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LOUISIANA RED DRUM

Fishery Management Plan

Louisiana Department of Wildlife & Fisheries

Office of Fisheries

Authors: Jesse DuBose, Ryan Lehman, Jason Adriance, and Jack Isaacs

Editor/Point of Contact: Jason Adriance, jadriance@wlf.la.gov

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Executive Summary

Red Drum (*Sciaenops ocellatus*) is a popular sportfish in Louisiana. The highest total harvest on record (over 15 million pounds) occurred in 1986. However, after enacting commercial regulations in the late 1980s, Red Drum landings substantially declined from the 1986 peak. The recreational fishery now comprises 100% of Louisiana's directed Red Drum harvest. Aside from 2016, 2020, and 2021, recreational landings of Red Drum in Louisiana have remained above 5 million pounds per year in the most recent decade.

Following the development of Louisiana's Red Drum fishery, managers implemented a number of preventative measures against overharvesting in an effort to maintain the Red Drum population at sustainable levels. Regular biological monitoring and assessment of this resource ensures the efficacy of such measures, and helps inform future management decisions to protect the viability of the Red Drum resource for future generations.

The Gulf of Mexico Fishery Management Council (GMFMC) established management thresholds, in consultation with Louisiana and the other four Gulf States, for Red Drum in the Gulf of Mexico region as a 20% spawning potential ratio, based on a 30% escapement rate from the inshore fishery. Results from the most recent assessment (West et al. 2022), of Louisiana's Red Drum stock indicates the stock is currently not overfished, but is experiencing overfishing. The current spawning potential ratio estimate is 40% and the current escapement rate estimate is 20%. The recent downturn in recreational landings are likely due to a series of below average annual recruitments to the stock, where the most recent annual recruitment estimates are the lowest in the history of the assessment. Management actions are needed in order to prevent future overfishing and prevent the stock from becoming overfished.

This fishery management plan creates a centralized document that summarizes the current biology and status of Louisiana's Red Drum stock, Louisiana's recreational and historic commercial fishery for Red Drum, the effects of Red Drum and its fisheries on the ecosystem, and environmental influences on Louisiana's Red Drum resource. This plan also discusses state and regional level management approaches, along with long-term management goals and objectives. Ongoing management issues are identified, and recommendations are made to address such issues and direct future research.

Introduction

DEFINITION OF MANAGEMENT UNIT

The management unit consists of the population of Red Drum (*Sciaenops ocellatus*) residing in the coastal and estuarine waters of Louisiana.

MANAGEMENT AUTHORITY AND PROCESS

The Louisiana State Legislature (Legislature), the Louisiana Wildlife and Fisheries Commission (Commission), and the Louisiana Department of Wildlife and Fisheries (LDWF) are responsible for managing fisheries for Red Drum in Louisiana's state waters, which include inland waters and extend seaward from the shoreline to three nautical miles.

Louisiana Revised Statutes (LA R.S.) Title 56, provide for the preparation and implementation of fishery management plans that will prevent overfishing and will achieve and maintain plentiful fish populations to ensure, on a continuing basis, the optimum yield from each fishery. Louisiana's fishery management plans are developed according to applicable principles and standards of the Food and Agriculture Organization (FAO) of the United Nations' Code of Conduct for Responsible Fisheries (LA R.S. 56:638.1 and following sections).

Responsible fisheries management requires an ongoing process of continual improvement, including active monitoring of fisheries resources and timely responses to any observed changes. Fishery management plans are flexible and can be improved with collection and analyses of relevant data. Management plan work groups continuously review new research every year, document progress toward fishery management goals, and review management plans. Managers and stakeholders prioritize and identify issues, while refining management options.

MANAGEMENT GOALS AND OBJECTIVES

The goal of the Louisiana Red Drum Fishery Management Plan is to ensure long-term conservation and sustainable use of the Red Drum resource for the maximum environmental, social, and economic benefit to the state of Louisiana, its citizens, and visitors. LDWF will use the following objectives to achieve this goal:

1. Prevent overfishing and ensure Red Drum are able to successfully reproduce and maintain the population.
2. Achieve a level of fishing capacity that provides for a sustainable harvest and allows for a vibrant fishery.
3. Minimize conflicts among user groups.
4. Minimize fishery impacts on undersized and oversized Red Drum and other species while maintaining a sustainable adult spawning population.
5. Continue to produce stock assessments that establish acceptable biological reference points for fishing mortality and population abundance.
6. Promote research to better understand the impacts of environmental factors on both the Red Drum population and fisheries as well as the impacts of Red Drum fisheries on the ecosystem.
7. Promote research to improve knowledge of the fisheries for Red Drum, including harvest data and socioeconomic information to enhance social and economic benefits derived from the use of the resource.

Description of the Stock

Red Drum Resilience

Productivity is a function of fecundity, growth rates, natural mortality, age of maturity, and longevity and can be a reasonable proxy for resilience.

Red Drum are considered to have medium to low productivity, and therefore not as resilient as other species with shorter life spans. The stock is currently undergoing overfishing and management measures have been enacted to ensure future resilience.

BIOLOGICAL PROFILE

Overstreet (1983) provides a comprehensive biological profile of Red Drum (*Sciaenops ocellatus*), commonly known as Redfish, in the Gulf of Mexico (GOM) focusing on the biological description, reproduction, and life history of this species. A decade later, LDWF published an updated bio-profile, with emphasis on information specific to Louisiana's Red Drum stock (Hoese et al. 1991). The most recent stock assessment by LDWF was published in 2022 (see *Appendix I*). The Gulf States Marine Fisheries Commission's Management Profile for GOM Red Drum (Vanderkooy and Rester 2023) combines these works and more to provide the most complete biological profile of the Red Drum to date. Other texts that further investigate the biology, reproduction, and life history of this species are also mentioned in this text.

PHYSICAL DESCRIPTION

Red Drum are a member of the Sciaenidae family, a family that includes species typically referred to as drum or croakers. This family is within the order Perciformes, which is the largest order of fishes with over 6,000 species. Red Drum are generally characterized by an elongated body with a slightly subterminal mouth that lacks barbels (Grubich 2000). Red Drum are typically bronze in color, but individuals found over sandy bottoms can display a more silvery coloration (Wenner 1992), while those found inshore over muddy bottom with vegetation are often tinted orange in color (Simmons and Breuer 1962, Overstreet 1983). Regardless of coloration, a distinct ocellated black spot typically occurs on both sides of the upper caudal fin insertion with some fish exhibiting an atypical series of spots.

DISTRIBUTION

Red Drum are distributed in the western Atlantic from Tuxpan in central Mexico throughout the Gulf of Mexico, around the Florida peninsula, and up the Atlantic coast to Massachusetts (Simmons and Breuer 1962, Yokel 1966, Castro-Aguirre 1978, Matlock 1980, Murphy and Taylor 1990, Porch et al. 2002). While Red Drum can be found throughout this distribution, they are more reliably found in United States (U.S.) waters from Texas to South Carolina, particularly in the waters of the GOM (Yokel 1966, Ward and Armstrong 1980). Red Drum have also been introduced to Singapore (Jaafar et al. 2012), Taiwan and the surrounding Matsu Islands (Liao et al. 2009), some Caribbean islands including Martinique and the Bahamas (Chakalall 1993), as well as Reunion Island (Letourneur et al. 2004), and Israel (Golani and Mires 2000, Galil 2007, Golani et al. 2015).

HABITAT

Within their distribution, Red Drum exhibit ontogenetic differences in habitat usage. All life stages are resilient to a variety of water temperatures, and are found from 2-35 degrees Celsius (^{O}C) (36–95 degrees Fahrenheit (^{O}F)) (Simmons and Breuer 1962, Yokel 1966, Miranda and Sonksi 1985, Whitehurst and Robinette 1994, Procarione and King 1993). All life stages have been found in salinities from 0 to 55 parts per thousand (ppt) (Simmons and Breuer 1962, Yokel 1966, Perret et al. 1971, Perret et al. 1980, Crocker et al. 1981, Holt et al. 1981, Benson 1982, Konikoff and Hoese 1989, and Tomasso and Kempton 2000, Molina et al. 2016). They show a somewhat lower rate of metabolic cost increase in low salinities than other sciaenids (Wakeman and Wohlschlag 1983). As a result of their temperature and salinity tolerances, Red Drum can be found in a variety of different offshore and nearshore habitats including brackish estuaries, bayous, canals, saltwater bays, lagoons, and in offshore waters, depending on life stage.

Larval Red Drum spend their first few weeks as plankton in the water column after hatching in near-offshore waters (Peters and McMichael 1987, Holt et al. 1983, Holt et al. 1985). Sampling plankton off the Louisiana, Mississippi, and Alabama coasts revealed larval Red Drum concentrate in the upper 5 meters (m) (16.4 feet (ft.)) of the water column (Lyczkowski-Shultz et al. 1988, Comyns et al. 1991). Larval transport occurs by tidal action from these nearshore waters into natal estuaries, where they will remain for most of their juvenile life stage (Peters and McMichael 1987, Rooker and Holt 1997, Rooker et al. 1999, Brown et al. 2000). Larvae may move to shallow areas or move vertically in the water column during tidal ebb (Holt et al. 1989) to prevent being returned to offshore waters (King 1971). The highest concentrations of Red Drum larvae are found between September–October (Leffler 1989).

Red Drum postlarvae and early juveniles have been shown to favor natal estuaries with marsh habitat, seagrass beds, and oyster beds (Holt et al. 1983, Rooker and Holt 1997, Rooker et al. 1999, Stunz et al. 2002, and Havel et al. 2015). Post larval Red Drum found in *Spartina alterniflora* marshes with marsh edge interfaces were found to support much higher densities than nearby non-vegetated bottom (Stunz et al. 2002). While oysters provide structure that may be used as habitat, Stunz et al. (2002) were unable to find any larvae on sampled oyster reefs. Once larvae have entered shallow bays through passes, and become more bottom-oriented as early juveniles, they remain in slower moving water and coves until they are large enough to overcome tidal currents (Simmons and Breuer 1962, Yokel 1966, Perret et al. 1980, Ward and Armstrong 1980, Overstreet 1983).

Young of the year Red Drum in Texas seem to prefer submerged seagrass beds (Holt et al. 1983), an uncommon estuarine habitat in Louisiana. True seagrasses such as turtle grass (*Thalassia testudinum*) and shoal grass (*Halodule wrightii*) are most common in the Chandeleur Islands, but occasionally beds develop in Terrebonne and Timbalier Bay (Montz 1977, Franze 2002). Seagrasses have trouble growing due to the sediment rich water from the Mississippi River (Ward and Armstrong 1980), as well the conditions created by freshwater outflow. Other seagrasses and types of submerged aquatic vegetation occur throughout Louisiana (Hester et al. 2005); however, Pearson (1929) found that juvenile Red Drum in Louisiana seemed to prefer saline *Spartina alterniflora* marshes with shallow bottom and sandy substrate. In the Barataria Basin, Louisiana, young Red Drum (5-12 millimeters (mm) Standard Length (SL) (0.2-0.4 inches (in))) were collected over sandy bottoms that often included a mixture of clay, silt and oyster shell fragments (Baltz et al. 1998). Juveniles are also found over oyster beds; however, cage experiments suggest their presence there is influenced by exposure to predators, causing individuals to seek out more structurally complex habitats than bare substrate (Gain 2009), however Stunz et al. (2001) reported that wild Red Drum did seek out more structured habitat, such as oyster reefs, in the absence of predators.

Juvenile Red Drum are present in Louisiana estuaries year round (Hoese et al. 1991). However, individuals will move out of shallow flats and small lakes, especially in mid-winter (Herke et al. 1987). When juveniles move out of protected backwaters, they can be found in a wide variety of habitats (Holt et al. 1983). Juvenile Red Drum can be found in interior *Spartina alternflora* marshes, channels, bays, flats, islands, tidal rivers. However, individuals occur at higher densities within, and display preference for more complex vegetated ecosystems like Louisiana's *Spartina alternflora* marsh edges (Rooker and Holt 1997). In 1998, Rooker et al. found that juveniles that settled into more vegetated areas had a higher rate of survival because of increased predator avoidance rather than increased growth rates due to more favorable foraging conditions.

Adult Red Drum are present in Louisiana estuaries year-round (Hoese et al. 1991), and are also found offshore, often in large schools (Overstreet 1983, National Marine Fisheries Service 1986, Wilson and Nieland 1994). After reaching sexual maturity, Red Drum migrate into nearshore coastal waters (Peters and McMicheal 1987, Winner et al. 2014). In late summer and early fall, Red Drum will move out of the estuaries and into the coast-

al offshore waters where they gather in schools in preparation for spawning (Pearson 1929, Overstreet 1983, Wilson and Nieland 1994, Mullin et al. 1996). However, several studies have documented large schools of Red Drum at other times of the year (Lohoefener et al. 1987, Wilson and Nieland 1994, Mullin et al. 1996, Powers et al. 2012, Lowerre-Barbieri et al. 2016). In offshore waters, Red Drum tend to move along coastlines (Nichols 1988). During recapture studies, movements of up to 778 kilometers (km) (483.4 miles (mi)) have been documented during a two-year timespan (Overstreet 1983). Hightower et al. (2022) examined catch per effort across the northern GOM and showed that adult Red Drum were significantly more abundant in state waters when compared to offshore federal waters.

AGE AND GROWTH

Red Drum, in the GOM, live to approximately age 30, with some specimens aged over 40 (Winner et al. 2014). In Louisiana, the oldest Red Drum collected by LDWF, determined via otolith analysis, were an age 36.07 male and an age 36.49 female, corresponding to sizes of 1014 mm (39.9 in) and 947 mm (37.3 in), respectively. However, the Southeast Area Monitoring and Assessment Program (SEAMAP) recorded an age 40 male, measuring 1000 mm (39.4 in) in length during 2018 surveys off the coast of Louisiana (E Lang, LDWF, personal communication). Growth rates are similar across the GOM (VanderKooy and Rester 2023). Overall, Red Drum growth is exponential in the first year, slows significantly after age 5 and approaches to asymptotic length at age 10 (Beckman 1989, Ross et al. 1995; *Figures 1-3*). This coincides with age at sexual maturity for Red Drum, which is generally by age 5, however, some Red Drum have been documented to spawn as early as age 3 or as late as age 7 with 50% maturity occurring about 4 years of age (Peters and McMichael 1987, Wilson et al. 1988, Wilson and Nieland 1994, Winner et al. 2014, Bennetts et al. 2019). There are strong seasonal growth coefficients of juvenile Red Drum occurring in the warm summer months (Porch et al. 2002). In Louisiana, the largest Red Drum on record are 1093 mm (M) and 1152 mm (F), with corresponding ages of 22.39 and 21.81, respectively.

REPRODUCTION

Adult Red Drum mature sexually around age five, however, some Red Drum have been documented to spawn as early as age 3 or as late as age 7 with 50% maturity occurring about 4 years of age (Peters and McMichael 1987, Wilson et al. 1988, Wilson and Nieland 1994, Winner et al. 2014, Bennetts et al. 2019). (Peters and McMichael 1987, Winner et al. 2014). Bennetts et al. (2019) indicated a 50% maturity rate in male and female Red Drum at 639 mm (25.1 in) and 638 mm (25.1 in) in length, respectively. After maturity, or about age 5, sexual dimorphism occurs, wherein females are generally longer than males, on average (Beckman 1989, Bennetts et al. 2019, Hightower et al. 2022). Sexually mature male Red Drum, as their name suggests, produce low frequency sounds by vibrating specialized drumming muscles in combination with their air bladder, which is used during courtship (Burkenroad 1931, Guest and Lasswell 1978, Holt 2008). In preparation for spawning, the normally quiet males begin drumming and nudging females (Arnold et al. 1977). Each male will produce a multitude of pulses repeated at various rates and patterns, however, it is unknown whether particular drumming patterns are associated with specific spawning behavior (Guest and Lasswell 1978, Holt 2008).

Red Drum are autumnal spawners throughout their range in the GOM (Bennetts et al. 2019). Published estimates of spawning season in the Gulf (Pearson 1929, Springer and Woodburn 1960, Yokel 1966, Jannke 1971, Christmas and Waller 1973, Heffernan 1973, Johnson 1978, Overstreet 1983, Hein and Shepard 1984, Ditty 1986, Murphy and Taylor 1990) vary geographically. Wilson and Nieland (1994) demonstrate an eight to nine week spawning season from mid-August through early October. In Louisiana waters, including the MS/LA barrier island chains, spawning is reported from August to November (Pearson 1929, Sabins 1973, Hein and Shepard 1984), specifically 8/21-11/2, based on spawning dates back-calculated from larval otolith analysis (Shaw et al. 1988). The main spawning peak may last only a few weeks during late September although two or more peaks can occur in September or early October.

Red Drum spawning begins when water temperatures fall below 29^{O}C (84.2^{O}F), with the lower limit of spawning occurring around 200C (68^{O}F) (Lyczkowski-Shultz et al. 1988). In laboratory experiments, spawning was initiated when temperatures dropped to 23-26^{O}C (73.4-78.8^{O}F) and photoperiod was reduced from 12 hours (hrs) light/12 hrs dark to 9 hrs light/15 hrs dark at salinities between 26 and 32 ppt (Arnold et al. 1977, Holt et al. 1985). Spawning under laboratory conditions is ideal when temperature and light cycle are reduced to 23^{O}C (73.4^{O}F) and 10 hrs, respectively (Roberts 1987). Experimentally, Red Drum have been shown to be capable of spawning year-round in laboratory simulated mesocosms (Arnold 1988). When temperature, salinity, and photoperiod conditions are met, Red Drum spawning is thought to occur between the dusk and midnight, as evidenced by behavior in captivity and the presence of eggs and larvae in plankton samples (Arnold et al. 1977, Guest and Lasswell 1978). Holt et al. (1985) reported spawning in the lab from just before sunset for the next three hours, but in the field from one to three hours after sunset.

Gonadosomatic and histological examinations of Red Drum ovarian development (Fitzhugh and Thompson 1987, Fitzhugh et al. 1988, Wilson et al. 1988, Wilson and Nieland 1994) provide further definition of the Red Drum spawning season in Louisiana. Fitzhugh and Thompson (1987) and Wilson et al. (1988) support spawning at the onset of darkness by determining the timeline of oocyte hydration, the transitory final stage of oocyte maturation, as mid to late afternoon (Fitzhugh and Thompson 1987, Wilson et al. 1988). It has been hypothesized that the timing of spawning with the onset of darkness is a strategy that allows maximum dispersal of the eggs before daylight, thereby lessening the impact of predation by sight feeding predators (Holt et al. 1985). Spawning peaks also coincide with new or full moon phases, as determined by back-calculated spawning dates from known ages of surviving larvae and juveniles (Peters and McMichael 1987, Lyczkowski-Shultz et al. 1988). Fitzhugh

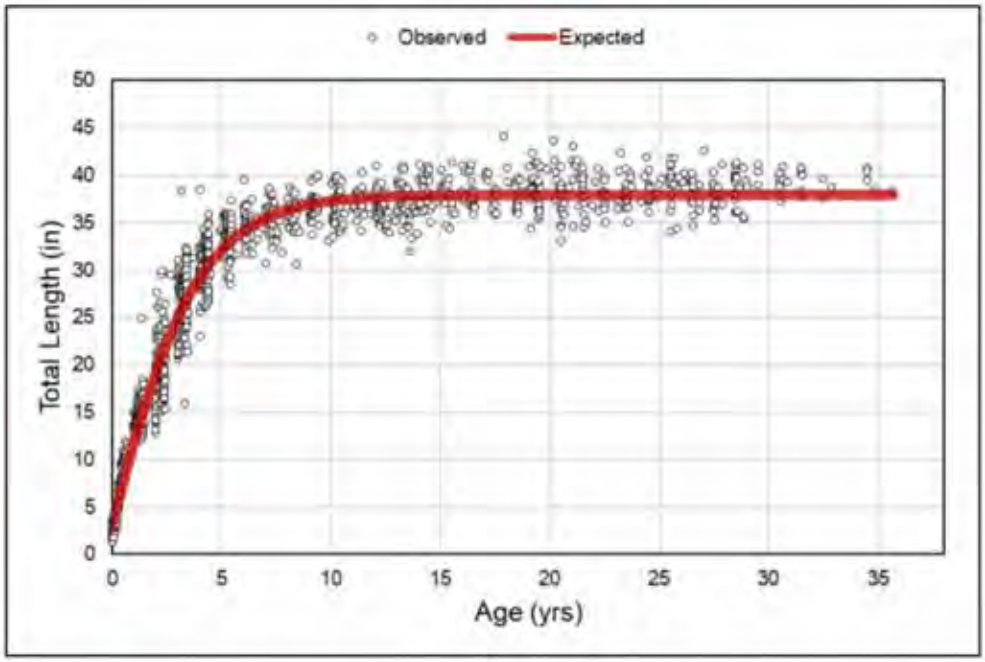

FIGURE 1. Louisiana Red Drum (Sciaenops ocellatus) total length-at-age observations and predicted total length-stage from the damped growth model using fisheries dependent and fisheries independent length and age data. Units are total length in inches and age in years (from Lang and West, 2022).

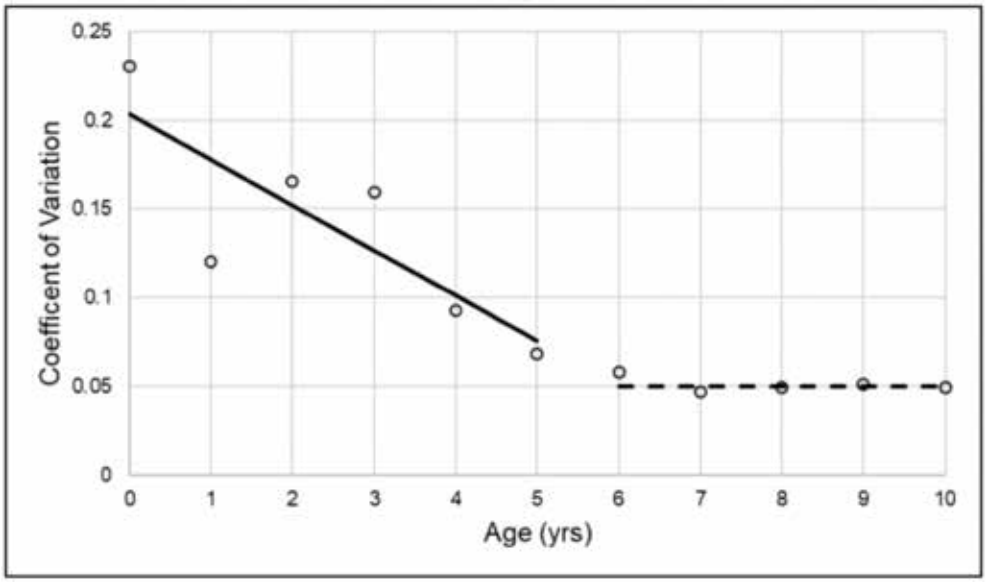

FIGURE 2. Age-specific (0–10+) coefficient of variations (CV) for Louisiana Red Drum (Sciaenops ocellatus) from the damped growth model using fisheries-independent and fisheries-dependent length and age data with a linear regression fit from age-0 to age-5 with CV represented by the solid diagonal line and a uniform CV of the age-6 plus group represented by the dashed horizontal line (from Lang and West, 2022).

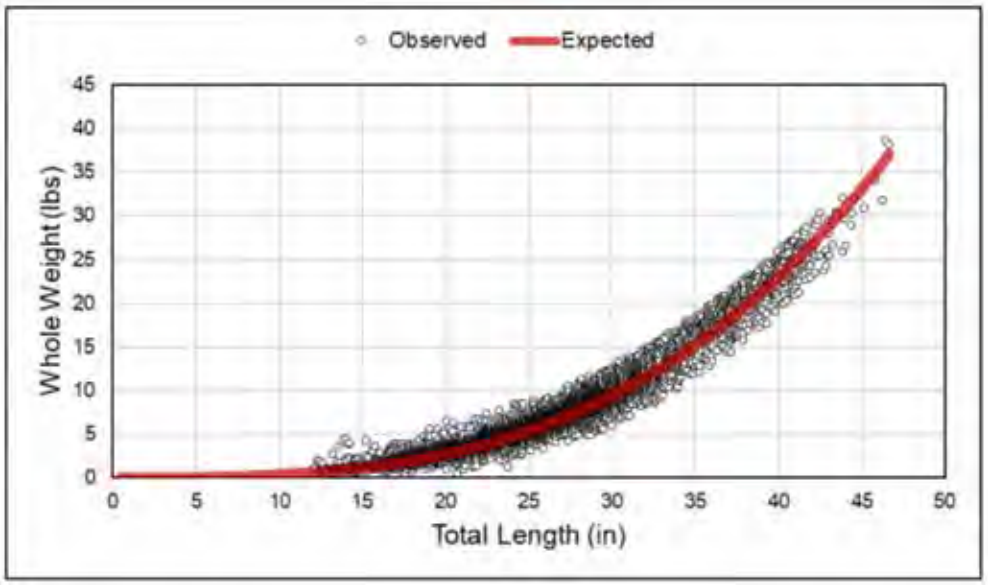

FIGURE 3. Louisiana Red Drum (Sciaenops ocellatus) whole weight/total length observations and predicted values from the power model using fisheries-independent and fisheries-dependent age and growth otolith data. Units are total length in inches and whole weight in pounds (from Lang and West 2022).

and Thompson (1987) and Wilson et al. (1988) also indicate Red Drum are batch spawners, with a wide distribution of oocyte maturation in the ovaries, resulting in two or more populations of oocytes in ovarian tissues over the course of the spawning season. This spawning approach is supported in additional literature (Wallace and Selman 1981; Bennetts et al. 2019). Wilson and Nieland (1994) reported that the onset of spawning, as evidenced by the presence of post-ovulatory follicles (POF) in ovarian tissues, was first observed on 18 August, 19 August, and 14 August for the years 1986, 1987, and 1988, respectively. Hydrated oocytes and POF continue to show sporadically in the samples of all years through the end of September to early October. The completion of the spawning season by mid-October was indicated by a peak in oocyte degeneration. A peak in oocyte degeneration indicated the completion of the spawning season by mid-October.

Laboratory observations of Red Drum spawning confirm the fractional nature of Red Drum spawning (Roberts et al. 1978). Wilson et al. (1988) estimated interspawning interval, or the time interval between spawning events, for Red Drum in the northern GOM using the POF method from Hunter and Macewicz (1985). Interspawning interval (ISI) estimates for the spawning seasons of 1986, 1987, and 1988 were 3.0 days, 5.3 days and 10.3 days, respectively. The overall estimate for the three spawning seasons was 5.2 days. Fitzhugh and Thompson (1987) estimated ISI in 1986 as 3.0 days while Wilson and Nieland (1994) estimated ISI of two to four days for adult Red Drum females with post-ovulatory follicles.

Red Drum have been widely reported to spawn in deeper nearshore, high salinity waters close to channels, inlets, and passes (Pearson 1929, Miles 1950, Simmons and Breuer 1962, Yokel 1966, Jannke 1971, Johnson 1978, Perret et al. 1980, Hein and Shepard 1984, Holt et al. 1985, Peters and McMichael 1987, Nakayama et al. 2011, Bennetts et al. 2019). However, Wilson et al. (1988) stated that sampling of Red Drum between August - October at various nearshore fishing rodeos along the Louisiana coast produced few females in hydrated condition. Observations of mature fish taken from offshore waters suggest offshore spawning is more common (Christmas and Waller 1973, Heffernan 1973, Fitzhugh and Thompson 1987, Wilson et al. 1988).

In coastal Texas, Brown et al. (2000) use particle transport models to suggest Red Drum spawning occurs near Aransas Pass in coastal Texas to take advantage of tidal forcing for larval transport. Holt et al. (2008) build on this theory using acoustic data provided via hydrophone, finding evidence of widespread spawning across the coastline, rather than in discrete groups. However, spawning in this region may still be linked to the adjacent sea grass beds within the estuary (see Brown et al. 2000). In coastal Florida, Walters et al. (2020) demonstrated that natal estuaries drive Red Drum spawning site selection with studies using tagged Red Drum. While earlier studies suggested (Murphy and Taylor 1990, Johnson and Funicelli 1991, Nicholson and Jordan 1994, Woodward 1994, Luczkovich et al. 1999) Red Drum exclusively utilized near shore habitats for spawning, recent studies (Beckwith et al. 2006; Powers et al. 2012, Hightower et al. 2022) suggest that Red Drum utilize a variety of estuarine habitats along the coast.

Red Drum eggs collected off southeast Louisiana were found most concentrated approximately 5 km (3.1 mi) off barrier islands (Shaw et al. 1988). Eggs and larvae of Red Drum collected off the Mississippi and Louisiana (MS/LA) barrier island complex were found between 6-34 km (3.7-21.2 mi) south of Horn Island in 10-30 m (33-99 ft.) of water (Shaw et al. 1988), with the highest concentrations captured between 1-5 m (3.1-16.5 ft.) (Lyczkowski-Shultz et al. 1988). These data suggest that Louisiana Red Drum generally spawn farther offshore than those in either Texas or Florida, perhaps due to lower salinity waters contributed by Louisiana.

Peak catches of larvae in the waters offshore of Mississippi and Louisiana have been made at 28-29^{O}C (82.4-84.2^{O}F) and salinities of 32-34 ppt (Shaw et al. 1988), well within the range of optimal conditions for larval survival and growth in the lab. Arnold et al. (1977) reported 94-97% hatching success rate of Red Drum eggs in the lab at 24^{O}C (75.2^{O}F). Temperature and salinity have a combined effect on hatching success and survival in the first 24 hours (Holt et al. 1981). Holt et al. (1981) found that optimum lab conditions are 25^{O}C (77^{O}F) and a salinity of 30 ppt. Holt et al. further noted that salinities below 10 ppt result in poor hatching success, even at optimum temperatures, and eggs have increased sensitivity to temperature changes at salinities above and below 25 ppt (1981). Eggs and larvae, within 24 hrs of hatching, are more sensitive to lower salinities than larvae that are 24 hours to 14 days old (Holt et al. 1981). McCarty (1987) documented 64% survival to 36 hrs after hatching in laboratory conditions of 23-25^{O}C (73.4-77^{O}F) and salinities from 32-34 ppt.

After hatching, Red Drum larvae drift into bays with strong currents during flood tides after reaching ~7 mm (0.3 in) in size (Sabins 1973). Several studies (Sabins 1973, King 1971, Ditty 1986, and Leffler 1989) described strong peaks of Red Drum larvae in plankton samples during September and October, unlike other sciaenids in Louisiana, which provide substantial immigrating larvae for three to six months, often with two or more peaks (Sabins 1973).

Populations of Red Drum are thought to be genetically healthy, based on a wide range of studies using nuclear and mitochondrial DNA data (e.g., Turner et al. 1999). While genetic differences, or heterozygosity, has been found in many studies (Gold and Turner 2002; Michaelsen 2015; Pillar et al. 2015), patterns of population structure do not indicate populations require management as discrete biological units within the northern Gulf of Mexico. Recruitment likely plays a large role in population structure, as gene flow is suggested to take place in an island/stepping-stone pattern, via migration to geographically close (i.e., within 700-900 km) nursery sites (Gold et al. 1993, 2001, Gold and Turner 2002).

Hatchery-raised fish have been introduced into natural estuaries in both the Gulf (Texas and Florida) and along the Atlantic coast of the U.S. The introduction of hatchery raised fish to supplement population numbers to date does not appear to have

strongly influenced the genetic health or behavior of wild Red Drum populations in the Gulf of Mexico (Karlsson et al. 2008, Tringali et al. 2008, Carson et al. 2009), or Atlantic (Chapman et al. 2002, Jenkins et al. 2004, Denson et al. 2012, Katalinas et al. 2018). However, the contributions of hatchery-raised fish to the spawning stock to date have been relatively minor, so genetic health of the spawning stock remains a long-term concern. Concerns also remain regarding the interactions between naturally spawned Red Drum and those introduced from hatcheries affecting growth or survival of those naturally spawned Red Drum. While behavioral differences have also been observed between naturally spawned Red Drum and those introduced from hatcheries (Stunz et al. 2001), those likely have more implications for estimating efficacy of the stocking efforts than population genetics.

PREDATOR-PREY RELATIONSHIPS

There have been numerous studies of stomach contents of Red Drum across the northern GOM. Camp et al. (2019) identified crustaceans (i.e., mysid shrimp and amphipods) as major prey species of early juvenile Red Drum, and fish species including *Sciaenidae spp*. (drum) and *Mugilidae spp*. (mullet) as major prey of adult Red Drum via stomach content analysis in Florida's coastal waters. Specifically, mysid shrimp made up ~30% of stomach contents, on average, for early juvenile Red Drum while amphipods accounted for another ~9% (Camp et al. 2019). The remaining stomach contents were divided amongst 11 other species of crustaceans and bony fishes (Camp et al. 2019). Soto et al. (1998) showed that Red Drum between 4-20 mm (0.2-0.8 in) consumed copepods and mysid shrimp and had overlapping diets with Atlantic Croaker in Texas seagrass nurseries.

Later juvenile Red Drum in Louisiana will typically depredate on the most abundant food sources in an area, including decapod and fish species (Bass and Avualt 1975). Food habit studies, although often showing a predominance of crustaceans, especially crabs, indicate an omnivorous diet (Overstreet and Heard 1978, Peacock 2014). This type of diet suggests that Red Drum are wide roaming through benthic and pelagic habitats. The sub-inferior mouth of Red Drum, an adaptation to benthic feeding, tilts downward and allows for digging while the fish supports itself on its pelvic fins (Yokel 1966). Despite this adaptation, there are numerous reports of Red Drum feeding on pelagic fish such as mullet, herrings, menhaden, and anchovies (Overstreet and Heard 1978, Matlock 1987). Based on bone structure (Topp and Cole 1968), Red Drum are adapted to a niche between the more benthic feeding Black Drum (*Pogonias cromis*) and the more pelagic seatrouts (*Cynoscion*).

Crustaceans and fish account for most of the reported prey items of Red Drum throughout the GOM and South Atlantic (Fontenot and Rogillio 1970, Music and Pafford 1984, Facendola and Scharf 2012, Peacock 2014). Kroetz et al. (2017) indicated adult Red Drum are dietary generalists with juvenile Red Drum diets composed of mainly crustaceans, primarily crabs and shrimp. Percentage of food types preyed upon by Red Drum varies with geographic location, season, habitat, and size of fish. Scharf and Schlight (2000) showed that the diet of Red Drum in Galveston Bay, Texas has significant seasonal patterns dominated by White Shrimp (*Penaeus setiferus*) during the fall and Gulf Menhaden (*Brevoortia patronus*) in the spring, with Blue Crabs (*Callinectes sapidus*) being present during both seasons. Boothby and Avault (1971) surveyed gut content from adult Red Drum near Hopedale, Louisiana and found that 14 fish species and three crustacean species, including Blue Crab and Penaeid Shrimp. Boothby and Avault (1971) also demonstrated the seasonal preference in diet for Red Drum where fish species dominated the winter and spring diets, and crustacean species were the bulk of the summer and fall diets. Guillory and Prejean (2001) found that Blue Crab is the most frequently encountered species in the Red Drum diet off the coast of Louisiana, with Blue Crabs occurring in 24% of Red Drum stomachs throughout the years 1986-1996. Llanso et al. (1998) noted that smaller juvenile Red Drum (<200mm) showed flexibility in their diet by feeding on abundantly available micro-crustacea, such as amphipods, in a restored mangrove impoundment of Upper Tampa Bay, Florida.

