Southern Flounder

Paralichthys lethostigma

Gulf of Mexico

Handlines and harpoon

Report ID 27899

June 5, 2023

Seafood Watch Standard used in this assessment: Fisheries Standard v3

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About Seafood Watch

Monterey Bay Aquarium's Seafood Watch program evaluates the environmental sustainability of wild-caught and farmed seafood commonly found in the United States marketplace. Seafood Watch defines sustainable seafood as originating from sources, whether wild-caught or farmed, which can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems. The program's goals are to raise awareness of important ocean conservation issues and empower seafood consumers and businesses to make choices for healthy oceans.

Seafood Watch's science-based ratings are available at www.SeafoodWatch.org. Each rating is supported by a Seafood Watch assessment, in which the fishery or aquaculture operation is evaluated using the Seafood Watch standard.

Seafood Watch standards are built on our guiding principles, which outline the necessary environmental sustainability elements for fisheries and aquaculture operations. The guiding principles differ across standards, reflecting the different impacts of fisheries and aquaculture.

- Seafood rated Best Choice comes from sources that operate in a manner that's consistent with our guiding principles. The seafood is caught or farmed in ways that cause little or no harm to other wildlife or the environment.

- Seafood rated Good Alternative comes from sources that align with most of our guiding principles. However, one issue needs substantial improvement, or there's significant uncertainty about the impacts on wildlife or the environment.

- Seafood rated Avoid comes from sources that don't align with our guiding principles. The seafood is caught or farmed in ways that have a high risk of causing harm to wildlife or the environment. There's a critical conservation concern or many issues need substantial improvement.

Each assessment follows an eight-step process, which prioritizes rigor, impartiality, transparency and accessibility. They are conducted by Seafood Watch scientists, in collaboration with scientific, government, industry and conservation experts and are open for public comment prior to publication. Conditions in wild capture fisheries and aquaculture operations can change over time; as such assessments and ratings are updated regularly to reflect current practice.

More information on Seafood Watch guiding principles, standards, assessments and ratings are available at www.SeafoodWatch.org.

Guiding Principles

Seafood Watch defines sustainable seafood as originating from sources, whether fished[1] or farmed, that can maintain or increase production in the long term without jeopardizing the structure or function of affected ecosystems.

The following guiding principles illustrate the qualities that fisheries must possess to be considered sustainable by the Seafood Watch program (these are explained further in the Seafood Watch Standard for Fisheries):

- Follow the principles of ecosystem-based fisheries management.
- Ensure all affected stocks are healthy and abundant.
- Fish all affected stocks at sustainable levels.
- Minimize bycatch.
- Have no more than a negligible impact on any threatened, endangered, or protected species.
- Managed to sustain the long-term productivity of all affected species.
- Avoid negative impacts on the structure, function, or associated biota of aquatic habitats where fishing occurs.
- Maintain the trophic role of all aquatic life.
- Do not result in harmful ecological changes such as reduction of dependent predator populations, trophic cascades, or phase shifts.
- Ensure that any enhancement activities and fishing activities on enhanced stocks do not negatively affect the diversity, abundance, productivity, or genetic integrity of wild stocks.

These guiding principles are operationalized in the four criteria in this standard.Each criterion includes:

- Factors to evaluate and score
- Guidelines for integrating these factors to produce a numerical score and rating

Once a rating has been assigned to each criterion, Seafood Watch develops an overall recommendation. Criteria ratings and the overall recommendation are color coded to correspond to the categories on the Seafood Watch pocket guides and online guide:

Best Choice/Green: Buy first; they're well managed and caught or farmed responsibly.

Good Alternative/Yellow: Buy, but be aware there are concerns with how they're caught, farmed or managed.

Avoid/Red: Take a pass on these for now; they're caught or farmed in ways that harm other marine life or the environment.

[1] "Fish" is used throughout this document to refer to finfish, shellfish and other invertebrates

Summary

This report provides a recommendation for southern flounder (*Paralichthys lethostigma*) caught off the coast of Texas (U.S.) in the Gulf of Mexico. The primary fishing methods for southern flounder in this area are handlines, hand-operated pole-and-lines, and gig (a single- or multi-pronged spear used for fishing). Gig is being grouped under harpoons as a spear-like implement used in fishing.

The southern flounder is distributed in the Western Central Atlantic Ocean off the U.S. coast from North Carolina to Florida; it is absent along Florida's southern peninsula, but present throughout the Gulf of Mexico. Southern flounder is a demersal species generally found on muddy or silty substrate in estuary or nearshore waters most of the year, with sexually-mature individuals migrating to open Gulf waters to spawn when water temperatures drop in the fall (October to December). Juvenile and small southern flounder feed primarily on invertebrates, while adults and larger individuals prefer fish. Fishery-dependent and -independent information is collected yearly on the southern flounder in Texas.

The restriction of gear to gig, handlines, and hand-operated pole-and-lines, imposed by the Texas Parks and Wildlife Department, produces minimal negative impacts to the environment. Also, these fishing methods lead to quite limited by-catch. Sheepshead and black drum are targeted and retained in the gig fishery along with southern flounder, but neither is overfished or experiencing overfishing.

The Texas Parks and Wildlife Department (TPWD), through the Texas Parks and Wildlife Commission, is the direct managing entity of the southern flounder commercial and recreational fishery up to 9 nautical miles (nm) off the coast of Texas. The TPWD has implemented strict regulations in the southern flounder fishery, including size limits, bag limits, gear restrictions, and a seasonal closure. There is also a regional management plan in place through the Gulf States Marine Fisheries Commission (GSMFC).

The southern flounder fishery off the Texas coast in the Gulf of Mexico is rated Yellow, or a Good Alternative.

Final Seafood Recommendations

SPECIES | FISHERY	C 1 TARGET SPECIES	C 2 OTHER SPECIES	C 3 MANAGEMENT	C 4 HABITAT	OVERALL	VOLUME (MT) YEAR
Southern Flounder | Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Texas	2.644	5.000	3.000	3.464	**Good Alternative (3.424)**	Unknown
Southern Flounder | Gulf of Mexico | Atlantic, Western Central | Harpoons | United States | Texas	2.644	3.318	3.000	3.464	**Good Alternative (3.090)**	Unknown

Summary

The southern flounder (*Paralichthys lethostigma*) is a demersal flatfish distributed in the Western Central Atlantic Ocean off the coast of the U.S. from North Carolina to Florida; it is absent along Florida's southern peninsula, but present throughout the Gulf of Mexico. This report covers the Texas southern flounder handline, hand-operated pole-and-line, and gig fisheries, which account for all southern flounder landings in Texas.

The Good Alternative rank for southern flounder from Texas is driven by the relatively low conservation concern for stock status, management, and habitat impacts, and by the low concern for impacts on other species.

Scoring Guide

Scores range from zero to five where zero indicates very poor performance and five indicates the fishing operations have no significant impact.

Final Score = geometric mean of the four Scores (Criterion 1, Criterion 2, Criterion 3, Criterion 4).

Best Choice/Green = Final Score >3.2, and no Red Criteria, and no Critical scores

Good Alternative/Yellow = Final score >2.2-3.2, and neither Harvest Strategy (Factor 3.1) nor Bycatch Management Strategy (Factor 3.2) are Very High Concern2, and no more than one Red Criterion, and no Critical scores

Avoid/Red = Final Score ≤2.2, or either Harvest Strategy (Factor 3.1) or Bycatch Management Strategy (Factor 3.2) is Very High Concern or two or more Red Criteria, or one or more Critical scores.

[2] Because effective management is an essential component of sustainable fisheries, Seafood Watch issues an Avoid recommendation for any fishery scored as a Very High Concern for either factor under Management (Criterion 3).

Introduction

Scope of the analysis and ensuing recommendation

This report provides recommendations for southern flounder (*Paralichthys lethostigma*) caught off the Texas coast (U.S.) in the Gulf of Mexico. Southern flounder is typically caught using handlines, hand-operated pole-and-lines, and gig (a single- or multi-pronged spear used for fishing).

Species Overview

Southern flounder is a demersal flatfish found in the estuaries, bays, and coastal waters of the southwest Atlantic Ocean, from the coast of North Carolina to northern Mexico; however, the species is absent from southern Florida between the Loxahatchee River and the Caloosahatchee River (Enge and Mulholland 1985). Adult southern flounder typically live in estuaries and bays most of the year but migrate into open water to spawn when water temperatures decrease in the fall (October to December) (Stokes 1977). Female southern flounder spawn as many as 13 times during the winter, releasing around 120,000 eggs total (Arnold et al. 1977). The eggs are fertilized by a male flounder that follows closely behind the female as she releases the eggs (Arnold et al. 1977)(Stokes 1977). Larvae are transported by ocean currents to bays and estuaries, where the larvae stay until reaching sexual maturity between 1 and 3 years of age (GSMFC 2000)(Midway and Scharf 2012). Southern flounder is sexually dimorphic, which means that males and females grow to different sizes; for southern flounder, females are larger and live longer (Stunz et al. 2000) (Midway and Scharf 2012).

Southern flounder larvae look the same as many other fish—with one eye on each side of the head. It is not until the end of the larval stage that the metamorphosis of the right eye onto the left side of the body begins (Figure 1) (Daniels 2000). Both nostrils are on the left (or upper) side of the body, and the mouth twists during metamorphosis to be more toward the upper side of the body (Daniels 2000). The flounder's coloring is a light to dark brown on the upper side of the body, with the possibility of some darker spots and/or blotches (more common in smaller individuals), and the underside is white to off-white (Gutherz 1967). Although males and females are born genetically with XX and XY chromosomes, respectively, sex may be reversed in females that are exposed to water temperatures above 64.4 °F (18 °C) near the end of the larval stage (known as a temperature-dependent form of genetic sex determination) (Luckenbach et al. 2003). There are varying reports on maximum age, size, and rate of growth, which could be influenced by prey availability, water temperature, and salinity (Enge and Mulholland 1985)(Corey et al. 2017); the influence of genetic population differences on growth is largely unknown (Anderson et al. 2012). For the purposes of this report, information specific to southern flounder found in Texas waters will be used whenever possible. Maximum age reports vary from 3 to 8 years in the Gulf of Mexico, with females living longer than males (Fischer and Thompson 2004). In Texas, recent studies report a maximum age of 4 years (Stunz et al. 2000). Female southern flounder can reach lengths exceeding 630 mm in Texas, while males rarely exceed 356 mm (Stahl 2016).

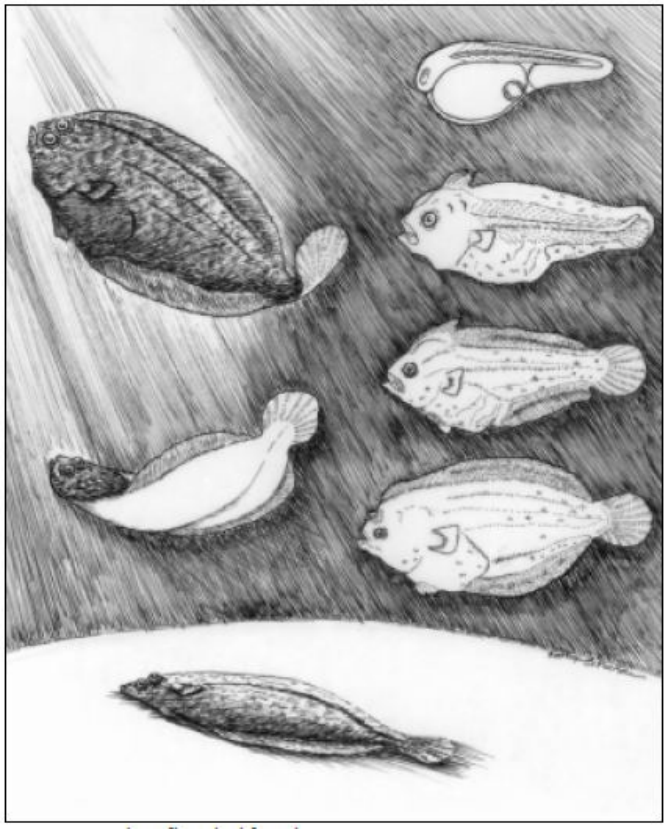

Figure 1: Southern flounder life cycle. From Daniels 2000.

