing; Dr.

Isaacs stated when the mail survey was sent out, a message was added outlining the general topic noting the spotted seatrout numbers and how and why the people were selected for the survey. He further stated the questionnaire contained a brief explanation of the biological assessment along with two graphs on the change in female spawning stock biomass and the change in harvest. The **Commissioner** then wondered how the increase in the amount of licensees dating back to when the Department started analyzing catch rates; Dr. Isaacs stated that was difficult to address with the number of licenses that had saltwater fishing privileges but the biology may give an idea from saltwater fishing efforts. **Commissioner Sunseri** felt the information would be important to know how that effort has changed since 1987 to current; he then wondered how environmental conditions have impacted the fishery (habitat) since 1987. He thought that the number of years since 2010 of low salinity in the estuaries has had biological impacts on the fishery. **Commissioner Sunseri** expressed appreciation for the survey and thanked the Department for doing it again. In response to the thousands of comments received, Dr. Isaacs mentioned he tried to categorize them by topic.

Next, **Chair Smitko** asked Mr. Jason Adriance, Fisheries Biologist, to come forward for the first of his two items, **Receive and Consider an Updated Assessment of Spotted Seatrout in Louisiana Waters with Basin Specific Trends and Updated Spotted Seatrout Management Measures**. Mr. Adriance began by reminding everyone that the Department presented an assessment, based on 2018 data, to the Commission in 2019 and in 2020, staff came back to the Commission with management options. At that time, the Commission suggested holding public meetings to get feedback along with an email and web survey. In October 2020, a proposed rule change was presented to the Commission of 15 fish at 13.5" at which time staff was directed to do another assessment (basin specific trends), re-survey the public and present those findings. Today, Mr. Adriance explained the current assessment was data through 2020 along with age data and sampling data, landings data and basin specific trends. First discussed was fishery landings showing overall landings from 1982-2020 (slight increase from 2019 but this year's landings may be lower than 2020) were virtually non-existent for commercial landings (under 7,000 pounds per year). Recreational landings for 1982-2020 with basin landings being specified since 2014 (89% of landings come from south central – southeastern portion of the state). A graph on recreational effort for the years 2014-2020 noted 74% of that effort comes from the south central – southeastern portion of the state. Private versus charter recreational landings for 2014-2020 showed about 92% of the effort comes from private anglers with a one-third/two-thirds proportion of private over charter anglers coming from Calcasieu-Sabine area. Then Mr. Adriance talked on age composition for female landings from 1982-2020 noting the proportion of age 2 female landings in 2020 was just under 40%. The percent of age 3+ female landings (1982-2020) continued to trend downward. A similar graph was shown of percent of age 3+ female landings by basin for 2014-2020 and Mr. Adriance mentioned it was more of a straight line due to not having the historical perspective (Vermilion-Teche has a greater variability due to not getting that many samples from that area of the state). Winter severity index relates to a stretch of 7 days below 44°F statewide plotted against landings and discards which helps explain a 53% variability in any year's landings. Next series of slides centered on the gillnet survey which are conducted by the Department biologist's each year and are for years 1980 through 2021 (samples are taken from April to September and the 2021 indices which were included indicated they all went down). The 1.0-inch mesh panel showed an increase for the years 2019 and 2020 but 2021 would be back down to the 1.0 mean line. Next graph shown was

the 1.0-inch mesh panel by basin for 2014-2021. Then shown was the panel graph for the 1.25-inch mesh and it showed trends have been going down with 2021's results also down. The 1.25-inch mesh panel results by basin was shown for 2014-2021. The biggest panel was the 1.5-inch mesh panel and the results showed the trends has been decreasing for a while with the 2021 point being below the 2020 point. **Commissioner McPherson** asked what size fish was being caught in each panel and Mr. Adriance answered 1.0-inch mesh was typically a 8" plus fish (may have 9, 10 or 11" fish), 1.25-inch mesh was 9" plus fish (may contain 11-12" fish) and the 1.5-inch mesh was usually 10" plus (may have 13-15" fish). He continued with the presentation talking about the stock assessment results. The age composition from the stock showed age 2 fish accounted for 20% of the stock whereas landings for age 2 were 39% which means there is a disproportionate harvest compared to what was in the stock. Age 1 female recruits from 1980 to now have increased over the last 2 years but recruitment tends to be somewhat stable (the problems are occurring after the fish are recruited). The female spawning stock biomass showed that the status of the stock was overfished. Fishing mortality for years 1980-2021 showed the efforts vary from year to year but Mr. Adriance added that the efforts may be close to average but the catch per unit effort was dropping. From this graph, overfishing was still occurring. The assessment summary was essentially the same as the last assessment with very little movement in the indices with the stock still overfished and overfishing still occurring. The overfishing has happened in 7 out of the last 10 years; spawning stock biomass was still at some of the lowest levels seen; there was a lower proportion of age 3+ fish; and recent landings were at its lowest levels as well as catch per unit effort. Stock projections was similar to what has been presented in the past based on a 10-year projection (2022-2031); assume future recruitment and winter events would be similar to the most recent 10-year period (2011-2020); and each scenario was calculated from a 5% reduction to a 30% reduction. A graph showing the 10%, 20% and 30% projections of female spawning stock biomass with the 20% reduction gets the stock above target and rebuilds the stock within a 5-year timeframe. Fishery reductions were calculated from creel and biological samples using the years 2018-2020; reductions in terms of female harvest; and reductions from creel and size limits with creel limits based on future directed effort and size limit reductions were based on 10% discard mortality. The next 2 graphs (Creel Limit Reductions and Minimum Size Limit Reductions) were skipped with the table Size and Creel Options discussed. Mr. Adriance stated the yellow portions of the table indicated a change from the last time this information was shown, but were the closest to that 20% without being under. The slot limit of 13"-20" actually increased the creel by one fish whereas the 12" minimum and 13" minimum dropped a fish as the condition of the stock has not improved. The next steps was to recover the stock to target or above by 2027 (this will be based on when action was taken on changes) and to determine what option for the recovery (creel limit changes only, size limit changes only including slot limits, any combination of creel and size limit changes, special regulations following a significant freeze event or alternative changes such as seasonal or areal closures). Mr. Adriance concluded asking the Commission for guidance on management options and guidance on bringing forward a Notice of Intent that will address the issues with the stock. (A copy of Mr. Adriance's presentation is included in the Appendices Section of the Minutes.)

**Commissioner Reynolds** stated, based on the surveys and assessment and the possibility of action being presented, he wanted to make a motion to create a panel with recreational fishermen, CCA, charter fishermen, and possibly a Commission Member to focus on what to vote on. The **Commissioner** added there are many options but if the panel could develop a

concrete plan, it would make it easier going forward. **Commissioner Guidry** seconded the motion. **Commissioner McPherson** asked who would appoint the members to the panel, what would be the selection criteria and what would they give that the surveys did not give so the Commission could make their decision. **Commissioner Reynolds** felt the participation was relatively low with the surveys; **Commissioner McPherson** asked if the panel would be 7-10 members to which **Commissioner Reynolds** stated the panelists could go out over the next several months along with social media to get additional information. Then **Commissioner Reynolds** asked **Commissioner McPherson** if he wanted the Commission or Department to choose the members and he was told neither, that he opposed the panel. **Chair Smitko** mentioned her area and further west were still covered with blue tarps and the area around Terrebonne and Lafourche were devastated and then you add Covid into mix, she knew there was a problem with the stock but suggested waiting on making a decision. She added that she likes getting more input but was concerned with the Commission not doing their job; the **Chair** did not think right now was the time to put additional regulations on people. **Commissioner Sunseri** speaking on the motion stated he would be in favor of having a committee of the Commission to go into this in more detail but was not in favor of having outside people included and was not in favor of the motion. **Commissioner Reynolds** knew this subject was presented last year and again this year with a proposed change and he felt everyone agreed that the fishery was declining; however, if a panel did not meet to review this information, then there would be the same conversation occurring when the next proposed action comes forward with nothing happening. The **Commissioner** explained that the stakeholders, including Commission members, could sit and determine which option would work for the next 4-5 years. **Chair Smitko** asked **Commissioner Sunseri** if he was making a substitute motion and she was told it was just a comment in opposition to the current motion but would be in favor of a panel of just Commission Members. **Commissioner Sunseri** agreed that making a decision was what the Commission should do based on the data presented. **Chair Smitko** suggested having three Commission Members.(not to violate any Open Meetings Law) reach out to any stakeholder and then report back to the Commission, then a decision to accept or not accept the recommendation could be made. **Commissioner McPherson** stated the Commission looked at this issue last year and again this year and had staff do two scientific surveys and what was seen was numerous comments from every possible angle. The **Commissioner** then suggested having a Special Commission Meeting to discuss this item, but he felt there was a universal agreement that there was a problem with spotted seatrout in this State. **Commissioner McPherson** felt the Commission should take action even though the Department does not have a specific recommendation; the Department provided the Commission with 5 or 6 options that achieves the goals even though the public accepts and rejects to various degrees. He then commented that the Commission will need to make a decision at some point but also added that it could be changed the next year if it does not work or for any number of other reasons. **Commissioner Reynolds** stated he was okay with having a Special Commission Meeting. **Commissioner McPherson** then stated there were over 900 responses from the email survey and over 2,000 from the web survey and that was more public input than what he wanted, it was just a matter of deciding what to do. **Commissioner Blanchard** stated he wanted to know why spotted seatrout was more predominant in Terrebonne, Barataria Bay and why those fish are not in the western part of the State; Mr. Adriance stated the majority of the effort was concentrated in those Basins with Vermilion having its own issues with the Atchafalaya River (freshwater input) and Calcasieu has its own separate regulations but there was very little effort. The **Commissioner** knew that 30-40

years ago, spotted seatrout were over 7 pounds in the western part of the State and has seen some 7-15 pounds but now he did not think a spotted seatrout could be caught in that area. Mr. Adriance stated that was exactly what the age 3+ graph showed, the fish are continuing to be harvested that so few are making it to the larger sizes at a rate greater than the biomass can replenish. Dr. Isaacs stated he could look at the survey results and see how opinions changed based on the basins the people fished and **Commissioner Blanchard** felt that may be helpful. **Chair Smitko** then called for a vote on the motion and **Commissioner Reynolds** voted for the motion while **Commissioners Sunseri, McPherson, Guidry and Blanchard** opposed the motion. The motion failed to which **Chair Smitko** did not think this was an action item, Mr. Adriance stated it was as the wording for the item was to Receive and Consider. Going on with the discussion, **Commissioner Sunseri** asked if it was known what the average fish caught was for Louisiana and Mr. Adriance stated that for the 18-20 creel data, charter fishermen caught an average 14 ½” while private fishermen averaged 14.3” (this was heavily influenced by the number of age 2 taken in 2020). Then the **Commissioner** wondered about increases or decreases of spotted seatrout caught across the Gulf; Mr. Adriance stated this problem was being seen in other states except for maybe Texas. Mississippi reduced their limits (15 fish-15 inch) due to their assessment results and Alabama just recently reduced their limits after doing a stock assessment. At this point, a slide was shown on the Gulf wide regulations that was a result of the stock trending down in the north central Gulf. **Commissioner Sunseri** asked what the dates for the most recent survey were and Mr. Adriance felt it was August. He then thought it was during the time of Hurricane Ida to which Mr. Adriance stated it was set to end right at the time of the storm but it was left open longer. The survey closed between mid to late September in order to analyze the data but Mr. Adriance added that a lot of the input was provided prior to the storm. **Commissioner Sunseri** felt that was important to know; Mr. Adriance stated that if you look at the results from this year, the results were very similar to what was seen last year. The **Commissioner** explained he has talked with fishermen that target spotted seatrout and redfish about what they are catching and he heard they are catching smaller trout (12-13” range), they are catching their limits (Terrebonne East) and have been for some time now. Also, based on one option of 14-inch size with 25-fish creel was the best to get to the goal, **Commissioner Sunseri** knew that was not what the fishermen he has talked with were catching. The **Commissioner** mentioned that the freshwater in the eastern portion of the State has had a tremendous impact on the spotted seatrout fishery and the environment and habitat has gotten worse on the eastern side of the River due to coastal erosion. **Commissioner McPherson** asked what was the importance of the slide that showed the number of female trout over 3 years of age, Mr. Adriance explained that you get into the individual fecundity of a fish versus the overall fecundity of the stock. He added that at least 50% of the smaller fish (8, 10 or 11 inches) reaches maturity and can spawn but would not have as many eggs as the older fish. The idea was to rebuild the stock, increase the percentage of older fish and rebuild the stock across all ages so the impact of a dramatic event would be lessened. The **Commissioner** asked when did Mississippi put their regulations into effect and was their information from those states on what effect their regulations had; Mr. Adriance stated it was about 4 years ago that Mississippi switched from 13 inch-20 fish to the current regulation. Mr. Adriance explained that Mississippi had the same issues as Louisiana with a stock that was undergoing overfishing. **Commissioner McPherson** added that a Florida Captain and his crew have no limits and assumed that would not be a significant factor to which Mr. Adriance stated they ran that analysis last year and it was a 1% or less reduction in harvest. Then the **Commissioner** asked how old was a 12-inch fish and he was

told that it varied, but typically an age 1 female could be 6-13 inches and a 1 year old male could be 5-11 inches with the majority of the harvest being females. **Commissioner McPherson** then stated that the 1 year old males (11-11 ½”) were being thrown back but the females (12” or more) were being taken out and Mr. Adriance felt that was a fair statement. A 100% mature fish occurs at 15 inches, so that 13 ½” fish is between that 50% and 100% maturity and gives the smaller fish more chances to spawn. The **Commissioner** asked how old are 13”, 13 ½” and 14” fish on average; Mr. Adriance felt it was age 2 fish. **Commissioner McPherson** named people in attendance at the meeting and added there were respondents from the surveys but no one wanted to speak on this topic at today’s meeting. **Commissioner Blanchard** asked what month do spotted seatrout spawn and what was the survival rate once those eggs spawn; Mr. Adriance did not think there was any reports on survival of the eggs but the spawning season was April through September and that the recruitment and survival was environmentally driven. The **Commissioner** then asked, with spotted seatrout being caught at 12”, was there any data that supports the number of fish that does not survive and Mr. Adriance stated staff as well as other Gulf States use 10% as the number of discard mortality which was an average over a year. **Chair Smitko** asked how does the fecundity increase with age and Mr. Adriance commented that the bigger older females would broadcast more eggs in a spawning event. The **Chair** then asked if it was a major difference like with other fish; Mr. Adriance added that on average, a fish can spawn between 28,000 to 1.6 million eggs (based on more recent data and size of the fish), but for a Red Snapper as it gets bigger and older, they produce more eggs. **Chair Smitko** wondered if there was an age or size that correlated to that or was it some fish produce more eggs than others do; Mr. Adriance stated there are averages by size. He added that a document was sent to the Commissioners last October on this but, in response to **Chair Smitko’s** comment that there was not a lot of data, Mr. Adriance answered no but added that the previous study almost matches what was used in the assessment. **Commissioner McPherson** stated 40 years ago, he listened to the Freshwater Fisheries Biologist talk about how they were not worried about catching big fish, they just wanted to catch fish to eat which delayed the introduction of Florida Bass into Louisiana and hunters were not concerned about what deer they would kill. He felt the State may still have this same mind set with spotted seatrout going from the 12-inch limit to a 13 ½ inch in one year and added further that maybe the Commission should look at history in deciding public opinion if they could catch 14” trout instead of 12” trout.

There being no further discussion on spotted seatrout, **Chair Smitko** began the next agenda item, **Discussion of Limits and Seasons for the Harvest of Sharks in Louisiana** by Mr. Jason Adriance, Fisheries Biologist, stating that Charter fishermen contacted her saying they have seen a tremendous number of sharks. The **Chair** noticed several summers ago that for every trout caught while fishing around Lake Pelto, three little sharks were caught but there are monster sharks in offshore waters. She has also been told from commercial shrimpers that there was a shark problem. Mr. Adriance began his presentation talking on quotas and commercial seasons, noting NOAA’s Highly Migratory Species Division sets the commercial seasons at the Federal level. Three groups of sharks have quotas – Large Coastal Sharks (blacktip, bull, lemon, tiger, spinner, nurse, smooth hammerhead, great hammerhead, scalloped hammerhead, silky and sandbar), Pelagic (common thresher, shortfin mako, oceanic whitetip, blue and porbeagle) and Small Coastal Sharks (sharpnose, bonnethead, blacknose and finetooth), with the Large Coastal Sharks quota being split between the eastern and western Gulf of Mexico. From the western Gulf of Mexico quota, the Large Coastal Sharks quota contains three subgroups (Blacktip

Sharks, Aggregated Large Coastal Sharks that includes bull sharks and Hammerhead Sharks) and any excess from the blacktip shark quota can be carried over for stocks that are not overfished or overfishing. For 2021, roughly 765,000 pounds of blacktip sharks, 158,000 pounds of Aggregated Large Coastal Sharks and 26,000 pounds of the three species of Hammerhead Sharks were caught (all of these totals are gutted weights). The commercial season usually begins January 1 of each year with a 45 shark per day limit but this limit can be adjusted anywhere between 0 and 55 sharks. All shark possession for both recreational and commercial fishermen are prohibited in Louisiana from April through June of each year. Recreational limits for the Atlantic sharpnose and bonnethead was 1 daily per person of either with no size limit; shortfin mako was 1 in aggregate with a male minimum size of 71" fork length and female minimum size of 83" fork length; all other sharks was 1 in aggregate with a minimum of 54" fork length. Mr. Adriance did comment that there are no minimum size limits for commercial harvest. A list of prohibited sharks for both commercial and recreational included the Atlantic angel, basking, bigeye sand tiger, bigeye sixgill, bigeye thresher, bignose, Caribbean reef, Caribbean sharpnose, dusky, Galapagos, longfin mako, largetooth sawfish, narrowtooth, night, sandbar, sand tiger, sevengill, silky, sixgill, smalltail, whale and white sharks. Recreational landings for a year are mostly blacktip sharks (average 320 per year) along with unidentified sharks (average 373 per year); commercial landings are confidential due to the small number of dealers but it was recorded 810,000 pounds were harvested for the Large Coastal Sharks for 2020, small coastal sharks data was confidential and also for 2020, 4,000 pounds of the pelagic sharks were harvested. Next, Mr. Adriance talked on participation and challenges for this fishery. About 346 commercial fishermen hold a State Shark Permit which limits them to state waters with 12 holding the federal directed permit. The shark fishery tends to be a winter fishery before the shrimp season with the real value of the sharks during the Lenten season mainly in Mexico. For sharks to be legally landed they have to have their fins attached which were then cut off and sent to market once landed, however, Texas passed a law that bans the transport of sharks with fins unattached which affected the transport of sharks to Mexico. Florida and California have also passed fin bans that has created challenges in harvesting sharks. **Commissioner McPherson** asked what was the basis for Texas passing that law and Mr. Adriance did not know. **Chair Smitko** asked if the quota on commercial was per vessel and Mr. Adriance stated a few years ago the Commission changed the regulation to where it was per fisherman on a vessel. He added that the State Permit fishermen are limited to one trip per day whereas the federally permitted fishermen can take multiple trips. Going on with the presentation, Mr. Adriance stated that the fins are the highest product from a shark and the United States fishermen are very good about abiding by the regulations; however, international fishermen do not believe in regulations which results in unnecessary regulations. Also, it was noted that with the establishment of quotas, regulatory changes and market shifts changed the season structure that lead to the elimination of a traditional summer fishery in the Atchafalaya Basin. **Chair Smitko** asked if a shark was not going through Texas, did the fin have to be attached and Mr. Adriance could not answer for sure, he did not know the regulations in other states. **Commissioner McPherson** stated, even though the fins have the highest value, the meat must also have a substantial value or there would not have been the reduction seen in recent years; Mr. Adriance stated that reduction was purely because those sharks could not move through Texas. If the value was in the fins, the **Commissioner** wondered if it would be wanton waste to keep the fins and dispose of the meat to which he was told that has happened in the past. Mr. Adriance stated the Federal Program has done two stock assessments on blacktips and the results shows it can allow for more harvest but

it has to go through accountability measures first. Louisiana's issues were mainly with the bull and blacktip sharks, with the bull sharks being part of the aggregated coastal sharks that could sustain more harvest but was tied into the lower quota. NOAA did not think it was a priority to run a stock assessment on bull sharks in the Gulf of Mexico. The issue of depredation was national, not just Louisiana; presentations were made during the last Gulf Council Meeting and it was being looked at by researchers on the East Coast and Gulf Coast. **Chair Smitko** asked what was meant by depredation and Mr. Adriance stated it was essentially the loss of a fish that has been mangled from a shark that has to be thrown back. The **Chair** asked Mr. Adriance to stay on the Federal people and try to get more sharks out of the water. (A copy of Mr. Adriance's presentation is included in the Appendices Section of the Minutes.)

**Chair Smitko** received public comment cards on spotted seatrout, so she allowed them to speak at this time.

Ms. Rebecca Triche, Louisiana Wildlife Federation, stated they do recognize that the spotted seatrout count was down but were waiting for the Department's recommendations to which the Commission suggested getting public input. The Federation has been waiting for those results that were presented and then wanted to hear from the Commission on what their thoughts were from these results. Now, Ms. Triche felt her group would discuss all of this information and then present what the leadership feels would be best going forward. She suggested they did want to see a decision, but continuing to lay the decision was not improving the situation for the fisheries long-term recovery. Loss of habitat was an issue with all wildlife species whether it was through saltwater intrusion, more freshwater inputs, estuaries, but the Department has given their biological assessment. Ms. Triche mentioned some decision needed to be made to address the downturn. **Commissioner Sunseri** asked Ms. Triche if they did not have a position on this subject and Ms. Triche knew there was lots of differences on what would be palatable and was why they did not make a decision, but agreed they did want to hear what the recommendation from the Department was based on the information and what was the public input. Ms. Triche added that they do agree there needs to be a reduction in size or limits or both. **Commissioner Sunseri** stated that coastal erosion has impacted the fishery significantly and are seeing a decline in the fishery because of the habitat and salinity change. Ms. Triche said this was similar to the debate on waterfowl, how much was pressure and how much was change in loss of habitat in the coastal zones. **Commissioner McPherson** mentioned that the Commission slipped by putting this off a year but the problem is there is no clear consensus from anyone anywhere including the Louisiana Wildlife Federation, but the Commission needs to make a decision which could be modified if the desired efforts are not reached. Ms. Triche agreed that a Commissioner's role was tough, but it was important as there was flexibility with the 5 options the Department thought could reach the desired goal. **Commissioner Guidry** agreed with Ms. Triche that there was no perfect decision but noticed Mr. David Cresson with CCA and Mr. Richard Fischer with the Charter Boat Association were not in attendance at the meeting and he wanted to hear their input in order to make the best decision.

As the next speaker was coming up, **Chair Smitko** felt there was data from other states in terms of what has happened with their stocks as a result of their new regulations and asked Mr. Adriance to gather information on when it went into effect and results of what the limits are and

send it to the Commissioners. She thought this information would be a good guidepost for the Commission to look at.

Mr. Benjy Rayburn, Denham Springs, Louisiana, stated spotted seatrout was a passion of his and has been since 1985, fishing in the Barataria Basin and his experience was exactly what the science shows. The fishing has gone down over the years and he has seen the land loss along with an increase in fishing pressure. Mr. Rayburn felt a decision was needed and knew the Commission was the ones to make the decision. He then asked for help in saving the trout population adding that from the people he has talked with, no one has a problem with a 15-fish creel limit. The questions came from the minimum size limit.

Mr. Marc Maniscalco, Oyster Lease Program, handled the next agenda item, **Receive and Consider a Declaration of Emergency to Accept Oyster Lease Renewals by Mail**. Mr. Maniscalco stated he was asking the Commission to suspend the mandatory in-person appearance requirement that was being done due to Hurricane Ida and Covid. He asked that mail-in renewals be allowed for this year.

**Commissioner McPherson** asked why there was a requirement for the applicants to come in-person; Mr. Maniscalco stated the lease terms are for 15 years and due to the nature of an oyster lease that can be inherited or transferred, it was good to know that the applicants were a Louisiana resident and still have ownership of the lease. The **Commissioner** then asked what percentage of leases have been renewed in the last 2 years and Mr. Maniscalco stated they typically do 500 leases each year but this year, they would be doing 1500 out of the 8000 total leases. Hearing no further discussion, **Commissioner Guidry** made a motion to adopt the Declaration of Emergency, seconded by **Commissioner McPherson** and passed with no opposition.

(The full text of the Declaration of Emergency is made a part of the record.)

## **DECLARATION OF EMERGENCY**

### **Department of Wildlife and Fisheries Wildlife and Fisheries Commission**

#### Suspension of In-Person Appearance Requirement for Oyster Lease Renewal Applicants

The Wildlife and Fisheries Commission has established by rule in LAC 76:VII.501.C.2 that all applicants must appear in person at the oyster lease section office to apply for an oyster lease renewal. Due to the devastation in coastal communities caused by Hurricane Ida, and the continued concern over the Covid-19 pandemic, the Wildlife and Fisheries Commission hereby suspends the in-person appearance requirement for oyster lease renewal applicants for the 2021-22 renewal period and directs the Department of Wildlife and Fisheries to develop an alternative method for applicants to submit oyster lease renewal applications by mail and in compliance with all other applicable laws and rules.

The Wildlife and Fisheries Commission finds that the significant losses suffered by coastal communities because of Hurricane Ida has made it difficult for applicants to appear in person. It is necessary to adopt this Declaration of Emergency to suspend the requirement for in-person appearance to assist individuals who have suffered devastating losses and may not be able to appear in person at this time.

This Declaration of Emergency is promulgated in accordance with the emergency provisions of the Administrative Procedure Act, R.S. 49:953.1 et seq., and shall become effective on November 5, 2021. It shall expire on March 1, 2022.

Jerri G. Smitko  
Chair

**Chair Smitko made the Announcement of 2022 Commission Meeting Dates (January 6, February 3, March 3, April 7, May 5, June 2, July 7, August 4, September 1, October 6, November 3 and December 1).**

For **Public Comments** this month, a public comment was received through the Commission's email portal requesting the primitive weapon deer season be extended for seniors 65 and older that have trouble pulling a bow and this would allow for more time in the woods.

There being no further business, **Chair Smitko Adjourned** the meeting.

## **APPENDICES**



## Recreational System Enhancements

Alvin R. Henry, Jr. | November 4, 2021

### LA Wallet



# What is the LA Wallet mobile app?

- Louisiana's Legal Digital Driver's License
- 100% Legal for driving purposes per Louisiana law of Act 625 of the 2016 session.
- Louisiana State Police will accept the LA Wallet Digital Driver's License!
- ATC legally approved all responsible vendors to accept LA Wallet for real-time age verification-required purchases and deliveries.
- Completely free to add and display your license

## LDWF Licenses in LA Wallet

### Features in LA Wallet

- <https://www.youtube.com/watch?v=lyf0UrvQOc>



- LDWF Licenses went live on October 18, 2021
- Works Offline
- Displays the live status of the license.
  - ❖ Revocations
- Future: Turkey/Deer Tags



## Text-to-Tag

*Ditch your paper tags and tag electronically!*



## What is Text-to-Tag?

*Hunters can now tag and validate their deer or turkey harvests directly from their smartphone (via text) immediately after the animal is harvested.*

- Text-to-Tag via Text Messaging
- <https://www.youtube.com/watch?v=041l9lnWYwQ>
- Text-to-Tag via a Link
- <https://www.youtube.com/watch?v=3rzeleNtP9o>
- If you use the electronic tagging method prior to moving the animal you **DO NOT** need to put a physical "paper" tag on the animal.



# Future Enhancements



## Future Enhancements

*ACT 356 of the 2021 Regular Session has a few changes that go into effect on June 1, 2022*

- 365 License (ACT 356)
- Auto Renew (ACT 356)
- Mobile App
  - ❖ Offline Tagging of Deer/Turkey



## Questions?

**Contact Info:**  
**Alvin R. Henry, Jr.**  
**Louisiana Department of Wildlife & Fisheries**  
**Office of the Secretary**  
[ahenry@wlf.la.gov](mailto:ahenry@wlf.la.gov)  
2000 Quail Drive, Baton Rouge, LA 70808  
(o) 225-765-2843





## SUMMARY OF 2021 SPOTTED SEATROUT SURVEYS

Jack Isaacs | LWFC Meeting | November 4, 2021

### *Email and Web Based Survey*

- Sent 10,000 random e-mails to licensed residents with saltwater privileges.
- Email survey sent August 18
  - Two Reminders
  - Closed September 23
  - 990 Responses (10.4% of adjusted sample)
- Web survey open to anyone August 24
  - Results through September 23 Analyzed Here
  - 4,228 Responses



# Respondents to Both Surveys *Especially Web Survey Respondents*

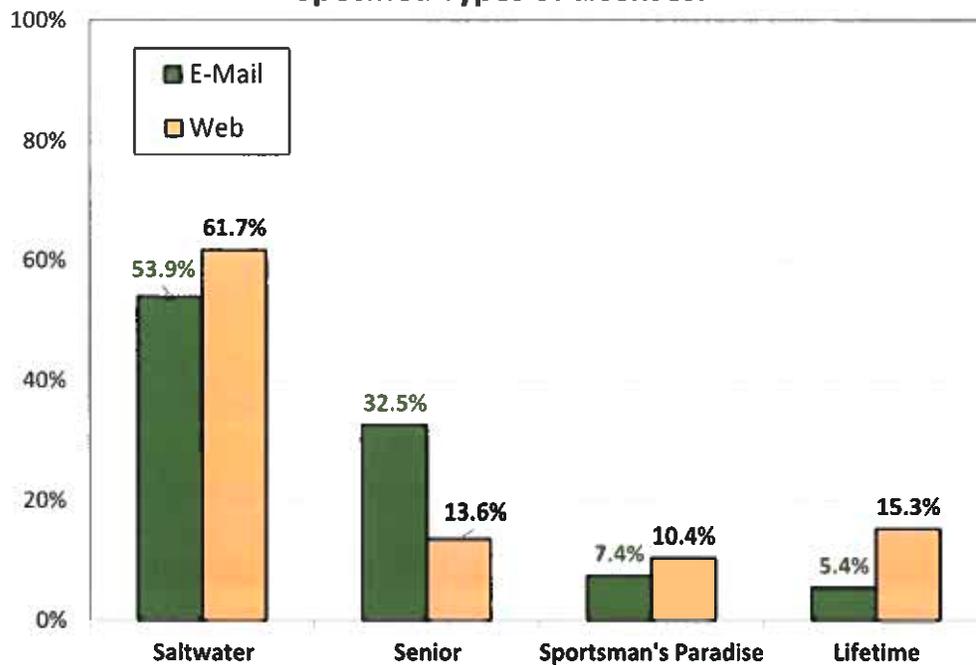
Seem to Be

**More Avid**

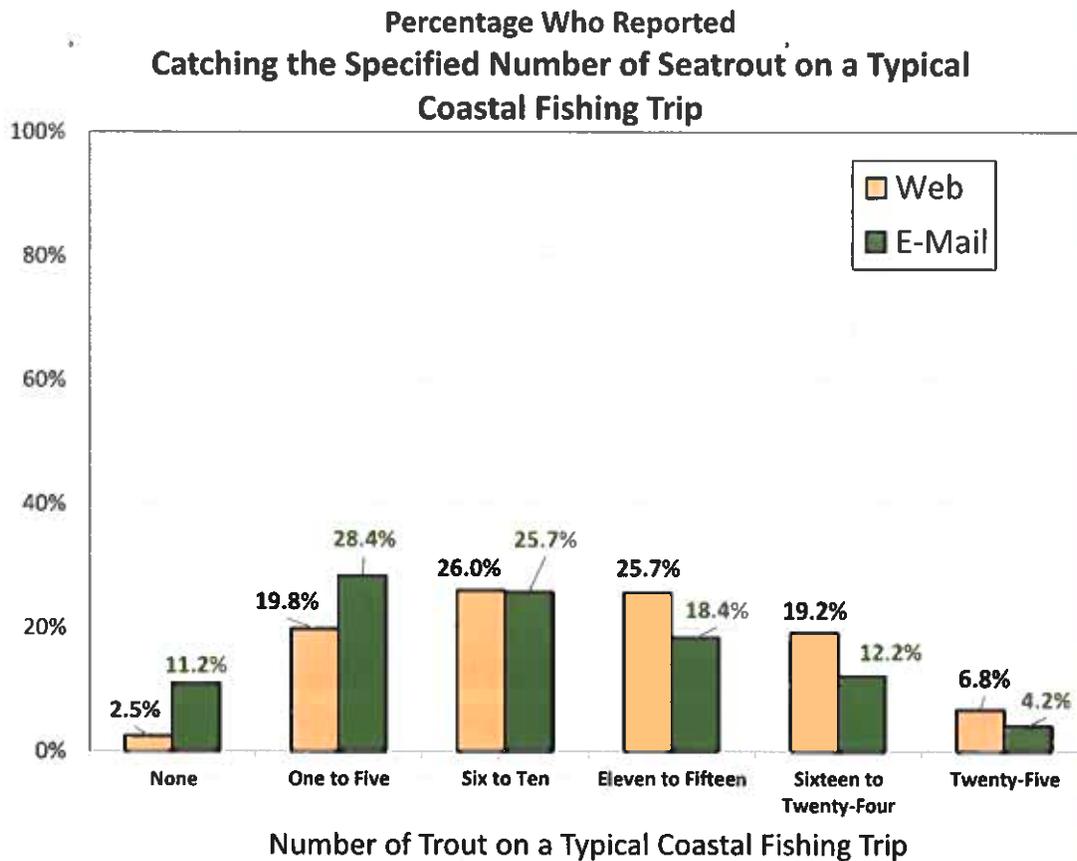
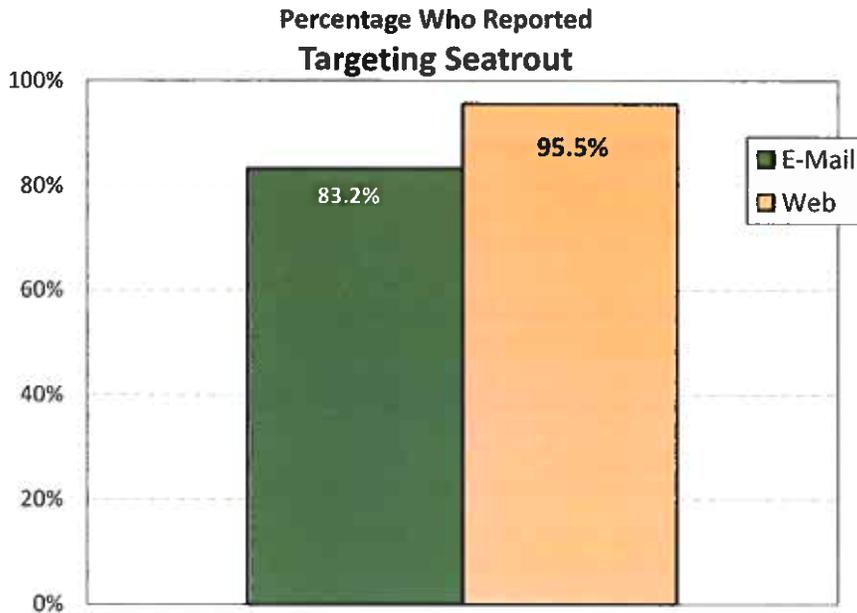
than Most Louisiana Resident Anglers



Percentage Who Held the Specified Types of Licenses:



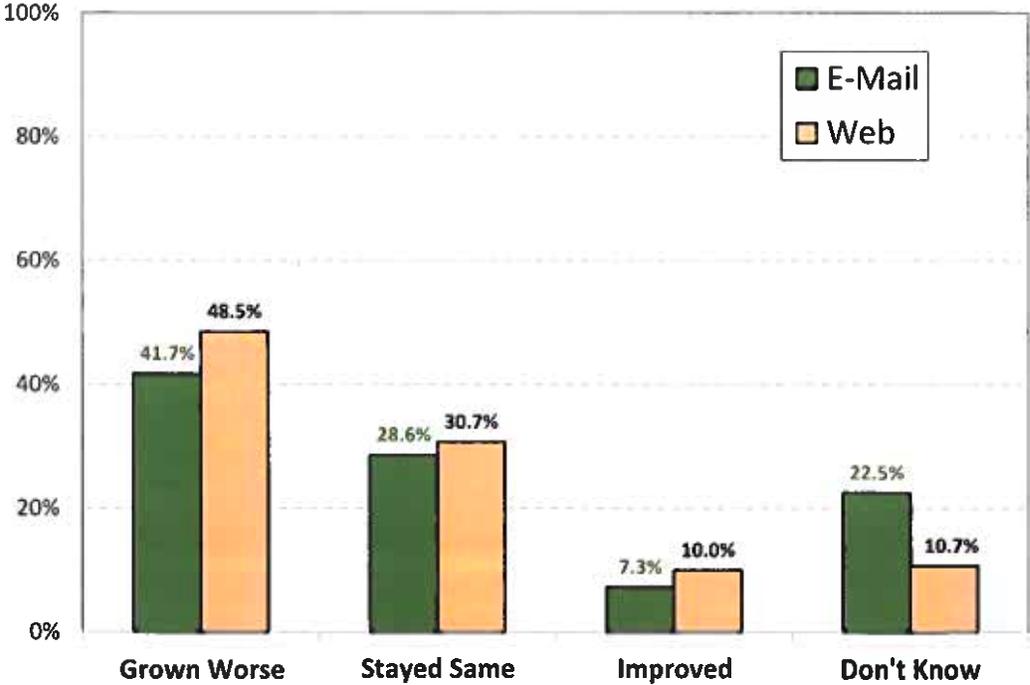
Reported Number of Coastal Fishing Trips		
	E-Mail	Web
Average	15	25.5
Median	10	15



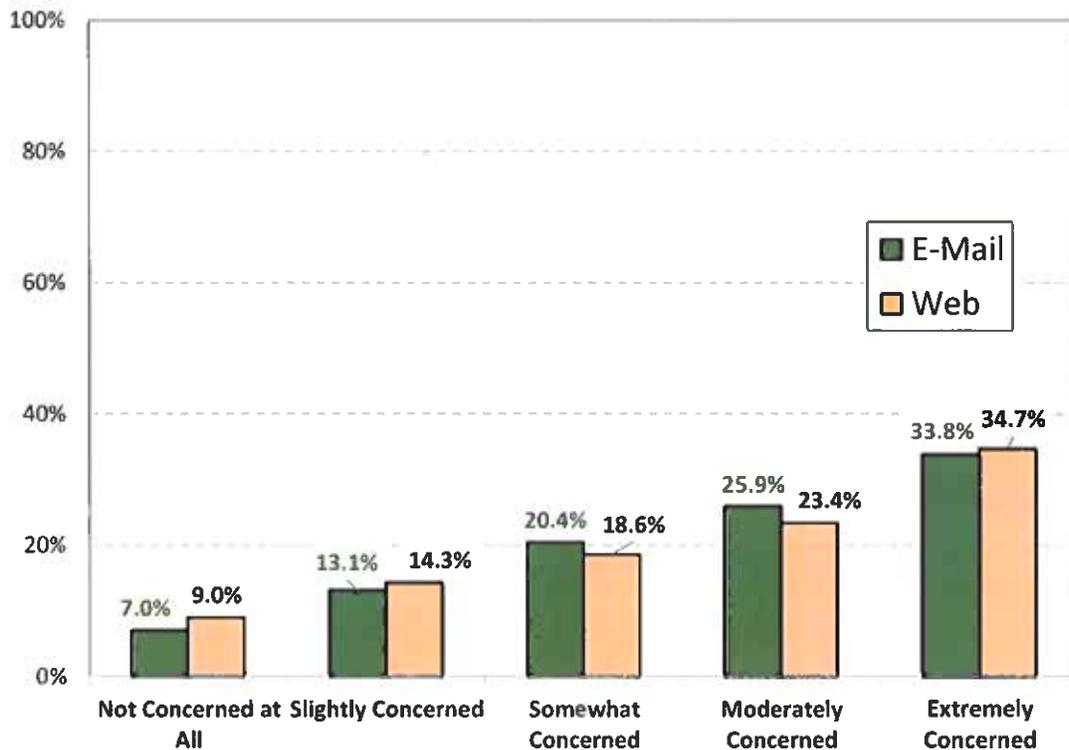
# Respondents' Views of Change in Spotted Seatrout Stocks



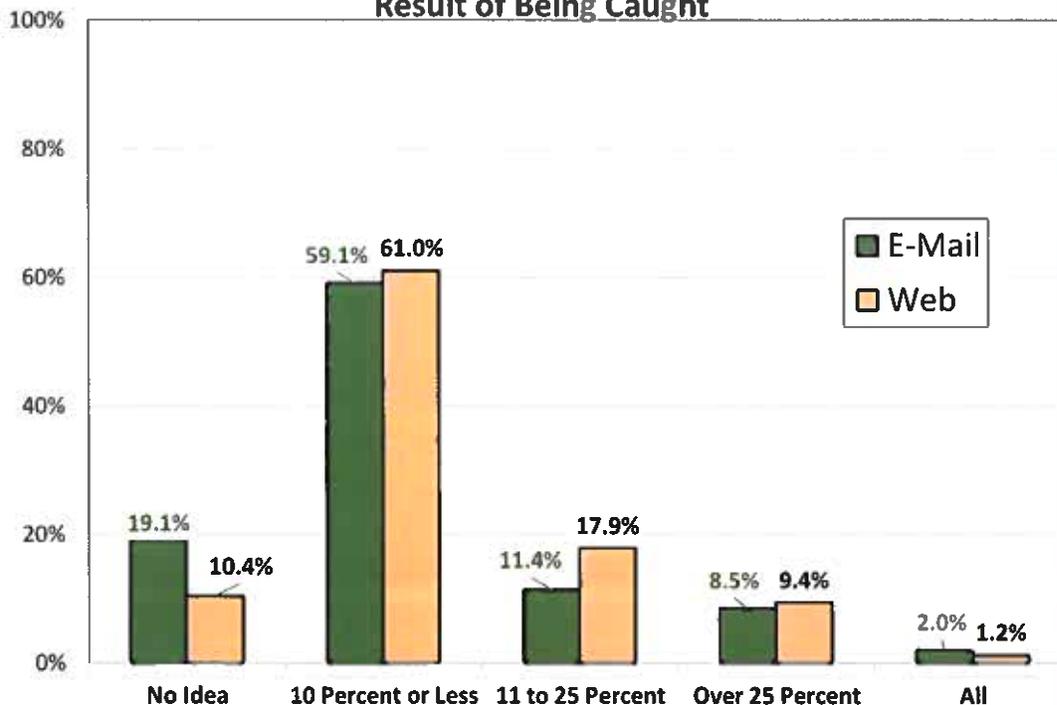
Percentage Who Offered the Following Description of the Change in Spotted Seatrout Fishing in Area They Fished the Most



### Percentage Expressing the Specified Level of Concern for Spotted Seatrout



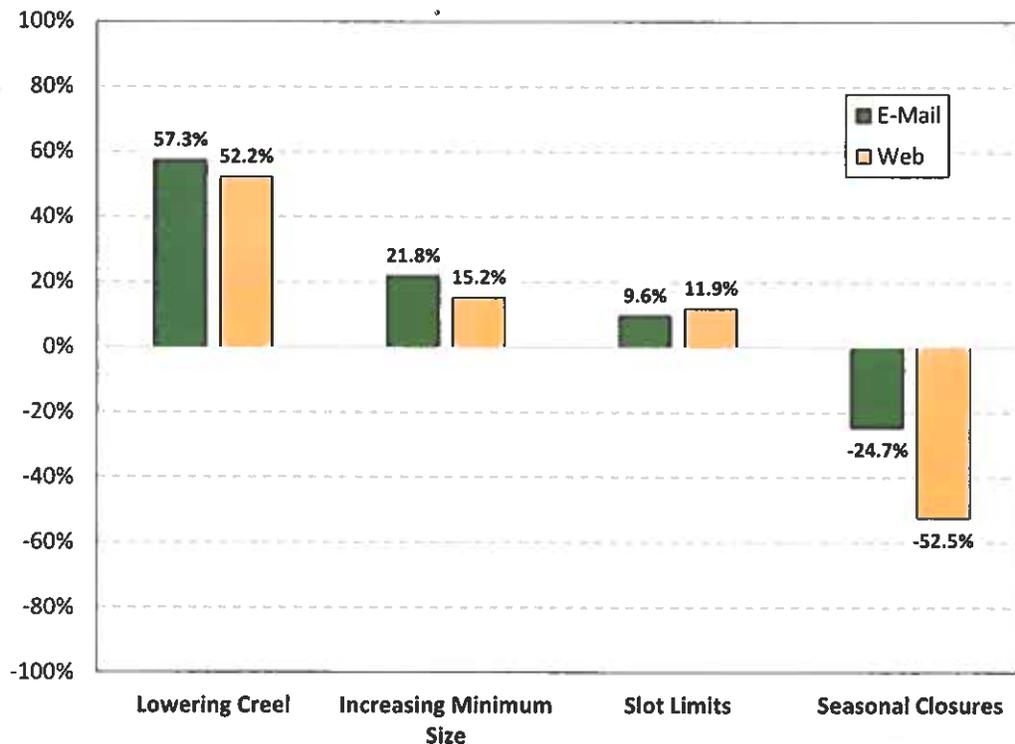
### Percentage Who Believed That the Specified Percentage of Released Seatrout Died as a Result of Being Caught



# Questions about General Management Preferences

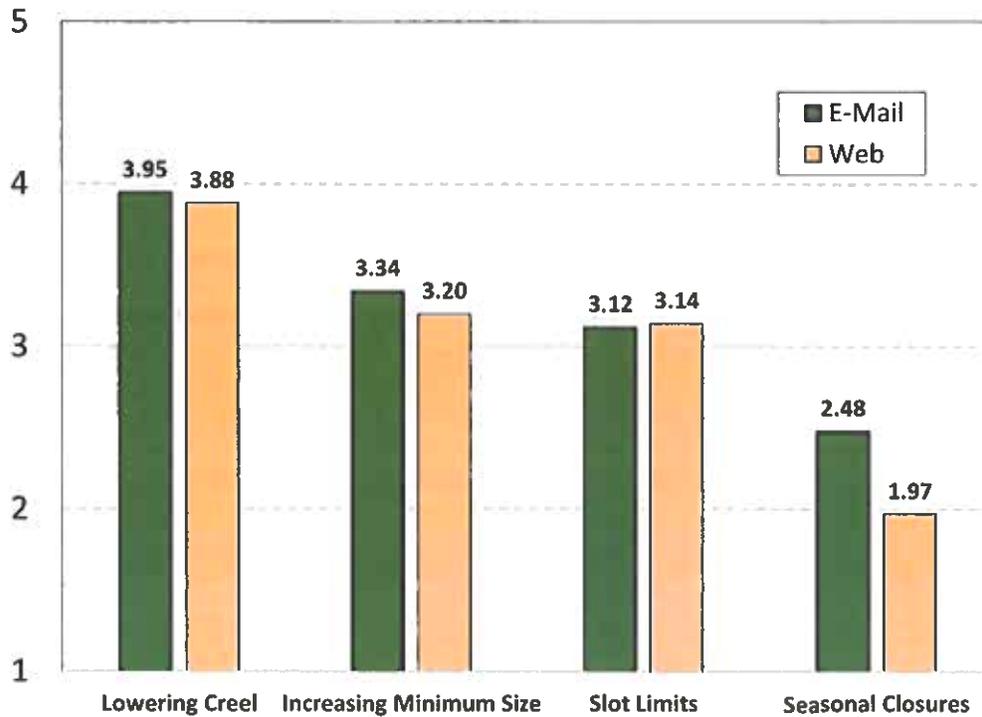


**Net Preferences for General Management Options**



Net Preference = (Percent Strongly or Slightly Support) – (Percent Strongly or Slightly Oppose)

## Weighted Score for General Management Options

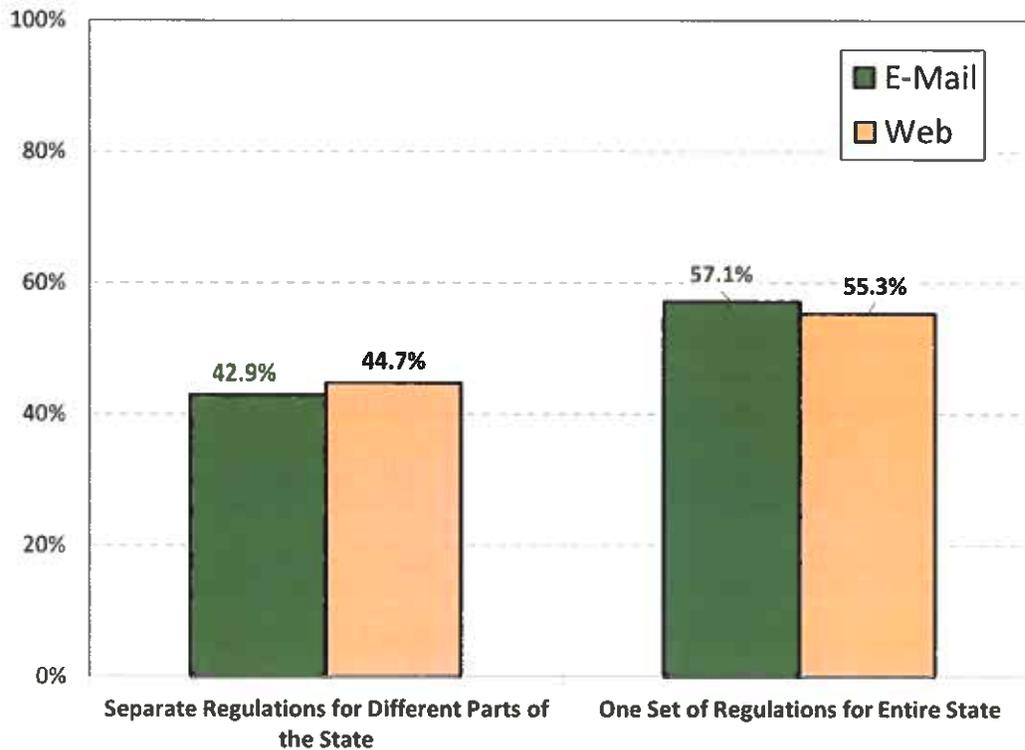


Weighted Score= Average Score on a Scale from One to Five

Respondents' Preferences for  
**Consistent Statewide**  
or  
**Variable Regional**  
Regulations for Spotted Seatrout



## Percentage Preferring Consistent Statewide or Variable Regional Seatrout Regulations



## Questions about Specific Management Scenarios

Respondents Rated on a 5-Point Scale  
(From "Strongly Oppose" to "Strongly Support")

Current Seatrout Regulations

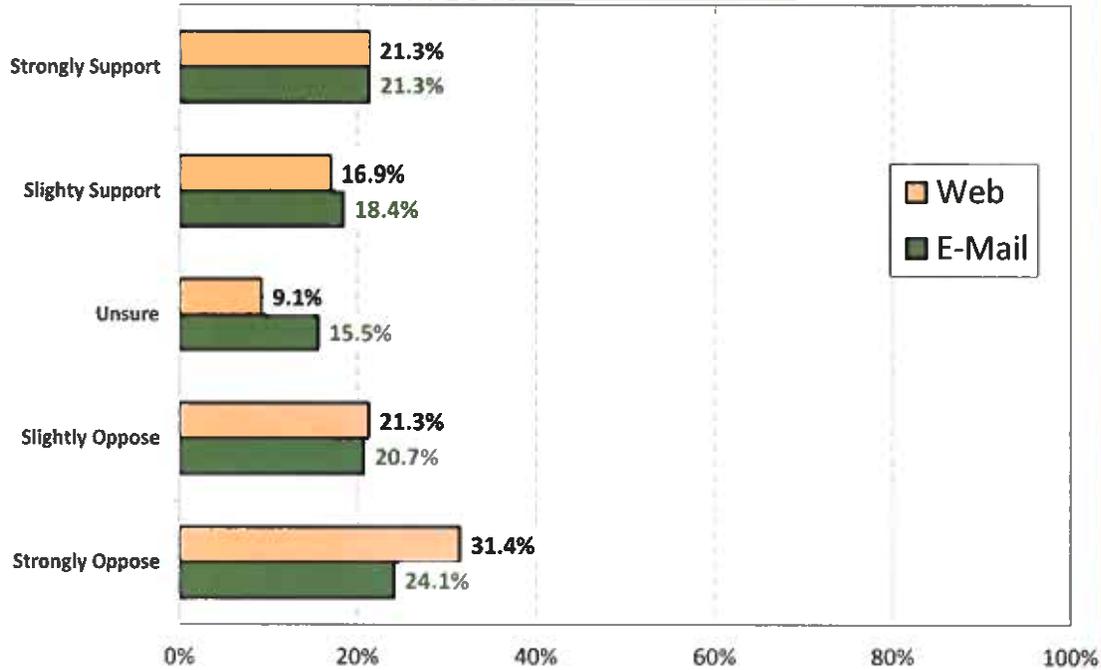
+

Five Alternatives

Intended to Reduce Landings by 20% and Rebuild  
the Fishery within Five Years

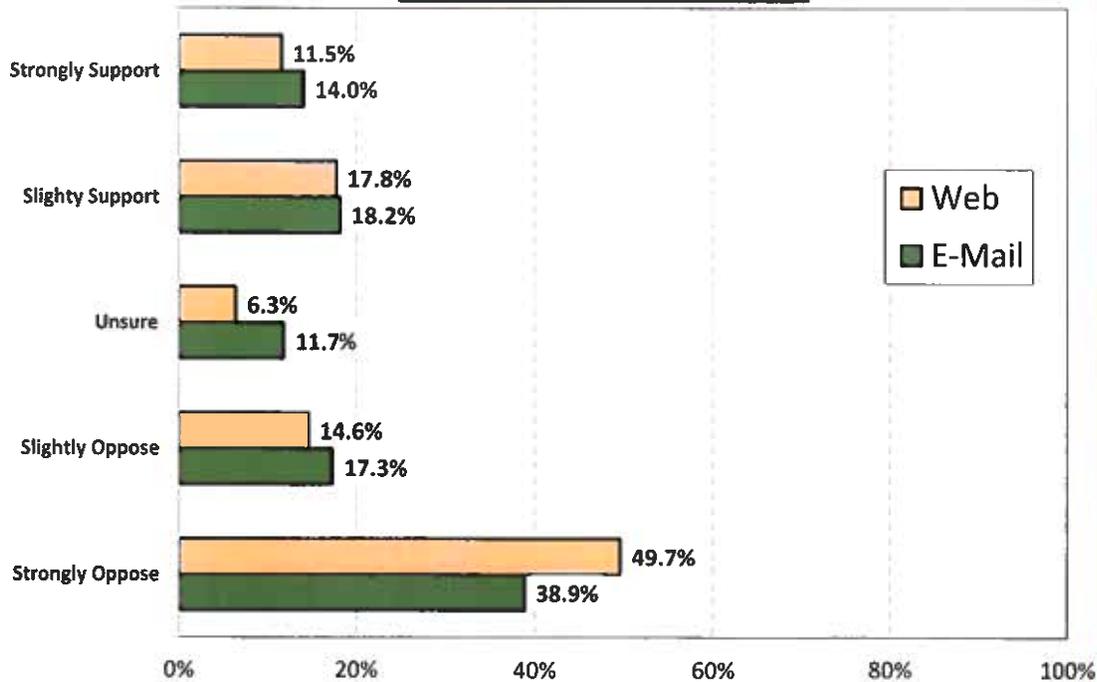
## Current Seatrout Regulations

Minimum Size Limit: 12"  
Creel Limit: 25 Fish



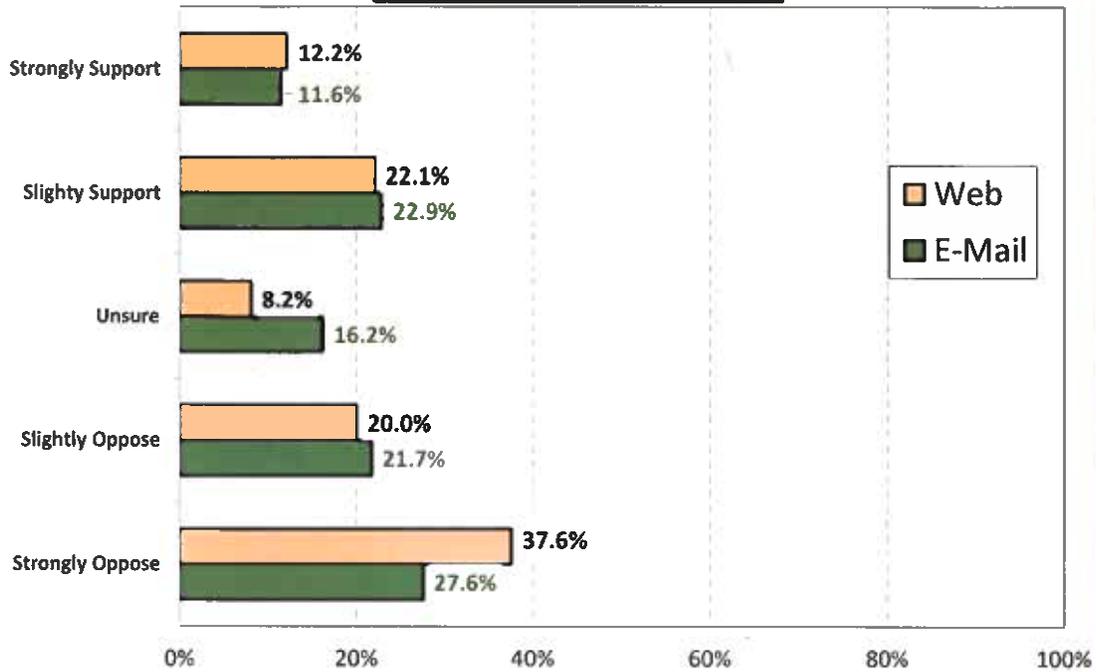
## Creel Change Only Option

Minimum Size Limit: 12"  
Creel Limit: 9 Fish



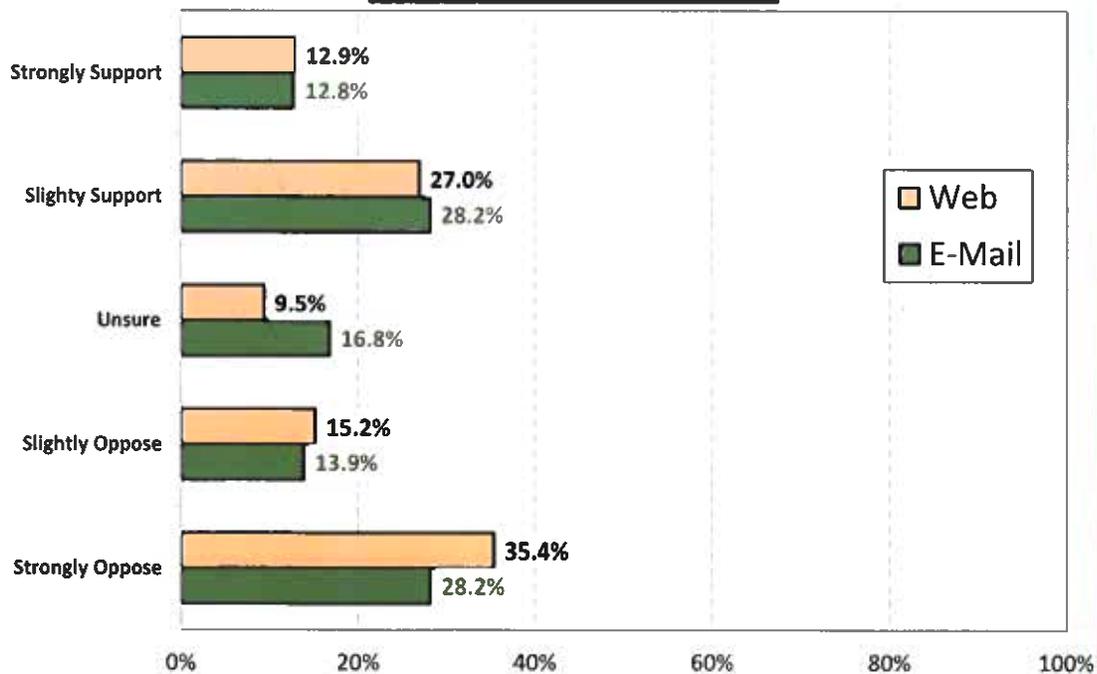
## Size Change Only Option

Minimum Size Limit: 14"  
Creel Limit: 25 Fish



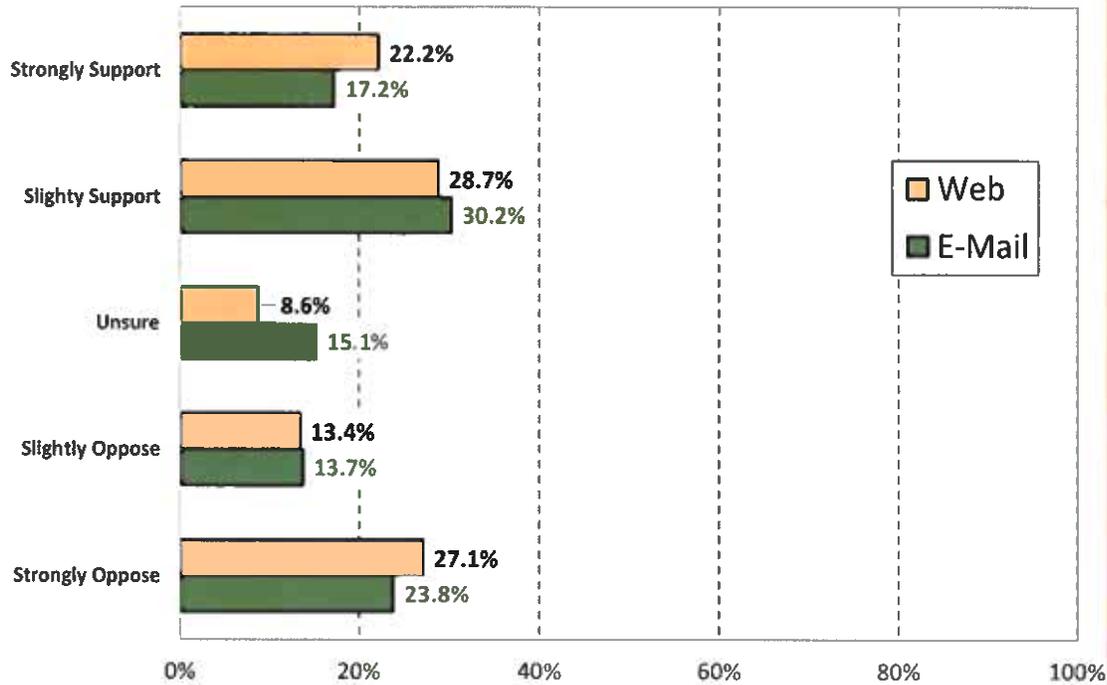
## Creel & Size Change I Option

Minimum Size Limit: 13"  
Creel Limit: 11 Fish



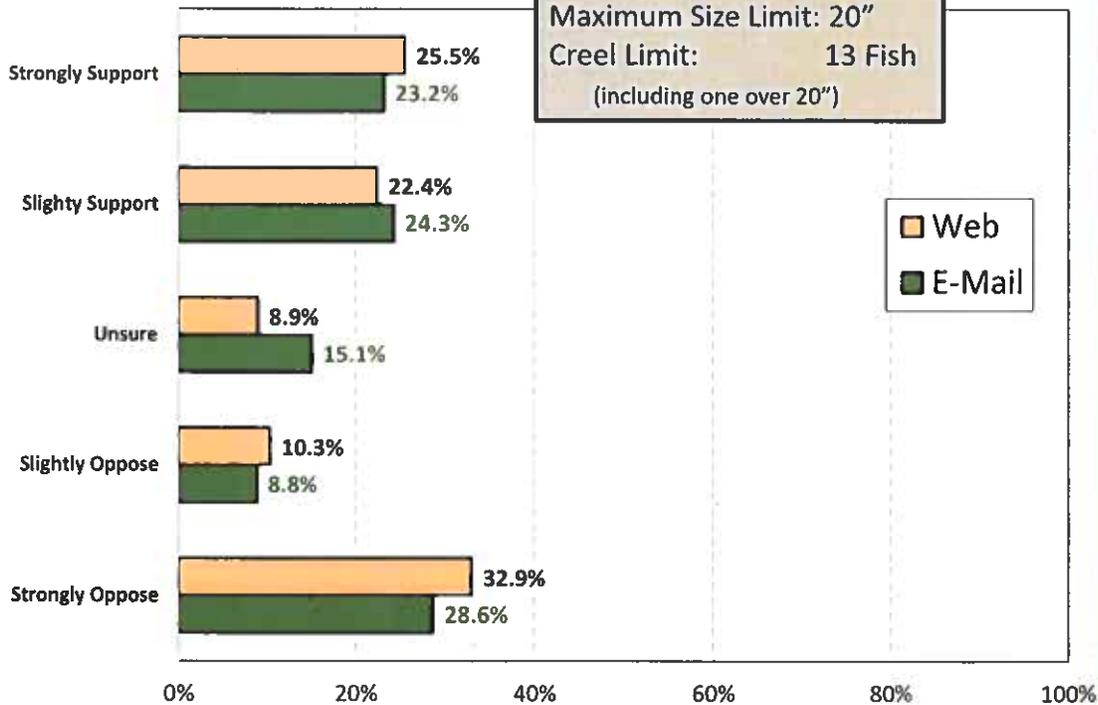
## Creel and Size Change II Option

Minimum Size Limit: 13.5"  
Creel Limit: 15 Fish



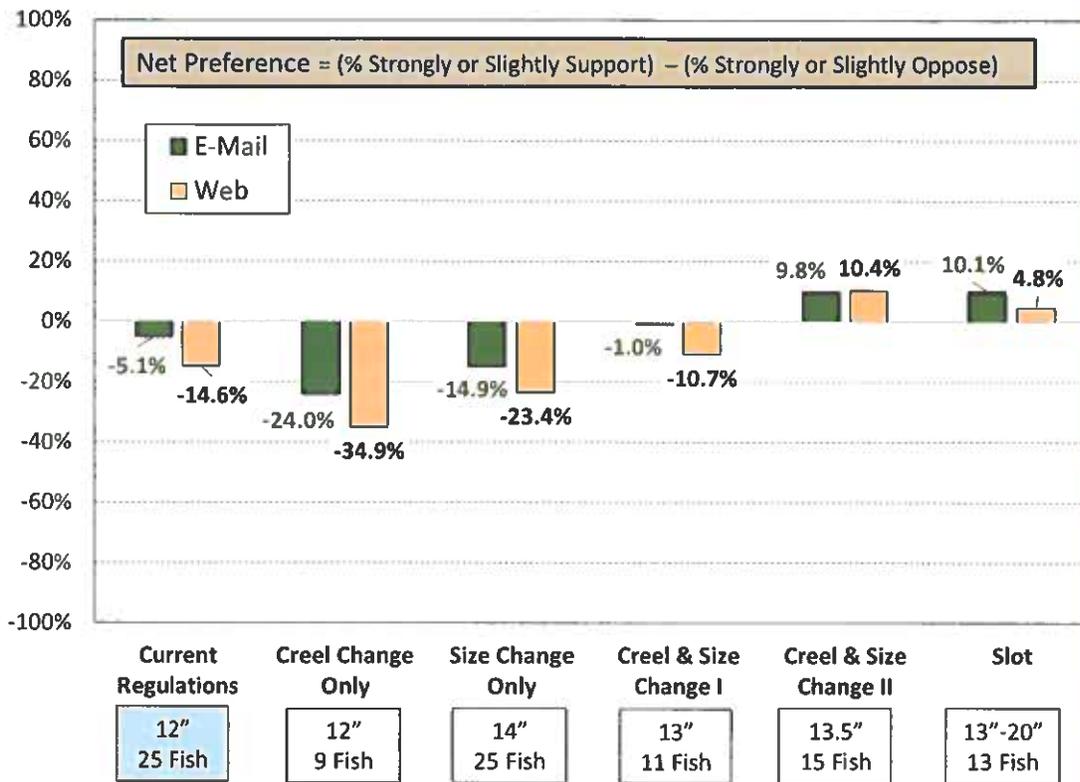
## Slot Option

Minimum Size Limit: 13"  
Maximum Size Limit: 20"  
Creel Limit: 13 Fish  
(including one over 20")