Predation of Red Drum by numerous different predators has been documented. Marsh dwelling mammals, like river otters (*Lutra canadensis*) and minks (*Mustela vison*), are specifically adapted for a fish dependent diet and will feed on a wide variety of fishes, including Red Drum (Chapman and Feldhamer 1982). Likewise, bird species, such as Great Blue Herons (*Ardea herodias*), Cormorants (*Phalacrocorax spp*.), and Great Egrets (*Ardea alba*), are prolific predators of fish, and will take fish species in abundance, including Red Drum (Bent 1926). There are also fish species documented to feed on Red Drum, including Blacktip Sharks (*Carcharhinus limbatus*) whose stomach contents were comprised of a high amount of Red Drum in a study done in coastal Texas water (Matich et al. 2020). Other large aquatic predators like Tiger Sharks (*Galeocerdo cuvier*) and Bottlenose Dolphins (*Tursiops truncatus*) will also prey upon Red Drum (Kemp 1949). Successful predation on Red Drum by fish species is dependent on the size of the Red Drum being preyed upon, with younger, smaller individuals having a higher predation rate than an older, larger individuals (Fuiman 1994). Many mesopredators (predators ranked in the middle of the trophic web) favor smaller fish, such as Pinfish (*Lagodon rhomboides*) and Spotted Seatrout (*Cynoscion nebulosus*), while larger pelagic predators like Blacktip Sharks (*Carcharhinus limbatus*) and Bottlenose Dolphins (*Tursiops truncatus*) prey upon larger individuals (Matich et al. 2020).

STOCK STATUS AND ASSESSMENT METHODOLOGY

STOCK UNIT DEFINITION

Red Drum occur in estuaries and the nearshore and offshore habitats along the Atlantic and Gulf Coasts from the Gulf of Maine southward through the GOM into northern Mexico (GMFMC/GSMFC 1984). Studies using mitochondrial DNA markers (Gold and Richardson 1991, Gold et al. 1994) found significant differences in the frequencies of haplotypes of GOM and Atlantic Red Drum, implying that GOM and Atlantic Red Drum

populations are genetically distinct. Recent genetic studies using microsatellites and mitochondrial DNA to assess population structure and gene flow of Red Drum in the inshore and offshore waters of the northern GOM (Gold and Turner 2002; Michaelsen 2015; Pillar et al. 2015) found high connectivity, and concluded that identified heterogeneity does not delineate subpopulations or stocks with fixed geographical boundaries. Juvenile Red Drum exhibit very little to no movement between estuaries or regions (Walters et al. 2020).

For the purposes of this fishery management plan, the management unit is defined as Red Drum and its fisheries in the estuarine and coastal waters of Louisiana.

ASSESSMENT FREQUENCY, REFERENCE POINTS AND CONTROL RULES

LDWF's most recent Red Drum stock assessment was completed in 2022 using data through 2021. Prior to this assessment, escapement rates were typically calculated for Red Drum as a management measure as there is no legislative or regulatory timeline for conducting an assessment of the Red Drum stock in Louisiana waters. The stock was typically assessed when needed based upon monitoring data. If an assessment report indicates the Red Drum stock is in such a condition as to jeopardize its sustainability (overfished or overfishing), LDWF is obligated to provide management options that recover the stock to sustainable levels to the Commission for its consideration.

While no formal biomass or fishing mortality targets are established for Red Drum by the Legislature or in the Louisiana Administrative Code (LAC), such as those established for Black Drum (*Pogonias cromis*), Southern Flounder (*Paralichthys lethostigma*), and Sheepshead (*Archosargus probatocephalus*), the stock is monitored in relation to its historical status similar to those three species. Management thresholds have been established for Red Drum in the Gulf of Mexico Fishery Management Council (GMFMC) Red Drum Fishery Management Plan (FMP). Amendment 2 of the Red Drum FMP, implemented in 1988, and reestablished with Amendment 5 in 2022, designates a 20% spawning potential ratio (SPR) limit and requests the GOM States to enact rules to achieve that standard by providing 30% escapement of juvenile fish to offshore waters (GMFMC 1988). The state of Louisiana has endorsed that standard, as it was included in Act 889 of the 1988 Regular Legislative Session. A provision of Act 889, which was to become effective Sept. 1, 1991, authorized the Wildlife and Fisheries Commission to set a quota for commercial harvest of Red Drum, based on 30% escapement to offshore waters. This provision never became effective, since that section was repealed by Act 157 of the 1991 Regular Legislative Session. However, it does seem to have established legislative intent to endorse the conservation standard recommended by the GMFMC. Using those criteria, LDWF monitors the Red Drum stock to be above an SPR of 20% and an Escapement Rate of 30%.

STOCK STATUS

LDWF's most recent assessment of Red Drum in Louisiana waters (West et al. 2022, shown as *Appendix I* in this document) estimated that the stock is not currently overfished, with an estimated SPR of 40%. The stock is estimated to be experiencing overfishing, and overfishing has occurred in the past. The estimate of overfishing for the terminal year of the assessment is below the overfishing limit (fishing rate is above the limit) with an escapement rate of 20%. The following section summarizes the methods and findings. See the full assessment report in *Appendix I* for complete details of the current stock status and assessment methods.

Average fishing mortality rates (F) have varied over the time-series of the assessment with a steep increase in the earlier years up to peaks of 0.29 and 0.28 estimated in 1986 and 1987. After 1987, average fishing mortality rates declined steeply after Red Drum harvest in the Exclusive Economic Zone (EEZ) and commercial harvest in state waters (February 1988) was prohibited. In the most recent decade, average fishing mortality rates increased from 0.10 estimated in 2012 to another peak of 0.23 estimated in 2018. Since 2018, average fishing mortality estimates have declined. The 2021 estimate of average F is 0.11.

Escapement rates of juvenile fish calculated from the assessment (i.e., the proportion of juvenile fish that survive the inshore fishery to become adults) have also varied through time, where the lowest escapement rates occurred in 1986 and 1987 (8.6 and 9.9%) before increasing steeply in 1988 to 66.4%. Since 1988, escapement has generally declined. In the most recent decade, escapement estimates have declined overall from an estimate of 38.2% in 2012 to an estimate of 22.2% in 2021 with lows of 17.4 and 17.1% escapement estimated in 2018 and 2020.

Fishing mortality rates of adult fish calculated from the assessment (i.e., the proportion of adult fish that die due to fishing) follow a trend similar to average F and escapement rates, where the highest adult F (46.8%) occurred in 1986 before declining to a relatively stable level between 5 and 8% after harvest in the EEZ was prohibited. Beginning in 2010, adult F rates increased above 10%, which corresponds with the decline observed in stock size and female spawning stock fecundity in the most recent decade. The 2021 estimate of adult F is 14.7%.

Red Drum stock size has varied considerably over the time-series examined in the assessment. Stock size decreased from 13.8 million fish estimated in 1982 to 10.1 million fish estimated in 1989. After 1989, stock abundance increased to a peak of 23.0 million fish in 1999. Since 1999, stock size has generally declined. In the most recent decade, stock size has decreased from the 18.3 million fish estimated in 2012 to the lowest stock size of the modeled time series estimated in 2021 (8.7 million fish).

ASSESSMENT METHODS

LDWF's most recent Red Drum assessment (West et al. 2022) uses an Age-Structured Assessment Program (ASAP), a statistical catch-at-age model, to describe the dynamics of the Red Drum stock in Louisiana and adjacent federal waters from 1982

through 2021. This model projects abundance at age from estimates of abundance in the initial year of the time series and recruitment estimates in subsequent years. Minimum data requirements for the model are fishery catch-at-age and an index of abundance. Landings are taken from LDWF's Recreational Creel Survey (LA Creel), the National Marine Fisheries Service's (NMFS) commercial statistical records, and Fisheries Marine Recreational Information Program (MRIP). Indices of abundance are developed from the LDWF estuarine trammel net survey and the LDWF component of the Southeast Area Monitoring and Assessment Program (SEAMAP) nearshore bottom long line survey. Estimates of absolute abundance are taken from the NOAA Fisheries northern GOM mark-recapture experiments. Age composition of fishery catches are estimated with age-length-keys derived from fishery age samples and a growth model.

Fishery Catch-at-Age

Commercial Red Drum landings are taken from NOAA Fisheries commercial statistical records as reported in the most recent federal Red Drum stock assessment (Porch 2000). In the assessment model, inshore Louisiana landings are used to represent the inshore commercial fishery operating in Louisiana waters and the GOM offshore landings are used to represent the offshore commercial fishery that operated across state boundaries. Estimates of commercial live releases are not available and were not considered further in the assessment.

Size compositions of Louisiana inshore commercial harvest and GOM offshore commercial harvest are available from historical port sampling (Russell 1988). No age composition samples are available for the Louisiana inshore commercial inshore fishery. The size composition information from the Russell samples collected from the inshore fishing gears (hook and line, trammel nets, and non-runaround gillnets) are pooled to develop a single size distribution to represent Louisiana inshore commercial landings. Ages are then assigned to the inshore commercial catches from a growth model. Age composition samples of landings of the offshore purse seine fishery are available for a limited number of years (Beckman 1989). The size composition information from the Russell samples collected from the offshore fishing gears (purse seines, haul seines, and runaround gillnets) are pooled to represent GOM offshore commercial landings for purposes of mean weight calculations.

Recreational Red Drum landings and live release estimates are taken from the LDWF recreational creel survey (LA Creel; 2014–2021) and estimates hindcast to the historic MRIP time-series (1982-2013). Consequently, the pre-2014 recreational estimates used in this assessment differ from the LA estimates currently published by MRIP. Furthermore, due to changes made to the MRIP Access Point Angler Intercept Survey (APAIS) in 2013 and the recent transition from the MRIP Coastal Household Telephone Survey to the new Fishing Effort Survey, harvest estimates currently available from MRIP also differ from those used in prior LDWF Red Drum stock assessments (LDWF 1997, Shepard 2004, Blanchet 2005). Live releases are further delineated as undersized/non-undersized with the LA Creel and MRIP catch disposition codes.

Annual seasonal size compositions of Red Drum harvest estimates are derived from the LDWF Biological Sampling Program (2014–2021) and MRIP (1982-2013). Seasons represent January through April (season 1), May through August (season 2), and September through December (season 3). Size compositions from the LDWF Biological Sampling Program are derived by statistically weighting the size composition samples by the corresponding recreational landings estimates for each basin and mode of fishing (Private and Charter). Size compositions of non-undersized live releases are assumed equivalent to harvest. Size composition of under-sized releases in each year and season are estimated by pooling the annual seasonal size frequency information available prior to implementation of the 16-inch Minimum Length Limit (MLL) and using those distributions as a proxy of undersized catches beginning in 1988.

Ages of recreational Red Drum landings are derived from a growth model (1982-2001) and otoliths collected from the recreational fishery (2002-2021).

Index of Abundance

For sampling purposes, coastal Louisiana is currently divided into five Coastal Study Areas (CSAs; *Figure 4*). LDWF biologists routinely sample within each CSA using standardized gear (marine gill net, trammel net, and beach seines) as part of a long-term comprehensive monitoring program to collect life history information and measure relative abundance and size distributions of recreationally and commercially important species.

Red Drum indices of abundance (IOA) are developed from the LDWF fishery-independent estuarine trammel net survey and the LDWF component of the South Eastern Area Monitoring and Assessment Program (SEAMAP) fishery-independent nearshore bottom long line survey. Catch per unit effort (CPUE) for the trammel net survey is defined as the number of Red Drum caught per trammel net sample. Trammel net samples collected during the months of January, February, and March are grouped with the previous year's October, November, and December samples for IOA development (e.g., October - March 1989-1990 denoted as 1989). Catch per unit effort for the nearshore bottom long line survey is defined as the number of Red Drum caught per 100 hook/hr. To reduce unexplained variability in catch rates unrelated to changes in abundance, each IOA was standardized.

Current CSAs are defined as: CSA 1 - Mississippi state line to South Pass of the Mississippi River (Pontchartrain Basin); CSA 3 - South Pass to Bayou Lafourche (Barataria Basin); CSA 5 - Bayou Lafourche to eastern shore of Atchafalaya Bay (Terrebonne Basin); CSA 6 - Atchafalaya Bay to western shore of Vermilion Bay (Vermilion/Teche/Atchafalaya Basin); and CSA 7 - western shore of Vermilion Bay to Texas state line (Mermentau/Calcasieu/Sabine Basins).

FIGURE 4. Map of Louisiana's coastal study areas (CSAs).

TABLE 1. FAO proposed guidelines for indices of productivity for exploited aquatic species.

PARAMETER	PRODUCTIVITY			SPECIES: RED DRUM	SCORE
	Low (1)	Medium (2)	High (3)		
Natural mortality rate (M)	<0.2	0.2 - 0.5	>0.5	0.116	1
von Bertalanffy growth rate (K)	<0.15	0.15 - 0.33	>0.33	0.259	2
Age at maturity (t_{mat})	>8	3.3 – 8	<3.3	6	2
Maximum age (t_{max})	>25	14 – 25	<14	39	1
Examples	orange roughy, many sharks	cod, hake	sardine, anchovy	Red Drum Productivity Score = 1.50 (medium to low)	

REGIONAL ASSESSMENT EFFORTS

Individual Gulf states have produced state-specific assessments of Red Drum; however, no regional assessment of inshore Red Drum has been produced. The last stock assessment of Red Drum in federal waters was produced in 2000 (Porch 2000). The five Gulf states regularly monitor the Red Drum stock within their state waters. Given that sampling methods and coverage vary across the Gulf states, producing inconsistent data sets, a Gulf-wide assessment of inshore stocks of Red Drum is not currently feasible. Harvest regulations and conservation standards also vary greatly state by state.

STOCK RESILIENCE

LDWF's most recent Red Drum stock assessment evaluates factors that can be used to gauge the resilience of the Red Drum stock (West et al. 2022). The age of maturity used in the assessment and noted in the table below is a result of direct LDWF data inputs to the assessment and may vary from other published age at maturity ranges described in this document. Productivity is a function of growth rates, natural mortality, age of maturity, and longevity and can be a reasonable proxy for resilience. We characterize the relative productivity of GOM Red Drum based on life-history characteristics, following SEDAR 9 (SEDAR 2006), with a classification scheme developed at the FAO's Second Technical Consultation on the Suitability of the Convention on International Trade in Endangered Species of Wild Fauna and Flora Criteria for Listing Commercially-Exploited Aquatic Species (FAO 2001; *Table 1*). 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 is averaged to compute an overall productivity score. In this case, the overall productivity score is 1.50 for GOM Red Drum indicating medium to low productivity. The von Bertalanffy growth rate typically used in the above analysis is substituted with the mean growth rate across ages from the damped growth model evaluated at the midpoint of the calendar year and weighted by expected survivorship-at-age (k = 0.259).

Description of the Fishery

Photo by Josh Lewis

Fishery Monitoring

While there is no current commercial fishery for Red Drum, LDWF monitors commercial landings and fishing effort through a trip ticket program. Through this program, LDWF collects commercial landings data on a trip basis from wholesale/retail seafood dealers and commercial fishermen holding fresh products licenses.

LDWF conducts economic research pertaining to Louisiana and Gulf fisheries resources using information from the trip ticket program and surveys.

Comprehensive descriptions of the Louisiana commercial and recreational Red Drum fisheries prior to 1986 including development and history of exploitation, effort and harvest, economics, markets, value, and processing are available through various publications including Perret et al. (1980), Matlock (1980) and Goodyear (1987). More recent descriptions of GOM and LA Red Drum fisheries include VanderKooy and Rester (2023) and West et al. (2022).

DATA COLLECTION AND ANALYSIS

In Louisiana, commercial harvest of Red Drum has occurred since the 1700s, with landings in the GOM rising above 1 million pounds near the middle of the 20th century (VanderKooy and Rester 2023). However, commercial harvest of Red Drum was banned in 1986 in federal waters and 1988 in Louisiana waters. Since then, 'harvest' in commercial fisheries has been primarily as incidental bycatch. Unless otherwise noted, the commercial data presented throughout this section are sourced from NOAA. All data collected by LDWF are published in aggregate form, meaning the sum of data submitted by three or more individuals; data submitted by less than three individuals are confidential and are denoted as such in the tables below. Data are presented from 1970 through 2023. Value is presented as real dockside value, in constant, inflation-adjusted 2023 dollars calculated from the nominal or current dollar values using the U.S. Bureau of Economic Analysis Implicit Price Deflator. Volume is presented in pounds whole-weight.

Prior to 2014, recreational landings data are available through MRFSS/MRIP. In 2014, LDWF created a recreational landings survey called LA Creel to estimate recreational harvest of saltwater finfish in Louisiana. From 2014 forward, LDWF has not participated in MRFSS/MRIP; MRFSS/MRIP landings estimates are not yet directly comparable to LA Creel landings estimates. NOAA Fisheries and LDWF are currently working together to calibrate landings estimates from the two surveys to allow for historical comparison of recreational landings for all species; however, this methodology has

not yet been fully developed. LDWF's Socioeconomic Research and Development Section conducts economic research pertaining to Louisiana and Gulf fisheries resources using information from Louisiana's trip ticket program, LA Creel, and surveys. This section publishes results in LDWF reports and peer-reviewed scientific journals, presents research findings at professional and scientific meetings, and provides information and support to LDWF and other agencies to support scientific research and resource management.

COMMERCIAL FISHERY

VOLUME AND VALUE OF LANDINGS

The commercial Red Drum fishery in Louisiana prior to the late 1970s has been described as lightly regulated and underutilized. According to statistics published by NMFS, commercial landings rose from 789,000 pounds (whole weight) with a dockside value of $770,000 (in constant, inflation-adjusted 2023 dollars) in 1970 to 2.2 million pounds with a dockside value of $2.5 million in 1976 (*Table 2*). The adoption of maximum net length and minimum mesh size regulations among other restrictions in 1977 coincided with declines in commercial landings to 1.2 million pounds in 1978 and 1.1 million pounds in 1979. The establishment of a minimum mesh size of 3 inches bar on the outer layer of saltwater trammel nets in 1980 coincided with declines in landings to under 1 million pounds in 1980 and 1981.

TABLE 2. Louisiana Commercial Red Drum Landings: 1970–1988.

YEAR	Pounds	Dockside Value	Dockside Value Per lb.
1970	789,200	$769,822	$0.98
1971	723,700	$788,196	$1.09
1972	889,000	$866,049	$0.97
1973	1,183,500	$1,200,055	$1.01
1974	1,436,100	$1,424,636	$0.99
1975	1,362,300	$1,449,623	$1.06
1976	2,212,500	$2,499,743	$1.13
1977	1,435,500	$1,950,953	$1.36
1978	1,218,797	$1,954,113	$1.60
1979	1,056,697	$1,907,839	$1.81
1980	724,777	$1,313,338	$1.81
1981	898,585	$1,834,568	$2.04
1982	1,454,503	$2,546,966	$1.75
1983	1,938,615	$3,607,984	$1.86
1984	2,608,383	$5,422,770	$2.08
1985	2,933,573	$6,700,266	$2.28
1986	7,817,694	$13,458,573	$1.72
1987	4,571,177	$11,876,752	$2.60
1988	245,365	$766,413	$3.12

Pounds of whole-weight fish. Dollars values are expressed in inflation-adjusted 2023 dollars.

An apparent increase in consumer demand for Red Drum beginning in the mid-1980s was evident as landings increased to 1.9 million pounds in 1983 and 2.6 million pounds in 1984. Landings increased during this time, even as additional restrictions were placed on trammel nets and minimum net sizes used in the commercial fishery along with the establishment of a commercial slot limit. Commercial landings rose to nearly 3 million pounds in 1985 and spiked at 7.8 million pounds in 1986. After the implementation of a 30-inch maximum size limit for the commercial fishery, the prohibition on the use of purse seines in 1986, and the establishment of a commercial quota in 1987, landings declined to 4.6 million pounds in 1987.

Public concerns about overharvest in the commercial fishery and its impact on the recreational fishery led to the designation of Red Drum as a game fish in 1988. In February 1988, the Louisiana commercial Red Drum fishery was placed under a harvest moratorium with subsequent actions leading to a permanent closure of the commercial fishery in 1991. Since that date, Louisiana's Red Drum fishery has functioned as a recreational fishery only with no commercial landings.

Pounds and Value of Landings in Other States

Though commercial harvest, and, therefore, landings, have been prohibited in Louisiana since 1988, commercial fishers continue to land Red Drum in other states. NOAA Fisheries reported Red Drum landings in 13 different states at some point between 2000 and 2022. Most states recorded only periodic landings of a few thousand pounds whole-weight (*Table 3 & 4*). In 2022, commercial landings occurred in six different states. In three of these states (Alabama, Maryland, and Rhode Island), the number of participants was sufficiently limited as to preclude the disclosure of weight or dockside value statistics. Reported commercial landings were highest in North Carolina (175,000 pounds with a dockside value of $550,000). Mississippi's commercial landings weighed in at 47,000 pounds with a dockside value of $149,000. Landings in Virginia amounted to approximately 18,000 pounds with a dockside value of $38,000.

Domestic and Foreign Markets

Red Drum accounts for a small share of U.S. seafood landings and an even smaller portion of the national commercial seafood market. There are likely other saltwater or freshwater fish products with similar characteristics that may serve as acceptable substitutes. The United Nations Food and Agriculture Organization (FAO) groups all drums with groupers, snappers, and croakers in their classification of the global seafood products trade, an indication that these seafood types occupy a similar market niche. Changes in the supplies of these seafood types may have an effect on the market for Red Drum.

U.S. commercial landings of Black Drum varied between 4.4 million pounds and 6.1 million pounds during the first 15 years of the 2000-2022 period (*Table 5*). Landings followed a downward trend in later years, dropping from 6.3 million pounds in 2015 to 3.0 million pounds in 2022. The per-unit for Black Drum generally trended upward from $0.96 per pound in 2001 and 2002 to $1.41 per pound in 2022.

TABLE 3. Annual Red Drum landings (thousands of pounds whole-weight) and dockside value (thousands of 2023 dollars) by state: 2000-2023.

State	YEAR								
	2000	2001	2002	2003	2004	2005	2006	2007	2008
Alabama	0/$0	0/$0	0/$0	0/$0	-/$-	-/$-	-/$-	-/$-	-/$-
Delaware	0/$0	0/$0	0/$0	0/$0	0/$0	0.03/$0.02	0/$0	0/$0	0/$0
Georgia	0.7/$1.8	0/$0	0/$0	0/$0	0/$0	0/$0	0/$0	-/$-	-/$-
Maine	0/$0	0/$0	0/$0	0/$0	0/$0	0.04/$0.02	0/$0	0/$0	0/$0
Maryland	0.9/$1.0	0/$0	0/$0	0.8/$1.1	0/$0	0/$0	0/$0	6.7/$5.8	-/$-
Massachusetts	0/$0	0/$0	0/$0	0/$0	0/$0	0/$0	0/$0	0/$0	-/$-
Mississippi	38.1/$97.5	22.7/$58.4	17.9/$40.3	22.4/$8.3	18.5/$38.6	30.1/$58.0	22.2/$42.9	22.7/$47.2	28.0/$58.8
New Jersey	0/$0	0/$0	0/$0	0/$0	0.01/$0.02	0/$0	0/$0	0/$0	0/$0
New York	1.2/$3.5	0.1/0.05	0.1/0.04	0.04/0.1	0/$0	0/$0	0/$0	0/$0	-/$-
North Carolina	271.0/$495	149.7/$280.5	81.4/$144.3	90.6/$167.9	54.1/$107.5	128.8/$260.0	169.3/$338.6	243.7/$500.2	229.8/$490.8
Rhode Island	0/$0	0/$0	0/$0	0/$0	0/$0	0/$0	0/$0	0/$0	0/$0
South Carolina	0/$0	0/$0	0/$0	0/$0	0/$0	0/$0	0/$0	0/$0	0/$0
Virginia	11.5/$16.4	5.3/$10.9	7.8/$13.4	2.8/$3.4	0.8/$1.6	0.7/$1.0	2.1/$3.9	7.1/412.6	5.3/$12.2

State	YEAR								
	2009	2010	2011	2012	2013	2014	2015	2016	2017
Alabama	-/$-	-/$-	-/$-	-/$-	-/$-	-/$-	-/$-	-/$-	-/$-
Delaware	0/$0	0/$0	0/$0	0/$0	0/$0	0/$0	0/$0	0/$0	0/$0
Georgia	-/$-	-/$-	-/$-	0/$0	0/$0	0/$0	0/$0	0/$0	0/$0
Maine	-/$-	0/$0	0/$0	0/$0	0/$0	0/$0	0/$0	0/$0	0/$0
Maryland	-/$-	-/$-	0/$0	0.3/$0.2	3.0/$96.1	0.3/$0.6	-/$-	-/$-	1.0/$1.5
Massachusetts	-/$-	0/$0	0/$0	0/$0	0/$0	0/$0	0/$0	0/$0	0/$0
Mississippi	32.0/$69.6	36.4/$88.1	28.4/$77.4	34.8/$90.9	36.5/$96.1	43.2/$117.7	61.5/$195.4	60.5/$186.4	56.6/$170.9
New Jersey	-/$-	0/$0	0/$0	-/$-	-/$-	-/$-	0/$0	0/$0	-/$-
New York	-/$-	0/$0	0/$0	0/$0	0.04/$0.1	0/$0	0.1/$0.2	0/$0	-/$-
North Carolina	200.3/$450.4	231.8/$575	92.0/$222.8	66.5/$182.4	371.9/$922.4	90.7/$264.4	80.4/$244.0	77.1/$252.2	187.0/$610.3
Rhode Island	-/$-	0/$0	0/$0	0/$0	0/$0	0/$0	-/$-	0/$0	0/$0
South Carolina	0/$0	0/$0	0/$0	0/$0	0/$0	0/$0	0/$0	0/$0	-/$-
Virginia	9.4/$25.5	4.0/$10.0	4.4/$12.8	2.9./$7.6	30.1/$61.9	14.7/$37.5	0.8/$1.5	1.9./$4.0	7.0/$17.3

State	YEAR					
	2018	2019	2020	2021	2022	Average
Alabama	-/$-	-/$-	-/$-	-/$-	-/$-	
Delaware	0/$0	0/$0	0/$0	0/$0	0/$0	0.001/$0.001
Georgia	0/$0	0/$0	0/$0	0/$0	0/$0	
Maine	0/$0	0/$0	0/$0	0/$0	0/$0	
Maryland	-/$-	-/$-	-/$-	-/$-	-/$-	
Massachusetts	0/$0	0/$0	0/$0	0/$0	0/$0	
Mississippi	47.7/$138.1	61.5/$181.2	51.8/$154.3	35.2/$101.6	46.7/$149.2	36.0/$96.9
New Jersey	0/$0	0/$0	0/$0	0/$0	0/$0	
New York	0/$0	-/$-	0/$0	0/$0	0/$0	
North Carolina	144.5/$461.7	56.4/$192.3	165.7/$505.2	200.4/$357.5	175.1/$550.1	154.7/$375.6
Rhode Island	0/$0	0/$0	-/$-	0/$0	-/$-	
South Carolina	0/$0	0/$0	0/$0	0/$0	0/$0	
Virginia	1.0/$3.1	2.6/$10.5	8.3/$30.2	18.7/$58.5	18.1/$37.6	7.2/$16.5

-/$-: Values are withheld in compliance with NMFS confidentiality standards.

TABLE 4. U.S. landings of Black Drum, snappers, groupers, and croakers (millions of pounds and real dockside value per pound), 2000-2022.

YEAR	BLACK DRUM		SNAPPERS		GROUPERS		CROAKERS	
	Millions of Pounds	Real Value per lb	Millions of Pounds	Real Value per lb	Millions of Pounds	Real Value per lb	Millions of Pounds	Real Value per lb
2000	6.0	$1.17	10.3	$3.55	12.7	$3.59	27.0	$0.64
2001	5.8	$0.96	10.5	$3.46	13.3	$3.55	28.9	$0.45
2002	6.1	$0.96	10.4	$3.40	13.2	$3.38	26.3	$0.54
2003	5.5	$0.98	9.8	$3.41	12.1	$3.57	28.8	$0.42
2004	5.4	$1.04	10.0	$3.51	13.0	$3.40	25.6	$0.53
2005	4.7	$1.19	8.8	$3.70	11.8	$3.50	24.6	$0.55
2006	4.4	$1.15	9.0	$3.84	10.3	$3.72	20.8	$0.67
2007	4.5	$1.15	8.0	$3.86	8.8	$4.03	20.0	$0.61
2008	4.5	$1.12	8.4	$3.84	9.8	$3.82	19.0	$0.72
2009	5.2	$1.10	9.9	$3.52	7.6	$3.71	16.1	$0.96
2010	4.8	$1.19	8.4	$3.79	5.8	$3.94	16.3	$0.90
2011	5.8	$1.06	10.3	$3.89	7.8	$3.91	12.1	$1.03
2012	6.1	$1.13	10.2	$4.04	8.7	$3.96	11.7	$1.29
2013	6.0	$1.15	10.5	$4.43	8.0	$4.25	9.7	$1.28
2014	5.4	$1.26	11.3	$4.53	9.3	$4.37	8.4	$1.13
2015	6.4	$1.22	11.9	$4.60	8.1	$4.53	7.0	$1.26
2016	6.3	$1.27	11.8	$4.55	8.0	$4.56	6.5	$1.26
2017	5.8	$1.27	12.9	$4.50	6.0	$4.73	4.2	$1.43
2018	4.5	$1.22	11.8	$4.62	4.9	$5.13	4.4	$1.66
2019	5.4	$1.28	12.7	$4.60	4.8	$5.56	2.4	$1.92
2020	2.7	$1.41	11.4	$4.48	4.9	$5.24	1.0	$2.89
2021	2.5	$1.47	11.4	$4.58	5.6	$5.24	1.2	$2.40
2022	3.0	$1.41	11.7	$4.81	4.8	$5.60	0.9	$2.37

U.S. commercial landings of all species of snapper dropped from 10 million pounds in 2000 and 2001 to 8.0 million pounds in 2007 then subsequently rose to a range of 11 to 12 million pounds in the last nine years. U.S. commercial landings of all species of grouper dropped from 12 to 13 million pounds in each of the first five years of the 2000-2022 period to approximately 5 million pounds in each of the last five years. Judging by their relatively high real dockside values, snappers and groupers are likely to occupy a higher value portion of the market than drum and may thus be imperfect substitutes for black drum.

Commercial landings of croaker, mainly Atlantic Croaker but also Pacific White Croaker, dropped from 27.0 million pounds in 2000 and 28.9 million pounds in 2001 to approximately 1 million pounds in each of the last three years. Real dockside value per pound of croaker rose from $0.64 per pound in 2000 to $2.37 per pound in 2022.

Mariculture Production of Red Drum

Though commercial landings of Red Drum in the U.S. are limited, global production in mariculture operations around the world have been substantial for the last decade or longer. Global farmed production of Red Drum, according to FAO statistic, rose from 89.6 million pounds in 2004 to 185.9 million pounds in 2020, (*Table 6*).

Most of the increase in global output was associated with increased productivity in China. Production from China doubled from approximately 84 million pounds in 2004 to nearly 171 million pounds in 2020.

U.S. production generally fluctuated between 3.0 and 3.3 million pounds between 2004 and 2016, reaching a high of 4.0 million pounds in 2007 and a low of 2.3 million pounds in 2016. Production rose to 7.2 million pounds in 2018, 2019, and 2020. Most U.S. commercial mariculture production of Red Drum is centered in Texas which contained five Red Drum farms covering 1,100 acres in 2016 (Treece 2017). Mariculture of Red Drum in Louisiana has taken place sporadically since the about the 1980s, and is still permitted through the Louisiana Administrative Code Title LAC 76:VII.900.D. However, Red Drum mariculture in Louisiana is often seen as economically inviable due to logistical constraints and high mortality (Herke 1995, Lutz et al. 1997), and, therefore, is not currently a major industry in the state.

Production in Mauritius increased remarkably in relative terms during this period. The nation's Red Drum production in 2020 (7.1 million pounds) was 10 times the quantity produced (0.7 million pounds) in 2004.

Other nations with reported Red Drum production between 2004 and 2020 included Guadeloupe, Israel, Martinique, Mayotte, and Mexico.

Foreign Trade

No statistics are publicly available on U.S. trade of Red Drum, Black Drum or croakers. Statistics are available for U.S. trade of snappers and groupers, which may be used to describe trends for imported products that may bear some similarity to Red Drum. Trade statistics are reported for two product forms: fresh fish and frozen fish.

TABLE 5. UN FAO estimates of global mariculture production of Red Drum, 2004-2020 (Millions of Pounds, Live Weight).

YEAR	CHINA	UNITED STATES OF AMERICA	MAURITIUS	OTHER	TOTAL
2004	83.9	3.0	0.7	2.0	89.6
2005	88.2	3.3	0.8	1.2	93.5
2006	102.4	3.3	0.9	1.3	107.9
2007	108.7	4.0	0.3	1.2	114.2
2008	112.3	3.1	0.4	1.3	117.1
2009	107.0	3.1	0.7	1.4	112.2
2010	111.8	2.5	1.1	1.3	116.8
2011	136.3	3.2	1.0	1.2	141.7
2012	138.8	3.2	0.9	0.9	144.0
2013	124.8	3.3	0.5	2.6	131.2
2014	147.4	3.3	1.2	1.7	153.7
2015	151.4	3.3	1.3	1.3	157.3
2016	149.8	2.3	1.6	1.3	154.9
2017	151.1	2.3	2.6	0.8	156.9
2018	150.5	7.2	4.3	0.5	162.4
2019	154.7	7.2	6.9	1.0	169.8
2020	170.7	7.2	7.1	1.0	185.9

TABLE 6. U.S. imports of grouper products, 2000-2022.

YEAR	FRESH GROUPER			FROZEN GROUPER		
	Millions of Pounds	Millions of Dollars	Real Value per lb	Millions of Pounds	Millions of Dollars	Real Value per lb
2000	8.1	$26.2	$3.25	0.6	$1.8	$2.83
2001	5.8	$17.7	$3.02	0.8	$1.5	$2.04
2002	7.7	$22.9	$2.97	0.8	$1.8	$2.12
2003	7.2	$21.8	$3.03	1.2	$2.7	$2.28
2004	7.0	$23.1	$3.30	1.3	$2.6	$2.02
2005	8.4	$29.9	$3.57	1.1	$2.5	$2.23
2006	8.8	$35.4	$4.00	1.4	$3.4	$2.45
2007	9.2	$38.1	$4.13	1.4	$2.6	$1.86
2008	7.8	$31.7	$4.08	1.0	$2.6	$2.73
2009	8.3	$30.2	$3.63	1.2	$2.6	$2.26
2010	9.4	$37.0	$3.93	1.6	$3.7	$2.37
2011	8.2	$35.0	$4.29	2.0	$4.6	$2.33
2012	9.2	$40.9	$4.46	1.3	$3.2	$2.52
2013	10.0	$46.7	$4.68	1.5	$4.5	$3.04
2014	8.6	$45.0	$5.22	1.8	$4.6	$2.61
2015	10.7	$55.8	$5.24	1.3	$3.9	$3.13
2016	11.4	$58.8	$5.14	0.8	$1.9	$2.31
2017	12.3	$61.9	$5.05	1.4	$2.3	$1.62
2018	12.4	$63.7	$5.15	4.6	$6.9	$1.49
2019	11.3	$59.1	$5.23	3.5	$5.3	$1.53
2020	10.4	$45.3	$4.34	0.8	$1.7	$2.06
2021	12.2	$63.9	$5.23	2.2	$5.7	$2.60
2022	11.7	$65.4	$5.60	1.3	$2.9	$2.15
2023	12.6	$66.6	$5.29	1.2	$2.6	$2.27

Imports of fresh grouper followed a generally upward trend from 8.1 million pounds in 2000 to 12.6 million pounds in 2023 (*Table 7*). U.S. imports of frozen grouper fluctuated between 0.6 million pounds and 1.4 in the first decade of the 2000-2022 period, spiked to 4.6 million pounds in 2018 and 3.5 million pounds in 2019, and afterwards slid to 1.3 million pounds in 2022 and 1.2 million pounds in 2023.