Southern flounder fisheries are managed by individual states, but fish enter federal waters during offshore spawning migrations, where populations mix. The Gulf States Marine Fisheries Commission (GSMFC) helps to coordinate the five state agencies that border the Gulf of Mexico, to ensure that monitoring and management strategies are consistent throughout the region (GSMFC 2000)(GSMFC 2015). The GSMFC recognizes the need for a gulf-wide assessment, but insufficient data have prohibited such an assessment to date. The Texas Parks and Wildlife Department (TPWD), through the Texas Parks and Wildlife Commission, is responsible for the implementation and oversight of the flounder fishery up to 9 nm off the coast of Texas (GSMFC 2000)(GSMFC 2015). A gig is the most common fishing tool used to catch southern flounder in Texas waters (pers. comm., J. Esslinger 2018). Gillnets and trawls are used in other states, but catch from these gears has been steadily declining (GSMFC 2015).

Figure 2: A typical gig (https://www.pinterest.com/pin/395472411003785282/).

Production Statistics

Because of the similarities in species and equal valuation in the marketplace, gulf and southern flounder were not differentiated in the National Marine Fisheries Service database until 2010. But, southern flounder make up approximately 90% of the flounder caught off the coast of Texas (GSMFC 2015). The highest commercial landings since 1950 were recorded in 1986 at 560,309 lb (NOAA 2021). The lowest commercial landings occurred in 2014 at 2,643 lb (NOAA 2021). The large difference between these two numbers may be attributable to strict regulations set in place by the Texas Parks and Wildlife Department and variations in population and environmental conditions. In 2018 and 2020, southern flounder landings were 4,088 lb and 7,556 lb, respectively (NOAA 2021).

Importance to the US/North American market.

The average yearly value of commercially caught flounder species from the coast of Texas from 1998 to 2011 was USD 257,000 (GSMFC 2015). In 2016, commercial landings of southern flounder in Texas equaled 63,125 lb valued at USD 235,742 (NOAA 2017). No flounder exports are reported in the yearly fisheries summary, leading to the assumption that all southern flounder caught off the coast of Texas are sold to U.S. consumers (NOAA 2017).

Common and market names.

Southern flounder, flounder, doormat, mud flounder, and fluke.

Primary product forms

Southern flounder is typically purchased as whole fish or fillets, with the majority of items sold as a fresh product (GSMFC 2015).

Assessment

This section assesses the sustainability of the fishery(s) relative to the Seafood Watch Standard for Fisheries, available at www.seafoodwatch.org. The specific standard used is referenced on the title page of all Seafood Watch assessments.

Criterion 1: Impacts on the species under assessment

This criterion evaluates the impact of fishing mortality on the species, given its current abundance. When abundance is unknown, abundance is scored based on the species' inherent vulnerability, which is calculated using a Productivity-Susceptibility Analysis. The final Criterion 1 score is determined by taking the geometric mean of the abundance and fishing mortality scores. The Criterion 1 rating is determined as follows:

- ***Score >3.2=Green or Low Concern***
- ***Score >2.2 and ≤3.2=Yellow or Moderate Concern***
- ***Score ≤2.2 = Red or High Concern***

Rating is Critical if Factor 1.3 (Fishing Mortality) is Critical.

Guiding principles

- *Ensure all affected stocks are healthy and abundant.*
- *Fish all affected stocks at sustainable level*

Criterion 1 Summary

SOUTHERN FLOUNDER			
REGION / METHOD	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Texas	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Gulf of Mexico | Atlantic, Western Central | Harpoons | United States | Texas	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)

Criterion 1 Assessments

SCORING GUIDELINES

Factor 1.1 - Abundance

Goal: Stock abundance and size structure of native species is maintained at a level that does not impair recruitment or productivity.

- *5 (Very Low Concern) — Strong evidence exists that the population is above an appropriate target abundance level (given the species' ecological role), or near virgin biomass.*
- *3.67 (Low Concern) — Population may be below target abundance level, but is at least 75% of the target level, OR data-limited assessments suggest population is healthy and species is not highly*

vulnerable.

- *2.33 (Moderate Concern) — Population is not overfished but may be below 75% of the target abundance level, OR abundance is unknown and the species is not highly vulnerable.*
- *1 (High Concern) — Population is considered overfished/depleted, a species of concern, threatened or endangered, OR abundance is unknown and species is highly vulnerable.*

Factor 1.2 - Fishing Mortality

Goal: Fishing mortality is appropriate for current state of the stock.

- *5 (Low Concern) — Probable (>50%) that fishing mortality from all sources is at or below a sustainable level, given the species ecological role, OR fishery does not target species and fishing mortality is low enough to not adversely affect its population.*
- *3 (Moderate Concern) — Fishing mortality is fluctuating around sustainable levels, OR fishing mortality relative to a sustainable level is uncertain.*
- *1 (High Concern) — Probable that fishing mortality from all source is above a sustainable level.*

Southern Flounder

Factor 1.1 - Abundance

Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Texas
Gulf of Mexico | Atlantic, Western Central | Harpoons | United States | Texas

Moderate Concern
The abundance of southern flounder in the Gulf of Mexico is uncertain, and the Texas stock may occur on the boundary between two populations (Blandon et al. 2001), although more recent genetic analyses suggest a single Gulf stock for the purposes of assessment (Anderson et al. 2012). The International Union for the Conservation of Nature (IUCN) assessed southern flounder as "Near Threatened" in 2015, but the data for Gulf populations are primarily based on studies from 2011 or earlier (Munroe 2015).

Texas, Louisiana, and Alabama have each assessed the southern flounder populations that occur in their respective state waters. These stock assessments reached conflicting conclusions about whether the stock is overfished. The 2014 Texas stock assessment determined that the stock is not overfished, with a spawning potential ratio (SPR) of 46% in 2012 (Martinez-Andrade 2014). The 2018 Alabama stock assessment concluded that the stock is above B_{MSY} (Powers et al. 2018). The 2020 Louisiana stock assessment is the most up to date, containing data through 2018. It reports the stock as overfished, with SSB/SSB_{LIMIT} = 0.94 and current SPR at 19% (West et al. 2020).

Because of the uncertainty from conflicting stock assessments results, a productivity-susceptibility analysis (PSA) was performed, using data specific to the Texas coast. The Texas-specific PSA resulted in a vulnerability score of "moderate" (see Justification). The species is not highly vulnerable, but there is uncertainty about whether the abundance is above the limit reference point. Recent fishery-independent data for Texas waters suggest that the stock is declining in abundance (Martinez-Andrade 2018) (pers. comm., Fernando Martinez-Andrade 2021). Therefore, southern flounder abundance is deemed a moderate concern.

Justification:
A stock assessment encompassing the entire Gulf of Mexico stock has not been completed, due to a lack of and varying life history data throughout the geographic range of this stock. This complexity is compounded by the species' sexual dimorphism and high variability in size and year classes; sex and size composition; and catch per unit effort (GSMFC 2015). In addition, southern and gulf flounder were not differentiated from one another in historic landing records of flounder (NOAA 2021). Despite these challenges, the assessments completed by Texas, Alabama, and Louisiana provide some insight into the status of the Gulf of Mexico southern flounder stock.

The Texas stock assessment utilized a virtual population analysis (VPA) model with fishery-dependent and fishery-independent data from 1984 through 2013. The VPA results showed SPR below 20% for 1985 through 2005. New regulations for size limit and bag limit, plus seasonal modifications implemented in 2009, were successful in bringing the SPR up to 46% in 2012

(Martinez-Andrade 2014). More recent data from the annual fishery-independent surveys conducted by Texas Parks and Wildlife Department indicate that the abundance of southern flounder has decreased from 2014 through 2020 (Figure 3). The declining abundance may be the result of environmental factors such as warmer winters, which increase mortality and the masculine proportion of the sex ratio through genetic sex determination with temperature effects (Erikson et al. 2021)(Honeycutt et al. 2019). The most recent assessment of SPR is from 2012 and does not capture these changes in population dynamics. This leaves uncertainty about the status of abundance for the Texas population. It is unclear whether this population is above or below a limit reference point that is appropriate for this species, such as $SPR_{35\%}$ (Seafood Watch 2020).

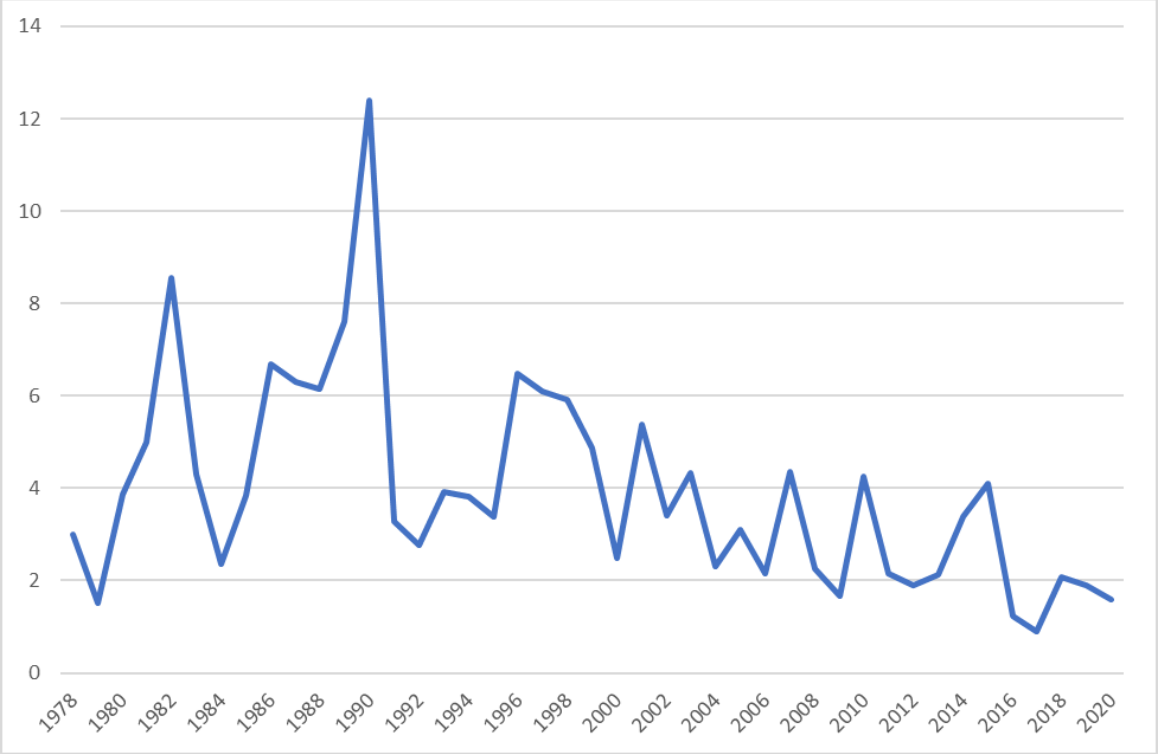

Figure 3: Coastwide mean catch rate (number caught per hectare) of southern flounder in bag seines as part of the annual TPWD fisheries-independent survey (pers. comm., Fernando Martinez-Andrade 2021).

The 2018 Alabama stock assessment is based on the age-structured assessment program (ASAP) developed by the National Marine Fisheries Service (NMFS). The ASAP model is a catch-at-age, stage-structured model that was tuned with fishery-dependent and fishery-independent data from 2001 through 2017 (Powers et al. 2018). The stock biomass was estimated to be above B_{MSY}. But, the model did not directly estimate a stock recruitment relationship; instead, it assumed average recruitment for most years. This assumption was likely violated, considering that changing environmental conditions and the possible greater masculine proportion of the sex ratio could both be driving a decline in recruitment (Erikson et al. 2021)(Honeycutt et al. 2019). Furthermore, the model fit was relatively poor for the indices of abundance, and it consistently overestimated abundance throughout the time series (Figures 4 and 5). These factors lead to uncertainty about the

abundance of southern flounder in Alabama state waters.