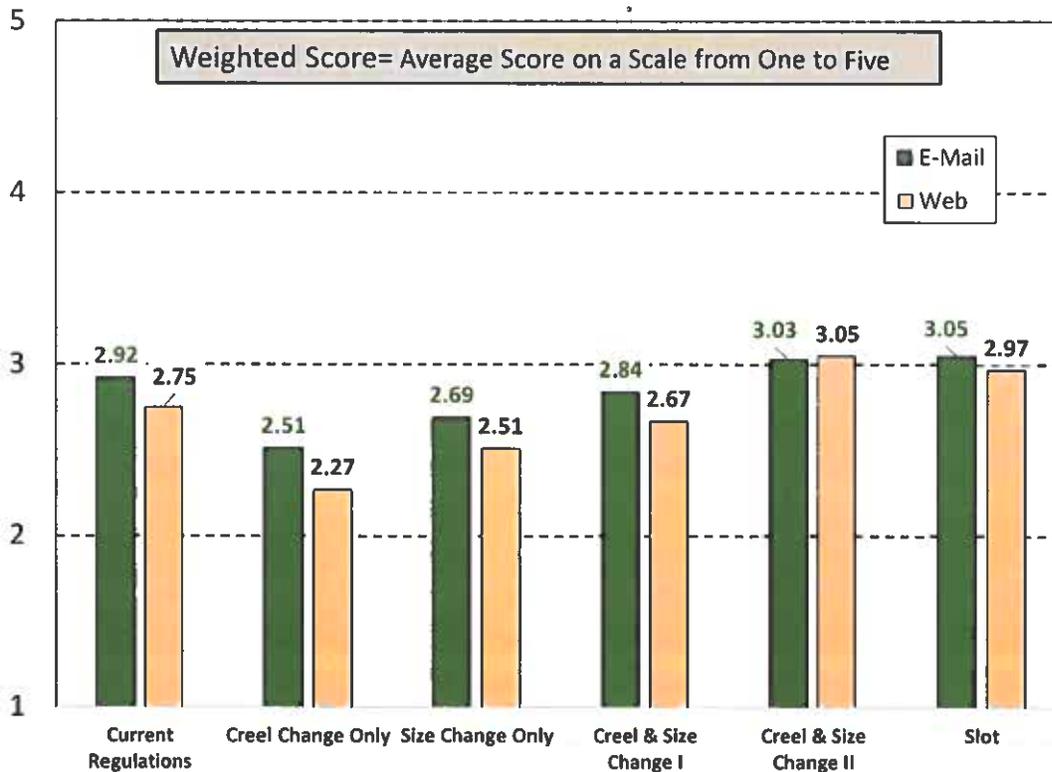


## SUMMARY:

### Net Preferences for Specific Management Options



### Weighted Score for Specific Management Options



# SUMMARY

Respondents to Both Surveys Gave *Relatively High Ratings* to Two Options with a 20% Harvest Reduction & Five-Year Rebuilding Goal with  
Mid-Range Decreases in Creels  
AND  
Increases in Minimum Size Limits

- 15 Fish Creel - 13½" Minimum
- 13 Fish Creel – 13-20" Slot (with 1 over 20")

*at the Time of the Survey*

- Both Options Were More Highly Rated than Current Regulations
- Large Percentages of Respondents Remained UNSURE about Both
  - Especially in the E-Mail Survey



# Thank You !

- Dr. Rex Caffey – LSU Ag Center and Sea Grant Program
- Jason Adriance – LDWF
- Dr. Maryam Tabarestani – LDWF
- Chris Schieble-LDWF
- Harry Blanchet – LDWF
- Christian Winslow – LDWF
- Rebecca Hildebrandt - LDWF
- Dr. Steve Midway – LSU Department of Oceanography and Coastal Sciences
- David Smith – Texas Parks and Wildlife Department
- Jason Froeba – LDWF
- Patrick Banks - LDWF



# Questions

Jack Isaacs  
Economist 4B  
(225)-765-2605  
[jisaacs@wlf.la.gov](mailto:jisaacs@wlf.la.gov)





## **SPOTTED SEATROUT STATEWIDE AND BASIN TRENDS, ASSESSMENT, AND MANAGEMENT OPTIONS**

Jason Adriance | LWFC Meeting | November 4, 2021

### ***Introduction***

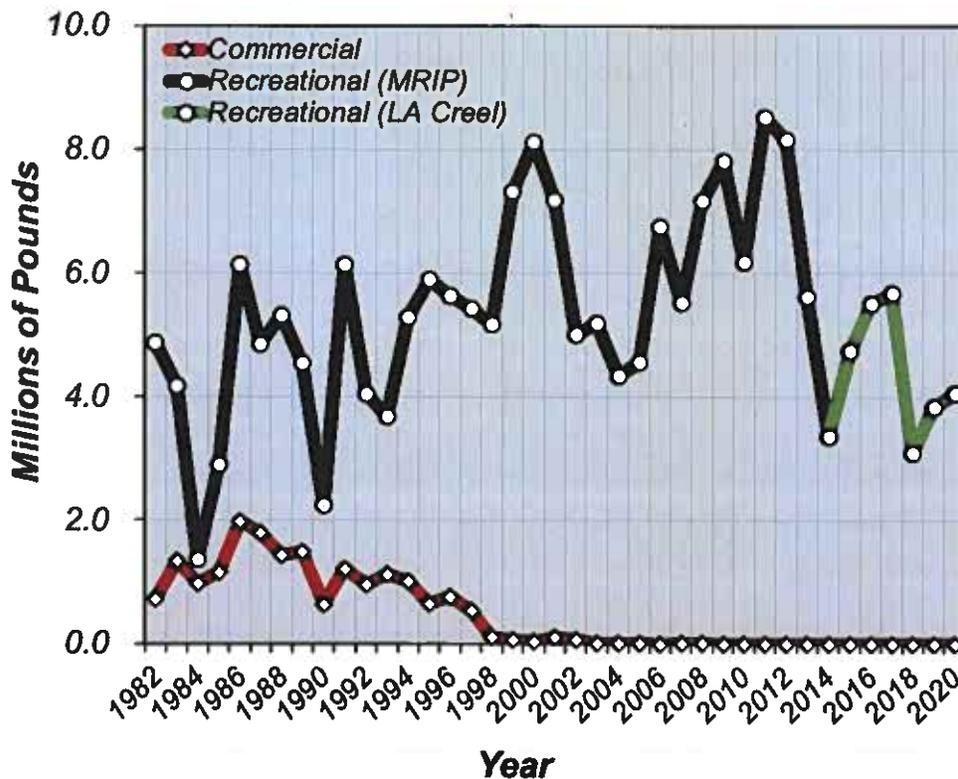
- In 2020 LDWF presented management options to the Commission and then held public meetings
- LDWF presented the results of the public meetings and surveys conducted via email and web
- In October 2020 LDWF brought forward a NOI to adjust recreational size and bag limits (15 fish at 13.5 inches)
- Commission heard from recreational groups and anglers about good catches and directed LDWF to wait one year, re-run the stock assessment, re-survey the public, and present those findings in 2021
- Today LDWF will provide landings and age data, sampling data, results of the 2021 stock assessment (data through 2020), basin specific trends, and new projections of management options



# Fishery Landings



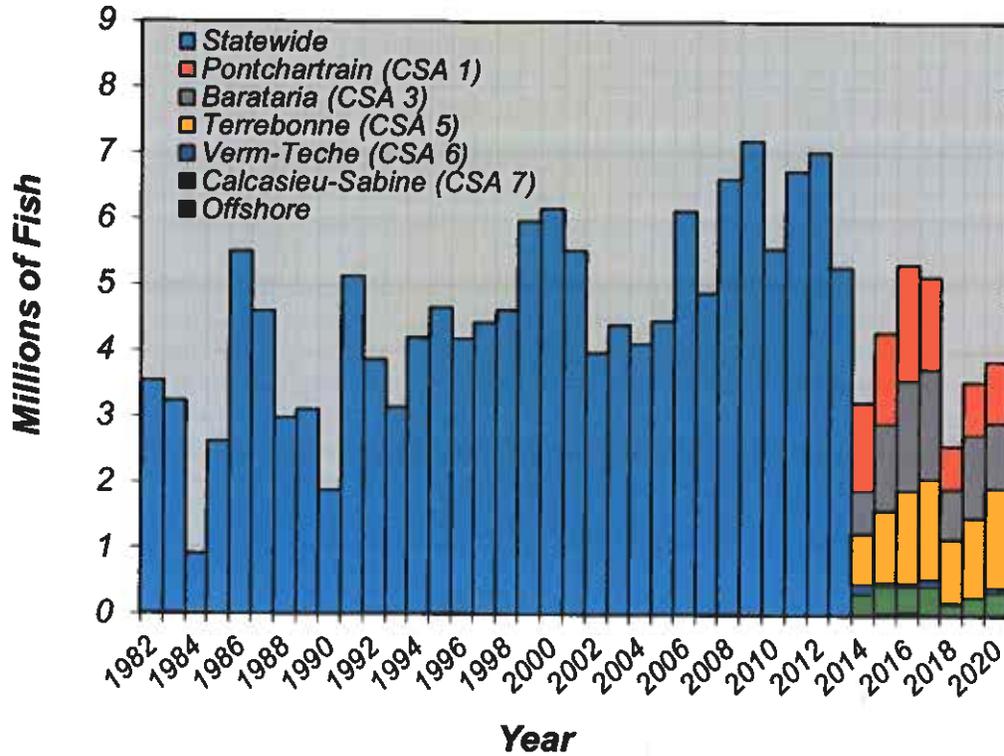
## Landings (1982-2020)



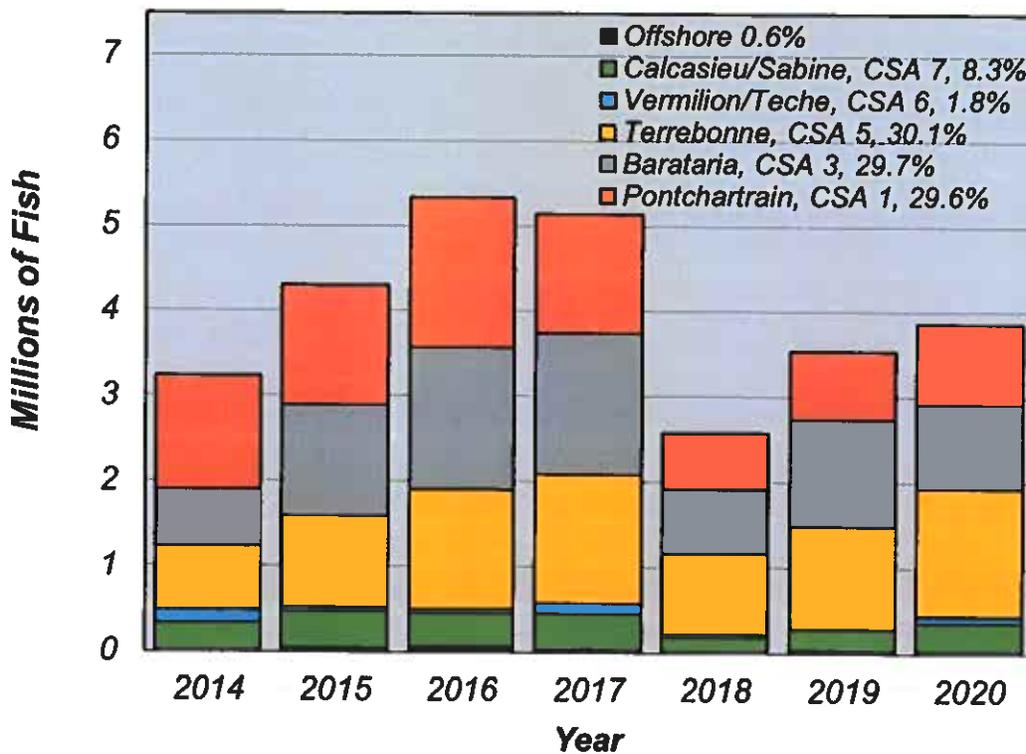
Note: 1982-2013 recreational landings values are MRIP data back-calculated to LA Creel. 2014-2020 landings values are LA Creel values.



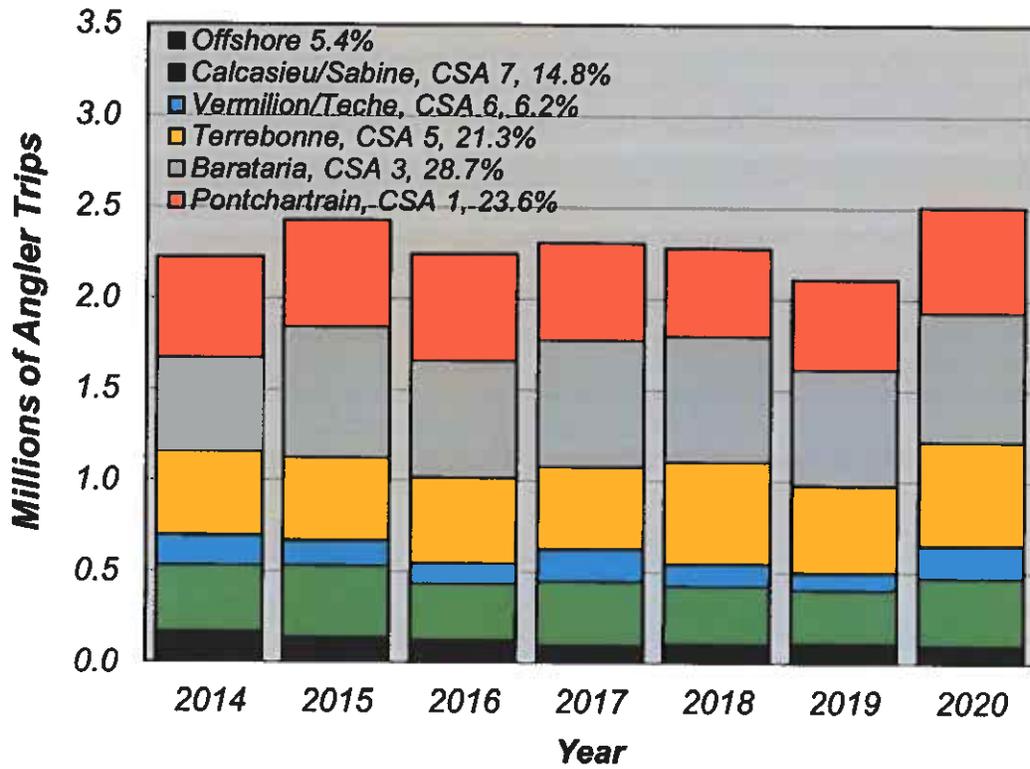
## Recreational Landings (1982-2020)



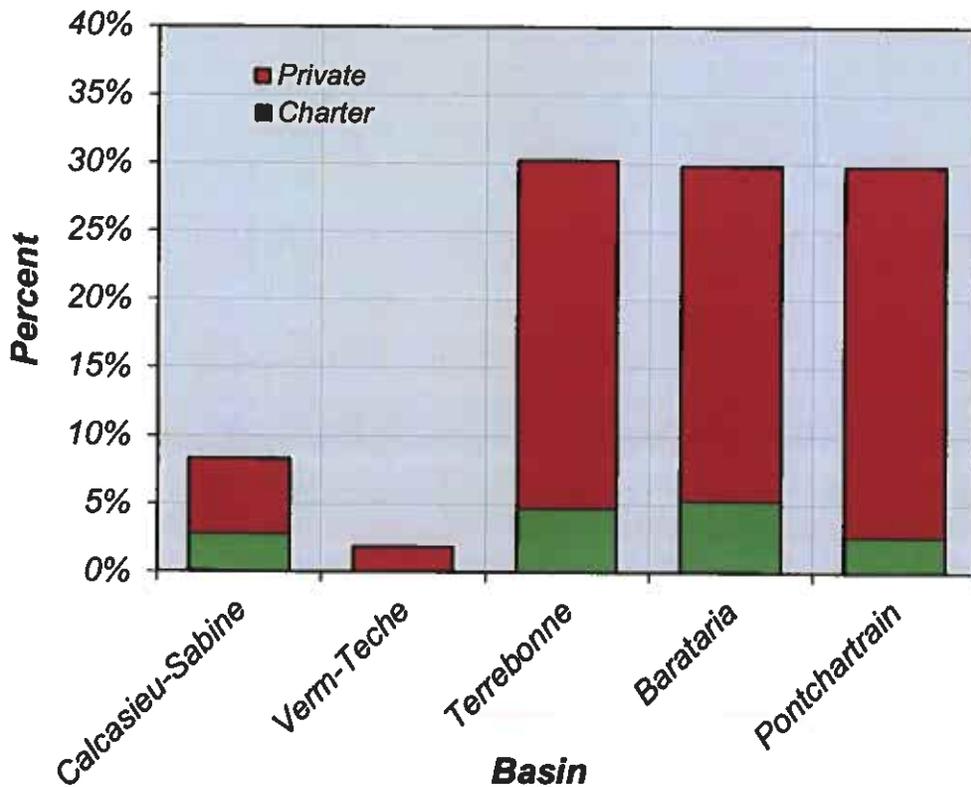
## Recreational Landings (2014-2020)



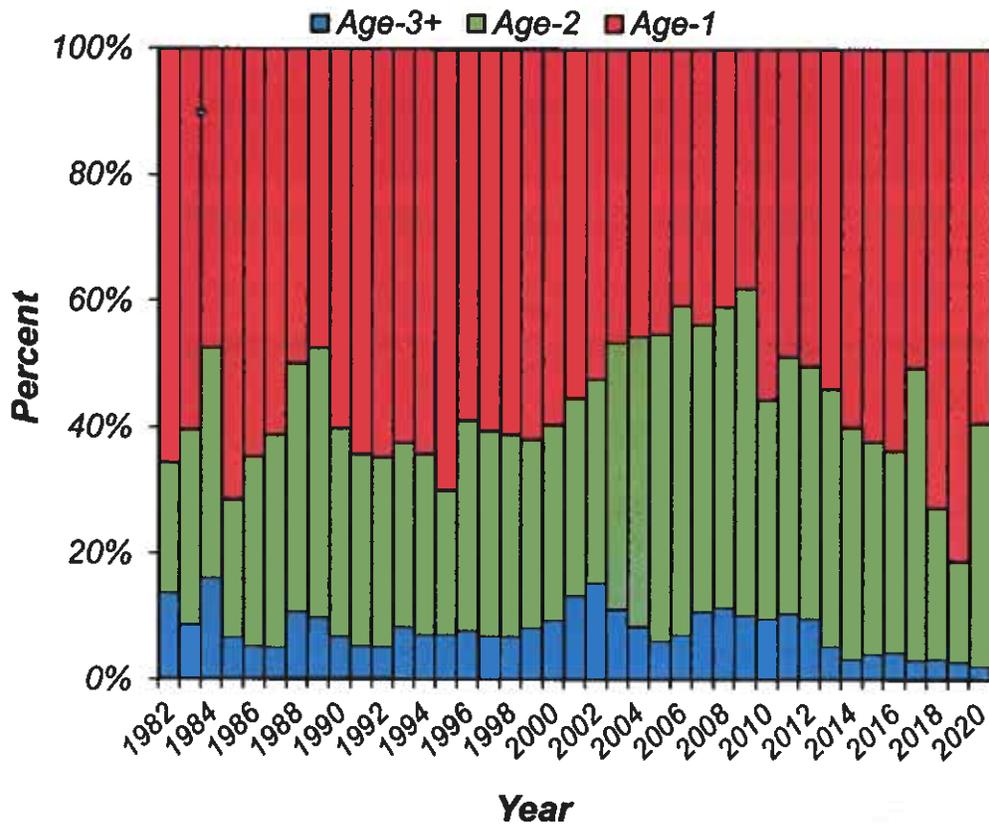
## Recreational Effort (2014-2020)



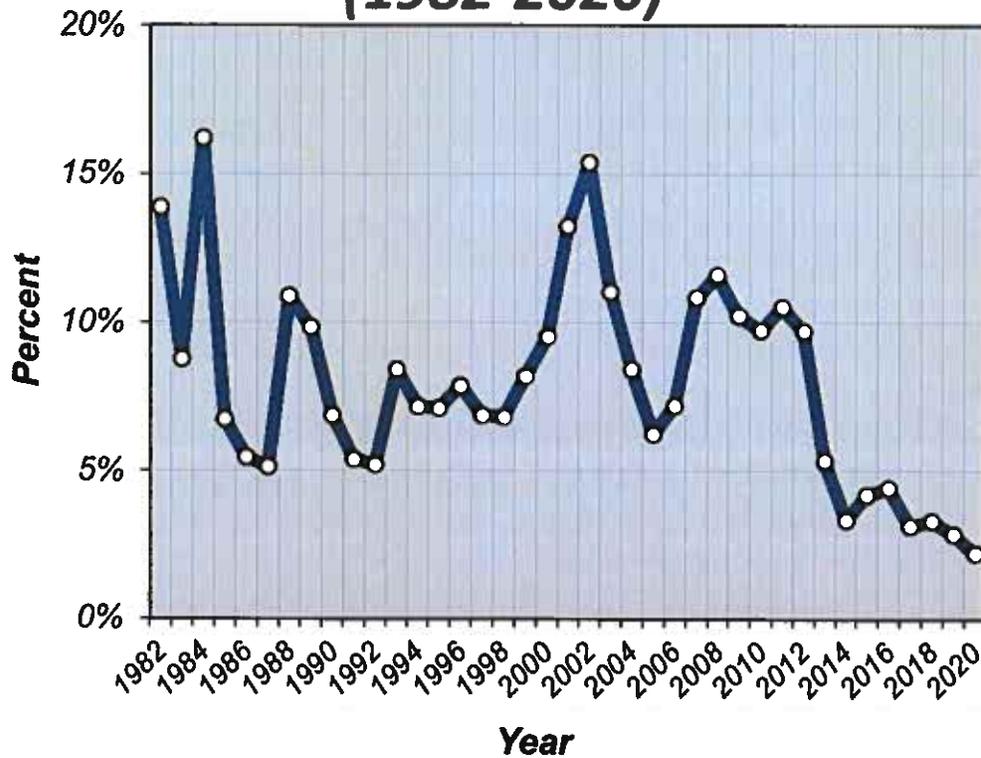
## Recreational Landings (2014-2020)



# Age Composition Female Landings (1982-2020)

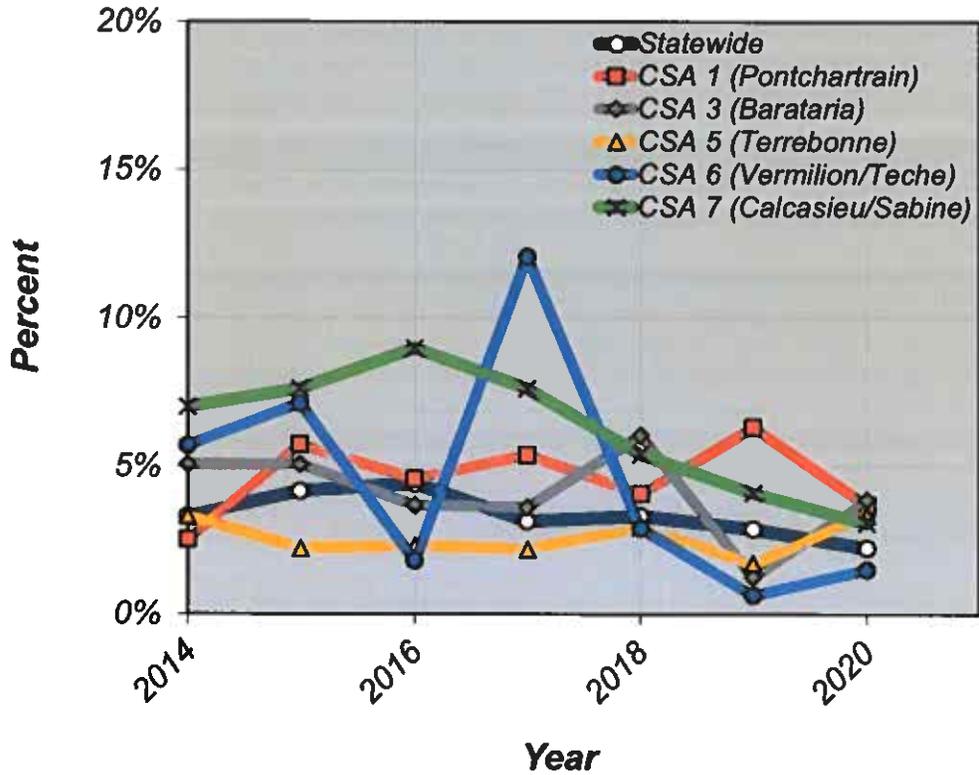


## Percent of Female Landings Age-3+ (1982-2020)

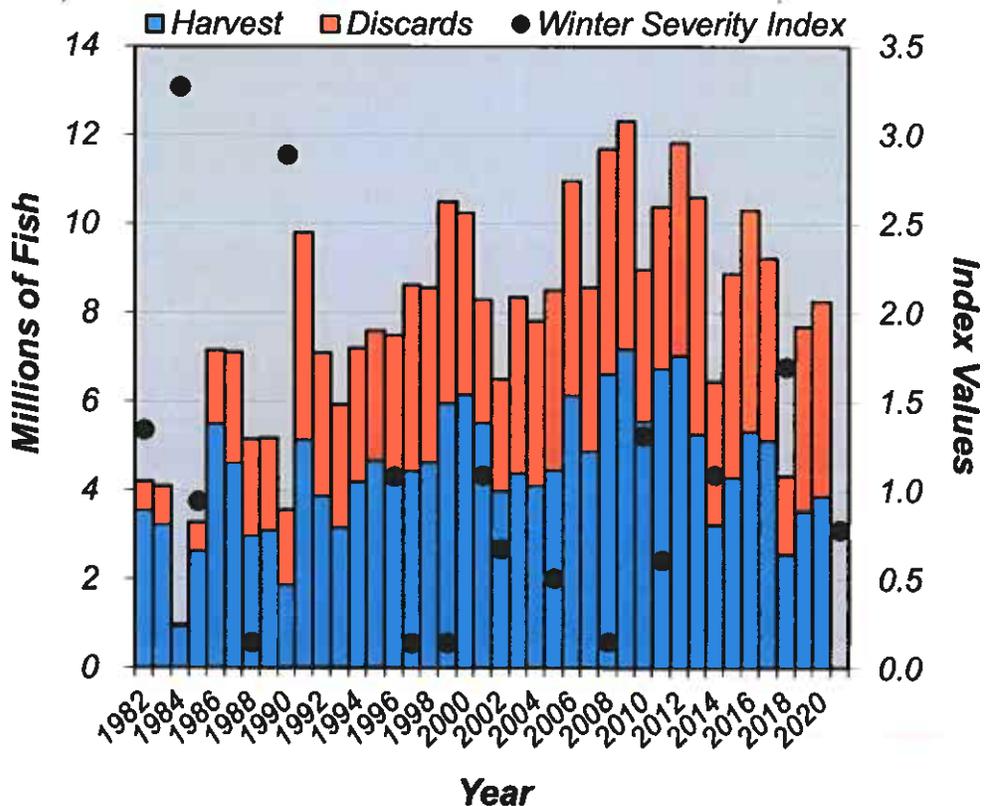


## Percent of Female Landings Age-3+ (2010-2020)

*\*Recreational Only*



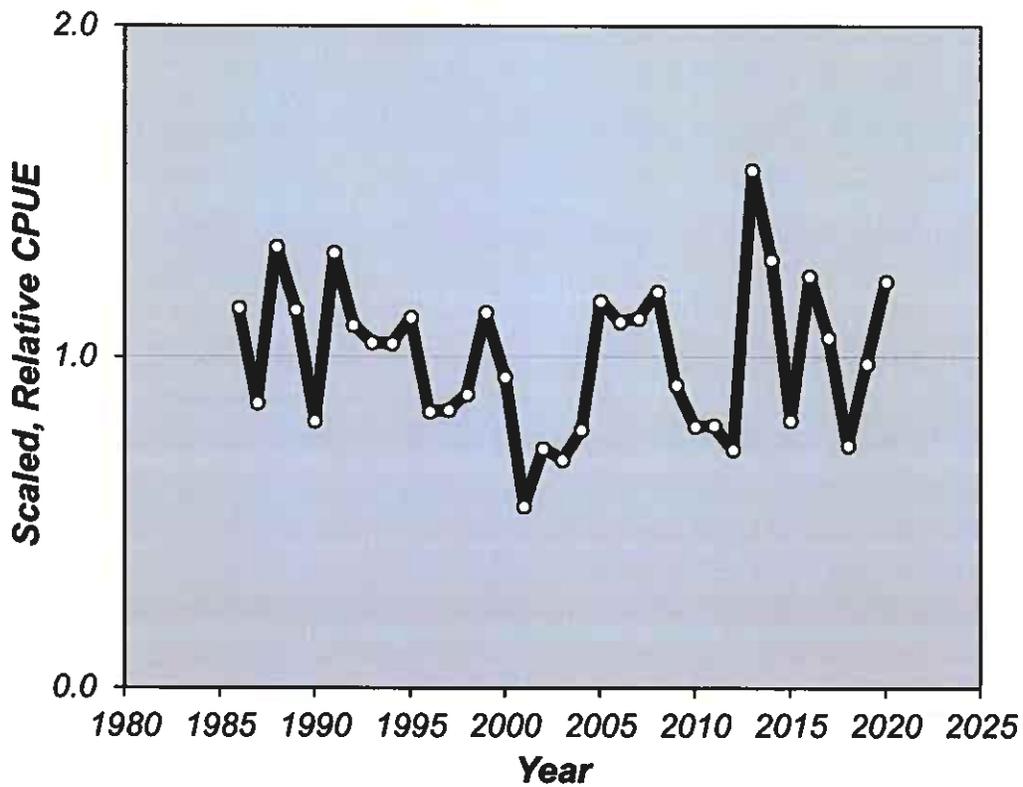
## Winter Severity Index



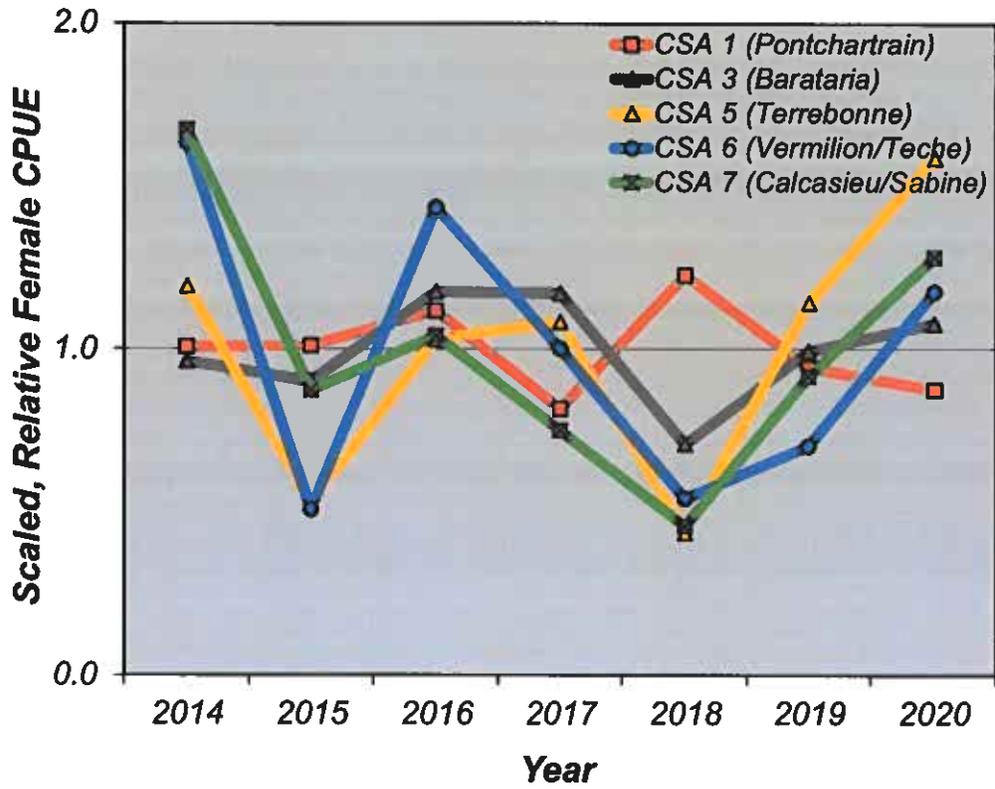
# Gillnet Survey



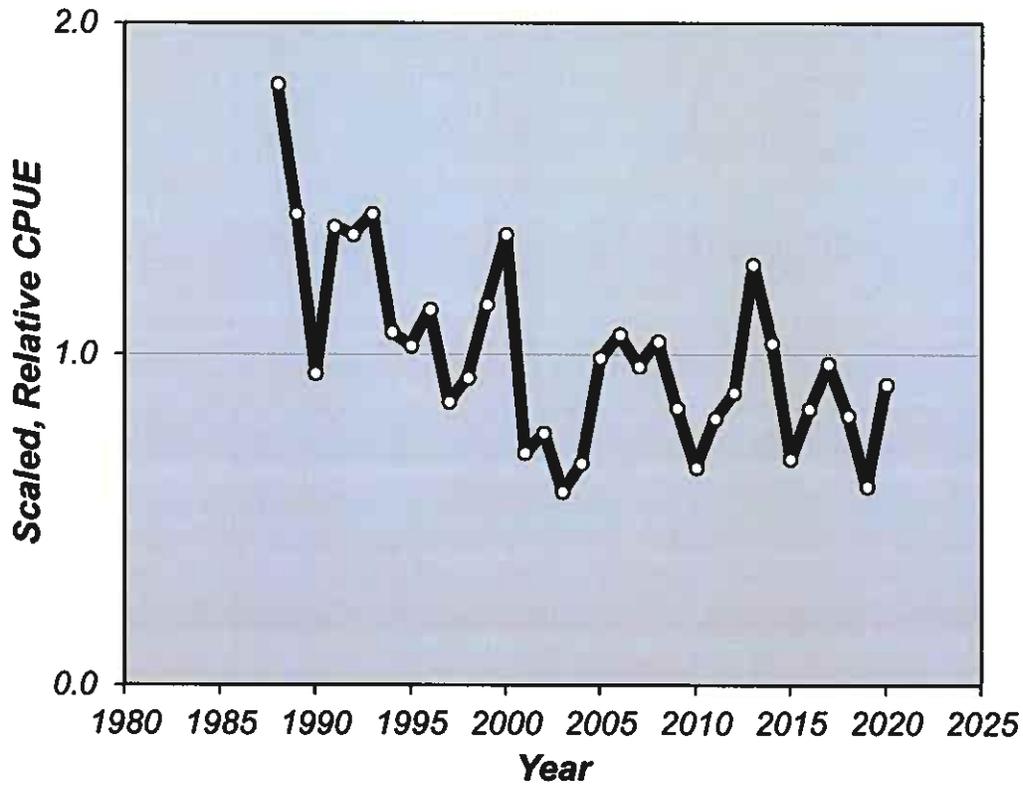
## 1.0-inch Mesh Panel



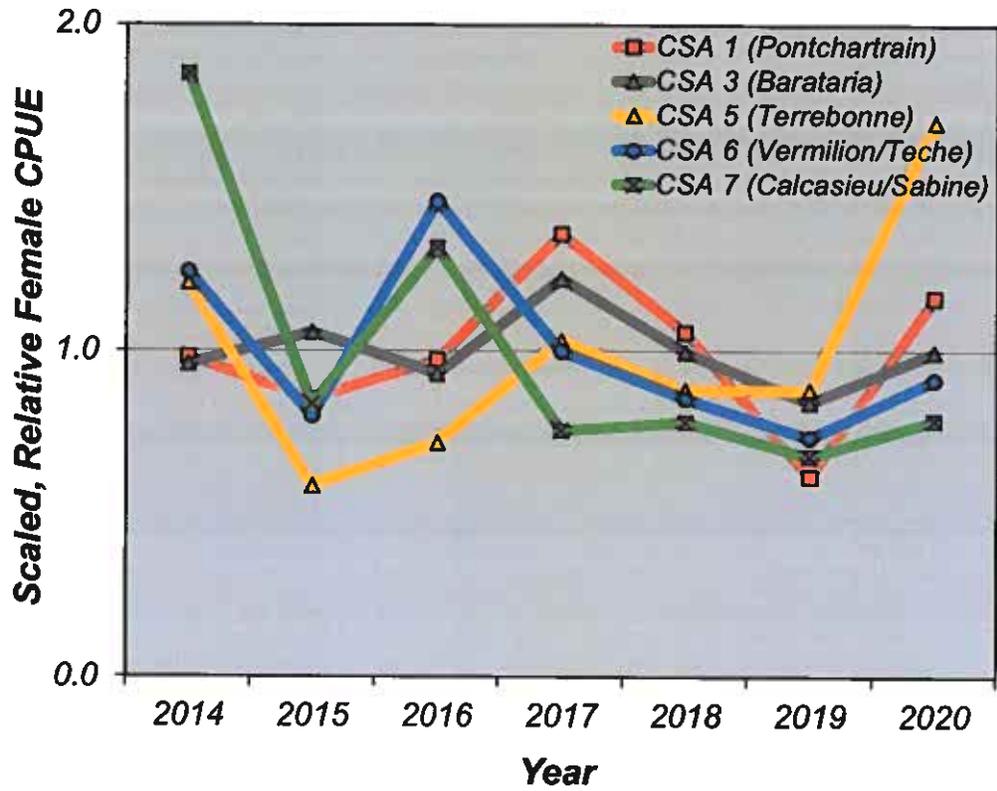
## 1.0-inch Mesh Panel



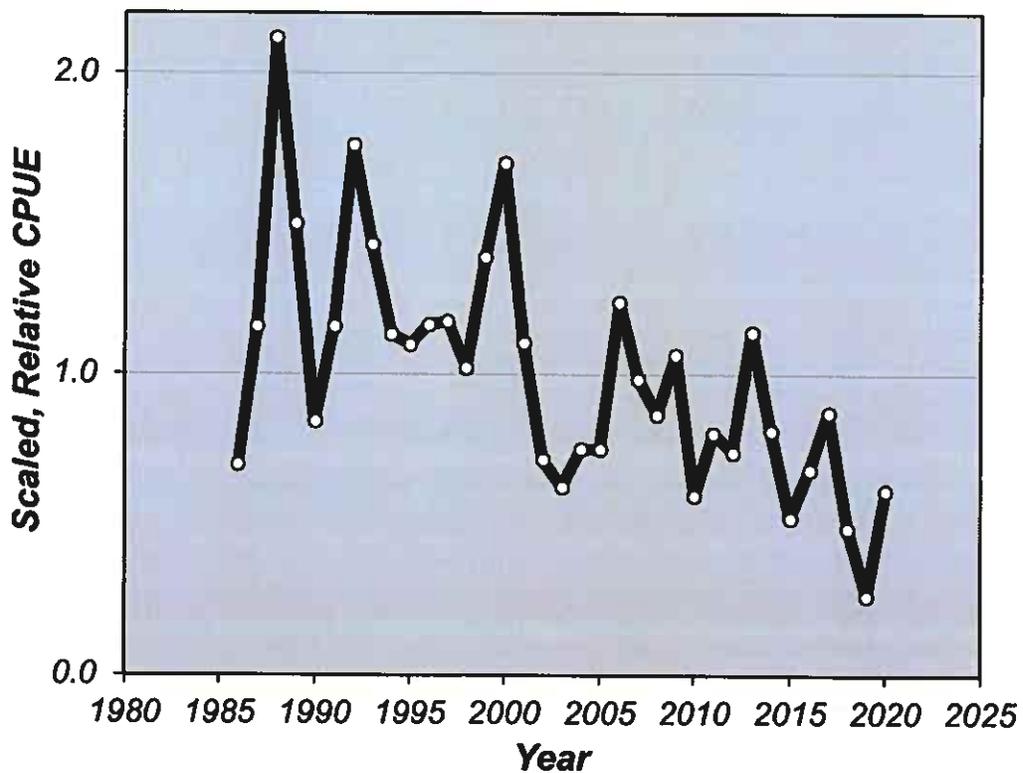
## 1.25-inch Mesh Panel



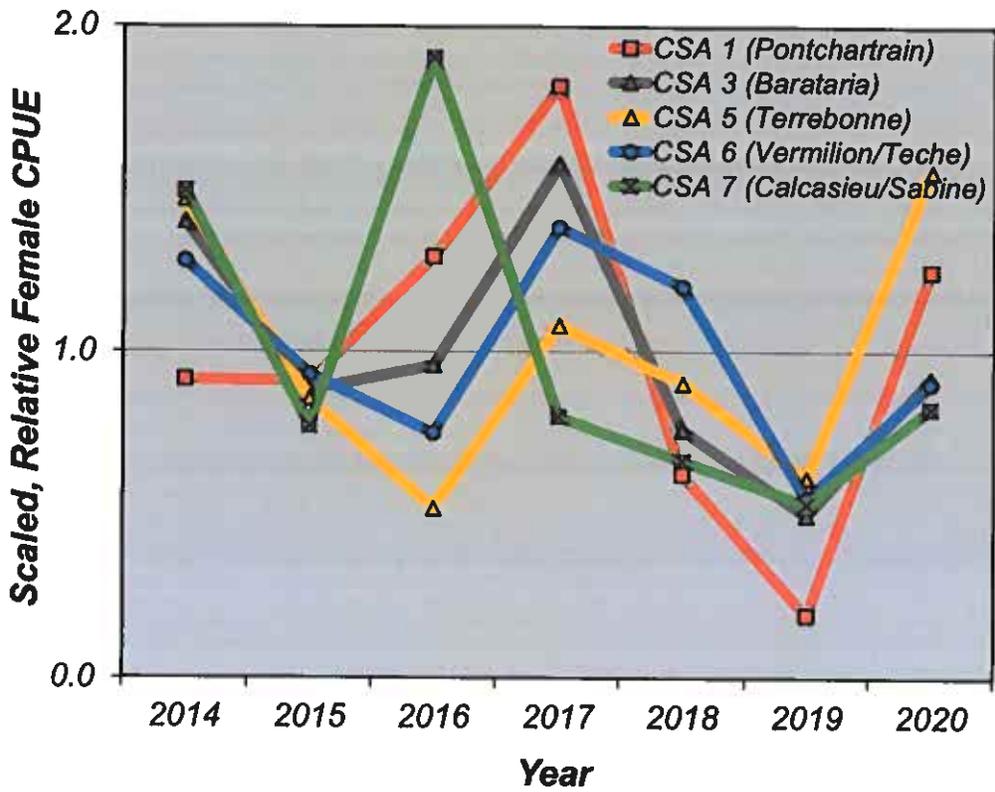
## 1.25-inch Mesh Panel



## 1.5-inch Mesh Panel



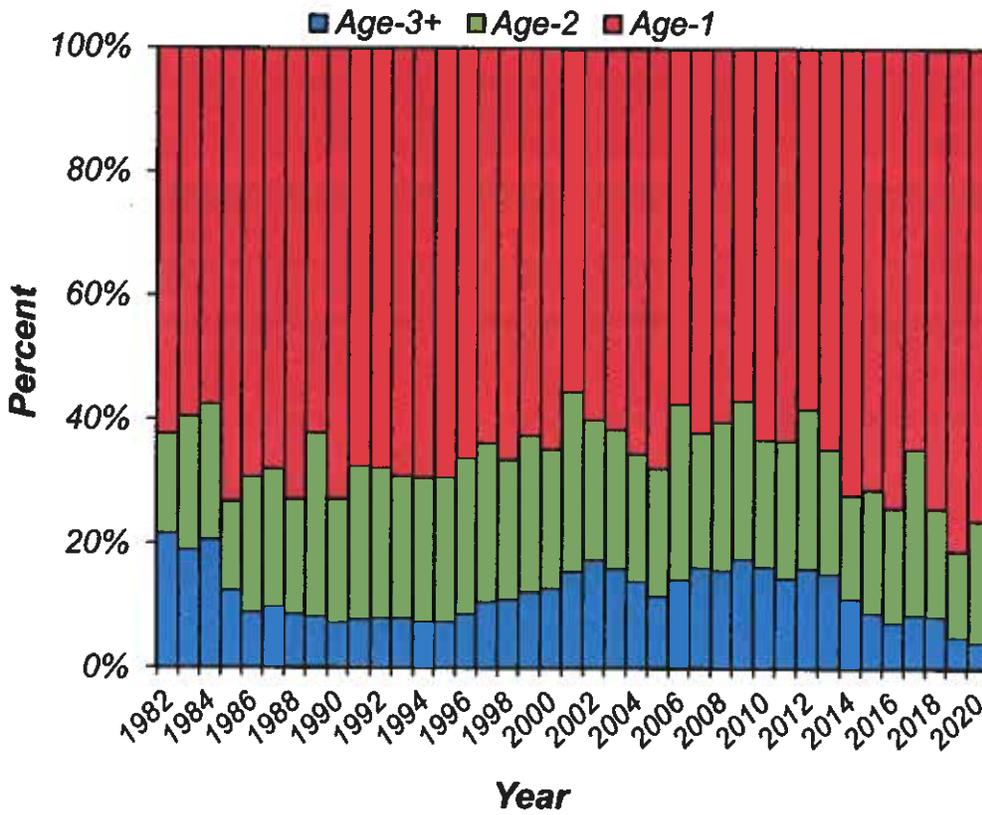
## 1.5-inch Mesh Panel



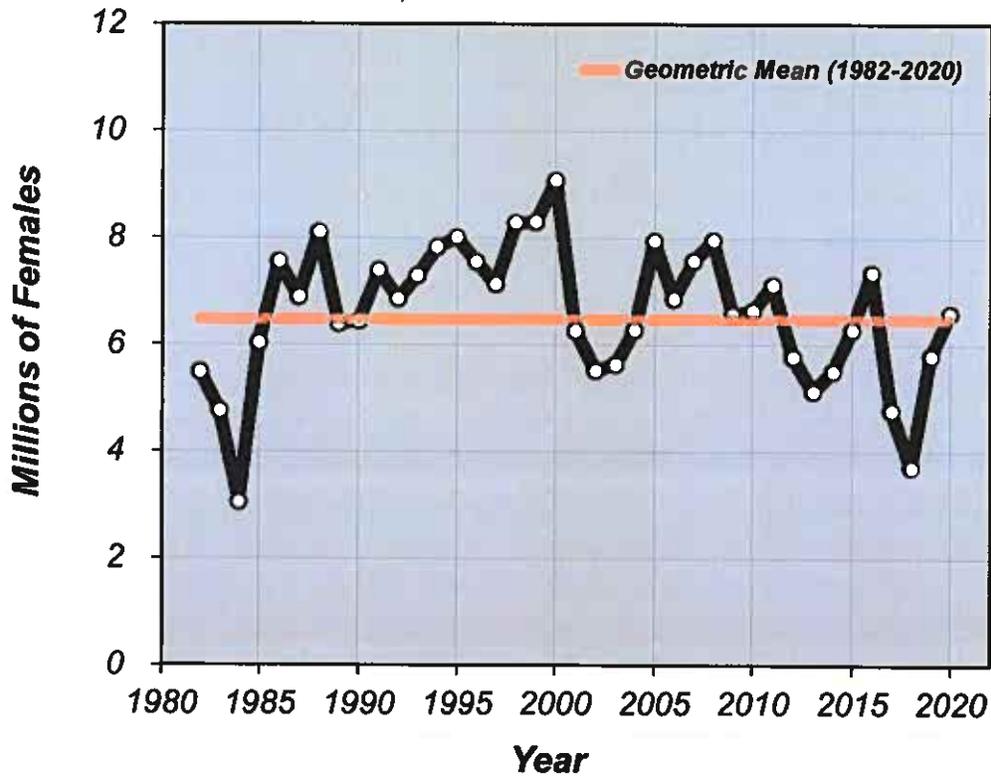
**Stock Assessment Results**



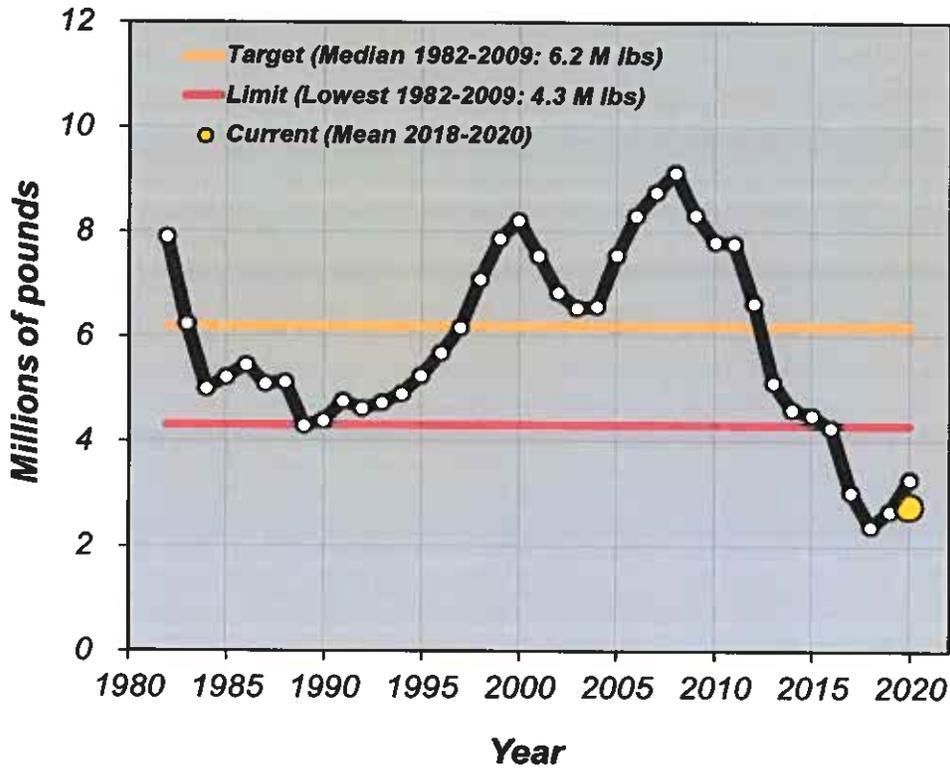
# Age Composition Female Stock



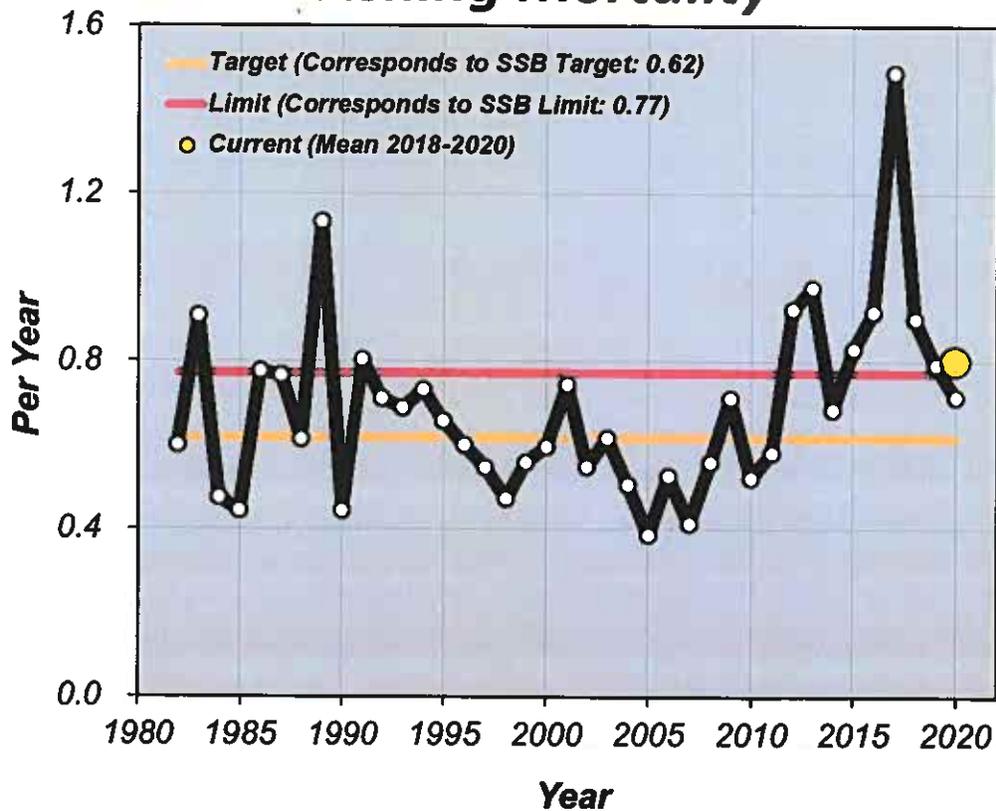
# Age-1 Female Recruits



# Female Spawning Stock Biomass



# Fishing Mortality



# *Assessment Summary*

- **Spotted seatrout stock is overfished with overfishing currently occurring**
- **Overfishing has occurred frequently in the most recent decade (70%)**
- **Spawning stock biomass and SPR are at the lowest levels seen in the history of the assessment**
- **Proportion of older fish (age-3+) in the stock at lowest levels seen**
- **Recent landings at lowest level observed since the early 1990's**
- **An experimental winter severity index has been reviewed that helps explain the low landings observed following severe winters**

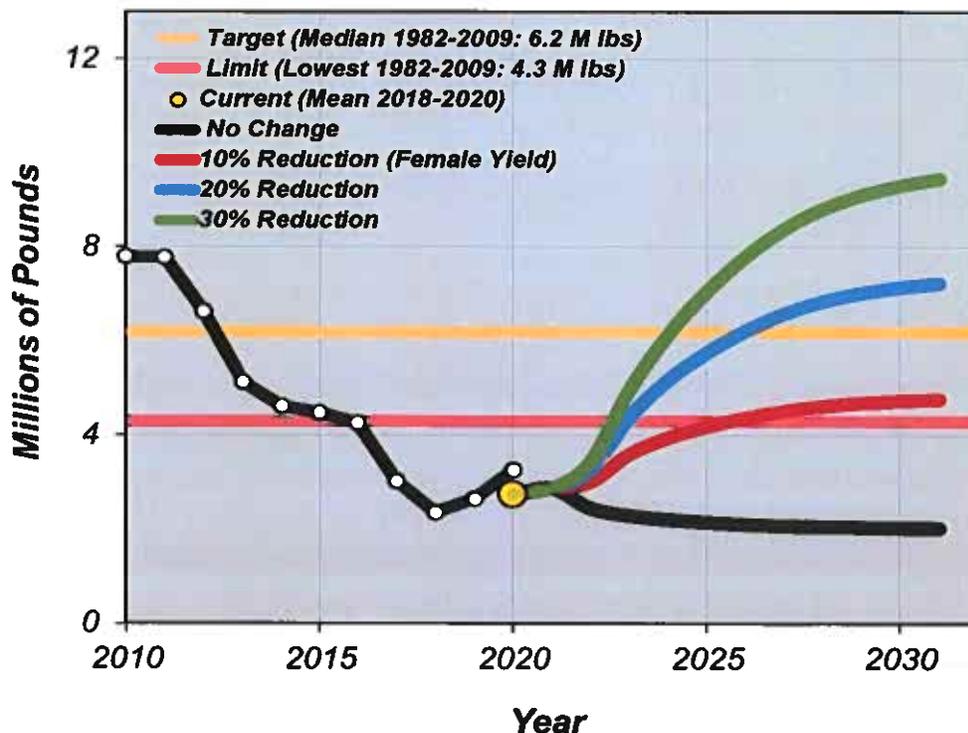
## *Stock Projections*



# Projection Summary

- Ten-year stock projection (2022-2031) of base model
- Projected population metrics are stock status indicators only (SSB, SPR, and average F)
- Future recruitment levels assumed equivalent to the most recent decade (mean 2011-2020)
- Future winter severity impacts also assumed equal to most recent decade (mean 2011-2020)
- Each management scenario represents a specific percent savings of female landings in terms of weight (5, 10, 15, 20, 25, and 30%)

## Female Spawning Stock Biomass



# *Fishery Reductions*

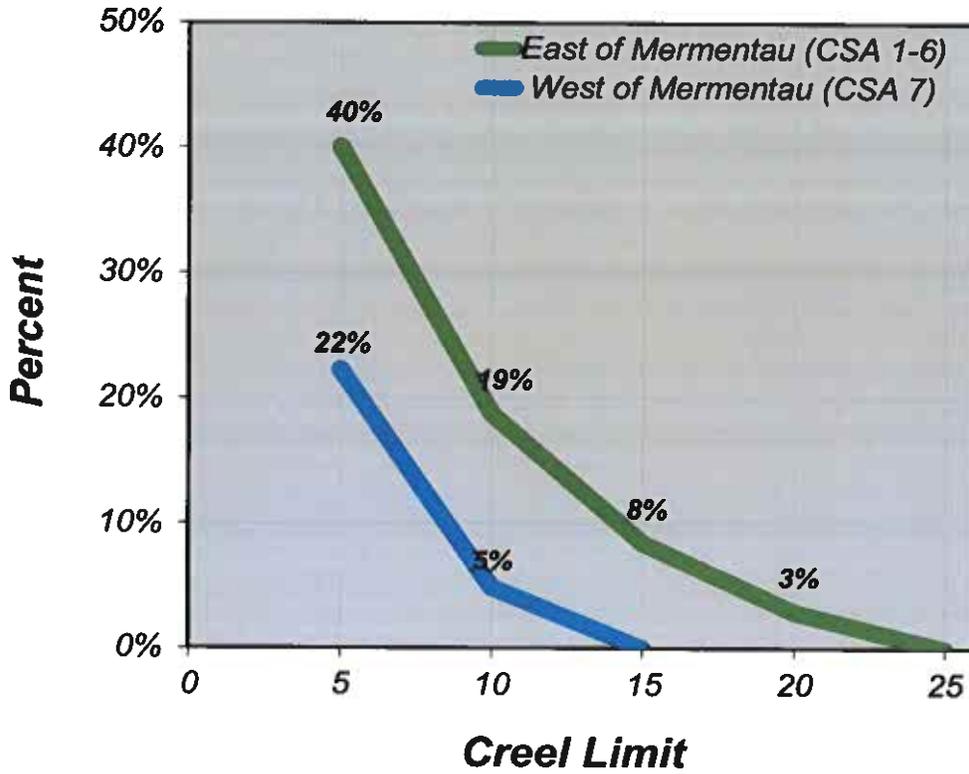


## *Fishery Reductions Summary*

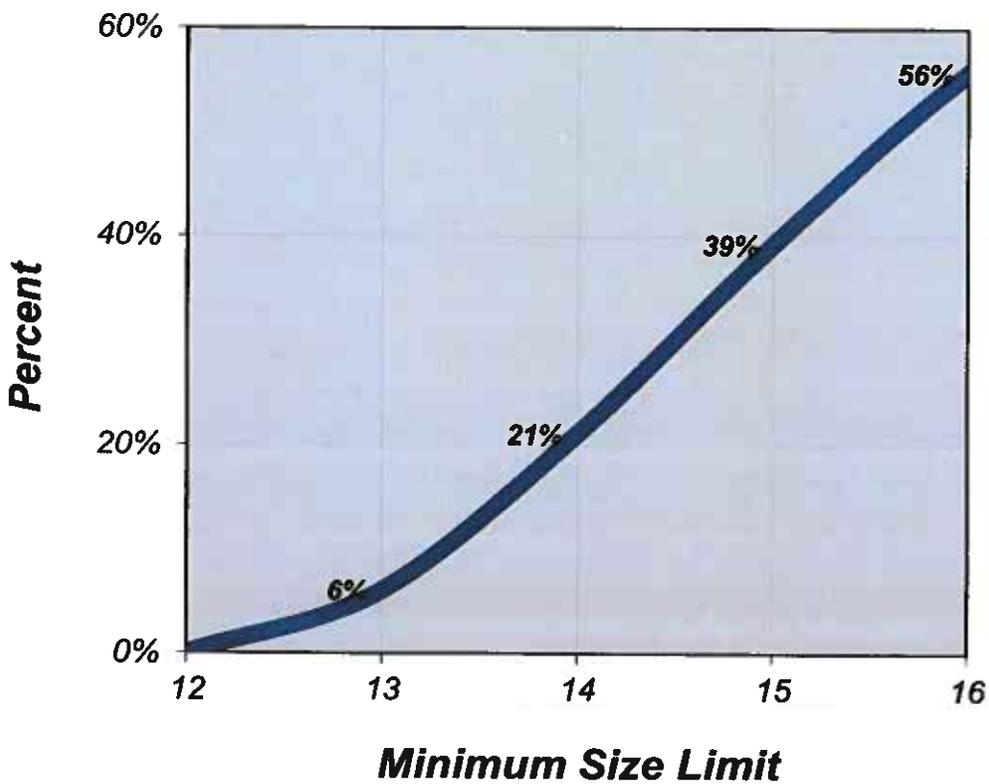
- **Fishery reductions calculated from the LDWF Recreational Creel and Biological Sampling Programs (2018-2020)**
- **Reductions in terms of female yield reductions**
- **Reductions from creel and size limit changes only**
- **Creel limit reductions based on future directed effort remaining comparable to current**
- **Size limit reductions based on a 10% discard mortality assumption**



## Creel Limit Reductions



## Minimum Size Limit Reductions



## ***Size and Creel Options***

<b>Minimum Size</b>	<b>Creel</b>	<b>Reduction</b>
12"	9	21%
12.5"	10	21%
13"	11	21%
13.5"	15	20%
14"	25	21%

<b>Slot Limit</b>	<b>Creel</b>	<b>Reduction</b>
12" - 20"	11	20%
12.5" - 20"	12	20%
13" - 20"	13	21%
13.5" - 20"	21	20%
14" - 20"	25	25%

## ***Next Steps***

- **Recover stock (SSB, SPR) to target or above by 2027(5 year recovery timeline)**
- **Recovery options:**
  - **Creel limit changes only**
  - **Size limit changes only (including slot limits)**
  - **Any combination of creel and size limit changes**
  - **Supplemental: Special regulations following significant freeze events (will require further development of options)**
  - **Alternative: Seasonal or areal closures (not recommended)**



## *Next Steps*

- Guidance from the LWFC on Management Options
- Guidance on bringing forward a Notice of Intent at the December or January meeting to begin addressing the problems with the stock

## Questions ?

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## **Spotted Seatrout Management Scenarios**

Joe West, Taylor Allgood, Xinan Zhang, and Jason Adriance  
Office of Fisheries  
Louisiana Department of Wildlife and Fisheries

### Overview

The simulated projections of the Louisiana spotted seatrout stock presented in this report use the parameter values and population dynamics model of the most recent Louisiana Department of Wildlife and Fisheries (LDWF) spotted seatrout stock assessment (West et al. 2021). To remain in the same currency as the stock assessment, the stock projections and fishery savings presented in this report represent only the female proportion of the population and landings.