Fresh grouper imports in 2023 ($66.6 million) comprised 96.2% of the year's combined value of grouper imports. The value of fresh grouper imports represented at least 88% of the total grouper imports value in each of the previous 23 years.

The per-unit value of imported grouper was consistently higher for the fresh product than for the frozen product. In 2022, the value per pound of fresh grouper ($5.29) was more twice the corresponding value for frozen grouper ($2.27).

The per-unit of fresh grouper followed a generally upward trend from $3.25 per pound in 2000 to $5.29 per pound in 2021. The value per pound of frozen grouper varied broadly along an upward trajectory from $2.04 per pound in 2001 to $3.13 per pound in 2015, dropped to approximately $1.50 per pound in 2018 and 2019, and afterwards climbed to $2.27 per pound in 2023.

The United States imported more snapper than grouper between 2000 and 2023. U.S. imports of fresh snapper ranged between 21 million pounds and 29 million pounds for the first 16 years. Fresh snapper imports varied between 30 and 36 million pounds after 2016 (*Table 8*).

The imports of frozen snapper fluctuated widely during the period from a low of 5.5 million pounds in 2000 to a high of 18.2 million pounds in 2021. Frozen snapper imports in 2023 were 11.7 million pounds.

The value of fresh snapper imports in 2023 ($139.2 million) was equivalent to 77% of the total value of snapper imports that year. In previous years, imports of fresh snapper accounted for at least 69% and as much as 82% of the total value of imported snapper.

Value per pound of both imported snapper product forms generally trended upward between 2000 and 2022. Value per pound of fresh snapper imports climbed from $2.60 in 2000 to $4.35 in 2022. Value per pound of frozen snapper imports climbed from $2.59 per pound in 2000 and 4.09 per pound in 2022 and $3.55 per pound in 2023.

No exports of snapper or grouper from the United States were reported during the 2000-2023 time period.

RECREATIONAL FISHERY

Red Drum are a popular sportfish for Louisiana anglers. They are relatively abundant throughout the state's inshore and nearshore waters. Red Drum typically gather in large numbers along the coast and barrier islands during the spring and summer months and the fishery transitions inshore during the fall and winter months to lakes, bayous, and deeper channels. Red Drum can be caught using a variety of tackle including soft and

TABLE 7. U.S. imports of snapper products, 2000-2022.

YEAR	FRESH SNAPPER			FROZEN SNAPPER		
	Millions of Pounds	Millions of Dollars	Real Value per lb	Millions of Pounds	Millions of Dollars	Real Value per lb
2000	24.5	$63.7	$2.60	5.5	$14.2	$2.59
2001	25.2	$67.3	$2.67	7.6	$15.9	$2.09
2002	25.6	$69.6	$2.72	8.4	$18.2	$2.17
2003	27.0	$71.7	$2.66	9.0	$20.1	$2.24
2004	26.2	$72.3	$2.76	8.5	$18.8	$2.21
2005	27.5	$78.1	$2.84	12.7	$29.1	$2.29
2006	26.3	$79.2	$3.02	12.0	$29.9	$2.50
2007	29.0	$85.2	$2.94	12.5	$34.0	$2.72
2008	23.8	$76.0	$3.20	8.3	$23.6	$2.86
2009	21.4	$68.2	$3.18	8.1	$21.9	$2.70
2010	22.8	$81.0	$3.56	11.0	$32.4	$2.94
2011	21.7	$81.8	$3.77	8.5	$26.6	$3.12
2012	22.6	$85.9	$3.79	11.4	$38.2	$3.34
2013	23.1	$87.6	$3.79	10.5	$34.4	$3.28
2014	23.6	$91.6	$3.89	9.3	$30.9	$3.32
2015	26.1	$99.2	$3.80	12.3	$41.6	$3.38
2016	30.5	$112.2	$3.68	14.4	$47.2	$3.29
2017	31.1	$110.0	$3.54	12.8	$42.4	$3.32
2018	30.5	$115.2	$3.78	12.2	$41.9	$3.43
2019	32.7	$128.5	$3.93	11.4	$40.9	$3.59
2020	32.3	$126.3	$3.91	15.8	$53.9	$3.40
2021	35.9	$164.9	$4.59	18.2	$73.9	$4.06
2022	32.1	$147.4	$4.59	16.9	$69.2	$4.09
2023	32.0	$139.2	$4.35	11.7	$41.5	$3.55

TABLE 8. Annual recreational landings of Red Drum (*Sciaenops ocellatus*) in Louisiana, 2000-2013 (MRIP).

YEAR	NUMBER OF FISH	POUNDS
2000	5,248,786	24,288,077
2001	5,245,801	21,979,107
2002	4,544,588	22,244,546
2003	3,464,691	17,589,421
2004	3,319,801	17,239,979
2005	3,047,716	15,443,089
2006	2,933,262	14,564,143
2007	3,486,038	15,690,906
2008	3,992,186	16,817,448
2009	3,917,679	17,377,312
2010	5,850,457	24,498,826
2007	5,780,291	24,918,366
2008	3,941,202	17,041,268
2009	5,678,669	24,850,276

hard plastics, live bait or plastic under a cork, or live or artificial bait fished on the bottom.

As noted earlier, published estimates of recreational harvest differ between the two saltwater creel surveys that have collected information in Louisiana in recent years. Thus, each is reviewed independently here, rather than concatenating the two sets of estimates. Recreational landings, derived from NMFS MRIP estimates from 2000-2013 show large variability in the amount of Red Drum landed in Louisiana (*Table 9*). In recent years, landings have been more consistent but seem to vary cyclically. Recreational landings averaged 4.23 million Red Drum annually from 2003-2013 (Pers. comm. NMFS Fisheries Statistics Division, 2024).

LA Creel landing estimates from 2014-2023 show a range of variability in the amount of Red Drum landed in Louisiana (*Figure 5*). During this time period, 11.68 million fish were harvested statewide in coastal waters, and ranged from a high of 1.98 million to a low of 724,174 individual fish. LA Creel landings estimates show that in 2014, 1.28 million Red Drum were landed statewide, with a decrease to 1.24 million Red Drum landed statewide in 2015 and 1.05 million in 2016. Statewide landings increased in 2017 and 2018 to 1.64 and 1.98 million fish per year, respectively. Landings then decreased steadily from 1.22 million fish in 2019 to just over 700 thousand fish in 2023.

The total number of saltwater fishing trips taken by private recreational fisherman in Louisiana, between 2014-2023, has varied from a low of 1.44 million trips in 2022 to a high of 2.27 million trips in 2015 with an average of 1.96 million trips (*Table 10*). During the same time period, an average of 161,251 for-hire trips were taken in Louisiana (*Table 10*). For-hire trips varied from a high of 183,310 trips in 2018 to a low of 130,614 trips in 2014. The total number of recreational saltwater fishing trips, including private and for-hire, in Louisiana averaged 2.13 million trips from 2014-2023 (*Table 10*).

From 2014–2023, Red Drum were observed in 11.7-42.6% of private recreational fishing trips surveyed through LA Creel (*Table 11*). Similarly, Red Drum were observed in 17.0-50.5% of for-hire trips surveyed through LA Creel from the same time-period (2014-2023).

The LA Creel survey collects information on the major basin where the majority of the harvest or effort occurred for surveyed trips. Between 2014-2023, most Red Drum harvested by private recreational fishermen were landed from the Barataria Basin (*Figure 6*). An average of 273,248 Red Drum per year were landed, with a high of 457,788 fish landed in 2018 and a low of 165,627 fish landed in 2021 (*Figure 6*). The next highest amount of annual private recreational landings came from the Lake Pontchartrain Basin, with an average of 246,440 Red Drum per year, a high of 349,937 fish in 2020, and a low of 94,256 fish in 2023. The Terrebonne/Timbalier Basin private recreational landings of Red Drum averaged 227,632 per year, with a high of 509,625 in 2018 and a low of 84,739 in 2021. The Calcasieu Basin private recreational landings averaged 126,086 Red Drum per year, with a high of 289,280 fish in 2015 and a low of 64,126 fish in 2023. The Vermilion/Teche Basin private recreational landings

TABLE 9. Statewide effort of private recreational and for-hire saltwater fishing trips, 2014-2023 (LA Creel).

YEAR	PRIVATE TRIPS	FOR-HIRE TRIPS	TOTAL TRIPS
2014	2,096,246	130,614	2,226,860
2015	2,266,506	159,789	2,426,295
2016	2,063,347	179,234	2,242,581
2017	2,127,350	178,717	2,306,067
2018	2,092,640	183,310	2,275,950
2019	1,939,883	168,571	2,108,454
2020	2,389,704	115,424	2,505,128
2021	1,724,626	163,233	1,887,859
2022	1,446,630	162,620	1,609,250
2023	1,497,927	170,994	1,668,921

TABLE 10. Annual percentage of surveyed private recreational and for-hire saltwater fishing trips that landed Red Drum, 2014-2023 (LA Creel).

YEAR	PRIVATE TRIPS	FOR-HIRE TRIPS
2014	11.62%	21.50%
2015	32.95%	55.21%
2016	30.27%	52.66%
2017	36.52%	59.93%
2018	39.76%	60.85%
2019	33.57%	56.76%
2020	29.06%	41.52%
2021	28.07%	51.41%
2022	29.07%	47.34%
2023	28.06%	49.55%

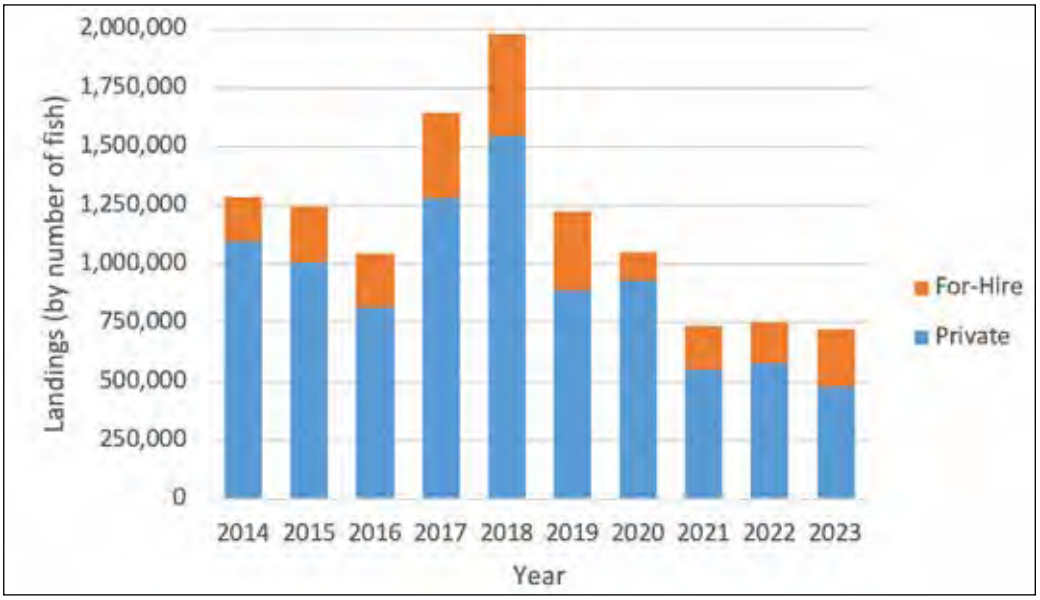

FIGURE 5. Annual private recreational and for-hire landings of Red Drum (*Sciaenops ocellatus*) in Louisiana in number of fish, 2014-2023 (LA Creel).

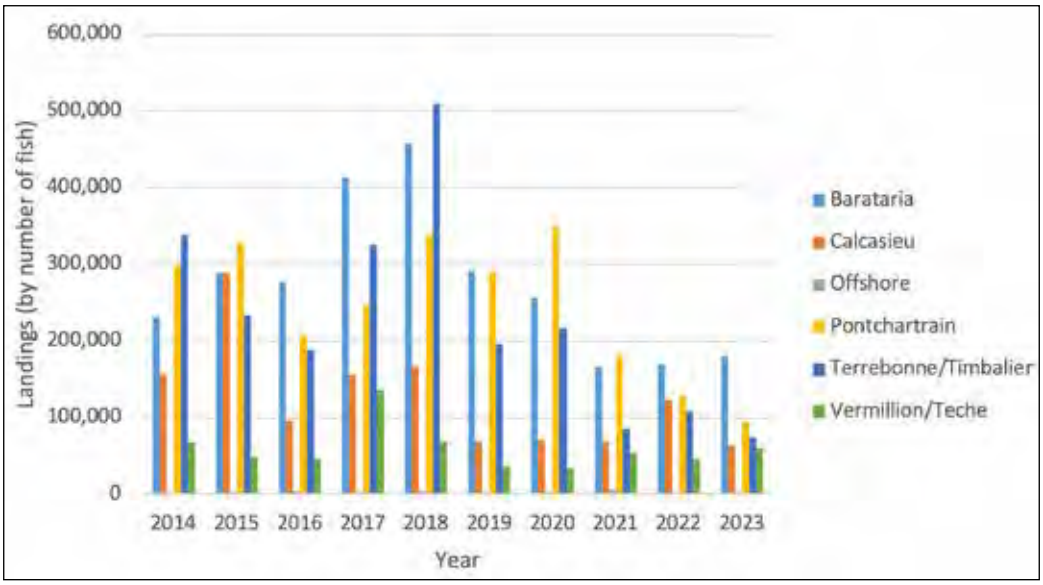

FIGURE 6. Annual private recreational landings of Red Drum (*Sciaenops ocellatus*) in Louisiana waters by area, in number of fish, 2014-2023 (LA Creel).

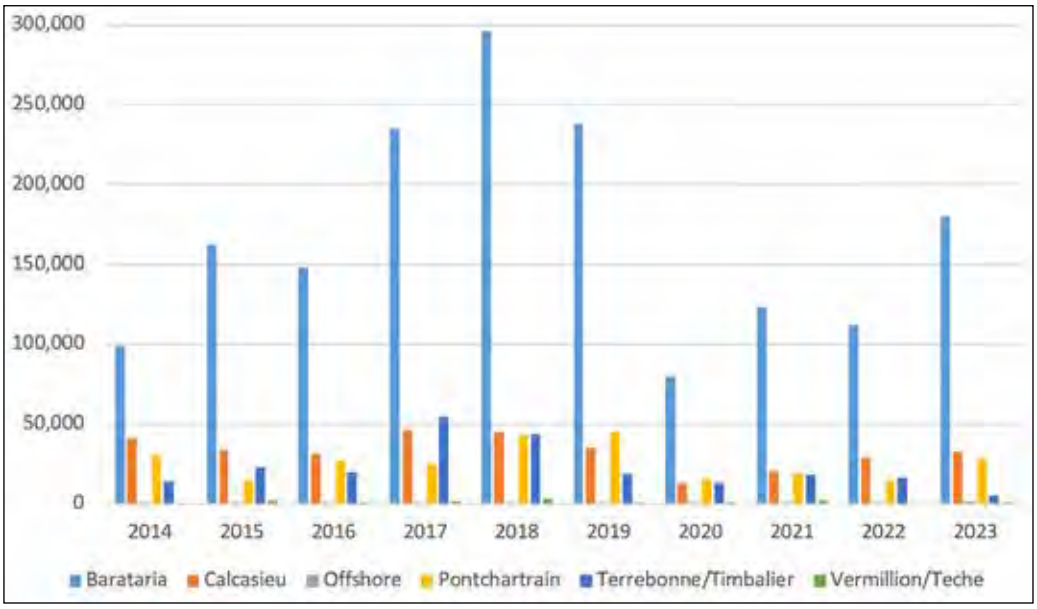

FIGURE 7. Annual for-hire landings of Red Drum (*Sciaenops ocellatus*) in Louisiana waters by area, in number of fish, 2014-2023 (LA Creel).

averaged 60,034 Red Drum per year, with a high of 136,434 fish in 2017 and a low of 33,797 fish in 2020. There is some recreational catch of Red Drum in offshore waters off Louisiana; offshore landings averaged 2,997 Red Drum per year during the same time period, with a high of 7,056 fish in 2021 and a low of 1,208 fish in 2022.

From 2014–2023, for-hire landings of Red Drum in Louisiana averaged highest in the Barataria Basin at 167,237 Red Drum per year, with a high of 296,002 fish in 2018 and a low of 79,574 fish in 2020 (*Figure 7*). The next highest average came from the Calcasieu Basin, with an average of 32,886 Red Drum per year, a high of 45,978 fish in 2017, and a low of 13,034 fish in 2020. The Lake Pontchartrain Basin averaged 26,477 Red Drum per year, with a high of 45,108 fish in 2019 and a low of 14,952 fish in 2022. The Terrebonne/Timbalier Basin averaged 22,729 Red Drum per year, with a high of 54,463 fish in 2017 and a low of 5,578 fish in 2023. For-hire landings in the Vermilion/Teche Basin averaged 1,356 Red Drum per year, with a high of 3,165 fish in 2018 and a low of 239 fish in 2020. Offshore for-hire landings averaged 778 Red Drum per year with a high of 1,539 fish in 2023 and a low of 234 in 2022.

INTERACTIONS WITH OTHER FISHERIES OR USER GROUPS

Given there is no current commercial Red Drum fishery allowed in Louisiana, there is no impact from a directed Red Drum commercial fishery to other fisheries, however, there may be incidental catch considerations and interactions.

In 1986, the Redfish Conservation and Management Act (H.R. 4690) was introduced into the 99th Congress. This Act was not ratified into law; however, the Secretary of Commerce did choose to issue an emergency ruling, limiting landings of Red Drum from the US GOM EEZ to under a million pounds per year until a Fisheries Management Plan was completed. Following the completion of the plan in 1986, the GMFMC first limited landings to <625,000 pounds from the EEZ for both commercial and recreational fisheries that year, and then completely prohibited commercial and recreational landings of Red Drum for 1987 onward via Amendment 1 of the FMP (Red Drum Fishery of the Gulf of Mexico 16, U.S.C. § 1801 (1987); 50 C.F.R. Part 653). Further, in 2007, then-President George W. Bush signed an Executive Order, officially closing the commercial Red Drum fishery in federal waters by prohibiting the sale of any individuals caught in the EEZ (Exec. Order No. 13,449, 2007).

Even though Red Drum are one of the top two recreationally targeted species in Louisiana, most recreational anglers target multiple species during the same trip, making the Red Drum fishery contemporaneous with that of Spotted Seatrout, Southern Flounder, Sheepshead, and other finfish. LDWF has received concerns from some anglers within the recreational community in regards to the for-hire industry (e.g., captains possessing limits, multiple trips in a day, etc.). These concerns have also extended into the private-boat recreational and for-hire harvest of Red Drum with bowfishing gear.

Bowfishing has garnered more public attention in recent years and is considered a user conflict issue. Complaints from user groups include but are not limited to: heavy fishing pressure from round-the-clock fishing activity with no “rest period”, high mortality rates of under sized and non-target species, ethics of “shining” Red Drum during vulnerable time periods, and harvesting fish during lower periods of patrols and surveys being conducted. The current LDWF license structure does not single out bowfishing as a user group, so total number of anglers harvesting Red Drum with bowfishing gear cannot be easily defined. Fishing creel surveys in Louisiana currently do not have a nighttime component to characterize nighttime catch rates, however nighttime effort is captured. Survey effort data for nighttime angling indicates a low proportion of effort occurs

at night in Louisiana, thus there is likely a low harvest of many popular species at night. Louisiana recently created a Bowfishing Permit that will require any angler or charter guide that is fishing with bow and arrow gear in saltwater areas of the state or is harvesting saltwater species with bow and arrow gear to have the permit. This permit will provide much needed information on the universe of anglers utilizing this gear to harvest saltwater fish, such as Red Drum.

While rod and reel gear may have minimal impacts to habitat, the vessels used may have impacts to habitats, in particular shallow water habitats. There is potential for conflicts between commercial, for-hire, and recreational anglers that utilize the same waterways. As access to private lands under navigable waterways continues to be limited through physical or legal impediments, recreational, for-hire, and commercial fishermen find themselves crowding the same productive water bodies often leading to confrontations. Likewise, the presence of commercial vessels occupying and disturbing preferred angler fishing locations may be a minor inconvenience but does not seem to be a major concern for the majority of anglers.

There is some concern from anglers that other legal fisheries may have an impact on the Red Drum stock, predominantly the commercial harvest of Gulf Menhaden. The Gulf Menhaden fishery for reduction is the largest commercial fishery operating in the GOM, with the majority of landings occurring in Louisiana waters or off Louisiana. The menhaden fishery deploys large purse-seines to capture large schools of menhaden in nearshore and coastal waters. An analysis by LDWF, of Red Drum bycatch in the commercial menhaden fishery, indicates that Red Drum bycatch in that fishery accounts for median of 2.45% (between 0.35% (minimum) and 5.12% (maximum)) of all total combined (recreational, commercial, and bycatch) Red Drum landings (West et al. 2024). An updated analysis of bycatch in the commercial reduction fishery for menhaden is being conducted during the 2024 season through the GSMFC.

Cagle and West (2020) summarized an evaluation of bycatch from the inshore commercial shrimp fishery in Louisiana waters. Results of vessel-based observations of shrimp trawl bycatch indicate five individual Red Drum recorded from 363 tows of vessels utilizing otter trawls, butterfly nets, and skimmer nets while also equipped with exclusion devices.

Ecosystem Considerations & Environmental Factors

Addressing Potential Impacts

LDWF actively monitors the impact of the Red Drum fishery on the ecosystem and the impact of other fisheries to the Red Drum population, for example, conducting research on bycatch in other fisheries that may encounter Red Drum such as the menhaden fishery.

ECOSYSTEMS CONSIDERATIONS

HABITAT

There is little data available specifically on the impacts of Louisiana's recreational Red Drum fisheries on habitat; however, the impacts of the fishery on habitat could include ghost fishing, pollution, and disease. Rod and reel/hook and line gear is considered to have minimal impacts on Louisiana estuarine habitat, but improperly disposed of fishing line and tackle can entangle and harm organisms (Barnette 2001). The use of outboard motor vessels and airboats introduces noise pollution, and petroleum products into natural habitats (see Whitfield and Becker 2014). Bowfishing can also introduce light pollution at nighttime, and the improper use of watercraft at any time of day can damage habitat (e.g., destruction of marsh grass; see Whitfield and Becker 2014).

While commercial fishing for Red Drum is prohibited, commercial fishing, in general, is prohibited in more than 2,529 square kilometers (km^2)(625,000 acres) of Louisiana's coastal areas, approximately1,391 km^2 (343,699 acres) of which are water bottoms, including Red Drum habitat. There are restrictions on recreational fishing in some of these areas as well. These coastal areas include state wildlife management areas, private sanctuaries, state and federal wildlife refuges, and areas designated by LA R.S. 56 or LAC 76.

BYCATCH AND DISCARDS

Data regarding the type and frequency of bycatch and discards of Red Drum in Louisiana's Red Drum fisheries are limited to inferences drawn from commercial fisheries at sea observer programs, and LA Creel interviews for recreational landings. A pilot study conducted by LDWF, beginning in June 2019 and running through June 2020, to help quantify and enumerate the type of bycatch captured in the Louisiana inshore trawl fishery (Cagle and West 2020). Estimates from these data sources are limited as no programs currently target Red Drum specifically, but present the best opportunity to quantify Red Drum bycatch and discards. Since Dec. 19, 1986, landing of Red Drum in commercial fisheries has been prohibited in Federal waters (50 C.F.R. pt. 604 and 653

(2022)), and since February, 1988 in Louisiana State waters (LA R.S. 56:325.3). Recreational regulations were established in the mid-1980s, intended to maintain the escapement percentage of Red Drum above the minimum of 30%. Recreational anglers may retain a variety of bycatch as long as it complies with applicable regulations, which have been amended most recently in 2022 (LA R.S. 56:325.1).

Finfish

Over the past century, the landings and gear types used to harvest Red Drum in the GOM has undergone changes. Historically, the majority of Red Drum harvested in U.S. waters have been harvested in the GOM, with landings above 1 million pounds annually (VanderKooy and Rester 2023). In Louisiana, commercial landings averaged 400,000 - 500,000 pounds annually, but spiked to over a million by the 1970s, and then fell to near zero following the retention prohibition, ratified in 1988 (West et al. 2022). Since 1988, Red Drum are caught as bycatch in the commercial shrimp fishery with otter trawls and skimmer and butterfly nets. The amount of bycatch in the shrimp industry has declined as a trend toward skimmer trawl gear has minimized overall bycatch in the industry (Cagle and West 2020). In commercial shrimp fisheries operating in the offshore waters of the GOM during 1998, Red Drum made up <0.25% of all catch (i.e., 200,000 - 300,000 fish; Porch 2000; Scott-Denton et al. 2012). More recent data from 2019-2020 in Louisiana inshore waters indicate a low Catch Per Unit Effort (CPUE) level for Red Drum (0.152, or 5,637 fish) in commercial shrimp fisheries (Cagle and West 2020). Red Drum are also incidentally caught in the commercial Menhaden fishery. An analysis by LDWF of Red Drum bycatch in the commercial Menhaden fishery indicates that Red Drum bycatch in that fishery is negligible. Pulver and Scott-Denton (2012) observed a total of 223 purse seine sets during 54 sea days for menhaden fishery in the GOM. During this study they observed 23 different bycatch species with one of those being Red Drum. Currently, commercial fishermen are prohibited from retaining any Red Drum in Louisiana waters, even for personal consumption.

Prior to 1988, Red Drum could be harvested commercially using stationary gears such as gillnets and trammel nets. However, in 1988 Red Drum gained gamefish status and a commercial harvest moratorium was put in place, and ultimately the Louisiana Legislature enacted a ban on the use of entanglement nets in 1995 with a phase out period for strike nets through 1998 (Adkins et al. 1998). After the entanglement net ban was enacted, the primary harvest of Red Drum became recreational hook and line fishing, and, more recently, bowfishing. However, presently, Red Drum may also be recreationally harvested using trolling line, hand-line, yo-yos or trigger devices, dip nets, and fly casting apparatus. LA Creel can provide a general description of Red Drum bycatch and discards recreationally. Statewide, Red Drum is the second most popular target (34.95%) of recreational fishers in Louisiana waters based upon LA Creel data, and also appears as catch when other popular species (e.g., Spotted Seatrout, Sheepshead, Black Drum) are targeted.

Mortality of discarded Red Drum from recreational fishermen using hook and line is believed to be minimal. Discard mortality estimates from hook and line fishing for Red Drum are lower than other sportfish, between 1.9-3.3% depending on hook type (Vecchio and Wenner 2007). Studies report that post-release mortality depends on multiple factors including bait/hook type, anatomical hooking location, and water quality (Vecchio and Wenner 2007; Nelson et al. 2021). Mortality of released Red Drum increases to around 6% for live weight tournaments due to the increased handling time of those fish (Nelson et al. 2021). Discard mortality is assumed to be 5% for LDWF's modeling purposes; this rate is incorporated directly into recreational landings estimates and represents an annual average from GOM studies (West et al. 2022). For recreational harvest by bowfishing gear, discard mortality for finfishes is high (Montague et al. 2023). While specific metrics are not currently available for Red Drum, finfish mortality is estimated to be >87% post release (Montague et al. 2023). Furthermore, post-release mortality after wounding or escape during bowfishing can increase from disease susceptibility, which in turn, increases overall release mortality in that fishery (Scarnecchia and Schooley 2020 and Montague et al. 2023).

Incidental bycatch of Red Drum has also been reported in Black Drum trotline fisheries. Trotlines are deployed horizontally at various depths, depending on the bottom in a location, with anchors at each end to hold it in place. While more selective than other types of fishing gear, mortality of Red Drum in trotline fisheries has been reported near 0% (Martin et al. 1987). Individuals can be released alive if gear is checked frequently.

Protected Species

Five species of sea turtles share some habitat with Red Drum in Louisiana and Gulf waters. All of these species are currently listed as threatened or endangered under the Endangered Species Act (ESA; *Table 12*).

There are no cases of sea turtles caught as bycatch in the recreational or commercial Red Drum fishery. Under Section 118 of the Marine Mammal Protection Act (MMPA), NMFS is required to classify all U.S. commercial fisheries into one of three categories based on the level of incidental serious injury and mortality of marine mammals. Commercial fishermen must report to NMFS all incidental mortalities and injuries of marine mammals that occur during commercial fishing operations, regardless of the category in which the fishery is placed (I, II, or III), within 48 hours of the end of the fishing trip. In addition, any animal that ingests fishing gear or any animal that is released with fishing gear entangling, trailing, or perforating any part of the body is considered injured, regardless of the presence of any wound or other evidence of injury, and must be reported. Recreational fisheries are not categorized by NMFS in this manner, however recreational and subsistence fisheries can be impacted by the regulatory environment surrounding protected species.

TABLE 11. Protected species in Louisiana and Gulf of Mexico waters.

Common Name	Scientific Name	ESA Status
Loggerhead sea turtle	*Caretta caretta*	Threatened
Green sea turtle	*Chelonia mydas*	Threatened
Kemp's ridley sea turtle	*Lepidochelys kempii*	Endangered
Leatherback sea turtle	*Dermochelys coriacea*	Endangered
Hawksbill sea turtle	*Eretmochelys imbricate*	Endangered

ENVIRONMENTAL FACTORS

HYDROLOGICAL CONDITIONS (Salinity, Water Temperature, Dissolved Oxygen and Turbidity)

As a thermo-tolerant and euryhaline species, Red Drum are resilient to the rapidly changing conditions of estuarine environments. However, low temperatures (i.e., <20°C; 68°F) can prevent spawning in the offshore population and result in fish kills of smaller Red Drum (Lyczkowski-Shultz et al. 1988), while low salinities (i.e., <10 ppt) can inhibit hatching success (Holt et al. 1981), however, those lower salinities are rare during the fall in the offshore spawning areas of Red Drum.

Dissolved oxygen is also an important environmental parameter that impacts the distribution of Red Drum. Large areas of hypoxic or oxygen-depleted waters documented off of Louisiana's continental shelf occur seasonally, from late spring through early fall, which may impact Red Drum (Rabalais et al. 2002). Hypoxic areas are often referred to as dead zones where dissolved oxygen levels in deeper water may be too low to sustain marine life. Dissolved oxygen levels above 4 milligrams/liter (mg/L) are adequate to sustain most aquatic organisms. However, levels below 2 mg/L, particularly during prolonged periods, may cause stress and mortalities (Renaud 1986). These hypoxic areas are largely attributed to heavy nutrient loads discharged by the Mississippi River (Rabalais et al. 2002). Hypoxic areas may impact Red Drum through direct mortality, increased susceptibility to disease, or redistribution as Red Drum move to more favorable areas (Blaylock and Overstreet 2003). In 2013, over 5,000 Red Drum died in Breton Sound, Louisiana from a suspected freshwater plume from the Mississippi River. Areas of predictable low dissolved oxygen exist in Louisiana waters (e.g., Terrebonne Bay and Pointe Aux Chenes) and are susceptible to annual kills during the summer time when conditions are right, but these are not dominated by Red Drum (J Adriance, LDWF, personal communication). While hypoxic events can occur in the estuarine waters of the state, Red Drum are generally able to move away from these waters and remain unaffected. There are exceptions under certain conditions such as the passage of a major storm or fish being trapped due to prevailing weather and tidal conditions. LDWF biologists monitor hydrological conditions through their sampling program to determine how they influence Red Drum and other resources.

There is evidence of mortality from low temperature in Louisiana, documented from the severe 1983 freeze (Bejarano 1984) and the December 1989 freeze (H. Blanchet, pers. comm.). Because older individuals occur in the Gulf during winter, one might expect the main temperature threat to involve the 0 - 1 year class fish. Effects of freezes on commercial fishes in Texas, including Red Drum, were given by Pianka (1988) as an example of a density-independent system. Anderson and Scharf (2013) reported mortality on age-0 Red Drum from North Carolina exposed to temperatures in the 3-5^{O}C range, with size-dependent mortality in conditions seen during moderate winters. They also reported the fish often rested on the bottom of the tank at water temperatures below 5^{O}C.

Beckman (1989) reported data suggesting that Red Drum year-class variability may be influenced by environmental variability. Relative year class abundances (back calculated using year class distributions of offshore schooling Red Drum) were correlated with environmental variables, although correlations depended on the total mortality (Z) assumed for back calculations. Assuming Z = 0.1, significant correlations resulted with fall winter sea level, river discharge (both positive), and cold front frequency (negative). Spring summer air temperatures at 0 to 3 years of age were negatively correlated with year class abundances assuming instantaneous mortalities from 0.1 - 0.25.

Meteorological events such as hurricanes which move unusually large volumes of offshore water shoreward may aid in transport of postlarvae or juveniles into an area (Breder, 1962) which may positively influence year-class strength (Matlock 1987b).

DISEASES AND PARASITES

Red Drum have the potential to carry many different infections as well as endo- and ecto-parasites that can lead to a variety of different diseases (Lorio and Perret 1980; Blaylock and Overstreet 2003). These infections may affect many somatic tissues including the skin and fins and internal organs such as the brain and stomach. Symptoms of these infections may present themselves in orientation, hemorrhaging, or lesions. Outside of aquaculture, many of these sickened fish are removed by predation events, which aid in the decrease in number of large mortality events. However, in aquaculture, high stock densities and increased parasite life cycles can lead to lethal infections.

Bacteria, viruses, and fungi can cause disease. Bacterial outbreaks regularly cause a mortality event in many cultured fishes, including Red Drum (Blaylock and Whelan 2004). Some common parasites of Red Drums include dinoflagellates, flat and round worms, copepods, and fish lice which are often observed on the skin, fins, or gills. Some species of louse can occur internally in the digestive tract of a Red Drum (Nahhas and Short 1965). Additionally, Overstreet (1983) provides a list of 65 species of parasites including protists, nematodes, copepods, and most other common parasites of fishes. Little evidence of effects on natural populations were given, but there has been mortality from protists (Trimble 1979, Overstreet 1983) under the crowded conditions of pond culture, the area of study concentration (Johnson 1987).

Of the bacteria affecting marine fishes, *Vibrio* is the most often reported bacteria encountered (Johnson 1990). *Vibrio* can cause lesions on fishes in marine and estuarine waters of the GOM (Overstreet and Hawkins 2017). Tao et al. (2012) reported three of five Red Drum samples during the 2009-2011 study were positive for *Vibrio vulnificus* on external surfaces throughout the northern GOM. Of the fish tested, 37% were positive for *Vibrio vulnificus*, with an increase in positivity correlating to an increase in water temperature (Tao et al. 2012).