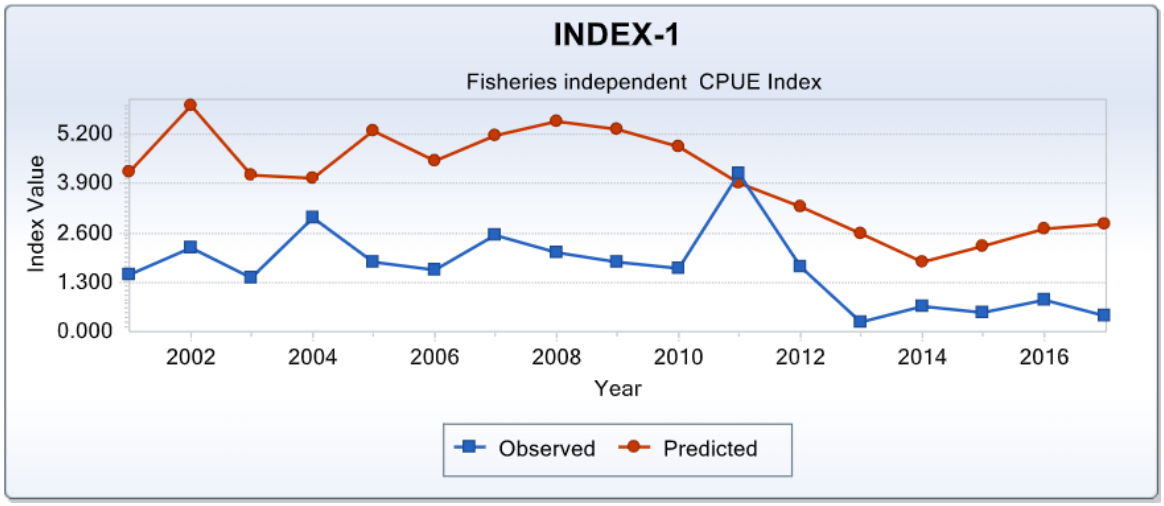

Figure 4: Observed catch per unit effort (CPUE) of southern flounder in Alabama's fisheries-independent gillnet surveys compared to the ASAP model fit for this index of abundance (Powers et al. 2018).

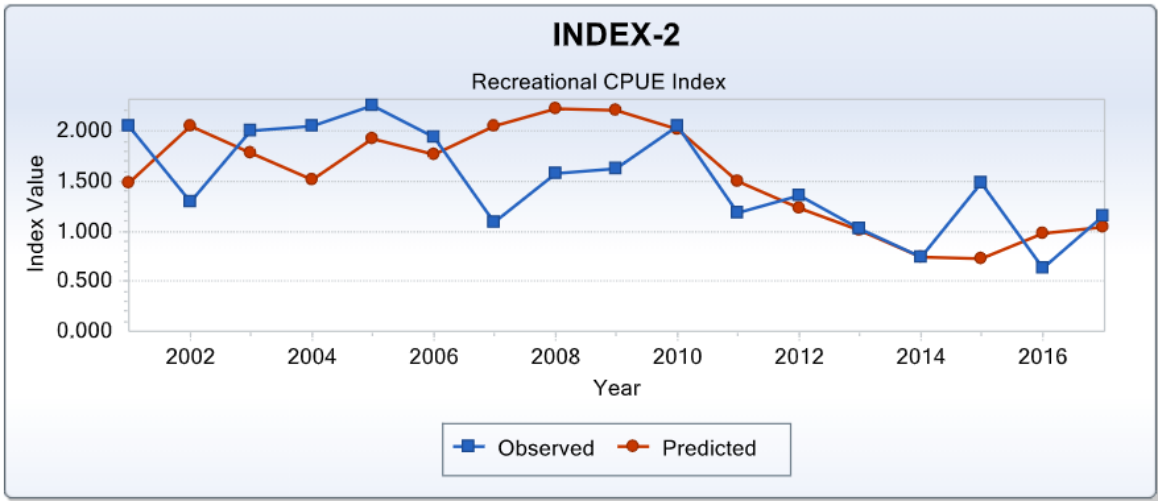

Figure 5: Observed catch per unit effort (CPUE) of southern flounder in Alabama's recreational fishery compared to the ASAP model fit for this index of abundance (Powers et al. 2018).

The 2020 Louisiana stock assessment is also based on the ASAP model. It utilized the most up-to-date dataset out of these three assessments, with fishery-dependent and fishery-independent data from 1982 through 2018 (West et al. 2020). As of 2018, the SPR is 19% and $SSB/SSB_{LIMIT} = 0.94$, which indicates that the stock is overfished. SSB_{LIMIT} was defined as the equilibrium female spawning stock biomass that results in $SPR_{20\%}$. Seafood Watch considers a limit reference point of $SSB_{35–40\%}$ to be appropriate for this species (Seafood Watch 2020). Therefore, the stock is farther

below an appropriate limit reference point than the results of SSB/SSB_{LIMIT} = 0.94 initially seem to indicate.

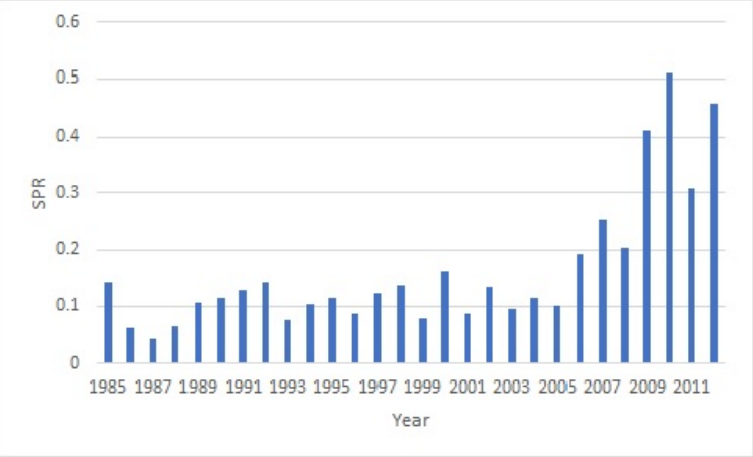

Figure 6: Texas southern flounder estimated spawning potential ratio (SPR) by year from VPA model. From (Martinez-Andrade 2014).

Southern flounder, Texas coast handline, pole-and-line, gig			
Productivity Attributes	**Value**	**Score (1 = low risk; 2 = medium risk; 3 = high risk)**	**Reference**
Average age at maturity (years)	2	1	(Stunz et al. 2000)
Average maximum age (years)	4	1	(Bumguardner et al. 2002)
Von Bertalanffy (Brody) Growth Coefficient (K) (to be used for species that exhibit first-order growth)	0.45	1	(Bumguardner et al. 2002)
Fecundity (eggs/yr)	120,000	1	(Arnold et al. 1977)
Average maximum size (cm) (not to be used when scoring invertebrate species)	45–59 (sexes combined)	1	(Bumguardner et al. 2002)
Average size at maturity (cm) (not to be used when scoring invertebrate species)	40–43 (sexes combined)	1	(Stunz et al. 2000)
Reproductive strategy	Broadcast spawner	3	(Arnold et al. 1977)
Density dependence (invertebrates only)	N/A		
Quality of Habitat	Moderately altered	2	(USDA 2015)
Productivity Subscore		1.125	

Susceptibility Attribute	**Information**	**Score (1 = low risk; 2 = medium risk; 3 = high risk)**	**Reference**

Areal overlap (considers all fisheries)	Southern flounder is fished throughout its entire range.	3	(Munroe 2015)
Vertical overlap (considers all fisheries)	Southern flounder is known to live in depths up to 62 m. Default score for target species.	3	(Stokes 1977)
Seasonal availability (considers all fisheries; score using the most conservative option)	The southern flounder recreational and commercial fisheries are open year-round except for November 1 to December 14.	3	(TPWD 2021a)
Selectivity of fishery (specific to fishery under assessment)	Default score for selectivity of fishery.	2	
Post-capture mortality (specific to fishery under assessment)	Default score for retained species.	3	
Susceptibility Subscore		2.8	

Productivity-Susceptibility Score	**3.02**
Vulnerability Rating (high, medium, or low)	**Medium**

Factor 1.2 - Fishing Mortality

Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Texas
Gulf of Mexico | Atlantic, Western Central | Harpoons | United States | Texas

Moderate Concern

The Texas, Alabama, and Louisiana stock assessments were all used to score fishing mortality (F). The three stock assessments reach differing conclusions about the intensity of fishing mortality. The 2014 Texas stock assessment calculated the catch-weighted fishing mortality for female flounder age 2+ (Figure 7). Following new regulations in 2009 that curtailed recreational and commercial bag limits, the average F for 2010–12 was 0.39. This is below the 0.6 estimate of natural mortality for southern flounder off the coast of Texas (Martinez-Andrade 2014). The Alabama management target of $F_{SPR30\%}$ (the level of fishing mortality that would draw the stock down to $SPR_{30\%}$) was estimated at 0.50. $F_{CURRENT}$ for 2017 was estimated at 0.66, indicating that the stock was experiencing overfishing (Powers et al. 2018). The high level of fishing mortality can likely be attributed to a management strategy that remained static while recruitment declined. The Louisiana stock assessment reported $F_{CURRENT}/F_{SPR20\%}$ = 0.50 for 2018 (West et al. 2020). This is below the 1.0 limit reference point used by the stock assessment and indicates that overfishing is not occurring. But, an appropriate limit reference point for the species is $F_{SPR35–40\%}$. Because $F_{SPR20\%} > F_{SPR35–40\%}$, the fishing mortality ratio should be higher than 0.50, but it is unclear if it is greater than 1.0. Thus, the overfishing status of southern flounder in Louisiana is uncertain.

With the Texas stock assessment concluding no overfishing, the Alabama stock assessment determining that overfishing is occurring, and unclear results from the Louisiana stock assessment, the level of fishing mortality is uncertain. Therefore, fishing mortality is scored a moderate concern.

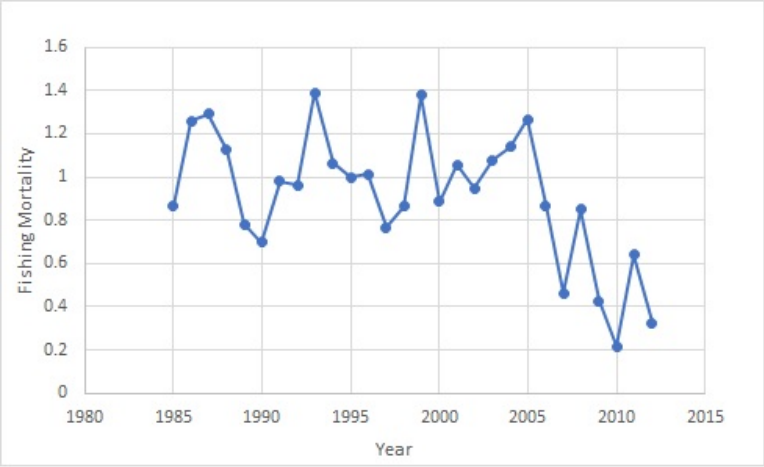

Figure 7: Estimated fishing mortality of age 2+ female Texas southern flounder. From (Martinez-Andrade 2014).