### Management Scenarios

Management scenarios representing reductions in female yield were projected forward ten years from 2021 (Table 1; Figure 1) by reducing total apical fishing mortality rates corresponding with specific percent reductions in equilibrium female yield (5, 10, 15, 20, 25, and 30% reductions). The ten-year projection was conducted by assuming future recruitment levels and winter severity impacts as averages of the most recent decade (2011-2020). The projection from the terminal year of the assessment through 2021 assumed equivalent fishing mortality rates. Projected population metrics are stock status indicators only: spawning stock biomass (SSB), spawning potential ratio (SPR), and the average fishing mortality rate ( $F_{avg}$ ).

In each projection, 2022 represents the first full year of new regulation implementation. If regulations are implemented during the course of 2022, the effects of those measures would be to a lesser extent than a full year. In such a case, specific values of each following year would be different, but the equilibrium population trajectories would remain consistent with those reported here.

Changes to size limits were not explicitly modeled due to limitations of the age-structured population dynamics model. Estimated benefits for each management scenario are modeled directly from changes in the overall fishing mortality rate without adjusting the age-structure of the catch. If size limit regulations are modified upward, population trajectories of SPR and SSB would likely increase marginally from those reported here due to that differential fishing mortality-at-age.

### Fishery Savings

Empirical fishery savings, in terms of female yield (landed weight), from changes in creel and size limits were calculated using the 2018-2020 information available from the LDWF Recreational Creel Survey and Biological Sampling Programs (Tables 2-4; Figures 2-4). Female yield reductions from size limit increases were calculated based a 10% discard mortality rate. Female yield reductions from creel limit decreases were calculated based on the assumption that future directed fishery effort will remain comparable to current directed fishery effort. Fishery savings from alternative management measures such as closed seasons or areas are not included in this report.



Table 3: Fishery savings in terms of female yield (% reductions) for different combinations of MLL and creel limits (CSA 1-6 creel savings).

MLL_Inches/Creel	%Reduction (Female Yield)				
	5	10	15	20	25
12	40%	19%	8%	3%	0%
13	44%	24%	14%	9%	6%
14	53%	36%	28%	23%	21%
15	64%	51%	44%	41%	39%
16	74%	64%	60%	57%	56%

Table 4: Fishery savings in terms of female yield (% reductions) for different combinations of slot limits and creel limits (CSA 1-6 creel savings).

SL_Inches/Creel	%Reduction (Female Yield)				
	5	10	15	20	25
12 to 20	43%	23%	13%	8%	5%
13 to 20	47%	27%	18%	13%	11%
14 to 20	56%	40%	32%	28%	26%
15 to 20	66%	54%	49%	46%	44%
16 to 20	76%	68%	64%	62%	60%

Figures:

Figure 1: Projections of average F, SSB, and SPR.

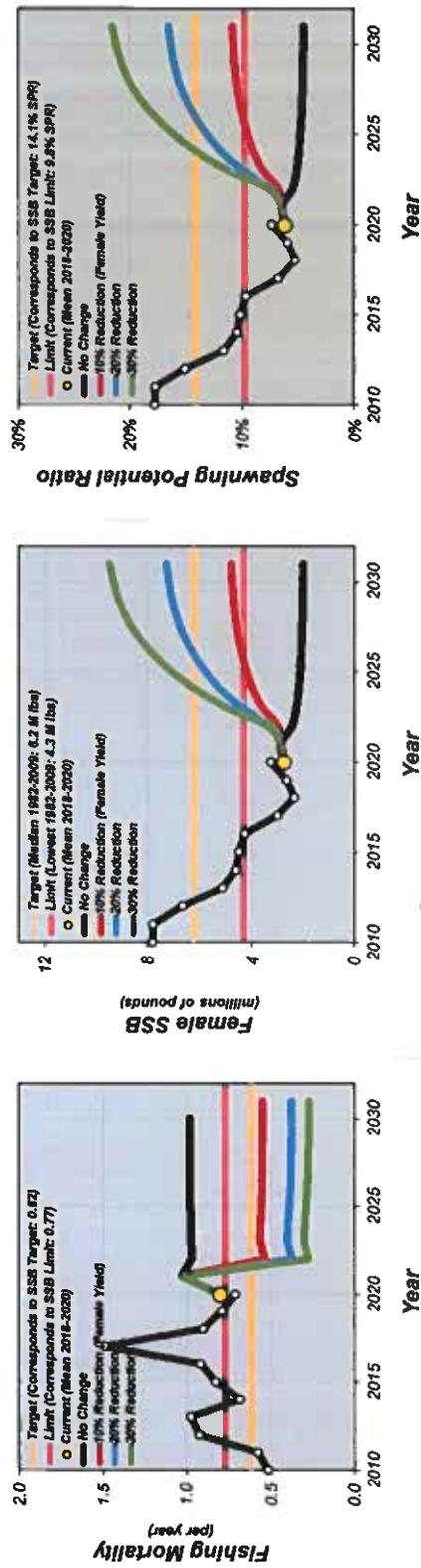


Figure 2: Fishery savings in terms of female yield (% reductions) for different creel limits, minimum length limits, and slot limits.

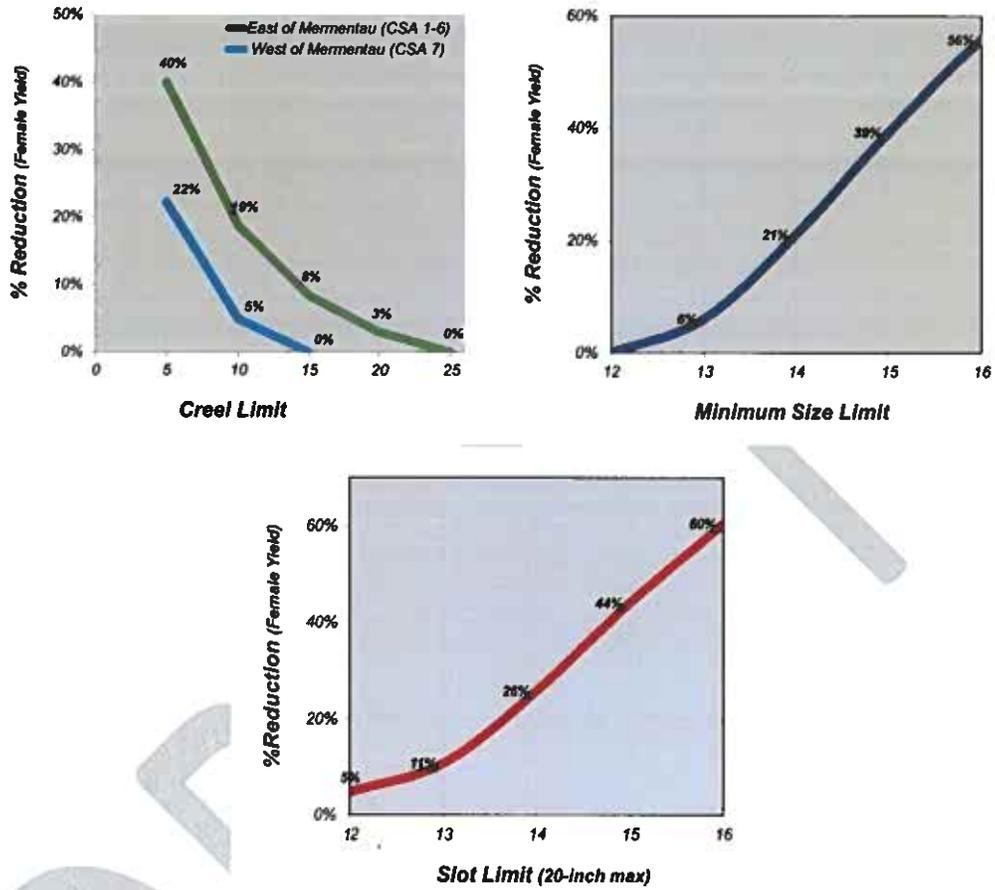


Figure 3: Fishery savings in terms of female yield (% reductions) for different combinations of minimum length limits and creel limits (CSA 1-6 creel savings).

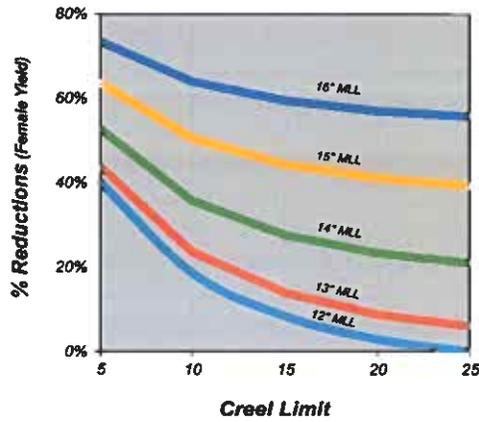
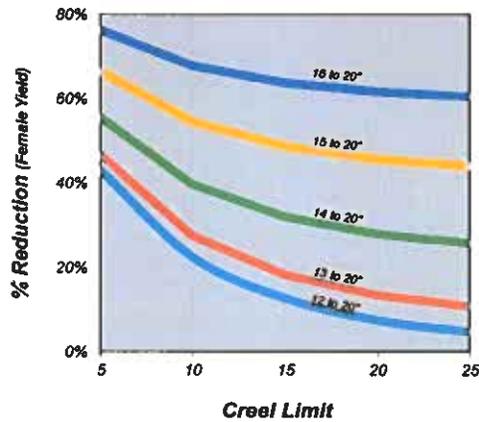


Figure 4: Fishery savings in terms of female yield (% reductions) for different combinations of slot limits and creel limits (CSA 1-6 creel savings).

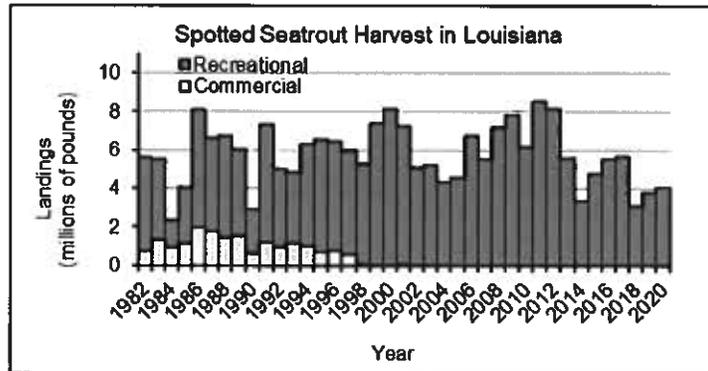


## Update Assessment of Spotted Seatrout (*Cynoscion nebulosus*) in Louisiana Waters 2021 Report

### Executive Summary

Landings of spotted seatrout (SST) in Louisiana have remained below 5 million pounds per year in the most recent decade with the exceptions of 2011-2013 and 2016-2017. The 2014 and 2018-2020 recreational harvests were the lowest observed since 1990. The highest recreational harvest on record (over 8 million pounds) was observed in 2011. After the commercial net ban in 1997, when rod and reel gear became the only allowed method of spotted seatrout harvest, commercial landings declined significantly and account for less than 0.1% of annual landings in the most recent decade.

A statistical catch-at-age model is used in this stock assessment to describe the dynamics of the female portion of the Louisiana spotted seatrout stock. The assessment model forward projects



annual abundance at age from estimates of abundance in the initial year of the time-series and recruitment estimates in subsequent years. The model is fit to the data with a maximum likelihood fitting criterion. Minimum data requirements are fishery catch-at-age and an index of abundance. Landings are taken from the Louisiana Department of Wildlife and Fisheries (LDWF) Recreational Creel Survey and Commercial Trip Ticket Programs, the National Marine Fisheries Service (NMFS) commercial statistical records, and the NMFS Marine Recreational Information Program (MRIP). Abundance indices are developed from the LDWF experimental marine gillnet survey. Age composition of fishery catches are estimated with age-length-keys derived from age samples of the fishery and a growth model.

In earlier assessments of the LA SST stock (West et al. 2011, West et al. 2014, West et al. 2019), targets and explicit limits of fishing were proposed to ensure future sustainability of the stock. The proposed limits of fishing were based on the history of the stock by requiring female spawning stock biomass not fall below the lowest level observed earlier in the fishery in which the stock demonstrated sustainability. Based on results of this assessment update, estimates of stock status relative to the proposed limits indicates the stock is currently overfished and undergoing overfishing. Management actions will be needed in order to prevent future overfishing and recover the stock from its current overfished condition.

### Summary of Changes from 2019 Assessment

Assessment model inputs have been updated through 2020. No changes have been made to the assessment model itself. Trends in basin-specific fishery landings, fishery-independent gill-net catch rates, and corresponding age compositions (2014-2020) have also been included this report (see *Appendix 4*).

**Update Assessment of Spotted Seatrout (*Cynoscion nebulosus*) in Louisiana Waters  
2021 Report**

Joe West, Xinan Zhang, Taylor Allgood, and Jason Adriance  
Office of Fisheries  
Louisiana Department of Wildlife and Fisheries

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## 1. Introduction

A statistical catch-at-age model is used in this stock assessment to describe the dynamics of the female portion of the Louisiana (LA) spotted seatrout *Cynoscion nebulosus* (SST) stock from 1982-2020. The assessment model forward projects annual abundance at age from estimates of abundance in the initial year of the time-series and recruitment estimates in subsequent years. The model is fit to the data with a maximum likelihood fitting criterion. Minimum data requirements are fishery catch-at-age and an index of abundance (IOA). Commercial landings values are taken from the Louisiana Department of Wildlife and Fisheries (LDWF) Trip Ticket Program and the National Marine Fisheries Service (NMFS) commercial statistical records. Recreational harvest estimates are obtained from the LDWF Recreational Creel Program (LA Creel) and the NMFS Marine Recreational Information Program (MRIP). Abundance indices are developed from the LDWF experimental marine gillnet survey. Age composition of fishery catches are estimated with age-length keys derived from age samples of the fishery (2002-2020) and a growth model (1982-2001).

### 1.1 Fishery Regulations

The LA SST fishery is governed by the LA State Legislature, the Wildlife and Fisheries Commission, and the Department of Wildlife and Fisheries. Current recreational regulations are a 12-inch minimum length limit (MLL) and a 25-fish per day creel limit, with the exception of south-west Louisiana (from the Texas border to the Mermentau River) that is currently managed with a 15-fish daily creel limit with a 12-inch MLL and no more than two fish allowed over 25-inches. Commercial harvest is limited to rod and reel gear only, with a 14-inch MLL. Historic commercial and recreational SST fishery regulations were reviewed in an earlier assessment report (West *et al.* 2011).

### 1.2 Trends in Harvest

Time-series of recreational and commercial landings are presented (Table 1, Figure 1). Louisiana spotted seatrout landings have remained below 5 million pounds per year in the most recent decade with the exceptions of 2011-2013 and 2016-2017. The 2014 and 2018-2020 recreational harvests were the lowest observed since 1990. The highest recreational harvest on record (>8 million pounds) was observed in 2011. After the commercial net ban in 1997, when rod and reel gear became the only allowed method of spotted seatrout harvest, commercial landings declined significantly and account for less than 0.1% of annual landings in the most recent decade.

## 2. Data Sources

### 2.1 Fishery Independent

The LDWF fishery-independent experimental marine gillnet survey is used in this assessment to develop abundance indices for use in the assessment model. Below is a brief description of this surveys methodology. Complete details can be found in LDWF (2018).

For sampling purposes, coastal Louisiana is currently divided into five LDWF coastal study areas (CSAs). Current CSA definitions are as follows: CSA 1 – Mississippi State line to South Pass of the Mississippi River (Pontchartrain Basin); CSA 3 – South Pass of the Mississippi River to Bayou Lafourche (Barataria Basin); CSA 5 – Bayou Lafourche to eastern shore of Atchafalaya Bay (Terrebonne Basin); CSA 6 – Eastern shore of Atchafalaya Bay to western shore of Freshwater Bayou Canal (Vermillion/Teche/Atchafalaya Basins); CSA 7 – western shore of Freshwater Bayou Canal to Texas State line (Mermentau/Calcasieu/Sabine Basins).

The LDWF Marine Fisheries Section conducts routine standardized sampling within each CSA as part of a long-term comprehensive monitoring program to collect life-history information and measure relative abundance/size distributions of recreationally and commercially important species. These include the experimental marine gillnet, trammel net, and bag seine surveys.

In this assessment, only the experimental marine gillnet survey is used. This survey has the highest spotted seatrout catch rates, frequency of occurrence, and precision when compared to the other LDWF FI surveys. The survey is conducted with standardized design. Hydrological and climatological measurements are taken with each biological sample, including water temperature, turbidity, conductivity and salinity. Survey gear is a 750-foot monofilament gillnet comprised of five 150-foot panels of 1.0, 1.25, 1.5, 1.75, and 2.0-inch bar meshes.

Samples are taken by ‘striking’ the net. All captured SST are enumerated and a maximum of 30 randomly selected SST per mesh panel are collected for length measurements, gender determination, and maturity information. When more than 30 SST are captured per mesh panel, catch-at-size is derived as the product of total catch and proportional subsample-at-size.

The survey was conducted from 1986 to April 2013 at fixed sampling locations within each CSA. The 1.25 and 1.75-inch bar mesh sizes were not included in the survey until 1988. In October of 2010, additional fixed stations were added to this survey allowing more spatial coverage within each CSA. Beginning in April 2013, the survey design was modified where sampling locations are now selected randomly from the established stations within each CSA (Figure 2).

## 2.2 Fishery Dependent

### Commercial

Commercial SST landings are taken from NMFS commercial statistical records (1982-1998; NMFS 2021a) and the LDWF Trip Ticket Program (1999-2020).

For aging purposes, annual landings are allocated into six-month seasons (*i.e.*, January-June and July-December). Because only limited seasonal landings data are available from earlier in the fishery, the monthly landings records that are available are pooled into time-periods of consistent regulation (1981-1996 and 1997-1998) to develop seasonal catch compositions. Starting in 1999, seasonal catches are taken directly from the LDWF Trip Ticket Program.

Size composition of commercial catches in each year and season are derived from LDWF sampling effort (pre-1997 and 2014-2020) and MRIP records (1997-2013). Pre-1997 size distributions are only available for a limited number of years (1986 and 1990-1992) during which time the commercial sector operated under different MLLs and used a wider variety of harvest methods. Therefore, the 1990-1992 data are combined to describe the size composition of commercial catches from 1987-1996 (*i.e.*, primarily a net fishery with a 14-inch MLL) and the 1986 data are used to describe the 1981-1986 commercial size compositions (*i.e.*, primarily a net fishery with 10 and 12-inch MLLs; Table 2). Seasonal size distributions of commercial catches are not available pre-1997; therefore, equivalent size composition is assumed for each six-month period. For years following the commercial net ban (*i.e.*, 1997-present; only rod and reel harvest allowed with a 14 inch MLL), size composition of commercial catches are taken from MRIP records and the LDWF Biological Sampling Program (*i.e.*, assuming equivalent vulnerability to rod and reel gear for both fisheries, but selecting only sizes  $\geq 14$  inches total length; Table 3).

### Recreational

Recreational SST landings estimates are taken from the LDWF recreational creel survey (LA Creel; 2014-2020) and estimates hindcast to the historic MRIP time-series (1982-2013; details in *Appendix 1*). Consequently, the pre-2014 recreational harvest estimates used in this assessment differ from the LA estimates currently published by MRIP (<https://www.st.nmfs.noaa.gov/recreational-fisheries/data-and-documentation/queries/index>). Furthermore, due to changes made to the MRIP Access Point Angler Intercept Survey (APAIS) in 2013 (see <https://www.fisheries.noaa.gov/topic/recreational-fishing-data#making-improvements>) and the recent transition from the MRIP Coastal Household Telephone Survey to the new Fishing Effort Survey (FES; see <https://www.fisheries.noaa.gov/recreational-fishing-data/types-recreational-fishing-surveys#fishing-effort-survey>), harvest estimates currently available from MRIP also differ from those used in earlier LA SST stock assessments (West *et al.* 2011, West *et al.* 2014).

For aging purposes, SST harvest and live release estimates are derived in six-month periods described in the previous section. Live releases are further delineated as legal or illegal with LA Creel and MRIP catch disposition codes.

Size composition of SST harvest estimates are derived from the LDWF Biological Sampling Program (2014-2020) and MRIP (1982-2013; prior to the APAIS and FES calibration changes) for each year and six-month season (Table 3); size composition of legal live releases is assumed equivalent. Statewide size compositions obtained from the LDWF Biological Sampling Program are derived by statistically weighting the CSA-specific size compositions by the corresponding recreational landings estimates.

Size composition of under-sized releases in each year and season is estimated by first assuming all illegal discards as < 12 inches total length. Some catch, however, is in fact legal-sized, but coded as illegal due to catches greater than the creel limit. These catches (~2% of LA angler trips per year, 2018-2020; LA Creel unpublished data) occur infrequently and are thus considered negligible for purposes of this assessment. Size composition of SST catches < 12 inches are pooled from the years prior to recreational MLL implementation and used as proxies of sublegal size composition after the 12 inch MLL was implemented in 1987.

#### Bycatch

##### Menhaden Reduction Fishery

Time series of incidental catch of SST from the LA menhaden reduction fishery have been developed from observations of retained and released SST CPUE (numbers per purse seine set) and annual effort estimates of the menhaden reduction fishery (LDWF 2020, see *Appendix 2*). The mean estimates of spotted seatrout bycatch in the most recent decade indicate very low levels of SST bycatch relative to the landings of the directed LA fisheries (0.07% in units of weight). Due to the negligible level of estimated SST bycatch relative to the landings of the LA directed fisheries, incidental SST catches of the LA menhaden reduction fishery are not considered further in this assessment.

##### Shrimp Fishery

Bycatch has been characterized for the 2019-2020 inshore LA shrimp fishery (Cagle and West 2020; see *Appendix 3*). Incidental catches of SST were observed in this study. A time-series of annual LA inshore bycatch of SST in units of weight can be estimated as the product of the mean bycatch to shrimp sample ratio from the bycatch study, the annual inshore LA shrimp landings, and the proportion of SST observed in the catches of the bycatch study, under the assumption that estimates from the study are characteristic of the inshore fishery through time. While this assumption allows calculation of a time-series of bycatch,

the fishery has transformed and developed over time making this assumption unlikely. Nevertheless, a time-series of SST bycatch estimates are calculated, following the method outlined, for comparison to the SST landings of the directed LA fisheries (Figure 3). The estimates of annual SST bycatch from the LA inshore shrimp fishery in the most recent decade indicate relatively low levels of bycatch when compared to the landings of the directed LA fisheries (6.6% in units of weight).

The age and sex composition of the annual estimates of SST bycatch can be calculated from the size composition of SST bycatch observed in the study, the annual SST bycatch estimates in units of numbers (converted from weight using the mean weight of SST observed in the study), the estimated sex ratio at size (see 3. *Life History Information*), and an age-length-key. Since the majority of samples in the bycatch study occurred in the fall months, the ALK developed in this assessment to assign ages to landings based on size in the second half of the calendar year (July-December) is used for this purpose (Table 8; see 5. *Catch at Age Estimation*). All SST bycatch from the inshore LA shrimp fishery are assumed to not survive.

The time-series of estimated SST bycatch from the LA inshore shrimp fishery, as numbers of females greater than age-0, along with the corresponding annual yield and age-specific mean weights are included in a sensitivity run of the assessment model (Table 4; see 6. *Assessment Model*).

### 3. Life History Information

#### 3.1 Unit Stock Definition

Spotted seatrout occur in estuaries and nearshore coastal habitat along the Atlantic and Gulf coasts from Cape Cod, Massachusetts, to the Bay of Campeche, Mexico (GSMFC 2001). Most of the harvest, however, is taken in the Gulf of Mexico (GOM) with the largest recreational harvest occurring in LA waters.

Studies using mitochondrial DNA markers (Gold and Richardson 1998; Gold *et al.* 1999) have confirmed significant population substructuring across GOM SST populations. For the purpose of this assessment, the unit stock is defined as those female SST occurring in LA waters. This approach is consistent with the current statewide management strategy; although SST in south-west LA (from the Texas border to the Mermentau River) are managed with slightly different regulations (see 1.1 *Fishery Regulations*).

#### 3.2 Morphometrics

Weight-length regressions for LA SST were developed by Wieting (1989). For the purpose of this assessment, only the female-specific relationship is used with weight calculated from size as:

$$W = 1.17 \times 10^{-5} (FL)^{2.97} \quad [1]$$

where  $W$  is whole weight in grams and  $FL$  is fork length in mm. Fish with only  $FL$  measurements available are converted to  $TL$  (and conversely) using a relationship provided by the Florida Fish and Wildlife Institute (personal communication from Joe O'Hop, July 2010) as:

$$TL = 1.0008 \times FL + 0.6306 \quad [2]$$

where  $FL$  is in mm.

### 3.3 Growth

Spotted seatrout exhibit differences in growth between males and females, with larger SST being predominantly female (Wieting 1989). The growth model developed for female SST in the previous assessment (West *et al.* 2018) that accounts for decreasing growth rates with age (*i.e.*, damped growth model; Porch *et al.* 2002) is used in this assessment. Total length-at-age is calculated with the damped growth model as:

$$TL_a = 28.1 \times (1 - e^{\beta - 0.113(a - 0.0373)}) \quad [3]$$

$$\beta = \frac{0.414}{0.329} (e^{-0.329a} - e^{-0.329 \times 0.0373})$$

where  $TL_a$  is female  $TL$ -at-age in inches and years.

### 3.4 Sex Ratio

The probability of being female at a specific size is calculated with a logistic function developed in West *et al.* (2011) as:

$$P_{fem,l} = \frac{1}{[1 + e^{[-0.464(TL - 10.9)]}]} \quad [4]$$

where  $P_{fem,l}$  is the estimated proportion of females in 1 inch  $TL$  intervals. The minimum sex ratio-at-size is assumed as 50:50.

### 3.5 Fecundity/Maturity

Spotted seatrout are serial spawners where annual fecundity is seasonally indeterminate. To realistically estimate annual fecundity (total egg production), the number of eggs spawned per batch and the number of batches spawned per season must be known. Estimates from a recent LDWF fecundity study (LDWF unpublished data) suggests female fecundity-at-size and female weight-at-size are roughly equivalent. However, estimates from the recent study were hindered by low sample sizes due to the inherent difficulty obtaining samples of spawning fish in the proper condition which led to large estimates of error around the fecundity estimates precluding their use for assessment purposes. Therefore, female spawning

stock biomass (SSB) is used as a proxy for total egg production in this assessment. This may introduce bias if fecundity does not scale linearly with body weight (Rothschild and Fogarty 1989).

Female maturity at size is calculated with a logistic function developed in West *et al.* (2011) as:

$$P_{mat,TL} = \frac{1}{[1+e^{(-0.765(TL-7.70))}]} \quad [5]$$

where  $P_{mat,TL}$  is the estimated proportion of sexually mature female spotted seatrout in 1 inch TL intervals. Female maturity at age is then calculated by substituting equation [5] into equation [3].

### 3.6 Natural Mortality

Spotted seatrout can live to at least ten years of age (GSMFC 2001, Herdter *et al.* 2019). For purposes of this assessment, a value of average  $M$  is assumed (0.3) based on longevity of the species, but is allowed to vary with weight-at-age to calculate a declining natural mortality rate with age. This value of  $M$  is consistent with a stock where approximately 5% of the stock remains alive to 10 years of age (Quinn and Deriso 1999). Following SEDAR 12 (SEDAR 2006), the average value of  $M$  is rescaled where the mean mortality rate over ages vulnerable to the fishery is equivalent to the average  $M$  rate as:

$$M_a = M \frac{nL(a)}{\sum_{a_c}^{a_{max}} L(a)} \quad [6]$$

where  $M$  is the average natural mortality rate over exploitable ages  $a$ ,  $a_{max}$  is the oldest age-class,  $a_c$  is the first fully-exploited age-class, and  $n$  is the number of exploitable ages. The Lorenzen curve as a function of age is calculated from:

$$L(a) = W_a^{-0.288} \quad [7]$$

where -0.288 is the allometric exponent estimated for natural ecosystems (Lorenzen 1996) and  $W_a$  is weight-at-age.

### 3.7 Discard Mortality

Reported SST discard mortality estimates are highly variable (~5-95%; Murphy *et al.* 1995; Stunz and McKee 2006; James *et al.* 2007; personal communication from Glenn Thomas, LDWF, July 2011). Results of these studies suggest the magnitude of post-release mortality as dependent on a number of factors including water quality, bait/hook type, anatomical hooking location, and angler skill-level. Spotted seatrout landings, however, are not directly separable into such components. Therefore, discard mortality is assumed constant in this assessment (10%). This rate is consistent with the overall rod-and-reel release mortality rates from the previously mentioned studies, *i.e.* 5, 11, 10 and 14%, respectively. For modeling purposes, stock losses due to discard mortalities are incorporated directly into recreational landings estimates (see 5. *Catch at Age Estimation*).

### 3.8 Winter Mortality

Spotted seatrout are subject to winter mortality events that vary with winter severity (Ellis *et al.* 2017). An index of winter severity was developed by compiling water temperature data from continuous water temperature monitoring stations across the LA coast and was calculated as the product of the number of days with water temperatures  $\leq 7$  degrees Celsius (*i.e.*, approximate water temperature SST cold-stun deaths begin to occur; Ellis *et al.* 2017) and the inverse of the mean water temperature during that duration (Table 5, Figure 4). Water temperature data from the months of November and December are grouped with the following year's January-March water temperatures for index development (e.g., winter of 1989-90 denoted as 1990).

### 3.9 Relative Productivity / Resilience

The key parameter in age-structured population dynamics models is the steepness parameter ( $h$ ) of the stock-recruitment relationship. Steepness is defined as the ratio of recruitment levels when the spawning stock is reduced to 20% of its unexploited level relative to the unexploited level and determines the degree of compensation in the population (Mace and Doonan 1988). Populations with higher steepness values are more resilient to perturbation and if the spawning stock is reduced to levels where recruitment is impaired are more likely to recover sooner once overfishing has ended. Generally, this parameter is difficult to estimate due to a lack of contrast in spawning stock size (*i.e.*, data not available at both high and low levels of stock size) and is typically fixed or constrained during the model fitting process. Estimates of steepness are not available for spotted seatrout.

Productivity is a function of fecundity, growth rates, natural mortality, age of maturity, and longevity and can be a reasonable proxy for resilience. We characterize the relative productivity of LA SST based on life-history characteristics, following Southeast Data Assessment and Review (SEDAR) 9, with a classification scheme developed at the Food and Agriculture Organization of the United Nations (FAO) second technical consultation on the suitability of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) criteria for listing commercially-exploited aquatic species (FAO 2001; Table 6). Each life history characteristic (von Bertalanffy growth rate\*, age at maturity, longevity, and natural mortality rate) is assigned a rank (low=1, medium=2, and high=3) and then averaged to compute an overall productivity score. In this case, the overall productivity score is 2.75 for LA spotted seatrout indicating high productivity and resilience. The von Bertalanffy growth rate referenced above is replaced in this assessment with the mean growth rate across ages from the damped growth model weighted by expected relative abundance-at-age ( $k = 0.357$ ).

## 4. Abundance Index Development

Abundance indices are developed separately for each mesh panel of the LDWF experimental marine gillnet survey with the exception of the 1.75 and 2.0-inch bar meshes that are excluded due to low catch rates. Stations not sampled regularly through time (prior to October 2010) and the less frequent ‘cold-month’ samples (*i.e.*, October–March) are also excluded. Catch per unit effort is defined as the number of female SST caught in each mesh panel per net sample. To reduce unexplained variability in catch rates unrelated to changes in abundance, each IOA time-series was standardized using methods described below.

A delta lognormal approach (Lo *et al.* 1992; Ingram *et al.* 2010) is used to standardize female SST catch-rates in each year as:

$$I_y = c_y p_y \quad [8]$$

where  $c_y$  are estimated annual mean CPUEs of non-zero female SST catches assumed as lognormal distributions and  $p_y$  are estimated annual mean probabilities of female SST capture assumed as binomial distributions. The lognormal and binomial means and their standard errors are estimated with generalized linear models as least square means and back transformed. The lognormal model considers only samples in which SST were captured; the binomial model considers all samples. Each IOA is then computed from equation [8] using the estimated least-squares means with variances calculated from:

$$V(I_y) \approx V(c_y)p_y^2 + c_y^2V(p_y) + 2c_y p_y \text{Cov}(c, p) \quad [9]$$

where  $\text{Cov}(c, p) \approx \rho_{c,p} [SE(c_y)SE(p_y)]$  and  $\rho_{c,p}$  represents the correlation of  $c$  and  $p$  among years.

Because of the designed nature of the experimental marine gillnet survey, model development was rather straightforward. Variables considered in model inclusion were year, CSA, and sampling location. Because only ‘warm’ month samples (*i.e.*, April–September) are included, time of year was not considered in model inclusion. To determine the most appropriate models, we began the model selection process with a fully-reduced model that included only year as a fixed effect. More complex models were then developed including interactions and random effects and compared using AIC and log-likelihood values. All sub-models were estimated with the SAS generalized linear mixed modeling procedure (PROC GLIMMIX; SAS 2008). In the final sub-models, year was considered a fixed effect, CSA was considered a random block effect, and sampling locations within CSAs were considered random subsampling block effects.

Sample sizes, proportion positive samples, nominal CPUE, standardized indices, and coefficients of variation of the standardized indices are presented (Table 7). Standardized IOAs and nominal CPUEs, normalized to 1 for comparison, are also presented (Figure 5).

### 5. Catch at Age Estimation

Age-length-keys (ALKs) are developed to estimate the age composition of fishery and survey catches as described below.

Spotted seatrout in LA exhibit a protracted spawning season, with spawning primarily occurring across a six-month period from April through September (Hein and Shepard 1980). The mid-point of the spawning season (July 1<sup>st</sup>) is typically assumed as a biological birthday. However, for purposes of this assessment, ages were assigned based on the calendar year by assuming a January 1<sup>st</sup> birthday, where SST spawned the previous year become age-1 on January 1<sup>st</sup> and remain age-1 until the beginning of the following year.

### 5.1 Fishery

Beginning in 2002, ALKs are developed from age samples collected from the fishery. For earlier years, ALKs are developed from the damped growth model.

1982-2001 Probabilities of age  $a$  given length  $l$  in each six-month season ( $s$ ; January-June and July-December) are computed as:

$$P(a|l)_s = \frac{P(l|a)_s}{\sum_a P(l|a)_s} \quad [10a]$$

where the probability of length given age in each season is estimated from a normal probability density as:

$$P(l|a)_s = \frac{1}{\sigma_{as}\sqrt{2\pi}} \int_{l-d}^{l+d} e \left[ -\frac{(l-l_{as})^2}{2\sigma_{as}^2} \right] dl \quad [10b]$$

where length bins are 1 inch TL intervals with midpoint  $l$ , maximum  $l + d$ , and minimum  $l - d$  lengths. Mean length-at-age in each season  $l_{as}$  is estimated from equation [3]. Variance in length-at-age is approximated as  $\sigma_{as} = l_{as}CV_l$ , where the coefficient of variation in length-at-age  $CV_l$  is assumed constant (in this case 0.05). To approximate changes in growth during each season, mean length-at-age is calculated at the midpoint of each six-month period. Thus, two seasonal  $P(a|l)_s$  matrices are developed to assign ages to female SST fishery landings from 1982-2001 (Table 8) and also for instances discussed below.

2002-2020 Probabilities of age given length for each year and six-month season are computed as:

$$P(a|l)_{yfs} = \frac{n_{lays}}{\sum_a n_{lays}} \quad [11]$$

where  $n_{lays}$  is female sample-size in each length/age bin in each year and six-month season (Table 10). When  $\sum_a n_{lays} < 10$ , the  $P(a|l)$  for that 1 inch TL interval is estimated with Equation [10].

Annual fishery-specific ( $f$ , recreational or commercial) catch-at-age (females only) is then calculated as:

$$C_{afy} = \sum_l \sum_s P_{fem,l} C_{lfs} P(a|l)_{ys} \quad [12]$$

where  $P_{fem,l}$  is taken from equation [4],  $C_{lfs}$  is fishery-specific catch-at-size in each year and six-month season, and  $P(a|l)_{ys}$  are taken from Equations [10 or 11]. Recreational discard mortalities are incorporated directly into the recreational harvest-at-age by applying a 10% discard mortality rate to the estimated recreational releases-at-size and combining them with the recreational harvest-at-size estimates. Resulting fleet-specific annual catch-at-age (including discard mortalities) and associated mean weights-at-age are presented (Tables 12-14).

### 5.2 Survey

Probabilities of age given length for female SST catches of the LDWF marine gillnet survey are computed from equation [10]. Mean length-at-age is estimated from equation [3]. Variance in length-at-age is approximated as  $\sigma_{as} = l_{as} CV_l$ , where the coefficient of variation in length-at-age  $CV_l$  is assumed constant (in this case 0.05). To approximate changes in growth during the survey period (April-September), mean length-at-age is calculated at the midpoint of the six-month survey period. Resulting survey  $P(a|l)$  is presented (Table 9). Annual survey female catch-at-age is then taken from equation [12] with annual gear-specific survey catch-at-size substituted. Resulting annual survey age compositions (females only) are presented (Table 11, Figure 5).

## 6. Assessment Model

The Age-Structured Assessment Program (ASAP3 Version 3.0.12; NOAA Fisheries Toolbox) is used in this assessment to describe the dynamics of the female proportion of the LA SST stock. ASAP is a statistical catch-at-age model that allows internal estimation of a Beverton-Holt stock recruitment relationship and MSY-related reference points. Minimum data requirements are fishery catch-at-age, corresponding mean weights-at-age, and an index of abundance. ASAP projects abundance at age from estimates of abundance in the initial year of the time-series and recruitment estimates in subsequent years. The model is fit to the data with a maximum likelihood fitting criterion. An overview of the basic model configuration, equations, and their estimation, as applied in this assessment, are provided below. Specific details and full capabilities of ASAP can be found in the technical documentation (ASAP3; NOAA Fisheries Toolbox).

### 6.1 Model Configuration

For purposes of this assessment, the model is configured with annual time-steps (1982-2020) and a calendar year time-frame.

### Mortality

Fishing mortality is assumed separable by age  $a$ , year  $y$ , and fishery  $f$  as:

$$F_{ayf} = v_{af} Fmult_{yf} \quad [13]$$

where  $v_{af}$  are age and fishery-specific selectivities and  $Fmult_{yf}$  are annual fishery-specific apical fishing mortality rates. Apical fishing mortalities are estimated in the initial year and as deviations from the initial estimates in subsequent years.

Fishery-specific selectivities are modeled with double logistic functions as:

$$v_{af} = \left( \frac{1}{1+e^{-(a-\alpha_f)/\beta_f}} \right) \left( 1 - \frac{1}{1+e^{-(a-\alpha_{2f})/\beta_{2f}}} \right) \quad [14]$$

Total mortality for each age and year is estimated from the age-specific natural mortality rate  $M_a$  and the estimated fishing mortalities as:

$$Z_{ay} = M_a + \sum_f F_{ayf} \quad [15]$$

For reporting purposes, annual fishing mortalities are averaged by weighting by population numbers at age as:

$$F_y = \frac{\sum_a F_{ay} N_{ay}}{\sum_a N_{ay}} \quad [16]$$

### Abundance

Abundance in the initial year of the time series and recruitment in subsequent years are estimated and used to forward calculate the remaining numbers at age from the age and year-specific total mortality rates as:

$$N_{ay} = N_{a-1,y-1} e^{-Z_{a-1,y-1}} \quad [17]$$

Numbers in the plus group  $A$  are calculated from:

$$N_{Ay} = N_{A-1,y-1} e^{-Z_{A-1,y-1}} + N_{A,y-1} e^{-Z_{A,y-1}} \quad [18]$$

### Stock Recruitment

Expected recruitment is calculated from the Beverton-Holt stock recruitment relationship, reparameterized by Mace and Doonan (1988), with annual lognormal deviations as:

$$\hat{R}_{y+1} = \frac{\alpha SSB_y}{\beta + SSB_y} + e^{\delta_{y+1}} \quad [19]$$

$$\alpha = \frac{4\tau(SSB_0/SPR_0)}{5\tau-1} \text{ and } \beta = \frac{SSB_0(1-\tau)}{5\tau-1}$$

where  $SSB_0$  is unexploited female spawning stock biomass,  $SPR_0$  is unexploited spawning stock biomass per recruit,  $\tau$  is steepness, and  $e^{\delta_{y+1}}$  are annual lognormal recruitment deviations..

### Spawning Stock

Female spawning stock biomass in each year is calculated from:

$$SSB_y = \sum_{i=1}^A N_{ay} W_{SSB,a} p_{mat,a} e^{-Z_{ay}(0.5)} \quad [20]$$

where  $W_{SSB,a}$  are female spawning stock biomass weights-at-age,  $p_{mat,a}$  is the proportion of mature females-at-age, and  $-Z_{ay}(0.5)$  is the proportion of total mortality occurring prior to spawning on July 1<sup>st</sup>.

### Catch

Expected fishery catches are estimated from the Baranov catch equation as:

$$\hat{C}_{ayf} = N_{ay} F_{ayf} \frac{(1-e^{-Z_{ay}})}{Z_{ay}} \quad [21]$$

Expected age composition of fishery catches are then calculated from  $\frac{\hat{C}_{ayf}}{\sum_a \hat{C}_{ayf}}$ . Expected fishery yields are computed as  $\sum_a \hat{C}_{ayf} \bar{W}_{ayf}$ , where  $\bar{W}_{ayf}$  are observed mean catch weights.

### Catch-rates

Expected survey catch-rates are computed from:

$$\hat{l}_{ay} = q \sum_a N_{ay} (1 - e^{-Z_{ay}(0.5)}) v_a \quad [22]$$

where  $v_a$  are survey selectivities,  $q$  are the estimated catchability coefficients, and  $-Z_{ay}(0.5)$  is the proportion of the total mortality occurring prior to the time of the survey (July 1<sup>st</sup> midpoint). Survey selectivities are modeled with double logistic functions (equation [14]). Expected survey age composition is then calculated as  $\frac{\hat{l}_{ay}}{\sum_a \hat{l}_{ay}}$ .

### Parameter Estimation

The number of parameters estimated is dependent on the length of the time-series, number of fisheries/selectivity blocks modeled, and the number of abundance indices modeled. Parameters are estimated in log-space and then back transformed. The base model of this assessment was defined with an

age-6 plus group, steepness fixed at 1.0, five fishery selectivity blocks, and three survey selectivity blocks. For the base model, 158 parameters are estimated:

1. 32 selectivity parameters (5 blocks for the commercial and recreational fisheries; 3 blocks for the surveys)
2. 78 apical fishing mortality rates ( $F_{\text{mult}}$  in the initial year and 38 deviations in subsequent years for 2 fisheries)
3. 39 recruitment deviations (1982-2020)
4. 5 initial population abundance deviations (age-2 through 6-plus)
5. 3 catchability coefficients (3 survey IOAs)
6. 1 stock-recruitment parameter ( $SSB_0$ ; the steepness parameter is fixed at 1.0 for the base run).

The model is fit to the data by minimizing the objective function:

$$-\ln(L) = \sum_i \lambda_i (-\ln L_i) + \sum_j (-\ln L_j) \quad [23]$$

where  $-\ln(L)$  is the entire negative log-likelihood,  $\ln L_i$  are log-likelihoods of lognormal estimations,  $\lambda_i$  are user-defined weights applied to lognormal estimations, and  $\ln L_j$  are log-likelihoods of multinomial estimations.

Negative log-likelihoods with assumed lognormal error are derived (ignoring constants) as:

$$-\ln(L_i) = \ln(\sigma) + 0.5 \sum_i \frac{[\ln(obs_i) - \ln(pred_i)]^2}{\sigma^2}, \quad [24]$$

where  $obs_i$  and  $pred_i$  are observed and predicted values; standard deviations  $\sigma$  are user-defined CVs as  $\sqrt{\ln(CV^2 + 1)}$ .

Negative log-likelihoods with assumed multinomial error are derived (ignoring constants) as:

$$-\ln(L_j) = -ESS \sum_{i=1}^A p_i \ln(\hat{p}_i) \quad [25]$$

where  $p_i$  and  $\hat{p}_i$  are observed and predicted age composition. Effective sample-sizes  $ESS$  are used to create the expected numbers  $\hat{n}_a$  in each age bin and act as multinomial weighting factors.

## 6.2 Model Assumptions/Inputs

Model assumptions include: 1) the unit stock is adequately defined and closed to migration, 2) observations are unbiased, 3) errors are independent and their structures are adequately specified, 4) fishery and survey vulnerabilities are dome-shaped, 5) abundance indices are proportional to absolute abundance, and 6) natural mortality and growth do not vary significantly with time. Lognormal error is

assumed for catches, abundance indices, the stock-recruitment relationship, apical fishing mortalities, selectivity parameters, initial abundance deviations, and catchabilities. Multinomial error is assumed for fishery and survey age compositions.

The base model was defined with an age-6 plus group, steepness fixed at 1.0, five fishery selectivity blocks, three survey selectivity blocks, and input levels of error and weighting factors as described below.

Input levels of error for recreational fishery landings estimates were specified with the corresponding CV's estimated from the LDWF LA Creel survey (2014-2020) and estimates hindcast to the historic MRIP time-series (1982-2013; Table 12). Input levels of error for commercial fishery landings were specified with CV's of 0.1 for years where landings were obtained from NMFS commercial records (1982-1998) and CV's of 0.05 for years where landings were obtained from the LDWF Trip Ticket Program (1999-2020; Table 13). Input levels of error for survey catch-rates were specified with CV's estimated from each IOA standardization (Table 7). Annual recruitment deviations were specified with CV's of 0.5 for all years of the modeled time-series.

Lognormal components included in the objective function were equally weighted (all lambdas=1). Input effective sample sizes (ESS) for estimation of fishery and survey age compositions were specified equally for all years of the time-series (all ESS=200).

### 6.3 Model Results

Objective function components, weighting factors, and likelihood values of the base model are summarized in Table 15.

#### Model Fit

The base model provides an overall reasonable fit to the data. Model estimated catches match the observations well (Figure 6); however, in the recreational landings time-series, catches are generally over-estimated in earlier years of the time-series and under-estimated in the more recent years prior to 2014. Model estimated survey catch-rates provide acceptable fits to the data, but fail to fit all extremes with a noticeable lack of fit to the catch rates of the 1.0-inch mesh panel in the most recent years of the time-series (Figure 7). Patterning of the residuals is also apparent, where catch-rates are generally under-estimated in the beginning of each time-series and then over-estimated in later years of each time-series until the beginning of the most recent decade, suggesting a contradiction between data sources (*i.e.*, fishery landings vs. survey catch-rates). Model estimated fishery and survey age compositions provide reasonable fits to the input age proportions (Figures 8-10).

#### Selectivities

Estimated fishery and survey selectivities are presented in Figures 11 and 12. Survey estimates indicate full-vulnerability to the 1.0 and 1.25-inch bar mesh sizes at age-1 and full-vulnerability to the 1.5-inch bar mesh size at age-2. Commercial selectivity estimates indicate full-vulnerability at age-2 for each period of consistent regulation. Recreational estimates also indicate full-vulnerability at age-2 for each period of consistent regulation. After the 12-inch recreational MLL regulation was implemented in 1987, the age-1 recreational selectivity estimate was reduced by approximately 50%

#### Abundance, Age Composition, Recruitment, and Spawning Stock

Total stock size and abundance-at-age estimates from the ASAP base model are presented in Table 16. Total stock size has varied considerably over the time-series. Stock size generally increased over the first half of the time-series from 8.8 million females estimated in 1982 to a maximum of 14.0 million females estimated in 2000. After 2000, stock size generally decreased to a minimum of 5.0 million females estimated in 2018. The 2020 estimate of female stock size is 8.7 million females.

The age composition of the stock in the most recent years of the time-series (2015-2020) indicates further age truncation where the proportion of the stock  $\geq$  age-3+ remains less than 10%. (Figure 13). The 2019 and 2020 estimates of the proportion of the stock  $\geq$  age-3+ are the lowest on record (5% and 4% respectively). The age composition of the stock  $\geq$  age-3+ varied in earlier years of the time-series prior to 2015, with a maximum of 22% estimated in 1982, a minimum of 7% estimated in 1990, and an average of 13% from 1982-2014. The age-composition  $\geq$  age-3+ observed in the landings time-series depicts a similar trend where the lowest estimates on record are the most recent (Figure 13).

Estimates of age-1 recruitment (Figure 14) follow comparable trends with total stock size (Table 16). The average recruitment (geometric mean) over the entire time-series is 6.5 million fish. The average recruitment (geometric mean) in the most recent decade is 5.7 million fish. The 2018 recruitment estimate is the second lowest of the time-series (3.7 million female fish). The 2020 age-1 recruitment estimate is 6.6 million female fish.

Female SSB estimates are presented in Figure 15. Female SSB has also varied considerably over the time-series. After an initial decline in earlier years of the time-series to a low of 4.3 million pounds estimated in 1989, female SSB generally increased to a maximum of 9.1 million pounds observed in 2008. After 2008, female SSB began to decrease. The most recent SSB estimates of the time-series (2016-2020) are the lowest on record (4.27, 3.0, 2.4, 2.7, and 3.3 million pounds respectively).

#### Fishing Mortality

Estimated fishing mortality rates are presented in Table 17 (annual apical, average, and age-specific) and Figure 16 (average only). Fishing mortality rates have varied over the time-series with a clear upward trend apparent in the most recent decade. Before 2012, the time-series of average F estimates was relatively flat and generally lacked a trend with a mean of 0.62 per year from 1982-2011. Beginning in 2012, average fishing mortality rates increased to over 0.9 per year and have remained high with a mean of 0.91 per year from 2012-2020. The 2017 estimate of average F is the highest on record (1.7 per year). The 2020 estimate of average F is 0.72 per year.

#### Stock-Recruitment

No discernable relationship is observed between female SSB and subsequent age-1 recruitment (Figure 17). However, the most recent female SSB estimates are the lowest on record and the 2018 estimate of age-1 female recruits is the second lowest on record. The ASAP base model was run with steepness fixed at 1.0. The estimated unexploited female SSB was 43.5 million pounds. Alternate runs with steepness values fixed at 0.95, 0.90, 0.85, and 0.80 are discussed in the *Model Diagnostics* Section below.

#### Parameter Uncertainty

In the ASAP base model, 158 parameters were estimated. Asymptotic standard errors ( $\pm 2$ ) for the time-series of age-1 female recruits are presented in Figure 14. Markov Chain Monte Carlo (MCMC) derived confidence intervals (95%) for the average fishing mortality rate and female SSB time-series are presented in Figures 15 and 16.

#### 6.4 Management Benchmarks

Overfishing and overfished limits should be defined for exploitable stocks. The implication is that when biomass falls below a specified limit, there is an unacceptable risk that recruitment will be reduced to undesirable levels. Management actions are needed to avoid approaching this limit and to recover the stock if biomass falls below the limit.

Precautionary limits were proposed in earlier LDWF SST assessments (West *et al.* 2011, West *et al.* 2014, West *et al.* 2019) based on the history of the stock by requiring that female SSB not fall below the lowest level observed in the fishery prior to 2010 in which the stock demonstrated sustainability (*i.e.*, no observed decline in recruitment over a wide range of female SSB; Figure 17). This would be similar to maintaining the stock above a limit spawning potential ratio (SPR; Goodyear, 1993) where SPR is estimated from mature female biomass rather than total egg production. The method for calculating the SPR<sub>limit</sub> and the corresponding limit reference points is presented below.

When the stock is in equilibrium, equation [20] can be solved, excluding the year index, for any given exploitation rate as:

$$\frac{SSB}{R}(F) = \sum_{i=1}^A N_a p_{mat,a} W_{SSB,a} e^{-Z_a(0.5)} \quad [29]$$

where total mortality at age  $Z_a$  is computed as  $M_a + v_a \times F_{mult}$ ; vulnerability at age  $v_a$  is taken by rescaling the current F-at-age estimate (geometric mean 2018-2020) to the maximum. Per recruit abundance-at-age is estimated as  $N_a = S_a$ , where survivorship at age is calculated recursively from  $S_a = S_{a-1} e^{-Z_a}$ ,  $S_1 = 1$ . Per recruit catch-at-age is then calculated with the Baranov catch equation [21], excluding the year index. Yield per recruit (Y/R) is then taken as  $\sum_a C_a \bar{W}_a$  where  $\bar{W}_a$  are current mean fishery weights at age (arithmetic mean 2018-2020). Fishing mortality is averaged by weighting by relative abundance-at-age.

Equilibrium spawning stock biomass  $SSB_{eq}$  is calculated by substituting  $SSB/R$  estimated from equation [29] into the Beverton-Holt stock recruitment relationship as  $\alpha \times SSB/R - \beta$ . Equilibrium recruitment  $R_{eq}$  and yield  $Y_{eq}$  are then taken as  $SSB_{eq} \div SSB/R$  and  $Y/R \times R_{eq}$ . Equilibrium SPR (e.g.,  $SPR_{limit}$ ) is computed as the ratio of  $SSB/R$  when  $F > 0$  to  $SSB/R$  when  $F = 0$ .

As reference points to guide management, we estimate the spawning potential ratio and average fishing mortality rate that lead to the lowest SSB observed prior to 2010 ( $SSB_{limit}$ ,  $SPR_{limit}$ , and  $F_{limit}$ ). The targets of fishing should not be so close to the limits that the limits are exceeded by random variability of the environment. Therefore, we propose a SSB target ( $SSB_{target}$ ) as the median SSB prior to 2010 in which the stock demonstrated sustainability and estimate the SPR and average F that lead to this target ( $SPR_{target}$  and  $F_{target}$ ).

The proposed limits and targets of fishing are presented in Figure 18 relative to each respective time-series. Current estimates are taken as the geometric mean of the 2018-2020 estimates.

Also presented are a plot of the stock-recruitment data, equilibrium recruitment, and diagonals from the origin intersecting  $R_{eq}$  at the  $SSB_{limit}$ ,  $SSB_{target}$ , and maximum SSB estimates of the time-series, corresponding with a  $SPR_{limit}$  of 9.8%, a  $SPR_{target}$  of 14.1%, and a maximum SPR of 20.8% (Figure 19). Limit and target reference points are also presented in Table 18.

## 6.5 Model Diagnostics

### Sensitivity Analysis

In addition to the base model run, a series of sensitivity runs were used to explore uncertainty in the base model's configuration.

The ASAP base model was run with steepness fixed at 1.0. Alternate runs were conducted examining reference point estimates with steepness fixed at 0.95, 0.90, 0.85 and 0.80 (Models 1-4).

Additional sensitivity runs were conducted by separately up-weighting the contributions of fishery yield and the IOA components within the base models objective function (lambdas increased from 1 to 10; Models 5 and 6).

An additional sensitivity run was conducted by time-varying the baseline M-at-age used in the ASAP base model by adjusting it to the winter severity index presented in Table 5 (Model 7). Baseline M-at-age ( $M_a$ ) was allowed to vary with time ( $M_{a,y}$ ) by adjusting to the winter severity index ( $WS_y$ ) assuming winter mortality events are additive as:

$$M_{a,y} = M_a + (WS_y \times c) \quad [30]$$

The value of the scaling parameter ( $c$ ) above was chosen arbitrarily (in this case  $c=0.25$ ).