In a recent study, Quang et al. (2020) reported four *Vibrio* species in association with aquaculture Red Drum within the Tua Thien Hue province of Vietnam. The study went on to indicate an increased mortality event rate for other cultured marine organisms including seabasses and shrimp (Quang et al. 2020). Yen et al. (2021) identified 30 strains of *Vibrio* in Red Drum in an aquaculture setting, which caused vibriosis of the brain, hem-

orrhagic site and digestive tract. Four toxic genes were isolated and 25 out of 30 *Vibrio* strains contained one or more toxic gene, with five isolated strains carrying three toxic genes (Yen et al. 2021). The digestive tract was the location of the most common *Vibrio* strains (*alginolyticus* and *azureus*) (Yen et al. 2021).

Another cause for concern in Red Drum aquaculture include *Mycobacterium*, which can be present in many fishes in the GOM (Diamant et al. 2000, Mugetti et al. 2020). *Streptococcus* has been linked to mortality events in the northern GOM and in the Mediterranean (Plumb et al. 1974, Eldar et al. 1999). The first record of *Nocardio* in Red Drum in the GOM was recorded by del Rio-Rodriguez et al. (2021) and was reported in an aquaculture environment. Often times the outbreaks are related to a deterioration of the water quality that facilitates conditions for bacterial growth (del Rio-Rodriguez et al. 2021).

There are two viruses that have been commonly identified to infect Red Drum in the wild . Viral Nervous Necrosis (Betanodavirus) is a virus that targets the nervous system of marine fishes in tropical and subtropical regions with temperatures ranging from 20-25^{O}C and has no treatment (Yanong 2019). This virus has been associated with significant mortality events of marine fishes including Red Drum (Yanong 2019). Lymphocystis Disease Virus (LCDV) is a waterborne virus that affects the spleen and heart of Red Drum (Colorni and Diamant 1995). A population of Red Drum was transported from Texas to Israel and developed LCDV (Colorni and Diamant 1995). These fish developed lesions on their skin and fins, however the virus did not spread to all fish, suggesting the disease was caused by a group of closely related viruses (Colorni and Diamant 1995). The infections to the internal organs of the fish were more sporadic pointing to a more systemic condition of the individual fish (Colorni and Diamant 1995). Currently, the FAO does not have a treatment for any viruses in marine aquaculture systems.

Fungal infections in Red Drum are rare in nature, however Johnson (1990) reported observing *Saprolegnia* in wild caught fish that were weakened due to rapid and extreme changes in temperature. The infections in the GOM occur on the skin as grey and white fibrous patches (Johnson 1990).

Amyloodinium ocellatum, a parasitic dinoflagellate, can be found on numerous fish species in the GOM including Red Drum, and typically does not cause mortality events for wild Red Drum (Lawler 1980). However, Red Drum aquaculture presents the risk of amplification and spread of disease due to high density of fish in ponds (Francis-Floyd and Floyd 2011). Another mode of spread of *Amyloodinium* involves birds and other wildlife species visiting the Red Drum aquaculture ponds (Francis-Floyd and Floyd 2011). Serious outbreaks of *A. ocellatum* have occurred and mass mortality of Red Drum has been reported from the outbreaks (Trimble 1979, Francis-Floyd and Floyd 2011). The short life cycle of *A. ocellatum* (three to six days) and the need for only one host aids in the rapid proliferation of the protozoan (Francis-Floyd and Floyd 2011). Along with the simple life cycle, *A. ocellatum* can tolerate a wide range of temperatures (16-30^{O}C) and salinities (12-50 ppt) (Francis-Floyd and Floyd 2011). The adult stage of the parasite produces a velvety appearance which resulted in the common name of 'velvet disease' (Blaylock and Whelan 2004). This adult stage attaches to epithelial cells while feeling on the surrounding cells, and causes hyperplasia, inflammation and necrosis in the gills which causes a disruption in gas exchange (Blaylock and Whelan 2004). The free-swimming stage is the most vulnerable to treatment for control of outbreaks and multiple treatments may be required (Francis-Floyd and Floyd 2011).

Cestoda worms (*Poecilancistrium caryophyllum*) also known more commonly as spaghetti worms or tape worms, are the most common parasite of Red Drums (Simmon and Breuer 1962, Overstreet 1983). Spaghetti worms are easily seen in the muscle tissue of Red Drum and can reach a length of 17 centimeters (cm) (Simmons and Breuer 1962). The presence of this worm often causes Red Drum flesh to be unnecessarily discarded as inedible. There is some evidence that the prevalence of infection is related to salinity (Overstreet 1977). Means of transmittal and host-parasite relationships are poorly understood; however, these parasites are probably transmitted to fish by ingestion of food such as penaeid shrimp, which harbor tapeworm larvae. Sharks, such as Bull Sharks (*Carcharhinus leucas*) and Lemon Sharks (*Negaprion brevirostris*), have also been identified as definitive hosts of this parasite (Schlicht and McFarland 1967, Overstreet 1977, Overstreet 1983). Additionally, Bullard and Overstreet (2004) identified a new species of worm, (*Cardicola currani*), in the heart of wild Red Drum off the coast of Mississippi and Louisiana.

Copepods are one of the most abundant parasite of Red Drum, and have been observed on the gills, skin, and fins (Yokel 1966). While multiple copepod species have been identified from Red Drum (Causey 1953), Simmons and Breuer (1962) noted a lack of copepods on Red Drum in hypersaline waters. Landsberg et al. (1991) demonstrated successful treatment of a Red Drum infested with *Caligus sp.* copepods using a 20-minute freshwater dip. These results indicate copepods can tolerate a broad range of salinities and an intolerance to freshwater (Landsberg et al. 1991).

In general, numerous vectors of infection can pose risks to many marine fish species, including Red Drum. This risk becomes further elevated as the fish density increases in aquaculture environments. Biosecurity protocols and quarantine measures can be used to prevent the spread of diseases; however, a prevention of the pathogens prior to rearing fishes is important to aquaculture operations. The Southern Regional Aquaculture Center has developed resources to aid aquaculturists in this regard (Francis-Floyd and Floyd 2011).

PREDATION

While Red Drum may be predators throughout their range, research evaluating the diet of many apex predators like the Blacktip Sharks and Bottlenose Dolphins, has indicated that Red Drum are an abundant and viable food source for many species. Matich et al. (2020) was able to examine the feeding habits of Blacktip Sharks in the San Antonio Bay system of Texas and found that Red Drum comprise 35.2% of all biomass weight found in large (1351-1600 mm) Blacktip Shark stomachs. This study also indicated that the large Blacktip Sharks preyed upon on a high amount of high trophic level fish, including Gafftopsail Catfish (*Bagre marinus*), and Sharpnose Sharks (*Rhizopriono-*

don terraenovae) (Matich et al. 2020). A study by Plumlee and Wells (2016) further emphasized the importance of sciaenids in Blacktip Shark diets and Sharpnose Shark diets, where sciaenids made up 31.91% and 7.96%, respectfully, of the diets of those sharks. Other fish species will also prey upon juvenile Red Drum, including Pinfish (*Lagodon rhomboides*) and Spotted Seatrout (*Cynoscion nebulosus*), in variety of habitats (Stunz and Minello 2001). Similarly, Pate and McFee (2012) demonstrated sciaenids dominated Bottlenose Dolphin diets off the coast of South Carolina. While Star Drum (*Stellifer lanceolatus*) made up the majority of the dolphins' diet, other sciaenids, including Red Drum, were found to be in mature dolphin gut contents (Pate and McFee 2012). Other marsh dwelling marine mammals will also prey on Red Drum, including river otters and minks (Chapman and Feldhamer 1982).

Many bird species also use Red Drum as a food source, Kent (1986), reported Little Blue Herons (*Egretta caerulea*) feeding on Red Drum in Old Tampa Bay and Safety Harbor, FL. Withers and Brooks (2004) reported Cormorants using sciaenids as a food source in Lavaca Bay, TX. Although many of the sciaenid samples found in the Cormorants' stomach were unidentified there was evidence of Red Drum being a part of the Cormorant diet (Withers and Brooks 2004).

COMPETITION FROM OTHER SPECIES

Red Drum are able to utilize and exploit many different salinity and habitat regimes throughout their geographic distribution. As such, Red Drum share available food sources with other predatory fish species. There is concern that competition for limited resources can be detrimental to both the habitat and a species, like Red Drum, that utilize that habitat (Shaw et al. 2016). A study in Bulls Bay, South Carolina examined the concentration of carbon (C^{13}) and nitrogen (N^{15}) stable isotopes between 10 fish species (including three teleosts: Red Drum, Southern Flounder, and Spotted Seatrout) to examine the interconnectivity of food webs within the region (Shaw et al. 2016). The variance that occurred in carbon and nitrogen stable isotopes indicated that the different fish species utilized different feeding regimens (Shaw et al. 2016). In particular, Red Drum demonstrated similar feeding regimens to Southern Flounder (Shaw et al. 2016). Further, Red Drum and Southern Flounder exhibited the closest dietary niche overlap between bony fish (33.6% and 25.4% overlap, respectively) (Shaw et al. 2016).

Along with sharing food sources with other predatory fish species, Red Drum also share a wide variety of habitats and life history strategies with other fish species and other sciaenids which potentially allows for inter-species competition for resources and habitat. In a study by Moulton et al. (2016), Red Drum were shown to frequent habitats similar to other species, such as Spotted Seatrout. Bacheler et al. (2012) further reinforced the notion of common habitats among species by reporting five fish, including Spotted Seatrout and Black Drum, commonly caught alongside Red Drum in Pamlico Sound, North Carolina. Along with competing for habitat availability with other species, Bacheler et al. (2012) reported a density dependence for habitat use and suggested a constraint on relative abundance and distribution. This suggests that Red Drum not only compete with other species for habitat availability, but also compete with other Red Drum.

While the intricate relationships within marine food webs are still being researched, these studies above indicate that the density and distribution of Red Drum may be influenced by not only interspecific competition, but by competition within the species and other biotic factors.

INVASIVE SPECIES

Global connectivity has led to the proliferation of invasive species around the world and in the U.S.. Invasive species can present many problems for native species by competing for both habitat and prey resources, as well as the introduction of new diseases to a region. In Louisiana, invasive species have not yet posed a documented threat to the Red Drum population, but the potential for threats continues and should be monitored.

One species of concern is the Lionfish (*Pterois* spp.), which has a documented introduction in the northern GOM, including Louisiana (Fogg et al. 2013, Johnston et al. 2016). Their prolific, year-round spawning frequency, short larval stage, and their ability to rapidly spread has raised concerns throughout Gulf Coast states for native ecosystems and species. Their voracious appetite for crustacean species and juvenile fish species could lead to potential competition with native species for food, while also becoming a potential predator of native fish juveniles (Fogg et al. 2013, Dahl and Patterson III 2014).

Although there is a lack of research on the impacts of invasive species on Red Drum, threats from invasive species remain a concern. Continued monitoring efforts remain the primary method for reporting new invasive species and their impacts on native species within our coastal environments.

HABITAT LOSS AND RESTORATION

Eighty percent of annual coastal marsh loss in the United States occurs in Louisiana with an estimated annual land loss rate of 100 $km^2\ yr^{-1}$ (39 $mi^2 yr^{-1}$) (Day et al. 2000). Natural factors (e.g., subsidence, sea level rise, storms, and floods) and manmade factors (e.g., water management, dredging for oil and gas exploration, construction of pipelines and navigation channels, saltwater intrusion, and coastal development) both contribute to regional marsh loss. Changes resulting from natural fluctuations have usually occurred less frequently and over a longer period of time than man-induced changes (CPRA 2023). Marsh loss may affect the abundance of estuarine dependent species such as Red Drum. Most likely, overall populations have been reduced as a result of habitat alterations; loss of vegetated wetlands have the most serious impact to larval and juvenile Red Drum as these low salinity areas provide food and shelter during these highly sensitive early life stages (Perret et al. 1971).

Louisiana's Coastal Protection and Restoration Authority (CPRA) monitors and measures coastal habitat loss and has proposed and/or implemented a number of coastal protection and restoration projects to help combat and slow some of these impacts through the Louisiana's Coastal Master Plan. These projects range from freshwater diversion and marsh creation to the construction of levees (CPRA 2023). These projects may have both positive and negative impacts on Red Drum abundance from increased marsh habitat through marsh creation to changes in salinity/temperature regimes through freshwater and sediment

diversions. These projects may also impact Red Drum fisheries. For example, levees and other protection features could create access issues by disrupting travel to or modifying existing fishing grounds; however, they could also protect the existing fishery infrastructure as well as residences of fishermen. LDWF provides input into the Coastal Master Plan, but its authority is limited on project selection. However, LDWF will be directly involved in drafting operational plans for diversions and, as feasible, provide guidance while considering conditions required for Red Drum and all estuarine species to thrive while also protecting Louisiana's land-dwelling population. Unfortunately, both habitat loss and efforts to minimize its impacts could affect the ability of marshes to provide habitats for Red Drum and other estuarine dependent species. In fact, the changing coast of Louisiana would impact the fishery and Red Drum even if nothing were done to counteract the natural and manmade causes of coastal land loss. Increased monitoring before, during, and after construction of large-scale ecosystem restoration projects will allow LDWF to document response by species of importance and can help inform the adaptive management process, which may be relied on as Louisiana moves forward on these unprecedented steps to maintain some portion of coastal Louisiana.

2010 *DEEPWATER HORIZON* OIL SPILL

The Programmatic Damage Assessment and Restoration Plan (PDARP) documents the impacts to the habitat and natural resources of the Gulf caused by the 2010 *Deepwater Horizon* oil spill. According to the PDARP, approximately 65% of the total oiled shorelines and oiled wetland shorelines occurred in Louisiana, and the "heaviest and most persistent shoreline oiling occurred in salt marshes in Northern Barataria Bay" (DWH NRDA 2016). Some laboratory studies demonstrated that exposure of Red Drum to oil contamination resulted in a series of adverse effects, including reduced growth, phenotype expression changes, reduced metabolic performance, and reduced reproductive success (Khursigara et al. 2021, McGruer et al. 2021). However, a recent genetic study (Michaelsen 2015) found no impacts from the 2010 *Deepwater Horizon* oil spill on the genetic health (e.g., population structure, diversity, gene flow) of Red Drum in the northern GOM. Projects to restore natural resources injured as a result of the 2010 *Deepwater Horizon* oil spill in Louisiana will focus on restoring Louisiana coastal marshes, given both the extensive impacts to Louisiana marsh habitats and species and the critical role that these habitats play across the Gulf for many injured resources and the overall productivity of the Gulf. These projects will be consistent with the Coastal Master Plan, to the extent possible. Additional details regarding completed and ongoing restoration projects can be found at *www.gulfspillrestoration.noaa.gov/restoration-areas/louisiana*.

Fishery Management Program

Collaborative Fishery Management

Louisiana's fishery management authorities collaborate with the other Gulf states, other aquatic resource management authorities, public health and safety authorities, industry, and other stakeholders in the management of the state's Red Drum resource and fisheries, primarily through the Gulf States Marine Fisheries Commission and the Gulf of Mexico Fishery Management Council.

MANAGEMENT FRAMEWORK

The Constitution of Louisiana provides the foundation for the sustainable management of the state's fisheries resources, including Red Drum, recognizing their importance to Louisiana's environment, citizens, and economy. According to the Constitution of Louisiana, "The freedom to hunt, fish, and trap wildlife, including all aquatic life, traditionally taken by hunters, trappers and anglers, is a valued natural heritage that shall be forever preserved for the people. Hunting, fishing and trapping shall be managed by law and regulation consistent with Article IX, Section I of the Constitution of Louisiana to protect, conserve and replenish the natural resources of the state." Louisiana's legislative statutes and administrative code provide the legal and administrative framework for the state's fishery management system. LA R.S. 56:638.1–5 define the legislative intent, findings, purposes, policy, and standards for the conservation, management, and sustainability of all species of fish in Louisiana and are similar to those found in the Magnuson-Stevens Fishery Conservation and Management Act (MSA), the law that guides U.S. federal fishery management. According to these statues, fishery conservation and management in Louisiana should sustain:

- A sustainable Red Drum fishery.
- Louisiana's fisheries resources (fish and shellfish)
- The ecosystems in which they live (habitat and other aquatic species)
- The people that depend upon these resources (commercial and recreational fishing industries and coastal communities).

See *Appendix II* for specific details of these statutes.

AUTHORITIES

LOUISIANA

Legislature

The primary authority for managing the Red Drum fishery in Louisiana's state waters rests with the Legislature. The Legislature is the lawmaking body of the state and enacts Revised Statutes defining the legal framework for fishery management. The Constitution of Louisiana empowers the Legislature to enact laws to protect, conserve, and replenish the natural resources of the state, with consideration for the health, safety, and welfare of the people. The Legislature has delegated some of its authority to the Commission and the Secretary of LDWF. In general, management actions such as gear changes, licensing, and entry limitations are under the authority of the Legislature. With respect to Red Drum, in 1988, the Legislature outlawed the retention of Red Drum in commercial fisheries (LA R.S. 56:325.3), and classified Red Drum as a gamefish (LA R.S. 56:327). The Legislature also set the length, bag, and possession limits for recreational harvest of Red Drum, but has allowed the Commission authority to change those regulations (LA R.S. 56:325.1). The Legislature adopts laws according to Louisiana's legislative process. LDWF, in coordination with the Louisiana Finfish Task Force, may develop proposed legislation specific to the Red Drum fishery and assist in finding sponsors for those particular bills. Legislators also develop bills independent of those entities.

See *Appendix III* for a diagram outlining Louisiana's legislative process, and *Appendix XI* for a chronology of major changes.

Governor

The governor of Louisiana also has authority to issue executive orders, which are not statutes like those passed by the Legislature but do have the force of law.

Wildlife and Fisheries Commission

The Commission is charged with the control and supervision of the wildlife of the state, including all aquatic life. Part of the executive branch, the Commission consists of seven members appointed by the governor, subject to confirmation by the Senate. The Commission operates as a policy-making and budgetary control board, with no administrative function. The Commission receives and reviews biological, socioeconomic, and other technical data and management recommendations from LDWF, gathers public input, and ultimately votes on actions to achieve management goals. The Commission has the authority to set seasons, times, places, size limits, quotas, daily take, and possession limits based upon biological data among other authorities. With respect to Red Drum, the Commission is granted the authority to adjust seasons, size limits, bag, and possession limits of Red Drum within the constraints already established by the Legislature (LA R.S. 56:325.3 and 326.3). See *Appendix IV* for complete details on the Commission's authorities and duties as outlined in LA R.S. 56. The Commission adopts rules according to the process defined in Louisiana's Administrative Procedure Act (APA, LA R.S. 49:950ff). The APA requires that the Commission give appropriate notice of their intended action, make the proposed rule available for public review and comment, and include a Fiscal and Economic Impact Statement (FEIS), summarizing what social and economic impacts the proposed rule might have. In addition to the FEIS, a proposed rule must also include Family Impact, Poverty Impact, and Provider Impact Statements. Once the rule has gone through the APA process and is approved, it is published as final in the Louisiana Register and is compiled with other Commission rules in LAC 76.

Department of Wildlife and Fisheries

LDWF serves as the administrative and operational arm of the Commission. The Secretary of LDWF is appointed by the governor, subject to confirmation by the Senate. The Secretary is the executive head and chief administrative officer of LDWF. In general, LDWF monitors fishery populations and fisheries by collecting and analyzing fishery dependent and independent data; conducts scientific research; provides data and management recommendations to the Commission and Legislature; and administers and enforces laws, rules, and regulations as adopted by the Commission and Legislature. The Legislature and Commission may grant the Secretary of LDWF additional authorities to create administrative rules. For example, the Secretary, where authorized by the Commission or Legislature, can make a declaration of emergency in times when public health, safety, and welfare are in jeopardy or quick and immediate action is required. See *Appendix V* for complete details of the Secretary and LDWF's authorities and duties related to Red Drum as described in LA R.S. 56 and LAC 76.

Finfish Task Force

The Legislature established the Louisiana Finfish Task Force to study and monitor the finfish industry and to make recommendations to the Commission, LDWF, and other state agencies for the maximization of benefit from that industry for the state of Louisiana and its citizens. The Louisiana Finfish Task Force is composed of 15 voting (including six alternates) and six non-voting members.

Voting members include:

- Three certified licensed Louisiana commercial fishermen (and three alternates) appointed by the governor - three of which must be selected from a list of six nominees submitted by the Louisiana Shrimp Association and three of which must be selected from a list of six nominees submitted by the Delta Commercial Fisheries Association
- One active Louisiana dock buyer of finfish appointed by the governor
- Three licensed Louisiana recreational freshwater and saltwater fishermen (and three alternates) appointed by the governor - four of which must be selected from a list of eight nominees submitted by the Coastal Conservation Association of Louisiana and two of which must be selected from a list of four nominees submitted by the Louisiana Chapter of the Bass Anglers Sportsman Society
- One member of the Senate appointed by the president of the Senate
- One member of the House of Representatives appointed by the speaker of the House of Representatives.

Non-voting members include:

- The governor or his designee
- Three members appointed by the Secretary of LDWF including a fisheries biologist, an enforcement agent, and an economist
- The commissioner of the Louisiana Department of Agriculture and Forestry (LDAF) or his designee
- The secretary of the Louisiana Department of Health (LDH) or his designee.

The Louisiana Finfish Task Force has no direct management authority for the Red Drum fishery. According to LA R.S. 56:301.10, the Louisiana Finfish Task Force is responsible for:

- Coordinating efforts to increase finfish production and marketability
- Studying the decline in finfish marketability and market price
- Studying the impacts of imported finfish on the domestic market
- Assisting in the development of a state finfish inspection program
- Assisting in the development of a Louisiana finfish certification and branding program
- Making recommendations to the Commission, LDWF, the Louisiana Department of Natural Resources (LDNR), LDAF, and LDH on policies to help enhance the domestic finfish industry
- Making recommendations on issues pertaining to the finfish industry and finfish production to state agencies responsible for elements of the finfish industry in Louisiana, including LDWF, LDNR, CPRA, LDH, LDAF, and the Legislature.
- Developing markets and marketing strategies for the development and expansion of markets for finfish harvested from Louisiana waters
- Representing the interests of the Louisiana finfish industry before federal and state administrative and legislative bodies on issues important to the Louisiana finfish industry
- Contracting for legal services to represent the interests of the Louisiana finfish industry in judicial, administrative, and legislative proceedings
- Performing any acts deemed necessary and proper to carry out its duties and responsibilities.

Other Aquatic Resource Management Authorities

Although not involved in marine fishery management directly, several state and local agencies are involved in managing other aquatic or coastal resources, such as protecting habitat or monitoring water quality. The Louisiana Department of Natural Resources is charged with regulating development activities and managing resources in Louisiana's coastal zone. Several coastal parishes have also developed their own coastal zone management programs. The Coastal Protection and Restoration Authority (CPRA) is responsible for developing, implementing, and enforcing the Coastal Master Plan, including monitoring and measuring coastal habitat loss and coordinating habitat restoration projects. Louisiana Department of Wildlife and Fisheries collaborates with all of these agencies, reviewing permits, commenting on coastal zone management and habitat restoration activities, and participating in the Coastal Master Plan development process.

Public Health and Safety Authorities

All seafood produced and processed in Louisiana must meet quality and safety standards set forth in the Louisiana Sanitary Code. The Louisiana Department of Health routinely inspects the state's approximately 350 seafood processing plants using federal Hazard Analysis Critical Control Point (HACCP) requirements to ensure safe handling practices and that only safe products reach the market. More details on these programs are available from LDH.

The Louisiana Department of Environmental Quality is responsible for setting pollution standards and monitoring all waters of the state, including the Gulf, to ensure they meet water quality standards. LDH works with LDEQ to issue fish consumption advisories based on fish tissue sampling in areas of suspected contamination and assessments of risk to human health. LDH and LDEQ consult LDWF and LDAF throughout the advisory development and dissemination process.

Public Participation and Engagement

Louisiana's fishery management authorities encourage public participation throughout the management process. All meetings of the Legislature's natural resources committees and the Commission are open to the public according to Louisiana's Open Meetings Law (LA R.S. 42:12-28). This law mandates that government decisions be made in an open forum, ensuring state integrity and the public's trust and awareness of its governing officials. Meetings must be announced at least 24 hours in advance, provide opportunities for public comment, allow for audience recording of the meeting, and have recorded minutes of the proceedings.

REGIONAL

Other Gulf States

The other U.S. states bordering the Gulf are responsible for the conservation and management of Red Drum fisheries within their respective waters. Louisiana cooperates with other Gulf states in the scientific research and management of fisheries that cross jurisdictional boundaries, including Red Drum, through the GSMFC. Louisiana Revised Statutes 56:71–87 established Louisiana's authority to enter into the Gulf States Marine Fisheries Compact with other states. The GSMFC has no direct authority over the Red Drum fishery but is authorized to make recommendations to the governors and legislatures of the five Gulf states on programs beneficial to management of shared fisheries. The GSMFC also consults with and advises member states over fishery conservation problems, advises U.S. Congress, and testifies on legislation and marine policies affecting the Gulf states. Specific to the Red Drum fishery, the GSMFC has assisted in addressing issues of importance to Red Drum on a regional scale. In 1978, the GSMFC provided the forum for the first interstate meeting discussing management of Red Drum (Williams et al., 1980). The GSMFC also developed the first fishery profile of Red Drum in the Gulf of Mexico (Perret et al., 1980) and a recent fishery management plan for Red Drum (VanderKooy and Rester, 2023), due to the importance of the fishery across the Gulf states.

See Appendices VI and VII for a table of other states' regulations for commercial and recreational Red Drum fisheries.

Federal Authorities

The Gulf of Mexico Fishery Management Council (Gulf Council) and NMFS are responsible for monitoring and managing fisheries resources in Gulf federal waters (from the seaward boundary of state territorial waters to 200 nautical miles offshore) and Red Drum do occur extensively in federal waters. Red Drum fisheries operate almost exclusively in state waters; no recent commercial or recreational landings are reported from federal waters. Federal agencies do not exclusively manage Red Drum, however, do have exclusive authority of the species in federal waters through their administration of laws, regulations, and policies. For example, in 2007, then-President George W. Bush signed an Executive Order, officially closing the Red Drum commercial fishery in federal waters by prohibiting the sale of any individuals caught in the EEZ (Exec. Order No. 13,449, 2007). Additionally, The Gulf Council established a minimum Escapement Rate (30%) that leads to a Spawning Potential Ratio of 20%.

See *Appendix VIII* for a list of related federal management institutions and their authorities and jurisdictions and *Appendix IX* for a list of related federal laws, regulations, and policies.

EXISTING MANAGEMENT MEASURES

PLANS

LDWF's Report on the Assessment of Red Drum (Sciaenops ocellatus) in Louisiana (West et. al. 2022) and the Biological and Fisheries Profile of Louisiana Red Drum (Hoese et. al., 1991) summarized relevant scientific information and studies regarding the management of Red Drum; described the biological and economic aspects of the Red Drum fishery; reviewed Louisiana management authorities and laws affecting Red Drum; described the problems and needs of the Red Drum fishery; and suggested management strategies and options to meet the needs to the stock (West et al. 2022). The GSMFC's Management Profile for Gulf of Mexico Red Drum (2023) summarized, referenced, and discussed relevant scientific information and studies regarding the management of Red Drum; described the biological, social, and economic aspects of the Red Drum fishery; reviewed state and federal management authorities and their jurisdictions, laws, regulations, and policies affecting Red Drum; described the problems and needs of the Red Drum fishery; and suggested management strategies and options to solve problems and meet the needs of the stocks.

POLICIES

LA R.S. 56:6 tasks the Commission with promulgating rules and regulations for Red Drum to set seasons, times, places, size limits, quotas, daily take, and possession limits based upon biological and technical data. LDWF provides the Commission with scientific and technical data, including an assessment of the Red Drum stock in Louisiana waters, for consideration of management to maintain the sustainability of the stock.

LA R.S. 56:325.1 gives the Commission authority to set take, possession, and size limits for saltwater finfish caught recreationally, while LA R.S. 56:325.3 tasks the Commission with regulating the maximum annual quota, seasons, possession, and other aspects of commercial Red Drum fishery.

LA R.S. 56:638.1-638.5 identifies fishery standards, the State's policy for stewardship, and standards for Commission rules and regulations regarding harvesting, conservation, management, and sustainability of all species of fish.

STATUTES AND RULES

Louisiana's Red Drum fisheries are governed by both legislative statutes (LA R.S. 56) and rules promulgated by the Commission (LAC 76). Specific regulations are described below. This summary of regulations does not retain their exact language and should be not be relied on for legal purposes. See *Appendix X* for detailed text of these regulations. See *Appendix XI* for a chronological history of major changes to Louisiana's Red Drum regulations.

Commercial

The following subsections are provided for general informational purposes, but the commercial harvest, possession or sale of Red Drum is prohibited, therefore, many of these may not be relevant to Red Drum specifically.

Licensing

No person shall be issued a license or permit for the commercial taking of Red Drum.

Both resident and nonresident fishermen must have the appropriate commercial fishing and gear licenses to harvest finfish commercially in Louisiana waters. Gear licenses may not be transferred between licensed commercial fishermen. Nonresidents may not purchase licenses for commercial fishing gear prohibited in the state in which they reside. Five dollars of each resident gear license fee and 20 dollars from each nonresident gear license fee are deposited in the Seafood Promotion and Marketing Fund. Vessel owners must also have the appropriate vessel licenses. Licensed commercial fishermen may transport and sell their own catch to any licensed Louisiana wholesale/retail seafood dealer located within Louisiana. They must have a fresh products license to sell their catch directly to a consumer; they may purchase a secondary fresh products license for their spouse for a reduced fee. Commercial fishermen that sell their catch to anyone other than a consumer or licensed dealer and anyone else that buys, acquires, handles, transports, or exports finfish for sale or resale must have the appropriate licenses. A portion of each license fee is deposited in the Seafood Promotion and Marketing Fund. Licenses may be suspended, denied or revoked for failure to pay child support, nonpayment of unemployment compensation overpayment, and nonpayment of individual income taxes.

Fishery Access

The commercial harvest of Red Drum is prohibited by act of the Louisiana Legislature.

Legal Gear and Gear Requirements
Commercial fishermen must have the appropriate gear license to harvest in state waters. Commercial fishermen may not use any of the following types of gear to harvest in state saltwater areas:
- Spears (except for flounder and garfish)
- Stupefying substances or devices
- Guns
- Poisons
- Explosives
- Tree-topping devices
- Electric shocking instruments or devices
- Seines (unless harvesting menhaden and/or herring-like species)
- Gill, trammel, and strike nets (unless harvesting under a permit to use strike nets to harvest mullet or pompano)
- Snagging devices (not including bows and arrows)
- Longlines (not the same as trotlines, longlines are longer than 440 yards)
- Bandit gear
- Elevated trotlines (except in exempt areas).

Additionally, commercial fishermen may not use any aircraft including fixed-wing aircraft, dirigibles, balloons, helicopters, or any other form of aerial surveillance to assist in harvesting.

Seasons
Commercial harvest of Red Drum is prohibited.

Size and Possession Limits
Commercial harvest of Red Drum is prohibited.

Bycatch
Commercial fishermen are permitted to retain and sell most bycatch for commercial purposes as long as they are in compliance with appropriate regulations for those species. However, they may not commercially harvest gamefish like Red Drum. LDWF monitors landings and sales of these species through LDWF's trip ticket program. Commercial fishermen may also retain bycatch for personal consumption; however, they must have applicable recreational fishing licenses and any retained fish must be within recreational minimum size and daily possession limits. However, the possession of Red Drum is not allowed when commercial fishing gear is present aboard a vessel, other than as specified in R.S. 325.1(A)(3)(a). Fishermen may not waste any fish of this state. Waste is defined as harvesting of any fish for commercial purposes which results in the excessive killing of such fish. Excessive killing is defined as the killing resulting from taking or attempting to take any fish in excess of what the possessor thereof can process, utilize, or transport from the fishing grounds.

Area Restrictions
Commercial fishermen may not set gear that interferes with the free passage of fish within 500 feet of the mouth of any inlet or pass or within 500 feet of any water control structures. Gear and other restrictions may vary in state wildlife management areas, refuges, and other areas to protect important habitat and reduce conflicts with other users. Commercial fishing is prohibited in coastal national wildlife refuges.

Operational Restrictions
Commercial fishermen must land commercial species whole with heads and tails attached to assist enforcement agents in easily identifying the fish. However, fish may be gilled and gutted prior to landing.

Fishing Gear Interactions
It is illegal for any person to knowingly and intentionally use or employ any net to encircle a vessel or to otherwise knowingly and intentionally use or employ any vessel or fishing gear to interfere with the legal fishing of another. It is also illegal for any person to knowingly and intentionally use or employ any vessel or recreational gear to interfere with the legal commercial fishing of another.

Packaging
The Secretary of LDWF has the authority to adopt rules and regulations to establish standards for the packaging of seafood in Louisiana for wholesale or retail sale. These standards may govern the quality, contents, and weight of all seafood packaged in this state. The Louisiana Seafood Promotion and Marketing Board may make recommendations to the Secretary for standards for the packaging of seafood. Shipments containing fish shall be plainly marked, the tags or certificates to show the date and names of the consignor and the consignee, with an itemized statement of the number of pounds of fish and the names of each kind contained therein. Bills of lading issued by a common carrier for such shipments shall state the number of packages which contain fish, and the date and names of the consignor and consignee, with an itemized statement of the number of pounds of fish and the names of each kind contained therein.

Recreational

Licensing
Residents and nonresidents 18 years of age and older must have basic and saltwater fishing licenses to harvest Red Drum recreationally in Louisiana.

Legal Gear and Gear Requirements
Recreational fishermen typically use hook and line gear to catch Red Drum. Recreational fishermen may not use any of the following to take Red Rum (or other saltwater finfish):
- Spears (except for garfish)
- Gillnets, seines, and other forms of entanglement netting
- Poisons
- Stupefying substances or devices
- Explosives
- Guns
- Tree-topping devices
- Any instrument or device capable of producing electric current to shock fish
- Snagging devices.

Exemptions
Recreational fishers may harvest Red Drum using the following methods:
- Bowfishing
- Standard Spearing Equipment used by a skin diver submerged in water when sport fishing

Seasons
The recreational possession and harvest of Red Drum is permitted year-round.

Size and Possession Limits
Red Drum must be between 18 inches minimum total length and 27 inches maximum total length to be kept. Harvest of Red Drum over 27 inches total length is prohibited. Each licensed angler may keep 4 fish per day total. Charter captains and crew members shall not retain a bag limit of Red Drum while operating or representing themselves as a charter vessel or headboat, but may engage in fishing activity to assist passengers.

Recreational saltwater anglers may possess a two days' bag limit on land; however, no person shall be in possession of fish over the daily bag limit in any one day or while fishing or while on the water, unless that recreational saltwater angler is aboard a trawler engaged in commercial fishing for a consecutive period of longer than 25 hours and in state waters or the conditions below are met.