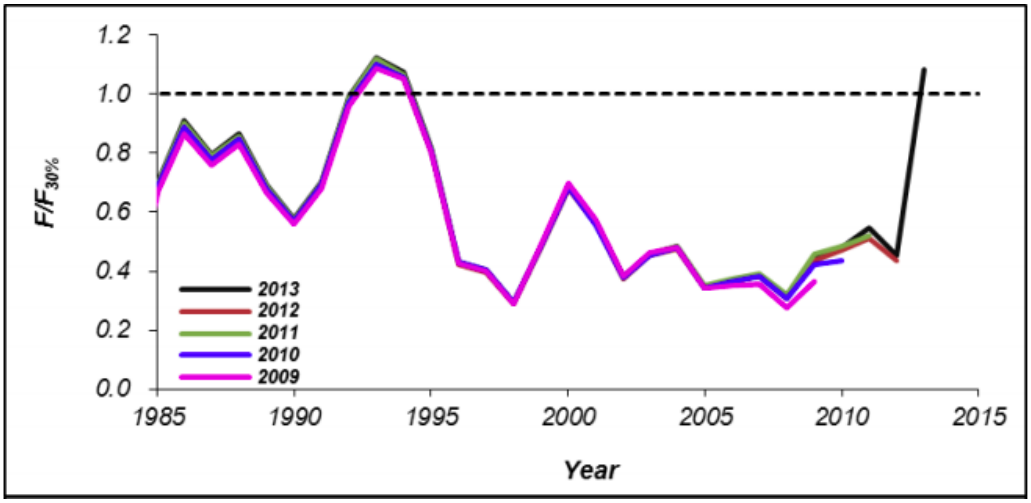

Figure 8: Model estimated ratios of annual average fishing mortality to $F_{30\%}$ for southern flounder in Louisiana. From (Davis et al. 2015).

Landings for this species have been recorded by NMFS since 1950 (see Appendix A); however, until 2010, flounder (predominantly southern and gulf flounder in Texas) landings information was combined into one "flatfish" category (NOAA 2021). Many TPWD regulations have affected southern flounder landings, starting in 1981 with the ban on the commercial sale of spotted sea trout and red drum (GSMFC 2015). This led commercial fishers to increase fishing pressure on the southern flounder, and the highest commercial landings were recorded in 1986 at 560,309 lb (GSMFC 2015)(NOAA 2021). Nine other regulations were passed between 1988 and 2020 that affected southern flounder landings (see Appendix B). These regulations have been aimed at decreasing overall fishing pressure and mortality during the fall migration to offshore spawning grounds.

In addition to the targeted commercial and recreational fisheries, southern flounder is also caught as

bycatch in the shrimp trawl fishery. As many as 9.7 million fish per year have been reported as bycatch in the shrimp trawl fishery (Munroe 2015), but there appears to be limited data on incidental catch in the shrimp trawl fisheries outside of Florida and Mississippi (GSMFC 2015). In Texas, approved bycatch reduction devices are required, and the bag limit for southern flounder is five fish for each person with a shrimp boat captain's license, except from November 1 through December 14, when retention is prohibited (TPWD 2021a)(TPWD 2021b). The total weight of all retained aquatic products also may not exceed 50% of the weight of shrimp on a shrimp boat (TPWD 2021b).

The fishing mortality in Texas has only been assessed through 2012 (Martinez-Andrade 2014). But, it is likely that fishing mortality has decreased since then because of more stringent regulations that were implemented in 2014 and 2020. Both the Alabama and Louisiana stock assessments utilize limit reference points for fishing mortality that are higher than what is appropriate for the species (Powers et al. 2018)(West et al. 2020)(Seafood Watch 2020). As a result, findings that state that the stock is not overfished should be interpreted with caution.

Criterion 2: Impacts on Other Species

All main retained and bycatch species in the fishery are evaluated under Criterion 2. Seafood Watch defines bycatch as all fisheries-related mortality or injury to species other than the retained catch. Examples include discards, endangered or threatened species catch, and ghost fishing. Species are evaluated using the same guidelines as in Criterion 1. When information on other species caught in the fishery is unavailable, the fishery's potential impacts on other species is scored according to the Unknown Bycatch Matrices, which are based on a synthesis of peer-reviewed literature and expert opinion on the bycatch impacts of each gear type. The fishery is also scored for the amount of non-retained catch (discards) and bait use relative to the retained catch. To determine the final Criterion 2 score, the score for the lowest scoring retained/bycatch species is multiplied by the discard/bait score. The Criterion 2 rating is determined as follows:

- ***Score >3.2=Green or Low Concern***
- ***Score >2.2 and ≤3.2=Yellow or Moderate Concern***
- ***Score ≤2.2 = Red or High Concern***

Rating is Critical if Factor 2.3 (Fishing Mortality) is Crtitical

Guiding principles

- *Ensure all affected stocks are healthy and abundant.*
- *Fish all affected stocks at sustainable level.*
- *Minimize bycatch.*

Criterion 2 Summary

Criterion 2 score(s) overview

This table(s) provides an overview of the Criterion 2 subscore, discards+bait modifier, and final Criterion 2 score for each fishery. A separate table is provided for each species/stock that we want an overall rating for.

SOUTHERN FLOUNDER			
REGION / METHOD	**SUB SCORE**	**DISCARD RATE/LANDINGS**	**SCORE**
Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Texas	5.000	1.000: < 100%	Green (5.000)
Gulf of Mexico | Atlantic, Western Central | Harpoons | United States | Texas	3.318	1.000: < 100%	Green (3.318)

Criterion 2 main assessed species/stocks table(s)

This table(s) provides a list of all species/stocks included in this assessment for each 'fishery' (as defined by a region/method combination). The text following this table(s) provides an explanation of the reasons the listed species were selected for inclusion in the assessment.

GULF OF MEXICO | ATLANTIC, WESTERN CENTRAL | HANDLINES AND HAND-OPERATED POLE-AND-LINES | UNITED STATES | TEXAS			
SUB SCORE: 5.000	DISCARD RATE: 1.000	**SCORE: 5.000**	
SPECIES	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Southern Flounder	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)

GULF OF MEXICO | ATLANTIC, WESTERN CENTRAL | HARPOONS | UNITED STATES | TEXAS			
SUB SCORE: 3.318	DISCARD RATE: 1.000	**SCORE: 3.318**	
SPECIES	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Southern Flounder	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Black drum	3.670: Low Concern	3.000: Moderate Concern	Green (3.318)
Sheepshead	5.000: Very Low Concern	3.000: Moderate Concern	Green (3.873)

Handline, hand-operated pole-and-line, and gig are all highly selective gears. From 2007 to 2017, only 0.6% of commercially caught southern flounder was caught using handlines or hand-operated pole-and-lines; therefore, no bycatch species were included for these gears (pers. comm., J. Esslinger 2018).

Almost all the commercially caught southern flounder in Texas are caught with gig (pers. comm., J. Esslinger 2018). In this fishery, black drum and sheepshead are also targeted (pers.. comm., M. Stahl 2018). The International Union for the Conservation of Nature (IUCN) has assessed the Gulf of Mexico populations of both black drum and sheepshead as "Least Concern." Fishery-independent data-limited assessments, as well as the IUCN assessment for black drum, rate this species a low concern. A sheepshead assessment by Louisiana, along with the IUCN assessment, rates this species a low concern. Black drum is the limiting factor for the gig fishery because it is unknown whether fishing mortality is at a sustainable level.

Criterion 2 Assessment

SCORING GUIDELINES

Factor 2.1 - Abundance
(same as Factor 1.1 above)

Factor 2.2 - Fishing Mortality
(same as Factor 1.2 above)

Factor 2.3 - Modifying Factor: Discards and Bait Use
Goal: Fishery optimizes the utilization of marine and freshwater resources by minimizing post-harvest loss. For fisheries that use bait, bait is used efficiently.

Scoring Guidelines: The discard rate is the sum of all dead discards (i.e. non-retained catch) plus bait use divided by the total retained catch.

Ratio of bait + discards/landings	Factor 2.3 score
<100%	1
>=100	0.75

Black drum

Factor 2.1 - Abundance

Gulf of Mexico | Atlantic, Western Central | Harpoons | United States | Texas

Low Concern

In Texas, fisheries-independent data are used to determine relative abundance, size, and long-term trends in abundance and stability of black drum, to assist in managing and allocating harvest of marine resources and implementing management regulations (Martinez-Andrade 2018). Fishery-independent gillnet sampling is conducted overnight during each spring and fall season, while bag-seine sampling occurs on a biweekly period every month (Martinez-Andrade 2018). In 2020, all fishery-independent sampling was canceled during April and May due to COVID-19 (pers. comm., Dr. Fernando Martinez-Andrade, TPWD). As a result, seasonal bag-seine catch rates (June and July; peak recruitment months) are used to assess black drum abundance status because annual catch rate estimates may be misleading (pers. comm., Dr. Fernando Martinez-Andrade, TPWD). Furthermore, both seasonal gillnet catch rates (spring/fall) and annual catch rates (excluding 2020) are used to assess black drum abundance for the same reason (pers. comm., Dr. Fernando Martinez-Andrade, TPWD). The bag-seine time series shows fluctuating seasonal catches, with a decreasing trend beginning in 2017. The annual and seasonal gillnet time-series show an overall trend of increased abundance, with a relatively stable mean in recent years (Figures 10–12).

Abundance is considered to be of low concern, because the stock is not highly vulnerable (medium vulnerability based on a productivity-susceptibility analysis) and there are two appropriate data-limited assessment methods based on distinct data sources that suggest the stock is healthy. Vulnerability was rated as "medium" based on an overall productivity-susceptibility analysis score of 3.07 (productivity = 2, susceptibility = 2.32) (Figure 9).

Justification:

Vulnerability was rated as "medium" based on an overall productivity-susceptibility analysis score of 3.07 (productivity = 2, susceptibility = 2.32).

Productivity Attribute	Relevant Information	Score (1 = low risk, 2 = medium risk, 3 = high risk)
Average age at maturity	5 yrs (Murphy & Taylor 1989)	2
Average maximum age	43 years (Beckman et al. 1990)	3
Fecundity	32 million eggs/yr (Fitzhugh et al. 1993)	1
Average maximum size	100 cm (Beckman et al. 1990)	2
Average size at maturity	62 cm (Fitzhugh et al. 1993)	2
Reproductive strategy	broadcast spawner	1
Trophic level	3.9 (Froese & Pauly 2017)	3

Susceptibility Attribute	Relevant Information	Score (1 = low risk, 2 = medium risk, 3 = high risk)
Areal overlap (Considers all fisheries)	Default score due to limited information	3
Vertical overlap (Considers all fisheries)	Species is targeted	3
Selectivity of fishery (Specific to fishery under assessment)	Species is targeted	2
Post-capture mortality (Specific to fishery under assessment)	Retained species	3

Figure 9: Productivity-susceptibility analysis.

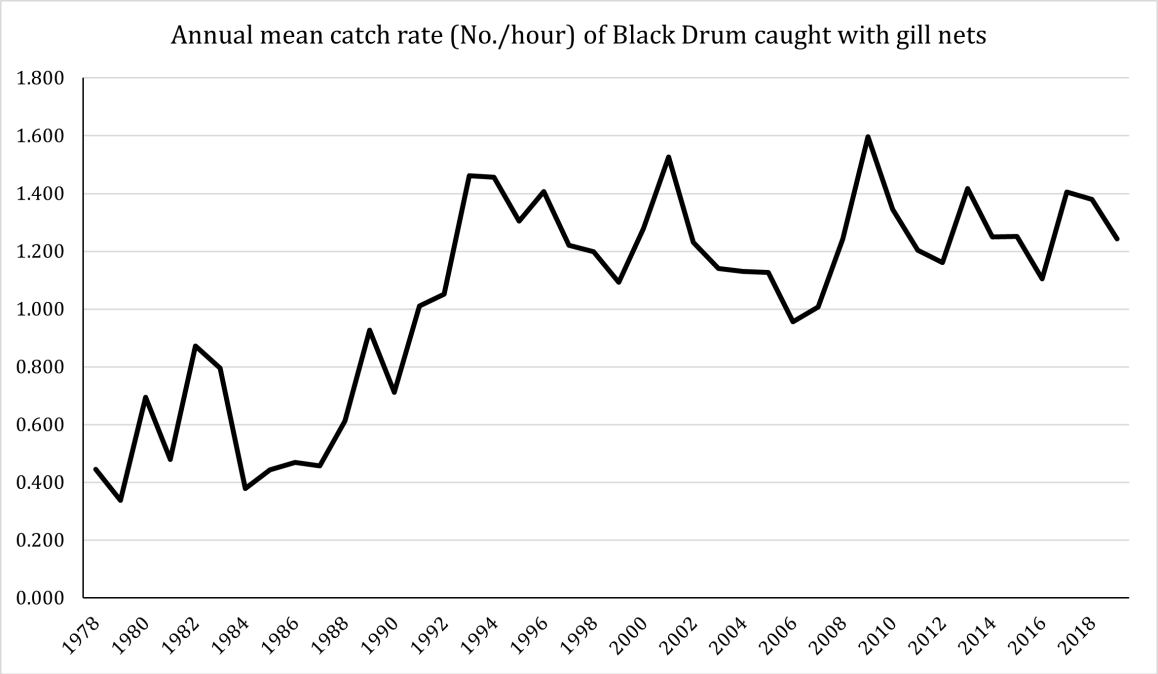

Figure 10: Fisheries-independent gillnet annual survey time series of black drum catch per hour 1978–2018 (data provided by Dr. Fernando Martinez-Andrade, TPWD).