Another sensitivity run was conducted by increasing the discard mortality rate assumption from 10% to 25% (Model 8).

An additional sensitivity run was conducted where the ALK's developed from the damped growth model (Table 6) were used to assign ages to the entire time-series of fishery landings (Model 9).

Another sensitivity run was conducted using the MRIP ACAL time-series (see <https://www.fisheries.noaa.gov/recreational-fishing-data/recreational-fishing-data-glossary#calibrated-data>), rather than the FCAL time-series, to hindcast LA Creel estimates to the historic MRIP time-series (Model 10). This time-series was developed using the same approach described in *Appendix 1* with the ACAL estimates substituted for the FCAL estimates.

Another sensitivity run was conducted using the MRIP size distributions with the FES and APAIS calibrations applied (Model 11).

A final sensitivity run was conducted that included estimates of SST bycatch (females only > age-0) from the LA inshore shrimp fishery (Table 4) as an additional fishery fleet (Model 12).

Results of each sensitivity run relative to the proposed limit reference points are presented in Table 19. Current estimates of female SSB and average F are taken as the geometric mean of the 2018-2020 estimates. Estimates from all sensitivity runs indicate the stock is currently below  $SSB_{limit}$ . Estimates from all sensitivity runs indicate the fishery is currently operating above  $F_{limit}$  with the exception of Models 5, 7, and 10. Model 7 (winter-severity index used to time-vary M) resulted in the lowest estimate of current F due to a high M estimated from the severe winter in 2018, but also led to one of the lowest estimates of current SSB of all model runs.

Also presented are estimates of maximum sustainable yield (MSY) and associated reference points for those sensitivity runs with the steepness parameter not fixed at 1 (Table 20). Results of each run indicate that the fishery is currently operating past MSY, where ratios of current F and SSB to  $F_{MSY}$  and  $SSB_{MSY}$  are above and below 1 respectively. It's important to note, however, that the selection of specific values for the steepness parameter results in specified values of  $SSB_{MSY}$ ,  $F_{MSY}$ , and other MSY statistics. Therefore, MSY values are not estimated per se, but are the results of the value selected for steepness.

### Retrospective Analysis

A retrospective analysis was conducted by sequentially truncating the base model by a year (terminal years 2016-2020). Retrospective estimates of age-1 female recruits, SSB and average fishing mortality differed from the base run (Figure 20). Terminal year estimates of age-1 recruits and female SSB indicate a marginal positive bias, where estimates tend to decrease as more years are added to the model. Terminal year estimates of average fishing mortality rates indicate a larger negative bias, where estimates tend to increase as more years are added to the model.

### 7. Stock Status

The history of the LA SST stock relative to  $F/F_{limit}$  and  $SSB/SSB_{limit}$  is presented in Figure 21. Fishing mortality rates exceeding  $F_{limit}$  ( $F/F_{limit} > 1.0$ ) are defined as overfishing; spawning stock sizes below  $SSB_{limit}$  ( $SSB/SSB_{limit} < 1.0$ ) are defined as the overfished condition.

#### Overfishing Status

The current estimate of  $F/F_{limit}$  is  $> 1.0$ , suggesting the stock is currently undergoing overfishing. The current assessment model also indicates that the stock has been undergoing overfishing since 2012 with the exception of 2014 and the terminal year and also experienced overfishing in a few years earlier in the time-series.

#### Overfished Status

The current estimate of  $SSB/SSB_{limit}$  is  $< 1.0$ , suggesting the stock is currently in an overfished state. The current assessment model also indicates that the stock has been overfished since 2016. The current SPR estimate is 6.3% ( $SPR_{limit} = 9.8\%$ ).

### Control Rules

There is currently no harvest control rule established for the LA SST stock.

### 8. Research and Data Needs

As with any analysis, the accuracy of this assessment is dependent on the accuracy of the information of which it is based. Below we list additional recommendations to improve future assessments of SST in Louisiana.

Assessment of regional or estuarine-specific spotted seatrout populations could differentiate exploitation rates and stock status within the state. If time-series of fine-scale spatial distribution data become available that allow for spatially-explicit assessment, results could be used to determine if regional management is an effective alternative to a statewide management strategy. Current LDWF surveys and commercial landings reported through the LDWF Trip Ticket Program could form the basis for this approach, but the time-series of basin-level recreational harvest and corresponding biological sampling are still not long enough for reliable assessment of regional populations.

Spotted seatrout in south-west LA from the Texas border to the Mermentau River are currently managed with slightly different regulations than the remainder of the state. Again, if data become available that allow for spatially-explicit assessment, results could be used to determine if current management has altered exploitation/stock status in the south-west region and, if so, used as a framework for future management. Current LDWF surveys (LA Creel, fishery-independent, and biological sampling) and commercial landings reporting through trip tickets could form the basis of this approach, but the recreational harvest and biological sampling time-series are still not long enough for reliable assessment of regional populations.

Information describing the connectivity of nearshore and inshore spotted seatrout populations along the Louisiana coast is currently not available. As data becomes available for spatially-explicit assessments, understanding the link between nearshore and inshore populations will become necessary.

The relationship between wetlands losses and the continuation of fishery production within Louisiana has been discussed by numerous authors. Understanding this relationship as it applies to the LA SST stock should be an ongoing priority.

This assessment highlights differing trends between fishery-independent catch-rates and fishery-dependent data sources. These differences should be evaluated further to determine which trends are truly reflective of population abundance, or whether other factors (e.g., increasing harvest efficiencies, changing vulnerabilities of the stock, etc.) are involved.

Only limited age data are available from the LDWF marine gillnet survey. Ages of survey catches in this assessment were assigned from ALK's developed from a growth model. Continuing the collection of age

samples directly from the survey would allow a more accurate representation of survey age composition in future assessments.

Winterkill events were included as a sensitivity run in this assessment by time-varying M-at-age proportionally to a winter-severity index. If age-classes are affected disproportionately to cold-stun deaths this approach will introduce bias into model estimates. Investigation of the relationship between spotted seatrout cold-stun deaths and age-class is needed.

Factors that influence year-class strength of spotted seatrout are poorly understood. Investigation of these factors, including inter-annual variation in seasonal factors and the influence of environmental perturbations, could elucidate causes of inter-annual variation in abundance, as well as the species stock-recruitment relationship.

Spawning potential ratio estimates may be biased if egg production does not scale linearly with female body weight. Recent estimates of a LDWF fecundity study suggest fecundity at size and female biomass at size are roughly equivalent; however, error estimates around the fecundity estimates were large due to low sample sizes precluding their use in this assessment update. Current management benchmarks are based on the history of the stock by requiring the stock biomass to not fall below the lowest level observed earlier in the fishery. If management strategy were to change so that benchmarks are based on the reproductive potential of the stock, unbiased estimates of SPR would be needed.

Fishery-dependent data alone is not a reliable source of information to assess status of a fish stock. Consistent fishery-dependent and fishery-independent data sources, in a comprehensive monitoring plan, are essential to understanding the status of fishery. Present monitoring programs should be assessed for adequacy with respect to their ability to evaluate stock status, and modified if deemed necessary.

With the recent trend toward ecosystem-based assessment models (NMFS 2001), more data is needed linking spotted seatrout population dynamics to environmental conditions. The addition of meteorological and physical oceanographic data coupled with food web data may lead to a better understanding of the spotted seatrout stock and its habitat.

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10. Tables

Table 1: Louisiana annual commercial and recreational spotted seatrout landings (in millions of pounds) derived from NMFS statistical records, LDWF Trip Ticket Program, MRIP, and LA Creel. Recreational landings represent harvest only. Confidential commercial landings records (\*\*\*\*) are not presented.

Year	Harvest		%Commercial	%Recreational
	Commercial	Recreational		
1982	0.73	4.87	13.0	87.0
1983	1.34	4.17	24.3	75.7
1984	0.97	1.36	41.7	58.3
1985	1.16	2.90	28.6	71.4
1986	1.98	6.14	24.4	75.6
1987	1.80	4.85	27.1	72.9
1988	1.43	5.31	21.2	78.8
1989	1.49	4.55	24.6	75.4
1990	0.65	2.25	22.4	77.6
1991	1.22	6.13	16.6	83.4
1992	0.97	4.05	19.4	80.6
1993	1.14	3.68	23.6	76.4
1994	1.02	5.29	16.2	83.8
1995	0.66	5.90	10.0	90.0
1996	0.77	5.63	12.1	87.9
1997	0.55	5.43	9.2	90.8
1998	0.11	5.18	2.1	97.9
1999	0.08	7.32	1.0	99.0
2000	0.04	8.12	0.5	99.5
2001	0.11	7.19	1.5	98.5
2002	0.07	5.01	1.4	98.6
2003	0.02	5.19	0.4	99.6
2004	0.02	4.33	0.5	99.5
2005	0.02	4.56	0.4	99.6
2006	0.00	6.75	0.0	100.0
2007	0.01	5.53	0.2	99.8
2008	0.01	7.16	0.1	99.9
2009	0.00	7.82	0.0	100.0
2010	****	6.18	0.0	100.0
2011	****	8.53	0.0	100.0
2012	0.00	8.16	0.0	100.0
2013	0.00	5.62	0.1	99.9
2014	0.01	3.36	0.2	99.8
2015	0.00	4.74	0.1	99.9
2016	0.00	5.51	0.0	100.0
2017	0.00	5.68	0.1	99.9
2018	0.00	3.09	0.1	99.9
2019	****	3.84	0.0	100.0
2020	****	4.06	0.0	100.0

Table 2: Louisiana commercial size frequencies of spotted seatrout landings derived from LDWF commercial landings records.

Commercial, 1981-1996		
TL in	1981-1986	1987-1996
10	1	
11	12	
12	80	3
13	166	61
14	276	347
15	304	441
16	146	384
17	89	316
18	47	172
19	39	81
20	23	42
21	10	16
22	11	7
23	7	5
24	11	1
25	3	1
26	1	1
27		





Table 4: Louisiana inshore shrimp fishery spotted seatrout bycatch-at-age and yield estimates (females only), and corresponding mean weights-at-age in pounds.

Inshore Shrimp Bycatch-at-age								Inshore Shrimp Bycatch Mean Weight-at-age						
Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Yield (lbs)	Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+
1982	113,351	2	0	0	0	0	72,979	1982	0.64	1.06	--	--	--	--
1983	95,320	1	0	0	0	0	61,370	1983	0.64	1.06	--	--	--	--
1984	127,988	2	0	0	0	0	82,403	1984	0.64	1.06	--	--	--	--
1985	123,987	2	0	0	0	0	79,827	1985	0.64	1.06	--	--	--	--
1986	173,777	3	0	0	0	0	111,884	1986	0.64	1.06	--	--	--	--
1987	139,207	2	0	0	0	0	89,627	1987	0.64	1.06	--	--	--	--
1988	131,638	2	0	0	0	0	84,753	1988	0.64	1.06	--	--	--	--
1989	114,592	2	0	0	0	0	73,779	1989	0.64	1.06	--	--	--	--
1990	157,056	2	0	0	0	0	101,118	1990	0.64	1.06	--	--	--	--
1991	100,306	1	0	0	0	0	64,581	1991	0.64	1.06	--	--	--	--
1992	105,573	2	0	0	0	0	67,971	1992	0.64	1.06	--	--	--	--
1993	100,703	1	0	0	0	0	64,836	1993	0.64	1.06	--	--	--	--
1994	104,194	2	0	0	0	0	67,084	1994	0.64	1.06	--	--	--	--
1995	130,037	2	0	0	0	0	83,722	1995	0.64	1.06	--	--	--	--
1996	104,613	2	0	0	0	0	67,353	1996	0.64	1.06	--	--	--	--
1997	108,911	2	0	0	0	0	70,121	1997	0.64	1.06	--	--	--	--
1998	148,478	2	0	0	0	0	95,596	1998	0.64	1.06	--	--	--	--
1999	168,799	3	0	0	0	0	108,679	1999	0.64	1.06	--	--	--	--
2000	207,433	3	0	0	0	0	133,553	2000	0.64	1.06	--	--	--	--
2001	186,163	3	0	0	0	0	119,859	2001	0.64	1.06	--	--	--	--
2002	134,305	2	0	0	0	0	86,471	2002	0.64	1.06	--	--	--	--
2003	169,642	3	0	0	0	0	109,222	2003	0.64	1.06	--	--	--	--
2004	185,231	3	0	0	0	0	119,259	2004	0.64	1.06	--	--	--	--
2005	142,146	2	0	0	0	0	91,519	2005	0.64	1.06	--	--	--	--
2006	196,326	3	0	0	0	0	126,402	2006	0.64	1.06	--	--	--	--
2007	172,493	3	0	0	0	0	111,057	2007	0.64	1.06	--	--	--	--
2008	145,850	2	0	0	0	0	93,904	2008	0.64	1.06	--	--	--	--
2009	162,803	2	0	0	0	0	104,819	2009	0.64	1.06	--	--	--	--
2010	128,538	2	0	0	0	0	82,757	2010	0.64	1.06	--	--	--	--
2011	151,321	2	0	0	0	0	97,426	2011	0.64	1.06	--	--	--	--
2012	156,912	2	0	0	0	0	101,026	2012	0.64	1.06	--	--	--	--
2013	158,658	2	0	0	0	0	102,150	2013	0.64	1.06	--	--	--	--
2014	198,237	3	0	0	0	0	127,632	2014	0.64	1.06	--	--	--	--
2015	162,402	2	0	0	0	0	104,560	2015	0.64	1.06	--	--	--	--
2016	167,092	2	0	0	0	0	107,580	2016	0.64	1.06	--	--	--	--
2017	146,970	2	0	0	0	0	94,625	2017	0.64	1.06	--	--	--	--
2018	161,260	2	0	0	0	0	103,825	2018	0.64	1.06	--	--	--	--
2019	144,044	2	0	0	0	0	92,741	2019	0.64	1.06	--	--	--	--
2020	117,896	2	0	0	0	0	75,906	2020	0.64	1.06	--	--	--	--

Table 5: Annual winter severity index values (1982-2021) derived as the product of the number of days with water temperatures  $\leq 7$  degrees Celsius in each winter and the inverse of the mean water temperature during that period.

Year	days $\leq 7^{\circ}\text{C}$	Wtemp mean	WS Index
1982	8	5.95	1.34
1983	0	--	0.00
1984	15	4.58	3.27
1985	4	4.25	0.94
1986	0	--	0.00
1987	0	--	0.00
1988	1	6.65	0.15
1989	0	--	0.00
1990	9	3.12	2.89
1991	0	--	0.00
1992	0	--	0.00
1993	0	--	0.00
1994	0	--	0.00
1995	0	--	0.00
1996	6	5.55	1.08
1997	1	7.00	0.14
1998	0	--	0.00
1999	1	6.82	0.15
2000	0	--	0.00
2001	6	5.51	1.09
2002	4	5.93	0.67
2003	0	--	0.00
2004	0	--	0.00
2005	3	5.90	0.51
2006	0	--	0.00
2007	0	--	0.00
2008	1	6.58	0.15
2009	0	--	0.00
2010	6	4.58	1.31
2011	4	6.52	0.61
2012	0	--	0.00
2013	0	--	0.00
2014	6	5.51	1.09
2015	0	--	0.00
2016	0	--	0.00
2017	0	--	0.00
2018	9	5.31	1.70
2019	0	--	0.00
2020	0	--	0.00
2021	5	6.41	0.78

Table 6: FAO proposed guidelines for indices of productivity for exploited fish species.

Parameter	Productivity			Species	Score
	Low	Medium	High	Spotted Seatrout	
M	<0.2	0.2 - 0.5	>0.5	0.3	2
K	<0.15	0.15 - 0.33	>0.33	0.36	3
t <sub>mat</sub>	>8	3.3 - 8	<3.3	2	3
t <sub>max</sub>	>25	14 - 25	<14	10	3
Examples	orange roughy, many sharks	cod, hake	sardine, anchovy	Spotted Seatrout Productivity Score = 2.75 (high)	

Table 7: Annual sample sizes, nominal proportion of positive samples and nominal CPUEs of positive samples, indices of abundance, and corresponding coefficients of variation derived from the LDWF fishery-independent marine gillnet survey. Nominal CPUE and abundance indices have been normalized to their individual long-term means for comparison.

Year	1.0" Mesh					1.25" Mesh					1.5" Mesh				
	n	%Pos	CPUE	IOA	CV	n	%Pos	CPUE	IOA	CV	n	%Pos	CPUE	IOA	CV
1986	487	41%	0.88	1.15	0.31	--	--	--	--	--	487	22%	0.83	0.70	0.27
1987	475	33%	1.09	0.86	0.33	--	--	--	--	--	475	31%	1.03	1.16	0.24
1988	417	39%	1.19	1.33	0.31	417	50%	1.35	1.82	0.27	417	42%	1.36	2.12	0.22
1989	474	36%	1.04	1.14	0.32	472	46%	1.03	1.43	0.28	473	31%	1.29	1.50	0.24
1990	489	31%	1.00	0.81	0.34	489	37%	1.02	0.94	0.31	489	24%	1.13	0.84	0.26
1991	471	36%	1.48	1.31	0.32	470	40%	1.58	1.39	0.30	470	26%	1.38	1.16	0.25
1992	472	33%	1.38	1.10	0.33	472	41%	1.47	1.36	0.30	472	34%	1.45	1.76	0.23
1993	459	36%	1.09	1.04	0.32	458	41%	1.48	1.43	0.30	457	29%	1.52	1.43	0.25
1994	487	36%	1.11	1.04	0.32	487	38%	1.22	1.07	0.30	486	27%	1.06	1.13	0.25
1995	520	35%	1.61	1.12	0.32	520	38%	1.20	1.03	0.30	520	26%	1.24	1.10	0.25
1996	520	32%	0.94	0.84	0.33	520	42%	0.94	1.14	0.29	520	27%	1.13	1.16	0.24
1997	520	33%	0.95	0.84	0.33	520	33%	1.05	0.86	0.32	519	29%	1.07	1.18	0.24
1998	509	34%	1.00	0.89	0.32	509	34%	1.22	0.93	0.31	509	25%	1.16	1.02	0.25
1999	520	38%	1.19	1.13	0.31	520	38%	1.30	1.15	0.30	520	30%	1.59	1.39	0.24
2000	528	38%	0.82	0.94	0.31	528	44%	1.08	1.36	0.28	528	35%	1.22	1.70	0.22
2001	528	26%	0.74	0.55	0.35	528	31%	0.96	0.70	0.32	528	27%	1.12	1.11	0.25
2002	520	33%	0.73	0.72	0.33	520	35%	0.76	0.76	0.31	520	22%	0.75	0.72	0.26
2003	525	30%	0.90	0.69	0.34	525	27%	0.96	0.59	0.34	525	20%	0.87	0.63	0.27
2004	527	32%	0.85	0.78	0.33	527	30%	0.86	0.67	0.33	527	23%	0.90	0.75	0.26
2005	478	38%	1.25	1.17	0.31	478	37%	1.08	0.99	0.31	478	23%	0.80	0.75	0.26
2006	519	38%	0.98	1.11	0.31	518	37%	1.09	1.06	0.30	519	30%	1.05	1.24	0.24
2007	528	35%	1.02	1.12	0.32	528	37%	0.94	0.97	0.30	528	25%	0.92	0.98	0.25
2008	514	36%	1.23	1.20	0.32	514	37%	1.15	1.04	0.30	514	25%	0.87	0.87	0.25
2009	528	34%	1.01	0.92	0.32	528	32%	1.13	0.84	0.32	528	27%	1.13	1.07	0.25
2010	463	28%	0.99	0.79	0.34	463	27%	0.87	0.66	0.34	463	19%	0.73	0.60	0.28
2011	1202	28%	0.90	0.79	0.32	1202	30%	0.75	0.81	0.30	1202	19%	0.75	0.80	0.23
2012	1269	27%	0.68	0.72	0.32	1269	30%	0.78	0.89	0.29	1269	17%	0.70	0.74	0.23
2013	624	34%	1.21	1.56	0.29	624	33%	0.84	1.27	0.28	624	19%	0.88	1.14	0.25
2014	625	33%	0.74	1.29	0.29	625	32%	0.63	1.03	0.29	624	15%	0.81	0.81	0.26
2015	626	23%	0.78	0.81	0.33	626	22%	0.63	0.68	0.33	626	12%	0.60	0.52	0.29
2016	626	32%	0.79	1.24	0.30	626	25%	0.68	0.84	0.32	625	13%	0.72	0.68	0.28
2017	620	27%	0.95	1.06	0.31	620	27%	0.78	0.97	0.31	620	16%	0.78	0.87	0.26
2018	624	22%	0.64	0.73	0.34	624	24%	0.64	0.81	0.32	624	11%	0.73	0.49	0.29
2019	648	26%	0.93	0.98	0.32	648	21%	0.65	0.60	0.33	648	6%	0.75	0.27	0.35
2020	612	30%	0.90	1.23	0.30	612	27%	0.87	0.91	0.31	612	13%	0.65	0.61	0.28



Table 10: Length at age samples used in age assignments of spotted seatrout landings 2002-2018 (females only).

2002 (January-June)							
TL in	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Total
10							0
11							0
12	5	1					6
13	6	6					12
14	1	16					17
15		22	1				23
16	1	14	6				21
17		8	10				18
18		4	5				9
19			6	1			7
20		1	4	2			7
21			4				4
22							0
23							0
24							0
25							0
26							0
27							0
28							0
Total	13	72	36	3	0	0	124

2002 (July-December)							
TL in	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Total
10							0
11							0
12	25	5	1				31
13	54	5		1			60
14	64	8	2				74
15	41	10	2				53
16	18	19	1				38
17	7	18	4				29
18	2	15	8				25
19	1	4	6	1			12
20		3	3				6
21		1	1				2
22		1	2				3
23					1		1
24							0
25							0
26							0
27							0
28							0
Total	212	89	30	2	1	0	334

2003 (January-June)							
TL in	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Total
10							0
11	2						2
12	10	11	1				22
13	5	45	2				52
14	2	48	5	1			56
15		48	4				52
16		51	6				57
17		32	10				42
18		11	9	2	1		23
19		2	11	2			15
20		1	9	5	2		17
21			7	3			10
22			2	3	1		6
23				4	1		5
24			1	1			2
25				1			1
26							0
27							0
28							0
Total	19	249	67	22	5	0	362

2003 (July-December)							
TL in	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Total
10							0
11	2						2
12	57	10					67
13	119	15	2				136
14	75	25					100
15	41	31	1		1		74
16	15	41	1				57
17	3	41					44
18		22	5				27
19		8	2				10
20		4	9				13
21		1	6				7
22		1	3	1			5
23			1				1
24				3			3
25						1	1
26				1		2	3
27							0
28					1		1
Total	312	199	30	5	2	3	551

2004 (January-June)							
TL in	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Total
10							0
11							0
12	4	32	1				37
13	6	62	2	2			72
14		77					77
15		79					79
16		39	8				47
17		18	8				26
18		7	12	1			20
19		3	13				16
20			8	1	1	1	11
21			1	4	1		6
22				1	1		2
23		1		2			3
24						1	1
25							0
26							0
27							0
28							0
Total	10	318	53	11	3	2	397

2004 (July-December)							
TL in	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Total
10							0
11	2						2
12	59	6	1				66
13	110	25					135
14	91	30	1				122
15	44	33	1			1	79
16	19	34	3				56
17	4	29	3				36
18		18	5	1			24
19		7	7				14
20		1	4	1			6
21		2	2				4
22					2		2
23				2			2
24			2			1	3
25					1		1
26							0
27							0
28							0
Total	329	185	29	4	3	2	552

Table 10 (continued):

2005 (January-June)							
TL in	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Total
10							0
11							0
12	10	15					25
13	12	55	2				69
14	4	105	4	1			114
15		129	6		1		136
16		57	4				61
17		31	11				42
18		9	9				18
19		5	16	1			22
20		1	14				15
21			13		1		14
22			7				7
23			1				1
24				4			4
25						1	1
26							0
27				1		1	2
28							0
<b>Total</b>	<b>26</b>	<b>407</b>	<b>87</b>	<b>7</b>	<b>2</b>	<b>2</b>	<b>531</b>

2005 (July-December)							
TL in	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Total
10							0
11	1						1
12	37	2					39
13	69	9	1				79
14	48	20					68
15	37	31					68
16	12	33	3				48
17	5	34	3				42
18	1	15	2				18
19		5	2				7
20		2	3				5
21			5	2	1		8
22			1	1			2
23			1				1
24			1				1
25							0
26							0
27							0
28							0
<b>Total</b>	<b>210</b>	<b>151</b>	<b>22</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>387</b>

2006 (January-June)							
TL in	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Total
10							0
11	3						3
12	17	11	1				29
13	17	77	2				96
14	3	140	2				145
15	1	141	5				147
16	1	79	9				89
17		28	12				40
18		15	15	1			31
19		4	11				15
20		1	11	2			14
21			8				8
22			8				8
23			1	1			2
24				1			1
25							0
26							0
27							0
28							0
<b>Total</b>	<b>42</b>	<b>496</b>	<b>85</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>628</b>

2006 (July-December)							
TL in	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Total
10							0
11							0
12	40	2					42
13	103	8	3				114
14	75	33					108
15	39	70					109
16	9	40	1				50
17	5	43	2				50
18	1	25	4				30
19		11	1	1			13
20			6	1			7
21			4				4
22			1	1			2
23			2	1			3
24							0
25							0
26							0
27							0
28							0
<b>Total</b>	<b>272</b>	<b>241</b>	<b>17</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>532</b>

2007 (January-June)							
TL in	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Total
10							0
11	1						1
12	9	11	1				21
13	4	49	2				55
14		89	1				90
15		101	7				108
16		80	18	2			100
17		29	29				58
18		16	21	3			40
19		8	13	1			22
20		3	14	3	1		21
21			4	1			5
22			4	3	1		8
23			3	1			4
24					1		1
25							0
26							0
27							0
28							0
<b>Total</b>	<b>14</b>	<b>386</b>	<b>117</b>	<b>14</b>	<b>3</b>	<b>0</b>	<b>534</b>

2007 (July-December)							
TL in	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Total
10							0
11	2						2
12	71	8					79
13	110	23	1				134
14	91	39	3				133
15	47	70	4	1			122
16	13	57	1				71
17	3	57	4	1			65
18	2	29	9				40
19	1	14	7				22
20		4	2	2			8
21			5	1			6
22			5				5
23			1	1			2
24							0
25			1				1
26							0
27							0
28							0
<b>Total</b>	<b>340</b>	<b>301</b>	<b>43</b>	<b>6</b>	<b>0</b>	<b>0</b>	<b>690</b>

Table 10 (continued):

2008 (January-June)							
TL in	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Total
10	1						1
11		1					1
12	19	40	2				61
13	5	104	2				111
14	1	106	4				111
15		87	19	1			107
16		56	24				80
17		15	34				49
18		10	31	1			42
19		3	26	1	1		31
20		1	7	4			12
21			9	3			12
22			4	1			5
23			2				2
24					1		1
25					1		1
26							0
27							0
28							0
<b>Total</b>	<b>26</b>	<b>423</b>	<b>164</b>	<b>11</b>	<b>3</b>	<b>0</b>	<b>627</b>

2008 (July-December)							
TL in	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Total
10							0
11	1						1
12	78	12	3				93
13	145	41	5				191
14	109	71	6	1			187
15	69	68	3	1			141
16	28	64	7				99
17	4	38	9				51
18	1	28	13				42
19		8	14				22
20		3	15	3	1		22
21		4	8	2			14
22			2	3			5
23							0
24			1				1
25			1		1		2
26							0
27							0
28							0
<b>Total</b>	<b>435</b>	<b>337</b>	<b>87</b>	<b>10</b>	<b>2</b>	<b>0</b>	<b>871</b>

2009 (January-June)							
TL in	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Total
10							0
11		1					1
12	21	39	1	2			63
13	4	109	6	2			121
14	1	138	4	1			144
15	2	92	16				110
16		42	18	1			61
17		30	20	2			52
18		7	29	4			40
19		4	17	3	1		25
20		1	16	6			23
21			10	3			13
22			4	2			6
23			1	4			5
24				7			7
25				2	1		3
26							0
27							0
28							0
<b>Total</b>	<b>28</b>	<b>463</b>	<b>142</b>	<b>39</b>	<b>2</b>	<b>0</b>	<b>674</b>

2009 (July-December)							
TL in	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Total
10							0
11	2						2
12	56	9	2				67
13	121	30	3				154
14	104	52	4				160
15	55	71	4				130
16	28	66	5				99
17	6	52	2				60
18	4	28	13	2			47
19		12	7	1			20
20		5	7	2			14
21			9	1			10
22			6	4			10
23			4	3			7
24				1	2		3
25			1	3			4
26							0
27			1				1
28							0
<b>Total</b>	<b>376</b>	<b>325</b>	<b>68</b>	<b>17</b>	<b>2</b>	<b>0</b>	<b>788</b>

2010 (January-June)							
TL in	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Total
10							0
11							0
12	12	18	1				31
13	6	57	4	1			68
14	1	89	3	1			94
15		88	1				89
16		55	12	1			68
17		28	18	2			48
18		9	23	2			34
19			18	2			20
20			12	3			15
21			4	1			5
22				1			1
23			2	1			3
24				1			1
25							0
26							0
27							0
28							0
<b>Total</b>	<b>19</b>	<b>344</b>	<b>98</b>	<b>16</b>	<b>0</b>	<b>0</b>	<b>477</b>

2010 (July-December)							
TL in	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Total
10							0
11	1	1					2
12	69	5					74
13	152	18	2				172
14	127	26	4				157
15	55	41	3	1			100
16	13	32	4				49
17	3	33	1				37
18	1	21	2				24
19		6	3				9
20			1	2			3
21		1	1				2
22			2		1		3
23				3			3
24							0
25							0
26							0
27							0
28							0
<b>Total</b>	<b>421</b>	<b>184</b>	<b>23</b>	<b>6</b>	<b>1</b>	<b>0</b>	<b>635</b>

Table 10 (continued):

2011 (January-June)							
TL in	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Total
10		1					1
11		1					1
12	12	8					20
13	28	38	2				68
14	13	66	10	1			90
15	3	109	8				120
16		80	10				90
17		52	16				68
18		10	19				29
19		2	20				22
20		1	3				4
21			4	1			5
22				1			1
23							0
24						1	1
25				1			1
26					1		1
27							0
28							0
<b>Total</b>	<b>56</b>	<b>368</b>	<b>92</b>	<b>4</b>	<b>1</b>	<b>1</b>	<b>522</b>

2011 (July-December)							
TL in	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Total
10							0
11	3						3
12	70	9					79
13	119	12	2				133
14	123	15	2				140
15	66	42	1				109
16	36	51	1				88
17	6	53	7				66
18	3	30	12	1			46
19		8	6	2			16
20	1	5	6	1			13
21	1	1	2	4			8
22			1	1			2
23							0
24							0
25							0
26							0
27							0
28							0
<b>Total</b>	<b>428</b>	<b>226</b>	<b>40</b>	<b>9</b>	<b>0</b>	<b>0</b>	<b>703</b>

2012 (January-June)							
TL in	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Total
10							0
11	1						1
12	41	17	2				60
13	41	65	10				116
14	10	114	14	2			140
15	2	209	9	1			221
16	1	173	9	1			184
17		111	20	1			132
18		46	43	4			93
19		16	37	2	1	1	57
20		2	23	7	1		33
21			13	1			14
22		1	4	4			9
23			1	1			2
24					1		1
25				2			2
26							0
27							0
28							0
<b>Total</b>	<b>96</b>	<b>754</b>	<b>185</b>	<b>26</b>	<b>3</b>	<b>1</b>	<b>1065</b>

2012 (July-December)							
TL in	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Total
10							0
11							0
12	35	3					38
13	66	8	1				75
14	75	11	2				88
15	31	7	2				40
16	14	15					29
17	4	21	2		1		28
18		17	1				18
19		8	2				10
20		8	1	1			10
21			1	1			2
22							0
23							0
24							0
25							0
26							0
27							0
28							0
<b>Total</b>	<b>225</b>	<b>98</b>	<b>12</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>338</b>

2013 (January-June)							
TL in	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Total
10							0
11							0
12	18	39	2				59
13	14	119	5				138
14	4	168	7				179
15		158	2				160
16		101	1	1			103
17		57	4				61
18		22	12				34
19		5	16	1			22
20		2	18				20
21			7	2			9
22		1	2	2	1		6
23							0
24							0
25							0
26							0
27							0
28							0
<b>Total</b>	<b>36</b>	<b>672</b>	<b>76</b>	<b>6</b>	<b>1</b>	<b>0</b>	<b>791</b>

2013 (July-December)							
TL in	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Total
10	1						1
11	3	1					4
12	159	12					171
13	222	19					241
14	151	31	1				183
15	84	42	1				127
16	30	43		1			74
17	8	30					38
18	8	16	2	1			27
19	1	5	1				7
20			1				1
21			2				2
22		1					1
23							0
24							0
25							0
26							0
27							0
28							0
<b>Total</b>	<b>667</b>	<b>200</b>	<b>8</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>877</b>

Table 10 (continued):

2014 (January-June)							
TL in	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Total
10							0
11	2		1				3
12	60	71	2				133
13	77	215	7				299
14	20	229	14	2			265
15		196	9	2	1		208
16		153	19				172
17		83	16				99
18		26	25				51
19		5	25				30
20			11	1			12
21		1	3	3	1		8
22		1	7	2			10
23			1	1			2
24						1	1
25					2		2
26							0
27						2	2
28							0
<b>Total</b>	<b>159</b>	<b>980</b>	<b>140</b>	<b>11</b>	<b>4</b>	<b>3</b>	<b>1297</b>

2014 (July-December)							
TL in	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Total
10							0
11	19						19
12	301	19	2				322
13	359	54	4				417
14	284	130	2				416
15	161	144	1	2			308
16	59	153	5	1			218
17	14	100	8	1			123
18	3	49	10				62
19	2	15	11	1	1		30
20	2	10	4				16
21			3	1			4
22			1	2	1		4
23				1	2		3
24							0
25							0
26							0
27							0
28							0
<b>Total</b>	<b>1204</b>	<b>675</b>	<b>53</b>	<b>9</b>	<b>1</b>	<b>0</b>	<b>1942</b>

2015 (January-June)							
TL in	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Total
10							0
11	2	1					3
12	93	32	1				126
13	85	172	5	2			264
14	14	353	7				374
15		361	11	1			373
16	1	272	14	2			289
17		113	44	1			158
18		25	38	1			64
19		3	34	1			38
20		1	17	5			23
21			4	3			7
22				4			4
23			3				3
24							0
25							0
26							0
27							0
28							0
<b>Total</b>	<b>195</b>	<b>1333</b>	<b>178</b>	<b>20</b>	<b>0</b>	<b>0</b>	<b>1726</b>

2015 (July-December)							
TL in	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Total
10	2						2
11	11	2					13
12	247	15					262
13	372	24	4				400
14	335	58					393
15	184	132	3				319
16	66	128	7	1			202
17	18	119	13	2			152
18	6	53	12	1			72
19	2	32	6	1			41
20	2	10	21				33
21		1	6	2			9
22			2	2	2		6
23			1				1
24		1					1
25							0
26							0
27							0
28							0
<b>Total</b>	<b>1245</b>	<b>575</b>	<b>75</b>	<b>9</b>	<b>2</b>	<b>0</b>	<b>1906</b>

2016 (January-June)							
TL in	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Total
10							0
11	1	4					5
12	96	71	3	1			171
13	115	212	8	5			340
14	23	358	5				386
15	4	404	12		1		421
16	2	282	18	2			304
17		104	32				136
18		37	37	1			75
19		8	29				37
20			21		1		22
21			11	4			15
22			4	3	1		8
23				1		1	2
24				3			3
25					1		1
26							0
27							0
28							0
<b>Total</b>	<b>241</b>	<b>1480</b>	<b>180</b>	<b>20</b>	<b>4</b>	<b>1</b>	<b>1926</b>

2016 (July-December)							
TL in	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Total
10							0
11	9						9
12	340	19	1	1			361
13	537	40	3				580
14	359	75	6				440
15	160	94	3				257
16	40	96	2				138
17	10	78	7	1			96
18	2	29	13				44
19	2	11	10				23
20		5	5	1	1		12
21		1	7	1			9
22			2				2
23							0
24							0
25		1					1
26							0
27							0
28							0
<b>Total</b>	<b>1459</b>	<b>449</b>	<b>59</b>	<b>4</b>	<b>1</b>	<b>0</b>	<b>1972</b>

Table 10 (continued):

2017 (January-June)							
TL in	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Total
10		2					2
11	4	1					5
12	77	29	4				110
13	64	163	3	1			231
14	14	281	1	2			298
15	1	314	4	1			320
16		209	9	1			219
17	1	140	19		1		161
18		44	20	1			65
19		15	18	2			35
20		3	10	1			14
21			9	1	1		11
22			3	1	1		5
23			1	2			3
24			1	2			3
25				1			1
26							0
27							0
28							0
<b>Total</b>	<b>161</b>	<b>1201</b>	<b>102</b>	<b>16</b>	<b>3</b>	<b>0</b>	<b>1483</b>

2017 (July-December)							
TL in	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Total
10	2						2
11	6						6
12	133	11					144
13	213	49	3				265
14	240	90	1				331
15	134	109	2				245
16	43	90			1		134
17	21	91	7		1		120
18	3	56	3		1		63
19		24	3			1	28
20	1	10	1				12
21		3	1				4
22			2		2		4
23					1		1
24					1		1
25							0
26							0
27							0
28							0
<b>Total</b>	<b>796</b>	<b>533</b>	<b>23</b>	<b>7</b>	<b>1</b>	<b>0</b>	<b>1360</b>

2018 (January-June)							
TL in	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Total
10							0
11	3						3
12	52	21	3				76
13	56	93	4				153
14	30	155	8	1			194
15	1	269	10				280
16		201	20		1		222
17	2	107	43	1	2		155
18		39	37	1			77
19		22	37				59
20		2	28	2	1		33
21		1	12	1			14
22			5	1			6
23			7	2	1		10
24				1	2		3
25							0
26							0
27							0
28							0
<b>Total</b>	<b>144</b>	<b>910</b>	<b>214</b>	<b>10</b>	<b>7</b>	<b>0</b>	<b>1285</b>

2018 (July-December)							
TL in	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Total
10							0
11	9						9
12	165	7	1				173
13	314	18	1				333
14	296	22	3				321
15	190	58					248
16	91	53					144
17	26	46	2			1	75
18	3	41	5				49
19	3	20	2				25
20		9	3				12
21			1	1			2
22			1				1
23			1	1			2
24							0
25							0
26							0
27							0
28							0
<b>Total</b>	<b>1097</b>	<b>274</b>	<b>20</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>1394</b>

2019 (January-June)							
TL in	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Total
10							0
11	3						3
12	87	12					99
13	99	45	1				145
14	38	111	2				151
15	10	182	5	1	1		199
16	5	175	11	1	1		193
17	1	89	8	1			99
18		31	19	2	1		53
19		4	12				16
20		3	11	2			16
21	1	1	4				6
22			2	1			3
23							0
24			2		1		3
25				1			1
26							0
27							0
28							0
<b>Total</b>	<b>244</b>	<b>653</b>	<b>77</b>	<b>9</b>	<b>4</b>	<b>0</b>	<b>987</b>

2019 (July-December)							
TL in	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Total
10							0
11	5						5
12	269	3	1				273
13	584	4	1				589
14	396	9	1				406
15	192	13	2		1		208
16	59	26	1				86
17	18	44	2				64
18	6	32	5				43
19	3	5	3				11
20	1	1	3				5
21		2	1				3
22	1		1				2
23				1			1
24			1				1
25							0
26							0
27							0
28							0
<b>Total</b>	<b>1534</b>	<b>139</b>	<b>22</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>1697</b>

Table 10 (continued):

2020 (January-June)							
TL in	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Total
10							0
11	2	1					3
12	64	39		1			104
13	44	153	5	1			203
14	6	263	6				275
15	1	204	3		1		209
16		105					105
17		36	4				40
18		23	5				28
19		5	6				11
20		3	5	2			10
21			2				2
22				1			1
23							0
24							0
25				1			1
26							0
27							0
28							0
Total	117	832	36	6	1	0	992

2020 (July-December)							
TL in	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Total
10							0
11	3	2					5
12	170	13					183
13	282	25	1				308
14	232	69	1				302
15	136	90	1				227
16	44	77	2	1			124
17	13	60					73
18	4	50	1				55
19	1	20	1				22
20	2	6	2				10
21		2	3				5
22		2	1				3
23							0
24				1			1
25		1					1
26							0
27						1	1
28							0
Total	887	417	13	2	0	1	1320

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Table 11: Annual survey age composition and sample sizes of female spotted seatrout catches from the LDWF experimental marine gillnet survey.

Year	1.0" Mesh						1.25" Mesh						1.5" Mesh							
	n	Age 1	Age 2	Age 3	Age 4	Age 6+	n	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	n	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+
1986	561	0.980	0.020	0.000	0.000	0.000	—	—	—	—	—	—	—	277	0.394	0.576	0.030	0.000	0.000	0.000
1987	546	0.989	0.031	0.000	0.000	0.000	—	—	—	—	—	—	—	464	0.540	0.440	0.020	0.000	0.000	0.000
1988	627	0.950	0.040	0.010	0.000	0.000	1075	0.910	0.080	0.010	0.000	0.000	0.000	733	0.778	0.212	0.010	0.000	0.000	0.000
1989	571	0.910	0.080	0.010	0.000	0.000	862	0.840	0.150	0.010	0.000	0.000	0.000	589	0.590	0.390	0.020	0.000	0.000	0.000
1990	486	0.940	0.050	0.010	0.000	0.000	713	0.859	0.141	0.000	0.000	0.000	0.000	406	0.570	0.420	0.010	0.000	0.000	0.000
1991	803	0.930	0.070	0.000	0.000	0.000	1132	0.879	0.121	0.000	0.000	0.000	0.000	529	0.400	0.590	0.010	0.000	0.000	0.000
1992	685	0.920	0.070	0.010	0.000	0.000	1081	0.830	0.160	0.010	0.000	0.000	0.000	714	0.505	0.485	0.010	0.000	0.000	0.000
1993	573	0.930	0.060	0.010	0.000	0.000	1072	0.881	0.109	0.010	0.000	0.000	0.000	630	0.540	0.440	0.020	0.000	0.000	0.000
1994	620	0.919	0.071	0.010	0.000	0.000	868	0.889	0.111	0.000	0.000	0.000	0.000	436	0.560	0.410	0.030	0.000	0.000	0.000
1995	942	0.930	0.060	0.010	0.000	0.000	903	0.870	0.120	0.010	0.000	0.000	0.000	524	0.455	0.515	0.030	0.000	0.000	0.000
1996	508	0.870	0.090	0.020	0.010	0.000	776	0.848	0.141	0.010	0.000	0.000	0.000	497	0.475	0.495	0.030	0.000	0.000	0.000
1997	529	0.880	0.090	0.020	0.010	0.000	684	0.838	0.152	0.010	0.000	0.000	0.000	496	0.485	0.465	0.040	0.010	0.000	0.000
1998	555	0.909	0.061	0.020	0.010	0.000	821	0.870	0.130	0.000	0.000	0.000	0.000	449	0.556	0.414	0.030	0.000	0.000	0.000
1999	749	0.880	0.090	0.020	0.010	0.000	984	0.818	0.172	0.010	0.000	0.000	0.000	770	0.545	0.434	0.020	0.000	0.000	0.000
2000	517	0.850	0.090	0.030	0.010	0.010	958	0.879	0.111	0.010	0.000	0.000	0.000	703	0.570	0.370	0.050	0.010	0.000	0.000
2001	321	0.828	0.121	0.030	0.010	0.000	614	0.778	0.212	0.010	0.000	0.000	0.000	495	0.525	0.434	0.030	0.010	0.000	0.000
2002	396	0.850	0.110	0.020	0.010	0.000	527	0.840	0.140	0.010	0.000	0.000	0.010	271	0.540	0.430	0.020	0.000	0.000	0.010
2003	457	0.939	0.040	0.010	0.010	0.000	522	0.881	0.099	0.010	0.000	0.000	0.010	286	0.580	0.400	0.020	0.000	0.000	0.000
2004	466	0.900	0.050	0.020	0.010	0.000	516	0.890	0.080	0.010	0.000	0.000	0.020	334	0.610	0.340	0.020	0.000	0.000	0.020
2005	730	0.939	0.061	0.000	0.000	0.000	736	0.909	0.081	0.000	0.000	0.000	0.010	272	0.550	0.380	0.030	0.010	0.010	0.000
2006	621	0.891	0.079	0.020	0.010	0.000	811	0.778	0.212	0.010	0.000	0.000	0.000	513	0.400	0.540	0.050	0.010	0.000	0.000
2007	596	0.920	0.050	0.010	0.010	0.000	709	0.878	0.112	0.010	0.000	0.000	0.000	380	0.580	0.370	0.030	0.010	0.000	0.010
2008	723	0.920	0.060	0.010	0.000	0.010	834	0.830	0.150	0.010	0.000	0.000	0.010	352	0.510	0.420	0.040	0.010	0.010	0.010
2009	590	0.910	0.050	0.010	0.010	0.010	739	0.848	0.141	0.010	0.000	0.000	0.000	493	0.535	0.444	0.020	0.000	0.000	0.000
2010	405	0.900	0.060	0.010	0.010	0.000	414	0.879	0.111	0.010	0.000	0.000	0.000	198	0.396	0.505	0.059	0.020	0.010	0.010
2011	957	0.909	0.081	0.010	0.000	0.000	1045	0.859	0.131	0.010	0.000	0.000	0.000	538	0.480	0.480	0.030	0.010	0.000	0.000
2012	746	0.920	0.060	0.010	0.000	0.010	1152	0.879	0.111	0.010	0.000	0.000	0.000	474	0.400	0.550	0.040	0.010	0.000	0.000
2013	815	0.737	0.091	0.040	0.051	0.040	666	0.812	0.149	0.020	0.010	0.000	0.010	332	0.414	0.515	0.061	0.010	0.000	0.000
2014	488	0.980	0.020	0.000	0.000	0.000	479	0.889	0.101	0.010	0.000	0.000	0.000	240	0.545	0.406	0.040	0.010	0.000	0.000
2015	351	0.919	0.030	0.020	0.010	0.010	337	0.860	0.130	0.010	0.000	0.000	0.000	136	0.574	0.356	0.040	0.010	0.000	0.020
2016	500	0.970	0.030	0.000	0.000	0.000	404	0.870	0.120	0.010	0.000	0.000	0.000	186	0.495	0.434	0.061	0.010	0.000	0.000
2017	506	0.930	0.040	0.010	0.010	0.000	504	0.840	0.150	0.010	0.000	0.000	0.000	241	0.485	0.475	0.030	0.010	0.000	0.000
2018	277	0.940	0.050	0.010	0.000	0.000	365	0.880	0.110	0.010	0.000	0.000	0.000	149	0.500	0.470	0.020	0.010	0.000	0.000
2019	503	0.980	0.020	0.000	0.000	0.000	339	0.960	0.040	0.000	0.000	0.000	0.000	89	0.650	0.340	0.000	0.010	0.000	0.000
2020	525	0.949	0.051	0.000	0.000	0.000	549	0.910	0.090	0.000	0.000	0.000	0.000	166	0.640	0.350	0.010	0.000	0.000	0.000

Table 12: Recreational spotted seatrout catch-at-age and yield (females only), and ASAP base model input coefficients of variation.

Year	Recreational Catch-at-age						Yield (lbs)	CV
	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+		
1982	1,818,279	415,740	186,480	54,681	29,288	96,729	3,437,031	0.21
1983	1,694,837	641,628	94,457	52,208	22,089	22,855	3,008,300	0.24
1984	391,755	199,957	49,228	34,885	24,723	31,707	1,228,965	0.30
1985	1,501,525	208,313	46,230	18,466	8,293	7,598	1,749,025	0.21
1986	2,633,193	842,301	104,620	28,925	11,178	15,474	3,610,915	0.16
1987	2,548,528	897,532	50,771	17,580	5,494	3,273	3,507,535	0.17
1988	1,487,973	812,106	150,429	55,867	19,677	13,883	3,122,697	0.20
1989	1,476,612	979,986	137,268	43,066	15,603	20,631	3,437,101	0.17
1990	1,085,067	414,345	58,012	12,634	3,495	3,092	1,832,308	0.18
1991	3,002,943	1,070,330	114,805	24,111	9,176	11,572	4,524,888	0.17
1992	2,285,253	773,982	76,493	19,045	6,565	7,722	3,382,887	0.16
1993	1,852,853	537,393	110,829	32,450	12,661	14,908	2,815,927	0.17
1994	2,434,226	784,676	113,803	42,265	19,089	22,932	3,843,690	0.15
1995	2,797,444	718,486	137,437	47,669	20,249	30,429	4,227,036	0.20
1996	2,242,323	1,047,477	172,192	40,556	16,166	16,686	4,301,554	0.16
1997	2,401,381	1,051,553	160,089	29,997	11,778	22,891	4,139,145	0.16
1998	2,384,739	1,204,289	186,819	45,615	15,448	8,721	4,400,806	0.16
1999	3,092,437	1,463,862	238,406	89,735	36,088	36,470	5,927,097	0.14
2000	3,110,291	1,602,485	318,164	100,733	36,713	37,420	6,654,898	0.14
2001	2,603,830	1,450,127	372,252	116,122	49,827	70,476	6,297,577	0.13
2002	1,776,126	1,075,727	365,693	74,240	29,492	41,091	4,308,986	0.16
2003	1,723,601	1,564,798	296,999	52,115	23,102	33,744	4,509,671	0.15
2004	1,555,848	1,558,269	213,562	30,339	14,781	25,995	3,822,010	0.15
2005	1,682,168	1,799,367	198,589	17,063	8,621	6,817	4,096,272	0.14
2006	2,110,375	2,694,800	332,830	23,581	6,578	9,002	6,100,329	0.15
2007	1,784,603	1,851,821	343,331	50,101	20,639	26,709	4,865,481	0.14
2008	2,256,965	2,632,435	579,080	35,033	8,777	15,439	6,297,865	0.15
2009	2,268,888	3,088,448	502,249	79,771	5,249	22,516	6,719,497	0.14
2010	2,545,061	1,585,205	360,711	56,527	8,890	19,356	5,294,537	0.19
2011	2,793,285	2,334,920	436,470	79,623	28,377	57,790	7,374,019	0.16
2012	2,973,166	2,369,144	446,859	58,825	25,957	41,457	7,488,382	0.17
2013	2,392,436	1,818,372	180,867	29,375	12,483	13,459	5,000,219	0.15
2014	1,677,404	1,028,212	73,847	10,282	3,614	5,117	3,279,951	0.06
2015	2,332,459	1,252,861	132,163	15,619	3,886	4,040	4,481,251	0.05
2016	2,909,711	1,457,978	165,538	19,654	7,874	7,912	5,184,852	0.05
2017	2,266,899	2,074,552	105,611	19,126	6,942	8,135	5,560,356	0.04
2018	1,601,410	529,906	63,608	3,202	3,713	2,060	2,653,599	0.06
2019	2,474,821	488,025	60,879	12,404	5,953	8,398	3,400,851	0.05
2020	1,991,344	1,295,553	46,767	12,612	5,484	10,423	3,886,182	0.05



Table 14: Mean weight-at-age (pounds) of recreational and commercial spotted seatrout landings (females only).

Recreational Mean Weight-at-age						
Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+
1982	0.82	1.67	2.47	3.11	3.78	5.24
1983	0.87	1.50	2.53	3.12	3.53	4.07
1984	0.89	1.96	2.73	3.63	3.91	4.16
1985	0.79	1.59	2.41	3.17	3.44	4.30
1986	0.73	1.48	2.38	3.08	3.56	4.52
1987	0.81	1.37	2.47	3.02	3.31	3.68
1988	0.86	1.45	2.49	3.08	3.40	3.91
1989	0.94	1.46	2.46	3.04	3.51	4.71
1990	0.89	1.59	2.49	2.95	3.43	4.08
1991	0.84	1.49	2.33	3.00	3.56	4.42
1992	0.85	1.47	2.48	3.04	3.54	4.33
1993	0.83	1.48	2.46	3.06	3.53	4.39
1994	0.85	1.52	2.55	3.19	3.64	4.32
1995	0.86	1.55	2.57	3.15	3.64	4.61
1996	0.88	1.57	2.46	3.07	3.66	4.06
1997	0.82	1.47	2.40	2.96	3.72	4.55
1998	0.84	1.44	2.41	3.05	3.37	3.57
1999	0.83	1.49	2.55	3.09	3.51	4.22
2000	0.87	1.58	2.54	3.09	3.53	4.23
2001	0.88	1.54	2.46	3.12	3.62	4.45
2002	0.91	1.33	2.09	2.88	3.61	4.38
2003	0.82	1.31	2.19	2.81	3.20	4.86
2004	0.82	1.19	2.08	2.62	3.74	4.14
2005	0.81	1.23	2.12	2.71	3.16	3.89
2006	0.80	1.34	2.02	2.96	3.69	4.21
2007	0.82	1.27	2.06	2.91	3.73	4.31
2008	0.85	1.18	1.87	2.63	3.75	4.57
2009	0.84	1.17	1.83	1.88	4.09	4.96
2010	0.86	1.30	2.14	2.51	3.83	4.76
2011	0.95	1.38	2.02	2.98	3.79	4.77
2012	0.88	1.46	2.16	2.84	3.26	4.76
2013	0.87	1.27	2.25	2.92	3.42	4.32
2014	0.96	1.43	1.97	2.28	3.61	4.55
2015	0.97	1.49	2.17	2.60	3.81	4.00
2016	0.94	1.37	2.11	2.65	3.40	4.63
2017	0.99	1.44	2.06	2.39	3.46	4.42
2018	1.03	1.56	2.21	3.42	2.95	4.15
2019	0.97	1.59	2.18	2.95	3.36	4.62
2020	0.95	1.39	2.08	2.90	3.52	4.95

Commercial Mean Weight-at-age						
Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+
1982	1.04	1.46	2.47	3.12	3.78	4.79
1983	1.04	1.46	2.47	3.12	3.78	4.79
1984	1.04	1.46	2.47	3.12	3.78	4.79
1985	1.04	1.46	2.47	3.12	3.78	4.79
1986	1.04	1.41	2.44	3.11	3.78	4.79
1987	1.20	1.59	2.37	2.95	3.44	4.36
1988	1.20	1.59	2.37	2.95	3.44	4.36
1989	1.20	1.59	2.37	2.95	3.44	4.36
1990	1.20	1.59	2.37	2.95	3.44	4.36
1991	1.20	1.59	2.37	2.95	3.44	4.36
1992	1.20	1.59	2.37	2.95	3.44	4.36
1993	1.20	1.59	2.37	2.95	3.44	4.36
1994	1.20	1.59	2.37	2.95	3.44	4.36
1995	1.20	1.59	2.37	2.95	3.44	4.36
1996	1.20	1.59	2.37	2.95	3.44	4.36
1997	1.17	1.36	2.30	2.91	3.72	4.50
1998	1.18	1.33	2.33	3.00	3.35	3.51
1999	1.18	1.36	2.48	3.08	3.47	4.03
2000	1.21	1.51	2.50	3.05	3.48	4.14
2001	1.21	1.41	2.38	3.02	3.53	4.46
2002	1.27	1.37	2.13	3.07	3.59	4.20
2003	1.09	1.40	2.18	2.58	3.33	4.70
2004	1.19	1.39	2.20	3.21	3.73	4.32
2005	1.08	1.35	2.10	2.20	2.96	3.98
2006	1.22	1.39	2.14	2.98	3.75	4.24
2007		1.44	2.16	2.77	3.68	4.32
2008	1.19	1.31	1.96	2.81	3.76	4.52
2009	1.22	1.30	1.92	2.19	3.83	4.58
2010	1.20	1.45	2.24	2.60	3.82	4.76
2011	1.25	1.73	2.37	3.04	4.17	4.89
2012	1.17	1.48	2.42	2.68	3.74	4.35
2013	1.26	1.55	2.49	2.85	3.74	4.51
2014	1.26	1.54	2.12	2.21	3.71	4.42
2015	1.24	1.48	2.20	2.66	3.75	3.97
2016	1.20	1.43	2.23	3.10	3.29	4.55
2017	1.25	1.54	2.21	2.45	3.46	4.42
2018	1.26	1.58	2.35	3.26	2.99	4.15
2019	1.24	1.54	2.23	2.80	2.98	4.59
2020	1.19	1.36	2.14	3.20	2.71	4.05

Table 15: Summary of objective function components and negative log-likelihood values of the ASAP base model.

Objective function=	25665.8		
Component	Lambda	ESS	negLL
Catch_Recreational	1	--	-48
Catch_Commercial	1	--	-105
Index_1.0" mesh	1	--	-21
Index_1.25" mesh	1	--	-20
Index_1.5" mesh	1	--	-12
Catch_agecomps	--	15600	14242
Index_agecomps	--	20600	11643
Selectivity_parms_catch	20	--	1
Selectivity_parms_indices	12	--	12
Recruitment devs	1	--	-25

Table 16: Annual female spotted seatrout abundance-at-age and total stock size estimates from the ASAP base model.

Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Totals
1982	5,499,580	1,420,180	514,160	238,077	186,129	969,726	8,827,852
1983	4,768,340	1,720,030	402,969	204,816	124,118	794,079	8,014,352
1984	3,060,540	1,154,880	296,664	116,802	89,186	599,374	5,317,446
1985	6,043,130	1,182,430	347,012	127,584	64,983	488,382	8,253,521
1986	7,567,090	2,369,650	370,760	153,118	71,961	394,395	10,926,974
1987	6,895,680	2,249,230	487,326	123,312	73,062	313,872	10,142,482
1988	8,116,710	2,059,330	492,356	167,661	59,783	260,185	11,156,025
1989	6,392,620	3,048,030	382,064	162,246	86,688	228,755	10,300,403
1990	6,441,640	1,752,240	277,585	86,701	71,186	215,228	8,844,580
1991	7,401,140	2,718,060	491,744	119,942	51,078	209,711	10,991,675
1992	6,861,790	2,458,710	417,872	151,613	60,628	185,567	10,136,180
1993	7,299,870	2,415,570	448,445	142,945	80,464	176,139	10,563,433
1994	7,832,730	2,620,080	440,390	150,952	75,078	181,775	11,301,005
1995	8,019,600	2,696,860	455,910	147,140	79,305	182,474	11,581,289
1996	7,561,810	2,867,600	560,630	172,857	82,294	188,708	11,433,899
1997	7,135,470	2,867,070	670,258	224,800	98,976	196,391	11,192,965
1998	8,280,490	2,811,360	743,314	291,526	135,085	216,495	12,478,270
1999	8,311,700	3,333,410	844,386	355,702	182,387	259,301	13,286,886
2000	9,079,460	3,140,150	882,504	379,969	216,694	322,925	14,021,702
2001	6,266,740	3,276,420	759,008	379,902	227,079	392,889	11,302,038
2002	5,523,270	2,068,430	644,251	293,513	216,805	447,468	9,193,737
2003	5,646,650	2,054,680	526,635	283,905	177,210	487,540	9,176,620
2004	6,290,900	1,974,770	465,101	219,407	167,288	487,274	9,604,740
2005	7,955,890	2,406,900	541,533	213,403	134,779	484,649	11,737,154
2006	6,863,780	3,383,350	828,636	278,710	137,747	464,657	11,956,880
2007	7,577,340	2,674,900	970,422	389,357	172,965	447,801	12,232,785
2008	7,967,560	3,160,200	884,997	489,741	249,197	463,211	13,214,906
2009	6,577,740	2,961,030	817,676	394,693	297,168	522,598	11,570,905
2010	6,646,640	2,159,920	589,297	319,685	226,268	592,466	10,534,276
2011	7,118,700	2,492,580	570,915	265,768	194,913	604,328	11,247,204
2012	5,785,430	2,562,140	603,519	246,363	158,985	588,799	9,945,236
2013	5,141,980	1,595,430	351,342	195,643	130,268	538,001	7,952,664
2014	5,508,890	1,292,580	179,260	102,999	99,059	477,385	7,660,173
2015	6,280,180	1,761,180	242,193	67,945	58,264	422,122	8,831,884
2016	7,355,850	1,828,400	270,698	83,121	36,823	350,444	9,925,335
2017	4,789,000	1,980,970	238,109	85,483	43,458	281,360	7,418,380
2018	3,716,610	865,821	110,097	48,982	37,149	226,897	5,005,557
2019	5,807,810	998,522	111,925	34,622	25,564	190,875	7,169,317
2020	6,591,440	1,698,460	155,217	38,646	18,812	158,016	8,660,591

Table 17: Annual female spotted seatrout age-specific, apical, and average fishing mortality rates estimated from the ASAP base model.

Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6+	Apical F	Avg. F
1982	0.63	0.90	0.61	0.37	0.20	0.11	0.90	0.60
1983	0.89	1.39	0.93	0.55	0.30	0.16	1.39	0.91
1984	0.42	0.84	0.53	0.30	0.16	0.08	0.84	0.47
1985	0.41	0.80	0.51	0.29	0.15	0.08	0.80	0.44
1986	0.69	1.22	0.79	0.45	0.24	0.13	1.22	0.78
1987	0.68	1.16	0.76	0.44	0.24	0.12	1.16	0.77
1988	0.45	1.32	0.80	0.37	0.16	0.06	1.32	0.62
1989	0.77	2.03	1.17	0.54	0.23	0.09	2.03	1.13
1990	0.33	0.91	0.53	0.24	0.10	0.04	0.91	0.44
1991	0.57	1.51	0.87	0.40	0.17	0.07	1.51	0.80
1992	0.52	1.34	0.76	0.35	0.15	0.06	1.34	0.71
1993	0.50	1.34	0.78	0.36	0.15	0.06	1.34	0.69
1994	0.54	1.38	0.79	0.36	0.15	0.06	1.38	0.73
1995	0.50	1.21	0.66	0.30	0.12	0.05	1.21	0.66
1996	0.44	1.09	0.60	0.27	0.11	0.05	1.09	0.60
1997	0.40	0.99	0.52	0.22	0.09	0.04	0.99	0.55
1998	0.38	0.84	0.43	0.18	0.07	0.03	0.84	0.47
1999	0.45	0.96	0.49	0.21	0.09	0.03	0.96	0.56
2000	0.49	1.06	0.53	0.23	0.09	0.04	1.06	0.60
2001	0.58	1.26	0.64	0.28	0.11	0.04	1.26	0.74
2002	0.46	1.00	0.51	0.22	0.09	0.04	1.00	0.55
2003	0.52	1.12	0.57	0.24	0.10	0.04	1.12	0.62
2004	0.43	0.93	0.47	0.20	0.08	0.03	0.93	0.51
2005	0.33	0.70	0.35	0.15	0.06	0.02	0.70	0.39
2006	0.41	0.88	0.45	0.19	0.08	0.03	0.88	0.53
2007	0.35	0.74	0.37	0.16	0.07	0.03	0.74	0.41
2008	0.46	0.99	0.50	0.21	0.09	0.03	0.99	0.56
2009	0.59	1.25	0.63	0.27	0.11	0.04	1.25	0.71
2010	0.45	0.97	0.49	0.21	0.09	0.03	0.97	0.52
2011	0.49	1.05	0.53	0.23	0.09	0.04	1.05	0.58
2012	0.76	1.62	0.82	0.35	0.14	0.06	1.62	0.92
2013	0.85	1.82	0.92	0.40	0.16	0.06	1.82	0.97
2014	0.61	1.31	0.66	0.28	0.12	0.05	1.31	0.69
2015	0.71	1.51	0.76	0.33	0.13	0.05	1.51	0.83
2016	0.78	1.67	0.84	0.36	0.15	0.06	1.67	0.92
2017	1.18	2.53	1.27	0.55	0.22	0.09	2.53	1.49
2018	0.79	1.68	0.85	0.37	0.15	0.06	1.68	0.90
2019	0.70	1.50	0.75	0.32	0.13	0.05	1.50	0.79
2020	0.59	1.27	0.64	0.28	0.11	0.04	1.27	0.72

Table 18: Limit and target reference point estimates for the Louisiana spotted seatrout stock. Spawning stock biomass units are millions of pounds. Fishing mortality units are per year.

Management Benchmarks		
Parameters	Derivation	Value
$SSB_{limit}$	Lowest SSB (1982-2009)	4.30
$SPR_{limit}$	Equation [29] and $SSB_{limit}$	9.8%
$F_{limit}$	Equation [29] and $SPR_{limit}$	0.77
$SSB_{target}$	Median SSB (1982-2009)	6.19
$SPR_{target}$	Equation [29] and $SSB_{target}$	14.1%
$F_{target}$	Equation [29] and $SPR_{target}$	0.62

Table 19: Sensitivity analysis table of proposed limit reference points. Current estimates are taken as the geometric mean of the 2018-2020 estimates. Yield and spawning stock biomass units are millions of pounds, and fishing mortality units are per year.

Model run	negLL	SPR <sub>limit</sub>	Yield <sub>limit</sub>	F <sub>limit</sub>	SSB <sub>limit</sub>	SPR <sub>current</sub>	F <sub>current</sub> /F <sub>limit</sub>	SSB <sub>current</sub> /SSB <sub>limit</sub>
Base Model (h=1)	25665.8	9.8%	4.87	0.77	4.30	6.3%	1.03	0.64
Model 1 (h=0.95)	25665.7	10.0%	4.72	0.76	4.28	6.9%	1.05	0.64
Model 2 (h=0.90)	25665.8	10.3%	4.56	0.75	4.27	7.6%	1.07	0.64
Model 3 (h=0.85)	25666.2	10.7%	4.38	0.73	4.28	8.4%	1.10	0.64
Model 4 (h=0.80)	25666.9	11.2%	4.19	0.72	4.31	9.4%	1.13	0.64
Model 5 (Yield lambda*10)	24056.0	8.0%	5.11	0.86	3.61	6.2%	0.87	0.77
Model 6 (IOA lambdas*10)	24846.6	10.0%	4.46	0.75	4.02	5.8%	1.24	0.58
Model 7 (Winterkill index)	25695.7	8.1%	5.74	0.85	4.11	4.8%	0.86	0.59
Model 8 (Discard M=0.25)	25502.8	9.3%	4.98	0.81	4.27	6.0%	1.04	0.65
Model 9 (Growth model ALK's 1982-2020)	25265.6	10.1%	4.73	0.81	4.27	5.7%	1.09	0.57
Model 10 (ACAL MRIP hindcast)	25440.7	8.6%	5.15	0.84	3.97	5.9%	0.95	0.69
Model 11 (MRIP Size with FES and APAIS)	25663.6	9.7%	4.86	0.78	4.27	6.2%	1.04	0.63
Model 12 (Inshore shrimp bycatch fleet)	25605.6	9.5%	4.95	0.80	4.27	6.1%	1.04	0.64

Table 20: Sensitivity analysis table of MSY related reference points. Current estimates are taken as the geometric mean of 2018-2020 estimates. Yield and spawning stock biomass units are millions of pounds, and fishing mortality units are per year.

Model run	negLL	SPR <sub>MSY</sub>	MSY	F <sub>MSY</sub>	SSB <sub>MSY</sub>	SPR <sub>current</sub>	F <sub>current</sub> /F <sub>MSY</sub>	SSB <sub>current</sub> /SSB <sub>MSY</sub>
Base Model (h=1)	25665.8	--	--	--	--	6.3%	--	--
Model 1 (h=0.95)	25665.7	12.3%	4.75	0.67	5.40	6.9%	1.19	0.51
Model 2 (h=0.90)	25665.8	17.6%	4.88	0.53	8.36	7.6%	1.52	0.33
Model 3 (h=0.85)	25666.2	21.9%	5.28	0.45	11.82	8.4%	1.80	0.23
Model 4 (h=0.80)	25666.9	25.8%	6.08	0.39	16.82	9.4%	2.08	0.16

11. Figures

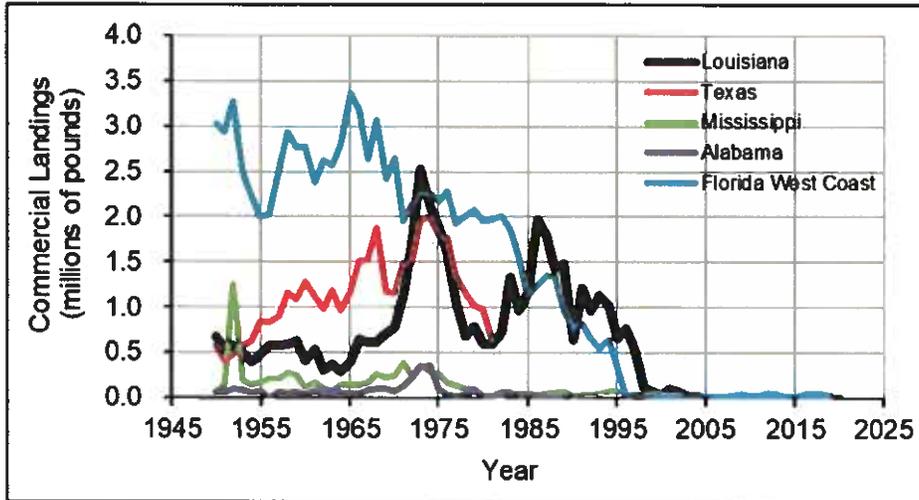


Figure 1: Reported commercial spotted seatrout landings of the Gulf of Mexico derived from NMFS statistical records and the LDWF Trip Ticket Program.



Figure 2: Station locations of the LDWF marine experimental gillnet survey. Yellow lines delineate LDWF Coastal Study Areas and state/federal waters.

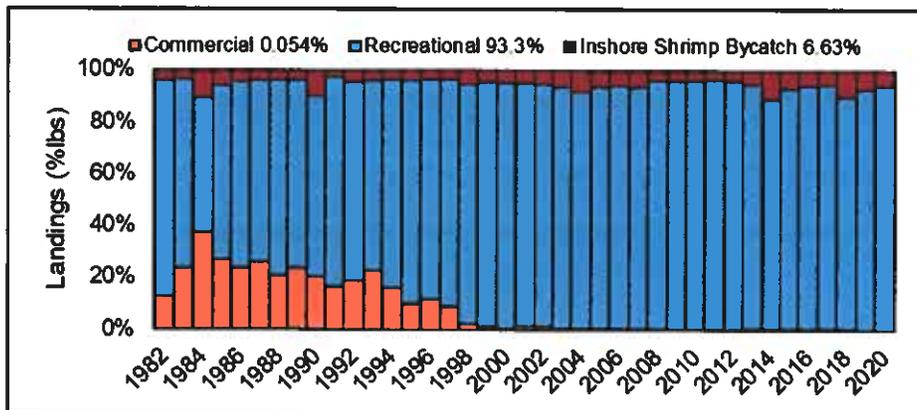


Figure 3: Comparison of LA spotted seatrout commercial and recreational landings, and LA inshore shrimp fishery spotted seatrout bycatch estimates from 1982-2020. Values in legends represent the mean landings percentages from each fishery in the most recent decade (2011-2020).

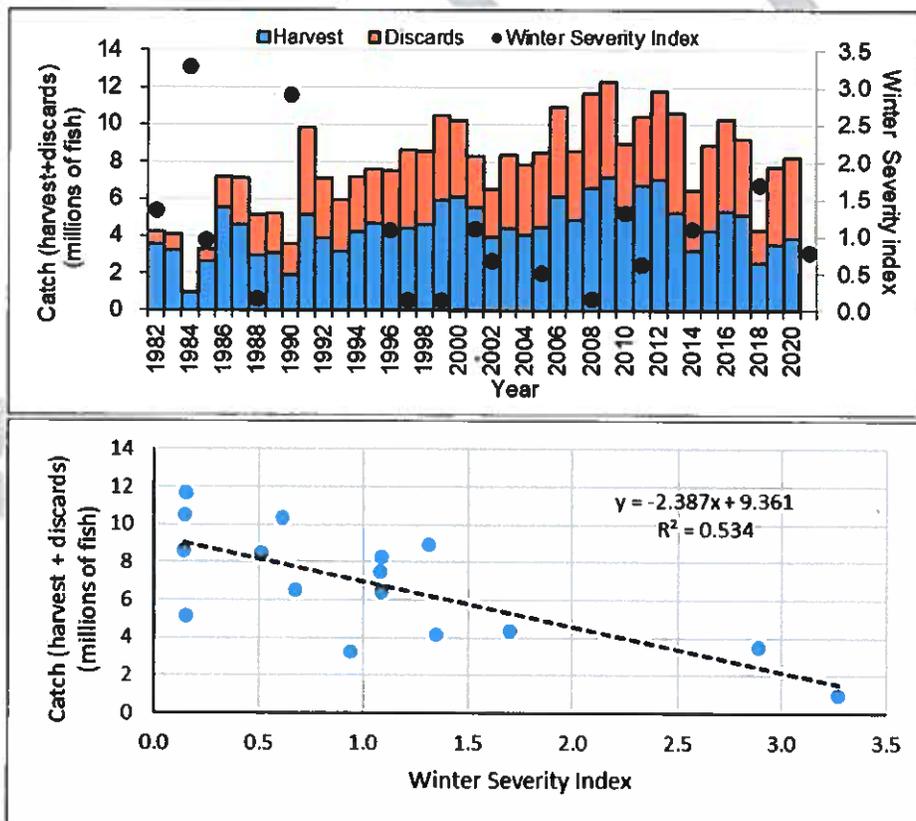


Figure 4: Louisiana recreational spotted seatrout total catch (harvest + discards, 1982-2020) and winter severity index values (1982-2021; top graphic) and the relationship between total recreational catch and winter severity index values in the years with winter severity index values  $>0$  (bottom graphic). The linear regression of total catch on winter severity index values in the bottom graphic explains 53% of the annual variability in total recreational catch.

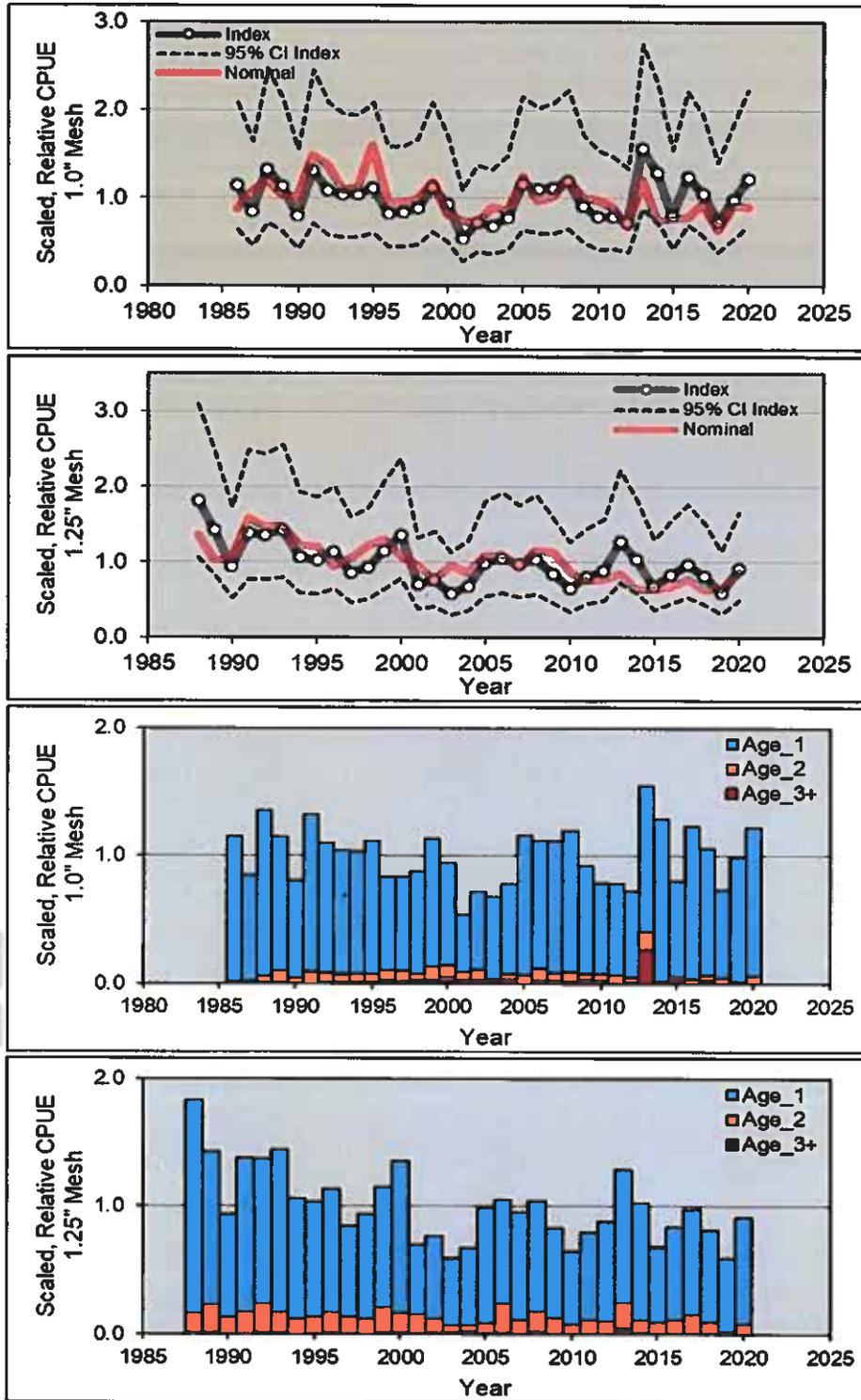


Figure 5: Standardized indices of abundance, nominal catch-per-unit-effort, and 95% confidence intervals of the standardized indices derived from the 1.0-inch and 1.25-inch meshes of the LDWF experimental marine gillnet survey (top graphics). Bottom graphics depicts the standardized indices of abundance by age-class. Each time-series has been normalized to its individual long-term mean.

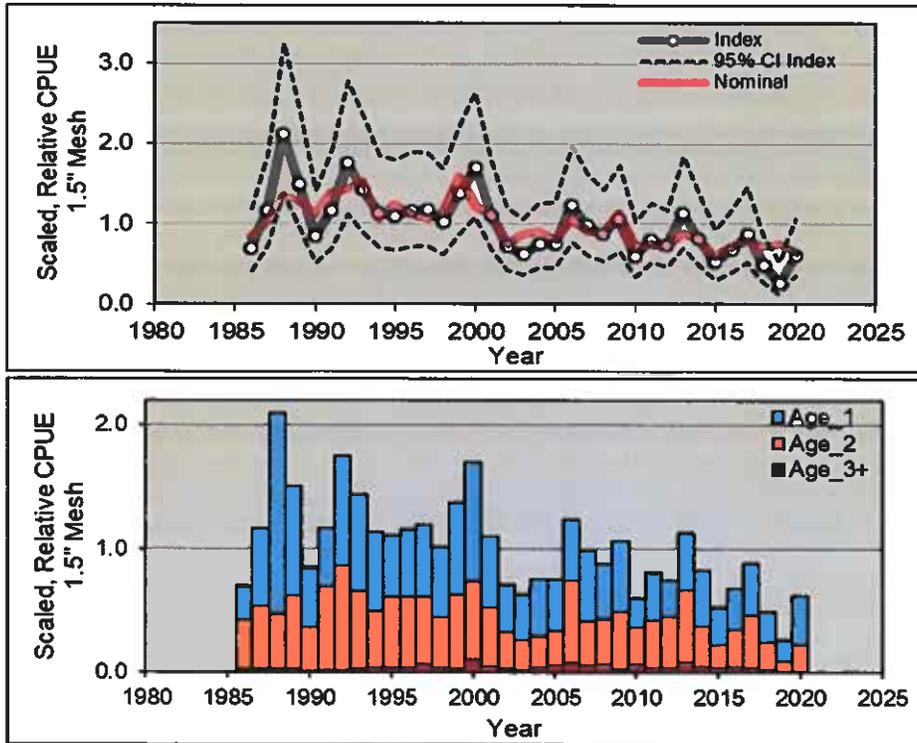


Figure 5 (continued): Standardized index of abundance, nominal catch-per-unit-effort, and 95% confidence intervals of the standardized index derived from the 1.5-inch mesh of the LDWF experimental marine gillnet survey (top graphics). Bottom graphic depicts the standardized index of abundance by age-class. Each time-series has been normalized to its individual long-term mean.

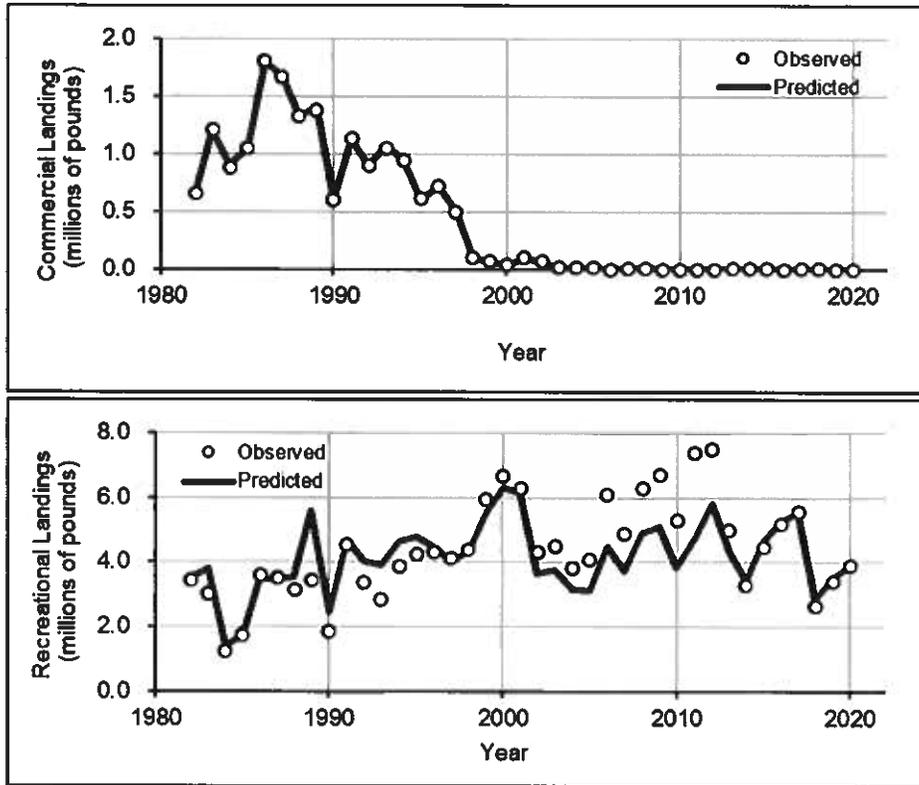


Figure 6: Observed and ASAP base model estimated commercial and recreational yield (females only).

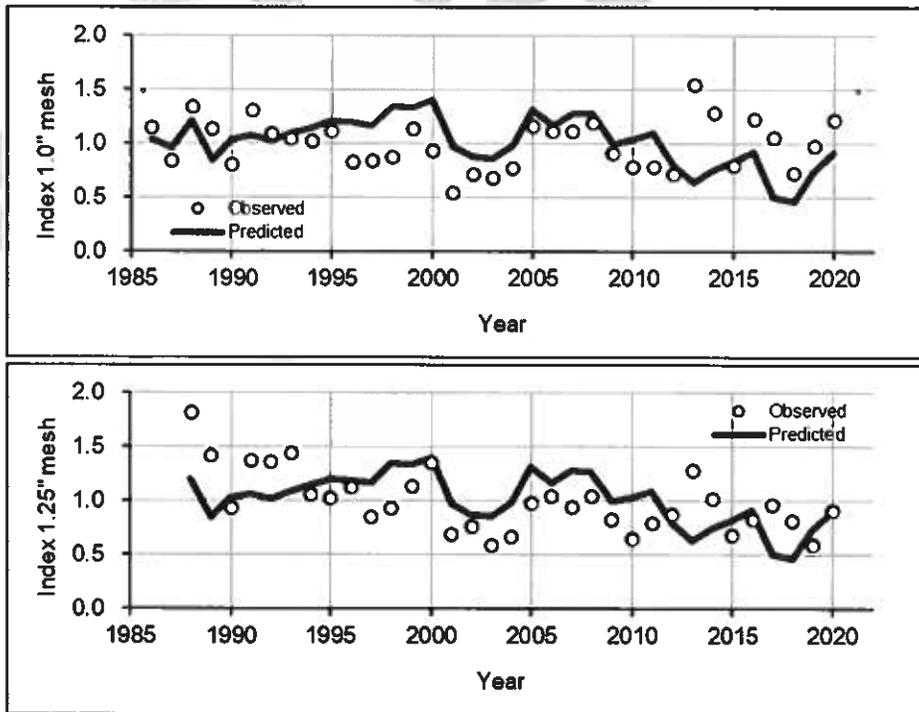


Figure 7: Observed and ASAP base model estimated survey indices of abundance (females only).

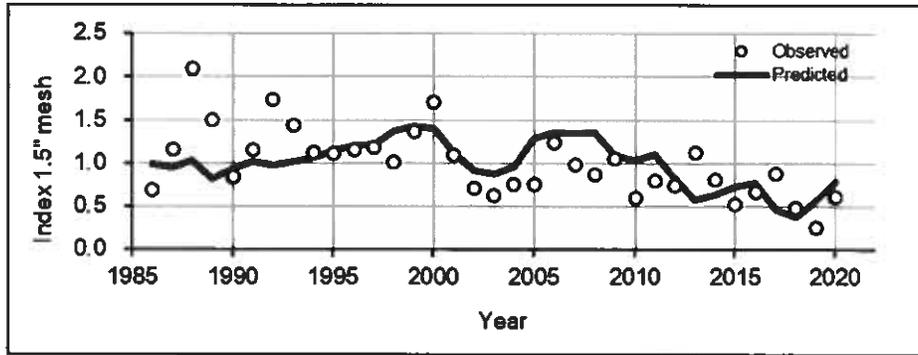


Table 7 (continued):

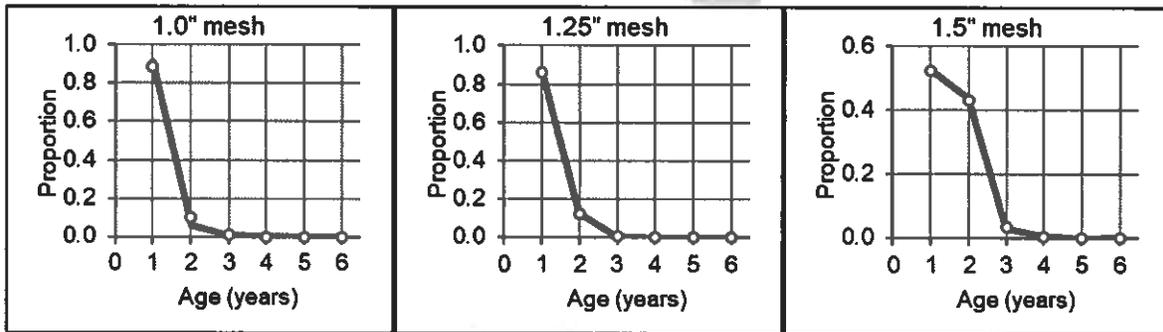


Figure 8: Overall (average) input (open circles) and ASAP estimated (bold lines) age compositions of experimental gillnet survey catches.

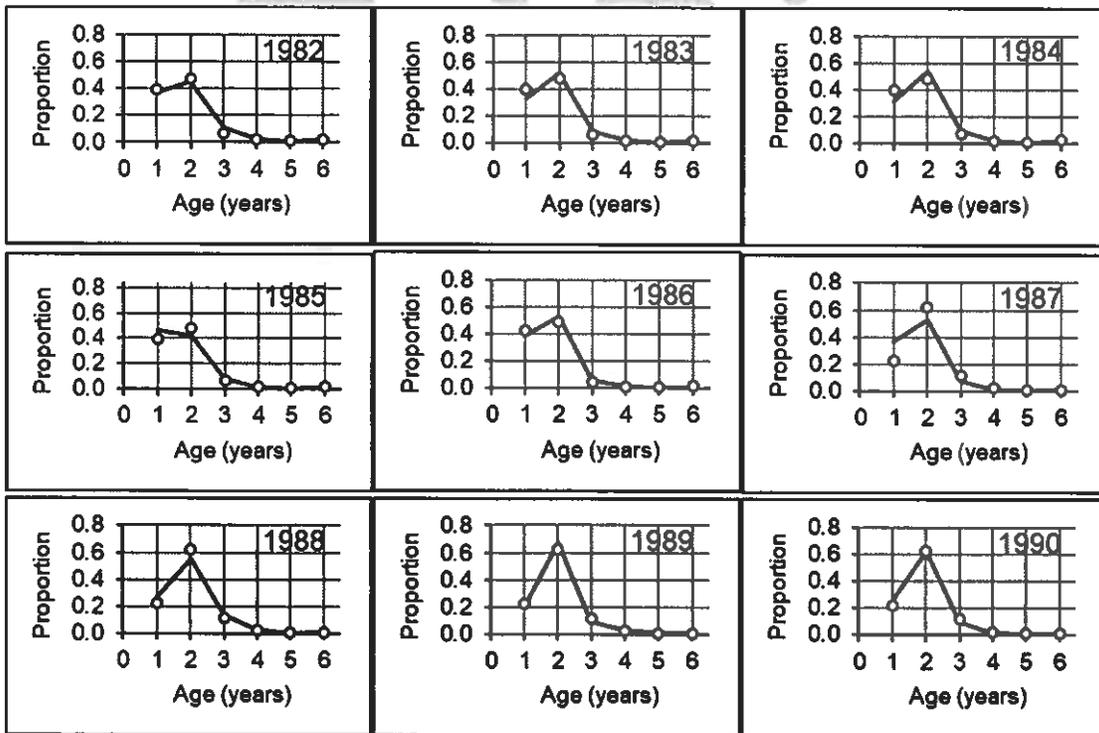


Figure 9: Annual input (open circles) and ASAP estimated (bold lines) commercial harvest age compositions.

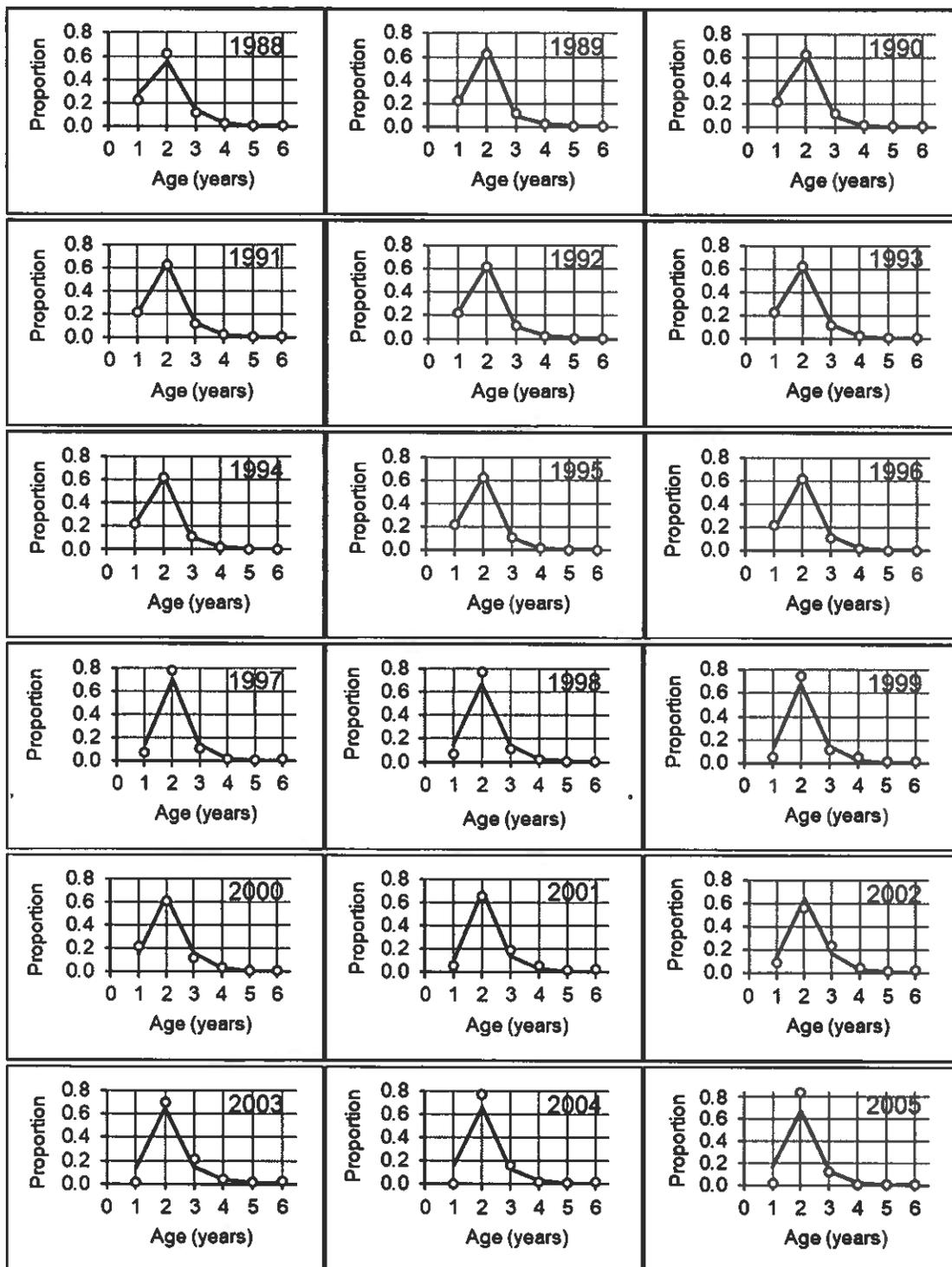


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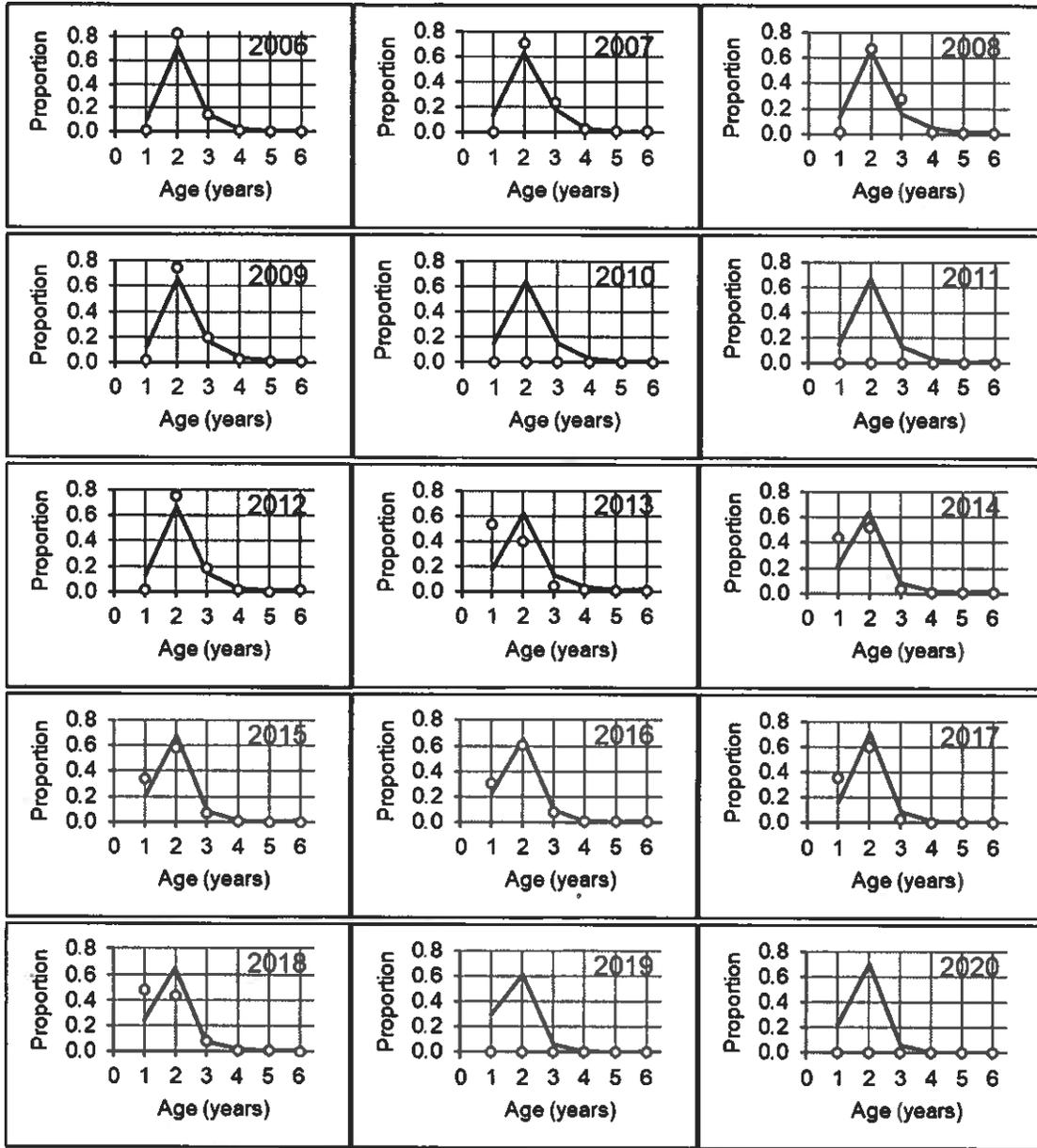


Figure 9 (continued):

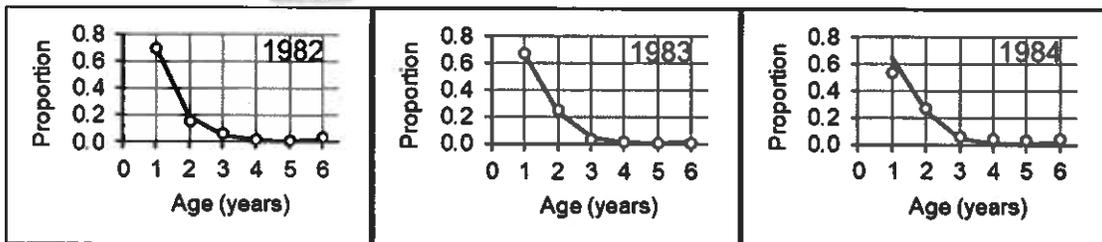


Figure 10: Annual input (open circles) and ASAP estimated (bold lines) recreational harvest age compositions.

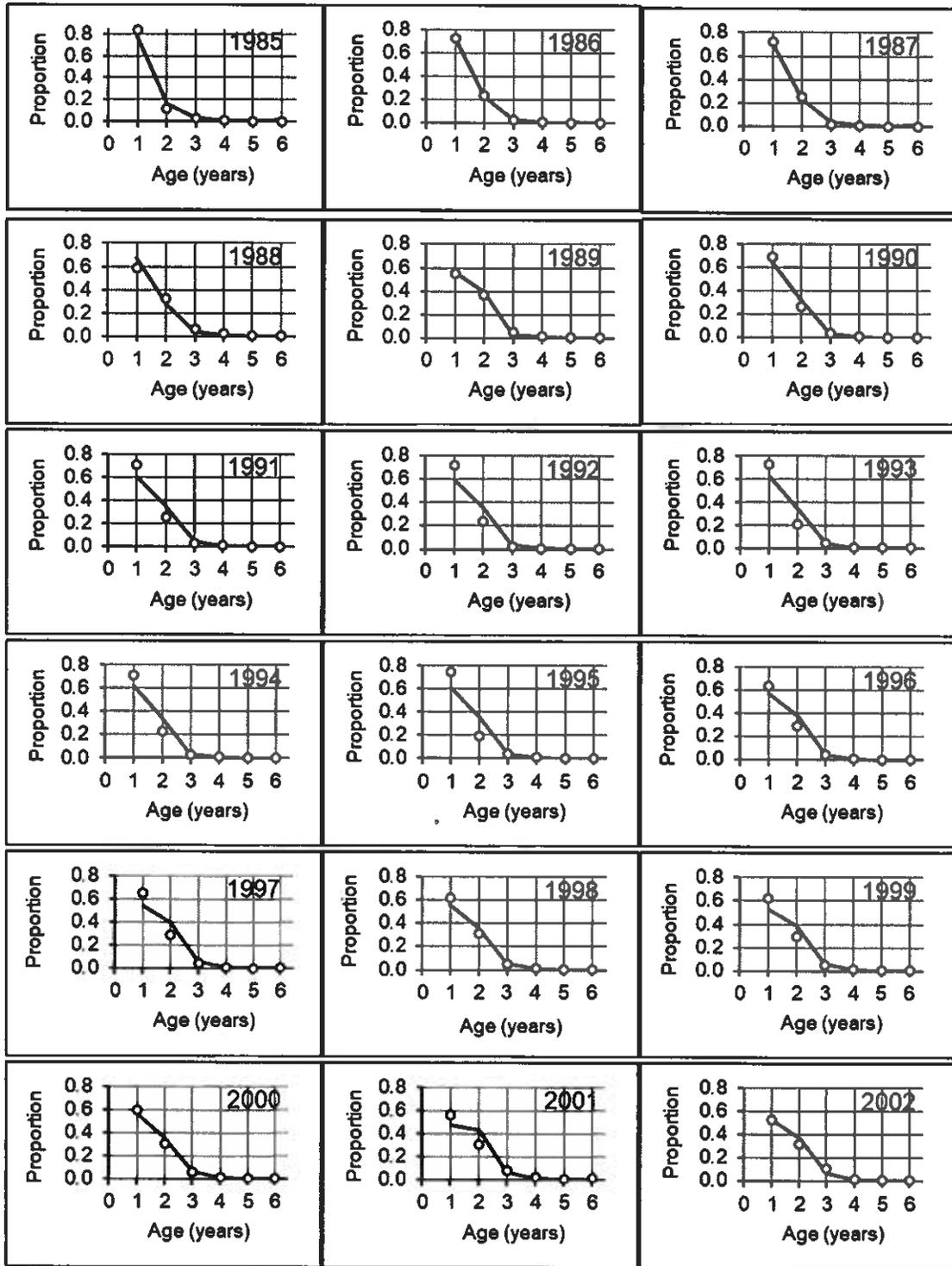


Figure 10 (continued):

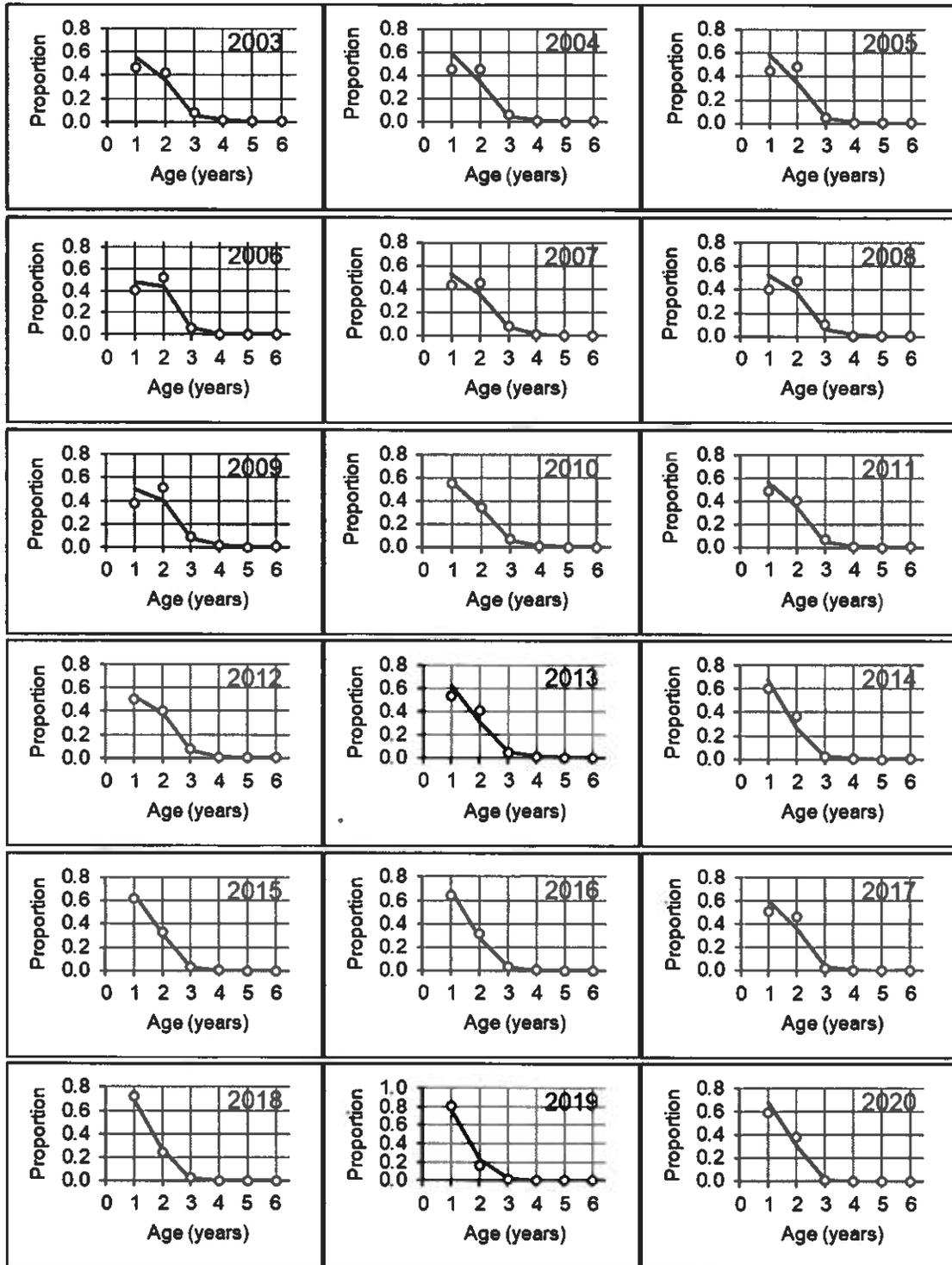


Figure 10 (continued):

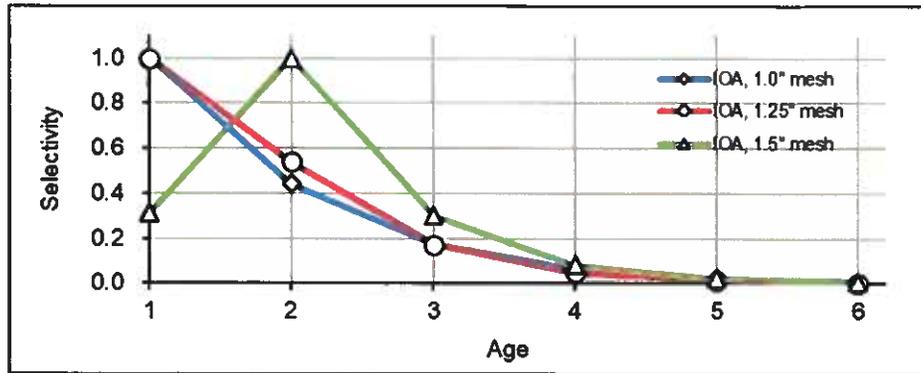


Figure 11: ASAP base model estimated survey selectivities (females only).

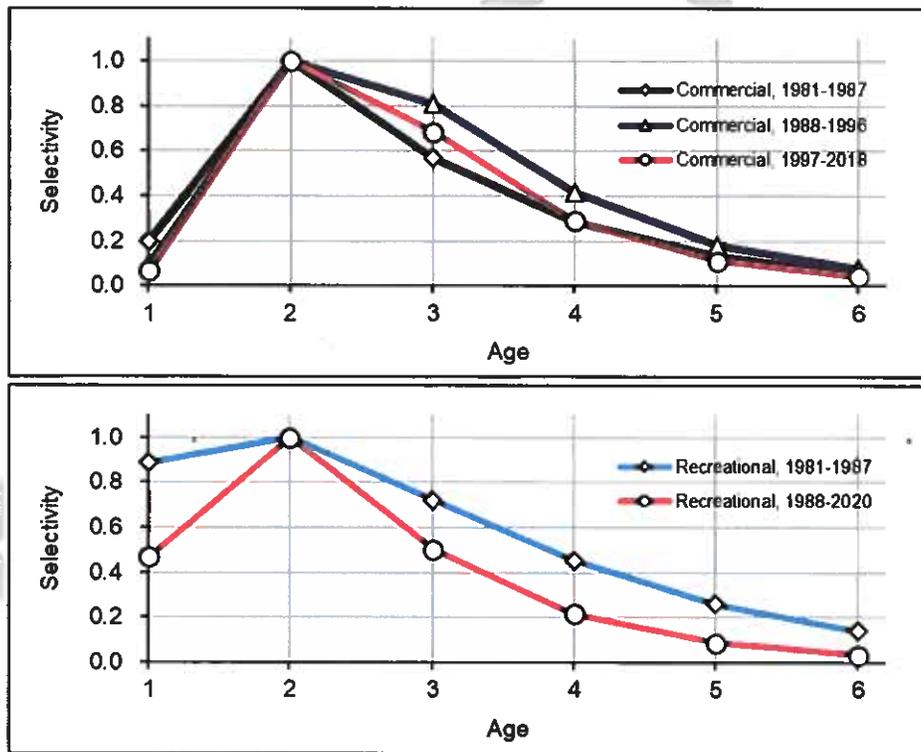


Figure 12: ASAP base model estimated fishery selectivities (females only).

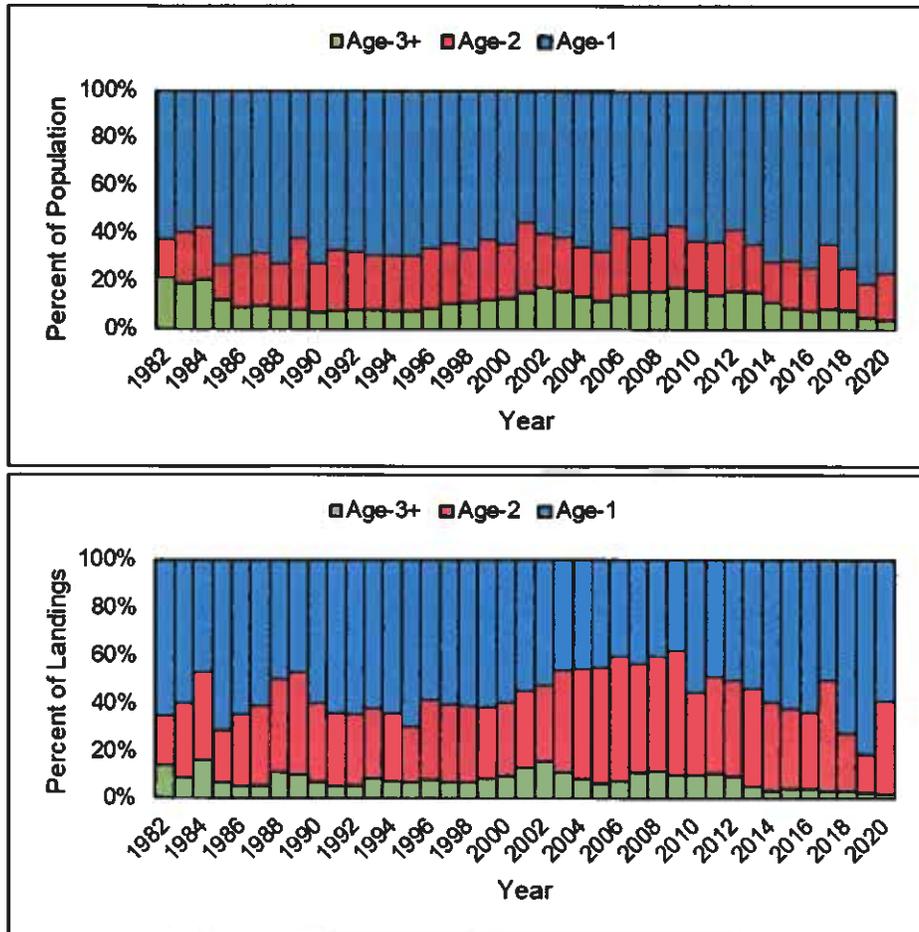


Figure 13: Age composition of the ASAP base model estimated female stock (top graphic) and the age composition of observed female landings (bottom graphic).

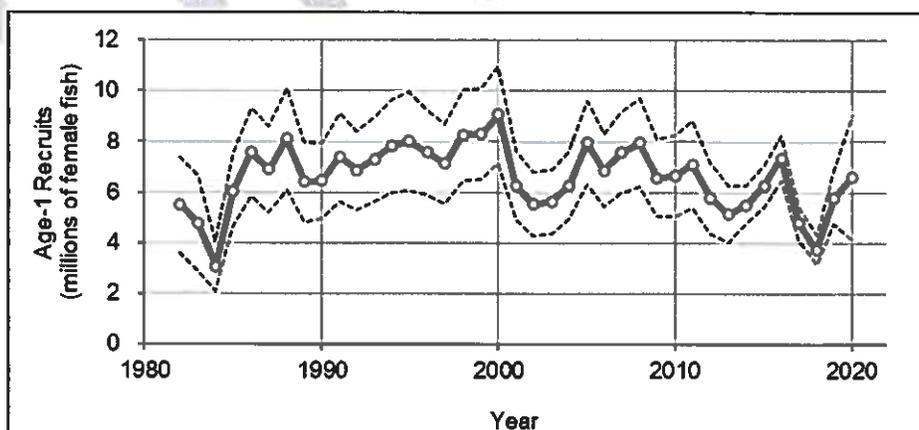


Figure 14: ASAP base model estimated recruitment (age-1 females). Dashed lines represent  $\pm 2$  asymptotic standard errors.

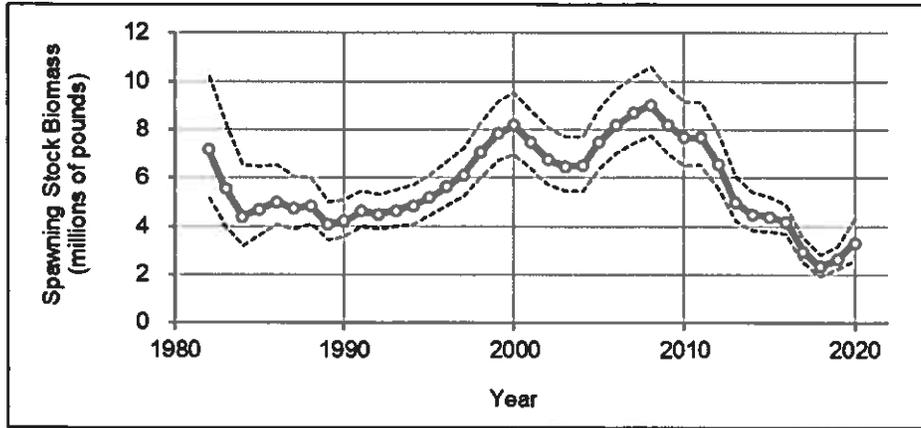


Figure 15: ASAP base model estimated female spawning stock biomass (MCMC median). Dashed lines represent 95% MCMC derived confidence intervals.

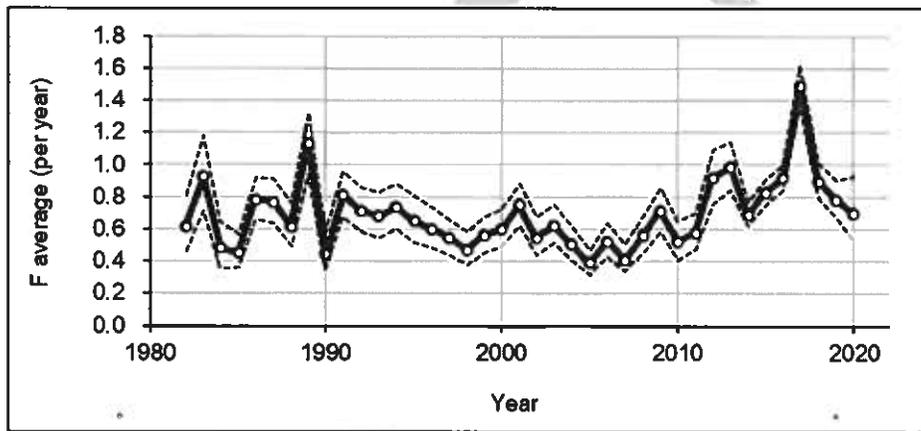


Figure 16: ASAP base model estimated average fishing mortality (MCMC median). Dashed lines represent 95% MCMC derived confidence intervals.

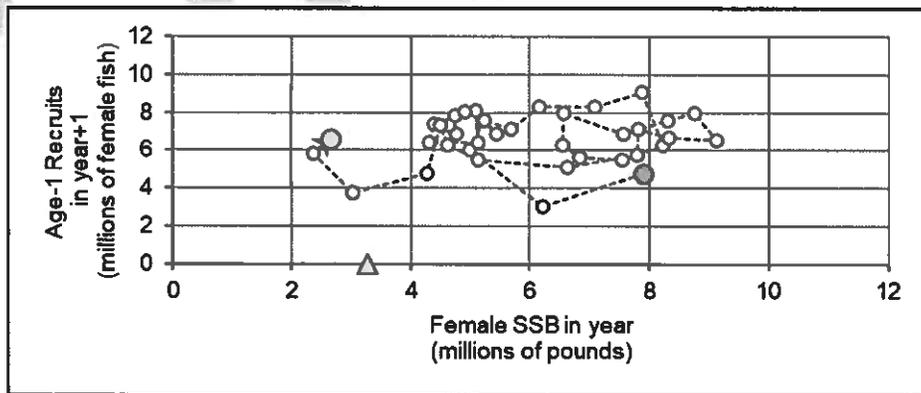


Figure 17: ASAP base model estimated age-1 recruits and female spawning stock biomass. Arrow represents direction of the time-series. The yellow circle represents the most current data pair (2020 age-1 recruits / 2019 female SSB) and the yellow triangle represents the 2020 SSB estimate. The green circle represents the first data pair (1983 age-1 recruits / 1982 female SSB).

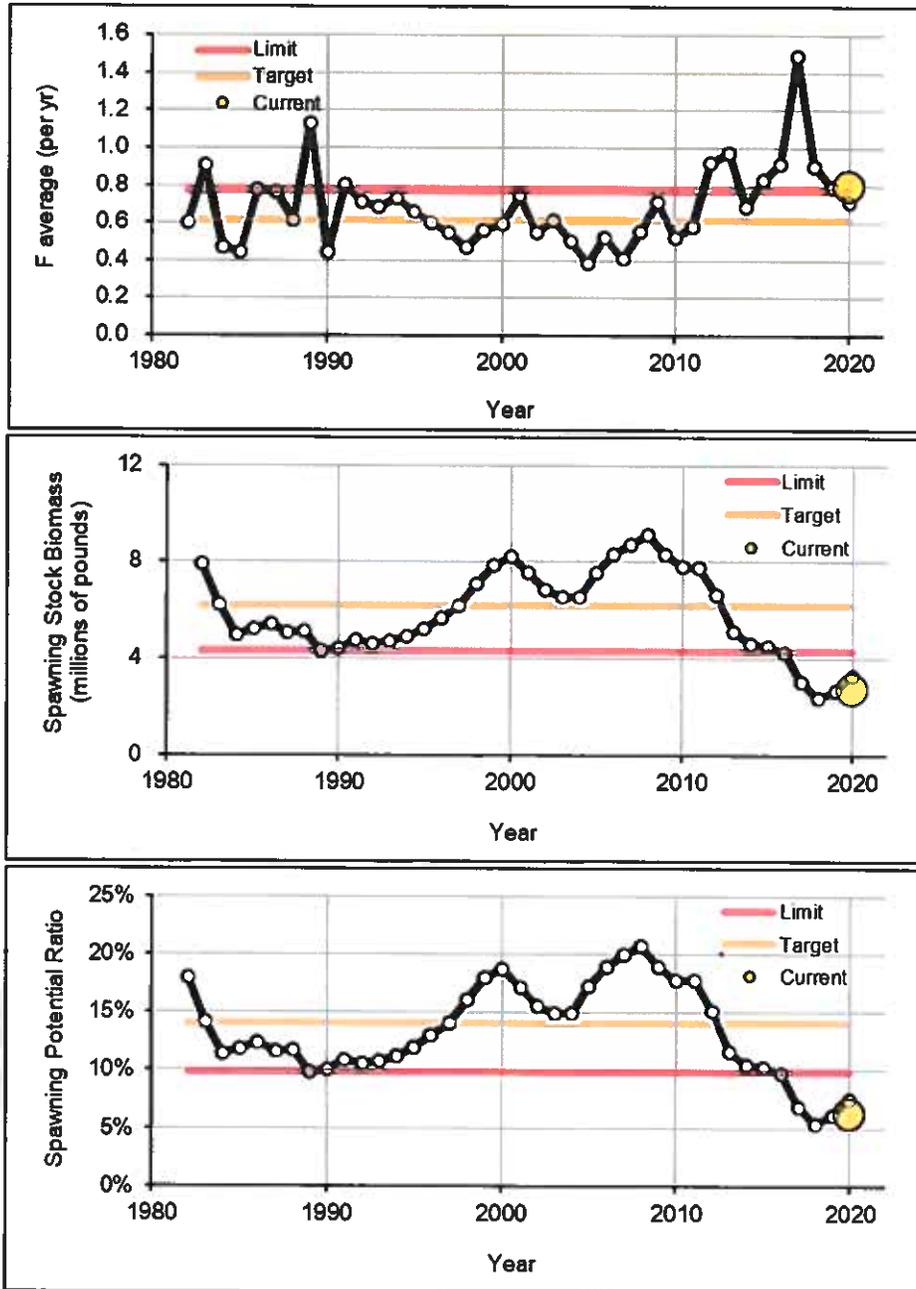


Figure 18: Time-series of ASAP base model estimated average fishing mortality rates, female spawning stock biomass, and spawning potential ratios relative to proposed limit and target reference points. Current values represent the geometric mean of the 2018-2020 estimates.

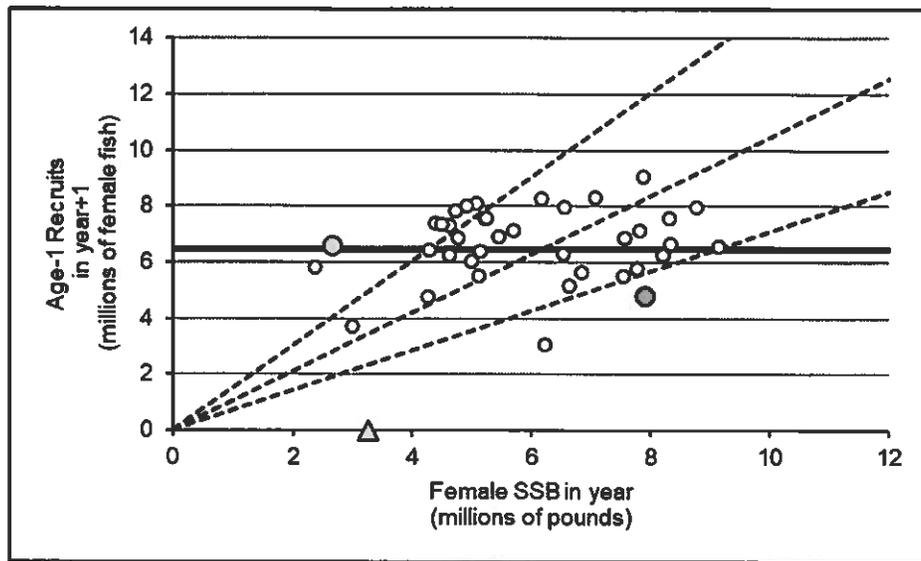


Figure 19: ASAP base model estimated age-1 recruits and female spawning stock biomass (open circles). Equilibrium recruitment is represented by the bold horizontal. The yellow circle represents the most current data pair (2020 age-1 recruits / 2019 female SSB) and the yellow triangle represents the 2020 SSB estimate. The green circle represents the first data pair (1983 age-1 recruits / 1982 female SSB). Equilibrium recruitment per spawning stock biomass corresponding with the limit and target spawning stock biomass reference point estimates and the maximum spawning stock biomass are represented by the slopes of the dashed diagonals ( $SSB_{limit}=9.8\%SPR$ ;  $SSB_{target}=14.1\%$ ; max.  $SSB=20.8\%SPR$ ).