The possession limit for Red Drum taken south of U.S. Hwy 90 is three times the daily take limit when the fisherman holds and is in possession of a valid recreational fishing license and can show a landing receipt from a public boat launch located south of U.S. Hwy 90 that demonstrates to the satisfaction of LDWF that the fisherman has been actively on the water or at a remote camp that can be accessed only by water for two days or more. The fish must be kept whole or whole gutted in separate bags for each species of fish. The bags must be marked with the date the fish were taken, the species, the number of fish contained in the bag, and the name and license number of the person taking the fish. The fish must only be in the possession of the person who harvested the fish. However, no fisherman may be actively fishing or engaged in fishing while in possession of more than the daily take limit.

A fisherman who holds and is in possession of a valid recreational fishing license and can demonstrate to LDWF's satisfaction use of a boat launch located south of U.S. Highway 90 and that the fisherman has been actively on the water or at a remote camp that can be accessed only by water for two days or more may possess up to the possession limit of filleted Red Drum. The filleted fish must have sufficient skin remaining on the fillet to allow for identification of the species and must be segregated by species into plastic bags or plastic containers that are marked by species to allow for easy identification, the date caught, and the name and license number of the person who took the fish. Red Drum fillets must be no less than 14 inches in length. The fish must be in possession only of the person who took the fish. However, no fisherman shall be actively fishing or engaged in fishing while in possession of more than the daily take limit. All regulations regarding these species apply whether caught in freshwater or saltwater areas.

Area Restrictions
Restrictions vary in state wildlife management areas, refuges, and other areas as well as coastal national wildlife refuge.

Operational Restrictions
Recreational fishermen must land Red Drum with their head and tail fins intact to assist in identification of the fish for enforcement purposes, except as mentioned above when fishing as specified under Size and Possession Limits, south of U.S. Highway 90.

Fishing Gear Interactions
It is illegal for any person to knowingly and intentionally use or employ any vessel or recreational gear to interfere with the legal commercial fishing of another.

Other

Louisiana Seafood Promotion and Marketing Board (LSPMB)
The Louisiana Seafood Promotion and Marketing Board works to enhance the public image of commercial fisheries products, promote the consumption of these products, and assist the seafood industry, including commercial fishermen and wholesale and retail dealers, in market development to better use existing markets and help establish new markets.

Louisiana Wild Seafood Certification Program (LWSCP)
The Louisiana Legislature authorized the LDWF to establish the Louisiana Wild Seafood Certification Program (LWSCP) to build a brand that guarantees the origin of Louisiana wild-caught seafood. Through strict chain of custody requirements, the program guarantees that all seafood products bearing the Certified Louisiana Wild Seafood logo were caught in Louisiana or Gulf waters by a licensed Louisiana fisherman, landed at a Louisiana dock, and processed and packaged by a Louisiana-based company. The program provides education for participants on best seafood handling and sanitation practices to ensure the utmost safety and quality. When a buyer sees this logo, they can be confident they are buying authentic Louisiana wild-caught seafood, a premium product known for fresh flavor, consistent quality, and sustainability, and that they are supporting local Louisiana fishing communities. By branding and showcasing Louisiana seafood, LWSCP helps suppliers increase the value of their seafood products and remain competitive in the seafood marketplace. LWSCP participants benefit from free program marketing support, such as:

- Market portal linking Certified Louisiana Wild Seafood suppliers with buyers
- Promotions through the program website, social media, and events including seafood festivals and industry conventions
- Free point-of-sale materials such as window clings, apparel, brochures, stickers, and decals
- Access to program partners including the LSPMB, Audubon GULF, NMFS, Louisiana Sea Grant, and other in- and out-of-state partners who purchase and promote Certified Louisiana Wild Seafood.

Licensed Louisiana commercial fishermen are automatically eligible for the program; licensed Louisiana wholesale/retail seafood dealers must apply for and receive a permit to participate. They must also comply with all state and federal reporting requirements and have all legally required permits to operate their business.

Professionalism Programs

LDWF, in collaboration with Louisiana Sea Grant and the LSU AgCenter, developed Louisiana Fisheries Forward, a multi-year, multi-phase professionalism program for all sectors of Louisiana's commercial fishing industry, including fishermen, dock owners, processors, and distributors. Launched in 2014, this program provides education and training essential for the continued economic success of the industry. This program delivers training videos and corresponding fact sheets on a number of topics such as; how to be a commercial fisherman, seafood business finance and management, as well as hands-on workshops, training days, and demonstrations to showcase new technology for vessel refrigeration/ cooler systems, seafood freezing equipment, fuel efficiency equipment, and fishing/harvesting equipment, plus seafood handling and processing best practices.

Fisheries Outreach

Through outreach efforts, LDWF promotes public awareness and advises the public on stewardship and best practices in preserving the unique nature of the state's natural resources. Via a strong presence at recreational events, industry-related expos, workshops, seminars, and other state sponsored events, LDWF strives to foster a community sense of resource and habitat stewardship. At these events, LDWF distributes an assortment of printed materials, which focus on fishing regulations, commercial and recreational fishing topics, as well as species profile brochures that highlight the life cycle and habitat requirements of Red Drum and other native Louisiana species. Through participation in events, distribution of educational materials, and other activities, LDWF reaches more than 200,000 Louisiana citizens each year.

COMPLIANCE

REPORTING METHODS AND REQUIREMENTS

LDWF monitors commercial harvest of finfish at the point of initial sale through LDWF's trip ticket program. Under the program, wholesale/retail seafood dealers purchasing or accepting transfers of finfish from commercial fishermen must complete a commercial trip ticket at the time of purchase or transfer of the catch from the fisherman to the dealer. Fresh products license holders (commercial fishermen licensed to sell their catch directly to consumers) are also required to submit trip tickets.

When a commercial fisherman sells or transfers their catch to a wholesale/retail dealer, they must present their license for verification and provide the dealer with information necessary to complete a commercial trip ticket. The dealer must record the sale or transfer on a three-part LDWF issued trip ticket form or via the electronic reporting program and include the following information:

- Commercial fisherman's name and license number
- Wholesale/retail seafood dealer's name and license number
- Vessel registration or U.S. Coast Guard (USCG) documentation number
- Transaction date
- Gear used
- Primary location of where the finfish was caught (according to LDWF-issued trip ticket maps)
- Duration of the fishing trip
- Species identification
- Quantity and units of each species
- Size and condition of each species
- Unit price of each species
- Permit number for species requiring a permit to harvest.

The harvester and dealer must sign each trip ticket attesting that the information is correct. The dealer retains one part of the trip ticket, provides the fisherman with one part, and submits one part to LDWF. If using the electronic trip ticket program, instead of a trip ticket form, the fisherman and dealer must fill out a signature log to sign the trip ticket. The signature log includes the trip ticket number, date, vessel name, fisherman's signature, and dealer's initials. By signing and initialing the signature log, the fisherman and dealer are attesting the information filled out electronically via the electronic trip ticket program is correct. When a commercial fisherman sells their catch under a fresh products license, they must record all information required on the commercial trip ticket, using their fresh products license number in place of the dealer license number. The commercial fisherman must sign each trip ticket, as both the dealer and commercial fisherman, attesting that the information provided is correct. On or before the 10th of each month, dealers and fresh products license holders must submit to LDWF all trip tickets from the previous month. A monthly submission sheet must accompany these trip tickets, certifying that the submitted trip tickets represent all of the dealer's transactions with commercial fishermen for that month. When using the electronic trip ticket program, dealers and fresh products license holders must submit the computer generated monthly submission sheet and the signature logs to LDWF on or before the 10th of the month. Trip ticket records must be maintained for three years and are open to inspection by LDWF. Trip ticket information is confidential and is protected by both state and federal law to limit access to business-specific information. However, LDWF and approved contractors may analyze and compile individual trip information into reports to provide reliable information for monitoring harvest from locations across the state, while still protecting sensitive information. LDWF enforces the trip ticket program; violation of statutes related to the program can result in citations written by LDWF or other law enforcement officials.

RECORDKEEPING REQUIREMENTS

Wholesale/retail seafood dealers, retail seafood dealers, restaurants, and retail grocers must keep records of the following:

- The quantity and species of fish acquired, the date the fish were acquired, and the name and license number of the wholesale/retail seafood dealer or the out-of-state seller from whom the fish were acquired
- The quantity and species of fish sold, the date the fish were sold, and the name and license number of the person to whom the fish were sold. When sold to a consumer, the records must indicate the quantity, species, and date and shall state that the fish were sold to the consumer.

ENFORCEMENT

Through events, outreach materials, and other resources, LDWF informs commercial and recreational fishermen about programs, projects, and most importantly, relevant regulations to prevent illegal activities. LDWF's Law Enforcement Division is responsible for ensuring compliance with all commercial and recreational licensing and harvesting regulations through regular patrols and investigations. LDWF's Law Enforcement Division is also responsible for enforcing laws as provided for in the Constitution of Louisiana; Louisiana Revised Statutes, and numerous federal laws including the MSA, ESA, MMPA, and Lacey Act. LDWF's Law Enforcement Division partners with NMFS and USCG enforcement agents and officers to increase their enforcement capabilities and carry out their important mission in Louisiana's waters and beyond. Local parishes also assist in enforcement, primarily through the legal functions of each parish's district attorney. Local sheriff's offices sometimes assist LDWF's Law Enforcement Division as well. Local and state sanitarians and health department employees help enforce public health and safety related regulations.

PENALTIES

Classes of violations vary by legislative statute or Commission rule. Specific penalties for violations vary with the severity of the violation and include fines, jail time, loss of fishing license, and forfeiture of property. In addition, LDWF may seize any Red Drum in connection with the violation. Specific penalties are listed in *Appendix XII*.

A person who kills, catches, takes, possesses, or injures any aquatic life in violation of an applicable state statute or regulation or a federal statute or regulation is also liable to the state for the value of each aquatic life unlawfully killed, caught, taken, possessed, or injured.

In recreational fisheries, a violation of over the limit of Red Drum is punishable by a fine of $25 per Red Drum over the limit of 5 or in violation of such minimum size and take and possession limits as established by the Commission. Possession of Red Drum over the maximum size limit is punishable by a fine of up to $150 per individual. In addition to any applicable fines, violators' fishing licenses may be revoked and they may be prohibited from obtaining any new fishing licenses for a period of up to three years thereafter.

In commercial fisheries, possession of Red Drum constitutes a class 5-B violation. The first offense is punishable by a fine of $350 - $500, or imprisonment in jail for 30 days. The second offense is punishable by a fine of $500 - $1000, or imprisonment in jail for 60 days. The third and all subsequent offenses are punishable by a fine of $1000 - $2000, and imprisonment in jail for ninety days. In addition, the license under which the violation occurred shall be revoked and shall not be reinstated at any time during the period for which it was issued and for one year thereafter. The above penalties in all cases shall include forfeiture to the department of anything seized in connection with the violation (R.S. 56:35).

Current Issues & Management Options

This section identifies current issues facing Louisiana's Red Drum fisheries, provides a description of each issue, and recommends options for future action to address these issues. Before implementing any recommendation, LDWF will evaluate the feasibility and potential impacts of the action on the resource and fisheries.

ACHIEVING MANAGEMENT GOALS

Addressing current issues facing Louisiana's recreational Red Drum fisheries through options identified in this section or through stakeholder participation will advance these fisheries toward meeting long-term management goals.

STOCK OVERFISHED

LDWF uses the escapement rate of juvenile Red Drum as an indicator of the health of the Red Drum population in Louisiana. Red drum escapement rates are defined as the proportion of Red Drum less than 5 years of age that survive the inshore fishery to enter the offshore spawning stock. Two measures of the status of the stock are used, a target (goal) and limit (threshold that should not be crossed). The target escapement rate for Louisiana Red Drum is currently 43%, which is the escapement that is estimated to lead to a 30% Spawning Potential Ratio (SPR) for the stock. The limit escapement rate for Louisiana Red Drum, consistent with the GMFMC GOM Red Drum FMP, is 30%. The 30% escapement rate limit is the escapement rate that leads to the SPR limit of 20%. These escapement rate and SPR limits represent fishing mortality and spawning biomass thresholds that the stock should not fall below, while the escapement rate and SPR targets represent a sustainable level of harvest and spawning biomass.

The 2022 stock assessment indicated that the stock size of Red Drum has declined from an estimated 18.3 million fish in 1999 to 8.7 million fish in 2021. Additionally, recruitment estimates of age-1 fish have generally declined in the most recent decade from an estimated 4.5 million fish in 2012 to an estimated 1.7 million fish in 2021. Escapement of juvenile Red Drum has also decreased through time from an estimated 66.4% in 1988 to 22.2% in 2021, which is below the established escapement rate limit of 30% indicating current overfishing of the stock.

If the escapement rate remains below the threshold, there is a high risk that the spawning population of Louisiana Red Drum will continue to decline and reach unsustainable levels where there may not be enough adult fish to maintain the population. The SPR for Louisiana Red Drum is currently above the established target of 30%, but is trending downward and will continue to decline as long as the escapement rate remains below the established target. Management actions are needed to recover escapement to sustainable levels to avoid the stock becoming overfished and entering an unsustainable condition. LDWF stock projections indicate that a 35% annual reduction in Red Drum harvest would be required to recover the escapement rate to the target rate within five years.

OPTIONS

In December of 2022, LDWF presented the Red Drum stock assessment to the LWFC with various management options to prevent future overfishing. Management options presented included bag limit and slot limit modifications, prohibition of charter guides retaining a bag limit on guided trips, and options for allowing harvest or prohibiting harvest of one Red Drum over a maximum size (the current maximum is 27 inches total length). During the 2023 Regular Session of the Louisiana Legislature, the Legislature passed Senate Concurrent Resolution (SCR) 46 which urged and requested the LDWF to prohibit any harvest of Red Drum over 27 inches. Subsequent to SCR 46, when LDWF presented a proposed change in Red Drum management, that proposed change included a prohibition of harvest over the maximum slot size limit in order to remain consistent with the intent of SCR 46.

In March of 2024, the LWFC proposed a regulation change to adjust the daily bag limit of Red Drum from 5 fish per day to 4 fish per day, adjust the current slot limit from 16-27in. to 18-27in., from allowing one Red Drum over 27in. as part of the daily bag limit to prohibiting retention of any Red Drum over 27in., and to eliminate the retention of a bag limit by a charter guide while on a guided trip. The proposed rule results in a projected decrease of 36.9% in the annual recreational harvest of Red Drum. These proposed rule changes became final on July 20, 2024.

Future Research & Data Needs

Throughout the development of this fishery management plan, LDWF has identified several research needs that would provide data to address some of the issues and data gaps in the Red Drum fishery or species biology.

Specific research needs are listed below. They are not listed in order of importance. The list includes aspects of the species or fisheries that have been noted for decades in addition to relatively recently identified issues.

- Continuing the SEAMAP nearshore bottom longline survey and corresponding age composition sampling are critical to estimating stock status since this survey supplies the only current estimates of adult Red Drum abundance.
- Updated estimates of offshore abundance with reasonable precision would provide more certainty in estimation of stock status in future assessments.
- Only limited age data are available from the LDWF estuarine trammel net survey. Ages of survey catches in this assessment were assigned from size with a growth function. Continuing the age composition sampling from the survey would allow a more accurate representation of survey age composition in future assessments.
- Development of a new fishery independent survey that better tracks Red Drum recruitment through time (full selection to survey gear at age-1) would provide better certainty in age-1 relative abundance estimates in future stock assessments.
- Estimates of Red Drum batch fecundity, spawning frequency, and maturity used in the most recent assessment were developed in 1996 with much of the underlying data from the late 1980s. Updated estimates of Red Drum batch fecundity, spawning frequency, and maturity at age/size are needed.
- Investigations of the habitat utilization of younger adult Red Drum (5-10 year olds), which are presumed to have escaped the inshore fishery and migrated to the offshore adult stock in the EEZ, are needed to determine what proportion of Red Drum truly escape the inshore fishery, as well as the efficacy of the current juvenile escapement rate based management policy.
- Incidental catches of Red Drum from the offshore GOM shrimp fishery were not considered in this assessment. Some previously reported estimates of incidental Red Drum catches in the offshore shrimp fishery indicated a relatively large bycatch when compared to estimates of Red Drum incidental catches of the Louisiana inshore shrimp fishery. Development of a current time series of offshore shrimp fishery Red Drum bycatch would allow for a better understanding of the current magnitude of offshore shrimp fishery bycatch relative to the directed fisheries.
- Factors that influence year-class strength of Red Drum are poorly understood. Investigation of these factors, including inter-annual variation in seasonal factors (seasonal salinities, winter severity, food availability, etc.) and the influence of environmental perturbations such as the 2010 *Deepwater Horizon* oil spill, could elucidate causes of inter-annual variation in abundance, as well as the species stock-recruitment relationship.
- With the recent trend toward ecosystem-based assessment models (Mace 2000; NMFS 2001), more data is needed

RESEARCH PRIORITIES, FUNDING AND PUBLICATIONS

LDWF prioritizes future research according to several factors, including whether or not it:

- Fits the agency's mission
- Can be adequately funded
- Can be reasonably expected to produce answers to specific management questions
- Can be reasonably undertaken without compromising other capabilities and efforts
- Has or will have the support of stakeholders
- Has or can engender cooperation with other researchers, managers, user groups, and/or the general public.

Research is typically funded through state license fees and federal, state, and private (nongovernmental organization) grants and programs. Funding is allocated based on priority as described above. While LDWF may not have funding for many of the topics listed above, additional funding sources may also be available for other researchers to pursue some of these studies. Our hope is that by our including these research and data needs here, those outside funding sources may be more inclined to support some of the studies described above. LDWF analyzes research and data and reports results in multiple formats, as appropriate. Ultimately, all information is publicly available (other than information linked to private enterprises, e.g., confidential landings data).

linking Red Drum 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 Red Drum stock and its habitat.

- 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.
- Conduct an assessment of basin-specific Red Drum populations to differentiate exploitation rates and stock status within the state to determine if regional management is an effective alternative to a statewide management strategy.
- Generate information describing the connectivity of nearshore and inshore Red Drum populations along the Louisiana coast.
- Investigate the relationship between wetland loss and the continuation of fishery production as it applies to the Louisiana Red Drum stock.
- Further evaluate differences between trends in fishery-independent catch rates and fishery-dependent sources to determine which trends are truly reflective of population abundance, or whether other factors (e.g., efficacy of fishery-independent techniques or changing vulnerabilities of the stock) are involved.
- Investigation of the relationship between Red Drum cold-stun deaths and age-classes is needed to determine if winter-kill events disproportionately affect certain aged fish within the population.
- SPR estimates may be biased if egg production does not scale linearly with female body weight and existing estimates of batch fecundity and spawning frequency are conflicting. A recent fecundity study conducted by LDWF suggests egg production and female body weight are equivalent. However, sample sizes from this study were low due to the difficulty obtaining samples of spawning fish in the proper condition.
- Estimate Red Drum spawning frequency and fecundity as a function of age and size.

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Appendices

APPENDIX I. Assessment of Red Drum *Sciaenops ocellatus* in Louisiana - 2022 Report

Joe West, Erik Lang, Xinan Zhang and Jason Adriance
Office of Fisheries
Louisiana Department of Wildlife and Fisheries

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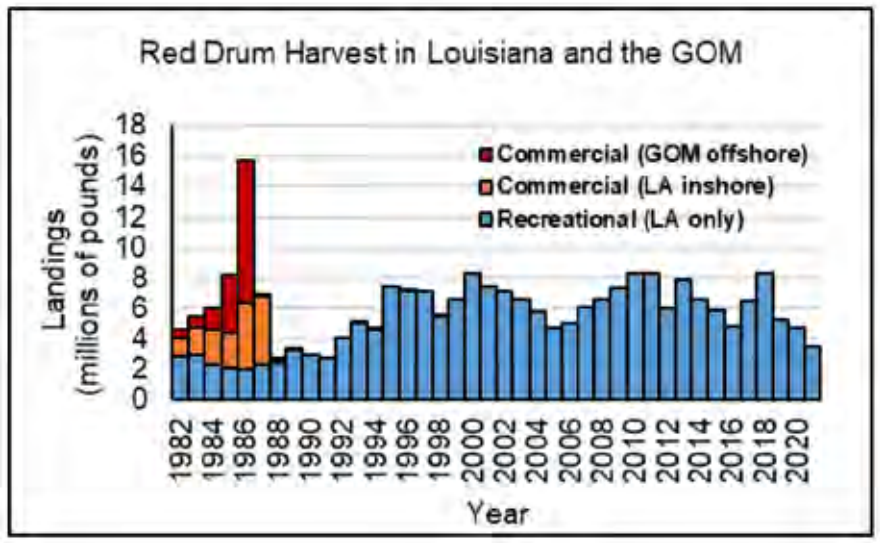
EXECUTIVE SUMMARY



Landings of Red Drum in Louisiana have remained above 5 million pounds per year in the most recent decade with the exceptions of 2016, 2020, and 2021. The highest harvest on record (over 15 million pounds) occurred in 1986. After commercial regulations were enacted in the late 1980's, Red Drum landings substantially declined from the 1986 peak. The recreational fishery now comprises 100% of the directed Louisiana Red Drum harvest.

A statistical catch-at-age model is used in this stock assessment to describe the dynamics of Red Drum in Louisiana and adjacent federal waters from 1982-2021. The assessment model projects abundance-at-age from estimates of abundance in the initial year of the time-series and recruitment estimates in subsequent years. 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, National Oceanic and Atmospheric Administration (NOAA) Fisheries commercial statistical records, and NOAA Fisheries Marine Recreational Information Program (MRIP). Indices of abundance are developed from the LDWF estuarine trammel net survey and the LDWF component of the Southeast Area Monitoring and Assessment Program (SEAMAP) nearshore bottom long line survey. Estimates of absolute abundance are taken from the NOAA Fisheries northern Gulf of Mexico (GOM) mark-recapture experiments. Age composition of fishery catches are estimated with age-length-keys derived from fishery age samples and a growth model.

Management thresholds have been established, though the Gulf of Mexico Fishery Management Council (GMFMC), for Red Drum in the state of Louisiana as a 20% spawning potential ratio, which is based on a 30% escapement rate from the inshore fishery. Based on results of this assessment, the Louisiana Red Drum stock is currently not overfished, but is experiencing overfishing. The current spawning potential ratio estimate is 40% and the current escapement rate estimate is 20%. The recent downturn in recreational landings are due to a series of below average annual recruitment to the stock where the most recent annual recruitment estimates are the lowest of the time-series examined. Management actions will be needed in order to prevent future overfishing and prevent the stock from becoming overfished.

1. INTRODUCTION

A statistical catch-at-age model is used in this stock assessment to describe the dynamics of Red Drum Sciaenops ocellatus in Louisiana (LA) and adjacent federal waters from 1982-2021. The assessment model 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. Derivation of each of the data elements used in this assessment are described in detail in the Data Sources Section, but are summarized here. Commercial landings are taken from National Oceanic and Atmospheric Administration (NOAA) Fisheries commercial statistical records. Recreational harvest estimates are obtained from the Louisiana Department of Wildlife and Fisheries (LDWF) Recreational Creel Program (LA Creel) and estimates hindcast to the historic NOAA Fisheries Marine Recreational Information Program (MRIP) time-series. Indices of relative abundance are developed from the LDWF estuarine trammel net survey and the LDWF component of the Southeast Area Monitoring and Assessment Program (SEAMAP) nearshore bottom long line survey. Estimates of absolute abundance are taken from the NOAA Fisheries northern Gulf of Mexico (GOM) mark-recapture experiments. Age composition of recreational fishery catches are estimated with age-length-keys derived from otolith samples of the fishery (2002-2021) and a growth model (1982-2001). Age composition of commercial landings are estimated with age samples of the fishery (offshore) and age-length-keys derived from a growth model (inshore).

1.1 FISHERY STATUS

A comprehensive history of the Red Drum (RD) resource and associated fishery within LA is described in Hoese et al. (1991) and for the Gulf of Mexico in GMFMC/GSMFC (1984). A current summary of the Louisiana RD fishery is presented below.

Commercial

Red Drum are no longer allowed to be landed commercially in Louisiana. Prior to 1984, no specific commercial RD regulations existed in LA. Through the 1950s and 1960s, LA commercial landings of RD fluctuated between 400,000 to 500,000 pounds annually. By the late 1960s, LA landings began to increase steadily to nearly 1 million (M) lbs by 1972 and 2.2M lbs by 1976 with significant numbers of juvenile RD taken from inshore waters. Landings decreased to just over 1M lbs by the late 1970s, which can be attributed to restricting nets to 1,200 feet in length, prohibiting the use of monofilament gillnets, and changing the allowable mesh size for gill and trammel nets. Additionally, netting was prohibited in parts of Lake Pontchartrain, parts of Lake Borgne, and within one mile of the Chandeleur Islands beginning in 1978. Then, a rapid expansion of the fishery occurred in 1980 with landings reaching 7.8M lbs by 1986.
Prior to 1960, the majority of fish landed in Louisiana were from haul seines and hook-and-line, but starting in 1970, most of the increase in landings came from the use of gill and trammel nets. An additional increase in landings after 1985 was the result of an increase in the use of purse seines, which contributed an additional 3.4M lbs in landings in 1986. This increased pressure was directed at adults, whereas the entangling nets were mainly fished inshore and primarily targeted subadults and juveniles.

Prior to the 1980s, most of the RD landed in LA supplied local markets, especially in New Orleans. However, the popularity of blackened redfish peaked nationwide, especially in New York markets, and lead to increased demand, which increased harvest of adult RD throughout the 1980s. Given the increased demand from restaurants, commercial fishermen responded by catching RD in record numbers during 1986 and 1987. Landings fell dramatically in 1988 as a quota of 1.8M lbs was established late in 1987 and was reached by the end of February in 1988. In July of 1988, a commercial harvest moratorium was established for three years through legislation and that moratorium was extended indefinitely in 1991, although a few thousand pounds were still reported landed sporadically until 1998.

Recreational

Red Drum has always been one of the more popular fish with LA anglers. There are numerous mentions of people targeting them along the extensive marsh coastline since the mid-1800s and early 1900s (Daily Picayune 1892; Meise 1930). Norris (1865) mentioned RD in the GOM as a fish that will "…afford fine sport. They strike boldly, and run off thirty or forty feet of line at the first dash; as the mouth is fleshy, they are seldom lost when fairly hooked."

In 1984, LDWF conducted a recreational angler survey of nearly 13,000 individuals at various access points coast-wide (Adkins et al. 1990). Spotted Seatrout and RD were the preferred species of most anglers (63.8% and 49.3% respectively). Their results indicated that RD catches were lowest in the late spring and peaked in the fall (October - December). In an earlier survey in Barataria Bay (1975-1977) published by Guillory and Hutton (1990), Louisiana recreational anglers caught RD primarily with live bait (38.4%) and dead/cut bait singly (29.1 %) or in combination with artificial baits (18.2%).

Kelso et al. (1994) surveyed LA saltwater anglers and found similar results to Adkins et al. (1990) with the majority of respondents (56.1%) preferring Spotted Seatrout and 36.2% of respondents indicating a preference for RD. The results were reversed when asked about night fishing activities with the majority (53.1%) preferring RD over Spotted Seatrout. Flounder was the third most targeted species in either day or night fishing (Kelso et al. 1994). Recent LDWF unpublished LA Creel data (2017-2020) of statewide private inshore and shore based anglers indicates RD are the target of choice 37% of the time (Spotted Seatrout = 40% and no target = 18%) with a higher proportion of anglers targeting RD from the Vermilion Basin westward.

There were no regulations on the recreational harvest of RD in Louisiana prior to 1984 when a recreational bag limit was set at 50 RD and/or spotted seatrout per day in combination with no minimum size limit and only two fish ≥36 inches allowed. The first minimum size limits of RD were established in 1987. After their popularity increased with the blackened redfish craze in the mid-1980s, the Louisiana legislature approved gamefish status for RD in 1988.

The trends in recreational harvest since 1982 follow regulatory changes fairly well with a gradual reduction in harvest through 1987 under the first minimum size limits and new bag/possession limits, and the sharp decline in 1988 with the closing of all RD fishing from February through June and the new daily bag of 5 fish/angler that began in July 1988. Recreational harvest has increased steadily since RD attained gamefish status with exceptions during extraordinary years with active tropical storm seasons or following severe winters with major freeze events.

1.2 FISHERY REGULATIONS

The LA RD fishery is governed by the Louisiana State Legislature, the Wildlife and Fisheries Commission, and the LDWF. A review of LA commercial and recreational RD regulations are presented below.

Commercial

The RD fishery in Louisiana was mostly unregulated until the late 1970s. In 1977, monofilament webbing was banned in all saltwater nets (except those engaged in the underutilized species program while fishing pompano and black drum). In that same year, a maximum net length of 1,200 feet with a minimum mesh size of 2-inch bar for saltwater gillnets and a minimum 1-inch bar for the inside wall of saltwater trammel nets and fish seines was established. Additionally, netting was prohibited in parts of Lake Pontchartrain, parts of Lake Borgne, and within one mile of the Chandeleur Islands beginning in 1978. In 1980, a minimum bar size of 3-inches was established for the outer layer of saltwater trammel nets and further restrictions in 1983 mandated that all saltwater trammel nets consist of three layers. Size limits were first established for the commercial RD fishery in 1984 when a commercial slot limit of a minimum of 16-inches and a maximum of 36-inches total length was established. Also in 1984, further net restrictions were put in place that required a 1 ¾-inch bar for all saltwater gillnets and a 1 5/8-inch bar for the inside wall of saltwater trammel nets with a maximum mesh size of 12-inches bar for the outside of trammel nets. By 1986, the commercial slot limit maximum was reduced to 30-inches total length and all vessels carrying purse seines were banned from possessing Red Drum. In 1987, commercial net and size regulations were changed again by adjusting the commercial slot limit to a minimum of 18-inches and a maximum of 30-inches total length and minimum bar mesh sizes were changed to 1 ¾-inches for the inside wall of trammel nets and 1 ¾-inches for saltwater gillnets. A commercial quota of 1.8M lbs was also established in September of 1987. In February of 1988 the commercial RD fishery in Louisiana was closed after reaching the quota and a three-year moratorium was established on commercial harvest while the Louisiana legislature granted gamefish status to RD in the same year. In 1991 the commercial harvest moratorium on RD was extended indefinitely and remains in place to date with no commercial harvest of RD allowed in Louisiana.

Recreational

In 1984, recreational RD harvest regulations were implemented that established a recreational creel limit of 50 fish (combined RD and Spotted Seatrout) with no minimum size limit, but did include a maximum size limit of no more than two fish over 36-inches total length. In 1986, recreational size limits were adjusted to allow for no more than 2 fish over 30-inches total length. In 1987, a slot limit was enacted that established a minimum size of 14-inches total length and incorporated a maximum size of 30-inches total length, with no more than 2 fish over 30-inches allowed. Two changes in recreational size limits occurred in 1988, with a recreational minimum size limit of 15-inches total length implemented in January of that year with no change in creel or maximum size limits. In July of 1988, the recreational creel limit was changed to 5 fish per person and the slot limit was changed to a 16-inch total length minimum and a 27-inch total length maximum with no more than one fish over 27-inches allowed. In 1997, an allowance for two days possession of RD was made when on land or if a recreational saltwater angler is aboard a trawler engaged in commercial fishing for a consecutive period of longer than 25 hours. Further modifications to possession limits were made in 2018 that allowed for three times the daily possession limit if an angler launched from a publically accessible launch below Highway 90 and the angler has been actively on the water or at a remote camp only accessible by water for two days or more. In 2018, exceptions were also made for possession of Red Drum fillets. An angler, who launches from a access point south of Highway 90 and has been actively on the water or at a remote camp only accessible by water, can possess filleted RD, up to the possession limit of RD so long as there is sufficient skin remaining to identify the fillet to species and that the fillet is no less than 14-inches in length.

1.3 TRENDS IN HARVEST

Time-series of commercial RD landings (LA inshore and GOM offshore), and LA recreational RD landings and live releases (1982-2021) are presented (*Tables 1, 2, and 3*). See Section 2.2 for details of each data source.

Commercial

Time-series of commercial RD harvest in the Gulf of Mexico are presented in *Tables 1-2* and *Figure 1*. Red Drum are no longer allowed to be landed commercially in Louisiana. Through the 1950s and 1960s commercial landings of RD in Louisiana fluctuated between 400,000 to 500,000 lbs annually. By the late 1960s, Louisiana RD landings began to increase steadily to nearly 1M lbs by 1972 and 2.2M lbs by 1976. Some of the decline in landings in the late 1970s can be attributed to net restrictions established throughout the decade. A rapid expansion of the fishery then occurred in 1980 with landings reaching 7.8M lbs by 1986. Most of the increase in landings came from the use of gill and trammel nets. An additional increase in landings after 1985 were the result of an increased use of purse seines, which contributed an additional 3M lbs to the landings in 1986. Landings fell dramatically in 1988 as a quota of 1.8M lbs was established late in 1987 and was reached by the end of February 1988. In July of 1988, a commercial harvest moratorium was established for three years through legislation and that moratorium was extended indefinitely in 1991, although some RD were reported landed in a few years until 1998.

Recreational

Recreational landing estimates of RD in LA has varied considerably over the available time-series from a minimum of 0.44M fish harvested in 1988 to a peak of 2.0M fish harvested in 2010. After 1988, recreational RD landings generally increased up to 1.7 million fish harvested in 2000. Landings decreased between

2000 and 2005 to 0.93 million fish harvested in 2005. After 2005, recreational landings increased again to the peak of 2.0 million fish in 2010 before declining to 1.0 million fish landed in 2016. Landings increased again in 2017 and 2018 to 1.6 and 2.0 million fish respectively and then declined to 1.1 million fish harvested in 2020 and 0.74 million fish harvested in 2021.

Estimates of recreational live release are substantial when compared to the landings estimates. After implementation of recreational minimum size limits, more RD were released than harvested. In the most recent decade, live releases comprised 59% of the total recreational catch.

2. DATA SOURCES

2.1 FISHERY INDEPENDENT

LDWF Trammel Net Survey

The LDWF fishery-independent (FI) estuarine trammel net survey is used in this assessment to develop an index of relative abundance (1985-2021) and corresponding age compositions as inputs of the assessment model. Below is a brief descriptions of the 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 (Vermilion/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.

The trammel net survey is conducted with standardized design from October - March. Hydrological and climatological measurements are taken with each biological sample, including water temperature, turbidity, conductivity and salinity. Survey gear is a 750-foot long and 6-foot depth net, consisting of three walls constructed of nylon. The inner wall has 1 5/8-inch bar mesh wall, and the two outer walls have 6-inch bar mesh wall.

Samples are taken by 'striking' the net. All captured RD are enumerated and a maximum of 50 randomly selected RD are collected for length measurements, gender determination, and maturity information. When more than 50 RD are captured, catch-at-size is derived as the product of total catch and proportional subsample-at-size.

This survey was conducted from 1985 to October 2013 at fixed sampling stations within each CSA. In October 2010, additional fixed stations were added to allowing more spatial coverage within each CSA. Beginning in 2013, the survey design was modified where sampling locations are now selected randomly from the established stations within each CSA (*Figure 2*).