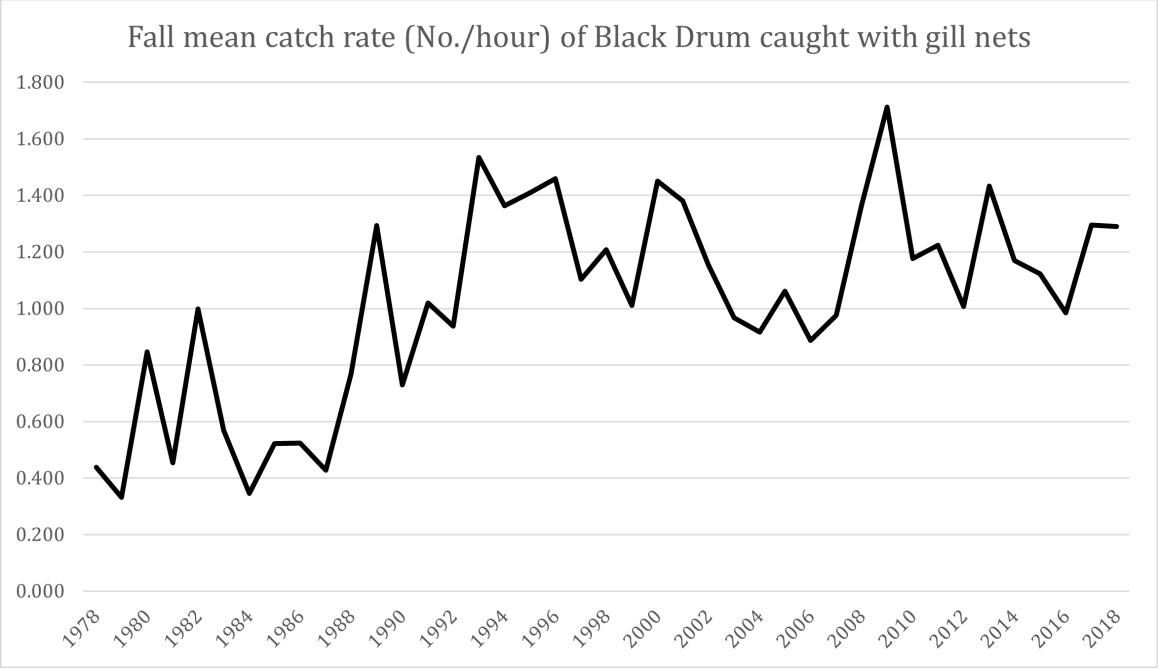

Figure 11: Fisheries-independent gillnet fall survey time series of black drum catch per hour 1978–2018 (data provided by Dr. Fernando Martinez-Andrade, TPWD).

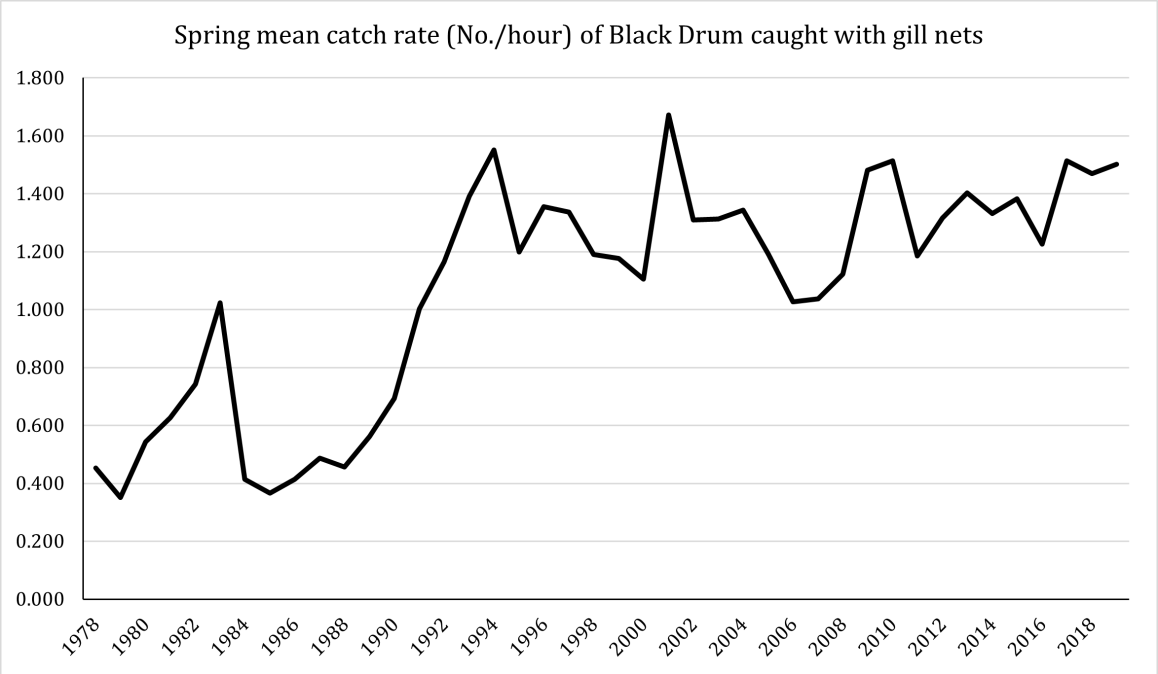

Figure 12: Fisheries-independent gillnet spring survey time series of black drum catch per hour 1978–2018 (data provided by Dr. Fernando Martinez-Andrade, TPWD).

Factor 2.2 - Fishing Mortality

Gulf of Mexico | Atlantic, Western Central | Harpoons | United States | Texas

Moderate Concern

An assessment of fishing mortality relative to a defined reference point is not available for Texas. Annual commercial fisheries landings data show a relatively stable mean for Texas landings in the last decade. Fishery mortality is scored a moderate concern because of the lack of a reference point in Texas.

Sheepshead

Factor 2.1 - Abundance

Gulf of Mexico | Atlantic, Western Central | Harpoons | United States | Texas

Very Low Concern

Sheepshead (*Archosargus probatocephalus*) was assessed in Louisiana waters in 2015 with a statistical catch-at-age model. Abundance was predicted using a statistical catch-at-age model and landings data from the Louisiana Department of Wildlife and Fisheries Trip Ticket Program, National Marine Fisheries Service commercial statistical records, and the NMFS Marine Recreational Information Program (West et al. 2015). The Louisiana Department of Wildlife and Fisheries fishery-independent marine trammel net survey data were used to develop an index of abundance. The assessment found that the species is not overfished ($SSB/SSB_{30\%} < 1.0$) and has not been

overfished during the entire time series (1981 to 2013) (West et al. 2015). The Louisiana report estimates that $SSB/SSB_{30\%}$ is 3.58 (West et al. 2015). The spawning potential ratio (SPR) is estimated at 65%, which is well above the conservation standard of SPR 30% (West et al. 2015). Because the Louisiana and Texas populations of sheepshead are part of a single stock, and there is evidence that the stock is above the target and limit reference points, sheepshead abundance is scored a very low concern.

Justification:

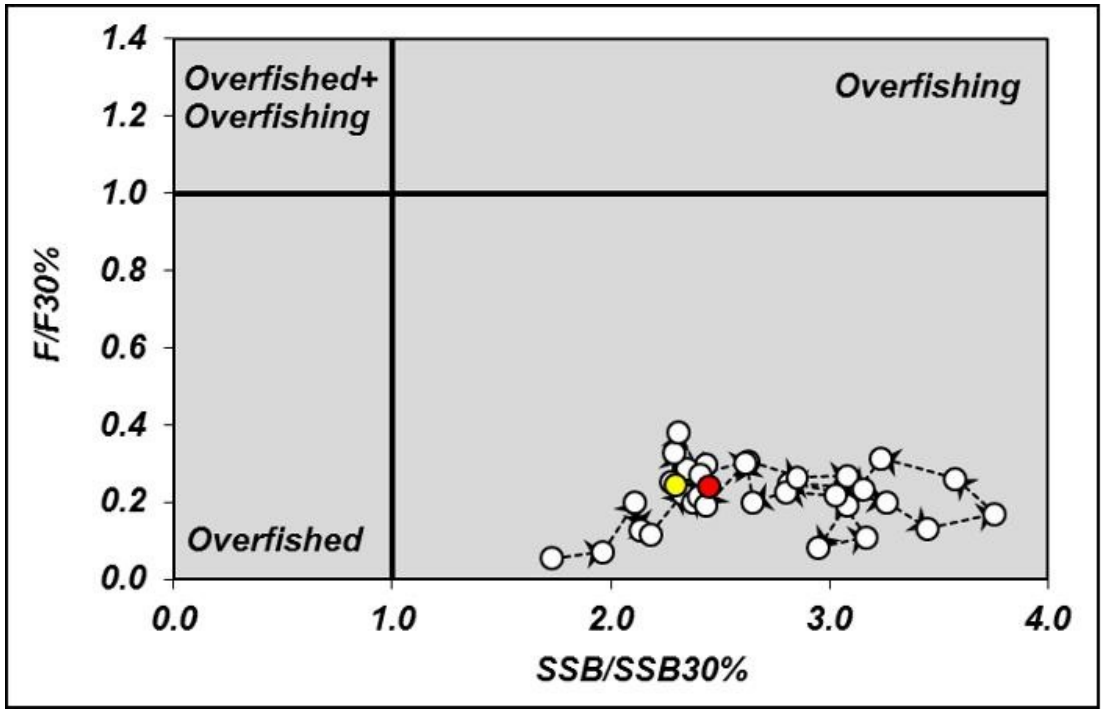

Figure 13: ASAP base model estimated ratios of annual average fishing mortality to $F_{30\%}$ and female spawning stock biomass to $SSB_{30\%}$. Arrows and dashed lines represent the direction of the time series. The yellow circle is the 2013 estimate, and the red circle is the current status (geometric mean of average F and female SSB 2011–13). From (West et al. 2015).