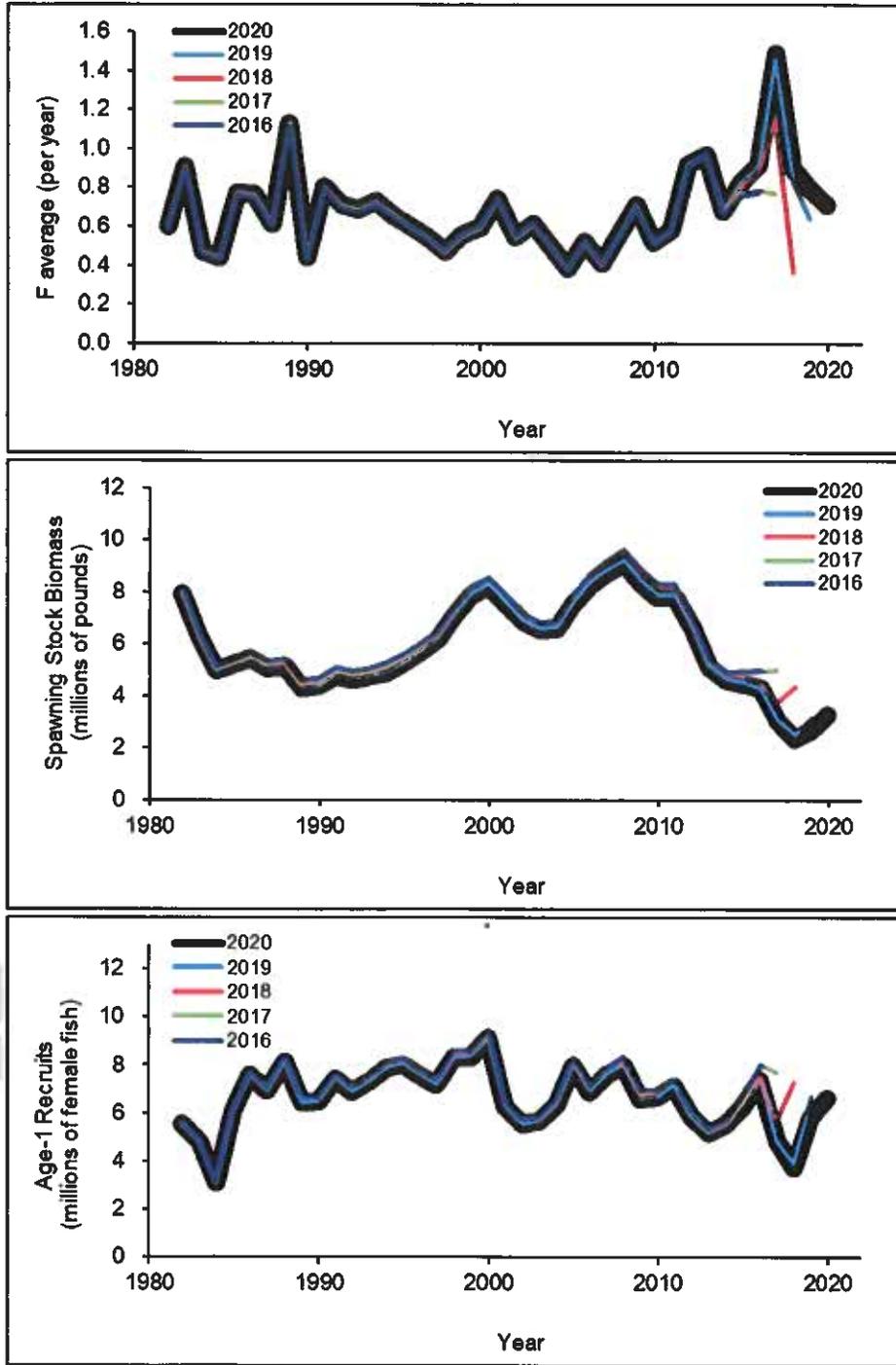


Figure 20: Retrospective analysis of ASAP base model. Top graphics depict annual average fishing mortality and female spawning stock biomass estimates. Bottom graphic depicts estimated age-1 female recruits.

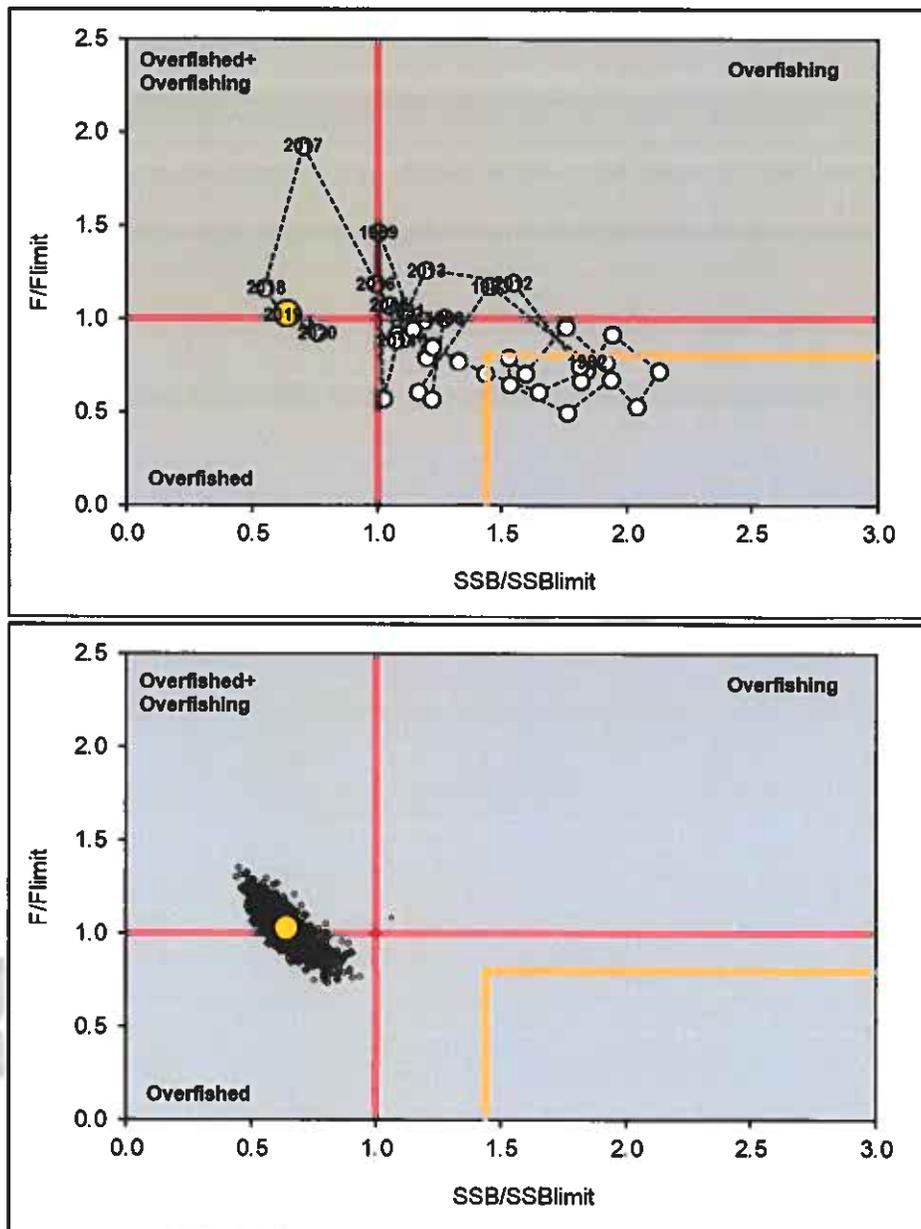


Figure 21: ASAP base model estimated ratios of annual average fishing mortality rates and female spawning stock biomass to the proposed limit reference points ( $F_{limit}$  and  $SSB_{limit}$ ). Also presented are the proposed target reference points (yellow lines). Arrow represents direction of time-series. The first and last year of the time-series are identified along with the years overfishing occurred and/or the stock was considered overfished. The yellow circle represents current status (geometric mean 2018-2020). Bottom graphic depicts current status and results of 2000 MCMC simulations relative to proposed limit and target reference points.

Appendix 1:

**LA Creel/MRIP Calibration Procedure**

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Office of Fisheries  
Louisiana Department of Wildlife and Fisheries  
Updated 10/29/2020

Overview

The Louisiana Department of Wildlife and Fisheries (LDWF) conducts stock assessments on important recreationally and commercially landed species. Time-series of fishery removals are critical components of these stock assessments as they provide the level of depletion of the resource through time. Beginning in 2014, LDWF started its own creel survey (LA Creel) to provide recreational landings estimates for Louisiana-specific fishery management and stock assessment purposes. Prior to 2014 recreational landings estimates were taken from the National Marine Fisheries Service's Marine Recreational Intercept Program and the earlier Marine Recreational Fisheries Statistical Survey (MRIP/MRFSS). The MRIP and LA Creel surveys were conducted simultaneously in 2015 for benchmarking purposes. Methods are now needed to calibrate MRIP landings estimates to LA Creel landings estimates for species with upcoming LDWF stock assessments.

Calibration Methodology

A ratio estimator approach is described below allowing hind-casting of LA Creel recreational harvest estimates to 1982. The calibration procedure to hind-cast LA Creel discard estimates is presented in the Appendix of this document.

Concurrent harvest rate estimates of LA Creel and MRIP are only available for the single year (2015) both surveys were conducted simultaneously. Effort estimates, however, are available from both surveys for multiple years (2015-2017). The reliability of this calibration procedure could be greatly improved with more comparison years of the surveys.

Note: MRIP private fishing effort is distributed across the various fishing modes (shore, inshore, and offshore) by applying the observed distribution of those modes from the dockside survey. In 2016 and 2017, the MRIP effort estimation process required additional estimations, as the dockside portion of that survey was not conducted in Louisiana. NOAA Fisheries applied the proportions of trips by fishing mode observed in 2015 to the effort data collected in 2016 and 2017 to obtain estimates of angler trips by fishing mode. While this method is clearly not

Abbreviations used in this document:

E - Fishing effort  
FM - Fishing mode  
    C - charter  
    CI - charter inshore  
    CO - charter offshore  
    P - private  
    PI - private inshore (LA Creel)  
    PO - private offshore  
    PR - private boat (MRIP)  
    SH - shore (MRIP)  
H - Harvest  
HR - Harvest rate  
D - Discards  
DR - Discard rate  
PSE - Percent standard error  
R - Ratio  
V - Variance  
y - Year  
w - Bimonthly period  
wk - Week of year

optimal, it does allow comparison of effort over additional years.

The LA Creel survey provides estimates for four fishing modes (FM): private inshore (PI), private offshore (PO), charter inshore (CI), and charter offshore (CO). The MRIP survey provides estimates for five fishing modes: private boat (PR), shore (SH), PO, CI, and CO. For calibration purposes, LA Creel estimates are transformed into a fifth fishing mode equivalent to the MRIP surveys SH mode by separating the PI mode into PR and SH modes. Additionally, the inshore/offshore fishing modes of each survey are collapsed into overall private (P) and charter (C) fishing modes for the species included in this report that support predominantly inshore fisheries.

Fishing effort (E) estimates of the two surveys are calibrated separately by collapsed fishing mode (P and SH only) and bimonthly period (w). Because the charter fishing effort frame used by the LA Creel and MRIP surveys are functionally equivalent, charter fishing effort and corresponding variance estimates of the two surveys are assumed equivalent and not adjusted. Harvest rates and corresponding variance estimates of the MRIP and LA Creel surveys for the species included in this report are also assumed equivalent and not adjusted. Calibrated effort estimates of the shore and private fishing modes are then combined with unadjusted MRIP harvest rate estimates to provide time-series of recreational harvest estimates for species with upcoming LDWF stock assessments as described below.

#### *Fishing Effort*

To allow hind-casting of LA Creel effort estimates to the historic MRIP effort time-series, fishing effort calibration factors are calculated as the ratio of mean fishing effort (2015-2017) from each survey by fishing mode (P and SH only) and bimonthly period as:

$$\hat{R}_{E,FM,w} = \frac{\bar{E}_{LAcreel,FM,w}}{\bar{E}_{MRIP,FM,w}} \quad [1]$$

Note: MRIP effort estimates in Equation [1] are based on the FES and APAIS methodologies.

Survey-specific mean fishing effort (angler trips) and calibration factors for the P and SH fishing modes by bimonthly period are presented below.

FM	w	$\bar{E}_{LAcreel}$	$\bar{E}_{MRIP}$	$\hat{R}_E$
P	1	141,988	760,757	0.187
P	2	229,436	608,036	0.377
P	3	425,433	908,285	0.468
P	4	349,345	1,075,253	0.325
P	5	284,077	935,917	0.304
P	6	277,228	806,998	0.344
SH	1	50,377	753,943	0.067
SH	2	80,580	642,766	0.125
SH	3	151,142	897,938	0.168
SH	4	73,203	1,095,251	0.067
SH	5	105,286	1,228,032	0.086
SH	6	64,342	950,532	0.068

The hind-cast LA Creel fishing effort estimates (1982-2013) are then calculated by fishing mode and bimonthly period as:

$$\hat{E}_{y,w,FM,R} = \hat{R}_{E,FM,w} \hat{E}_{y,w,FM,MRIP} \quad [2]$$

Note: MRIP effort estimates in Equation [2] have been calibrated to the FES and APAIS design changes (FCAL).

Variances of the hind-cast LA Creel fishing effort estimates from Equation [2] are approximated by fishing mode and bimonthly period as:

$$\hat{V}(\hat{E}_{y,w,FM,R}) = \hat{E}_{y,w,FM,MRIP}^2 \hat{V}(\hat{R}_{E,FM,w}) + \hat{R}_{E,FM,w}^2 \hat{V}(\hat{E}_{y,w,FM,MRIP}) - \hat{V}(\hat{R}_{E,FM,w}) \hat{V}(\hat{E}_{y,w,FM,MRIP}) \quad [3]$$

where

$$\hat{V}(\hat{R}_{E,FM,w}) = \hat{R}_{E,FM,w}^2 \left[ \frac{\hat{V}(\hat{E}_{LAcreel,FM,w})}{\hat{E}_{LAcreel,FM,w}^2} + \frac{\hat{V}(\hat{E}_{MRIP,FM,w})}{\hat{E}_{MRIP,FM,w}^2} \right]$$

#### Harvest

The hind-cast LA Creel harvest estimates (1982-2013) by fishing mode (P and SH only) for the species included in this report are then calculated as:

$$\hat{H}_{y,FM,R} = \sum_w \hat{E}_{y,w,FM,R} \hat{H}R_{y,w,FM,MRIP} \quad [4]$$

Note: MRIP harvest rate estimates in Equation [4] are FCAL estimates and represent A+ B1 landings only.

Variances of the calibrated harvest estimates are then calculated as:

$$\hat{V}(\hat{H}_{y,FM,R}) = \sum_w \left[ \hat{E}_{y,FM,w,R}^2 \hat{V}(\hat{H}R_{y,FM,w,MRIP}) + \hat{H}R_{y,FM,w,MRIP}^2 \hat{V}(\hat{E}_{y,FM,w,R}) - \hat{V}(\hat{E}_{y,FM,w,R}) \hat{V}(\hat{H}R_{y,FM,w,MRIP}) \right] \quad [5]$$

Percent standard errors of the calibrated harvest estimates are then calculated as:

$$PSE(\hat{H}_{y,FM,R}) = 100 \times \frac{\sqrt{\hat{V}(\hat{H}_{y,FM,R})}}{\hat{H}_{y,FM,R}} \quad [6]$$

The MRIP (FCAL) and hind-cast LA Creel harvest estimate time-series and corresponding PSEs by fishing mode for species with upcoming LDWF stock assessments are presented below.

FM = Private

Year	Black Drum				Red Drum				Sheepshead				Southern Flounder				Spotted Seatrout			
	MRIP		LA Creel		MRIP		LA Creel		MRIP		LA Creel		MRIP		LA Creel		MRIP		LA Creel	
	Harvest	PSE	Harvest	PSE	Harvest	PSE	Harvest	PSE	Harvest	PSE	Harvest	PSE	Harvest	PSE	Harvest	PSE	Harvest	PSE	Harvest	PSE
1982	1,106,821	27.1	422,174	33.0	3,046,664	12.0	921,357	20.0	511,387	34.3	188,413	39.4	497,263	19.5	190,627	25.9	9,160,786	16.2	3,146,198	22.6
1983	1,659,509	34.3	610,662	39.0	4,758,470	32.7	1,605,600	40.4	1,064,824	38.1	346,803	43.1	1,929,817	51.4	594,965	59.9	7,402,179	20.0	2,710,035	27.4
1984	362,104	26.0	137,134	32.9	2,976,458	38.9	983,477	41.9	548,364	47.5	174,784	39.8	213,064	23.0	72,613	29.7	2,503,426	29.8	807,030	34.7
1985	356,406	30.0	111,625	33.3	2,563,074	14.5	859,464	20.3	340,142	32.1	117,102	34.8	431,284	24.5	153,297	29.0	5,947,072	15.2	2,157,908	23.9
1986	918,541	24.1	310,194	28.1	2,635,843	10.0	855,348	19.4	252,644	15.5	85,391	21.7	1,464,132	48.5	500,797	49.1	14,077,720	7.8	5,037,007	16.1
1987	683,049	25.6	227,818	31.7	2,602,974	23.0	885,506	27.9	270,702	33.7	86,011	33.5	147,601	25.2	51,262	28.5	11,023,715	10.1	4,044,859	17.9
1988	344,681	15.4	117,966	20.7	1,160,955	20.2	351,623	22.6	277,793	21.3	92,972	25.8	358,099	13.2	123,938	18.5	6,890,452	14.3	2,445,984	20.4
1989	227,336	20.4	76,687	24.4	2,015,801	12.6	687,964	21.3	789,892	49.3	250,017	49.1	341,489	25.9	109,591	28.7	8,082,318	11.9	2,714,014	17.3
1990	231,168	22.9	80,781	26.4	1,469,547	16.8	477,778	22.0	270,726	27.1	102,078	30.5	805,964	23.6	271,576	27.4	4,881,711	13.7	1,677,370	19.8
1991	183,005	19.4	62,124	24.1	1,824,768	20.0	597,343	28.0	402,935	32.6	141,868	35.1	694,466	16.1	242,476	20.3	13,468,560	9.9	4,784,368	16.8
1992	333,217	23.9	116,216	27.5	2,807,145	8.7	926,924	15.4	563,816	25.3	178,285	27.1	615,928	14.6	218,119	18.7	10,680,755	9.3	3,608,794	16.0
1993	246,588	17.6	89,348	23.4	2,581,130	9.9	868,002	16.6	805,023	14.8	306,149	33.0	500,023	14.8	172,917	19.0	7,757,436	12.1	2,638,017	18.0
1994	234,272	16.9	80,413	23.5	2,311,786	9.5	770,586	15.8	508,883	17.8	172,554	23.1	578,264	21.0	211,204	25.3	10,418,883	10.5	3,491,233	17.0
1995	335,507	18.4	109,171	21.7	3,842,177	8.7	1,281,488	17.2	920,809	20.4	272,993	23.5	398,528	14.0	144,829	21.1	12,135,672	13.2	4,042,945	22.9
1996	414,798	12.9	136,121	18.6	3,197,497	9.0	1,088,408	15.6	760,607	21.7	248,066	27.2	416,737	11.4	147,144	16.9	10,306,475	11.3	3,538,044	17.9
1997	477,705	16.1	156,723	19.9	2,861,918	9.6	982,355	16.2	1,005,406	18.2	308,997	20.7	445,579	11.7	157,583	17.8	10,415,118	11.9	3,628,093	17.9
1998	920,933	14.6	306,943	20.2	2,762,600	8.0	943,728	15.0	1,138,280	15.6	360,910	21.7	393,018	13.8	147,920	19.9	10,005,379	8.7	3,642,009	17.6
1999	681,905	11.9	233,143	17.5	3,459,681	6.9	1,193,797	14.2	793,093	16.2	245,601	22.1	758,946	10.4	266,165	16.0	14,037,235	8.5	4,711,633	15.7
2000	1,017,717	12.8	346,026	17.7	4,249,272	6.9	1,462,416	14.3	769,653	28.0	250,138	32.0	670,295	13.3	239,347	18.6	15,977,551	7.7	5,316,672	16.1
2001	765,815	13.7	255,378	18.9	4,322,843	7.7	1,429,691	14.1	567,945	15.8	193,752	20.5	427,914	12.2	156,040	18.3	12,618,114	8.0	4,299,637	14.9
2002	908,616	12.6	311,241	18.7	3,445,574	8.2	1,156,118	14.6	1,249,437	18.7	412,469	26.6	443,758	18.8	172,816	26.5	9,816,916	10.3	3,471,004	16.7
2003	659,209	14.7	223,268	20.0	2,977,090	7.4	1,006,043	14.9	1,257,175	23.2	386,996	26.1	647,034	15.7	247,872	22.9	10,528,223	9.6	3,722,763	17.5
2004	546,776	12.0	180,874	17.0	2,605,118	8.1	887,098	14.8	1,722,589	24.9	554,019	30.5	408,006	12.6	149,051	18.1	9,728,915	10.5	3,369,942	17.4
2005	461,775	13.0	155,544	18.9	2,236,920	9.4	769,288	15.5	962,130	23.6	301,610	26.7	286,521	12.9	107,932	19.5	10,699,116	8.5	3,636,945	15.9
2006	354,910	14.3	114,788	18.6	2,385,907	10.7	805,677	15.9	430,504	25.3	121,203	28.8	285,429	11.9	96,047	16.6	13,779,620	8.7	5,041,323	16.9
2007	415,104	15.7	140,658	18.9	3,049,990	8.3	1,033,903	14.7	320,952	21.9	94,883	22.0	355,606	19.0	125,321	23.1	11,790,003	8.3	3,996,827	15.8
2008	668,820	12.8	223,760	19.0	3,336,041	7.9	1,138,176	14.5	623,988	17.6	205,956	24.0	239,893	10.9	85,657	16.7	15,551,638	9.5	5,406,002	17.2
2009	908,297	13.6	306,083	18.4	3,414,547	8.2	1,181,030	15.3	1,055,358	22.6	294,230	26.8	398,573	14.6	138,485	19.0	15,667,348	8.8	5,486,627	16.4
2010	697,188	14.5	231,978	18.5	5,128,842	8.0	1,770,689	14.5	753,414	22.4	253,947	26.8	571,870	14.4	214,835	20.6	14,465,717	10.7	5,109,130	20.0
2011	679,614	15.1	229,698	19.5	4,548,266	8.3	1,572,134	15.1	1,425,042	35.5	484,582	42.3	544,173	14.7	199,173	19.5	17,697,003	9.6	6,056,375	16.8
2012	694,257	12.8	239,881	19.1	3,458,029	8.8	1,205,064	16.3	577,843	16.7	173,799	20.6	524,259	14.8	186,030	19.6	17,938,248	8.9	6,291,503	18.2
2013	528,084	14.3	170,664	20.1	4,523,043	8.7	1,495,702	15.3	311,155	16.9	93,968	20.4	930,394	13.1	323,565	21.0	12,928,606	9.4	4,379,022	16.6

FM = Shore

Year	Black Drum				Red Drum				Sheepshead				Southern Flounder				Spotted Seatrout			
	MRIP		LA Creel		MRIP		LA Creel		MRIP		LA Creel		MRIP		LA Creel		MRIP		LA Creel	
	Harvest	PSE	Harvest	PSE	Harvest	PSE	Harvest	PSE	Harvest	PSE	Harvest	PSE	Harvest	PSE	Harvest	PSE	Harvest	PSE	Harvest	PSE
1982	880,444	22.8	105,131	42.4	2,388,907	23.1	274,159	38.6	676,628	29.0	62,101	32.8	834,940	21.4	95,797	40.1	2,787,818	23.5	281,415	36.0
1983	500,922	29.9	58,639	38.2	1,351,640	25.0	115,437	35.1	2,326,172	25.9	262,151	40.7	327,205	34.7	28,920	38.1	2,927,094	47.2	245,487	47.3
1984	536,866	34.1	47,392	47.4	660,866	35.0	54,017	35.4	987,229	41.9	80,659	41.6	112,657	45.9	9,158	48.8	331,308	40.5	29,935	42.2
1985	181,986	27.0	15,182	33.5	618,693	30.8	44,043	36.4	656,976	30.2	48,274	39.6	284,046	29.1	21,773	35.3	500,629	27.9	40,577	34.6
1986	469,638	52.0	36,857	49.3	243,647	45.9	17,936	49.4	782,112	81.2	54,471	79.8	189,325	42.5	16,675	48.5	1,815,727	55.4	135,153	52.9
1987	260,971	52.0	24,154	52.0	665,407	54.3	47,110	56.1	65,880	46.2	4,511	55.2	185,090	37.3	13,993	39.7	965,130	44.3	107,313	59.3
1988	429,974	36.6	44,760	47.2	237,418	45.6	16,866	48.4	662,260	57.5	53,517	54.6	90,283	40.5	7,779	40.9	398,803	39.6	39,377	48.7
1989	484,955	58.2	43,202	67.8	472,062	35.4	42,270	44.0	179,471	40.2	15,201	44.3	127,388	33.6	11,241	39.5	402,794	68.4	28,735	67.9
1990	122,352	47.4	15,053	64.0	627,617	29.6	51,503	40.2	80,673	46.7	7,133	53.2	238,834	24.9	20,903	33.4	1,178,966	28.6	114,639	44.3
1991	80,287	38.8	7,218	45.5	497,827	35.7	36,833	41.6	109,726	43.1	7,730	46.2	617,776	26.6	64,608	38.5	1,611,329	29.8	181,444	48.6
1992	266,722	39.0	22,670	43.9	535,731	21.7	54,124	31.7	1,470,811	61.9	102,204	66.6	197,948	31.2	16,495	33.6	1,622,752	18.8	151,030	26.5
1993	332,409	38.4	30,470	47.2	1,058,829	26.2	95,426	32.6	438,233	37.3	32,297	40.7	152,286	34.8	14,130	36.6	1,262,891	19.3	133,129	31.7
1994	111,090	26.4	11,042	37.0	973,065	30.5	79,607	36.6	339,821	55.8	25,980	51.8	245,182	26.2	24,351	30.8	2,585,733	32.7	212,925	35.3
1995	122,762	40.4	10,232	37.8	747,219	23.9	57,820	33.9	338,135	43.2	31,308	40.9	56,558	30.7	5,633	40.1	1,432,447	21.4	134,570	30.5
1996	529,054	58.3	39,338	55.7	864,227	22.6	79,139	28.0	682,583	41.1	50,882	43.8	134,402	31.1	13,388	42.7	2,327,551	27.4	260,453	42.7
1997	123,564	39.8	13,754	56.7	347,632	21.5	31,628	29.5	283,171	25.4	26,246	33.0	307,330	23.1	29,895	35.4	1,905,584	21.5	186,083	32.5
1998	86,575	34.3	11,317	53.9	397,083	31.2	36,709	34.9	450,254	36.2	32,677	41.5	128,645	26.4	14,741	40.5	2,415,887	30.1	303,726	52.7
1999	385,329	39.6	31,947	45.0	492,350	25.7	54,909	38.8	202,445	35.8	16,600	36.7	641,276	32.9	54,674	38.0	3,530,688	27.9	288,942	35.4
2000	625,217	26.3	51,753	31.9	822,698	21.3	69,669	26.6	202,744	52.7	17,790	51.6	136,953	43.0	12,753	44.5	2,697,901	36.0	222,046	40.3
2001	675,474	30.1	69,123	38.6	621,324	23.2	53,291	31.1	399,908	49.4	43,424	54.5	305,296	67.4	37,260	72.2	2,657,545	28.5	269,017	35.7
2002	399,178	23.6	36,575	30.2	945,520	31.8	80,339	37.4	872,663	35.4	72,526	43.6	323,826	31.2	33,693	40.6	923,988	31.5	99,269	39.8
2003	288,546	23.4	27,192	30.4	280,366	33.2	24,715	34.7	983,844	36.8	102,183	38.4	199,400	38.3	16,524	38.0	945,730	42.3	67,249	45.2
2004	137,240	36.0	12,726	38.9	559,991	19.0	50,246	28.0	603,693	36.9	46,089	43.2	395,552	36.1	38,056	47.6	1,303,971	45.1	178,356	62.5
2005	138,758	28.0	12,505	38.3	704,981	30.9	53,900	41.0	563,322	29.6	48,230	38.5	450,207	38.7	33,234	52.7	632,798	30.7	51,805	37.7
2006	261,544	30.8	23,555	40.8	389,280	25.4	32,980	36.4	593,305	31.2	42,006	38.8	335,766	29.1	32,038	32.6	788,193	22.7	71,014	31.4
2007	286,213	35.5	26,082	38.6	187,726	25.1	16,635	36.1	257,091	36.2	25,721	43.8	348,752	28.0	36,807	37.0	771,812	27.5	79,384	35.9
2008	247,234	25.5	20,967	34.3	374,463	27.9	28,401	32.9	1,396,084	30.3	106,247	36.9	260,865	36.4	22,101	34.7	1,140,758	33.3	125,464	47.3
2009	100,842	26.9	9,449	34.4	123,122	28.0	11,253	34.3	523,105	46.9	57,138	57.2	470,681	44.6	37,214	45.7	611,298	25.2	58,398	33.3
2010	184,668	41.2	15,662	42.7	531,708	32.4	47,942	35.0	561,648	40.1	42,755	40.8	94,348	29.4	8,368	33.9	584,064	43.3	42,629	45.1
2011	380,669	21.7	34,092	28.5	983,461	22.1	91,170	28.1	1,318,064	44.8	114,952	55.5	430,717	40.0	37,441	40.4	651,281	27.8	64,311	37.5
2012	283,508	22.6	24,574	32.7	279,299	36.1	21,571	40.0	695,553	42.6	50,298	45.6	155,170	30.6	14,154	34.0	727,577	29.5	76,733	39.3
2013	471,823	13.0	34,758	29.7	849,762	9.3	74,732	28.1	659,450	12.4	45,522	36.7	573,922	18.3	47,486	33.0	2,682,372	11.4	228,143	24.3

## Appendix

A ratio estimator approach is described below allowing hind-casting of LA Creel recreational discard estimates to 1982. Concurrent discard estimates of the LA Creel and MRIP surveys are not available.

Analogous to the procedure to hind-cast LA Creel harvest estimates, the hind-cast LA Creel effort estimates of the shore and private fishing modes are combined with unadjusted MRIP discard rate estimates to provide time-series of recreational discard estimates for species with upcoming LDWF stock assessments as described below. Discard estimates of the charter fishing mode for the LA Creel and MRIP surveys are assumed equivalent and not adjusted.

### *Discards (1982-2013)*

The hind-cast LA Creel discard estimates (1982-2013) are calculated by collapsed fishing mode (P and SH only) and bimonthly period as:

$$\widehat{D}_{y,FM,\hat{R}} = \sum_w \widehat{E}_{y,w,FM,\hat{R}} \widehat{DR}_{y,w,FM,MRIP} \quad [1a]$$

Note: MRIP discard rate estimates in Equation [1a] are FCAL estimates and represent B2 landings only. The calibrated effort estimates are taken from Equation [2].

Variances of the calibrated discard estimates from Equation [1a] are then calculated as:

$$\widehat{V}(\widehat{D}_{y,FM,\hat{R}}) = \sum_w \left[ \widehat{E}_{y,FM,w,\hat{R}}^2 \widehat{V}(\widehat{DR}_{y,FM,w,MRIP}) + \widehat{DR}_{y,FM,w,MRIP}^2 \widehat{V}(\widehat{E}_{y,FM,w,\hat{R}}) - \widehat{V}(\widehat{E}_{y,FM,w,\hat{R}}) \widehat{V}(\widehat{DR}_{y,FM,w,MRIP}) \right] \quad [2a]$$

Percent standard errors of the calibrated discard estimates are then calculated as:

$$PSE(\widehat{D}_{y,FM,\hat{R}}) = 100 \times \frac{\sqrt{\widehat{V}(\widehat{D}_{y,FM,\hat{R}})}}{\widehat{D}_{y,FM,\hat{R}}} \quad [3a]$$

### *Discards (2014-2016)*

Discard estimates of the LA Creel survey are only available from week 19 of 2016 to present. Discard estimates prior to week 19 of 2016 are imputed by fishing mode (P, SH, and C) and week of year (wk) by calculating discard to harvest ratios from the LA Creel estimates from week 19 of 2016 to week 18 of 2017 as:

$$\widehat{R}_{D/H,FM,wk} = \frac{\widehat{D}_{LAcreel,FM,wk}}{\widehat{H}_{LAcreel,FM,wk}} \quad [4a]$$

The imputed LA Creel discard estimates are then calculated by fishing mode from week 1 of 2014 to week 18 of 2016 as:

$$\widehat{D}_{y,wk,FM,\hat{R}_{D/H}} = \widehat{R}_{D/H,FM,wk} \widehat{H}_{y,wk,FM,LAcreel} \quad [5a]$$

Variances of the imputed LA Creel discard estimates from Equation [5a] are approximated by fishing mode and week of year as:

$$\hat{V}(\hat{D}_{y,wk,FM,R_{D/H}}) = \hat{H}_{y,wk,FM,LAcreel}^2 \hat{V}(\hat{R}_{D/H,FM,wk}) + \hat{R}_{D/H,FM,wk}^2 \hat{V}(\hat{H}_{y,wk,FM,LAcreel}) - \hat{V}(\hat{R}_{D/H,FM,wk}) \hat{V}(\hat{H}_{y,wk,FM,LAcreel}) \quad [6a]$$

where

$$\hat{V}(\hat{R}_{D/H,FM,wk}) = \hat{R}_{D/H,FM,wk}^2 \left[ \frac{\hat{V}(\hat{D}_{LAcreel,FM,wk})}{\hat{D}_{LAcreel,FM,wk}^2} + \frac{\hat{V}(\hat{H}_{LAcreel,FM,wk})}{\hat{H}_{LAcreel,FM,wk}^2} \right]$$

The MRIP (FCAL) and hind-cast/imputed LA Creel discard estimate annual time-series and corresponding PSEs by fishing mode for species with upcoming LDWF stock assessments are presented below.

Year	Black Drum						Red Drum						Sheepshead						Southern Flounder						Spotted Seatrout					
	MRIP			LA Creel			MRIP			LA Creel			MRIP			LA Creel			MRIP			LA Creel			MRIP			LA Creel		
	Discards	PSE		Discards	PSE		Discards	PSE		Discards	PSE		Discards	PSE		Discards	PSE		Discards	PSE		Discards	PSE		Discards	PSE				
1982	818,734	54.5	342,393	62.2	274,870	40.0	98,227	42.3	515,459	44.8	204,110	48.5	1,083,668	45.5	421,148	51.2	1,654,868	35.7	594,062	39.0										
1983	671,251	47.1	221,158	50.2	793,805	34.3	276,867	39.3	833,079	71.7	283,429	76.2	145,644	54.4	50,016	55.2	2,092,864	42.4	785,069	46.9										
1984	284,254	68.2	95,815	67.1	346,317	56.3	115,622	57.6	309,986	35.6	95,232	44.2	65,411	64.9	20,866	65.9	197,040	21.8	65,344	29.3										
1985	291,106	38.5	96,316	41.4	243,413	40.1	94,362	41.0	317,951	28.8	111,945	33.6	61,785	68.0	21,053	66.7	1,709,137	23.1	602,297	28.0										
1986	448,236	20.4	147,784	25.7	451,777	15.3	165,090	21.0	393,569	19.8	127,576	25.2	367,830	40.1	163,383	47.5	4,745,760	10.2	1,657,453	17.8										
1987	300,153	41.9	93,818	46.4	2,360,122	24.5	767,630	32.3	210,127	21.2	72,374	25.9	10,809	42.4	4,030	45.8	6,980,249	12.7	2,392,248	20.4										
1988	350,541	21.1	121,213	26.8	3,062,822	16.2	1,010,477	21.1	398,058	25.6	130,073	30.3	375,399	58.9	118,042	59.6	5,610,284	10.4	2,046,380	17.6										
1989	228,012	35.0	73,311	38.8	2,998,273	20.9	1,009,167	28.0	483,464	37.6	167,906	42.3	260,401	93.8	81,599	91.0	5,656,036	14.2	1,867,058	19.1										
1990	653,511	28.7	222,412	33.7	1,880,922	19.7	577,599	22.7	408,363	25.1	142,262	28.8	334,821	40.3	110,310	41.6	4,750,794	18.0	1,592,531	22.9										
1991	389,398	26.0	131,179	29.7	7,412,013	11.2	2,496,220	22.1	272,267	26.1	102,330	29.6	114,636	37.5	33,497	32.0	12,341,402	9.3	4,362,600	16.5										
1992	559,417	33.2	180,394	37.5	5,753,237	9.1	1,822,782	15.9	440,289	16.8	139,865	21.4	42,988	21.4	14,639	24.4	8,795,484	8.4	2,990,434	15.1										
1993	710,873	18.2	238,220	22.8	4,143,002	11.2	1,376,592	17.8	758,778	20.8	258,952	26.3	45,686	33.2	16,433	36.2	6,905,906	11.3	2,273,152	17.2										
1994	440,825	29.8	142,921	32.2	4,086,816	12.5	1,285,719	18.2	608,190	19.3	203,610	24.0	34,050	29.6	11,784	31.8	7,780,829	9.7	2,535,516	16.2										
1995	816,070	17.5	287,267	22.7	4,248,542	15.4	1,351,245	19.8	558,424	25.6	182,168	30.3	59,357	34.4	21,519	34.0	7,603,172	11.0	2,500,637	19.7										
1996	525,560	20.4	179,994	25.3	3,312,106	11.9	1,042,253	16.2	878,282	23.1	281,778	28.4	80,897	23.0	34,023	27.1	8,055,743	10.2	2,831,212	16.9										
1997	1,057,203	18.5	362,214	24.4	5,150,476	11.3	1,635,185	17.7	1,138,193	23.4	399,291	30.0	98,494	29.1	37,007	32.0	10,917,063	9.7	3,786,705	24.2										
1998	1,439,547	24.7	481,648	27.7	5,753,271	10.8	1,828,452	16.4	1,056,926	17.9	345,562	24.6	99,007	29.1	32,671	32.2	9,977,400	9.3	3,575,231	16.7										
1999	820,371	13.6	271,531	18.2	5,477,613	9.4	1,861,757	16.1	699,825	18.9	220,631	25.4	84,447	20.8	28,690	25.4	11,688,515	8.8	3,908,262	15.9										
2000	1,833,450	16.2	626,732	20.2	6,018,948	8.2	2,025,284	15.8	586,993	21.9	201,858	26.3	121,790	28.3	35,906	27.9	11,091,619	7.9	3,712,515	15.0										
2001	1,781,293	17.4	641,567	22.3	6,184,966	9.5	1,849,989	14.6	816,650	16.4	290,637	21.3	88,936	21.8	33,982	27.9	7,365,829	11.2	2,409,330	16.7										
2002	1,670,431	17.1	545,567	22.6	6,266,166	10.8	2,053,397	18.0	854,311	17.0	273,201	20.2	90,982	26.1	33,016	29.7	6,778,238	11.5	2,352,328	17.5										
2003	1,172,837	17.8	404,358	21.7	5,286,909	10.2	1,718,114	18.6	930,576	20.8	289,313	26.9	172,327	23.4	66,101	29.7	10,682,302	9.5	3,736,073	17.8										
2004	1,155,649	17.0	386,806	22.6	3,841,642	10.1	1,223,227	15.4	701,938	19.9	252,030	25.3	149,844	27.6	52,254	29.8	9,847,326	11.5	3,369,107	17.0										
2005	954,552	24.2	329,037	28.2	3,505,968	11.8	1,131,872	17.0	770,173	15.0	255,092	21.8	87,557	25.3	30,737	27.2	10,903,988	9.7	3,744,965	16.4										
2006	699,933	16.3	227,405	20.2	4,124,647	11.7	1,361,914	18.2	616,668	30.1	178,526	30.8	41,784	27.7	13,966	30.2	11,930,250	9.1	4,301,096	16.2										
2007	818,643	15.4	279,147	19.4	4,630,404	11.5	1,539,046	18.3	308,039	21.2	100,962	24.9	78,231	25.8	27,959	31.2	9,924,934	8.4	3,372,169	15.8										
2008	1,320,182	14.8	443,174	20.6	5,074,358	8.1	1,689,068	14.6	609,401	23.6	195,937	28.0	50,063	26.0	17,563	28.6	13,158,192	9.4	4,636,757	16.2										
2009	1,788,575	14.5	600,705	21.0	6,242,208	9.6	2,054,138	17.3	744,464	19.5	222,282	23.8	89,961	28.4	31,515	31.9	13,919,234	10.0	4,676,052	16.5										
2010	1,813,254	14.9	631,758	20.5	7,335,948	10.2	2,550,321	16.2	711,836	21.9	247,398	26.3	111,912	23.5	40,390	25.4	9,190,616	12.6	3,268,802	20.1										
2011	1,390,360	14.9	469,280	19.0	4,744,947	9.7	1,522,357	15.5	259,735	17.7	86,003	21.4	85,027	24.1	31,292	27.7	10,091,732	9.5	3,470,918	16.1										
2012	1,136,427	13.3	367,841	18.5	5,374,152	8.9	1,783,819	16.5	422,968	13.4	135,356	18.5	152,363	24.3	53,816	27.4	13,175,745	8.7	4,589,246	17.3										
2013	1,709,164	12.2	581,107	17.5	6,088,863	9.9	1,998,284	15.9	398,767	14.8	132,773	20.6	197,844	21.3	73,027	25.1	13,404,945	10.3	4,614,319	17.0										
2014			330,955	24.0	1,609,006	11.8	1,486,227	10.3	98,800	30.3	148,454	38.3	44,345	56.6	30,296	41.4	44,345	56.6	2,316,191	11.3										
2015			295,893	21.4	1,486,227	10.3	1,486,227	10.3	98,800	30.3	148,454	38.3	44,345	56.6	30,296	41.4	44,345	56.6	3,440,509	12.3										
2016			161,733	21.0	1,096,370	6.4	1,096,370	6.4	47,135	25.6	47,135	25.6	47,135	25.6	29,612	24.3	29,612	24.3	3,643,636	8.6										

FM = Private

Year	Black Drum						Red Drum						Sheepshead						Southern Flounder						Spotted Seatrout					
	MRIP			LA Creel			MRIP			LA Creel			MRIP			LA Creel			MRIP			LA Creel			MRIP			LA Creel		
	Discards	PSE		Discards	PSE		Discards	PSE		Discards	PSE		Discards	PSE		Discards	PSE		Discards	PSE		Discards	PSE		Discards	PSE				
1982	149,995	64.4	19,100	81.1	364,343	26.2	48,582	45.4	89,674	57.7	10,792	71.0	128,975	30.5	14,650	50.4	386,524	48.1	47,837	62.3										
1983	69,276	40.0	5,936	60.9	15,283	79.9	1,417	73.4	25,959	61.6	2,774	59.0	3,384	99.3	290	100.4	7,794	83.8	1,312	88.6										
1984	285,887	32.0	19,441	48.5	83,103	84.6	5,554	90.6	12,248	103.2	2,062	105.1	12,292	79.8	830	80.6	59,529	52.1	4,649	51.5										
1985	138,851	42.9	11,318	55.3	32,336	53.0	2,763	51.6	155,985	38.0	10,990	48.3	11,853	75.8	921	77.8	603,943	44.5	44,912	47.2										
1986	107,212	49.6	7,372	54.2	19,379	65.3	1,624	60.4	473,615	72.5	33,039	74.9	13,517	87.5	1,091	89.2	267,044	41.3	21,357	38.9										
1987	102,949	71.9	7,886	73.2	352,180	47.9	25,506	49.6	36,133	89.7	3,098	95.1	13,517	87.5	1,091	89.2	642,898	37.9	60,579	42.2										
1988	185,774	51.5	14,729	61.3	329,574	30.8	26,758	37.1	116,937	36.7	10,189	42.4	7,726	52.0	576	57.0	205,385	41.4	22,996	51.5										
1989	61,484	38.9	5,308	46.9	1,080,247	72.5	118,259	82.8	115,300	39.3	10,975	45.9	49,549	66.9	3,412	67.5	311,869	36.9	26,408	40.8										
1990	96,587	44.0	12,814	60.3	327,612	37.7	26,362	47.2	18,485	89.3	1,251	93.7	783,955	82.6	66,386	86.0	736,838	34.5	62,271	40.6										
1991	237,878	30.6	23,323	37.8	1,544,560	43.0	32,323	37.8	207,958	30.7	14,069	48.3	91,471	44.6	9,555	47.5	1,902,261	22.7	209,051	37.4										
1992	860,902	31.0	70,997	33.3	1,833,394	25.8	156,676	29.2	514,453	32.0	39,314	41.6	49,674	57.6	4,294	56.5	1,468,815	20.7	134,383	28.7										
1993	1,345,395	39.9	104,766	45.9	1,630,396	23.1	162,446	32.3	1,109,224	51.0	81,363	54.2	51,220	62.5	3,660	68.3	2,544,151	26.7	310,186	44.4										
1994	947,564	31.5	92,207	35.4	2,220,435	25.8	177,992	32.1	690,548	35.8	51,181	37.4	27,765	64.3	1,973	67.3	2,280,973	19.3	200,469	28.0										
1995	602,888	40.5	45,117	41.0	942,643	25.9	80,564	29.3	72,571	30.1	8,291	38.9	18,216	63.3	1,249	63.7	1,617,673	19.6	152,401	30.0										
1996	493,436	28.1	49,281	33.9	1,516,179	39.1	113,893	40.7	295,818	49.5	22,680	48.2	123,621	57.8	15,883	74.4	2,271,614	31.3	295,972	53.1										
1997	1,032,761	51.8	83,634	50.5	1,179,933	27.3	95,188	34.5	199,864	33.2	16,220	37.9	71,388	41.3	7,967	48.9	2,076,029	22.6	197,373	33.0										
1998	1,033,214	43.8	78,806	45.8	2,262,074	26.0	89,917	33.0	207,500	34.3	18,802	41.7	39,280	40.3	3,078	43.3	1,721,873	25.1	211,949	48.4										
1999	532,125	37.2	41,454	46.1	1,281,413	23.5	123,086	32.0	51,091	32.2	4,175	42.3	68,459	49.6	6,757	57.2	4,103,241	23.1	353,553	30.9										
2000	955,854	28.8	67,785	40.4	1,948,980	22.8	174,209	30.3	265,642	61.1	20,300	56.9	24,518	50.4	1,952	53.5	2,552,559	34.6	197,526	37.5										
2001	1,404,055	37.8	132,125	44.9	1,702,671	23.4	149,553	28.9	627,865	66.9	46,605	65.6	267,359	75.6	34,971	75.6	1,035,758	30.9	89,243	35.9										
2002	559,039	30.6	42,687	35.5	1,187,635	24.6	93,346	28.8	192,094	28.9	15,190	36.7	132,712	47.7	10,853	49.7	1,546,106	34.1	113,669	37.9										
2003	1,024,308	33.3	97,787	39.2	744,196	31.1	68,597	37.0	114,932	46.8	10,857	48.3	299,436	63.4	28,993	64.7	1,547,223	44.2	171,926	58.2										
2004	477,328	44.0	35,200	46.7	944,587	31.1	78,277	32.1	83,683	37.1	8,907	46.5	24,033	55.8	1,613	59.6	895,780	34.2	84,088	37.7										
2005	793,236	24.4	72,502	32.7	1,986,884	22.7	184,683	38.9	322,768	29.1	25,309	36.5	127,575	57.7	10,118	61.3	1,547,223	44.2	171,926	58.2										
2006	1,085,517	44.4	88,671	42.9	2,355,407	21.3	234,798	36.0	670,528	47.6	47,895	50.2	109,904	38.3	14,008	53.5	1,144,271	28.0	108,628	34.3										
2007	464,018	30.3	50,691	42.4	1,109,367	20.9	102,287	30.2	256,654	49.1	21,786	44.7	96,680	53.7	15,629	66.9	929,550	25.0	96,819	36.3										
2008	901,587	24.4	74,919	30.1	1,912,635	19.8	149,123	25.8	248,799	29.8	17,155	39.8	12,748	60.9	1,198	65.4	1,377,270	27.7	114,490	31.4										
2009	417,567	31.0	37,138	32.2	1,414,008	28.6	120,295	33.9	384,706	30.4	34,876	34.0	87,082	93.5	5,992	93.7	927,737	30.0	103,308	44.0										
2010	572,004	29.7	53,063	30.8	1,506,818	23.6	146,558	36.2	583,189	30.2	43,420	36.4	74,678	40.5	7,322	49.4	828,375	54.9	59,780	56.2										
2011	1,434,105	21.3	125,761	28.7	1,860,121	22.2	152,108	27.7	249,435	48.1	20,780	45.8	103,717	65.2	6,984	66.3	719,286	25.7	60,778	32.8										
2012	1,263,476	24.4	124,775	32.1	977,186	35.2	84,370	34.7	175,964	43.2	12,527	46.9	52,159	45.4	5,726	57.4	674,174	31.1	71,681	37.4										
2013	2,271,755	9.7	183,679	24.0	3,675,890	9.3	307,193	20.5	939,554	18.9	71,453	33.6	41,427	37.2	2,945	43.0	5,525,367	8.1	482,847	23.7										
2014			79,920	38.8	375,249	12.4	375,249	12.4	51,901	55.7	51,901	55.7	9,346	53.3	9,346	53.3			594,294	15.1										
2015			76,780	21.4	378,245	11.5	378,245	11.5	23,835	34.1	23,835	34.1	9,300	45.9	9,300	45.9			727,719	12.3										
2016			50,106	21.9	275,986	8.7	275,986	8.7	24,951	66.9	24,951	66.9	9,495	37.5	9,495	37.5			892,875	11.4										



Appendix 2:JOHN BEL EDWARDS  
GOVERNORJACK MONToucET  
SECRETARY

## Estimates of Spotted Seatrout and Red Drum Bycatch in the Louisiana Menhaden Reduction Fishery

Louisiana Department of Wildlife and Fisheries

Office of Fisheries

Overview

The Gulf menhaden reduction fishery is the largest commercial fishery operating in the Gulf of Mexico with the majority of landings occurring in Louisiana (LA) waters. Estimates of spotted seatrout (SST) and red drum (RD) incidental bycatch from the menhaden fishery have been requested to allow comparisons of menhaden fishery bycatch in LA waters relative to the directed LA fisheries.

Incidental bycatch has been characterized in the Gulf menhaden fishery from both at-sea and processing plant studies that were reviewed in SEDAR49-DW-04 (Sagarese et al. 2016). The earlier bycatch studies reviewed did not characterize released catches, only the retained portion, limiting their utility for total bycatch estimation. The more recent studies conducted characterized both released and retained catches (Condrey 1994, de Silva and Condrey 1997, Pulver and Scott Denton 2012\* as reviewed in Sagarese et al. 2016). Bycatch observations categorized as kept in Pulver and Scott Denton 2012\* are considered retained catches.

Methods

The bycatch information from the Gulf menhaden fishery used in this analysis was limited to the studies where both retained and released catches were reported along with the number of purse-seine sets observed allowing calculation of per set catch rates for SST and RD (Tables 1 and 2). Catch per set observations are summarized across studies (mean, minimum, and maximum) to provide a range of catch rates that are assumed constant through time and representative of catches in LA waters. The most recent study (Pulver and Scott-Denton 2012\*) accounted only for bycatch >50 cm (19.7 inches) and is excluded from the SST analysis for that reason.

Annual bycatch can be estimated by expanding the catch per set observations from the annual menhaden fishery effort (number of purse-seine sets per year). Annual menhaden fishery effort observations in LA waters are confidential. To avoid issues reporting bycatch estimates developed from confidential observations, fishery effort is estimated for all years included in this analysis (1982-2019, Figure 1) from a linear regression between the currently available annual effort observations (2000-2018) and the corresponding landings in pounds (sets=1.114E-05\*landings + 8.247E+03, p=0.01, r<sup>2</sup>=0.37).

Time-series of LA spotted seatrout and red drum incidental bycatch from the menhaden fishery (1982-2019, Table 3) are estimated by summing the product of the retained and released catches per set (mean, minimum, and maximum), the estimated annual LA menhaden fishery effort, and assumed mortality rates of the catches. All retained catches are assumed to die and released SST and RD catches are assumed to have 100% and 75% mortality rates respectively. No information is available on the mortality of released SST in the menhaden fishery, and observations of RD dead releases averaged across studies included in this analysis indicates a 45% mortality rate. That estimate is increased to account for delayed mortality of the live releases that are disoriented or injured.

Bycatch in units of numbers are converted into weight with assumptions of mean weight of the catches. Mean weight of red drum catches are assumed to be 12.6 pounds based on observations of the LDWF nearshore bottom longline survey and 1.44 pounds for SST assuming a 16-inch mean total length of the catches and applying the conversions in West et al. (2019).

Recreational landings estimates are taken from the LA Creel survey (2014-2019) and estimates hindcast to the historic MRIP time-series (1982-2013, West et al. 2019). Commercial landings are taken from the LDWF Trip Ticket program (1999-2019) and NOAA Fisheries commercial statistical records (1982-1998, NOAA Fisheries 2020).

### Results

Louisiana bycatch estimates (mean, minimum, and maximum) in units of weight are compared to the SST and RD landings from the recreational and commercial LA fisheries (Table 4).

Bycatch estimates of SST relative to the landings of the directed LA fisheries are minimal. Estimates of SST bycatch from the menhaden fishery in units of weight in the most recent decade are all less than one tenth of one percent (maximum=0.09%, mean=0.07%, minimum=0.06%) when compared to the landings of the commercial and recreational LA fisheries (Figure 2).

Bycatch estimates of red drum relative to the directed LA fisheries are also minimal but of greater magnitude than SST estimates. Estimates of RD bycatch from the menhaden fishery in units of weight in the most recent decade range from 4.4% (maximum) to 0.3% (minimum) with a mean of 2.1% when compared to the landings of the directed LA fisheries (Figure 3).

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Tables

Table 1: Spotted seatrout released and retained catches, number of sets observed, and the mean, minimum, and maximum catches per set across studies.

Study	Year	Species	released catch			retained catch		
			fish	sets	fish/set	fish	sets	fish/set
Condrey 1994	1992	SST	19	127	0.15	0	49	0.00
de Silva and Condrey 1997	1994	SST	26	235	0.11	3	220	0.01
de Silva and Condrey 1997	1995	SST	41	257	0.16	1	199	0.01
Pulver and Scott-Denton 2012*	2011	SST	0	223	0.00	0	223	0.00
		Min			<b>0.11</b>			<b>0.000</b>
		Mean			<b>0.14</b>			<b>0.006</b>
		Max			<b>0.16</b>			<b>0.014</b>

Table 2: Red drum released and retained catches, number of sets observed, and the mean, minimum, and maximum catches per set across studies.

Study	Year	Species	released catch			retained catch		
			fish	sets	fish/set	fish	sets	fish/set
Condrey 1994	1992	Rdrum	15	127	0.12	0	49	0.00
de Silva and Condrey 1997	1994	Rdrum	116	235	0.49	3	220	0.01
de Silva and Condrey 1997	1995	Rdrum	245	257	0.95	0	199	0.00
Pulver and Scott-Denton 2012*	2011	Rdrum	368	223	1.65	32	223	0.14
		Min			<b>0.12</b>			<b>0.00</b>
		Mean			<b>0.80</b>			<b>0.04</b>
		Max			<b>1.65</b>			<b>0.14</b>

Table 3: Time-series of LA spotted seatrout and red drum total bycatch estimates (numbers of fish) from 1982-2019 for the maximum, mean, and minimum catch per set observations.

Year	SST Bycatch			RD Bycatch		
	max	mean	min	max	mean	min
1982	4,478	3,779	2,861	35,684	16,597	2,291
1983	4,813	4,062	3,075	38,355	17,839	2,462
1984	4,818	4,066	3,078	38,393	17,857	2,464
1985	4,377	3,694	2,797	34,884	16,225	2,239
1986	4,244	3,582	2,712	33,823	15,731	2,171
1987	4,535	3,827	2,897	36,139	16,808	2,320
1988	3,583	3,024	2,289	28,555	13,281	1,833
1989	3,395	2,865	2,169	27,056	12,584	1,737
1990	3,184	2,687	2,034	25,371	11,800	1,629
1991	3,377	2,850	2,157	26,910	12,516	1,727
1992	2,947	2,487	1,883	23,484	10,923	1,507
1993	3,471	2,929	2,218	27,659	12,865	1,775
1994	4,331	3,655	2,767	34,513	16,052	2,215
1995	3,206	2,706	2,048	25,548	11,883	1,640
1996	3,253	2,746	2,079	25,926	12,059	1,664
1997	3,776	3,186	2,412	30,089	13,995	1,931
1998	3,181	2,684	2,032	25,347	11,789	1,627
1999	4,134	3,488	2,641	32,941	15,321	2,114
2000	3,509	2,961	2,242	27,962	13,005	1,795
2001	3,088	2,606	1,973	24,607	11,445	1,580
2002	3,540	2,988	2,262	28,211	13,121	1,811
2003	3,269	2,759	2,088	26,049	12,116	1,672
2004	3,094	2,611	1,977	24,653	11,466	1,582
2005	2,697	2,277	1,723	21,497	9,998	1,380
2006	2,869	2,421	1,833	22,862	10,633	1,468
2007	2,952	2,491	1,886	23,526	10,942	1,510
2008	2,859	2,413	1,826	22,781	10,595	1,462
2009	2,944	2,485	1,881	23,463	10,913	1,506
2010	2,680	2,262	1,712	21,356	9,933	1,371
2011	3,615	3,051	2,310	28,811	13,400	1,849
2012	3,078	2,598	1,967	24,533	11,410	1,575
2013	3,072	2,593	1,963	24,485	11,388	1,572
2014	2,775	2,342	1,773	22,118	10,287	1,420
2015	3,165	2,671	2,022	25,219	11,730	1,619
2016	2,992	2,525	1,912	23,843	11,089	1,530
2017	2,767	2,335	1,768	22,047	10,254	1,415
2018	3,087	2,606	1,973	24,604	11,444	1,579
2019	2,862	2,416	1,829	22,810	10,609	1,464

Table 4: Comparisons of LA spotted seatrout and red drum recreational and commercial landings (in pounds), and bycatch estimates (in pounds) from 1982-2019 for the maximum, mean, and minimum catch per set observations. Confidential commercial landings records (\*\*\*) are not presented.

Year	SST Landings		SST Bycatch			RD Landings		RD Bycatch		
	rec	com	max	mean	min	rec	com	max	mean	min
1982	4,869,061	727,606	6,429	5,426	4,107	2,855,725	1,454,503	450,138	209,363	28,894
1983	4,173,565	1,340,625	6,910	5,832	4,415	2,952,651	1,938,615	483,829	225,033	31,057
1984	1,362,509	973,250	6,917	5,837	4,419	2,367,474	2,608,383	484,310	225,257	31,088
1985	2,903,358	1,161,598	6,285	5,304	4,015	2,174,399	2,933,573	440,046	204,669	28,246
1986	6,140,234	1,978,038	6,094	5,143	3,893	1,993,626	7,817,694	426,663	198,445	27,387
1987	4,854,132	1,801,874	6,511	5,495	4,160	2,306,832	4,571,177	455,876	212,032	29,263
1988	5,313,332	1,433,408	5,145	4,342	3,287	2,424,843	245,365	360,214	167,539	23,122
1989	4,553,228	1,488,878	4,874	4,114	3,114	3,251,530	24,811	341,302	158,742	21,908
1990	2,246,316	648,645	4,571	3,858	2,920	2,977,243	0	320,042	148,854	20,543
1991	6,131,699	1,220,231	4,848	4,092	3,098	2,804,216	0	339,464	157,888	21,790
1992	4,047,596	971,481	4,231	3,571	2,703	4,072,597	0	296,240	137,784	19,016
1993	3,680,464	1,138,070	4,983	4,205	3,184	5,087,621	1,884	348,913	162,282	22,397
1994	5,287,571	1,023,687	6,218	5,248	3,973	4,610,560	2,957	435,373	202,496	27,946
1995	5,897,013	658,084	4,603	3,884	2,941	7,502,450	0	322,280	149,895	20,687
1996	5,633,898	774,474	4,671	3,942	2,984	7,157,264	1,925	327,053	152,115	20,993
1997	5,429,323	549,505	5,421	4,575	3,463	7,128,952	0	379,562	176,537	24,364
1998	5,177,850	111,979	4,567	3,854	2,918	5,442,578	4,769	319,748	148,717	20,524
1999	7,323,715	***	5,935	5,009	3,792	6,642,380	0	415,536	193,269	26,673
2000	8,118,153	***	5,038	4,251	3,219	8,288,060	0	352,729	164,057	22,642
2001	7,185,774	***	4,433	3,741	2,832	7,417,608	0	310,406	144,373	19,925
2002	5,012,133	***	5,082	4,289	3,247	7,196,064	0	355,868	165,517	22,843
2003	5,186,776	***	4,693	3,961	2,998	6,592,330	0	328,603	152,836	21,093
2004	4,332,901	***	4,442	3,748	2,838	5,778,575	0	310,993	144,646	19,963
2005	4,564,983	***	3,873	3,268	2,474	4,733,062	0	271,174	126,125	17,407
2006	6,745,371	***	4,119	3,476	2,632	5,098,331	0	288,400	134,137	18,512
2007	5,530,280	***	4,238	3,577	2,708	6,061,853	0	296,768	138,029	19,049
2008	7,164,674	***	4,104	3,464	2,622	6,672,823	0	287,370	133,658	18,446
2009	7,817,443	***	4,227	3,568	2,701	7,355,418	0	295,983	137,664	18,999
2010	6,184,412	***	3,848	3,247	2,458	8,346,255	0	269,401	125,301	17,293
2011	8,525,814	***	5,191	4,381	3,316	8,304,959	0	363,442	169,040	23,329
2012	8,163,839	***	4,420	3,730	2,824	6,044,853	0	309,474	143,939	19,865
2013	5,622,064	***	4,411	3,723	2,818	7,928,973	0	308,867	143,657	19,826
2014	3,251,893	***	3,985	3,363	2,546	6,367,723	0	279,007	129,769	17,909
2015	4,686,909	***	4,543	3,834	2,903	6,072,877	0	318,130	147,965	20,421
2016	5,367,655	***	4,295	3,625	2,744	4,711,394	0	300,766	139,889	19,306
2017	5,721,125	***	3,972	3,352	2,538	6,422,647	0	278,114	129,353	17,852
2018	2,982,455	***	4,433	3,741	2,832	7,633,391	0	310,375	144,358	19,923
2019	3,811,437	***	4,109	3,468	2,626	5,171,537	0	287,740	133,830	18,470

Figures

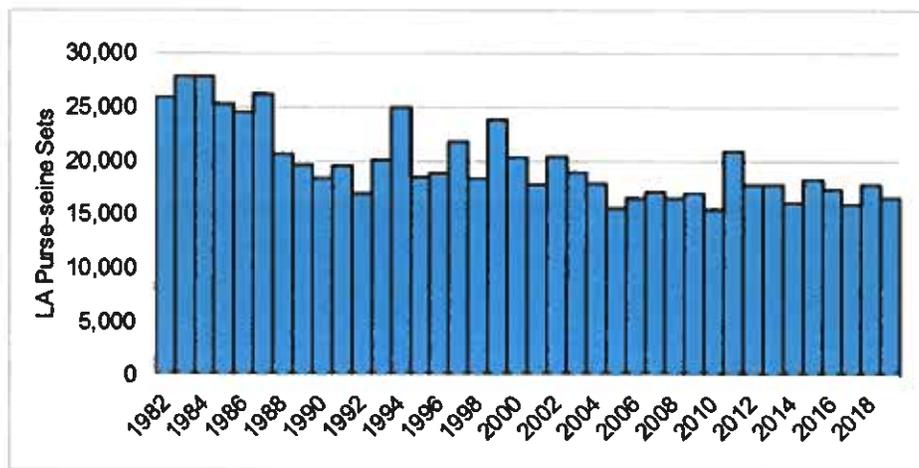


Figure 1: Time-series of estimated LA menhaden fishery effort (number of purse-seine sets per year).