SEAMAP Inshore Bottom Long Line Survey

The SEAMAP nearshore bottom long line (BLL) survey complements the existing long-term survey conducted by NOAA Fisheries but focuses on the shallow nearshore depths of the northern GOM. Study objectives are to characterize shark and finfish distributions and abundance in the shallow nearshore depths. The LA component of the SEAMAP nearshore BLL survey conducted by LDWF is used in this assessment to develop an index of relative abundance of adult RD (2015-2021) and corresponding age compositions as inputs of the assessment model. Below is a brief description of the survey methodology. Complete details can be found in SEAMAP (2013).

The inshore BLL survey is conducted with standardized design using a 1 nautical mile longline with 100 equally spaced ganglions and hooks. A single bait type is used to reduce to minimize variability in catches associated with the bait used. Sample locations are chosen randomly (*Figure 3*) and the gear is fully deployed and allowed to soak for one-hour before retrieval at each location while environmental measurements are collected. The gear is typically set parallel to depth contours and catch data are collected as the long line is retrieved.

NOAA Fisheries Mark-Recapture Experiments

Estimates of absolute abundance of RD are available from experiments conducted in the northern GOM waters from Alabama to Texas in 1986-1987 (Nichols 1988) and a decade later (Mitchell and Henwood 1998). Below are brief descriptions of the two studies.

Both studies utilized purse seines to capture schooling Red Drum where a proportion of the catches were tagged and released. After several months at large, the offshore schools were resampled to determine the ratio of tagged to untagged fish in the population. Abundance estimates in the study area were then calculated using the Peterson method after accounting for tagging mortality, tag shedding, and the fraction of mortality that occurred between the initial sampling and resampling events. Because the studies did not cover the entire range of RD in offshore waters of the northern GOM, estimates were expanded to account for RD occurring outside of the study area. However, the study area did include all of Louisiana.

The estimate of adult RD from the first study (Nichols 1988) without expansion to outside the study area was 5.3 million fish

with a relative standard error (RSE) of 17% (*Table 4*). The latter study (Mitchell and Henwood 1998) unfortunately encountered poor weather conditions which impeded the resampling of the adult RD schools, and no recaptures were made in the western zone of the study (west of the Mississippi River). Estimates of abundance were reported for three scenarios in the western zone (0 recaptures, 1 recapture, and 2 recaptures) due to the poor sampling conditions and lack of recaptures (*Table 4*). The estimated abundances for the entire study area without expansion to outside the study area from each recapture scenario were 15.1, 7.8, and 5.4 million fish respectively (RSE= 68%).

Age Composition of Offshore Schools

The age composition of offshore RD schools have been sampled by researchers with NOAA Fisheries and the Louisiana State University (LSU) College of the Coast and Environment (CCE) as part of the Marine Fisheries Initiative Program (MARFIN). These studies randomly sampled offshore RD schools using methods similar to the earlier offshore fishery (i.e., spotter planes and commercial purse seine vessels). Some of these data were collected to characterize the age composition of offshore RD as part of the mark-recapture studies described above. The age frequency data available from these projects, converted from biological to calendar ages, are presented in *Table 5* (data courtesy of Dave Neiland, formerly with LSU CCE). The 1987 and 1997 age frequencies are used to represent the age composition of the NOAA Fisheries mark-recapture estimates in the assessment model.

2.2 FISHERY DEPENDENT

Commercial

Commercial RD landings are taken from NOAA Fisheries commercial statistical records as reported in the most recent federal Red Drum stock assessment (Porch 2000; *Table 1*). In the assessment model, inshore LA landings are used to represent the inshore commercial fishery operating in LA waters and the Gulf of Mexico (GOM) offshore landings are used to represent the offshore commercial fishery that operated across state boundaries. Estimates of commercial live releases are not available and are not considered further in this assessment.

Size compositions of LA inshore commercial harvest and GOM offshore commercial harvest are available from historical port sampling (Russell 1988; *Figure 4*). No age composition samples are available for the LA inshore commercial inshore fishery. The size composition information from the Russel samples collected from the inshore fishing gears (hook and line, trammel nets, and non-runaround gillnets) are pooled to develop a single size distribution to represent LA inshore commercial landings (*Table 5*). Ages are then assigned to the inshore commercial catches from a growth model (see *5. Catch at Age Estimation*). Age composition samples of landings of the offshore purse seine fishery are available for a limited number of years (Beckman 1989; *Table 5*). The size composition information from the Russel samples collected from the offshore fishing gears (purse seines, haul seines, and runaround gillnets) are pooled (*Table 5*) to represent GOM offshore commercial landings for purposes of mean weight calculations.

Recreational

Recreational RD landings and live release estimates (*Table 3*) are taken from the LDWF recreational creel survey (LA Creel; 2014-2021) and estimates hindcast to the historic MRIP time-series (1982-2013; details in *Appendix 1*). Consequently, the pre-2014 recreational estimates used in this assessment differ from the LA estimates currently published by MRIP (*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 *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 *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 prior LDWF RD stock assessments (LDWF 1997, Shepard 2005, Blanchet 2006). Live releases are further delineated as undersized/non-undersized with the LA Creel and MRIP catch disposition codes.

Annual seasonal size compositions of RD harvest estimates are derived from the LDWF Biological Sampling Program (2014-2021; *Table 6*) and MRIP (1982-2013, post APAIS and FES calibration changes; *Table 6*). Seasons represent January - April (season 1), May-August (season 2), and September - December (season 3). Size compositions from the LDWF Biological Sampling Program are derived by statistically weighting the size composition samples by the corresponding recreational landings estimates for each basin (CSA) and mode of fishing (Private and Charter). Size compositions of non-undersized live releases are assumed equivalent to harvest. Size composition of under-sized releases in each year and season are estimated by pooling the annual seasonal size frequency information available prior to implementation of the 16-inch MLL and using those distributions as a proxy of undersized catches beginning in 1988.

Ages of recreational Red Drum landings are derived from a growth model (1982-2001) and otoliths collected from the recreational fishery (2002-2021; see *5. Catch at Age Estimation*).

Bycatch

Menhaden Reduction Fishery

Time series of incidental catch of RD from the LA menhaden reduction fishery have been developed from observations of retained and released Red Drum CPUE (numbers per purse seine set) and annual effort estimates of the menhaden reduction fishery (LDWF 2020, see *Appendix 2*). The mean estimates of Red Drum bycatch in the most recent decade indicate low levels of RD bycatch relative to the landings of the directed LA fisheries (~2% in units of weight). The time series of mean RD bycatch estimates from the LA menhaden reduction fishery are included as a fleet in the base assessment model (see *6. Assessment Model*).

Shrimp Fishery

Bycatch has been characterized for the 2019-2020 inshore LA shrimp fishery (Cagle and West 2020; see *Appendix 3*). Incidental catches were only observed for five large Red Drum that were all released alive. The total LA inshore bycatch of Red Drum can be

estimated over the study period (July 2019 through June 2020) as the product of inshore LA effort over that period (number of trips = 37,203) and the RD CPUE estimate of the bycatch study (5 individuals/ 33 trips observed = 0.152) which equates to 5,637 fish. Due to the low level of RD bycatch in the LA shrimp fishery relative to the landings of the LA directed fisheries (<1% in units of fish in 2020), incidental RD catches of the LA inshore shrimp fishery are not considered further in this assessment.

Incidental RD catches also occur in the offshore GOM shrimp fishery. Estimates of offshore incidental RD catches presented in the most recent federal assessment (Porch 2000) indicates that gulf-wide offshore shrimp fishery RD bycatch was substantial when compared to the recent LA inshore bycatch estimates. The estimated bycatch of RD from the GOM offshore shrimp fishery was just over 200,000 fish in 1998 with estimates exceeding 300,000 fish in a few earlier years. The most recent bycatch study from the GOM offshore shrimp fishery (Scott-Denton et al. 2012) indicates RD as only a small fraction of the total catch (<0.25%). However, an up-to-date time series of estimates of incidental RD catches of the GOM offshore shrimp fishery is currently unavailable and are not considered further in this assessment (see *8. Research and Data Needs*).

3. LIFE HISTORY INFORMATION

3.1 UNIT STOCK DEFINITION

Red drum occur in estuaries and the nearshore and offshore habitat along the Atlantic and Gulf Coasts from the Gulf of Maine southward through the GOM into northern Mexico (GMFMC/GSMFC 1984).

Studies using mitochondrial DNA markers (Gold and Richardson 1991, Gold et al. 1994) found significant differences in the frequencies of haplotypes of GOM and Atlantic RD, implying that GOM and Atlantic RD populations are genetically distinct. A more recent study using microsatellites to assess population structure and gene flow of RD in the northern GOM (Gold and Turner 2002) found significant genetic divergence across the northern GOM, but concluded that the genetic differences to not delineate subpopulations or stocks with fixed geographical boundaries. Approximate estimates of geographic neighborhood size from this study indicate that northern GOM adult Red Drum may migrate from 700 to 900 kilometers away from their natal estuaries.

For purposes of this assessment, the unit stock is defined as those RD occurring in LA and adjacent federal waters.

3.2 MORPHOMETRICS

Parameter estimates from a weight-length regression fit to LDWF FI Red Drum datasets (see *Appendix 4*) are used in this assessment to calculate weight from size as:

$$W = 0.000248 \times (TL)^{3.1003} \quad [1]$$

where W is whole weight in pounds and TL is total length in inches.

Fish with only FL measurements available are converted to TL from the following relationship reported in Porch (2000):

$$TL = 1.092 \times FL - 1.01 \quad [2]$$

where fork length is in units of inches.

3.3 GROWTH

Parameter estimates from a damped growth model (Porch et al. 2002) fit to LDWF FI Red Drum datasets (see *Appendix 4*) are used in this assessment to calculate RD length at age. This model provides a better fit to LDWF length at age data than the traditional three-parameter von Bertalanffy model. Red drum total length-at-age is calculated with the damped growth model as:

$$TL_a = 38.0 \times (1 - e^{\beta_1 - 0.460(t+0.321)}) \quad [3]$$

$$\beta_1 = \frac{-0.196}{0.298}(e^{-0.298t} - e^{0.321 \times 0.298})$$

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

3.4 FECUNDITY / MATURITY / SEX RATIO

Red drum are group-synchronous batch spawners that spawn each fall from mid-August into October (Wilson and Neiland 1994). To realistically estimate annual fecundity, the number of eggs spawned per batch and the number of batches spawned per season must be known.

For purposes of this assessment, estimates of batch fecundity and spawning frequency are calculated from the relationships reported in the latest federal assessment report (Porch 2000). Batch fecundity (BF) and spawning frequency (SF) are calculated as functions of age from:

$$SF_a = (1.07 + 0.847 \times ln\ ln\ (a))^2 \quad [4]$$

$$BF_a = e^{(14.57 - \frac{19.5}{a^2})} \quad [5]$$

The maturity at age estimates reported in the latest federal assessment are also used for purposes of this assessment where the proportion of females estimated to be mature were 0, 0.05, 0.25, 0.62, 0.90, and 1.0 for ages 1-6 and older.

Wilson and Nieland (1994) reported sex ratios for mature RD sampled from offshore schools in the northern GOM were not significantly different from 1:1. Sex ratios observed in Red Drum catches of the SEAMAP nearshore BLL survey conducted by LDWF are also not significantly different from 1:1. For purposes of this assessment, the sex ratio is assumed to be 1:1 across ages.

The age-specific mean annual fecundity of a female fish is then estimated as the product of the batch fecundity, spawning frequency, maturity, and sex ratio at age estimates from above.

3.5 NATURAL MORTALITY

Red drum can live to at least 39 years of age (LDWF unpublished data). For purposes of this assessment, a value of average M is calculated based on the observed longevity of the species (max. age = 39 yrs, M =0.116; Hoenig 1983), but is allowed to vary with weight-at-age to calculate a declining natural mortality rate with age (*Table 7*). 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, n is the number of exploitable ages, and $L(a)$ is the Lorenzen curve as a function of age. 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.

3.6 DISCARD MORTALITY

Reported short-term discard mortality estimates of RD vary with fish size, bait/hook type, and anatomical hooking location (LDWF unpublished data, Vecchio and Wenner 2007). Discard mortality estimates from these studies range from 1% up to 10%. For purposes of this assessment, a constant rate of discard mortality across time and fish size/age is assumed (5%). For modeling purposes, stock losses due to discard mortalities are incorporated directly into the catch-at-age estimates (see *5. Catch at Age Estimation*).

3.7 RELATIVE PRODUCTIVITY AND 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.*, stock size and corresponding recruitment information not available at both high and low levels of stock size) and is typically fixed or constrained during the model fitting process. Recent stock assessments of Red Drum in the Atlantic and in Florida waters have considered steepness values ranging from 0.99 to 0.65 (SEDAR 2015; Chagaris *et al.* 2015).

Productivity is a function of growth rates, natural mortality, age of maturity, and longevity and can be a reasonable proxy for resilience. We characterize the relative productivity of GOM RD based on life-history characteristics, following SEDAR 9 (SEDAR 2006a), with a classification scheme developed at the FAO second technical consultation on the suitability of the CITES criteria for listing commercially-exploited aquatic species (FAO 2001; *Table 8*). 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 is averaged to compute an overall productivity score. In this case, the overall productivity score is 1.50 for GOM RD indicating medium to low productivity. The von Bertalanffy growth rate typically used in the above analysis is substituted with the mean growth rate across ages from the damped growth model evaluated at the midpoint of the calendar year and weighted by expected survivorship-at-age ($\bar{k}$ = 0.259).

4. ABUNDANCE INDEX DEVELOPMENT

Red drum indices of abundance (IOA) are developed from the LDWF FI estuarine trammel net survey and the LDWF component of the SEAMAP FI nearshore bottom long line survey.

Catch per unit effort (CPUE) for the trammel net survey is defined as the number of RD caught per trammel net sample. Trammel net samples collected during the months of January, February, and March are grouped with the previous year's October, November, and December samples for IOA development (e.g., October-March 1989-90 denoted as 1989). Catch per unit effort for the nearshore bottom long line survey is defined as the number of RD caught per 100 hook/hour. To reduce unexplained variability in catch rates unrelated to changes in abundance, each IOA was standardized using methods described below.

A delta lognormal approach (Lo *et al.* 1992; Ingram *et al.* 2010) is used to standardize RD 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 Red Drum catches assumed as lognormal distributions and p_y are estimated annual mean probabilities of Red Drum capture assumed as binomial distributions. The lognormal and binomial means and their standard errors are estimated with generalized linear models as least squares means and back transformed. The lognormal model considers only samples in which Red Drum are captured; the binomial model considers all samples. The IOA is then computed from equation [6] using the estimated least-squares means with variances calculated from:

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

where

$$\mathrm{Cov}(c,p) \approx \rho_{c,p}\left[SE(c_y)SE(p_y)\right] \text{ and } \rho_{c,p}$$

represents the correlation of c and p among years.

Variables considered in model inclusion for the trammel net survey were year, CSA, and sampling location. Variables considered in model inclusion for the nearshore BLL survey were year and NOAA Fisheries statistical grid. All variables were categorical in both models. Because only seasonal samples are included (*i.e.*, October - March for the trammel net survey and May - September for the nearshore BLL survey), 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 trammel net IOA 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. In the final nearshore BLL IOA submodels, year was considered a fixed effect and NOAA Fisheries statistical grids were considered random block effects.

Sample sizes, nominal proportion of positive samples, nominal CPUE of positive samples, standardized indices of abundance, and coefficients of variation of the standardized indices are presented (*Tables 9 and 10*).

5. CATCH AT AGE ESTIMATION

Red drum spawn across a narrow window from mid-August into October (Wilson and Neiland 1994) with Oct. 1 typically assumed as the biological birthdate. However, for purposes of this assessment, RD ages are assigned based on the calendar year by assigning a Jan. 1 birthday, where RD spawned the previous year become age-1 on Jan. 1 and remain age-1 until the beginning of the following year.

Seasonal age-length-keys (ALKs) are developed to estimate the annual age composition of recreational Red Drum landings, inshore commercial landings, and survey catches as described below. The age composition samples available from the offshore commercial fishery (1987-1988) and the nearshore BLL survey (2018-2020) are used to represent the annual age composition of the offshore landings and survey catches for those years with available age samples.

5.1 FISHERY

1982-2001: Seasonal s probabilities of age a given length l for recreational and inshore commercial RD landings are computed from:

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

where the seasonal probabilities of length given age are estimated from normal probability densities as:

$$P(l|a)_s = \frac{1}{\sigma_{sa}\sqrt{2\pi}} \int_{l-d}^{l+d} exp\left[-\frac{(l-l_{sa})^2}{2\sigma_{sa}^2}\right] dl \quad [11]$$

where length bins are 1-inch TL intervals with midpoint l, maximum $l + d$, and minimum $l - d$ lengths. Seasonal mean total length-at-age l_{sa} are estimated from Equation [3]. Seasons represent January - April (season 1), May-August (season 2), and September-December (season 3). The standard deviation of seasonal mean length-at-age is calculated from $\sigma_{sa} = l_{sa}CV_l$, where the coefficient of variation in length-at-age is assumed normally distributed and changes linearly with age from a CV of 0.203 for age-0 fish to a CV of 0.0754 for age-5 fish and a uniform CV of 0.0499 for fish age-6 and older (see *Appendix 4*). To approximate changes in growth and vulnerability to the fishery through the year, mean l_{sa} is calculated at the mid-point of each season of the calendar/model year. The resulting $P(a\backslash l)_s$ matrices (*Table 11*) are used to assign ages to recreational fishery RD landings from 1982-2001 and for instances discussed below where minimum sample size requirements are not met. The season 2 (May-August) ALK is used to assign ages to the LA inshore commercial RD landings.

2002-2021: Annual seasonal probabilities of age given length for recreational fishery landings are computed from:

$$P(a|l)_{sy} = \frac{n_{lasy}}{\sum_a n_{lasy}} \quad [12]$$

where n_{lasy} are annual seasonal recreational RD sample sizes occurring in each length/age bin. When row samples sizes

$$(\sum_a n_{lasy})$$

are <10, the $P(a\backslash l)$ for that total length interval is estimated with Equation [10]. Resulting $P(a\backslash l)_{sy}$ matrices are presented (*Table 12*).

Annual recreational catch-at-age from 1982-2021 is then calculated as:

$$C_{ay} = \sum_{ls} C_{lsy}\, P(a|l)_{sy} \quad [13]$$

where C_{lsy} are annual seasonal catches-at-size in TL, and $P(a\backslash l)_{sy}$ are taken from Equations [10 or 12]. Recreational discard mortalities are incorporated directly into the recreational catch-at-age by applying a 5% discard mortality rate to the estimated live releases-at-size and combining them with the harvest-at-size estimates.

For modeling purposes, catches ≥age-10 are summed into a plus group. Resulting annual recreational catch-at-age, commercial catch-at-age (as proportions at age), and corresponding mean weights-at-age are presented (*Tables 13-15*). Annual recreational mean weights-at-age are calculated from the annual recreational size/age composition information. Inshore and offshore commercial mean weights are calculated from the available commercial size/age composition information.

5.2 SURVEY

Probabilities of age given length for RD catches of the LDWF estuarine trammel net survey (1985-2021) and the LDWF component of the SEAMAP nearshore BLL survey (2015-2017 only) are computed from equation [10]. Mean total length-at-age is estimated from equation [3]. The standard deviation in length-at-age is calculated as described above for the fishery. To approximate trammel net survey timing (i.e., a Jan. 1 midpoint), mean total length-at-age is calculated at the beginning of the calendar year. To approximate the nearshore BLL survey timing, mean total length-at-age is calculated at the midpoint of the calendar/model year. The resulting $P(l\backslash a)$ matrix for RD catches of the estuarine trammel net survey is presented (*Table 18*). The resulting $P(l\backslash a)$ matrix for RD catches of the nearshore BLL survey is equivalent to the season 2 ALK in *Table 11*. Annual survey catch-at-age is also taken from Equation [13] with annual survey catch-at-size substituted (*Tables 16 and 17*). Resulting annual age compositions of RD catches of the LDWF marine trammel net survey and the LDWF component of the nearshore SEAMAP BLL survey are presented along with the age compositions for the years age samples were available (*Tables 19 and 20*). Also presented are the age compositions from the MARFIN age samples that are used to represent the NOAA Fisheries mark-recapture estimates of absolute abundance (*Table 21*).

6. ASSESSMENT MODEL

The Age-Structured Assessment Program (ASAP3 Version 3.0.17; NOAA Fisheries Toolbox) is used in this assessment to describe the dynamics of RD occurring in LA and adjacent federal waters. 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 (1982-2021) and a calendar year time-frame.

Mortality

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

$$F_{ayf} = v_{af} Fmult_{yf} \quad [14]$$

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-at-age are modeled with single (commercial offshore) and double logistic functions (inshore commercial and recreational) as:

$$v_{af} = \left(\frac{1}{1+e^{-(a-\alpha_f)/\beta_f}}\right) \quad [15a]$$

$$v_{af} = \left(\frac{1}{1+e^{-(a-\alpha_f)/\beta_f}}\right)\left(1-\frac{1}{1+e^{-(a-\alpha 2_f)/\beta 2_f}}\right) \quad [15b]$$

Total mortality for each age and year is estimated from the age-specific natural mortality rates M_a and estimated annual fishery-specific fishing mortalities as:

$$Z_{ay} = M_a + \sum_f F_{ayf} \quad [16]$$

For reporting purposes, annual age-specific fishing mortalities are averaged by weighting by estimated population numbers at age N_{ay} as:

$$F_y = \frac{\sum_a F_{ay} N_{ay}}{\sum_a N_{ay}} \quad [17]$$

Annual escapement rates of juvenile fish (biological ages 0-4) are calculated from the calendar age F rates as:

$$E_y = e^{-(F_{1y}+F_{2y}+F_{3y}+F_{4y}+0.75F_{5y})} \quad [18a]$$

Annual fishing mortality rates of adult fish (biological ages 5-10+) are calculated from the calendar age F rates as:

$$AF_y = 1 - e^{-(0.25F_{5y}+F_{6y}+F_{7y}+F_{8y}+F_{9y}+F_{10y})} \quad [18b]$$

Population 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:

$$N_{ay} = N_{a-1,y-1} e^{-Z_{a-1,y-1}} \quad [19]$$

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

$$N_{Ay} = N_{A-1,y-1} e^{-Z_{A-1,y-1}} + N_{A,y-1} e^{-Z_{A,y-1}} \quad [20]$$

Stock Recruitment

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

$$\hat{R}_{y+1} = \frac{\alpha SSF_y}{\beta + SSF_y} + e^{\delta_{y+1}} \quad [21]$$

$$\alpha = \frac{4\tau(SSF_0/SPR_0)}{5\tau-1} \text{ and } \beta = \frac{SSF_0(1-\tau)}{5\tau-1}$$

where SSF_0 is unexploited female spawning stock fecundity, SPR_0 is unexploited female spawning stock fecundity per recruit, τ is steepness, and $e^{\delta_{y+1}}$ are the annual lognormal recruitment deviations.

Spawning Stock Biomass

Female spawning stock fecundity in each year is calculated from:

$$SSF_y = \sum_{i=1}^{A} N_{ay} \Phi_{ay} e^{-Z_{ay}(0.75)} \quad [22]$$

where Φ_{ay} are annual mean per capita fecundity-at-age of mature females, and $e^{-Z_{ay}(0.75)}$ is the proportion of the population surviving prior to spawning on Oct. 1.

Expected Catch

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

$$\hat{C}_{ayf} = N_{ay} F_{ayf} \frac{(1-e^{-Z_{ay}})}{Z_{ay}} \quad [23]$$

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.

Survey Catch-Rates

Expected survey catch-rates are computed from:

$$\hat{I}_{ay} = q \sum_a N_{ay}(1 - e^{-Z_{ay}(0.0)}) v_a \quad [24]$$

where v_a are survey selectivities, q is the estimated catchability coefficient, and 1 - $e^{-Z_{ay}(0.0)}$ is the proportion of the total mortality occurring prior to the time of the trammel net survey (Jan. 1 midpoint). Survey timing for the nearshore BLL survey and NOAA Fisheries mark-recapture estimates was set to the middle of the year. Survey selectivities are modeled with a double logistic function (trammel net survey; Equation 15b) and single logistic functions (BLL survey and NOAA Fisheries mark-re-

$$\frac{\hat{I}_{ay}}{\sum_a \hat{I}_{ay}}$$

capture estimates; Equation 15a). Expected survey age composition is then calculated as

Parameter Estimation

The number of parameters estimated is dependent on the length of the time-series, number of fleets modeled, number of selectivity blocks modeled, and number of abundance indices modeled. Parameters are estimated in log-space and then back transformed. In this assessment, 235 parameters are estimated:

1. 22 selectivity parameters (1 block for the inshore commercial fishery, 1 block for the offshore commercial fishery that is also shared by the menhaden reduction bycatch fleet, 2 blocks for the recreational fishery, and 1 block for each survey)
2. 160 apical fishing mortality rates (F_{mult} in the initial year and 39 deviations in subsequent years for 4 fleets)
3. 40 recruitment deviations (1982-2021)
4. 9 initial population abundance deviations (age-2 through 10-plus)
5. 3 catchability coefficients (1 per survey, and 1 for the NOAA Fisheries mark-recapture estimates that is constrained to 1.0 to represent absolute abundance)
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:

$$-ln(L) = \sum_i \lambda_i(-ln\, L_i) + \sum_j(-ln\, L_j) \quad [25]$$

where $-ln(L)$ is the entire negative log-likelihood, lnL_i are log-likelihoods of lognormal estimations, λ_i are user-defined weights applied to lognormal estimations, and lnL_j are log-likelihoods of multinomial estimations.

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

$$-ln(L_i) = 0.5 \sum_i \frac{[ln(obs_i) - ln(pred_i)]^2}{\sigma^2} \quad [26]$$

where obs_i and $pred_i$ are observed and predicted values; standard deviations σ are user-defined CVs as

$$\sqrt{ln(CV^2 + 1)}$$

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

$$-ln(L_j) = -ESS \sum_{i=1}^{A} p_i\, ln(\hat{p}_i) \quad [27]$$

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 adequately specified,
5. abundance indices are proportional to absolute abundance, and
6. fecundity, growth and sex ratio-at-age do not vary significantly with time.

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

A base model was defined with an age-10 plus group, the steepness parameter fixed at 1.0, two commercial fishery selectivity blocks, two recreational selectivity blocks, a discard mortality rate of 5%, the 1997 absolute abundance estimate from the NOAA Fisheries mark-recapture experiments with a single tagged fish recaptured in the western study area, and input levels of error and weighting factors as described below.

For the commercial fleets, a single selectivity block is modeled per fishery (inshore and offshore). The offshore commercial selectivity block is also used to represent the selectivity of the menhaden reduction fishery bycatch (along with the available age composition and mean weight information). Within the recreational fleet, two selectivity blocks are modeled that correspond to the following time-periods of consistent regulation:

1. 1982-1987 (no recreational size regulations implemented) and
2. 1988-2021 (current recreational slot limit implemented).

Input levels of error for commercial fishery landings were specified with CV's of 0.20 for each year of the time-series. Input levels of error for recreational fishery landings estimates were specified with CV's of 0.05 for each year of the time-series under the assumption that recreational landings estimates are known with less error than the commercial landings. Input levels of error for survey catch-rates were specified with CV's estimated from each IOA standardization (*Tables 9 and 10*). Annual recruitment deviations were specified with CV's of 0.4 for all years of the time-series. The catchability coefficient of the NOAA Fisheries mark-recapture absolute abundance estimates was estimated, but constrained to be 1.0 in the assessment model with a CV of 0.0001. Ideally, the catchability coefficient of an absolute abundance estimate would be fixed at 1.0 (by setting its phase to a negative value) rather than constrained to be 1.0, but the current configuration of the ASAP graphical user interface does not allow each surveys catchability phase to be adjusted separately. All selectivity parameters are constrained to initial guesses with a CV of 1.0 to improve model stability. To allow reasonable (non-zero) estimates of stock numbers-at-age in the first year of the time series, the estimated deviations of initial stock numbers of age-2 through 10+ fish are also constrained with a CV of 1.0.

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 with the observed annual sample sizes for the years where annual ALKs and annual age composition samples were available, but are capped at ESS=200 to prevent overfitting. For years where annual ALKs or annual age composition samples were not available and ages were assigned from size, the effective sample sizes were down-weighted to ESS=50.

6.3 MODEL RESULTS

Objective function components, weighting factors, and likelihood values of the base model are summarized in *Table 22*.

Model Fit

The base model provides an overall reasonable fit to the data. Fits to the commercial landings, recreational landings, and menhaden reduction fishery bycatch match the observations well (*Figure 5*). Model estimated catch-rates of the LDWF component of the SEAMAP BLL survey provide reasonable fits to the data (*Figure 6*). Model estimated catch-rates of the trammel net survey also provide reasonable fits to the data given the relatively large CV's of the time series, but are generally overestimated in the initial years of the time series and underestimated in the more recent years (*Figure 6*). Model fit of the NOAA Fisheries mark-recapture absolute abundance estimates are also reasonable given the large input CV of the 1997 estimate (CV=0.682), but are underestimated by approximately 1 million fish (*Figure 6*). Model estimated fishery and survey age compositions provide adequate fits to the input age proportions (*Figures 7-12*) with noticeably better fits for the years annual recreational ALKs were available, with a few exceptions. The model overestimates the input trammel net age compositions of age-2 and age-3 fish beginning in 2018, which are some of the lowest observations of the time series examined. Model fits to the input trammel net age compositions in recent years consistently underestimate the age-10+ group.

Selectivities

Estimated fishery and survey selectivities are presented in *Figure 13*. Fishery estimates indicate full-vulnerability to the inshore commercial fishery at age-3 and to the offshore commercial fishery at age-4. Recreational selectivities for each regulation block indicates full vulnerability to the fishery at age-2. The estimated recreational selectively of age-1 fish was reduced by approximately 86% after the 1988 size regulations were implemented. Survey estimates indicate full vulnerability to the FI trammel net survey gear at age-2 and to the nearshore BLL survey at age-10+. Selectivity estimates of the NOAA Fisheries mark-recapture estimates also indicate full vulnerability to the sampling gear at age-10+.

Abundance, Recruitment and Spawning Stock

Total stock size and abundance-at-age estimates are presented in *Table 23*. Stock size has varied considerably over the time-series examined. Stock size decreased from 13.8 million fish estimated in 1982 to 10.1 million fish estimated in 1989. After 1989, stock abundance increased to a peak of 23.0 million fish in 1999. Since 1999, stock size has generally declined. In the most recent decade, stock size has decreased from the 18.3 million fish estimated in 2012 to the lowest stock size of the modeled time series estimated in 2021 (8.7 million fish).

Estimates of age-1 recruitment are presented in *Table 23 and Figure 14*. Recruitment generally declined from the initial years of the time series from 3.5 million age-1 fish estimated in 1982 to a low of 1.7 million age-1 fish estimated in 1989. Following 1989, recruitment increased to a peak of 7.6 million age-1 fish estimated in 1994. Since 1994, recruitment has generally declined. In the most recent decade, age-1 recruitment has decreased from the 4.5 million fish estimated in 2012 to some of the lowest recruitment estimates of the modeled time series estimated in 2019-2021 (1.4, 1.4, and 1.7 million fish respectively). The average recruitment (geometric mean) of the time-series is 3.8 million age-1 fish. The average recruitment of the most recent decade of the time-series is 2.5 million age-1 fish.

Female spawning stock fecundity (SSF) estimates are presented in *Figure 15*. Estimates decreased from over 60 trillion eggs in the first years of the time-series to a minimum of 36.6 trillion eggs estimated in 1991. After 1991, SSF increased to a peak of 78.6 trillion eggs estimated in 2004. Since 2004, SSF has decreased to 50.7 trillion eggs estimated in 2021.

Fishing Mortality

Estimated fishing mortality rates are presented in *Table 24* (total apical, average N-weighted, age-specific, juvenile escapement, and adult F rates) and *Figure 16* (average F rates) and *Figure 17* (escapement rates).

Average fishing mortality rates have varied over the time-series with a steep increase in the earlier years up to peaks of 0.29 and 0.28 estimated in 1986 and 1987. After 1987, average fishing mortality rates declined steeply after RD harvest in the EEZ was prohibited and then became relatively stable in the years after inshore entanglement nets regulations were enacted. In the most recent decade, average fishing mortality rates increased from 0.10 estimated in 2012 to another peak of 0.23 estimated in 2018. Since 2018, average fishing mortality estimates have declined. The 2021estimate of average F is 0.11.

Escapement rates of juvenile fish calculated from Equation [18a] (i.e., the proportion of juvenile fish that survive the inshore fishery to become adults) have also varied through time, where the lowest escapement rates occurred in 1986 and 1987 (8.6 and 9.9%) before increasing steeply in 1988 to 66.4%. Since 1988, escapement has generally declined. In the most recent decade, escapement estimates have declined overall from an estimate of 38.2% in 2012 to an estimate of 22.2% in 2021 with lows of 17.4 and 17.1% escapement estimated in 2018 and 2020.

Fishing mortality rates of adult fish calculated from Equation [18b] (i.e., the proportion of adult fish that die due to fishing) follow a trend similar to average F and escapement rates, where the highest adult F (46.8%) occurred in 1986 before declining to a relatively stable level between 5 and 8% after harvest in the EEZ was prohibited. Beginning in 2010, adult F rates increased above 10% which corresponds with the decline observed in stock size and female spawning stock fecundity in the most recent decade. The 2021 estimate of adult F is 14.7%.

Stock-Recruitment

No discernible relationship is observed between female SSF and subsequent age-1 recruitment estimates (*Figure 18*). The steepness parameter was fixed at 1.0 in the ASAP base model run. The estimated unexploited SSF and age-1 recruitment was 133 trillion eggs and 3.80 million age-1 fish. Alternate runs with steepness values fixed at 0.9, 0.8, and 0.7 are discussed in the *Model Diagnostics* Section below.

Parameter Uncertainty

In the ASAP base model, 235 parameters are estimated. Asymptotic standard errors of the recruitment, spawning stock fecundity, and fishing mortality (average F and escapement rates) time-series are presented (*Figures 14-17*).

6.4 MANAGEMENT BENCHMARKS

Overfishing and overfished limits should be defined for exploitable stocks. The implication is that when spawning 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.

Management thresholds have been established for GOM Red Drum in the Gulf of Mexico Fishery Management Council (GMFMC) Red Drum Fishery Management Plan (FMP). Amendment 2 of the FMP, implemented in 1988, designates a 20% spawning potential ratio (SPR) limit and requests the GOM States to enact rules to achieve that standard by providing 30% escapement of juvenile fish to offshore waters (GMFMC 1988). The state of Louisiana has endorsed that standard, as it was included in Act 889 of the 1988 Regular Legislative Session. A provision of Act 889, which was to become effective Sept. 1, 1991, authorized the Wildlife and Fisheries Commission to set a quota for commercial harvest of Red Drum, based on 30% escapement to offshore waters. This provision never became effective, since the section was repealed by Act 157 of the 1991 Regular Legislative Session. However, it does seem to have established legislative intent to endorse the conservation standard recommended by the GMFMC. The method for calculating equilibrium reference points that correspond to the 20% SPR_{limit} are presented below.