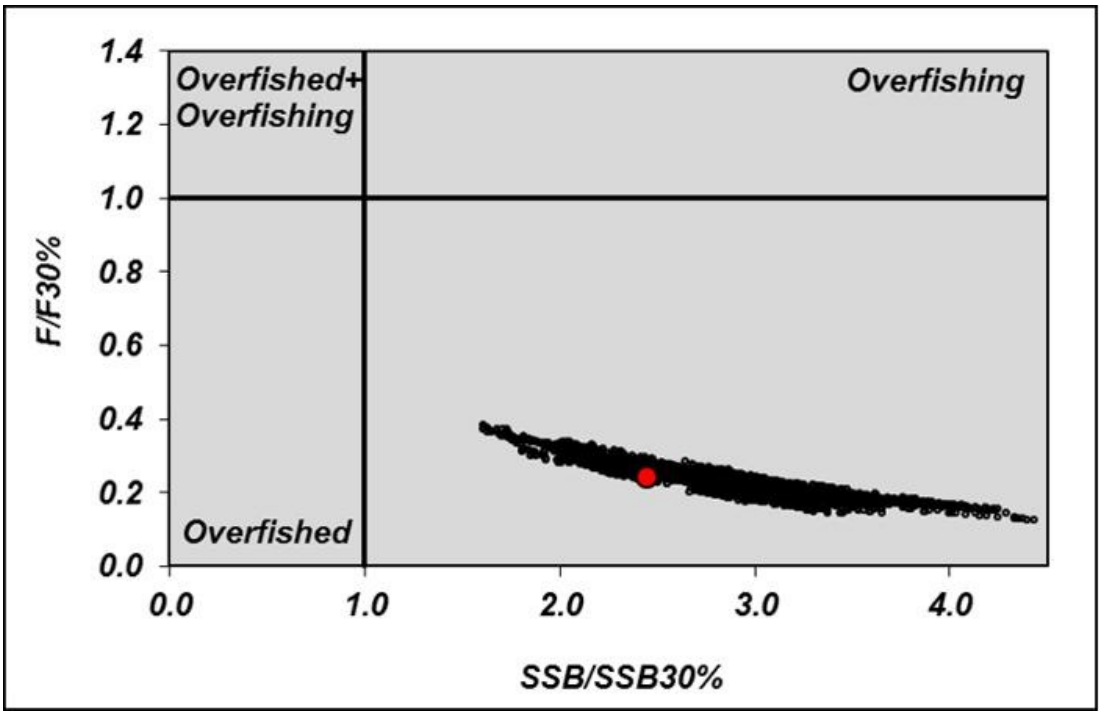

Figure 14: ASAP base model estimated ratios of annual average fishing mortality to $F_{30\%}$ and female spawning stock biomass to $SSB_{30\%}$. Graphic depicts current status (red dot) and the results of 2000 Markov Chain Monte Carlo (MCMC) simulations relative to limit reference points. From (West et al. 2015).

Factor 2.2 - Fishing Mortality

Gulf of Mexico | Atlantic, Western Central | Harpoons | United States | Texas

Moderate Concern

Sheepshead in the western Gulf of Mexico is considered a single stock that is separate from the eastern Gulf (Florida west coast) and Atlantic stock (Munyandorero et al. 2017). There is no gulf-wide stock assessment for this species. There is a stock assessment for sheepshead in Louisiana waters, but those authors define the unit stock as those sheepshead occurring in Louisiana waters only (West et al. 2015), and fishing mortality in Texas is excluded. In Louisiana, overfishing is not occurring. Fishing mortality for this stock is defined as overfishing when rates exceed $F_{30\%}$ ($F/F_{30\%} > 1$); the current $F/F_{30\%}$ is 0.24 and is well below that threshold, even including the recreational fishery, which is a significant contributor (West et al. 2015). Although fishing mortality is below a sustainable level in Louisiana, the sustainability of fishing in Texas is considered unknown. Therefore, it is assessed a moderate concern.

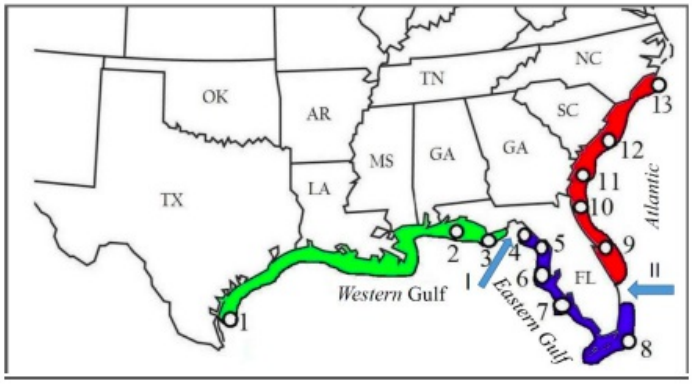

Figure 15. Boundaries of the three sheepshead genetic stocks. arrows indicate regions of genetic break between the western and eastern Gulf (I) and between the eastern Gulf and the Atlantic (II). Figure from (Munyandorero et al. 2017).

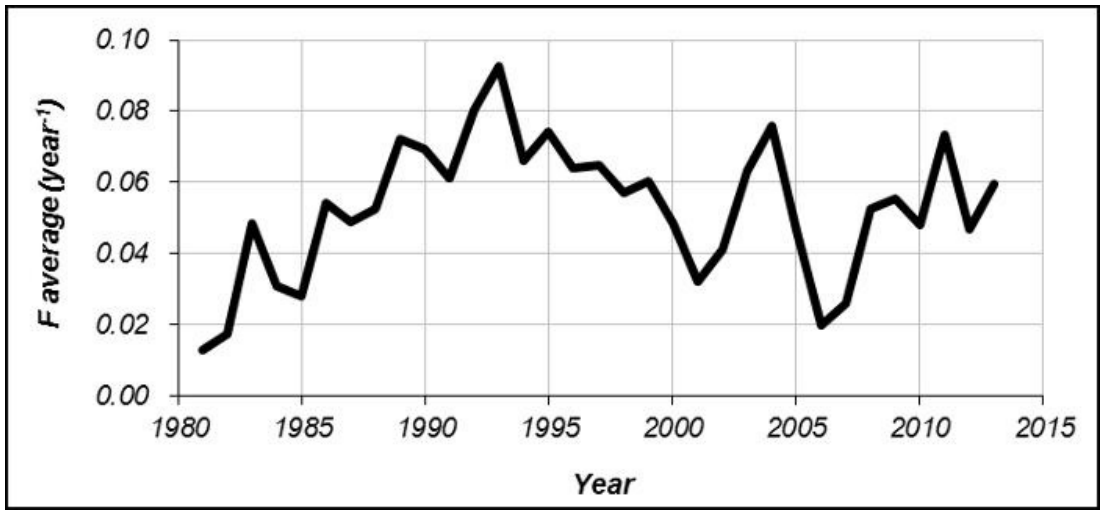

Figure 16. Model estimated average fishing mortality 1981–2013 in Louisiana. From (West et al. 2015).

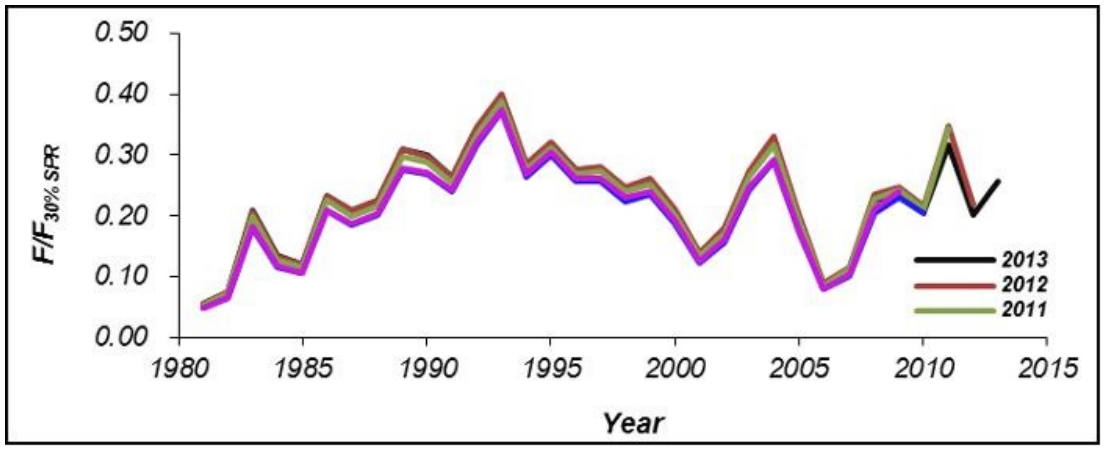

Figure 17. Retrospective analysis of ASAP base model (2009–13). The graphic depicts estimated ratios of annual average fishing mortality to $F_{30\%}$ in Louisiana. From (West et al. 2015).

Factor 2.3 - Discard Rate/Landings

Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Texas

< 100%

Specific discard rates are not available for southern flounder caught using handlines and pole-and-lines. Fisheries using these two gear types have been assessed to have weighted average discard rates of 2% (with a range of 0% to 7%) and 0.4% (with a range of 0% to 1%), respectively (Kelleher 2005). Flounder is commonly fished with artificial lures and natural bait in the recreational fishery (GSMFC 2000), but there is no quantitative information available on the amount of bait used. The bait/landings ratio is likely <100% and discard rates are quite low.

Gulf of Mexico | Atlantic, Western Central | Harpoons | United States | Texas

< 100%

Specific discard rates are not available for southern flounder off the Texas coast; however, Kelleher estimates the weighted average discard rate for gig fisheries as 0.1% (with a range of 0% to 1%) (Kelleher 2005).

Criterion 3: Management Effectiveness

Five factors are evaluated in Criterion 3: Management Strategy and Implementation, Bycatch Strategy, Scientific Research/Monitoring, Enforcement of Regulations, and Inclusion of Stakeholders. Each is scored as either 'highly effective', 'moderately effective', 'ineffective,' or 'critical'. The final Criterion 3 score is determined as follows:

- *5 (Very Low Concern) — Meets the standards of 'highly effective' for all five factors considered.*
- *4 (Low Concern) — Meets the standards of 'highly effective' for 'management strategy and implementation' and at least 'moderately effective' for all other factors.*
- *3 (Moderate Concern) — Meets the standards for at least 'moderately effective' for all five factors.*
- *2 (High Concern) — At a minimum, meets standards for 'moderately effective' for Management Strategy and Implementation and Bycatch Strategy, but at least one other factor is rated 'ineffective.'*
- *1 (Very High Concern) — Management Strategy and Implementation and/or Bycatch Management are 'ineffective.'*
- *0 (Critical) — Management Strategy and Implementation is 'critical'.*

The Criterion 3 rating is determined as follows:

- ***Score >3.2=Green or Low Concern***
- ***Score >2.2 and ≤3.2=Yellow or Moderate Concern***
- ***Score ≤2.2 = Red or High Concern***

Rating is Critical if Management Strategy and Implementation is Critical.

Guiding principle

- The fishery is managed to sustain the long-term productivity of all impacted species.

Five factors are evaluated in Criterion 3: Management Strategy and Implementation, Bycatch Strategy, Scientific Research/Monitoring, Enforcement of Regulations, and Inclusion of Stakeholders. Each is scored as either 'highly effective', 'moderately effective', 'ineffective,' or 'critical'. The final Criterion 3 score is determined as follows:

Criterion 3 Summary

FISHERY	MANAGEMENT STRATEGY	BYCATCH STRATEGY	RESEARCH AND MONITORING	ENFORCEMENT	INCLUSION	SCORE
Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Texas	Moderately Effective	Highly effective	Highly effective	Highly effective	Highly effective	**Yellow (3.000)**
Gulf of Mexico | Atlantic, Western Central | Harpoons | United States | Texas	Moderately Effective	Highly effective	Highly effective	Highly effective	Highly effective	**Yellow (3.000)**

Criterion 3 Assessment

SCORING GUIDELINES

Factor 3.1 - Management Strategy and Implementation

Considerations: What type of management measures are in place? Are there appropriate management goals, and is there evidence that management goals are being met? Do manages follow scientific advice? To achieve a highly effective rating, there must be appropriately defined management goals, precautionary policies that are based on scientific advice, and evidence that the measures in place have been successful at maintaining/rebuilding species.

Factor 3.2 - Bycatch Strategy

Considerations: What type of management strategy/measures are in place to reduce the impacts of the fishery on bycatch species and when applicable, to minimize ghost fishing? How successful are these management measures? To achieve a Highly Effective rating, the fishery must have no or low bycatch, or if there are bycatch or ghost fishing concerns, there must be effective measures in place to minimize impacts.

Factor 3.3 - Scientific Research and Monitoring

Considerations: How much and what types of data are collected to evaluate the fishery's impact on the species? Is there adequate monitoring of bycatch? To achieve a Highly Effective rating, regular, robust population assessments must be conducted for target or retained species, and an adequate bycatch data collection program must be in place to ensure bycatch management goals are met.