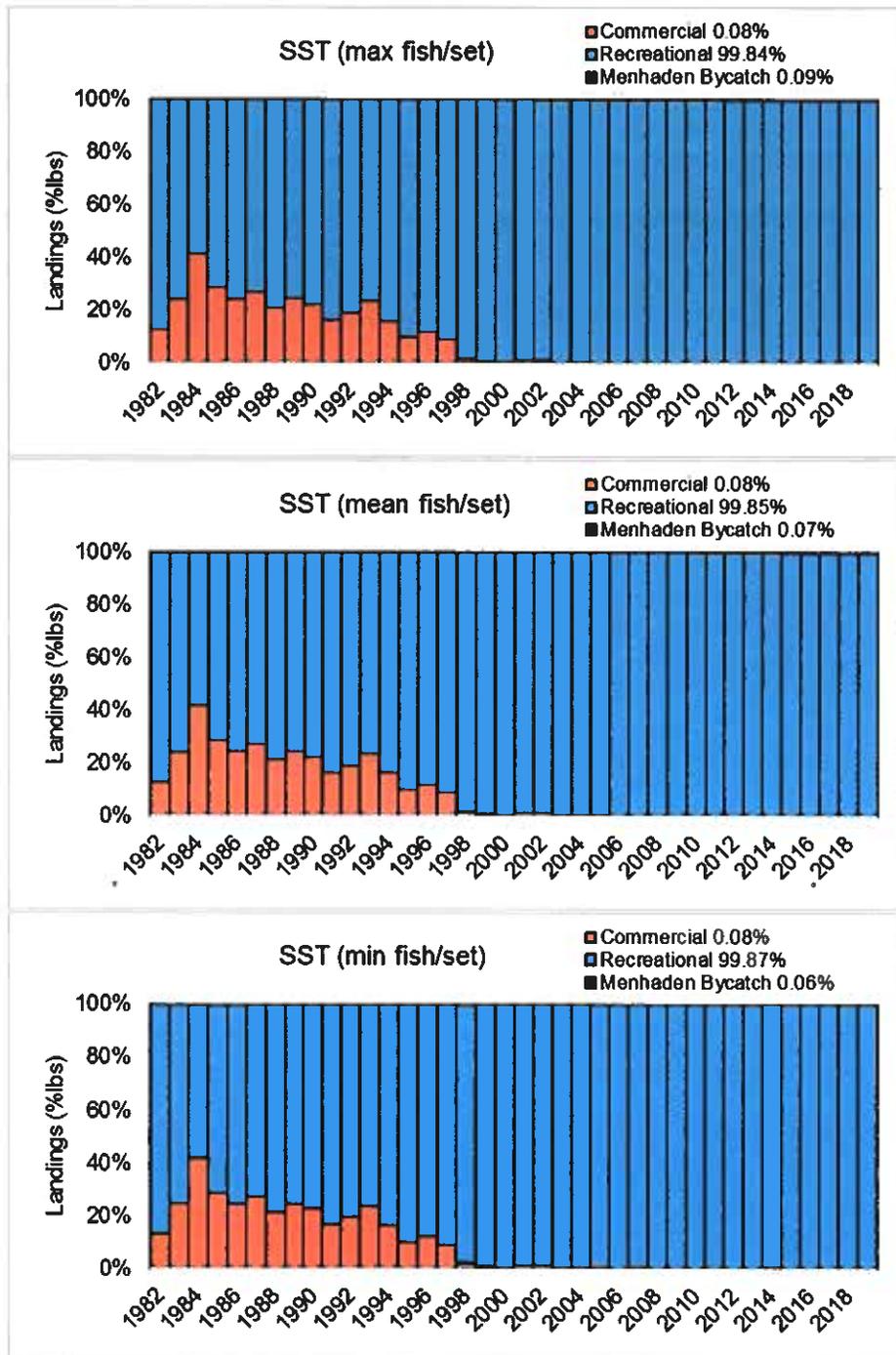


Figure 2: Comparison of LA spotted seatrout commercial and recreational landings, and LA menhaden bycatch estimates for the maximum (top), mean (center), and minimum (bottom) catch per set observations. Values in legends represent the mean landings percentages from 2010-2019.

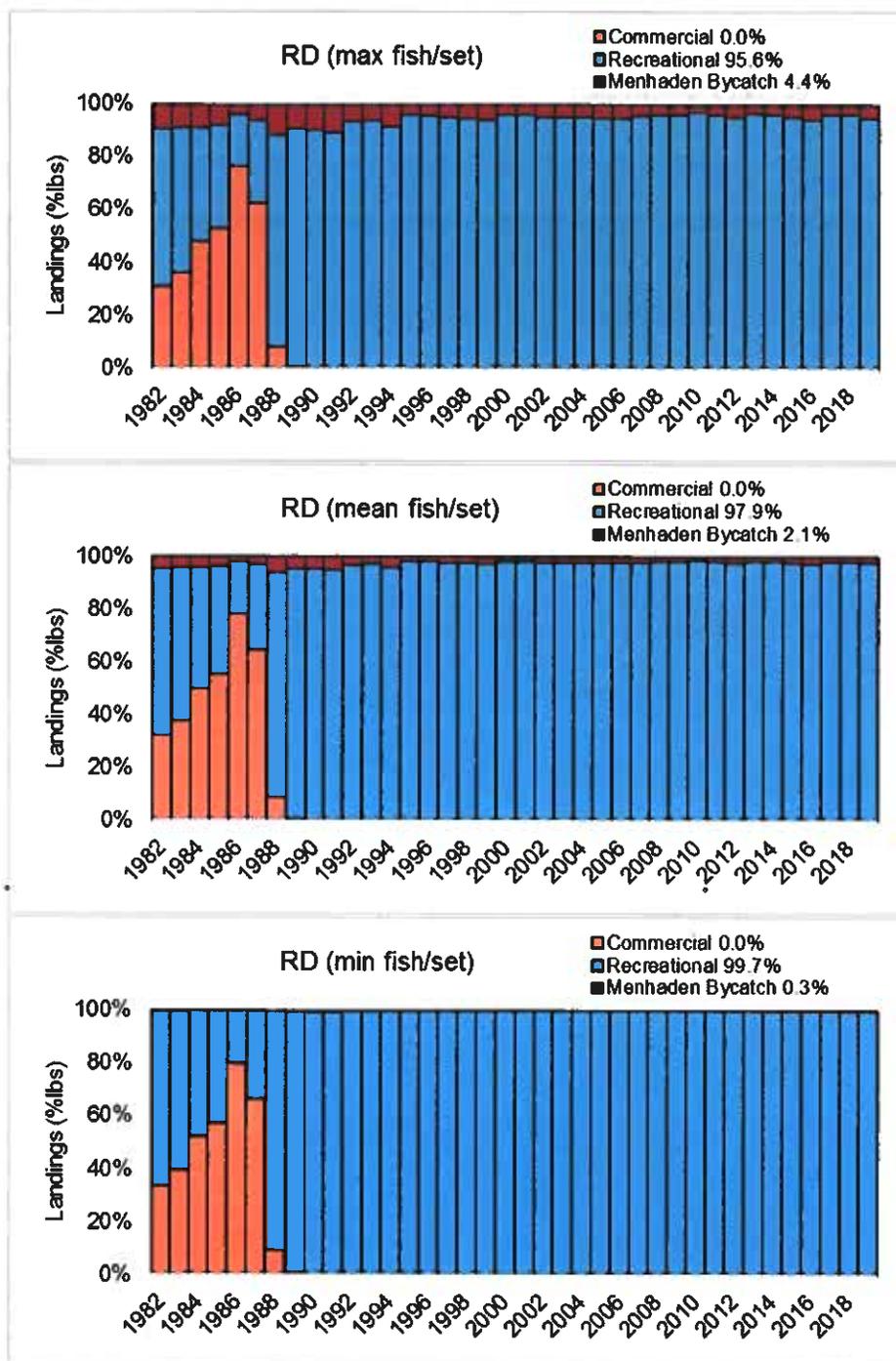


Figure 3: Comparison of LA red drum commercial and recreational landings, and LA menhaden bycatch estimates for the maximum (top), mean (center), and minimum (bottom) catch per set observations. Values in legends represent the mean landings percentages from 2010-2019.

Appendix 3:

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**Evaluation of Commercial Shrimp Fishery Bycatch in Louisiana Waters**

**Peyton Cagle and Joe West  
Office of Fisheries  
Louisiana Department of Wildlife and Fisheries  
November 2020**

Overview

*Project Need*

In 2010, a Fisheries Improvement Project (FIP) was initiated for the commercial shrimp fishery operating in Louisiana (LA) waters as a first step in the process of achieving a sustainability certification for the fishery. This was followed by an official improvement plan for the fishery in 2012. By 2015, the LA shrimp fishery met the goals outlined in the initial plan which allowed the fishery to progress into a comprehensive FIP that addresses all issues within the fishery to ensure the fishery is in compliance with the sustainability standards outlined by the certifying body.

Several action items were outlined in the comprehensive FIP, including the need for current bycatch data from the fishery to assess the main bycatch species per standards of the certifying body. The Louisiana Shrimp Task Force (LSTF) and involved members of the industry approached the Louisiana Department of Wildlife and Fisheries (LDWF) in 2016 and initiated discussions to conduct a study to characterize the current bycatch of the fishery in LA waters. In 2018, LDWF partnered with the LSTF and the American Shrimp Processors Association (ASPA) to fund a one-year observer study designed by the LDWF to focus exclusively on the bycatch of the shrimp fishery operating in LA waters, as the bycatch of the fishery operating in federal waters is monitored and reported by NOAA Fisheries.

*Project Objectives*

Objectives of this study were:

1. Characterize the current bycatch of the commercial shrimp fishery operating in LA waters.
2. Identify the main bycatch species of the fishery per standards of the Audubon Nature Institute (ANI) Gulf United for Lasting Fisheries (GULF) Responsible Fisheries Management (RFM) program (ANI 2020).
3. Assess the population resilience of the main bycatch species to fisheries exploitation.

*Fishery Description*

The commercial harvest of shrimp in LA dates back to the 1800s (LDWF 2016). As the popularity of shrimp as a food source grew in the early 1900s, the LA commercial shrimp industry expanded and commercial landings began to increase above 20 million pounds annually. Continued expansion of the industry into current times has led to the most valuable commercial fishery operating in LA waters with landings averaging over 70 million pounds annually in the most recent decade.

In the early 1900s, the otter trawl was developed and became the primary fishing gear used by LA shrimp fishers. This was followed by introduction of the butterfly net in the 1950s that allowed stationary fishing in tidal passes. The introduction of skimmer nets in the 1980s, which allowed fishers to focus efforts in shallower water and fish the entire water column, was widely accepted by the LA shrimp fishery.

A shift in gear preference of the LA commercial shrimp fishery has occurred over time as well as an overall decrease in license sales (Table 1). Based on commercial gear license sales, the use of otter trawl and butterfly net gear has decreased since 2000 while the use of skimmer nets has increased. The overall number of commercial licenses sold has decreased by over 70% since 2000.

Commercial shrimp landings in LA waters and the corresponding number of fishery trips have also decreased since 2000 (Figure 1). Commercial landings have decreased over 30% since 2000 while the number of fishery trips has declined by over 65%. This disproportionate decrease is primarily due to the characteristics of the shrimp fishery operating in LA waters changing over time, where a noticeable decline occurred in the mid-2000's in the number of trips less than 1-day at sea.

#### *Regulatory Authority*

Regulatory authorities for the LA shrimp fishery are the Governor of Louisiana, the Louisiana Legislature, the Louisiana Wildlife and Fisheries Commission (LWFC), and the Secretary of LDWF. The Governor has the authority to issue executive orders, in limited instances, which are enforced in the same manner as statutes passed by the legislature. The LA Legislature has the authority to enact laws to protect, conserve, and replenish the natural resources of the state, such as gear regulations, licensing requirements, and entry limitations. Some of the authority of the legislature has been delegated to the LWFC, allowing regulatory authority of seasons, quotas, size limits, and possession limits.

Specific to commercial shrimping, the LWFC has the authority to open and close state outside waters, set the inshore shrimp season dates, and modify gear mesh sizes during the special shrimp seasons. The LWFC also has the authority to promulgate regulations regarding the use and configuration of excluder devices. Some authority of the LWFC is delegated to the Secretary of LDWF, including the ability to open or close special and regular shrimp seasons as well as open or close state outside waters.

#### Methods

##### *Bycatch Characterization*

In 2019, LDWF, along with the LSTF and ASPA, initiated an observer study of the commercial shrimp fishery operating in Louisiana waters to characterize bycatch of the fishery from July 2019 through June

2020. LGL Ecological Research Associates, Inc. (LGL) was contracted for this study to provide biological staff to act as observers onboard commercial shrimp fishing vessels operating in LA waters.

Fishery participants were solicited through the LSTF, social media, and LDWF news releases, and an online portal was developed for interested commercial fishers to enroll. All commercial fishers operating out of LA ports were eligible to participate in this study. Commercial vessels in which observers were placed were selected randomly from the pool of participating commercial fishers. Commercial fishers randomly drawn from this group were compensated \$350 per day for each fishing trip where bycatch was observed by an LGL biologist. Fishing trips conducted with observers onboard were not to exceed 48 hours. Trips in which observers were placed were randomly assigned proportional to the recent fishery effort (number of trips) by fishing gear, LDWF Coastal Study Area (CSA), and fishing season (spring, fall, inshore closed).

Bycatch information was collected over the duration of each observed trip by sampling each tow. On vessels containing multiple nets, samples were collected by alternating which net the samples were collected from after each tow. Any observed interactions with sea turtles were to be documented, regardless of which net was sampled.

For each net sampled, the total weight of the tow was estimated through a volumetric approach as described in the NOAA Observer Training Manual (NOAA Fisheries 2010). Multiple fish baskets were equally filled with the entire catch of the sampled tow and then one fish basket was randomly chosen, weighed and used to extrapolate the weight of the entire tow's catch from the number of baskets filled. Catch of the randomly chosen basket was also characterized by sorting, enumerating, and weighing each species to the nearest gram with the exception of white and brown shrimp and jellyfish species where only weight measurements were recorded. The species weight composition of the subsample was then used to extrapolate the total catch weight of each tow.

Size measurements of up to thirty individuals per sampled tow were recorded for penaeid shrimp species and other selected species that are managed or commonly harvested. Large specimens that weren't included in the volumetric sampling method were identified by species, counted, released condition documented, and size or weight measurements recorded when possible. Tow times and locations were also recorded along with the position of the sampled net for each tow.

#### *Main Bycatch Identification*

The ANI GULF RFM program identifies relevant bycatch (non-target catches), whether discarded or retained, as managed non-target species (species regulated for commercial, bait, or recreational use) greater than 1% of total catch and non-managed non-target species greater than 10% of total catch (ANI 2020).

#### *Resilience to Exploitation*

Population resilience is a population's ability to withstand perturbation. Populations with higher resilience are at less risk of extinction due to fishery exploitation than populations with lower resilience. Productivity, which is a function of growth rates, fecundity, natural mortality, age at maturity, and

longevity, can be a reasonable proxy for population resilience. Productivity classification indices were developed for each species identified as main bycatch from their life history characteristics based on a classification scheme developed at the Food and Agricultural Organization of the United Nations (FAO) second technical consultation on the suitability of the Convention on International Trade in Endangered Species (CITES) criteria for listing commercially-exploited aquatic species (FAO 2001).

## Results

### *Bycatch Characterization*

Thirty-three shrimp fishing trips with 363 tows and 501 hours of tow time were observed from July 2019 through June 2020 from 12 individual commercial fishing vessels. Of the twelve participating vessels, 9 fished with skimmer nets, 2 with otter trawls, and 1 with butterfly net gear. The otter trawls were all equipped with bycatch reduction devices (BRDs) and turtle excluder devices, and two-thirds of the skimmer nets were equipped with BRDs.

Observer coverage of the fishery over the course of this study was approximately 0.1% (33 observed trips/37,203 fishery trips) and nearly proportional to the number of fishery trips by gear, CSA, and fishing season with the exception of CSA 6 and 7 due to the lack of fishery participation in those areas (Table 2, Figure 2).

From the 363 observed tows, 14,266 kg of total catch was observed consisting of 105 unique species or grouped species (Table 3). Four species of penaeid shrimp, 82 finfish species, 12 crustacean species (excluding penaeid shrimp), and 7 non-crustacean invertebrate species were observed. Penaeid shrimp species were the highest group caught by weight (48.1%), followed by finfish (40.2%), crustaceans other than penaeid shrimp (5.0%), and invertebrates (3.0%). Debris made up 3.7% of the total catch by weight.

The most abundant species caught consisting of >1% by weight of the total catch were white shrimp (44.3%), Gulf menhaden, (14.1%), Atlantic croaker (5.4%), blue crab (4.9%), brown shrimp (3.7%), spot (3.2%), jellyfish sp. (2.9%), sand seatrout (2.8%), hardhead catfish (2.2%), gafftopsail catfish (2.1%), and Atlantic cutlassfish (2.1%).

The bycatch to shrimp sample ratio error distribution was assumed lognormal and the corresponding sample ratio geometric mean in units of weight was 1.01 (Table 4). Size compositions and mean sizes of penaeid shrimp and the managed and commonly harvested species catches are presented in Table 5. Catch composition of large specimens not represented in the volumetric samples are presented in Table 6 along with released condition and corresponding size and weight measurements if available. Interactions with diamondback terrapins were observed in which all were released alive (Table 6). No interactions with sea turtles were observed.

### *Main Bycatch Identification*

Gulf menhaden and blue crab were identified as the main bycatch species of the current LA commercial shrimp fishery per ANI standards. Both are managed species that are greater than 1% of the total catch by weight. The other non-target species consisting of greater than 1% of the total catch are non-managed

species not regulated for recreational, bait, or commercial use. No non-managed non-target species was greater than 10% of the total catch by weight.

### *Resilience to Exploitation*

Blue crab and Gulf menhaden were assigned productivity/resilience levels (high, medium, or low) based on each species life history characteristics (Table 7). Life history parameter values were taken from the most recent stock assessments if available (SEDAR 2018, West et al. 2019). Parameter values not available in the stock assessment reports were taken from FishBase (Froese and Pauly 2011) and SeaLifeBase (Palomares and Pauly 2020). Parameter values for each of the main bycatch species indicate overall high productivity/resilience.

## Discussion

### *Historic Bycatch Ratios*

The bycatch to penaeid shrimp sample ratio mean from this study (1.01) is less than an earlier LDWF shrimp bycatch study conducted in LA waters (Adkins 1993). The bycatch to penaeid shrimp sample ratio mean in that study, recalculated as a geometric mean, was 1.24, suggesting bycatch in the LA shrimp fishery has decreased through time. This decrease is likely due to the changing characteristics of the fishery where skimmer nets have become the preferred gear of the fishery, along with the use of BRDs. An earlier NOAA Fisheries bycatch study conducted in LA waters (Scott-Denton et al. 2006), which only characterized bycatch from the skimmer net fishery operating primarily in Vermilion Bay (CSA 6), reported an overall ratio of bycatch to penaeid shrimp of 0.63.

### *Management Implications*

For managed species identified as main bycatch, the ANI standards require the effects of the fishery to be considered. Consideration of managed non-target species aims primarily at establishing whether the overall effects of fishing on the stock under consideration and all significant removals are accounted for; and that the management strategy and relative measures are effective in maintaining other managed species from experiencing overfishing and other impacts that are likely to be irreversible or very slowly reversible (ANI 2020).

The main bycatch species of the LA commercial shrimp fishery per ANI standards (Gulf menhaden and blue crab) are regulated species which undergo periodic stock assessments that output estimates used as metrics of stock status (SEDAR 2018, West et al. 2019) with fisheries that currently hold Global Sustainable Seafood Initiative (GSSI) accredited sustainability certifications. Removals of Gulf menhaden and blue crab as bycatch from the LA shrimp fishery have not been considered in the respective stock assessments. Bycatch from the offshore Gulf of Mexico shrimp fishery was considered in the most recent Gulf menhaden stock assessment (SEDAR 2018), but was ultimately not used as a model input by the assessment panelists due to the high uncertainty in the estimated time-series and the relatively insignificant level of bycatch when compared to the landings of the fishery.

Future LDWF blue crab and SEDAR Gulf menhaden stock assessments would be required to consider removals from the LA shrimp fishery per ANI standards. Time-series of bycatch removals could be

estimated directly from annual LA shrimp landings from the mean bycatch to shrimp ratio from this study and the earlier LDWF study (Adkins 1993) along with the percent composition of blue crab and Gulf menhaden in the catches and assumptions of discard mortality. These time-series would unfortunately be considered highly uncertain due to the few bycatch to shrimp ratio estimates available in LA waters over time coupled with the changing characteristics of the fishery, but would allow accurate estimation of the current bycatch removals of the LA shrimp fishery to determine their significance relative to the directed landings of each fishery.

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## Tables

Table 1. Louisiana annual commercial shrimp gear license sales (percent by gear and total sales), 2000-2019.

Year	Trawl	Skimmer	Butterfly	Total
2000	54%	34%	12%	22,218
2001	52%	37%	10%	22,865
2002	51%	40%	9%	21,627
2003	48%	44%	8%	20,586
2004	48%	43%	8%	17,347
2005	46%	45%	9%	15,420
2006	44%	48%	9%	13,646
2007	43%	48%	9%	12,590
2008	42%	49%	10%	11,476
2009	40%	50%	10%	12,082
2010	38%	52%	10%	12,806
2011	37%	54%	9%	13,234
2012	38%	53%	8%	12,728
2013	29%	64%	7%	10,123
2014	42%	49%	9%	7,319
2015	41%	50%	9%	7,551
2016	41%	51%	9%	7,340
2017	41%	51%	8%	6,867
2018	41%	51%	8%	6,236
2019	40%	51%	8%	5,791

Table 2: Louisiana shrimp fishery trips and observer coverage (July 2019 – June 2020) by gear, CSA, and fishing season.

Fishery trips	37,203			
Observed trips	33			
Gear	Fishery trips		Observed trips	
	Frequency	Percent	Frequency	Percent
Butterfly net	2276	6.1%	3	9.1%
Otter trawl	6452	17.3%	6	18.2%
Skimmer net	28475	76.5%	24	72.7%
CSA	Fishery trips		Observed trips	
	Frequency	Percent	Frequency	Percent
1	6564	17.6%	7	21.2%
3	11136	29.9%	12	36.4%
5	14607	39.3%	14	42.4%
6	1108	3.0%	0	0.0%
7	3788	10.2%	0	0.0%
Season	Fishery trips		Observed trips	
	Frequency	Percent	Frequency	Percent
Spring	7823	21.0%	7	21.2%
Fall	24457	65.7%	24	72.7%
Inshore closed	4923	13.2%	2	6.1%

Table 3: Species total catch composition and corresponding mean weights. Species mean weights are calculated from the subsampled weights and counts.

Species	total kg	% kg	mean kg
WHITE SHRIMP	6321.765	44.313	--
GULF MENHADEN	2013.137	14.111	0.014
ATLANTIC CROAKER	768.736	5.389	0.011
BLUE CRAB	700.646	4.911	0.054
BROWN SHRIMP	527.423	3.697	--
DEBRIS	521.480	3.655	--
SPOT	449.081	3.148	0.030
JELLYFISH SP.	415.590	2.913	--
SAND SEATROUT	402.123	2.819	0.012
HARDHEAD CATFISH	314.820	2.207	0.018
GAFFTOPSAIL CATFISH	302.624	2.121	0.015
ATLANTIC CUTLASSFISH	299.163	2.097	0.021
ATLANTIC THREAD HERRING	117.899	0.826	0.015
BAY ANCHOVY	102.212	0.716	0.001
GIZZARD SHAD	94.846	0.665	0.019
THREADFIN SHAD	68.982	0.484	0.014
COWNOSE RAY	68.401	0.479	0.772
SPANISH MACKEREL	67.702	0.475	0.023
SPOTTED SEATROUT	66.077	0.463	0.080
ATLANTIC MOONFISH	62.295	0.437	0.008
CATFISH SP.	54.260	0.380	0.022
STRIPED MULLET	43.462	0.305	0.039
ATLANTIC STINGRAY	41.300	0.289	0.215
HARVESTFISH	36.490	0.256	0.025
PINFISH	31.478	0.221	0.039
STRIPED ANCHOVY	31.222	0.219	0.012
HOGCHOKER	25.958	0.182	0.016
SHEEPSHEAD	23.683	0.166	1.203
SOUTHERN FLOUNDER	23.201	0.163	0.337
SOUTHERN KINGFISH	20.237	0.142	0.032
SILVER PERCH	17.558	0.123	0.026
SEABOB	17.386	0.122	0.005
BLUE CATFISH	16.445	0.115	0.007
LEAST PUFFER	16.150	0.113	0.007
WHITE MULLET	16.042	0.112	0.023
ATLANTIC BRIEF SQUID	15.726	0.110	0.009
BAY WHIFF	15.136	0.106	0.009
SCALED SARDINE	14.126	0.099	0.007
LADYFISH	10.005	0.070	0.102
CREVALLE JACK	9.887	0.069	0.028
STAR DRUM	8.882	0.062	0.014
INSHORE LIZARDFISH	8.292	0.058	0.034
ATLANTIC SPADEFISH	7.770	0.054	0.013
HIGHFIN GOBY	7.558	0.053	0.027
ATLANTIC BUMPER	6.027	0.042	0.003
VIOLET GOBY	5.584	0.039	0.030
LOOKDOWN	4.889	0.034	0.015
FLORIDA POMPAÑO	4.535	0.032	0.092
BLUE RUNNER	4.382	0.031	0.045
BLACK DRUM	3.471	0.024	0.088
GRAY SNAPPER	3.053	0.021	0.044
HERMIT CRAB SP.	2.905	0.020	0.018

Table 3 (continued):

Species	total kg	% kg	mean kg
BANDED DRUM	2.866	0.020	0.006
ATLANTIC MIDSHIPMAN	2.304	0.016	0.022
GULF STONE CRAB	2.166	0.015	0.440
ATLANTIC NEEDLEFISH	2.048	0.014	0.026
BLACKTIP SHARK	1.970	0.014	0.200
ATLANTIC SILVERSTRIPE HALFBEAK	1.871	0.013	0.035
SPINY SEAROBIN	1.723	0.012	0.004
LEATHERJACKET	1.615	0.011	0.008
INLAND SILVERSIDE	1.600	0.011	0.004
BIGHEAD SEAROBIN	1.590	0.011	0.005
ROUGH SILVERSIDE	1.492	0.010	0.002
BLACKCHEEK TONGUEFISH	0.985	0.007	0.033
GULF TOADFISH	0.886	0.006	0.036
PIGFISH	0.886	0.006	0.060
STRIPED BURRFISH	0.886	0.006	0.180
GULF BUTTERFISH	0.768	0.005	0.005
NEEDLEFISH SP.	0.704	0.005	0.029
SNAIL SP.	0.689	0.005	0.016
NAKED SOLE	0.596	0.004	0.020
NORTHERN KINGFISH	0.596	0.004	0.040
SHARKSUCKER	0.566	0.004	0.038
ISOPODA SP.	0.502	0.004	0.034
BAYOU KILLIFISH	0.478	0.003	0.019
GIANT TIGER PRAWN	0.359	0.003	0.073
FALSE SILVERSTRIPE HALFBEAK	0.355	0.002	0.024
ATLANTIC MENHADEN	0.345	0.002	0.070
MOJARRA SP.	0.295	0.002	0.015
BLUNTNOSE JACK	0.251	0.002	0.009
FALSE SHARK EYE	0.246	0.002	0.013
CRESTED CUSK EEL	0.197	0.001	0.040
THINSTRIPED HERMIT CRAB	0.197	0.001	0.013
FAT SLEEPER	0.177	0.001	0.018
FRINGED FLOUNDER	0.158	0.001	0.004
FLORIDA ROCKSNAIL	0.148	0.001	0.015
OYSTER TOADFISH	0.148	0.001	0.030
RIVER SHRIMP	0.148	0.001	0.030
SPOTFIN MOJARRA	0.148	0.001	0.015
YELLOWFIN MOJARRA	0.148	0.001	0.008
PYGMY SEA BASS	0.108	0.001	0.022
SMOOTH PUFFER	0.103	0.001	0.011
AMERICAN PADDLEFISH	0.098	0.001	0.020
BIVALVE CLAM SP.	0.098	0.001	0.020
MANTIS SHRIMP	0.098	0.001	0.010
PINK PURSE CRAB	0.098	0.001	0.010
WHITE RIVER CRAWFISH	0.098	0.001	0.010
SILVER ANCHOVY	0.079	0.001	0.008
BIGCLAW SNAPPING SHRIMP	0.049	0.000	0.010
REDEAR SUNFISH	0.049	0.000	0.010
FLORIDA LADY CRAB	0.044	0.000	0.009
TIDEWATER MOJARRA	0.044	0.000	0.009
ESTUARINE MUD CRAB	0.015	0.000	0.001
BIGEYE ROBIN	0.005	0.000	0.001
GULF PIPEFISH	0.005	0.000	0.001
SPECKLED SWIMMING CRAB	0.005	0.000	0.001

Table 4: Bycatch to penaeid shrimp (brown, white, seabob) sample ratio summary statistics in units of weight. The sample ratio mean and error estimates are geometric.

Ratio (bycatch /shrimp)			Ratio (bycatch/shrimp)	
Bin	Frequency	Percent	Mean	1.013
0.0	163	50.309	L95%CI	0.882
1.0	55	16.975	U95%CI	1.163
2.0	39	12.037	CV	1.986
3.0	18	5.556	Tows	324
4.0	16	4.938		
5.0	12	3.704		
6.0	5	1.543		
7.0	4	1.235		
8.0	2	0.617		
9.0	--	--		
10.0	2	0.617		
11.0	--	--		
12.0	--	--		
13.0	1	0.309		
14.0	--	--		
15.0	1	0.309		
16.0	2	0.617		
17.0	--	--		
18.0	--	--		
19.0	2	0.617		
--	--	--		
51.0	1	0.309		
--	--	--		
111.0	1	0.309		

Table 5: Bycatch size compositions of managed and commonly harvested species. Size measurements are fork length (finfish), total length (shrimp), and carapace width (crab).

Size bin (cm)	ATLANTIC CROAKER	BLACK DRUM	BLUE CRAB	BROWN SHRIMP	GRAY SNAPPER	GULF MENHADEN	SEABOB	SHEEPSHEAD	SOUTHERN FLOUNDER	SPOTTED SEATROUT	STRIPED MULLET	WHITE SHRIMP
0	2	--	--	--	--	--	--	--	--	--	--	--
1	1	--	30	1	--	--	--	--	--	--	--	--
2	--	--	96	1	2	1	--	--	--	--	--	1
3	3	--	291	--	1	6	--	--	--	--	--	6
4	1	--	358	15	--	64	--	--	--	--	--	14
5	39	--	285	91	--	302	--	--	--	--	--	74
6	284	--	177	419	--	627	1	--	--	--	1	263
7	485	--	139	1,087	--	1,074	6	--	--	--	2	700
8	748	1	111	1,246	--	970	28	--	--	--	4	1,039
9	632	--	91	635	--	579	34	--	--	5	9	1,043
10	618	--	94	260	1	742	15	--	--	9	24	788
11	988	--	123	112	1	830	1	--	--	12	39	1,035
12	822	--	116	20	--	330	--	--	--	18	25	1,395
13	513	--	89	4	1	156	--	--	--	11	30	1,562
14	261	--	82	1	--	172	--	--	--	6	27	1,021
15	120	--	99	--	--	126	--	--	--	6	16	336
16	55	--	124	--	--	53	--	--	--	6	12	78
17	24	2	71	--	--	11	--	--	--	8	6	9
18	10	--	24	1	--	5	--	--	--	1	8	2
19	3	3	6	--	--	1	--	--	--	4	6	2
20	1	1	--	--	--	1	--	--	1	8	3	--
21	3	1	--	--	--	--	--	--	1	12	2	--
22	--	--	--	--	--	1	--	--	--	13	1	--
23	--	--	--	--	--	--	--	--	1	5	2	--
24	--	--	--	--	--	--	--	--	1	6	--	--
25	--	--	--	--	--	--	--	--	--	8	--	--
26	--	--	--	--	--	--	--	--	1	3	--	--
27	--	--	--	--	--	--	--	--	--	5	--	--
28	--	--	--	--	--	--	--	--	1	4	--	--
29	--	--	--	--	--	--	--	--	1	2	--	--
30	--	--	--	--	--	--	--	1	1	2	--	--
31	--	--	--	--	--	--	--	--	--	--	--	--
32	--	--	--	--	--	--	--	1	--	--	--	--
33	--	--	--	--	--	--	--	--	--	2	--	--
34	--	--	--	--	--	--	--	1	--	3	--	--
35	--	--	--	--	--	--	--	--	2	--	--	--
36	--	--	--	--	--	--	--	--	1	1	--	--
37	--	--	--	--	--	--	--	--	1	--	--	--
38	--	--	--	--	--	--	--	--	--	--	--	--
39	--	--	--	--	--	--	--	--	--	--	--	--
40	--	--	--	--	--	--	--	--	--	--	--	--
41	--	--	--	--	--	--	--	--	--	--	--	--
42	--	--	--	--	--	--	--	--	--	--	--	--
43	--	--	--	--	--	--	--	1	--	--	--	--
Mean size (mm)	107	176	83	82	73	94	91	354	290	187	135	113
n	5613	8	2406	3893	6	6051	85	4	12	160	217	9368

Table 6: Large specimen catch composition. Size measurements are fork length.

Species	numbers	released condition			weight (kg)			size (mm)				
		alive	dead	unknown	mean	n	min	max	mean	n	min	max
Black Drum	33	20	2	11	7.67	2	6.98	8.35	905	1	905	905
Cownose Ray	27	5	--	22	0.81	5	0.60	0.96	323	4	136	410
Atlantic Stingray	25	10	11	4	0.86	3	0.41	1.16	146	1	146	146
Sheepshead	15	10	1	4	2.59	3	2.48	2.78	494	3	460	528
Longnose Gar	12	12	--	--	--	--	--	--	--	--	--	--
Diamondback Terrapin	5	5	--	--	--	--	--	--	--	--	--	--
Red Drum	5	5	--	--	--	--	--	--	--	--	--	--
Hardhead Catfish	5	5	--	--	--	--	--	--	--	--	--	--
Alligator Gar	4	4	--	--	--	--	--	--	1140	2	450	1829
Atlantic Tripletail	3	2	--	1	--	--	--	--	--	--	--	--
Bull shark	2	2	--	--	4.92	2	4.83	5.01	--	--	--	--
Spotted Seatrout	2	2	--	--	--	--	--	--	--	--	--	--
Bonnethead	1	1	--	--	--	--	--	--	--	--	--	--
Blacktip Shark	1	1	--	--	3.62	1	3.62	3.62	566	1	566	566

Table 7: FAO proposed guideline for indices of productivity/resilience for exploited aquatic species (top table) and corresponding productivity/resilience levels for blue crab and Gulf menhaden (bottom table). Parameter values are taken from the latest stock assessment reports (West et al. 2019, SEDAR 63) unless noted by an \* where values are taken from FishBase (Froese and Pauly 2011) for Gulf menhaden and SeaLifeBase (Palomares and Pauly 2020) for blue crab.

Parameter	Productivity/Resilience		
	Low	Medium	High
Intrinsic rate of population growth (r per yr)	<0.14	0.14 - 0.35	>0.35
Natural mortality rate (M per yr)	<0.2	0.2 - 0.5	>0.5
Individual growth rate (K per yr)	<0.15	0.15 - 0.33	>0.33
Age at maturity (yrs)	>8	8 - 3.3	<3.3
Maximum age (yrs)	>25	14 - 25	<14
Generation time (yrs)	>10	10.0 - 5.0	<5

Parameter	Blue Crab		Gulf Menhaden	
	Value	Index	Value	Index
Intrinsic rate of population growth (r per yr)	0.6*	High	3.0*	High
Natural mortality rate (M per yr)	1.0	High	1.1	High
Individual growth rate (K per yr)	1.9	High	0.3	High
Age at maturity (yrs)	1.0	High	2.0	High
Maximum age (yrs)	3.0	High	6.0	High
Generation time (yrs)	<3.0	High	2.4*	High
Overall productivity /resilience level	High		High	



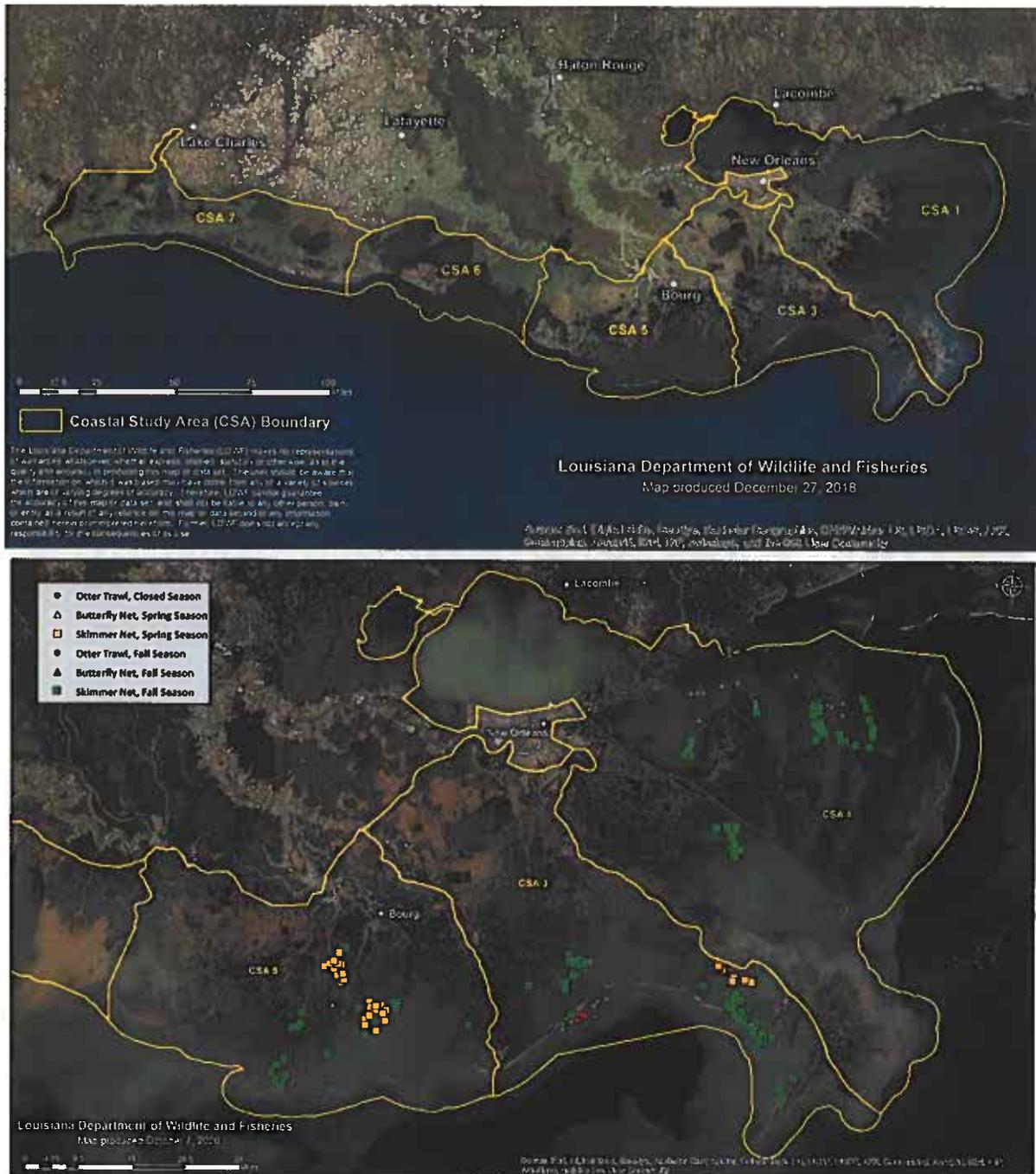


Figure 2: Louisiana state waters and LDWF Coastal Study Areas delineated by the yellow lines (top graphic) and locations of observed fishery tows (bottom graphic) by gear fished (otter trawl, skimmer net, butterfly net) and fishing season (spring, fall, inshore closed).

Appendix 4:**Louisiana Basin-specific Spotted Seatrout Information (2014-2020)**

Office of Fisheries  
Louisiana Department of Wildlife and Fisheries

**Overview**

The Louisiana spotted seatrout (SST) fishery is one of the largest fisheries operating in Louisiana (LA) waters. Basin-specific SST information has been requested as part of this stock assessment update to allow comparisons of fishery landings and survey catch rates among LA drainage basins.

The Louisiana Department of Wildlife and Fisheries (LDWF) recreational creel survey (LA Creel) estimates fishery effort and fishery catches (harvest + discards) for each LA drainage basin as well as the offshore waters of LA. The LDWF Biological Sampling Program collects size, sex, and age composition information from LA recreational and commercial fishery landings. The LDWF fishery-independent experimental marine gillnet survey collects relative abundance information along with size, sex, and age composition information from important marine species within the LA drainage basins.

Time-series of annual SST basin-specific recreational fishery landings, catch rates of the LDWF fishery-independent experimental marine gill net survey, and corresponding age compositions are presented in this report from 2014-2020. The basin-specific information presented in this report is derived in the same manner using the same methodology as the statewide metrics presented in the main assessment report. Due to confidentiality issues, basin-specific commercial landings are not presented.

**Fishery Information****Angler Effort, Harvest, and Discards**

Annual basin-specific estimates of recreational fishery effort (as angler trips), SST harvest, and SST discards (as numbers of male and female fish) from the LA Creel survey (2014-2020) are presented (Table 1, Figure 1).

Recreational fishery effort varies by LA drainage basin with the majority of angler trips from 2014-2020 occurring in the Pontchartrain, Barataria, and Terrebonne basins (24%, 29%, and 21% respectively). Fishing effort in the Vermilion/Teche and Calcasieu/Sabine drainage basins, and the offshore waters of LA accounts for a much smaller fraction of the total LA recreational marine fishing effort (6%, 15%, and 5% respectively).

Recreational harvest and discards (2014-2020) also vary with LA drainage basins and follow similar trends with fishery effort with the majority of harvest and discards occurring in the Pontchartrain, Barataria, and Terrebonne basins (harvest: 30%, 30%, and 30% respectively, and discards: 28%, 32%, and 34% respectively). Catches from the Vermilion/Teche and Calcasieu/Sabine drainage basins, and the

offshore waters of LA account for a much smaller percentage of the total LA recreational SST catch (harvest: 2%, 8%, and 1% respectively, and discards: 0.4%, 6%, and 0.1% respectively).

#### Female Harvest, Discards, and Age Composition

Annual basin-specific female SST harvest, discards, and corresponding age compositions of female removals (harvest + dead discards) derived from the LA Creel Survey and the LDWF Biological Sampling Program are presented (Table 2, Figure 2) along with the percentage of SST harvest taken by fishing mode (private versus charter). Due to the low SST catches that occur in the offshore waters of LA, offshore female SST landings and age compositions are not presented.

#### Pontchartrain Basin (CSA 1)

Female SST recreational harvest estimates in the Pontchartrain basin increased from 1.1 million females harvested in 2014 to 1.5 million females harvested in 2016. After 2016, female harvest decreased to a low of 0.58 million females estimated in 2018. The 2019 and 2020 harvest estimates are 0.69 and 0.84 million females respectively.

Female SST recreational discard estimates in the Pontchartrain basin follow a similar trend as the harvest estimates. Female discard estimates increased from 0.52 million females discarded in 2014 to 0.93 million females discarded in 2016. After 2016, female discards decreased to a low of 0.34 million females estimated in 2018. The 2019 and 2020 discard estimates are 0.35 and 0.59 million females respectively.

The age composition of the Pontchartrain basin female SST removals (harvest + dead discards) from 2014-2020 for age-0 through age-3+ fish are 1.2%, 57%, 37%, and 4.6% respectively.

The majority of the Pontchartrain basin female SST harvest (2014-2020) is taken by private anglers (92%).

#### Barataria Basin (CSA 3)

Female SST recreational harvest estimates in the Barataria basin increased from 0.55 million females harvested in 2014 to 1.4 million females harvested in 2016. After 2016, female harvest decreased to 0.62 million females estimated in 2018. The 2019 and 2020 harvest estimates are 1.1 and 0.88 million females respectively.

Female SST recreational discard estimates in the Barataria basin follow a similar trend as the harvest estimates. Female discard estimates increased from 0.61 million females discarded in 2014 to 0.82 million females discarded in 2016. After 2016, female discards decreased to a low of 0.23 million females estimated in 2018. The 2019 and 2020 discard estimates are 0.77 and 0.68 million females respectively.

The age composition of the Barataria basin female SST removals (harvest + dead discards) from 2014-2020 for age-0 through age-3+ fish are 1.5%, 65%, 29%, and 4.1% respectively.

The majority of the Barataria basin female SST harvest (2014-2020) is taken by private anglers (83%).

Terrebonne Basin (CSA 5)

Female SST recreational harvest estimates in the Terrebonne basin increased from 0.68 million females harvested in 2014 to 1.4 million females harvested in 2017. After 2017, female harvest decreased to 0.89 million females estimated in 2018. The 2019 and 2020 harvest estimates are 0.97 and 1.3 million females respectively.

Female SST recreational discard estimates in the Terrebonne basin follow a similar trend as the harvest estimates. Female discard estimates increased from 0.50 million females discarded in 2014 to 0.81 million females discarded in 2016. After 2016, female discards decreased to a low of 0.32 million females estimated in 2018. The 2019 and 2020 discard estimates are 0.95 and 0.97 million females respectively.

The age composition of the Terrebonne basin female SST removals (harvest + dead discards) from 2014-2020 for age-0 through age-3+ fish are 1.5%, 69%, 27%, and 2.6% respectively.

The majority of the Terrebonne basin female SST harvest (2014-2020) is taken by private anglers (85%).

Vermilion/Teche Basins (CSA 6)

Female SST recreational harvest estimates in the Vermilion/Teche basins decreased from 126 thousand females harvested in 2014 to 41 thousand females harvested in 2015. After 2015, female harvest increased to 87 thousand females estimated in 2017. The 2018-2020 harvest estimates are 29, 15, and 65 thousand females respectively.

Female SST recreational discard estimates in the Vermilion/Teche basins follow a similar trend as the harvest estimates. Female discard estimates increased from 6.8 thousand females discarded in 2014 to 11 thousand females discarded in 2015. After 2015, female discards decreased to a low of 5.4 thousand females estimated in 2018. The 2019 and 2020 discard estimates are 8.1 and 8.4 thousand females respectively.

The age composition of the female SST removals (harvest + dead discards) in the Vermilion/Teche basins from 2014-2020 for age-0 through age-3+ fish are 0.41%, 73%, 22%, and 4.5% respectively.

The female SST harvest (2014-2020) in the Vermilion/Teche basins is taken almost entirely by private anglers (99.5%).

Calcasieu/Sabine Basins (CSA 7)

Female SST recreational harvest estimates in the Calcasieu/Sabine basins increased from 243 thousand females harvested in 2014 to 329 thousand females harvested in 2017. After 2017, female harvest decreased to a low of 127 thousand females estimated in 2018. The 2019 and 2020 harvest estimates are 209 and 260 thousand females respectively.

Female SST recreational discard estimates in the Calcasieu/Sabine basins follow a similar trend as the harvest estimates. Female discard estimates increased from 122 thousand females discarded in 2014 to

153 thousand females discarded in 2015. After 2015, female discards decreased to a low of 64 thousand females estimated in 2018. The 2019 and 2020 discard estimates are 189 and 141 thousand females respectively.

The age composition of the female SST removals (harvest + dead discards) in the Calcasieu/Sabine basins from 2014-2020 for age-0 through age-3+ are 1.2%, 64%, 29%, and 6.2% respectively.

The female SST harvest (2014-2020) in the Calcasieu/Sabine basins is taken primarily by private anglers (66%).

### **Fishery-independent Information**

Basin-specific female SST indices of abundance and corresponding age compositions of female SST catches from each mesh panel of the LDWF marine experimental gill net survey (1.0-inch, 1.25-inch, and 1.5-inch panels only) are presented (Tables 3-5 and Figures 3-5). Each abundance index time-series has been normalized to 1 to facilitate comparisons.

#### **Pontchartrain Basin (CSA 1)**

##### *1.0-inch mesh panel*

Annual female SST abundance index values estimated from of the 1.0-inch mesh panel of the Pontchartrain basin gillnet survey increased from 1.0 in 2014 to 1.1 in 2016. After 2016, abundance index values decreased to 0.82 estimated in 2017 and then increased to 1.2 estimated in 2018. The 2019 and 2020 abundance index values are 0.94 and 0.88.

The age composition of the female SST catches of the 1.0-inch mesh panel of the Pontchartrain basin gillnet survey from 2014-2020 for age-0 through age-3+ fish are 0.75%, 97%, 1.6%, and 0.67% respectively.

##### *1.25-inch mesh panel*

Annual female SST abundance index values estimated from of the 1.25-inch mesh panel of the Pontchartrain basin gillnet survey decreased from 0.98 in 2014 to 0.85 in 2015. After 2015, abundance index values increased to 0.97 estimated in 2016 and 1.4 estimated in 2017 and then decreased to 1.1 estimated in 2018. The 2019 and 2020 abundance index values are 0.62 and 1.2.

The age composition of the female SST catches of the 1.25-inch mesh panel of the Pontchartrain basin gillnet survey from 2014-2020 for age-0 through age-3+ fish are 0.25%, 97%, 11%, and 1.7% respectively.

##### *1.5-inch mesh panel*

Annual female SST abundance index values estimated from of the 1.5-inch mesh panel of the Pontchartrain basin gillnet survey decreased from 0.92 in 2014 to 0.91 in 2015. After 2015, abundance index values increased to 1.3 estimated in 2016 and 1.8 estimated in 2017 and then decreased to 0.62 estimated in 2018. The 2019 and 2020 abundance index values are 0.19 and 1.3.

The age composition of the female SST catches of the 1.5-inch mesh panel of the Pontchartrain basin gillnet survey from 2014-2020 for age-0 through age-3+ fish are 0%, 67%, 29%, and 4.4% respectively.

Barataria Basin (CSA 3)

*1.0-inch mesh*

Annual female SST abundance index values estimated from of the 1.0-inch mesh panel of the Barataria basin gillnet survey decreased from 0.96 in 2014 to 0.90 in 2015. After 2015, abundance index values increased to 1.2 estimated in 2016 and 2017 and then decreased to 0.71 estimated in 2018. The 2019 and 2020 abundance index values are 1.0 and 1.1.

The age composition of the female SST catches of the 1.0-inch mesh panel of the Barataria basin gillnet survey from 2014-2020 for age-0 through age-3+ fish are 0.23%, 96%, 3.0%, and 0.25% respectively.

*1.25-inch mesh*

Annual female SST abundance index values estimated from of the 1.25-inch mesh panel of the Barataria basin gillnet survey increased from 0.96 in 2014 to 1.1 in 2015. After 2015, abundance index values decreased to 0.93 estimated in 2016 and then increased to 1.2 estimated in 2017. The 2018- 2020 abundance index values are 1.0, 0.84, and 1.0 respectively.

The age composition of the female SST catches of the 1.25-inch mesh panel of the Barataria basin gillnet survey from 2014-2020 for age-0 through age-3+ fish are 0%, 94%, 5.9%, and 0.02% respectively.

*1.5-inch mesh*

Annual female SST abundance index values estimated from of the 1.5-inch mesh panel of the Barataria basin gillnet survey decreased from 1.4 in 2014 to 0.88 in 2015. After 2015, abundance index values increased to 0.96 estimated in 2016 and 1.6 estimated in 2017 and then decreased to 0.76 estimated in 2018 and 0.50 estimated in 2019. The 2020 abundance index value is 0.92.

The age composition of the female SST catches of the 1.5-inch mesh panel of the Barataria basin gillnet survey from 2014-2020 for age-0 through age-3+ fish are 0%, 68%, 32%, and 0.85% respectively.

Terrebonne Basin (CSA 5)

*1.0-inch mesh*

Annual female SST abundance index values estimated from of the 1.0-inch mesh panel of the Terrebonne basin gillnet survey decreased from 1.2 in 2014 to 0.53 in 2015. After 2015, abundance index values increased to 1.0 estimated in 2016 and 1.1 estimated in 2017 and then decreased to 0.44 estimated in 2018. The 2019 and 2020 abundance index values are 1.1 and 1.6.

The age composition of the female SST catches of the 1.0-inch mesh panel of the Terrebonne basin gillnet survey from 2014-2020 for age-0 through age-3+ fish are 0.22%, 97%, 3.1%, and 0.14% respectively.

*1.25-inch mesh*

Annual female SST abundance index values estimated from of the 1.25-inch mesh panel of the Terrebonne basin gillnet survey decreased from 1.2 in 2014 to 0.59 in 2015. After 2015, abundance index values increased to 0.72 estimated in 2016 and 1.0 estimated in 2017 and then decreased to 0.88 estimated in 2018 and 2019. The 2020 abundance index value is 1.7.

The age composition of the female SST catches of the 1.25-inch mesh panel of the Terrebonne basin gillnet survey from 2014-2020 for age-0 through age-3+ fish are 0.11%, 91%, 8.1%, and 0.59% respectively.

*1.5-inch mesh*

Annual female SST abundance index values estimated from of the 1.5-inch mesh panel of the Terrebonne basin gillnet survey decreased from 1.5 in 2014 to 0.86 in 2015 and 0.52 in 2016. After 2016, abundance index values increased to 1.1 estimated in 2017 and then decreased to 0.90 estimated in 2018 and 0.61 estimated in 2019. The 2020 abundance index value is 1.6.

The age composition of the female SST catches of the 1.5-inch mesh panel of the Terrebonne basin gillnet survey from 2014-2020 for age-0 through age-3+ fish are 0.68%, 62%, 35%, and 1.8% respectively.

*Vermilion/Teche Basins (CSA 6)**1.0-inch mesh*

Annual female SST abundance index values estimated from of the 1.0-inch mesh panel of the Vermilion/Teche basins gillnet survey decreased from 1.6 in 2014 to 0.51 in 2015. After 2015, abundance index values increased to 1.4 estimated in 2016 and then decreased to 1.0 estimated in 2017. The 2018-2020 abundance index values are 0.54, 0.70, and 1.2 respectively.

The age composition of the female SST catches of the 1.0-inch mesh panel of the Vermilion/Teche basins gillnet survey from 2014-2020 for age-0 through age-3+ fish are 0.58%, 89%, 9.1%, and 1.2% respectively.

*1.25-inch mesh*

Annual female SST abundance index values estimated from of the 1.25-inch mesh panel of the Vermilion/Teche basins gillnet survey decreased from 1.2 in 2014 to 0.80 in 2015. After 2015, abundance index values increased to 1.5 estimated in 2016 and then decreased to 1.0 estimated in 2017 and 0.85 estimated in 2018. The 2019 and 2020 abundance index values are 0.73 and 0.91.

The age composition of the female SST catches of the 1.25-inch mesh panel of the Vermilion/Teche basins gillnet survey from 2014-2020 for age-0 through age-3+ fish are 0%, 84%, 15%, and 0.90% respectively.

*1.5-inch mesh*

Annual female SST abundance index values estimated from of the 1.5-inch mesh panel of the Vermilion/Teche basins gillnet survey decreased from 1.3 in 2014 to 0.93 in 2015 and 0.75 in 2016. After

2016, abundance index values increased to 1.4 estimated in 2017 and then decreased to 1.2 estimated in 2018 and 0.55 estimated in 2019. The 2020 abundance index value is 0.91.

The age composition of the female SST catches of the 1.5-inch mesh panel of the Vermilion/Teche basins gillnet survey from 2014-2020 for age-0 through age-3+ fish are 0%, 35%, 61%, and 3.8% respectively.

#### Calcasieu/Sabine Basins (CSA 7)

##### *1.0-inch mesh*

Annual female SST abundance index values estimated from of the 1.0-inch mesh panel of the Calcasieu/Sabine basins gillnet survey decreased from 1.7 in 2014 to 0.88 in 2015. After 2015, abundance index values increased to 1.0 estimated in 2016 and then decreased to 0.75 estimated in 2017 and 0.46 estimated in 2018. The 2019 and 2020 abundance index values are 0.92 and 1.3.

The age composition of the female SST catches of the 1.0-inch mesh panel of the Calcasieu/Sabine basins gillnet survey from 2014-2020 for age-0 through age-3+ fish are 0%, 80%, 8.0%, and 12% respectively.

##### *1.25-inch mesh*

Annual female SST abundance index values estimated from of the 1.25-inch mesh panel of the Calcasieu/Sabine basins gillnet survey decreased from 1.9 in 2014 to 0.84 in 2015. After 2015, abundance index values increased to 1.3 estimated in 2016 and then decreased to 0.75 estimated in 2017. The 2018-2020 abundance index values are 0.78, 0.67, and 0.79 respectively.

The age composition of the female SST catches of the 1.25-inch mesh panel of the Calcasieu/Sabine basins gillnet survey from 2014-2020 for age-0 through age-3+ fish are 0%, 77%, 20%, and 3.5% respectively,

##### *1.5-inch mesh*

Annual female SST abundance index values estimated from of the 1.5-inch mesh panel of the Calcasieu/Sabine basins gillnet survey decreased from 1.5 in 2014 to 0.77 in 2015. After 2015, abundance index values increased to 1.9 estimated in 2016 and then decreased to 0.80 estimated in 2017 and 0.67 estimated in 2018. The 2019 and 2020 abundance index values are 0.53 and 0.83.

The age composition of the female SST catches of the 1.5-inch mesh panel of the Calcasieu/Sabine basins gillnet survey from 2014-2020 for age-0 through age-3+ fish are 0%, 49%, 44%, and 8.1% respectively.

**Tables:**

Table 1: Annual basin-specific recreational fishing effort estimates (angler trips; top table), spotted seatrout harvest estimates (numbers of male and female fish; center table), and spotted seatrout discard estimates (numbers of male and female fish; bottom table). CSA 1 represents Pontchartrain basin, CSA 3 represents Barataria basin, CSA 5 represents Terrebonne basin, CSA 6 represents Vermilion/Teche basins, and CSA 7 represents Calcasieu/Sabine basins.