When the stock is in equilibrium, equation [22] can be solved, excluding the year index, for any given exploitation rate as:

$$\frac{SSF}{R}(F) = \sum_{i=1}^{A} N_a \Phi_a e^{-Z_a(0.75)} \quad [28]$$

where total mortality at age Z_a is computed as $M_a + v_a \times Fmult$; vulnerability at age v_a is taken by rescaling the current F-at-age estimate (geometric mean 2019-2021) 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 from the Baranov catch equation [23], excluding the year index. Yield per recruit (Y/R) is then taken as

$$\sum_a C_a \bar{W}_a \text{ where } \bar{W}_a$$

are current mean fishery weights at age (arithmetic mean 2019-2021). Fishing mortality is averaged by weighting by survivorship at age.

Equilibrium spawning stock fecundity SSF_{eq} is calculated by substituting SSF / R estimated from equation [28] into the Beverton-Holt stock recruitment relationship as $\alpha \times SSF / R - \beta$. Equilibrium recruitment R_{eq} and yield Y_{eq} are then taken as SSF_{eq} / (SSF/R) and $Y/R \times R_{eq}$. Equilibrium SPR (e.g. SPR_{limit}) is then computed as the ratio of SSF / R when F>0 to SSF / R when F=0. Equilibrium escapement rates are calculated from equation [18a] excluding the year index with equilibrium F-at-age calculated as $v_a \times Fmult$ where v_a is the current (2019-2021) vulnerability at age estimate. The equilibrium spawning stock fecundity, escapement rate, and average fishing morality rate that lead to the 20% SPR_{limit} (SSF_{limit}, E_{limit}, F_{limit}) are then calculated.

The established limits of fishing are presented in *Figure 19* relative to each time-series. Limit reference points are also presented in *Table 25*. Current estimates are taken as the geometric mean of the 2019-2021 estimates.

Also presented are a plot of the stock-recruitment data, equilibrium recruitment, and diagonals from the origin intersecting R_{eq} at the SSF_{limit}, and the minimum and maximum SSF estimates of the time-series, corresponding with a SPR_{limit} of 20%, and a minimum and maximum SPR of 27.4% and 58.7% (*Figure 20*).

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 0.9, 0.8, and 0.7 (Models 1-3).

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 4 and 5).

An additional sensitivity run was conducted where all input ESS were reduced by half (Model 6)

Another sensitivity run was conducted by increasing the discard mortality rate from 5% to 8% (Model 7).

An additional sensitivity run was conducted where the fishery ALK developed from the damped growth model was used to assign ages to the entire time-series of recreational fishery landings (Model 8).

Another sensitivity run was conducted that only included the LA offshore commercial landings rather than the GOM offshore commercial landings (Model 9).

An additional sensitivity run was conducted with spawning stock biomass estimated rather than spawning stock fecundity (Model 10).

Sensitivity runs were also conducted where the 1987 and 1997 NOAA Fisheries absolute abundance estimates are excluded from the assessment model (Model 11) and where only the 1997 NOAA Fisheries absolute abundance estimate is excluded (Model 12).

Final sensitivity runs were conducted where the base natural mortality rate was increased 20% (Model 13) and decreased 20% (Model 14).

Results of each sensitivity run relative to the limit reference points are presented in *Table 26*. Current estimates of female SSF, average F, and escapement rates are taken as the geometric mean of the 2019-2021 estimates. Estimates from all sensitivity runs with the exception of Model 11 indicate the stock is currently above the SSF_{limit}. Model 5 is the only run where the fishery is currently not overfishing in terms of escapement rates (>30%).

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 (Models 1-3; *Table 27*). Results of each run indicate that the fishery is currently overfishing in terms of escapement rates (<30%), where the inverse of ratios of current E to E_{MSY} are above 1. Spawning stock fecundity estimates from each run indicate the stock is currently above SSF_{MSY}.

Retrospective Analysis

A retrospective analysis was conducted by sequentially truncating the base model by a year (terminal years 2016-2021; *Figure 21*). Retrospective estimates of age-1 recruits and the average fishing mortality rate differ marginally from the base run where recruitment estimates generally tend to increase and fishing mortality rate estimates tend to decrease as years are added to the model. Retrospective estimates of spawning stock fecundity reveal a pattern where estimates in the initial year of the time series tend to decrease slightly as additional years are added to the model while estimates in the terminal year increase as additional years are added. The terminal retrospective pattern in female SSF can be explained by the addition of the LDWF component of the SEAMAP BLL survey that began in 2015. As more years of the BLL survey and corresponding age compositions (primarily age-10+ fish) are included in the modeled time series, the model estimates of age-10+ fish and female SSF increase as more information of the adult offshore population becomes available to the assessment model. When the BLL survey is not used as an input of the assessment model, the scale of the retrospective pattern in female SSF and age-10+ stock numbers is greatly reduced.

7. STOCK STATUS

The history of the LA Red Drum stock relative to E/E_{limit} and SSB/SSB_{limit} are presented in *Figure 22*. Escapement rate estimates below E_{limit} ($1/ (E/E_{limit}) >1.0$) are defined as overfishing; spawning stock fecundity estimates below SSB_{limit} ($SSB/SSB_{limit}< 1.0$) are defined as the overfished condition.

Overfishing Status

The current estimate of $1/ (E/E_{limit})$ is >1.0 (1.49), indicating the stock is currently undergoing overfishing. The current assessment model also indicates that overfishing occurred in earlier years of the time-series. The current escapement rate estimate is 20.1%.

Overfished Status

The current estimate of SSB/SSB_{limit} is >1.0 (2.00), indicating the stock is not currently overfished. The current SPR estimate is 40.1%.

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 LA stock assessments of Red Drum.

Continuing the SEAMAP nearshore bottom longline survey and corresponding age composition sampling are critical to estimating stock status since this survey supplies the only current estimates of adult RD abundance.

Updated estimates of offshore abundance with reasonable precision would provide more certainty in estimation of stock status in future assessments.

Only limited age data are available from the LDWF estuarine trammel net survey. Ages of survey catches in this assessment were assigned from size with a growth function. Continuing the age composition sampling from the survey would allow a more accurate representation of survey age composition in future assessments.

Development of a new fishery independent survey that better tracks Red Drum recruitment through time (full selection to survey gear at age-1) would provide better certainty in age-1 relative abundance estimates in future stock assessments.

Estimates of Red Drum batch fecundity, spawning frequency, and maturity used in this assessment were developed in 1996. Updated estimates of Red Drum batch fecundity, spawning frequency, and maturity at age/size are needed.

Investigations of the habitat utilization of younger adult Red Drum (5-10 yrs), which are presumed to have escaped the inshore fishery and migrated to the offshore adult stock in the EEZ, are needed to determine what proportion of Red Drum truly escape the inshore fishery, as well as the efficacy of the current juvenile escapement rate based management policy.

Incidental catches of RD from the offshore GOM shrimp fishery were not considered in this assessment. Some previously reported estimates of incidental RD catches in the offshore shrimp fishery indicated a relatively large bycatch when compared to estimates of RD incidental catches of the LA inshore shrimp fishery. Development of a current time series of offshore shrimp fishery RD bycatch would allow for a better understanding of the current magnitude of offshore shrimp fishery bycatch relative to the directed fisheries.

Factors that influence year-class strength of Red Drum are poorly understood. Investigation of these factors, including inter-annual variation in seasonal factors (seasonal salinities, winter severity, food availability, etc.) and the influence of environmental perturbations such as the 2010 *Deepwater Horizon* oil spill, could elucidate causes of inter-annual variation in abundance, as well as the species stock-recruitment relationship.

With the recent trend toward ecosystem-based assessment models (Mace 2000; NMFS 2001), more data is needed linking Red Drum 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 RD stock and its habitat.

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.

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10. TABLES

TABLE 1. Louisiana annual commercial inshore Red Drum landings and offshore Red Drum landings by state and for the Gulf of Mexico in units of pounds taken from NOAA Fisheries statistical records. Offshore landings post-1988 are assumed as miscoded inshore catches and not included in the GOM offshore landings values.

	Inshore_lbs	Offshore_lbs					
Year	LA	LA	TX	MS	AL	FL	GOM
1982	1,278,130	176,380	0	27,190	55,010	233,530	492,110
1983	1,761,350	177,270	0	10,000	342,320	198,860	728,450
1984	2,247,680	360,710	0	10,680	841,490	135,020	1,347,900
1985	2,229,310	704,280	0	16,270	2,841,650	215,610	3,777,810
1986	4,465,900	3,351,800	0	22,470	5,303,020	582,520	9,259,810
1987	4,528,900	42,280	0	27,510	11,520	53,220	134,530
1988	243,590	1,790	0	2,760	210	680	5,440
1989	24,810	0	0	1,340	890	0	0
1990	0	0	0	430	0	0	0
1991	0	0	0	890	10	0	0
1992	0	0	0	220	0	0	0
1993	1,880	0	0	20	0	0	0
1994	2,960	0	0	910	0	0	0
1995	0	0	0	0	0	0	0
1996	1,930	0	0	60	0	0	0
1997	0	0	0	1,030	0	0	0
1998	4,770	0	0	0	0	0	0
1999	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0

TABLE 2. Louisiana annual recreational and inshore commercial Red Drum landings along with the Gulf of Mexico offshore landings in units of pounds derived from NOAA Fisheries statistical records, LDWF Trip Ticket Program, MRIP, and LA Creel.

	Recreational	Inshore commercial	Offshore commercial	%Recreational	%Inshore commercial	%Offshore commercial
Year	LA	LA	GOM	LA	LA	GOM
1982	2,855,725	1,278,130	492,110	61.7%	27.6%	10.6%
1983	2,952,651	1,761,350	728,450	54.3%	32.4%	13.4%
1984	2,367,474	2,247,680	1,347,900	39.7%	37.7%	22.6%
1985	2,174,399	2,229,310	3,777,810	26.6%	27.2%	46.2%
1986	1,993,626	4,465,900	9,259,810	12.7%	28.4%	58.9%
1987	2,306,832	4,528,900	134,530	33.1%	65.0%	1.9%
1988	2,424,843	243,590	5,440	90.7%	9.1%	0.2%
1989	3,251,530	24,810	0	99.2%	0.8%	0.0%
1990	2,977,243	0	0	100.0%	0.0%	0.0%
1991	2,804,216	0	0	100.0%	0.0%	0.0%
1992	4,072,597	0	0	100.0%	0.0%	0.0%
1993	5,087,621	1,880	0	100.0%	0.0%	0.0%
1994	4,610,560	2,960	0	99.9%	0.1%	0.0%
1995	7,502,450	0	0	100.0%	0.0%	0.0%
1996	7,157,264	1,930	0	100.0%	0.0%	0.0%
1997	7,128,952	0	0	100.0%	0.0%	0.0%
1998	5,442,578	4,770	0	99.9%	0.1%	0.0%
1999	6,642,380	0	0	100.0%	0.0%	0.0%
2000	8,288,060	0	0	100.0%	0.0%	0.0%
2001	7,417,608	0	0	100.0%	0.0%	0.0%
2002	7,196,064	0	0	100.0%	0.0%	0.0%
2003	6,592,330	0	0	100.0%	0.0%	0.0%
2004	5,778,575	0	0	100.0%	0.0%	0.0%
2005	4,733,062	0	0	100.0%	0.0%	0.0%
2006	5,098,331	0	0	100.0%	0.0%	0.0%
2007	6,061,853	0	0	100.0%	0.0%	0.0%
2008	6,672,823	0	0	100.0%	0.0%	0.0%
2009	7,355,418	0	0	100.0%	0.0%	0.0%
2010	8,346,255	0	0	100.0%	0.0%	0.0%
2011	8,304,959	0	0	100.0%	0.0%	0.0%
2012	6,044,853	0	0	100.0%	0.0%	0.0%
2013	7,928,973	0	0	100.0%	0.0%	0.0%
2014	6,623,057	0	0	100.0%	0.0%	0.0%
2015	5,866,044	0	0	100.0%	0.0%	0.0%
2016	4,872,001	0	0	100.0%	0.0%	0.0%
2017	6,552,359	0	0	100.0%	0.0%	0.0%
2018	8,286,649	0	0	100.0%	0.0%	0.0%
2019	5,276,636	0	0	100.0%	0.0%	0.0%
2020	4,768,147	0	0	100.0%	0.0%	0.0%
2021	3,538,227	0	0	100.0%	0.0%	0.0%

TABLE 3. Louisiana annual recreational Red Drum harvest and live release (discards) estimates as numbers of fish derived from MRIP and LA Creel.

	Recreational			
Year	Harvest	Discards	%Harvest	%Discards
1982	1,227,523	146,809	89.3%	10.7%
1983	1,724,488	278,284	86.1%	13.9%
1984	1,083,042	121,176	89.9%	10.1%
1985	921,499	97,125	90.5%	9.5%
1986	895,241	166,739	84.3%	15.7%
1987	1,012,788	795,733	56.0%	44.0%
1988	436,543	1,038,796	29.6%	70.4%
1989	768,754	1,154,280	40.0%	60.0%
1990	553,138	634,266	46.6%	53.4%
1991	657,584	2,660,087	19.8%	80.2%
1992	1,036,207	2,043,424	33.6%	66.4%
1993	1,053,450	1,597,268	39.7%	60.3%
1994	954,950	1,534,416	38.4%	61.6%
1995	1,577,999	1,630,496	49.2%	50.8%
1996	1,371,690	1,269,247	51.9%	48.1%
1997	1,219,791	1,888,189	39.2%	60.8%
1998	1,151,118	2,157,019	34.8%	65.2%
1999	1,464,900	2,090,305	41.2%	58.8%
2000	1,708,900	2,307,833	42.5%	57.5%
2001	1,784,616	2,203,119	44.8%	55.2%
2002	1,389,950	2,285,344	37.8%	62.2%
2003	1,237,995	1,915,836	39.3%	60.7%
2004	1,092,037	1,407,440	43.7%	56.3%
2005	929,005	1,369,888	40.4%	59.6%
2006	996,732	1,741,012	36.4%	63.6%
2007	1,298,861	1,820,225	41.6%	58.4%
2008	1,448,257	2,036,602	41.6%	58.4%
2009	1,572,292	2,507,394	38.5%	61.5%
2010	2,008,538	2,848,129	41.4%	58.6%
2011	1,911,866	1,878,382	50.4%	49.6%
2012	1,430,510	2,021,773	41.4%	58.6%
2013	1,876,299	2,586,608	42.0%	58.0%
2014	1,282,923	2,337,498	35.4%	64.6%
2015	1,244,926	2,267,997	35.4%	64.6%
2016	1,045,128	1,711,377	37.9%	62.1%
2017	1,642,516	2,495,551	39.7%	60.3%
2018	1,977,147	2,741,797	41.9%	58.1%
2019	1,224,198	1,736,637	41.3%	58.7%
2020	1,053,003	1,472,163	41.7%	58.3%
2021	736,739	736,769	50.0%	50.0%

TABLE 4. Abundance estimates of the NMFS Red Drum mark-recapture experiments (without estimate expansion to outside the study areas).

	N estimates					
Year	west	east	total	SE	RSE	notes
1987	--	--	5,274,405	900,000	0.171	
1997	14,606,407	526,176	15,132,583	10,326,004	0.682	0 recapture west
1997	7,303,203	526,176	7,829,379	5,342,525	0.682	1 recapture west
1997	4,868,802	526,176	5,394,978	3,681,365	0.682	2 recapture west

TABLE 5. Size frequency of inshore and offshore commercial landings (Russell 1988), age compositions of offshore commercial purse seine landings (Beckman 1989), and the age composition of offshore fishery-independent purse seine samples of Red Drum schools conducted by NOAA Fisheries and the LSU Coastal Fisheries Institute (MARFIN). Biological ages have been adjusted to calendar ages.

Beckman

Years	n	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+
85-86	78 8	0.000	0.012	0.049	0.058	0.039	0.048	0.055	0.051	0.027	0.662
86-87	54 0	0.000	0.010	0.038	0.041	0.053	0.045	0.033	0.049	0.057	0.674

MARFIN

Year	n	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+
1986	17 4	0.000	0.017	0.046	0.052	0.029	0.023	0.029	0.052	0.017	0.736
1987	56 2	0.000	0.000	0.043	0.036	0.055	0.053	0.032	0.041	0.064	0.676
1988	61 4	0.000	0.000	0.036	0.042	0.065	0.052	0.046	0.062	0.054	0.643
1997	55 6	0.000	0.002	0.004	0.043	0.070	0.113	0.160	0.018	0.020	0.570
1998	37 1	0.000	0.000	0.003	0.024	0.159	0.084	0.137	0.162	0.027	0.404

Russell (gears combined) 1985-1987

TL_in	inshore	offshore
10	0.000	0.000
11	0.001	0.000
12	0.001	0.000
13	0.001	0.000
14	0.000	0.000
15	0.001	0.000
16	0.029	0.000
17	0.054	0.000
18	0.074	0.000
19	0.157	0.000
20	0.173	0.000
21	0.103	0.000
22	0.045	0.001
23	0.105	0.000
24	0.050	0.000
25	0.103	0.000
26	0.039	0.000
27	0.026	0.002
28	0.028	0.001
29	0.003	0.003
30	0.004	0.010
31	0.000	0.017
32	0.000	0.026
33	0.000	0.058
34	0.000	0.095
35	0.000	0.138
36	0.000	0.177
37	0.003	0.199
38	0.000	0.101
39	0.000	0.086
40	0.000	0.048
41	0.000	0.027
42	0.000	0.008
43	0.000	0.002
44	0.000	0.003
45	0.000	0.001

TABLE 6. Annual seasonal size frequencies of Louisiana recreational Red Drum harvest taken from MRIP (1982-2013) and the LDWF Biological Sampling Program. Seasons represent January-April (season1), May-August (season 2), and September-December (season 3).

season	TL IN	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
1	5																				
1	6												0.007								
1	7			0.005																	
1	8		0.033	0.029		0.019							0.024								
1	9	0.019		0.034	0.004									0.003		0.006					
1	10		0.010	0.097	0.009							0.002	0.024				0.001				
1	11		0.106	0.230								0.010	0.021			0.007	0.008				
1	12	0.008	0.178	0.068	0.019	0.005	0.039	0.015				0.008	0.007		0.006	0.011	0.006				
1	13	0.073	0.153	0.122	0.007	0.064	0.082	0.161				0.036	0.006		0.014	0.006	0.015	0.010		0.003	
1	14	0.128	0.015	0.150	0.083	0.067	0.103	0.426	0.015	0.023		0.044		0.012	0.019	0.004	0.007	0.045	0.008	0.003	0.006
1	15	0.059	0.065	0.129	0.061	0.099	0.114	0.118	0.123	0.009		0.149	0.012	0.086	0.016	0.013	0.013	0.115	0.015	0.025	0.022
1	16		0.028	0.035	0.173	0.116	0.230	0.037	0.121	0.032	0.016	0.249	0.069	0.049	0.059	0.072	0.048	0.203	0.103	0.084	0.089
1	17	0.078	0.111	0.060	0.207	0.213	0.130	0.044	0.225	0.090	0.169	0.179	0.090	0.060	0.079	0.085	0.073	0.140	0.138	0.126	0.081
1	18	0.044	0.141	0.003	0.229	0.243	0.050	0.040	0.121	0.088	0.113	0.072	0.130	0.059	0.039	0.060	0.076	0.044	0.075	0.053	0.075
1	19	0.107		0.003	0.024	0.014	0.055	0.059	0.164	0.030	0.066	0.007	0.040	0.127	0.060	0.083	0.082	0.016	0.085	0.057	0.080
1	20	0.055		0.004	0.047	0.042	0.023	0.042	0.055	0.229	0.060	0.010	0.127	0.127	0.133	0.140	0.079	0.053	0.112	0.045	0.099
1	21	0.128	0.051		0.004	0.002	0.006	0.030	0.046	0.128	0.039	0.013	0.113	0.118	0.115	0.101	0.056	0.035	0.096	0.078	0.106
1	22	0.111				0.002		0.010	0.005	0.131	0.057	0.016	0.088	0.075	0.090	0.076	0.066	0.046	0.079	0.115	0.101
1	23	0.003			0.008	0.003	0.082		0.027	0.050	0.103	0.020	0.072	0.101	0.069	0.091	0.108	0.034	0.085	0.103	0.117
1	24			0.013	0.009	0.027	0.026		0.028	0.041	0.083	0.014	0.027	0.045	0.025	0.060	0.054	0.061	0.050	0.044	0.080
1	25	0.126			0.004		0.002		0.026	0.017	0.116	0.019	0.023	0.081	0.089	0.044	0.088	0.064	0.032	0.053	0.041
1	26	0.059	0.064		0.060	0.060	0.010		0.003	0.026	0.068	0.054	0.024	0.029	0.081	0.040	0.075	0.046	0.045	0.082	0.034
1	27		0.029		0.008	0.012	0.042		0.029		0.052	0.046	0.022	0.019	0.033	0.043	0.025	0.032	0.012	0.028	0.022
1	28				0.002	0.003	0.001				0.022	0.013	0.020	0.001	0.023	0.020	0.023	0.017	0.018	0.036	0.012
1	29		0.015	0.009	0.012	0.007	0.003				0.033	0.009	0.019	0.002	0.002	0.018	0.025	0.009	0.011	0.031	0.020
1	30				0.004		0.000		0.000	0.007		0.004	0.008	0.002	0.003	0.010	0.020	0.001	0.007	0.005	0.003
1	31						0.001		0.012	0.014		0.003	0.010	0.001	0.019	0.003	0.011	0.010	0.001	0.000	0.006
1	32			0.009						0.000		0.002	0.002		0.002	0.002		0.006	0.004	0.005	
1	33									0.000						0.003	0.001		0.002	0.000	0.003
1	34									0.000		0.000		0.003	0.003	0.000		0.001	0.000		
1	35				0.009					0.000		0.003	0.000				0.000		0.002		
1	36					0.000				0.000		0.003					0.006	0.001	0.001		0.002
1	37				0.009	0.002				0.004		0.003	0.000	0.001		0.000	0.005	0.001	0.004		
1	38									0.040		0.004			0.013	0.000	0.004	0.001	0.004	0.002	
1	39				0.011						0.003	0.000			0.000	0.000	0.006	0.002	0.009		
1	40								0.000	0.040		0.004	0.001		0.000	0.001	0.007	0.001	0.001	0.002	0.002
1	41		0.000									0.002				0.001	0.009	0.002		0.004	
1	42							0.019				0.000						0.001		0.004	
1	43									0.000		0.000			0.003			0.001	0.000	0.007	
1	44																	0.001		0.003	
1	45																		0.002	0.002	
1	46												0.012		0.004						
1	47																				

season	TL IN	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
1	5																				
1	6																				
1	7																				
1	8																				
1	9																				
1	10																				
1	11																		0.001		
1	12										0.002			0.002							
1	13	0.002						0.002				0.001	0.003	0.002	0.005		0.003	0.003			
1	14			0.002			0.007	0.006	0.005	0.012	0.002	0.002	0.002	0.002		0.000	0.001	0.003		0.004	
1	15	0.003	0.027	0.042	0.065	0.057	0.040	0.021	0.084	0.015	0.046	0.026	0.020	0.014	0.035	0.034	0.059	0.046	0.037	0.038	0.050
1	16	0.028	0.106	0.091	0.119	0.195	0.105	0.097	0.117	0.080	0.111	0.092	0.105	0.046	0.105	0.107	0.186	0.103	0.077	0.096	0.135
1	17	0.060	0.056	0.047	0.076	0.132	0.075	0.088	0.135	0.055	0.060	0.083	0.091	0.083	0.068	0.092	0.161	0.059	0.101	0.105	0.103
1	18	0.096	0.023	0.028	0.012	0.078	0.061	0.090	0.066	0.080	0.037	0.098	0.095	0.084	0.038	0.053	0.083	0.065	0.089	0.052	0.078
1	19	0.132	0.060	0.056	0.069	0.060	0.108	0.083	0.035	0.071	0.053	0.060	0.069	0.119	0.034	0.079	0.035	0.054	0.100	0.034	0.060
1	20	0.129	0.055	0.086	0.049	0.024	0.070	0.135	0.073	0.081	0.120	0.099	0.048	0.131	0.076	0.107	0.032	0.109	0.115	0.092	0.051
1	21	0.070	0.103	0.116	0.044	0.034	0.076	0.055	0.099	0.077	0.125	0.094	0.074	0.121	0.115	0.095	0.060	0.104	0.094	0.060	0.067
1	22	0.060	0.062	0.051	0.101	0.062	0.066	0.105	0.117	0.127	0.077	0.068	0.046	0.071	0.085	0.076	0.053	0.086	0.113	0.066	0.069
1	23	0.054	0.057	0.062	0.075	0.094	0.056	0.076	0.061	0.124	0.088	0.079	0.067	0.066	0.067	0.048	0.071	0.069	0.084	0.054	0.068
1	24	0.049	0.087	0.088	0.054	0.042	0.136	0.046	0.049	0.066	0.083	0.036	0.055	0.045	0.059	0.048	0.069	0.062	0.042	0.081	0.064
1	25	0.083	0.137	0.039	0.044	0.067	0.050	0.062	0.049	0.049	0.051	0.026	0.083	0.043	0.081	0.046	0.041	0.068	0.043	0.056	0.042
1	26	0.047	0.053	0.065	0.041	0.021	0.050	0.030	0.018	0.058	0.059	0.045	0.037	0.029	0.055	0.041	0.019	0.038	0.017	0.088	0.021
1	27	0.018	0.024	0.014	0.044	0.018	0.020	0.026	0.020	0.051	0.025	0.033	0.071	0.033	0.044	0.038	0.031	0.023	0.022	0.054	0.044
1	28	0.021	0.046	0.035	0.027	0.033	0.038	0.019	0.046	0.020	0.017	0.035	0.038	0.023	0.035	0.030	0.027	0.032	0.017	0.032	0.043
1	29	0.013	0.028	0.009	0.032	0.032	0.007	0.016	0.006	0.013	0.009	0.088	0.008	0.018	0.030	0.039	0.023	0.045	0.014	0.030	0.025
1	30	0.035	0.018	0.006	0.002	0.010	0.008	0.004	0.003	0.006	0.007	0.015	0.027	0.014	0.016	0.024	0.009	0.006	0.009	0.020	0.024
1	31	0.001	0.025	0.003	0.022	0.000	0.014	0.010	0.001	0.006	0.000	0.004	0.018	0.010	0.011	0.006	0.012	0.013	0.007	0.014	0.018
1	32	0.007		0.005	0.007	0.010		0.007	0.003	0.000	0.010	0.003	0.002	0.008	0.017	0.004	0.011	0.001	0.006	0.008	0.010
1	33		0.004	0.003	0.001	0.003	0.005		0.001	0.003	0.009	0.000	0.002	0.002	0.001	0.009		0.003	0.003	0.008	0.001
1	34	0.001	0.004	0.000	0.013	0.008		0.002	0.001				0.007	0.001	0.005			0.001	0.000		0.001
1	35	0.003	0.000	0.010	0.000	0.002	0.005	0.001	0.001	0.001		0.003	0.004	0.005	0.000	0.003	0.003	0.002	0.003		0.004
1	36	0.003	0.005	0.008	0.009	0.002	0.003	0.003	0.005	0.001				0.005	0.004	0.007	0.000	0.001	0.003		0.001
1	37	0.000	0.007	0.019	0.022	0.006		0.005	0.001	0.001		0.008	0.003	0.000	0.000	0.003			0.000		0.003
1	38	0.001	0.003	0.048	0.013	0.002	0.000	0.001	0.001	0.000	0.000	0.002	0.014	0.003	0.003	0.009	0.002	0.002	0.003	0.004	0.002
1	39	0.001	0.005	0.032	0.009	0.003	0.000	0.001	0.001	0.001		0.002	0.002	0.004	0.003		0.003		0.000	0.005	0.007
1	40	0.047	0.003	0.011	0.028	0.000		0.004	0.001	0.001			0.008	0.006	0.001		0.004	0.000	0.001		0.005
1	41	0.035	0.000	0.009	0.019	0.001	0.001	0.004			0.009	0.001	0.002	0.001	0.001	0.000		0.001	0.000		0.002
1	42	0.001	0.001		0.001	0.001			0.000					0.002	0.001		0.003	0.000			0.002
1	43		0.001						0.000					0.005	0.003						0.001
1	44			0.015										0.001			0.000				
1	45							0.001						0.000					0.000		
1	46																				
1	47																				

TABLE 6. (continued)

season	TL IN	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
2	4				0.002																
2	5	0.010			0.002		0.012														
2	6																				
2	7	0.055		0.009		0.002	0.006	0.014					0.002								
2	8	0.084	0.040		0.011	0.017	0.044						0.011								
2	9	0.134	0.039	0.056	0.091	0.036	0.152	0.008				0.003	0.004								
2	10	0.147	0.043	0.021	0.072	0.181	0.088	0.023				0.001	0.002	0.002	0.001	0.000	0.001				
2	11	0.180	0.128	0.061	0.184	0.168	0.220	0.003		0.006	0.004	0.005		0.002	0.004		0.006		0.010		
2	12	0.070	0.116	0.274	0.106	0.162	0.034	0.028				0.006		0.002	0.007	0.001	0.009				
2	13	0.033	0.066	0.063	0.127	0.063	0.010	0.037	0.003		0.013	0.005		0.008	0.013	0.001		0.000	0.003	0.005	0.004
2	14	0.028	0.097	0.032	0.019	0.067	0.070	0.036	0.008	0.019	0.006	0.009	0.004	0.005	0.006	0.025	0.001	0.009	0.006		0.002
2	15	0.029	0.115	0.027	0.003	0.028	0.114	0.102	0.051	0.019		0.026	0.049	0.020	0.061	0.023	0.037	0.032	0.026	0.004	0.017
2	16	0.014	0.070	0.038	0.045	0.027	0.046	0.048	0.121	0.012		0.215	0.132	0.090	0.189	0.050	0.123	0.131	0.095	0.050	0.090
2	17	0.021	0.067	0.057	0.083	0.055	0.022	0.130	0.158	0.034		0.220	0.187	0.119	0.176	0.060	0.140	0.208	0.175	0.176	0.180
2	18	0.033	0.081	0.147	0.060	0.043	0.065	0.133	0.186	0.071	0.109	0.165	0.111	0.119	0.123	0.074	0.074	0.145	0.133	0.149	0.130
2	19	0.062	0.055	0.080	0.022	0.032	0.012	0.195	0.115	0.076	0.062	0.099	0.057	0.064	0.048	0.092	0.059	0.111	0.088	0.095	0.073
2	20	0.025	0.060	0.060	0.043	0.045	0.030	0.077	0.089	0.119	0.065	0.101	0.079	0.090	0.049	0.114	0.041	0.059	0.107	0.080	0.081
2	21	0.033		0.015	0.024	0.018	0.026	0.079	0.038	0.142	0.324	0.038	0.046	0.085	0.035	0.060	0.072	0.035	0.069	0.065	0.054
2	22	0.025			0.046	0.024	0.009	0.022	0.030	0.068	0.138	0.013	0.054	0.075	0.039	0.081	0.059	0.030	0.059	0.034	0.061
2	23	0.005	0.004	0.027		0.009	0.019	0.038	0.023	0.174	0.073	0.007	0.069	0.087	0.071	0.076	0.032	0.016	0.045	0.048	0.059
2	24	0.002		0.018	0.013	0.002	0.008	0.010	0.024	0.017	0.028	0.018	0.086	0.070	0.026	0.090	0.083	0.033	0.030	0.052	0.046
2	25	0.001	0.000	0.007	0.009	0.003		0.004	0.028	0.138	0.036	0.015	0.049	0.042	0.057	0.065	0.058	0.063	0.036	0.064	0.045
2	26		0.008	0.000	0.001	0.001	0.004		0.018	0.026	0.044	0.016	0.025	0.047	0.023	0.084	0.045	0.017	0.038	0.049	0.038
2	27		0.007			0.003	0.003	0.006	0.021	0.036	0.022	0.007	0.009	0.026	0.021	0.026	0.040	0.016	0.015	0.042	0.015
2	28	0.002		0.000	0.013	0.004	0.005		0.004	0.002	0.051	0.007	0.003	0.013	0.019	0.019	0.030	0.023	0.019	0.015	0.018
2	29	0.008	0.004	0.000	0.009	0.000			0.019	0.015	0.021	0.016	0.006	0.006	0.011	0.006	0.030	0.008	0.015	0.013	0.011
2	30			0.000	0.008	0.000	0.002	0.002	0.009			0.001		0.002	0.004	0.011	0.006	0.004	0.005	0.022	0.039
2	31					0.001		0.003	0.013	0.001		0.001			0.002		0.009	0.001	0.008	0.006	0.002
2	32	0.002			0.004	0.006			0.005	0.001							0.005	0.002	0.001	0.004	0.002
2	33				0.004				0.007						0.002		0.004		0.000	0.004	
2	34							0.000					0.002	0.003		0.003	0.002	0.001	0.001	0.003	0.001
2	35								0.002	0.000			0.002		0.001	0.005	0.001	0.007	0.001	0.001	0.009
2	36								0.016			0.001	0.002	0.002	0.002	0.001	0.004	0.004	0.002	0.000	0.000
2	37			0.000				0.000	0.001	0.006		0.002			0.001	0.003	0.006	0.014	0.000	0.006	0.000
2	38			0.000						0.012	0.005	0.002	0.000	0.003	0.002	0.002	0.002	0.009	0.002	0.001	0.010
2	39								0.001			0.001	0.006	0.002	0.003	0.002	0.004	0.004	0.003	0.001	0.001
2	40			0.002					0.006	0.006		0.000	0.001	0.004	0.001	0.007		0.005	0.004	0.001	0.007
2	41			0.002				0.000	0.003			0.001	0.000	0.003	0.001	0.007	0.006	0.004	0.002	0.003	0.004
2	42							0.002				0.001		0.003		0.009	0.010	0.003	0.001	0.005	
2	43					0.003				0.000			0.000		0.000		0.001	0.007	0.000	0.004	
2	44													0.003		0.001	0.001				
2	45																0.002		0.003		
2	46											0.000						0.000	0.000	0.001	0.003
2	47																				

season	TL IN	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
2	4																				
2	5																				
2	6																				
2	7																				
2	8																				
2	9							0.002		0.000		0.000									
2	10																				
2	11				0.001			0.000									0.001	0.001			
2	12						0.001						0.001				0.001		0.000		
2	13	0.000			0.000					0.001		0.003	0.001		0.001	0.002	0.001	0.001	0.006		0.000
2	14	0.000		0.005	0.002		0.000	0.001	0.003	0.002	0.005	0.001	0.001	0.003	0.002		0.004	0.003	0.006		
2	15	0.033	0.031	0.031	0.021	0.004	0.025	0.027	0.015	0.026	0.021	0.016	0.052	0.020	0.053	0.033	0.030	0.039	0.050	0.071	0.019
2	16	0.149	0.111	0.160	0.096	0.047	0.150	0.121	0.068	0.180	0.109	0.073	0.166	0.119	0.179	0.145	0.147	0.204	0.141	0.136	0.095
2	17	0.118	0.217	0.121	0.237	0.123	0.179	0.134	0.106	0.206	0.111	0.200	0.210	0.144	0.147	0.138	0.173	0.184	0.152	0.177	0.144
2	18	0.101	0.122	0.117	0.123	0.153	0.104	0.104	0.105	0.121	0.131	0.118	0.128	0.098	0.086	0.091	0.148	0.130	0.096	0.144	0.165
2	19	0.092	0.051	0.114	0.078	0.154	0.071	0.072	0.072	0.072	0.103	0.118	0.078	0.069	0.054	0.064	0.116	0.083	0.066	0.104	0.122
2	20	0.072	0.064	0.050	0.042	0.122	0.047	0.066	0.091	0.036	0.085	0.083	0.039	0.071	0.047	0.110	0.082	0.046	0.063	0.070	0.084
2	21	0.078	0.055	0.053	0.049	0.069	0.049	0.062	0.064	0.045	0.083	0.046	0.047	0.101	0.054	0.059	0.043	0.035	0.080	0.049	0.063
2	22	0.046	0.061	0.049	0.046	0.044	0.041	0.073	0.048	0.060	0.057	0.058	0.019	0.073	0.065	0.055	0.036	0.040	0.078	0.043	0.047
2	23	0.034	0.065	0.073	0.060	0.055	0.047	0.064	0.076	0.057	0.054	0.063	0.056	0.057	0.057	0.055	0.027	0.046	0.069	0.042	0.044
2	24	0.062	0.044	0.038	0.034	0.043	0.045	0.058	0.054	0.044	0.046	0.046	0.031	0.045	0.047	0.053	0.035	0.045	0.053	0.045	0.046
2	25	0.054	0.047	0.028	0.055	0.031	0.043	0.057	0.075	0.037	0.048	0.040	0.033	0.031	0.039	0.038	0.034	0.037	0.038	0.029	0.028
2	26	0.021	0.027	0.023	0.035	0.043	0.040	0.045	0.057	0.032	0.061	0.038	0.030	0.029	0.031	0.029	0.033	0.027	0.022	0.030	0.041
2	27	0.019	0.022	0.021	0.040	0.037	0.043	0.025	0.057	0.018	0.032	0.023	0.023	0.032	0.041	0.027	0.030	0.023	0.015	0.014	0.030
2	28	0.030	0.021	0.021	0.019	0.021	0.029	0.022	0.031	0.008	0.018	0.016	0.033	0.028	0.034	0.027	0.014	0.013	0.016	0.010	0.016
2	29	0.017	0.025	0.016	0.010	0.024	0.027	0.022	0.029	0.028	0.013	0.013	0.004	0.024	0.023	0.021	0.014	0.007	0.011	0.004	0.018
2	30	0.007	0.010	0.003	0.011	0.003	0.018	0.009	0.015	0.004	0.007	0.009	0.013	0.011	0.008	0.022	0.004	0.011	0.004	0.006	0.011
2	31	0.000	0.005	0.003	0.013	0.004	0.009	0.003	0.012		0.002	0.004	0.004	0.016	0.011	0.003	0.006	0.003	0.006	0.006	0.008
2	32	0.013	0.004	0.004	0.003	0.003	0.012	0.001	0.002	0.001	0.001	0.003	0.004	0.006	0.004	0.007	0.004	0.001	0.007	0.004	0.008
2	33	0.002	0.002	0.002	0.004	0.000	0.001	0.003	0.008		0.005	0.002	0.003	0.004	0.003	0.004	0.002	0.002	0.009	0.001	0.002
2	34	0.007	0.001	0.005	0.001	0.002	0.000	0.004	0.000		0.000	0.000	0.007	0.001	0.003	0.002	0.003	0.002			0.001
2	35	0.004	0.001	0.006	0.003		0.003	0.003	0.000	0.000	0.005	0.000	0.011	0.003		0.004	0.002	0.002	0.003	0.000	0.003
2	36	0.007	0.002	0.006		0.002	0.000	0.004	0.001		0.000	0.000	0.002	0.000	0.002	0.003	0.003	0.001	0.005	0.002	0.000
2	37	0.008	0.002	0.017	0.005	0.003	0.007	0.005	0.001	0.022	0.000	0.002	0.003	0.003	0.003	0.004	0.003	0.002	0.001	0.001	0.000
2	38	0.006	0.002	0.017	0.005	0.003	0.002	0.005	0.003	0.000	0.001	0.012	0.002	0.004		0.003	0.001	0.003		0.000	0.000
2	39	0.013	0.001	0.009	0.002	0.001		0.004	0.005		0.000	0.002		0.001	0.000	0.002	0.001	0.004	0.002	0.004	0.001
2	40	0.005	0.001	0.004	0.004	0.002	0.001	0.001	0.001		0.001	0.003		0.001	0.002		0.002	0.006	0.000	0.003	0.000
2	41	0.002	0.002	0.004		0.001		0.001	0.000		0.001	0.002		0.004	0.002		0.000			0.002	
2	42	0.001	0.002	0.001		0.007		0.001	0.001		0.001	0.002			0.002					0.002	0.001
2	43	0.000	0.000				0.001					0.003	0.000		0.002			0.001			0.000
2	44		0.001										0.000	0.001							0.001
2	45		0.000		0.001														0.000		
2	46		0.000																		
2	47																				