Factor 3.4 - Enforcement of Management Regulations

Considerations: Do fishermen comply with regulations, and how is this monitored? To achieve a Highly Effective rating, there must be regular enforcement of regulations and verification of compliance.

Factor 3.5 - Stakeholder Inclusion

Considerations: Are stakeholders involved/included in the decision-making process? Stakeholders are individuals/groups/organizations that have an interest in the fishery or that may be affected by the management of the fishery (e.g., fishermen, conservation groups, etc.). A Highly Effective rating is given if the management process is transparent, if high participation by all stakeholders is encouraged, and if there a mechanism to effectively address user conflicts.

Factor 3.1 - Management Strategy And Implementation

Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Texas
Gulf of Mexico | Atlantic, Western Central | Harpoons | United States | Texas

Moderately Effective
The Texas Parks and Wildlife Department (TPWD) is the managing body over fisheries in Texas waters up to 9 nautical miles (nm) from the state coast. There is also a gulf-wide management plan for flounder in place through the Gulf States Marine Fisheries Commission (GSMFC). Texas has implemented some of the strictest regulations on the flounder fishery in the Gulf of Mexico (GSMFC 2015)(GSMFC 2000). This is a limited-entry fishery, and a fishing license is required for all commercial fishers; there is a minimum length of 15 inches for any harvested flounder; there is a daily five fish bag and possession limit for recreational fishers. Commercial fishers are restricted to a daily 30 fish bag and possession limit. There is a full season closure for both the recreational and commercial fishery from November 1 to December 14 (TPWD 2021a). For black drum, there is a minimum length of 14 in and maximum length of 30 in (TPWD 2021a). The daily bag limit for black drum is five fish (TPWD 2021a). For sheepshead, there is a minimum length of 15 in and a daily bag limit of five fish (TPWD 2021a).

A trip ticket program is also in place for commercial wholesale, retail, and bait dealers, and for commercial fishers; it requires any dealer who receives or purchases aquatic product(s) from anyone other than another dealer to record, by individual (fishing) trip, all aquatic product transactions (TPWD 2021b)(TPWD 2021c). Trip tickets must be completed when the fisher delivers the aquatic product(s) to the dealer (TPWD 2021b). A report is filed with TPWD by the 10th day of each month of all individual trip tickets from the previous month (TPWD 2021b)(TPWD 2021c).

Management uses a "desirable spawning potential ratio (SPR) value" (target reference point) of 30% and an "accepted threshold" SPR value of 20% (limit reference point) for southern flounder. Seafood Watch considers SPR values of 35% to 40% as appropriate for moderately vulnerable species. The reference points ($SPR_{20\%}$ and $SPR_{30\%}$) may not be appropriate for this species, because SPR is based on an accurate population age structure and maturity schedule (Walters and Martell 2004); such data are limited in Texas, maturation rates vary among Gulf states (Corey et al. 2017), and proxies from other regions of the Gulf may not be appropriate. Because SPR may not be conservative enough for southern flounder, and there is not a complete stock assessment with identified reference points for more than black drum, management strategy is deemed moderately effective.

Justification:
Each trip ticket must include:

- Name of the seller
- Type of commercial license and license number of the seller
- Date of sale
- Texas driver's license

- Number of pounds sold by species
- Unit and condition codes
- Count and/or market size
- Water body or bay system where the products were harvested
- Price paid per pound, per species
- Gear used in harvesting the product
- Trip time
- Fishing time
- Commercial fishing vessel name and license number
- Name of the dealer
- Commercial license number of the dealer

Factor 3.2 - Bycatch Strategy

Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Texas

Highly effective

There are few bycatch species that are retained in the handlines and hand-operated pole-and-lines fisheries that catch southern flounder; undersized fish or individuals that do not meet regulations are likely released, with no harm to minimal harm (pers. comm., M. Stahl 2018). There are few concerns regarding bycatch in this fishery, so the bycatch strategy is considered highly effective.

Gulf of Mexico | Atlantic, Western Central | Harpoons | United States | Texas

Highly effective

Because of the nature of gigging—specifically, the fisher having to see the fish before impaling it—few, if any, bycatch species or undersized individuals are caught (pers. comm., M. Stahl 2018). Therefore, the bycatch strategy is deemed highly effective.

Factor 3.3 - Scientific Research And Monitoring

Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Texas
Gulf of Mexico | Atlantic, Western Central | Harpoons | United States | Texas

Highly effective

The Texas Parks and Wildlife Department (TPWD) monitors the southern flounder population yearly by sampling bays and estuaries with seine and gillnets and by surveying recreational anglers (Stahl 2016). Commercial landing data have been collected since 1950 by the National Marine Fisheries Service (NMFS). A stock assessment was conducted by TPWD in 2014 using a virtual population analysis (VPA) of southern flounder females with a model developed by NOAA (Martinez-Andrade 2014). Fisheries-independent and fisheries-dependent data, recreational fisheries, and the impact of southern flounder as bycatch in the shrimp trawl fishery were all taken into consideration in the

2014 assessment. Since the completion of the stock assessment, annual surveys of abundance have continued and allow TPWD to monitor the population (Martinez-Andrade 2018)(pers. comm., Fernando Martinez-Andrade 2021). There is little bycatch associated with either gear. The gig fishery also targets black drum and sheepshead. Black drum and sheepshead are monitored yearly by TPWD with fishery-independent seine and gillnet surveys, and fishery-dependent data have been collected by NMFS since 1950. Observer and/or video coverage is not included due to the small scale of the fishery. Because there is a recent, scientifically valid and robust stock assessment informing TPWD management, scientific research and monitoring is assessed as highly effective.

Factor 3.4 - Enforcement Of Management Regulations

Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Texas
Gulf of Mexico | Atlantic, Western Central | Harpoons | United States | Texas

Highly effective
The Law Enforcement Division of the Texas Parks and Wildlife Department (TPWD) is responsible for the enforcement of TPWD regulations. There are 110 game wardens that enforce these regulations along the 367 miles of Texas coastline (pers. comm., L. Casterline 2018). Between September 1, 2016 and April 11, 2018, there were six violations involving southern flounder: three involved the daily bag limit and three involved undersized southern flounder (pers. comm., L. Casterline 2018). In addition to the regular patrols by game wardens and the trip ticket program, TPWD has a program called Operation Game Thief for the public to report poaching to the TPWD, with rewards of up to $1,000 (TPWD 2018b). With regular enforcement by TPWD law enforcement and the trip ticket program, enforcement of management regulations is rated highly effective.

Factor 3.5 - Stakeholder Inclusion

Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Texas
Gulf of Mexico | Atlantic, Western Central | Harpoons | United States | Texas

Highly effective
The Texas Parks and Wildlife Commission (TPWC) is the agency that makes the policy decisions that are enforced by the Texas Parks and Wildlife Department (TPWD) (GSMFC 2015). The TPWC consists of nine commissioners appointed by the governor of Texas and confirmed by the Texas Senate to 6-year terms (GSMFC 2015)(TPWD 2018). The TPWC has an annual public hearing in August to receive input from any concerned party regarding policies, goals, programs, or responsibilities of the department (TPWD 2018).

TPWC is required by Texas law to notify the public of its meetings and the intended discussion topics and/ or items that the TPWC may take action on during the meeting; public comment is allowed on the posted topics at these meetings (TPWD 2018). In addition to oral comments at TPWC meetings, written comments may be submitted online, mailed, or delivered in person 1 hour before meetings (TPWD 2018). There are multiple ways that stakeholders may comment on proposed TPWC actions, and proposed actions are posted online and in print before meetings; therefore, stakeholder inclusion is considered highly effective.

Criterion 4: Impacts on the Habitat and Ecosystem

This Criterion assesses the impact of the fishery on seafloor habitats, and increases that base score if there are measures in place to mitigate any impacts. The fishery's overall impact on the ecosystem and food web and the use of ecosystem-based fisheries management (EBFM) principles is also evaluated. Ecosystem Based Fisheries Management aims to consider the interconnections among species and all natural and human stressors on the environment. The final score is the geometric mean of the impact of fishing gear on habitat score (factor 4.1 + factor 4.2) and the Ecosystem Based Fishery Management score. The Criterion 4 rating is determined as follows:

- ***Score >3.2=Green or Low Concern***
- ***Score >2.2 and ≤3.2=Yellow or Moderate Concern***
- ***Score ≤2.2 = Red or High Concern***

Guiding principles

- Avoid negative impacts on the structure, function or associated biota of marine habitats where fishing occurs.
- Maintain the trophic role of all aquatic life.
- Do not result in harmful ecological changes such as reduction of dependent predator populations, trophic cascades, or phase shifts.
- Ensure that any enhancement activities and fishing activities on enhanced stocks do not negatively affect the diversity, abundance, productivity, or genetic integrity of wild stocks.
- Follow the principles of ecosystem-based fisheries management.

Rating cannot be Critical for Criterion 4.

Criterion 4 Summary

FISHERY	FISHING GEAR ON THE SUBSTRATE	MITIGATION OF GEAR IMPACTS	ECOSYSTEM-BASED FISHERIES MGMT	SCORE
Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Texas	Score: 4	Score: 0	Moderate Concern	**Green (3.464)**
Gulf of Mexico | Atlantic, Western Central | Harpoons | United States | Texas	Score: 4	Score: 0	Moderate Concern	**Green (3.464)**

Criterion 4 Assessment

SCORING GUIDELINES

Factor 4.1 - Physical Impact of Fishing Gear on the Habitat/Substrate
Goal: The fishery does not adversely impact the physical structure of the ocean habitat, seafloor or associated biological communities.

- *5 - Fishing gear does not contact the bottom*
- *4 - Vertical line gear*
- *3 - Gears that contacts the bottom, but is not dragged along the bottom (e.g. gillnet, bottom*

longline, trap) and is not fished on sensitive habitats. Or bottom seine on resilient mud/sand habitats. Or midwater trawl that is known to contact bottom occasionally. Or purse seine known to commonly contact the bottom.

- *2 - Bottom dragging gears (dredge, trawl) fished on resilient mud/sand habitats. Or gillnet, trap, or bottom longline fished on sensitive boulder or coral reef habitat. Or bottom seine except on mud/sand. Or there is known trampling of coral reef habitat.*
- *1 - Hydraulic clam dredge. Or dredge or trawl gear fished on moderately sensitive habitats (e.g., cobble or boulder)*
- *0 - Dredge or trawl fished on biogenic habitat, (e.g., deep-sea corals, eelgrass and maerl)*
  Note: When multiple habitat types are commonly encountered, and/or the habitat classification is uncertain, the score will be based on the most sensitive, plausible habitat type.

Factor 4.2 - Modifying Factor: Mitigation of Gear Impacts
Goal: Damage to the seafloor is mitigated through protection of sensitive or vulnerable seafloor habitats, and limits on the spatial footprint of fishing on fishing effort.

- *+1 —>50% of the habitat is protected from fishing with the gear type. Or fishing intensity is very low/limited and for trawled fisheries, expansion of fishery's footprint is prohibited. Or gear is specifically modified to reduce damage to seafloor and modifications have been shown to be effective at reducing damage. Or there is an effective combination of 'moderate' mitigation measures.*
- *+0.5 —At least 20% of all representative habitats are protected from fishing with the gear type and for trawl fisheries, expansion of the fishery's footprint is prohibited. Or gear modification measures or other measures are in place to limit fishing effort, fishing intensity, and spatial footprint of damage caused from fishing that are expected to be effective.*
- *0 —No effective measures are in place to limit gear impacts on habitats or not applicable because gear used is benign and received a score of 5 in factor 4.1*

Factor 4.3 - Ecosystem-Based Fisheries Management
Goal: All stocks are maintained at levels that allow them to fulfill their ecological role and to maintain a functioning ecosystem and food web. Fishing activities should not seriously reduce ecosystem services provided by any retained species or result in harmful changes such as trophic cascades, phase shifts or reduction of genetic diversity. Even non-native species should be considered with respect to ecosystem impacts. If a fishery is managed in order to eradicate a non-native, the potential impacts of that strategy on native species in the ecosystem should be considered and rated below.