**Marine Recreational Fishery Effort (number of angler trips):**

Year	CSA 1	CSA 3	CSA 5	CSA 6	CSA 7	Offshore	Totals
2014	552,802	516,139	456,942	167,240	362,330	171,407	2,226,861
2015	584,987	716,714	452,291	138,546	393,296	140,459	2,426,292
2016	582,157	645,427	466,906	114,261	303,086	130,749	2,242,586
2017	532,832	697,968	446,958	179,957	347,370	100,985	2,306,069
2018	479,491	690,331	556,088	125,831	315,884	108,316	2,275,941
2019	490,411	638,076	480,277	93,897	293,421	112,381	2,108,462
2020	576,822	707,046	566,406	183,171	367,414	104,266	2,505,125

**Spotted Seatrout Harvest (numbers of male and female fish):**

Year	CSA 1	CSA 3	CSA 5	CSA 6	CSA 7	Offshore	Totals
2014	1,334,233	660,583	751,236	154,195	320,131	10,637	3,231,015
2015	1,397,377	1,304,600	1,079,507	51,255	421,625	39,052	4,293,416
2016	1,758,185	1,667,308	1,402,414	52,352	390,206	56,029	5,326,494
2017	1,393,041	1,660,878	1,519,482	121,868	417,754	22,706	5,135,729
2018	652,915	758,369	954,472	41,270	162,052	8,028	2,577,106
2019	800,492	1,254,731	1,202,587	15,586	251,016	17,231	3,541,643
2020	938,028	994,275	1,497,039	78,854	346,500	7,002	3,861,698

**Spotted Seatrout Discards (numbers of male and female fish):**

Year	CSA 1	CSA 3	CSA 5	CSA 6	CSA 7	Offshore	Totals
2014	954,375	1,123,645	911,426	12,171	223,156	2,603	3,227,377
2015	1,574,940	1,508,250	1,193,974	19,055	278,783	6,345	4,581,347
2016	1,704,350	1,522,343	1,467,565	16,834	261,015	3,822	4,975,929
2017	1,102,658	1,356,197	1,410,746	13,857	205,884	1,715	4,091,057
2018	625,451	423,021	592,700	9,919	113,511	822	1,765,424
2019	636,829	1,398,159	1,751,932	13,044	342,414	12,589	4,154,967
2020	1,079,790	1,247,013	1,790,960	15,133	249,169	1,885	4,383,950

Table 2: Annual basin-specific female spotted seatrout recreational harvest and discard estimates as numbers of fish, the percent of female harvest taken by fishing mode (private or charter), and the age composition of female removals (harvest + dead discards) with the corresponding female spotted seatrout sample sizes.

Pontchartrain (CSA 1)										
Year	Harvest	Discards	% Harvest PR	% Harvest CH	Year	n	Age-0	Age-1	Age-2	Age-3+
2014	1,106,101	516,550	83.6%	16.4%	2014	869	0.9%	51.0%	45.6%	2.5%
2015	1,200,555	852,803	93.5%	6.5%	2015	1153	1.6%	57.8%	34.9%	5.7%
2016	1,529,669	925,065	90.5%	9.5%	2016	1171	1.2%	49.4%	44.8%	4.6%
2017	1,168,229	600,380	91.7%	8.3%	2017	814	0.8%	32.2%	61.6%	5.4%
2018	580,145	340,044	94.6%	5.4%	2018	678	1.0%	76.6%	18.3%	4.1%
2019	691,112	347,602	91.2%	8.8%	2019	456	1.6%	64.7%	27.4%	6.3%
2020	844,058	585,307	96.8%	3.2%	2020	503	1.3%	68.1%	26.8%	3.7%

Barataria (CSA 3)										
Year	Harvest	Discards	% Harvest PR	% Harvest CH	Year	n	Age-0	Age-1	Age-2	Age-3+
2014	554,137	606,601	82.5%	17.5%	2014	850	2.0%	49.3%	43.7%	5.0%
2015	1,167,169	814,781	83.0%	17.0%	2015	597	1.6%	77.1%	16.2%	5.0%
2016	1,436,878	822,952	82.2%	17.8%	2016	922	1.0%	66.6%	28.8%	3.7%
2017	1,405,987	735,549	78.0%	22.0%	2017	850	2.0%	60.5%	34.0%	3.6%
2018	615,336	232,184	83.6%	16.4%	2018	576	1.3%	68.1%	24.5%	6.0%
2019	1,120,177	766,631	82.8%	17.2%	2019	753	1.3%	87.5%	10.0%	1.2%
2020	879,460	678,597	87.7%	12.3%	2020	633	1.1%	48.3%	46.8%	3.9%

Terrebonne (CSA 5)										
Year	Harvest	Discards	% Harvest PR	% Harvest CH	Year	n	Age-0	Age-1	Age-2	Age-3+
2014	684,040	503,372	88.9%	11.1%	2014	668	1.5%	68.2%	26.9%	3.3%
2015	903,841	655,534	82.1%	17.9%	2015	778	2.3%	67.9%	27.6%	2.2%
2016	1,191,978	806,262	82.7%	17.3%	2016	826	1.2%	81.4%	15.1%	2.3%
2017	1,351,941	762,623	84.0%	16.0%	2017	497	0.9%	54.5%	42.4%	2.2%
2018	885,960	322,075	86.8%	13.2%	2018	595	1.5%	68.6%	27.0%	2.9%
2019	965,125	945,610	83.9%	16.1%	2019	490	1.7%	82.2%	14.4%	1.7%
2020	1,345,089	970,029	85.1%	14.9%	2020	531	1.1%	61.2%	34.3%	3.3%

Vermilion/Teche (CSA 6)										
Year	Harvest	Discards	% Harvest PR	% Harvest CH	Year	n	Age-0	Age-1	Age-2	Age-3+
2014	125,978	6,796	100.0%	0.0%	2014	67	0.1%	68.5%	25.8%	5.7%
2015	41,170	10,555	100.0%	0.0%	2015	309	0.5%	67.3%	25.1%	7.1%
2016	42,771	9,413	100.0%	0.0%	2016	169	0.4%	78.5%	19.3%	1.8%
2017	86,586	7,580	100.0%	0.0%	2017	209	0.1%	57.9%	29.9%	12.1%
2018	28,633	5,439	100.0%	0.0%	2018	348	0.4%	73.3%	23.4%	2.9%
2019	14,756	8,065	100.0%	0.0%	2019	486	0.8%	93.7%	4.9%	0.6%
2020	64,757	8,410	96.4%	3.6%	2020	270	0.6%	69.7%	28.1%	1.5%

Calcasieu/Sabine (CSA 7)										
Year	Harvest	Discards	% Harvest PR	% Harvest CH	Year	n	Age-0	Age-1	Age-2	Age-3+
2014	242,928	122,238	70.4%	29.6%	2014	640	0.9%	74.8%	17.3%	7.0%
2015	322,252	153,007	63.2%	36.8%	2015	740	0.9%	50.6%	40.9%	7.6%
2016	291,478	143,164	62.8%	37.2%	2016	802	0.9%	63.3%	26.9%	9.0%
2017	328,567	113,401	63.3%	36.7%	2017	463	0.6%	57.2%	34.6%	7.6%
2018	127,091	64,325	52.0%	48.0%	2018	488	2.4%	68.5%	23.7%	5.4%
2019	208,997	188,926	75.5%	24.5%	2019	482	1.9%	84.3%	9.7%	4.1%
2020	259,872	140,712	71.9%	28.1%	2020	371	0.7%	46.1%	50.2%	3.1%

Table 3: Annual basin-specific sample sizes, nominal proportion of positive samples and nominal CPUEs of positive samples, indices of abundance and corresponding coefficients of variation, and the age composition of the female catches with the corresponding female spotted seatrout sample sizes from the 1.0-inch mesh panel of the LDWF fishery-independent marine gillnet survey. Nominal CPUE and abundance indices have been normalized to their individual long-term means for comparison.

Pontchartrain (CSA 1) 1.0-inch mesh:					
Year	n	%Pos	CPUE	IOA	CV
2014	179	25.7%	0.92	1.01	0.12
2015	180	18.3%	1.10	1.01	0.15
2016	182	24.2%	1.00	1.12	0.12
2017	177	19.8%	0.88	0.82	0.14
2018	180	23.3%	1.24	1.23	0.13
2019	179	20.1%	0.89	0.94	0.14
2020	180	18.3%	0.97	0.88	0.15

Year	n	Age-0	Age-1	Age-2	Age-3+
2014	80	0.0%	98.8%	1.2%	0.0%
2015	68	0.7%	96.3%	1.6%	1.4%
2016	83	1.2%	98.8%	0.0%	0.0%
2017	58	0.0%	94.9%	5.0%	0.0%
2018	98	0.0%	100.0%	0.0%	0.0%
2019	60	0.0%	98.3%	0.0%	1.7%
2020	61	3.3%	91.9%	3.2%	1.7%

Barataria (CSA 3) 1.0-inch mesh:					
Year	n	%Pos	CPUE	IOA	CV
2014	170	33.5%	0.84	0.96	0.17
2015	169	33.1%	0.99	0.90	0.18
2016	167	43.1%	0.99	1.18	0.15
2017	168	37.5%	1.31	1.17	0.16
2018	168	29.8%	0.69	0.71	0.19
2019	168	33.3%	1.31	1.00	0.18
2020	152	38.8%	0.87	1.08	0.17

Year	n	Age-0	Age-1	Age-2	Age-3+
2014	129	0.0%	96.9%	3.1%	0.0%
2015	149	0.3%	97.0%	2.0%	0.6%
2016	191	0.3%	96.7%	3.0%	0.0%
2017	221	0.0%	95.5%	3.5%	1.1%
2018	93	0.5%	93.2%	6.2%	0.0%
2019	197	0.5%	98.0%	1.4%	0.0%
2020	138	0.0%	98.0%	2.0%	0.0%

Terrebonne (CSA 5) 1.0-inch mesh:					
Year	n	%Pos	CPUE	IOA	CV
2014	60	56.7%	1.09	1.19	0.26
2015	61	34.4%	0.79	0.53	0.36
2016	61	63.9%	0.73	1.03	0.23
2017	59	52.5%	1.29	1.08	0.28
2018	60	33.3%	0.59	0.44	0.37
2019	60	58.3%	1.10	1.14	0.25
2020	60	65.0%	1.41	1.59	0.23

Year	n	Age-0	Age-1	Age-2	Age-3+
2014	156	0.0%	98.7%	1.3%	0.0%
2015	70	0.0%	92.6%	7.4%	0.0%
2016	120	0.0%	99.2%	0.8%	0.0%
2017	168	0.0%	97.8%	2.2%	0.0%
2018	50	1.5%	92.5%	5.2%	0.9%
2019	162	0.0%	99.4%	0.6%	0.0%
2020	232	0.0%	95.6%	4.4%	0.0%

Vermilion/Teche (CSA 6) 1.0-inch mesh:					
Year	n	%Pos	CPUE	IOA	CV
2014	108	22.2%	1.15	1.63	0.28
2015	108	10.2%	0.62	0.51	0.44
2016	108	18.5%	1.35	1.43	0.31
2017	108	15.7%	0.88	1.00	0.34
2018	108	8.3%	1.08	0.54	0.49
2019	120	11.7%	1.09	0.70	0.38
2020	120	20.0%	0.83	1.18	0.29

Year	n	Age-0	Age-1	Age-2	Age-3+
2014	50	2.0%	96.0%	2.0%	0.0%
2015	12	0.0%	83.6%	13.2%	3.2%
2016	49	2.1%	93.9%	4.0%	0.0%
2017	27	0.0%	96.2%	2.3%	1.5%
2018	18	0.0%	77.8%	21.7%	0.5%
2019	28	0.0%	92.8%	7.1%	0.1%
2020	36	0.0%	83.7%	13.5%	2.8%

Calcasieu/Sabine (CSA 7) 1.0-inch mesh:					
Year	n	%Pos	CPUE	IOA	CV
2014	108	40.7%	0.86	1.67	0.16
2015	108	18.5%	1.31	0.88	0.26
2016	108	21.3%	1.28	1.04	0.24
2017	108	19.4%	0.78	0.75	0.26
2018	108	13.0%	0.66	0.46	0.32
2019	121	23.1%	1.03	0.92	0.22
2020	100	28.0%	1.08	1.28	0.21

Year	n	Age-0	Age-1	Age-2	Age-3+
2014	74	0.0%	91.9%	4.1%	4.0%
2015	51	0.0%	66.6%	2.3%	31.1%
2016	58	0.0%	86.4%	10.1%	3.5%
2017	32	0.0%	50.9%	21.4%	27.8%
2018	18	0.0%	78.0%	5.7%	16.3%
2019	57	0.0%	96.6%	3.4%	0.0%
2020	59	0.0%	90.2%	9.1%	0.7%

Table 4: Annual basin-specific sample sizes, nominal proportion of positive samples and nominal CPUEs of positive samples, indices of abundance and corresponding coefficients of variation, and the age composition of the female catches with the corresponding female spotted seatrout sample sizes from the 1.25-inch mesh panel of the LDWF fishery-independent marine gillnet survey. Nominal CPUE and abundance indices have been normalized to their individual long-term means for comparison.

Pontchartrain (CSA 1) 1.25-inch mesh:					
Year	n	%Pos	CPUE	IOA	CV
2014	179	20.7%	0.88	0.98	0.20
2015	180	18.9%	0.81	0.85	0.21
2016	182	18.1%	1.16	0.97	0.21
2017	177	23.2%	1.08	1.36	0.19
2018	180	20.0%	0.98	1.06	0.20
2019	179	11.7%	1.00	0.62	0.27
2020	180	20.0%	1.10	1.16	0.20

Year	n	Age-0	Age-1	Age-2	Age-3+
2014	67	0.0%	86.8%	11.7%	1.5%
2015	56	1.8%	73.8%	19.5%	5.0%
2016	78	0.0%	91.2%	8.7%	0.0%
2017	91	0.0%	84.1%	14.8%	1.1%
2018	72	0.0%	89.1%	6.8%	4.1%
2019	43	0.0%	97.6%	2.4%	0.0%
2020	81	0.0%	85.8%	14.2%	0.0%

Barataria (CSA 3) 1.25-inch mesh:					
Year	n	%Pos	CPUE	IOA	CV
2014	170	27.6%	1.02	0.96	0.19
2015	169	32.5%	0.88	1.06	0.17
2016	167	30.5%	0.81	0.93	0.18
2017	168	34.5%	1.46	1.22	0.17
2018	168	32.1%	0.82	1.00	0.18
2019	168	28.0%	1.08	0.84	0.19
2020	152	30.9%	0.93	1.00	0.19

Year	n	Age-0	Age-1	Age-2	Age-3+
2014	137	0.0%	95.0%	5.0%	0.0%
2015	138	0.0%	90.3%	9.7%	0.0%
2016	118	0.0%	95.0%	5.0%	0.0%
2017	242	0.0%	82.8%	17.2%	0.1%
2018	126	0.0%	96.9%	3.1%	0.0%
2019	145	0.0%	100.0%	0.0%	0.0%
2020	124	0.0%	98.3%	1.7%	0.0%

Terrebonne (CSA 5) 1.25-inch mesh:					
Year	n	%Pos	CPUE	IOA	CV
2014	60	68.3%	0.75	1.21	0.17
2015	61	27.9%	1.03	0.59	0.31
2016	61	42.6%	0.66	0.72	0.24
2017	59	49.2%	0.81	1.03	0.22
2018	60	38.3%	1.01	0.88	0.26
2019	60	43.3%	0.84	0.88	0.24
2020	60	60.0%	1.90	1.70	0.19

Year	n	Age-0	Age-1	Age-2	Age-3+
2014	116	0.0%	95.6%	2.4%	2.0%
2015	66	0.0%	83.9%	16.0%	0.1%
2016	65	0.8%	93.3%	5.9%	0.0%
2017	89	0.0%	90.2%	9.3%	0.5%
2018	87	0.0%	90.6%	8.3%	1.1%
2019	82	0.0%	94.1%	5.9%	0.0%
2020	258	0.0%	90.8%	8.9%	0.4%

Vermilion/Teche (CSA 6) 1.25-inch mesh:					
Year	n	%Pos	CPUE	IOA	CV
2014	108	28.7%	0.82	1.24	0.14
2015	108	13.0%	1.10	0.80	0.23
2016	108	16.7%	1.58	1.46	0.20
2017	108	21.3%	0.84	1.00	0.17
2018	108	17.6%	0.94	0.85	0.19
2019	120	16.7%	0.76	0.73	0.19
2020	120	20.0%	0.97	0.91	0.17

Year	n	Age-0	Age-1	Age-2	Age-3+
2014	60	0.0%	83.7%	16.3%	0.0%
2015	37	0.0%	89.3%	10.6%	0.1%
2016	67	0.0%	83.9%	13.8%	2.3%
2017	46	0.0%	76.1%	22.7%	1.2%
2018	42	0.0%	72.1%	25.5%	2.5%
2019	36	0.0%	97.4%	2.6%	0.0%
2020	55	0.0%	84.3%	15.6%	0.2%

Calcasieu/Sabine (CSA 7) 1.25-inch mesh:					
Year	n	%Pos	CPUE	IOA	CV
2014	108	38.0%	1.14	1.85	0.17
2015	108	17.6%	0.99	0.84	0.27
2016	108	25.0%	1.33	1.31	0.22
2017	108	15.7%	1.02	0.75	0.29
2018	108	14.8%	1.12	0.78	0.30
2019	121	17.4%	0.74	0.67	0.26
2020	100	22.0%	0.66	0.79	0.25

Year	n	Age-0	Age-1	Age-2	Age-3+
2014	100	0.0%	73.3%	21.2%	5.5%
2015	40	0.0%	87.9%	9.5%	2.6%
2016	76	0.0%	66.5%	29.6%	3.9%
2017	37	0.0%	83.8%	7.4%	8.8%
2018	38	0.0%	64.2%	35.6%	0.2%
2019	33	0.0%	73.2%	23.6%	3.2%
2020	31	0.0%	87.5%	12.4%	0.1%

Table 5: Annual basin-specific sample sizes, nominal proportion of positive samples and nominal CPUEs of positive samples, indices of abundance and corresponding coefficients of variation, and the age composition of the female catches with the corresponding female spotted seatrout sample sizes from the 1.5-inch mesh panel of the LDWF fishery-independent marine gillnet survey. Nominal CPUE and abundance indices have been normalized to their individual long-term means for comparison.

Pontchartrain (CSA 1) 1.5-inch mesh:											
Year	n	%Pos	CPUE	IOA	CV	Year	n	Age-0	Age-1	Age-2	Age-3+
2014	179	10.6%	0.82	0.92	0.21	2014	28	0.0%	85.9%	14.0%	0.0%
2015	180	9.4%	0.88	0.91	0.23	2015	27	0.0%	66.7%	24.4%	8.8%
2016	182	11.0%	1.20	1.29	0.21	2016	43	0.0%	58.8%	33.9%	7.3%
2017	177	18.1%	0.96	1.82	0.16	2017	55	0.0%	71.5%	24.7%	3.8%
2018	180	5.6%	1.00	0.62	0.30	2018	18	0.0%	56.5%	32.7%	10.8%
2019	179	1.7%	0.93	0.19	0.56	2019	5	0.0%	60.7%	39.2%	0.1%
2020	180	9.4%	1.21	1.25	0.23	2020	37	0.0%	68.4%	31.6%	0.1%

Barataria (CSA 3) 1.5-inch mesh:											
Year	n	%Pos	CPUE	IOA	CV	Year	n	Age-0	Age-1	Age-2	Age-3+
2014	170	14.1%	1.22	1.40	0.26	2014	67	0.0%	78.0%	21.9%	0.1%
2015	169	12.4%	0.78	0.88	0.28	2015	38	0.0%	71.4%	28.4%	0.3%
2016	167	13.8%	0.88	0.96	0.27	2016	46	0.0%	74.5%	24.6%	0.9%
2017	168	15.5%	1.62	1.58	0.25	2017	96	0.0%	40.4%	58.3%	1.3%
2018	168	9.5%	0.93	0.76	0.33	2018	34	0.0%	62.5%	34.5%	3.0%
2019	168	6.5%	0.88	0.50	0.40	2019	22	0.0%	68.9%	30.9%	0.2%
2020	152	14.5%	0.70	0.92	0.28	2020	35	0.0%	77.5%	22.4%	0.2%

Terrebonne (CSA 5) 1.5-inch mesh:											
Year	n	%Pos	CPUE	IOA	CV	Year	n	Age-0	Age-1	Age-2	Age-3+
2014	59	22.0%	1.13	1.47	0.33	2014	40	0.0%	51.3%	47.5%	1.2%
2015	61	13.1%	1.15	0.86	0.44	2015	25	0.0%	76.3%	20.0%	3.8%
2016	61	14.8%	0.43	0.52	0.41	2016	11	4.8%	56.5%	37.2%	1.5%
2017	59	25.4%	0.56	1.08	0.31	2017	23	0.0%	65.5%	29.1%	5.3%
2018	60	15.0%	1.39	0.90	0.41	2018	34	0.0%	57.1%	42.8%	0.1%
2019	60	11.7%	1.05	0.61	0.47	2019	20	0.0%	55.2%	44.3%	0.5%
2020	60	20.0%	1.29	1.55	0.35	2020	42	0.0%	74.3%	25.4%	0.3%

Vermilion/Teche (CSA 6) 1.5-inch mesh:											
Year	n	%Pos	CPUE	IOA	CV	Year	n	Age-0	Age-1	Age-2	Age-3+
2014	108	17.6%	1.08	1.28	0.23	2014	47	0.0%	32.5%	62.8%	4.7%
2015	108	13.9%	0.73	0.93	0.27	2015	25	0.0%	29.8%	69.5%	0.8%
2016	107	10.3%	0.88	0.75	0.32	2016	22	0.0%	28.5%	65.7%	5.8%
2017	108	12.0%	1.55	1.38	0.29	2017	46	0.0%	32.9%	59.5%	7.6%
2018	108	17.6%	1.06	1.20	0.23	2018	46	0.0%	34.2%	64.3%	1.6%
2019	120	7.5%	0.88	0.55	0.35	2019	18	0.0%	67.1%	32.4%	0.5%
2020	120	14.2%	0.83	0.91	0.25	2020	32	0.0%	20.5%	73.9%	5.6%

Calcasieu/Sabine (CSA 7) 1.5-inch mesh:											
Year	n	%Pos	CPUE	IOA	CV	Year	n	Age-0	Age-1	Age-2	Age-3+
2014	108	18.5%	1.34	1.49	0.30	2014	59	0.0%	33.7%	51.9%	14.4%
2015	108	11.1%	0.80	0.77	0.40	2015	21	0.0%	34.4%	41.8%	23.8%
2016	108	18.5%	1.47	1.90	0.30	2016	64	0.0%	30.6%	55.9%	13.4%
2017	108	12.0%	0.74	0.80	0.38	2017	21	0.0%	44.6%	55.3%	0.1%
2018	108	11.1%	0.65	0.67	0.40	2018	17	0.0%	48.1%	51.6%	0.3%
2019	121	6.6%	1.37	0.53	0.50	2019	24	0.0%	67.4%	28.4%	4.2%
2020	100	14.0%	0.65	0.83	0.36	2020	20	0.0%	80.4%	19.5%	0.0%

**Figures:**

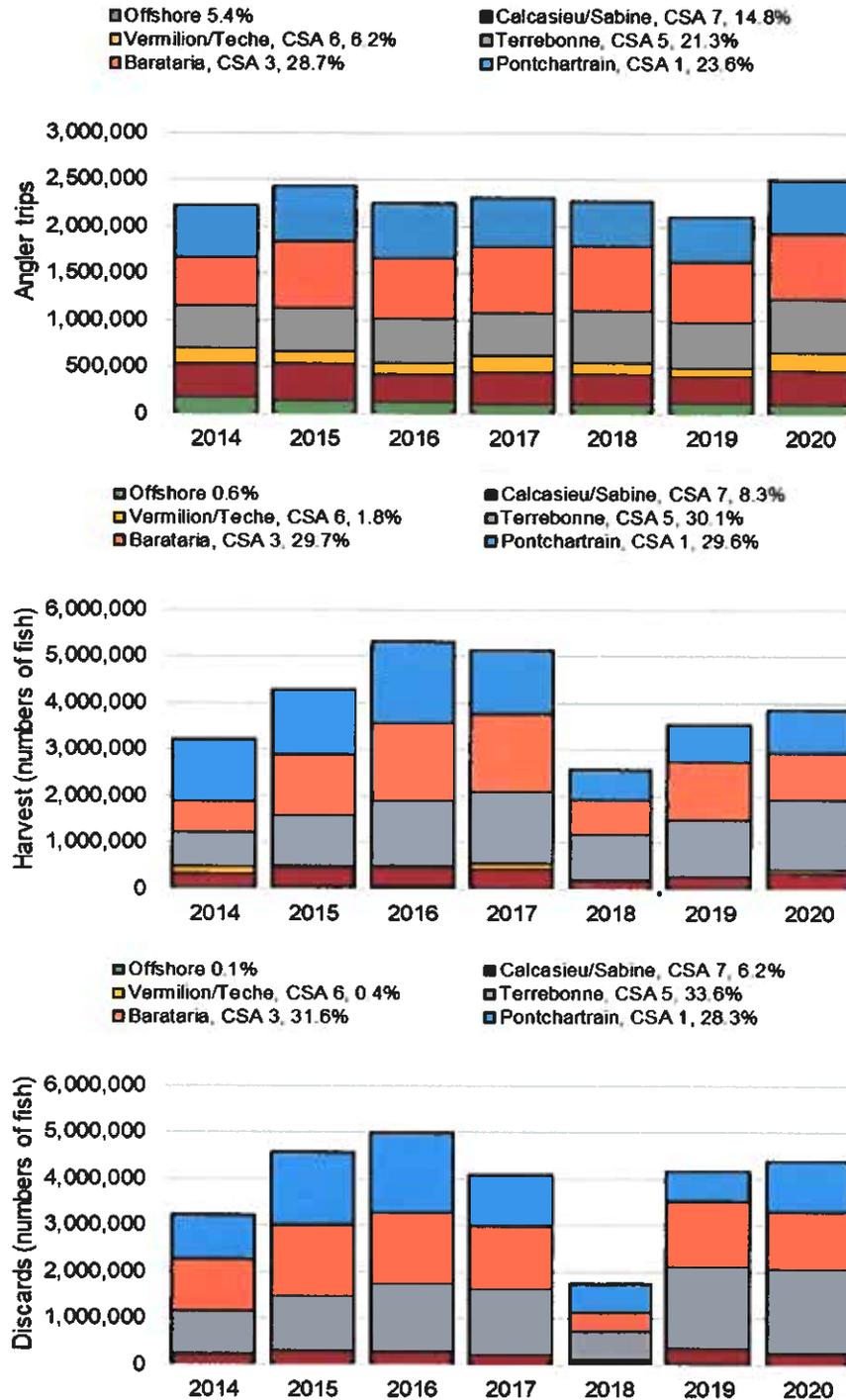
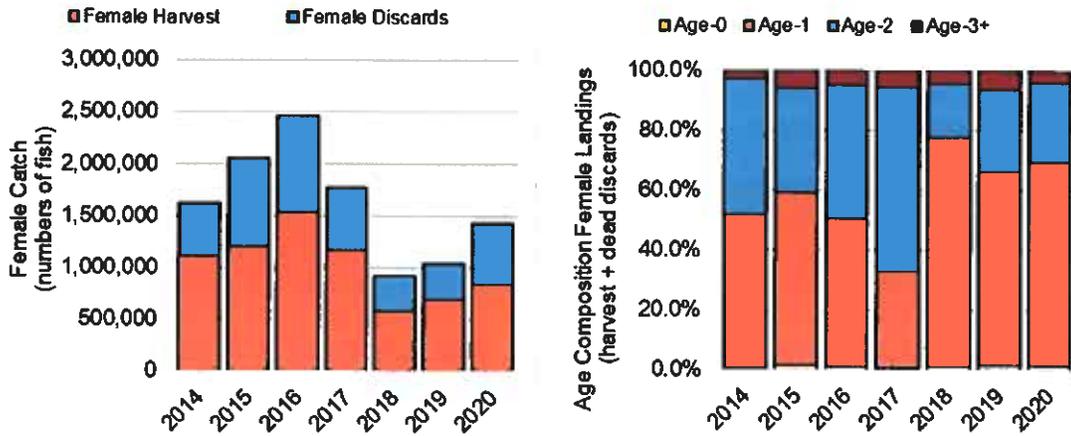
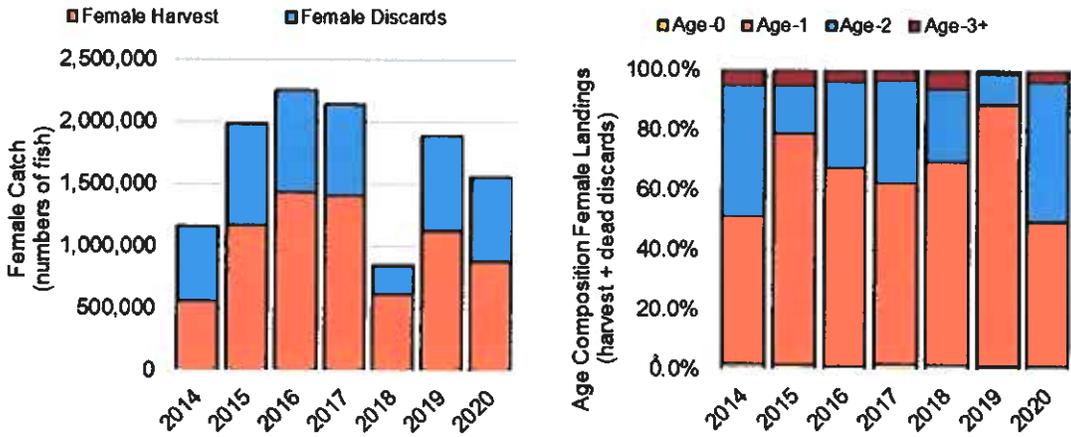


Figure 1: Annual basin-specific recreational fishing effort estimates (angler trips; top graphic), spotted seatrout harvest estimates (numbers of male and female fish; center graphic), and spotted seatrout discard estimates (numbers of male and female fish; bottom graphic). Values in legends represent the mean percentages of the time series (2014-2020).

Pontchartrain (CSA 1):



Barataria (CSA 3):



Terrebonne (CSA 5):

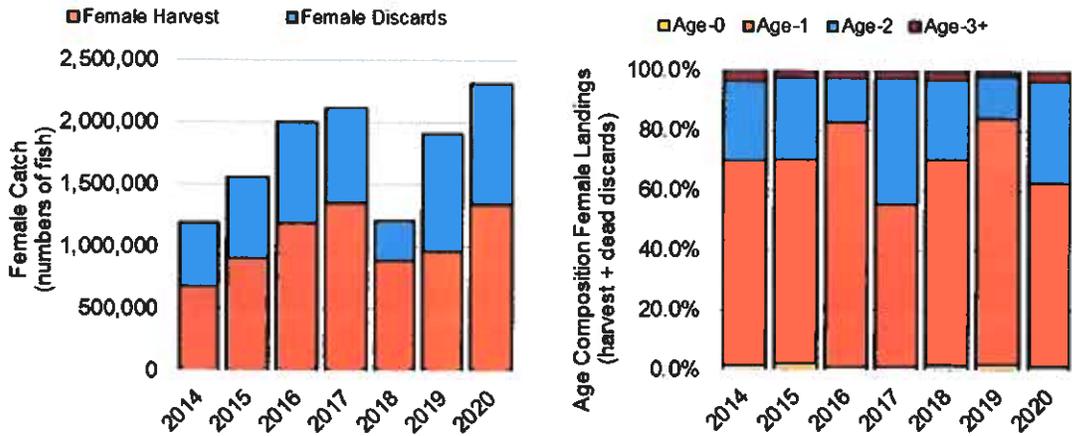
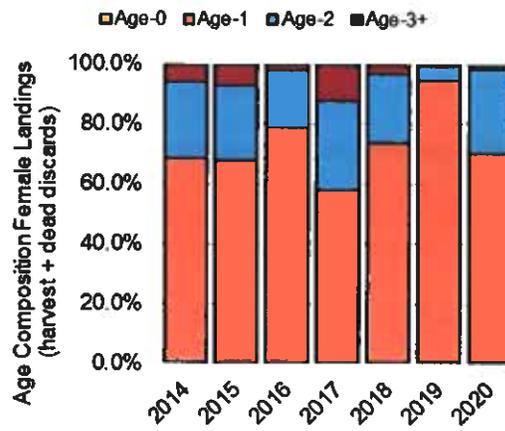
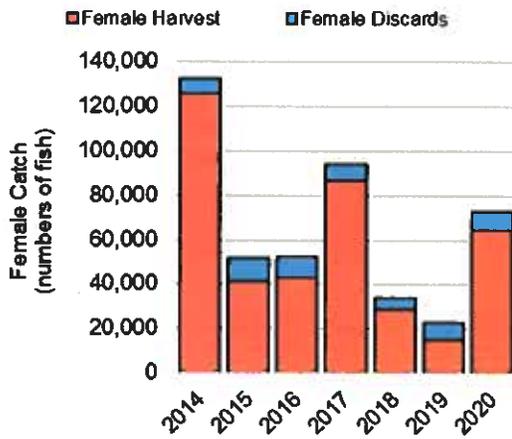


Figure 2: Annual basin-specific female spotted seatrout recreational catch estimates (harvest and discards) as numbers of fish, and the age composition of female landings (harvest + dead discards).

Vermilion/Teche (CSA 6):



Calcasieu/Sabine (CSA 7):

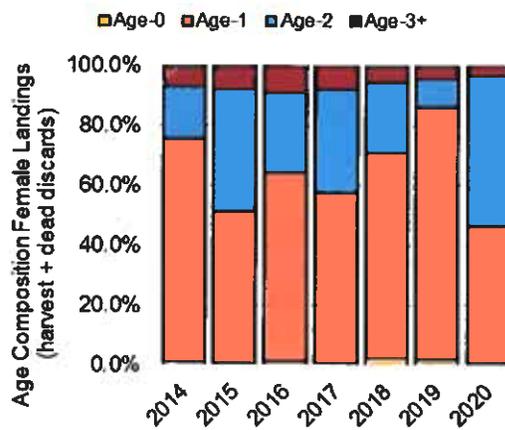
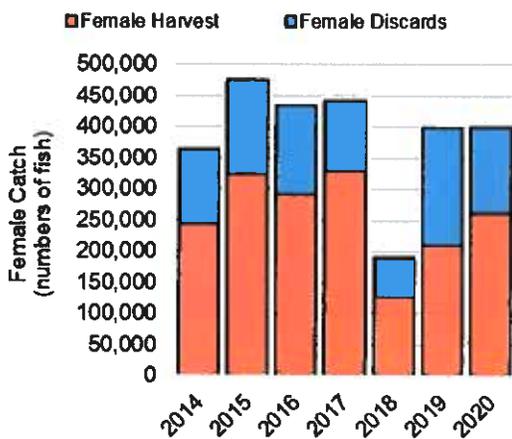
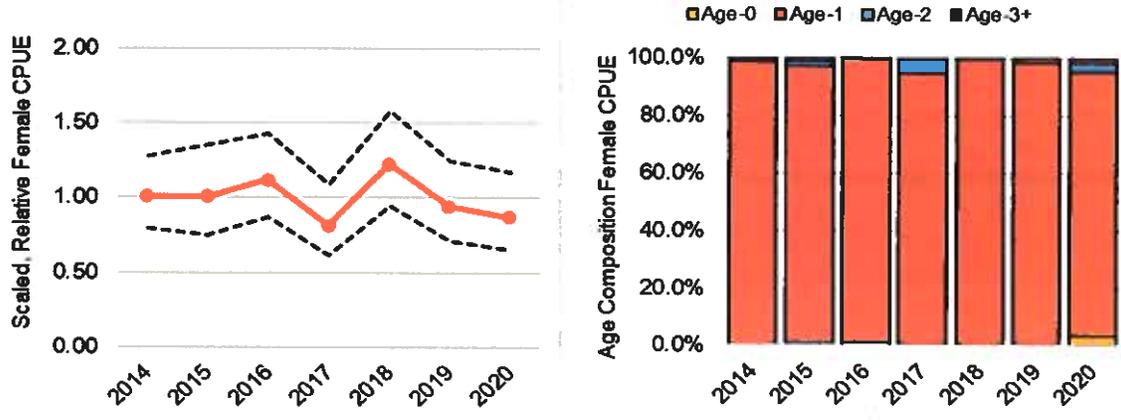
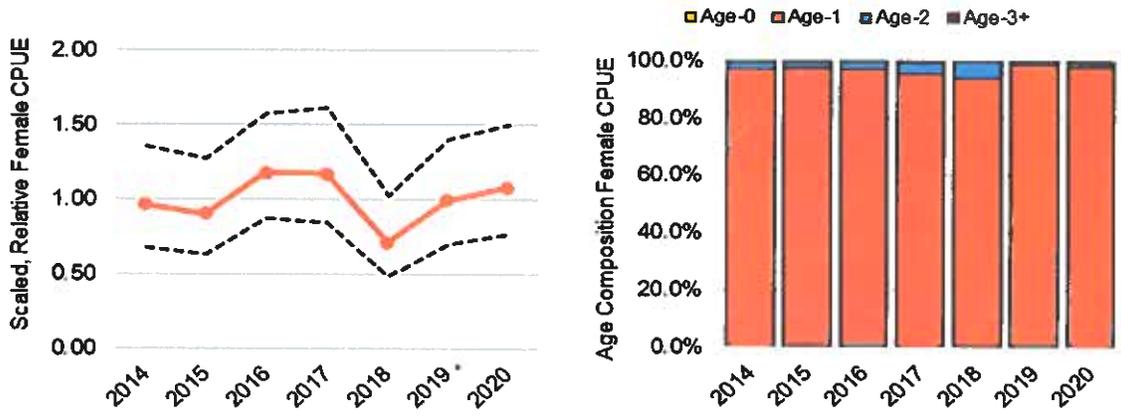


Figure 2: (continued)

Pontchartrain (CSA 1) 1.0-inch mesh:



Barataria (CSA 3) 1.0-inch mesh:



Terrebonne (CSA 5) 1.0-inch mesh:

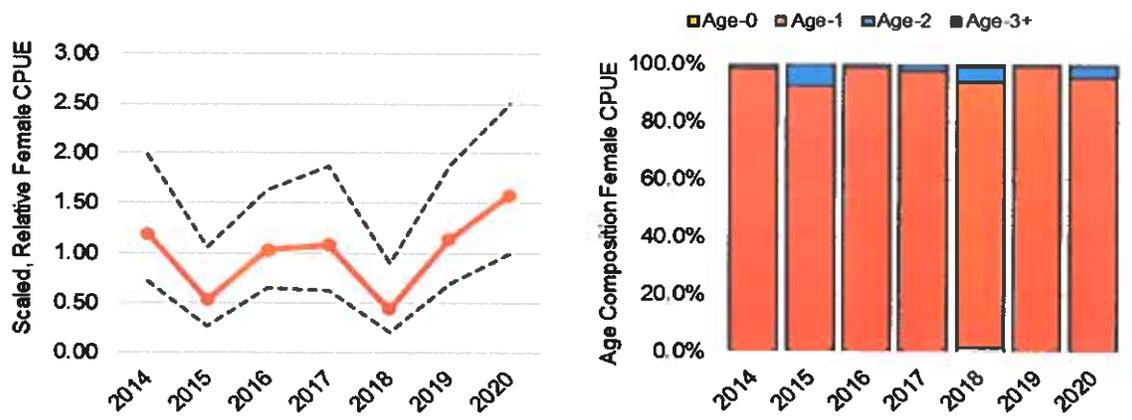
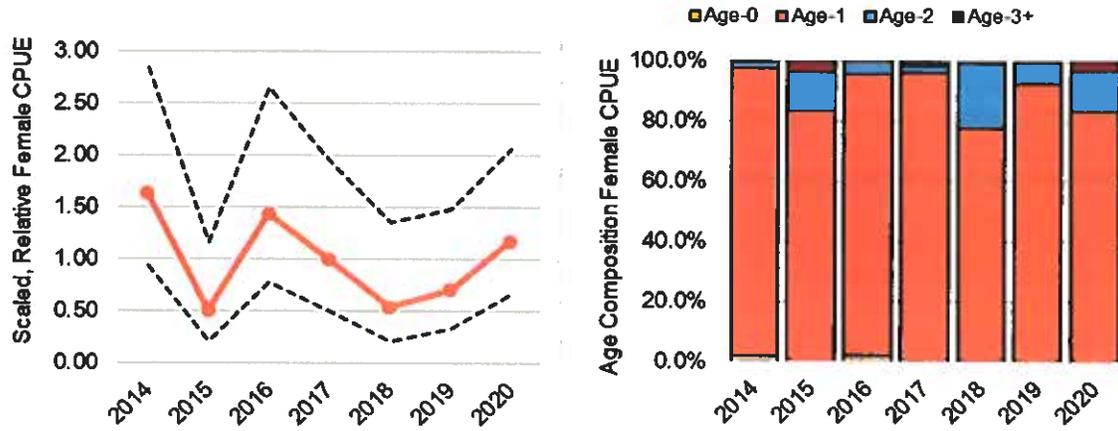


Figure 3: Annual basin-specific indices of abundance and 95% confidence intervals, and the age composition of the female catches derived from the 1.0-inch mesh panel of the LDWF fishery-independent marine gillnet survey. Abundance indices have been normalized to their individual long-term means

Vermilion/Teche (CSA 6) 1.0-inch mesh:



Calcasieu/Sabine (CSA 7) 1.0-inch mesh:

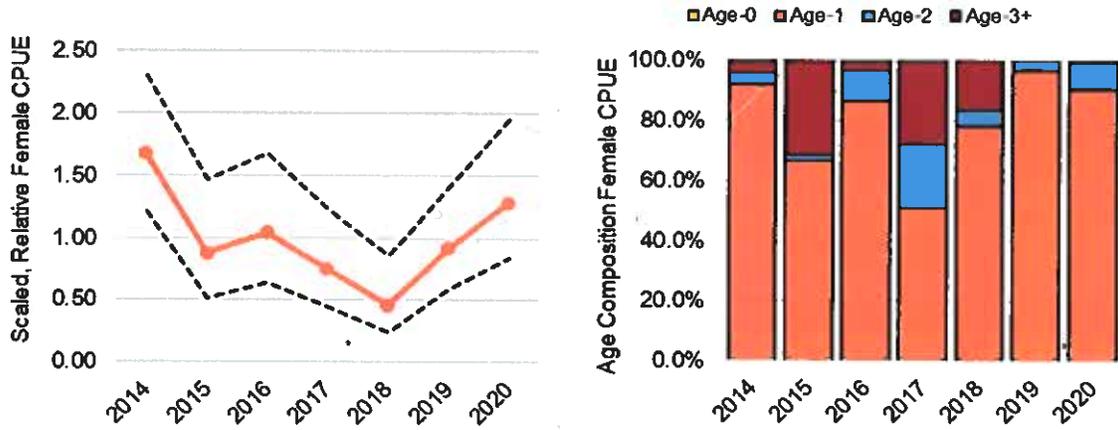
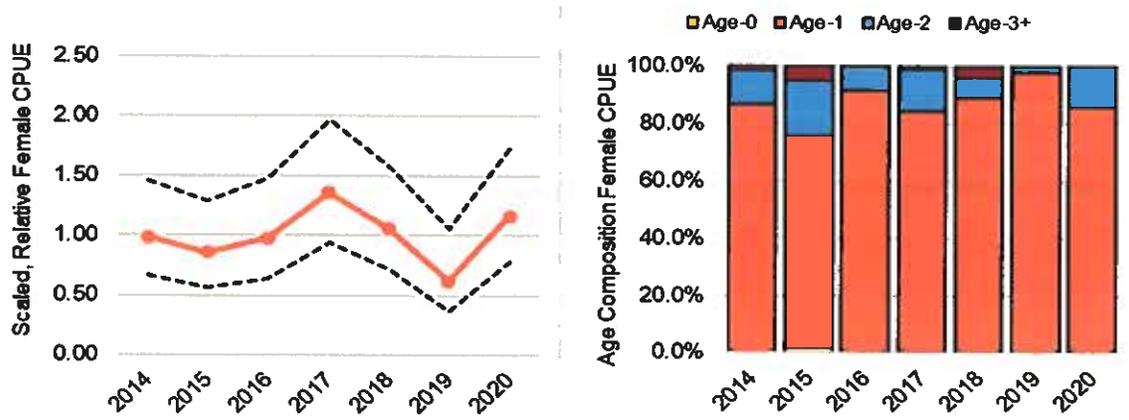
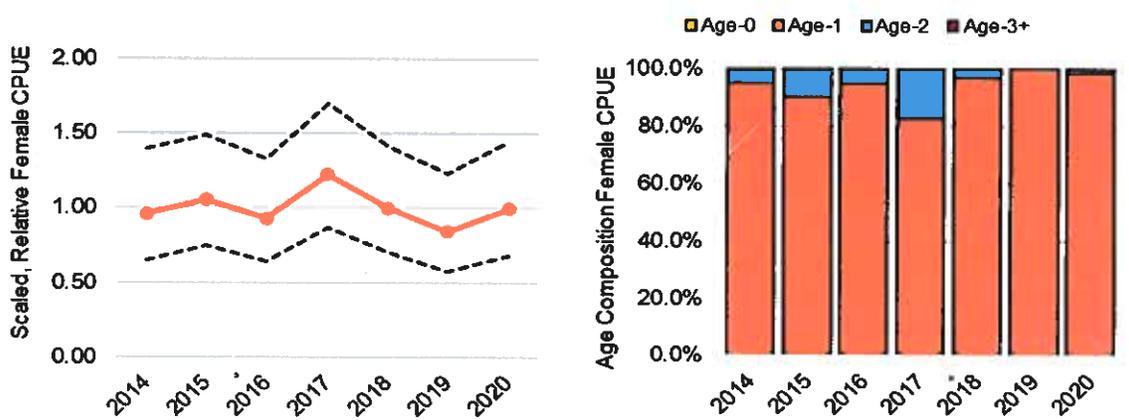


Figure 3: (continued)

Pontchartrain (CSA 1) 1.25-inch mesh:



Barataria (CSA 3) 1.25-inch mesh:



Terrebonne (CSA 5) 1.25-inch mesh:

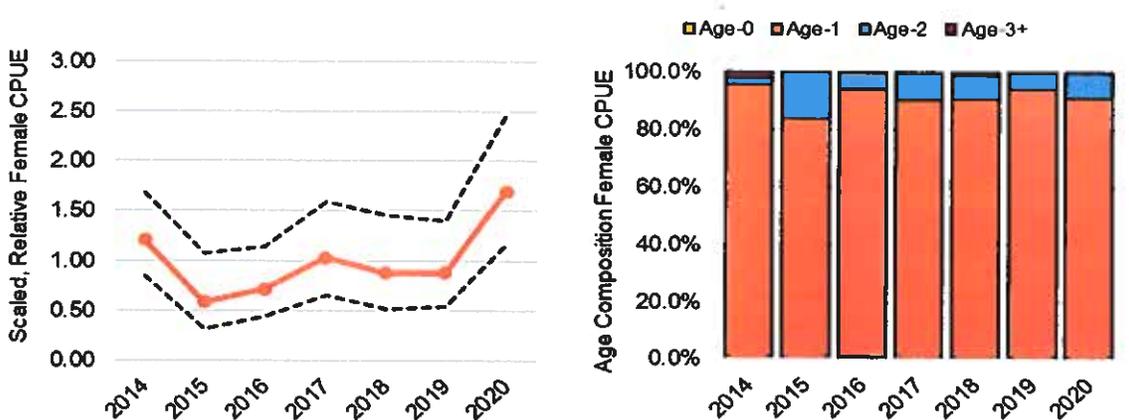
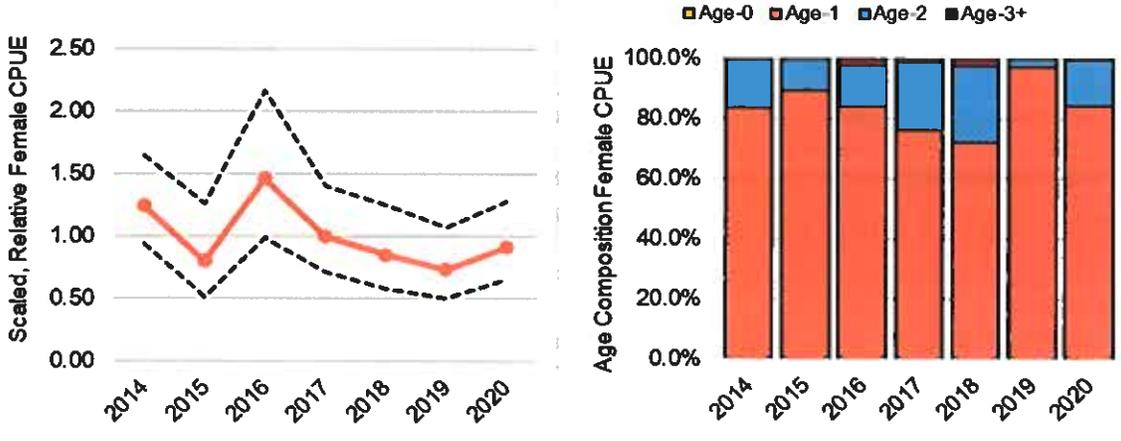


Figure 4: Annual basin-specific indices of abundance and 95% confidence intervals, and the age composition of the female catches derived from the 1.25-inch mesh panel of the LDWF fishery-independent marine gillnet survey. Abundance indices have been normalized to their individual long-term means

Vermilion/Teche (CSA 6) 1.25-inch mesh:



Calcasieu/Sabine (CSA 7) 1.25-inch mesh:

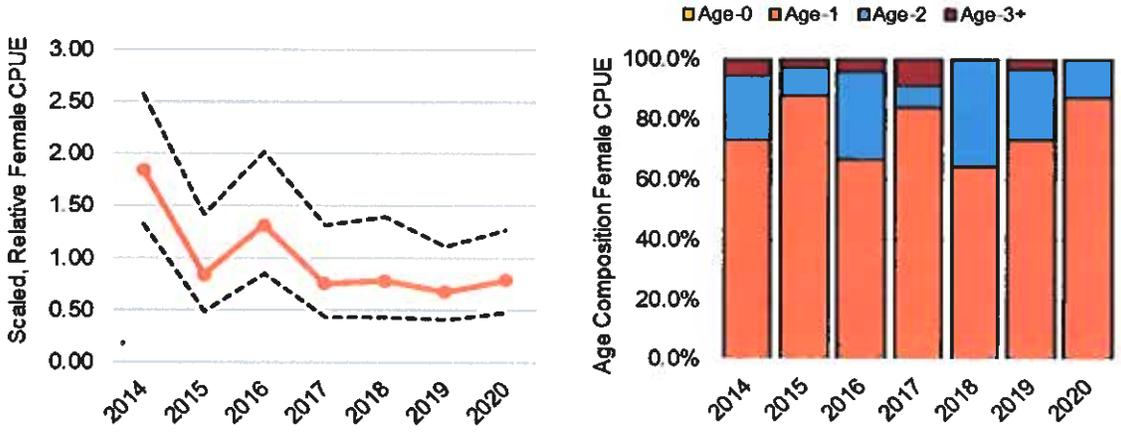
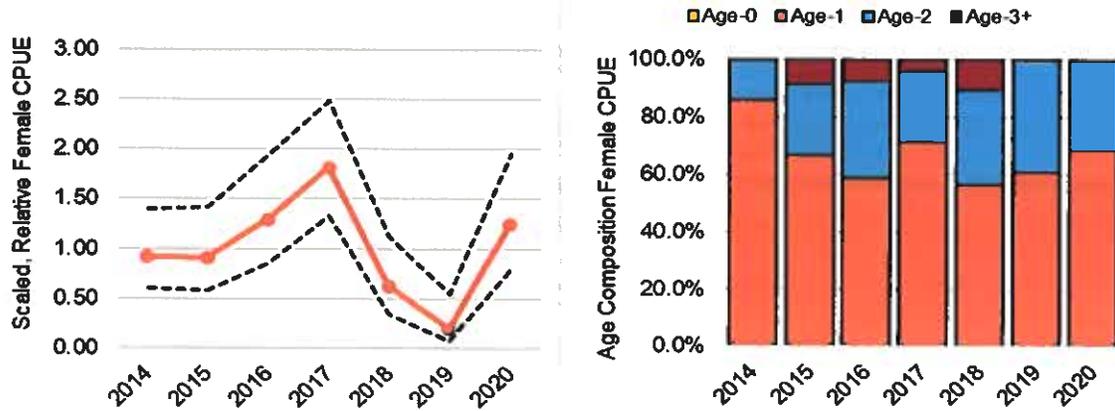
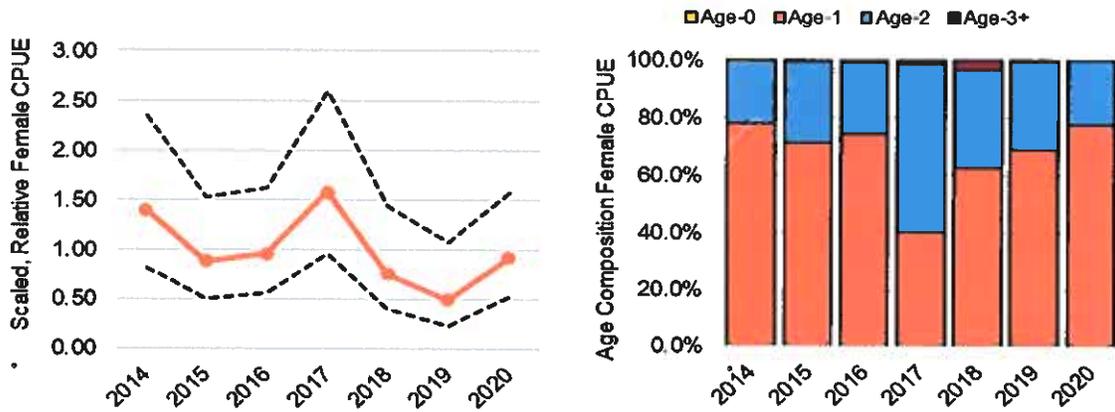


Figure 4: (continued)

Pontchartrain (CSA 1) 1.5-inch mesh:



Barataria (CSA 3) 1.5-inch mesh:



Terrebonne (CSA 5) 1.5-inch mesh:

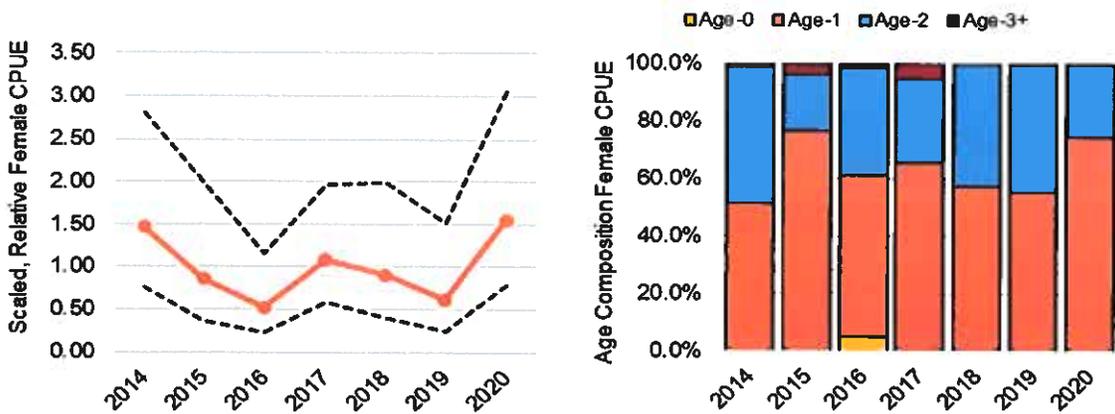
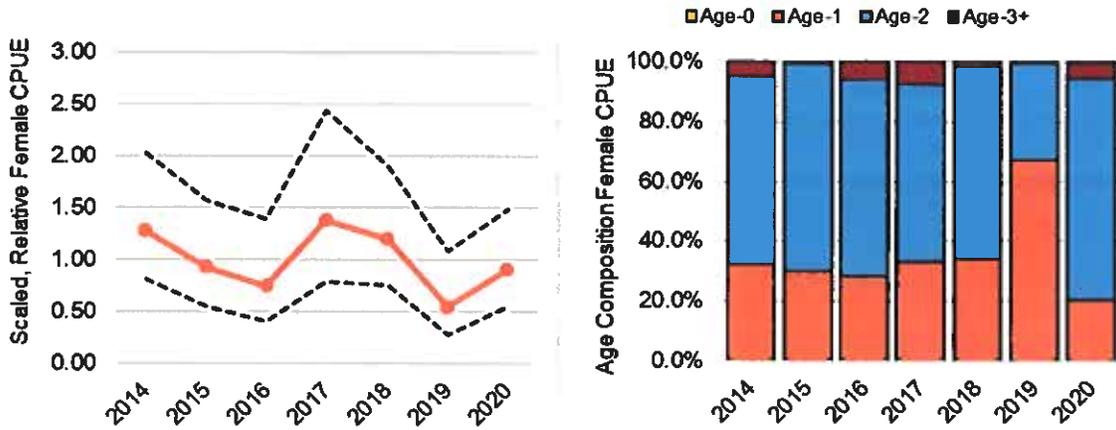


Figure 5: Annual basin-specific indices of abundance and 95% confidence intervals, and the age composition of the female catches derived from the 1.5-inch mesh panel of the LDWF fishery-independent marine gillnet survey. Abundance indices have been normalized to their individual long-term means

Vermilion/Teche (CSA 6) 1.5-inch mesh:



Calcasieu/Sabine (CSA 7) 1.5-inch mesh:

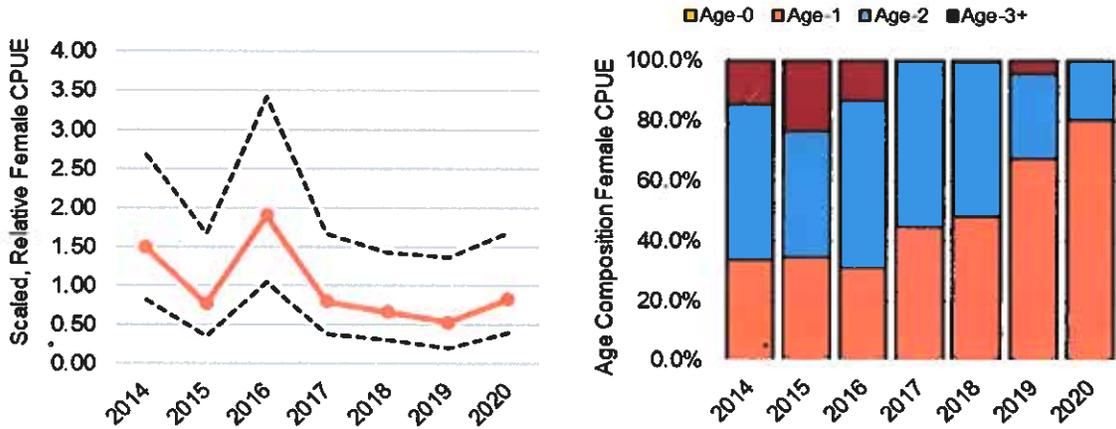


Figure 5: (continued)



## Shark Limits and Seasons Discussion

Jason Adriance | LWFC Meeting | November 4, 2021

## Quotas and Commercial Seasons

- Commercial quotas and seasons established at the federal level
- Three groups of sharks with quotas (Large Coastal (LCS), Pelagic Sharks, and Small Coastal (SCS))
  - LCS – blacktip, bull, lemon, tiger, spinner, nurse, smooth hammerhead, great hammerhead, scalloped hammerhead, silky, and sandbar
  - SCS – sharpnose, bonnethead, blacknose, and finetooth
  - Pelagic – common thresher, shortfin mako, oceanic whitetip, blue, and porbeagle
- Gulf of Mexico (GOM) LCS commercial quota split between the eastern GOM and the western GOM, pelagic sharks is nationwide Atlantic and GOM quota



# Quotas and Commercial Seasons

- Western Gulf of Mexico LCS quota contains three subgroups
  - Blacktip Sharks
  - Aggregated Large Coastal Sharks
  - Hammerhead Sharks
- 2021 commercial Western GOM LCS Quotas (if hammerhead quota is met, aggregated LCS closes)
  - Blacktip – 765,392 pounds
  - Aggregated LCS – 158,724 pounds
  - Hammerhead – 26,301 pounds
- Commercial LCS season usually opens January 1 of each year until the quota is met at a 45 shark per day limit
- All shark possession prohibited in Louisiana April through June each year for both Recreational and Commercial

## Recreational Limits

- Atlantic Sharpnose and Bonnethead – 1 daily per person with no size limit
- Shortfin Mako – 1 in aggregate per vessel per trip with a male minimum size of 71" fork length and a female minimum size of 83" fork length
- All other sharks – 1 in aggregate per vessel per trip with a minimum size limit of 54" fork length
- 22 prohibited sharks (Atlantic angel, basking, bigeye sand tiger, bigeye sixgill, bigeye thresher, bignose, Caribbean reef, Caribbean sharpnose, dusky, Galapagos, longfin mako, largetooth sawfish, narrowtooth, night, sandbar, sand tiger, sevengill, silky, sixgill, smalltail, whale, and white sharks)



# Landings

- Recreational landings are mostly blacktip sharks (average of 320 per year) and some “unclassified” or unidentified sharks (average of 373 per year) which are likely small coastals such as bonnethead or sharpnose. Occasionally a mako or lemon shark is landed.
- Commercial Landings in most years are confidential due to the small number of dealers.
  - 2020 All Large Coastal Sharks – 810,027 lbs
  - 2020 Small Coastal – Confidential
  - 2020 Pelagic Sharks – 4,412 lbs

## Participation and Challenges

- Approximately 346 commercial fishermen held a state shark permit in 2020 and 214 in 2021 (limited to fishing state waters only)
- About 12 federal directed permit holders (federal permits are limited access and must be acquired from someone who already has a permit)
- Shark fishery is an in-between fishery, it is before the shrimp season and at a time of year that not much else is available, markets are through Mexico mainly
- Several years ago a Texas state law banned the transport of sharks with fins unattached and this created issues that have since been overcome, but at higher burden on the fishery (landings dropped to tens of thousands of pounds versus hundreds of thousands in 2019)



# Participation and Challenges

- Fins are the highest value product from sharks and now must be transported attached to a shark prior to being removed and sold, previously removed at the dock in Louisiana prior to sharks being shipped separately
- Establishment of quotas, regulatory changes, and market shifts changed the seasonal structure and eliminated a traditional summer fishery in the Atchafalaya Basin that target mainly bull sharks
- Federal quotas will not be adjusted without new stock assessments and accountability measures in place (blacktip awaiting adjustment until after accountability measures amendment)
- Bull sharks in Gulf of Mexico unlikely to be assessed anytime soon, so no quota relief anytime soon

## Depredation

- National, not just Louisiana issue
- Being looked at by both the Gulf Council and researchers in the Gulf of Mexico region (non-lethal deterrent methods, degree of depredation, etc.)



# Questions ?

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