- *5 — Policies that have been shown to be effective are in place to protect species' ecological roles and ecosystem functioning (e.g. catch limits that ensure species' abundance is maintained at sufficient levels to provide food to predators) and effective spatial management is used to protect spawning and foraging areas, and prevent localized depletion. Or it has been scientifically demonstrated that fishing practices do not have negative ecological effects.*
- *4 — Policies are in place to protect species' ecological roles and ecosystem functioning but have not proven to be effective and at least some spatial management is used.*
- *3 — Policies are not in place to protect species' ecological roles and ecosystem functioning but detrimental food web impacts are not likely or policies in place may not be sufficient to protect species' ecological roles and ecosystem functioning.*

- *2 — Policies are not in place to protect species' ecological roles and ecosystem functioning and the likelihood of detrimental food impacts are likely (e.g. trophic cascades, alternate stable states, etc.), but conclusive scientific evidence is not available for this fishery.*
- *1 — Scientifically demonstrated trophic cascades, alternate stable states or other detrimental food web impact are resulting from this fishery.*

Factor 4.1 - Impact of Fishing Gear on the Habitat/Substrate

Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Texas
Gulf of Mexico | Atlantic, Western Central | Harpoons | United States | Texas

Score: 4
Handlines, hand-operated pole-and-lines, and gig have little contact with the seafloor, and any negative impacts are expected to be minimal.

Factor 4.2 - Modifying Factor: Mitigation of Gear Impacts

Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Texas
Gulf of Mexico | Atlantic, Western Central | Harpoons | United States | Texas

Score: 0
Handlines, hand-operated pole-and-lines, and gig are sufficiently benign to the seafloor; therefore, no mitigation to the gears is necessary, and no mitigation credits are added.

Factor 4.3 - Ecosystem-based Fisheries Management

Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Texas
Gulf of Mexico | Atlantic, Western Central | Harpoons | United States | Texas

Moderate Concern
Southern flounder is an ambush predator; it feeds throughout the day, with the highest feeding rates in the afternoon (GSMFC 2015). The typical prey varies as the flounder ages, with plankton, bottom invertebrates, and mysids being common for early life stages and juvenile fish (GSMFC 2000). As the juvenile fish grows, it increasingly adds small fish until those make up a majority of the diet (GSMFC 2000). In Texas waters, common prey species are anchovy, mullet, shrimp, menhaden, and Atlantic croaker (GSMFC 2000). When sheepshead is a large juvenile or small adult, it primarily consumes hard-shelled organisms (e.g., oysters, clams, blue crabs); as an adult, it feeds on a diet of algae, seagrass, and a variety of invertebrates (GSMFC 2006). Sheepshead may play an important role in shaping epifaunal diversity in bottom communities, including indirectly increasing motile epifauna diversity and sessile invertebrate communities (Sedberry 1987). Little is known about predation on sheepshead (GSMFC 2006). Black drum is a bottom feeder, with a preference for worms and mollusks, but it also consumes algae and small fish (Hill 2005).

The Gulf of Mexico Marine Fishery Management Council is in the research phase of ecosystem-based management (EBM) development. The most recent report identifies key indicators of the ecosystem's status, including land use change, commercial landings, bird abundance, hypoxia, artificial structures, fish stock status, sea surface temperature, Atlantic multidecadal oscillation, integrated

perspectives, and sea level rise (Karnauskas et al. 2017). The bag limit is greatly reduced during the peak of the spawning season (Martinez-Andrade 2014), which represents a precautionary strategy to protect spawning individuals as they migrate offshore; however, there are typically no closed areas or seasons (GSMFC 2015). TPWD did close the season for six weeks in 2021, but closures such as this are not routinely undertaken (TPWD 2021d). There is no evidence that food web impacts are likely in the flounder fishery, though it is possible that removal of sheepshead could affect epifaunal diversity. Because an EBM plan is being actively sought and negative food web impacts are unlikely, ecosystem-based fisheries management is deemed a moderate concern.

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Scientific review does not constitute an endorsement of the Seafood Watch® program, or its seafood recommendations, on the part of the reviewing scientists. Seafood Watch® is solely responsible for the conclusions reached in this report.

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Appendix A: Commercial Flounder Landings 1950–2020

Year	Species	Metric Tons	Pounds	$
1950	FLATFISH	104.3	229,900	56,341
1951	FLATFISH	39.4	86,900	21,925
1952	FLATFISH	94.4	208,100	45,832
1953	FLATFISH	82.1	181,100	39,745
1954	FLATFISH	62.2	137,200	31,669
1955	FLATFISH	50.4	111,200	28,548
1956	FLATFISH	57.2	126,000	29,014
1957	FLATFISH	63.8	140,700	34,955
1958	FLATFISH	52.8	116,500	24,979
1959	FLATFISH	81.6	179,900	37,251
1960	FLATFISH	78.4	172,800	45,768
1961	FLATFISH	69.6	153,500	38,787
1962	FLATFISH	95.6	210,800	51,344
1963	FLATFISH	125.2	276,100	69,007
1964	FLATFISH	138.6	305,600	77,377
1965	FLATFISH	132.7	292,500	72,783
1966	FLATFISH	172.4	380,100	94,522
1967	FLATFISH	111.0	244,700	62,264
1968	FLATFISH	152.5	336,200	75,438
1969	FLATFISH	133.4	294,100	63,750
1970	FLATFISH	134.8	297,200	64,844
1971	FLATFISH	144.7	319,100	75,603
1972	FLATFISH	205.8	453,800	119,735
1973	FLATFISH	155.1	341,900	105,275
1974	FLATFISH	230.0	507,100	149,081
1975	FLATFISH	223.4	492,600	176,032
1976	FLATFISH	198.2	437,000	181,177
1977	FLATFISH	141.0	310,900	171,573
1978	FLATFISH	107.6	237,150	173,202
1979	FLATFISH	105.4	232,444	190,076
1980	FLATFISH	88.2	194,448	153,239
1981	FLATFISH	58.6	129,266	136,860
1982	FLATFISH	242.9	535,487	520,915
1983	FLATFISH	214.9	473,877	444,988
1984	FLATFISH	172.4	380,000	350,758
1985	FLATFISH	201.2	443,504	444,989
1986	FLATFISH	254.2	560,309	539,973
1987	FLATFISH	249.0	549,050	536,195
1988	FLATFISH	124.2	273,806	337,295
1989	FLATFISH	75.6	166,688	200,543
1990	FLATFISH	65.3	143,958	180,481
1991	FLATFISH	123.9	273,088	316,101
1992	FLATFISH	135.0	297,646	377,647
1993	FLATFISH	96.4	212,555	328,310
1994	FLATFISH	105.2	232,004	385,123
1995	FLATFISH	135.7	299,130	517,765
1996	FLATFISH	110.1	242,833	447,235
1997	FLATFISH	85.0	187,378	341,866
1998	FLATFISH	98.8	217,911	422,598

1999	FLATFISH	130.5	287,768	603,057
2000	FLATFISH	72.4	159,545	321,677
2001	FLATFISH	54.7	120,682	248,776
2002	FLATFISH	78.6	173,329	371,245
2003	FLATFISH	71.9	158,512	335,891
2004	FLATFISH	68.5	151,059	324,782
2005	FLATFISH	65.3	143,984	275,764
2006	FLATFISH	30.7	67,787	164,079
2007	FLATFISH	11.0	24,313	62,035
2008	FLATFISH	26.3	57,910	143,502
2009	FLATFISH	14.5	31,936	90,699
2010	FLOUNDER, SOUTHERN	1.5	3,351	10,182
2011	FLOUNDER, SOUTHERN	12.3	27,225	68,653
2012	FLOUNDER, SOUTHERN	10.2	22,445	58,003
2013	FLOUNDER, SOUTHERN	2.1	4,737	17,230
2014	FLOUNDER, SOUTHERN	1.2	2,643	10,506
2015	FLOUNDER, SOUTHERN	2.2	4,873	15,669
2016	FLOUNDER, SOUTHERN	7.7	17,018	58,417
2017	FLOUNDER, SOUTHERN	4.0	8,843	35,201
2018	FLOUNDER, SOUTHERN	1.9	4,088	16,588
2020	FLOUNDER, SOUTHERN	3.4	7,556	35,073

Note: 2019 commercial southern flounder landings data has been withheld by NMFS for confidentiality. (NOAA 2021)

Appendix B: Texas Regulations Affecting Southern Flounder

1981: Commercial sales of spotted sea trout and red drum are banned. This leads to an increase in commercial fishing pressure on southern flounder.

1988: A ban on nets and seines to catch fish and a minimum size of 12 inches is established statewide. For recreational fishers, a bag limit of 20 fish is established with a possession limit of 40 fish. There is no bag limit for commercial fishers except for shrimp trawls, which must follow the recreational bag limits. This decreases fishing pressure, and the size limit allows the southern flounder to grow almost to sexual maturity (data on lengths at sexual maturity are varied) in order to reproduce.

1990: Shrimp trawls may only have aquatic products/bycatch that weigh up to 50% of the weight of the shrimp caught. This limits the amount of bycatch, including southern flounder, that shrimp trawls may keep.

1992: Turtle Exclusion Devices (TED) are required in all shrimp trawls in EEZ waters. This leads to less flounder bycatch because it is able to escape the trawl through the TED.

1995: A limited entry plan is implemented for shrimpers. This may have redistributed commercial fishing pressure.

1996: The minimum size of southern flounder is increased to 14 inches; the recreational bag limit is decreased to 10 fish with a 20 fish possession limit; the commercial bag is set at 60 fish, and shrimp trawls are confined to the recreational limits. This limits fishing pressure on the southern flounder, and it more likely (than the 12-inch minimum) allows them to reach sexual maturity in order to reproduce.

1998: Bycatch reduction devices (BRD) required in all trawls. This leads to a decrease in southern flounder as bycatch in trawls.

1999: A license limitation plan is implemented in the commercial finfish fishery. This leads to a decrease in fishing pressure.

2002: A shrimp vessel buy-back program is instituted, along with a limited entry program for commercial shrimping licenses. This leads to a decrease in southern flounder as bycatch.

2006: The recreational possession limit is decreased from 20 fish to the bag limit of 10 fish. This may lead to a reduction in fishing mortality.

2010: The bag and possession limit for commercial fishers is decreased from 60 fish to 30 fish. The recreational bag and possession limit is decreased from 10 fish to 5 fish. From November 1 to November 30, the recreational, commercial, and shrimper's bag and possession limit is two fish that may only be taken by pole-and-line. On a commercial shrimp boat, the limit is five fish per person with a current shrimp boat captain's license and is subject to the 50% bycatch rule (passed in 1990). This further decreases the fishing pressure on southern flounder, especially during November when it starts migrating to spawning areas.

2014: From December 1 to December 14, the daily bag and possession limit for recreational, commercial, and shrimpers is decreased to two fish that may be taken by any legal means. This further decreases the fishing pressure on southern flounder while it is migrating to spawning areas.

2020: The minimum size limit for southern flounder is increased to 15 inches. A seasonal closure is implemented from November 1 to December 14. During this time, southern flounder may not be caught or retained in the recreational or commercial sectors. These measures are aimed at increasing spawning potential of the population by allowing sexually mature females to remain in the population for longer and by eliminating fishing pressure when southern flounder migrates out to spawning areas (TPWD 2014) (GSMFC 2015)(Stahl 2016)(TPWD 2021b).

Appendix C: 2023 Rating Review

No ratings changes occurred and there were no score changes in any criterion. The only changes made were to update information.

Criterion 1

No score changes. Information in C1.1 and C1.2 was updated to include the new Alabama stock assessment and an updated Louisiana stock assessment.

Criterion 2

No score changes. Information on black drum was updated to match the revised black drum report published in January 2023.

Criterion 3

No score changes. C3.1 was updated with new fishing regulations. C3.3 added context to indicate that surveys of abundance are still being carried out.

Criterion 4

No score changes or updates.