TABLE 6. (continued)

season	TL IN	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
3	4	0.003																			
3	5	0.006																			
3	6	0.001																			
3	7	0.012	0.006																		
3	8	0.016	0.014		0.007								0.002								
3	9	0.005	0.008		0.007	0.000															
3	10	0.038	0.019	0.005	0.012	0.009						0.007	0.001								
3	11	0.090	0.044	0.015	0.018	0.059	0.008	0.001				0.006	0.009	0.002				0.001			
3	12	0.090	0.097	0.045	0.031	0.176	0.016		0.008			0.012	0.009	0.002	0.003	0.003	0.018	0.009		0.001	
3	13	0.074	0.131	0.098	0.146	0.134	0.067	0.026	0.002		0.013	0.007	0.025		0.002	0.006	0.005	0.005	0.002	0.002	
3	14	0.146	0.212	0.154	0.153	0.171	0.228	0.018	0.018	0.004	0.008	0.014	0.005	0.005	0.001	0.013	0.008	0.016	0.006		0.006
3	15	0.073	0.178	0.298	0.162	0.113	0.265	0.064	0.028	0.024	0.046	0.023	0.022	0.011	0.015	0.020	0.008	0.039	0.032	0.012	0.006
3	16	0.089	0.163	0.142	0.133	0.095	0.239	0.101	0.024	0.128	0.168	0.079	0.073	0.034	0.045	0.046	0.035	0.062	0.065	0.068	0.043
3	17	0.091	0.056	0.084	0.117	0.074	0.043	0.149	0.074	0.167	0.155	0.107	0.109	0.064	0.105	0.062	0.057	0.070	0.099	0.073	0.066
3	18	0.021	0.010	0.013	0.042	0.042	0.007	0.143	0.088	0.105	0.101	0.122	0.098	0.111	0.106	0.068	0.064	0.057	0.093	0.090	0.096
3	19	0.053	0.014	0.019	0.029	0.020	0.018	0.097	0.136	0.158	0.080	0.118	0.093	0.107	0.107	0.103	0.093	0.105	0.091	0.119	0.123
3	20	0.053	0.008	0.003	0.018	0.009	0.016	0.119	0.121	0.035	0.050	0.140	0.113	0.114	0.171	0.122	0.086	0.102	0.100	0.128	0.112
3	21	0.022		0.028	0.010	0.011	0.021	0.052	0.111	0.078	0.060	0.127	0.075	0.083	0.109	0.139	0.097	0.099	0.059	0.101	0.121
3	22	0.017	0.011	0.001	0.013	0.019	0.011	0.043	0.080	0.023	0.057	0.089	0.071	0.089	0.069	0.108	0.069	0.093	0.065	0.079	0.086
3	23	0.028	0.002	0.036	0.027	0.019	0.017	0.061	0.066	0.050	0.029	0.062	0.067	0.057	0.060	0.089	0.039	0.069	0.103	0.061	0.076
3	24	0.015		0.005	0.017	0.012	0.019	0.052	0.061	0.028	0.025	0.031	0.080	0.081	0.048	0.058	0.043	0.062	0.062	0.051	0.090
3	25	0.029	0.009	0.003	0.024	0.013	0.001	0.034	0.055	0.032	0.056	0.019	0.058	0.071	0.045	0.055	0.091	0.068	0.051	0.064	0.073
3	26	0.014	0.002	0.043	0.013	0.009		0.014	0.049	0.093	0.051	0.012	0.038	0.042	0.041	0.047	0.093	0.032	0.047	0.038	0.039
3	27	0.003		0.004	0.005	0.007		0.012	0.030	0.050	0.015	0.008	0.017	0.045	0.024	0.024	0.090	0.033	0.028	0.048	0.021
3	28	0.005	0.006	0.002	0.008	0.002		0.010	0.017	0.003	0.045	0.002	0.004	0.026	0.019	0.007	0.033	0.023	0.018	0.023	0.015
3	29	0.002		0.000	0.008	0.005		0.000	0.016	0.002	0.024	0.001	0.002	0.020	0.016	0.008	0.013	0.019	0.027	0.013	0.001
3	30					0.000	0.000	0.000	0.003		0.005	0.005	0.006	0.014	0.002	0.004	0.012	0.003	0.015	0.011	0.005
3	31		0.011					0.002	0.002	0.003			0.001	0.002	0.002	0.003	0.004	0.010	0.008	0.002	0.004
3	32			0.001		0.001		0.000		0.001	0.008	0.002	0.007	0.005	0.002	0.002	0.007	0.000	0.011	0.005	0.006
3	33			0.000				0.000	0.000			0.000		0.003	0.000	0.006	0.001	0.005	0.004	0.008	0.004
3	34			0.000			0.009	0.000	0.004	0.000		0.000	0.003	0.000	0.001		0.002	0.004	0.004		
3	35							0.000		0.001			0.000	0.001	0.001	0.002	0.003	0.003			
3	36							0.000	0.000	0.007		0.000	0.003	0.000	0.002		0.001	0.002	0.001		0.002
3	37			0.000				0.001	0.007	0.002		0.000	0.000	0.001	0.000	0.000	0.002	0.003	0.003		
3	38			0.000				0.001	0.000	0.001	0.005	0.001	0.001	0.000	0.001	0.000	0.005	0.000	0.001	0.002	
3	39			0.000			0.005	0.000	0.002	0.001		0.000		0.003	0.001	0.001	0.002		0.003		0.003
3	40						0.002	0.000	0.000	0.004		0.001	0.003	0.000	0.001	0.001	0.011			0.000	
3	41			0.000		0.000		0.000		0.001		0.000	0.002	0.000	0.001	0.003	0.004	0.002	0.000		
3	42						0.006	0.000		0.001		0.002		0.000	0.000	0.000	0.005	0.003	0.002	0.000	
3	43								0.001			0.000			0.000						
3	44									0.000				0.001						0.000	
3	45												0.002	0.002				0.002			
3	46																				
3	47											0.000		0.001							
3	48																				

season	TL IN	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
3	4																				
3	5																				
3	6																				
3	7																				
3	8																				
3	9																				
3	10																				
3	11			0.001												0.002					
3	12				0.010			0.002				0.002				0.003	0.001	0.004	0.000		
3	13	0.003		0.003		0.002		0.001	0.002							0.017	0.001	0.002		0.004	0.000
3	14	0.004		0.002	0.008		0.002		0.007				0.009		0.006	0.017			0.004	0.006	
3	15	0.034	0.026	0.020	0.028	0.027	0.029	0.010	0.020	0.004	0.010	0.005	0.012	0.007	0.009	0.033	0.010	0.015	0.028	0.030	0.022
3	16	0.095	0.044	0.087	0.090	0.034	0.061	0.057	0.041	0.033	0.040	0.050	0.062	0.043	0.065	0.061	0.054	0.061	0.072	0.090	0.074
3	17	0.099	0.061	0.093	0.055	0.039	0.079	0.080	0.084	0.095	0.067	0.105	0.154	0.086	0.121	0.074	0.103	0.141	0.073	0.054	0.073
3	18	0.071	0.092	0.093	0.044	0.041	0.080	0.116	0.118	0.148	0.101	0.075	0.140	0.116	0.107	0.085	0.117	0.124	0.101	0.075	0.056
3	19	0.083	0.092	0.139	0.095	0.050	0.111	0.119	0.077	0.105	0.105	0.082	0.091	0.086	0.113	0.091	0.117	0.142	0.112	0.107	0.049
3	20	0.073	0.085	0.092	0.060	0.104	0.091	0.096	0.099	0.115	0.099	0.088	0.071	0.099	0.090	0.103	0.117	0.119	0.085	0.068	0.068
3	21	0.116	0.116	0.105	0.078	0.090	0.083	0.094	0.108	0.096	0.047	0.129	0.065	0.090	0.051	0.088	0.115	0.092	0.060	0.072	0.081
3	22	0.086	0.071	0.045	0.109	0.107	0.047	0.084	0.068	0.096	0.072	0.109	0.049	0.090	0.067	0.067	0.071	0.055	0.073	0.089	0.061
3	23	0.103	0.089	0.046	0.092	0.098	0.053	0.085	0.066	0.063	0.092	0.077	0.093	0.046	0.058	0.063	0.081	0.048	0.078	0.070	0.081
3	24	0.070	0.075	0.033	0.054	0.101	0.067	0.074	0.091	0.042	0.074	0.045	0.049	0.075	0.048	0.065	0.046	0.046	0.087	0.100	0.056
3	25	0.065	0.051	0.039	0.031	0.060	0.086	0.060	0.051	0.043	0.081	0.058	0.045	0.035	0.041	0.061	0.048	0.043	0.061	0.055	0.074
3	26	0.025	0.048	0.071	0.035	0.043	0.070	0.041	0.048	0.030	0.098	0.066	0.036	0.060	0.055	0.038	0.040	0.034	0.037	0.053	0.071
3	27	0.030	0.033	0.046	0.036	0.038	0.031	0.040	0.043	0.026	0.045	0.044	0.031	0.036	0.038	0.034	0.017	0.031	0.062	0.035	0.065
3	28	0.006	0.023	0.027	0.136	0.038	0.029	0.030	0.024	0.032	0.029	0.014	0.022	0.036	0.031	0.027	0.022	0.013	0.030	0.032	0.044
3	29	0.015	0.015	0.007	0.003	0.024	0.017	0.004	0.021	0.029	0.014	0.014	0.009	0.016	0.016	0.020	0.018	0.006	0.013	0.023	0.032
3	30	0.005	0.011	0.008	0.008	0.013	0.015	0.005	0.004	0.012	0.009	0.008	0.018	0.023	0.016	0.012	0.006	0.002	0.006	0.010	0.026
3	31	0.006	0.006	0.014		0.006	0.012	0.000	0.009	0.001	0.003	0.009	0.011	0.008	0.010	0.007	0.002	0.002	0.005	0.013	0.020
3	32	0.000	0.017	0.000	0.001	0.002	0.006		0.002	0.005	0.003	0.001	0.007	0.010	0.013	0.009	0.003	0.002	0.003	0.001	0.013
3	33	0.000	0.004		0.000	0.003	0.002	0.000	0.007	0.002	0.009	0.004		0.004	0.001	0.004	0.002	0.002	0.002	0.002	0.003
3	34	0.001	0.001	0.002	0.000	0.003	0.000	0.000	0.001	0.008	0.000	0.002	0.004	0.003	0.010	0.002	0.001		0.004	0.004	0.010
3	35	0.001	0.003	0.006	0.002	0.002	0.003	0.000	0.000		0.000			0.003	0.003	0.002	0.002	0.000	0.000	0.004	0.005
3	36	0.000		0.001		0.001	0.002	0.001	0.001	0.003	0.000	0.001	0.009	0.004	0.007	0.005		0.007		0.001	0.005
3	37	0.001	0.005	0.004	0.002	0.004	0.006		0.004	0.004		0.001		0.002	0.005		0.004	0.003		0.001	0.003
3	38	0.003	0.003	0.008		0.022	0.007		0.000		0.000	0.007		0.002	0.006	0.003	0.000	0.001	0.002	0.000	0.004
3	39	0.001	0.004	0.001	0.021	0.046	0.002			0.003	0.001	0.000		0.009	0.004	0.000		0.003		0.000	0.002
3	40	0.000	0.004	0.007			0.003		0.003	0.002	0.000	0.000		0.006	0.005		0.001	0.003		0.000	
3	41	0.001	0.003	0.000			0.002			0.000		0.000	0.011	0.002	0.001	0.001		0.001		0.000	0.001
3	42	0.002	0.012		0.002	0.001	0.005					0.004		0.002		0.001			0.001		0.000
3	43	0.000	0.004			0.002										0.003	0.001				
3	44	0.000								0.002					0.002						
3	45																				
3	46															0.003					
3	47				0.001																0.000
3	48																				0.000

TABLE 7. Natural mortality at age vector used in ASAP base model.

Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+
0.349	0.206	0.157	0.134	0.122	0.115	0.110	0.108	0.106	0.104

TABLE 8. FAO proposed guideline for indices of productivity for exploited fish species and the parameter values and productivity score of Red Drum.

Parameter	Productivity			Species	Score
	Low	Medium	High	red drum	
M	<0.2	0.2 - 0.5	>0.5	**0.116**	1
K	<0.15	0.15 - 0.33	>0.33	**0.259**	2
tmat	>8	3.3 - 8	<3.3	**6**	2
tmax	>25	14 - 25	<14	**39**	1
Examples	orange roughy, many sharks	cod, hake	sardine, anchovy	**Red Drum Productivity Score = 1.50**	

TABLE 9. Annual sample sizes, nominal percent positive samples and CPUE of positive samples, standardized index of abundance, and corresponding coefficients of variation for Red Drum derived from the LDWF fishery-independent marine trammel net survey. Nominal CPUE and the standardized index of abundance have been normalized to their individual long-term means for comparison.

Year	n	%Pos	CPUE	IOA	CV
1985	95	6.3%	0.51	0.123	0.795
1986	92	30.4%	0.73	0.664	0.476
1987	180	22.2%	0.76	0.391	0.478
1988	165	34.5%	0.89	0.727	0.417
1989	202	20.8%	1.11	0.449	0.479
1990	191	12.6%	0.40	0.113	0.555
1991	207	37.7%	1.09	0.988	0.391
1992	220	42.7%	1.27	1.414	0.351
1993	225	41.3%	1.33	1.629	0.350
1994	213	40.8%	2.71	1.726	0.360
1995	215	35.3%	3.00	1.647	0.390
1996	216	40.3%	1.03	1.055	0.359
1997	219	34.7%	1.05	0.856	0.386
1998	223	36.3%	0.88	0.882	0.380
1999	217	35.5%	1.35	1.281	0.384
2000	209	39.7%	1.36	1.124	0.363
2001	219	31.1%	1.13	0.842	0.412
2002	217	41.0%	1.19	1.107	0.350
2003	222	38.3%	1.45	0.949	0.367
2004	222	49.1%	0.75	1.286	0.301
2005	215	41.9%	0.88	1.097	0.346
2006	217	47.5%	0.64	1.171	0.308
2007	226	48.7%	0.61	1.305	0.302
2008	219	40.6%	0.86	1.068	0.353
2009	222	45.9%	1.41	1.550	0.320
2010	508	43.9%	0.98	1.311	0.315
2011	543	43.8%	0.61	1.028	0.310
2012	515	45.8%	0.69	1.264	0.294
2013	263	40.3%	1.05	1.095	0.343
2014	263	41.4%	0.71	0.977	0.340
2015	271	43.9%	0.52	0.921	0.323
2016	271	43.5%	0.65	1.025	0.329
2017	269	44.6%	1.18	1.296	0.322
2018	270	38.5%	0.62	0.846	0.356
2019	271	34.7%	0.60	0.680	0.383
2020	265	34.7%	0.55	0.609	0.388
2021	264	31.4%	0.45	0.503	0.402

TABLE 10. Annual sample sizes, nominal percent positive samples and CPUE of positive samples, standardized index of abundance, and corresponding coefficients of variation for Red Drum derived from the LDWF fishery-independent bottom long line survey. Nominal CPUE and the standardized index of abundance have been normalized to their individual long-term means for comparison.

Year	n	%Pos	CPUE	IOA	CV
2015	79	46.8%	0.85	0.902	0.236
2016	74	24.3%	1.36	0.800	0.354
2017	91	47.3%	1.16	1.329	0.224
2018	96	38.5%	0.97	0.889	0.254
2019	88	46.6%	1.46	1.639	0.229
2020	25	36.0%	0.72	0.901	0.427
2021	80	35.0%	0.48	0.540	0.283

TABLE 11. Seasonal probabilities of age given length used in age assignments of Red Drum recreational and inshore commercial fishery landings from 1982-2001. Seasons represent January-April (season1), May-August (season 2), and September-December (season 3).

Season 1 (Jan-April)

TL in	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+
10	0.15	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.01	0.98	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.00	0.96	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.91	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.83	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.69	0.30	0.01	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.49	0.49	0.02	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.27	0.68	0.05	0.00	0.00	0.00	0.00	0.00	0.00
20	0.00	0.12	0.78	0.10	0.00	0.00	0.00	0.00	0.00	0.00
21	0.00	0.04	0.79	0.16	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.01	0.73	0.25	0.01	0.00	0.00	0.00	0.00	0.00
23	0.00	0.00	0.62	0.35	0.03	0.00	0.00	0.00	0.00	0.00
24	0.00	0.00	0.48	0.46	0.06	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.33	0.55	0.12	0.00	0.00	0.00	0.00	0.00
26	0.00	0.00	0.21	0.58	0.21	0.01	0.00	0.00	0.00	0.00
27	0.00	0.00	0.12	0.55	0.31	0.02	0.00	0.00	0.00	0.00
28	0.00	0.00	0.06	0.46	0.41	0.06	0.00	0.00	0.00	0.00
29	0.00	0.00	0.03	0.35	0.47	0.15	0.01	0.00	0.00	0.00
30	0.00	0.00	0.01	0.23	0.46	0.26	0.03	0.01	0.00	0.01
31	0.00	0.00	0.00	0.12	0.36	0.34	0.08	0.02	0.01	0.07
32	0.00	0.00	0.00	0.05	0.20	0.30	0.15	0.05	0.02	0.23
33	0.00	0.00	0.00	0.01	0.08	0.17	0.15	0.07	0.04	0.48
34	0.00	0.00	0.00	0.00	0.03	0.07	0.10	0.07	0.05	0.69
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.82
36	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.90
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.94
38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00

Season 2 (May-Aug)

TL in	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+
10	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.91	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.72	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.34	0.65	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.08	0.90	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.01	0.95	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.94	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.89	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.82	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.70	0.29	0.01	0.00	0.00	0.00	0.00	0.00	0.00
20	0.00	0.53	0.44	0.03	0.00	0.00	0.00	0.00	0.00	0.00
21	0.00	0.35	0.59	0.06	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.19	0.69	0.12	0.00	0.00	0.00	0.00	0.00	0.00
23	0.00	0.09	0.71	0.20	0.01	0.00	0.00	0.00	0.00	0.00
24	0.00	0.04	0.65	0.30	0.02	0.00	0.00	0.00	0.00	0.00
25	0.00	0.01	0.54	0.40	0.04	0.00	0.00	0.00	0.00	0.00
26	0.00	0.00	0.41	0.49	0.09	0.00	0.00	0.00	0.00	0.00
27	0.00	0.00	0.28	0.53	0.18	0.00	0.00	0.00	0.00	0.00
28	0.00	0.00	0.17	0.52	0.29	0.01	0.00	0.00	0.00	0.00
29	0.00	0.00	0.10	0.45	0.39	0.05	0.00	0.00	0.00	0.00
30	0.00	0.00	0.05	0.34	0.45	0.14	0.02	0.00	0.00	0.01
31	0.00	0.00	0.02	0.21	0.39	0.24	0.05	0.02	0.01	0.06
32	0.00	0.00	0.01	0.09	0.25	0.27	0.10	0.04	0.02	0.22
33	0.00	0.00	0.00	0.03	0.11	0.18	0.12	0.06	0.03	0.46
34	0.00	0.00	0.00	0.01	0.04	0.09	0.09	0.06	0.04	0.68
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.81
36	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.03	0.03	0.89
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.93
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.96
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.97
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00

TABLE 11. (continued)

Season 3 (Sept-Dec)

TL_in	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+
10	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.92	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.82	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.62	0.37	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.34	0.64	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.13	0.83	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.04	0.89	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.01	0.86	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	0.00	0.78	0.21	0.01	0.00	0.00	0.00	0.00	0.00	0.00
21	0.00	0.67	0.32	0.02	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.52	0.44	0.04	0.00	0.00	0.00	0.00	0.00	0.00
23	0.00	0.36	0.56	0.08	0.00	0.00	0.00	0.00	0.00	0.00
24	0.00	0.22	0.63	0.15	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.12	0.63	0.25	0.01	0.00	0.00	0.00	0.00	0.00
26	0.00	0.06	0.56	0.35	0.03	0.00	0.00	0.00	0.00	0.00
27	0.00	0.02	0.45	0.45	0.08	0.00	0.00	0.00	0.00	0.00
28	0.00	0.01	0.33	0.50	0.16	0.00	0.00	0.00	0.00	0.00
29	0.00	0.00	0.21	0.50	0.27	0.01	0.00	0.00	0.00	0.00
30	0.00	0.00	0.12	0.42	0.38	0.05	0.01	0.00	0.00	0.01
31	0.00	0.00	0.06	0.29	0.40	0.14	0.03	0.01	0.01	0.06
32	0.00	0.00	0.02	0.15	0.29	0.21	0.07	0.03	0.02	0.22
33	0.00	0.00	0.01	0.05	0.14	0.18	0.09	0.05	0.03	0.45
34	0.00	0.00	0.00	0.02	0.05	0.10	0.08	0.05	0.04	0.66
35	0.00	0.00	0.00	0.00	0.02	0.05	0.05	0.04	0.04	0.80
36	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.03	0.88
37	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.03	0.92
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.95
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00

TABLE 12. Annual seasonal probabilities of age given length used in age assignments of recreational Red Drum landings 2002-2013. Probabilities of age given length from Table 11 are substituted where the annual row sample sizes (total column) are <10. Seasons represent January-April (season1), May-August (season 2), and September-December (season 3).

2002 (season 1)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.15	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.01	0.98	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
14	0.00	0.96	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
15	0.00	0.91	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
16	0.00	0.83	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
17	0.00	0.69	0.30	0.01	0.00	0.00	0.00	0.00	0.00	0.00	
18	0.00	0.49	0.49	0.02	0.00	0.00	0.00	0.00	0.00	0.00	
19	0.00	0.27	0.68	0.05	0.00	0.00	0.00	0.00	0.00	0.00	
20	0.00	0.12	0.78	0.10	0.00	0.00	0.00	0.00	0.00	0.00	
21	0.00	0.04	0.79	0.16	0.00	0.00	0.00	0.00	0.00	0.00	
22	0.00	0.01	0.73	0.25	0.01	0.00	0.00	0.00	0.00	0.00	
23	0.00	0.00	0.62	0.35	0.03	0.00	0.00	0.00	0.00	0.00	
24	0.00	0.00	0.48	0.46	0.06	0.00	0.00	0.00	0.00	0.00	
25	0.00	0.00	0.33	0.55	0.12	0.00	0.00	0.00	0.00	0.00	
26	0.00	0.00	0.21	0.58	0.21	0.01	0.00	0.00	0.00	0.00	
27	0.00	0.00	0.12	0.55	0.31	0.02	0.00	0.00	0.00	0.00	
28	0.00	0.00	0.06	0.46	0.41	0.06	0.00	0.00	0.00	0.00	
29	0.00	0.00	0.03	0.35	0.47	0.15	0.01	0.00	0.00	0.00	
30	0.00	0.00	0.01	0.23	0.46	0.26	0.03	0.01	0.00	0.01	
31	0.00	0.00	0.00	0.12	0.36	0.34	0.08	0.02	0.01	0.07	
32	0.00	0.00	0.00	0.05	0.20	0.30	0.15	0.05	0.02	0.23	
33	0.00	0.00	0.00	0.01	0.08	0.17	0.15	0.07	0.04	0.48	
34	0.00	0.00	0.00	0.00	0.03	0.07	0.10	0.07	0.05	0.69	
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.82	
36	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.90	
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.94	
38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98	
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

2002 (season 2)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.91	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.72	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.34	0.65	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
14	0.08	0.90	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
15	0.01	0.95	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
16		0.92	0.08								24
17		0.80	0.17	0.03							30
18		0.93	0.07								27
19		0.85	0.15								13
20		0.47	0.53								17
21		0.21	0.68	0.11							19
22		0.11	0.78	0.11							18
23		0.13	0.87								15
24	0.00	0.04	0.65	0.30	0.02	0.00	0.00	0.00	0.00	0.00	9
25			0.63	0.38							16
26	0.00	0.00	0.41	0.49	0.09	0.00	0.00	0.00	0.00	0.00	6
27	0.00	0.00	0.28	0.53	0.18	0.00	0.00	0.00	0.00	0.00	6
28			0.17	0.67		0.17					12
29			0.31	0.69							13
30	0.00	0.00	0.05	0.34	0.45	0.14	0.02	0.00	0.00	0.01	5
31	0.00	0.00	0.02	0.21	0.39	0.24	0.05	0.02	0.01	0.06	1
32	0.00	0.00	0.01	0.09	0.25	0.27	0.10	0.04	0.02	0.22	4
33	0.00	0.00	0.00	0.03	0.11	0.18	0.12	0.06	0.03	0.46	1
34	0.00	0.00	0.00	0.01	0.04	0.09	0.09	0.06	0.04	0.68	
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.81	2
36	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.03	0.03	0.89	2
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.93	2
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.96	3
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.97	2
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	1
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	2
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

TABLE 12. (continued)

2002 (season 3)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.92	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
14	0.82	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
15	0.62	0.37	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5
16	0.66	0.34									29
17	0.65	0.35									26
18	0.40	0.60									15
19		0.94	0.06								17
20	0.05	0.86	0.10								21
21		0.87	0.13								30
22	0.04	0.58	0.38								26
23		0.54	0.39	0.07							28
24		0.29	0.47	0.24							17
25		0.07	0.53	0.40							15
26	0.00	0.06	0.56	0.35	0.03	0.00	0.00	0.00	0.00	0.00	9
27	0.00	0.02	0.45	0.45	0.08	0.00	0.00	0.00	0.00	0.00	5
28	0.00	0.01	0.33	0.50	0.16	0.00	0.00	0.00	0.00	0.00	3
29	0.00	0.00	0.21	0.50	0.27	0.01	0.00	0.00	0.00	0.00	3
30	0.00	0.00	0.12	0.42	0.38	0.05	0.01	0.00	0.00	0.01	
31	0.00	0.00	0.06	0.29	0.40	0.14	0.03	0.01	0.01	0.06	
32	0.00	0.00	0.02	0.15	0.29	0.21	0.07	0.03	0.02	0.22	
33	0.00	0.00	0.01	0.05	0.14	0.18	0.09	0.05	0.03	0.45	
34	0.00	0.00	0.00	0.02	0.05	0.10	0.08	0.05	0.04	0.66	
35	0.00	0.00	0.00	0.00	0.02	0.05	0.05	0.04	0.04	0.80	
36	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.03	0.88	
37	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.03	0.92	
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.95	
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98	
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	1
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

2003 (season 1)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.15	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.01	0.98	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
14	0.00	0.96	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
15	0.00	0.91	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
16	0.70	0.30									20
17	0.68	0.16	0.16								19
18	0.23	0.46	0.31								13
19	0.17		0.83								12
20	0.08		0.92								12
21	0.10	0.05	0.81	0.05							21
22			0.94	0.06							16
23	0.00	0.00	0.62	0.35	0.03	0.00	0.00	0.00	0.00	0.00	4
24			0.63	0.31	0.06						16
25			0.40	0.60							10
26			0.18	0.64	0.18						11
27			0.20	0.60	0.20						10
28	0.00	0.00	0.06	0.46	0.41	0.06	0.00	0.00	0.00	0.00	2
29	0.00	0.00	0.03	0.35	0.47	0.15	0.01	0.00	0.00	0.00	4
30	0.00	0.00	0.01	0.23	0.46	0.26	0.03	0.01	0.00	0.01	
31	0.00	0.00	0.00	0.12	0.36	0.34	0.08	0.02	0.01	0.07	4
32	0.00	0.00	0.00	0.05	0.20	0.30	0.15	0.05	0.02	0.23	1
33	0.00	0.00	0.00	0.01	0.08	0.17	0.15	0.07	0.04	0.48	
34	0.00	0.00	0.00	0.00	0.03	0.07	0.10	0.07	0.05	0.69	1
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.82	
36	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.90	1
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.94	1
38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	2
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98	1
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	2
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	3
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

TABLE 12. (continued)

2003 (season 2)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.91	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.72	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.34	0.65	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
14	0.08	0.90	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
15	0.01	0.95	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6
16		0.95	0.05								19
17		0.97	0.03								36
18	0.03	0.83	0.14								29
19		0.76	0.24								25
20		0.38	0.62								26
21		0.23	0.73	0.04							26
22		0.13	0.77	0.10							31
23		0.10	0.59	0.31							29
24			0.35	0.65							26
25		0.03	0.35	0.61							31
26			0.27	0.65	0.08						26
27			0.18	0.71	0.12						17
28	0.00	0.00	0.17	0.52	0.29	0.01	0.00	0.00	0.00	0.00	6
29	0.00	0.00	0.10	0.45	0.39	0.05	0.00	0.00	0.00	0.00	9
30	0.00	0.00	0.05	0.34	0.45	0.14	0.02	0.00	0.00	0.01	5
31	0.00	0.00	0.02	0.21	0.39	0.24	0.05	0.02	0.01	0.06	3
32	0.00	0.00	0.01	0.09	0.25	0.27	0.10	0.04	0.02	0.22	
33	0.00	0.00	0.00	0.03	0.11	0.18	0.12	0.06	0.03	0.46	
34	0.00	0.00	0.00	0.01	0.04	0.09	0.09	0.06	0.04	0.68	2
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.81	1
36	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.03	0.03	0.89	
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.93	
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.96	3
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.97	1
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	1
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	1
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

2003 (season 3)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.92	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
14	0.82	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
15	0.62	0.37	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
16	0.34	0.64	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9
17	0.20	0.73	0.07								15
18	0.11	0.85	0.04								27
19	0.06	0.94									35
20		0.63	0.31	0.06							16
21		0.69	0.23	0.08							26
22		0.56	0.40	0.04							25
23		0.45	0.45	0.09							22
24		0.20	0.68	0.12							25
25		0.21	0.56	0.21	0.03						39
26		0.12	0.41	0.47							17
27		0.10	0.45	0.35	0.10						20
28		0.10	0.30	0.60							10
29	0.00	0.00	0.21	0.50	0.27	0.01	0.00	0.00	0.00	0.00	8
30	0.00	0.00	0.12	0.42	0.38	0.05	0.01	0.00	0.00	0.01	3
31	0.00	0.00	0.06	0.29	0.40	0.14	0.03	0.01	0.01	0.06	1
32	0.00	0.00	0.02	0.15	0.29	0.21	0.07	0.03	0.02	0.22	4
33	0.00	0.00	0.01	0.05	0.14	0.18	0.09	0.05	0.03	0.45	4
34	0.00	0.00	0.00	0.02	0.05	0.10	0.08	0.05	0.04	0.66	1
35	0.00	0.00	0.00	0.00	0.02	0.05	0.05	0.04	0.04	0.80	2
36	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.03	0.88	1
37	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.03	0.92	2
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.95	2
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	3
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98	
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	3
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	1
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

TABLE 12. (continued)

2004 (season 1)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.15	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.01	0.98	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
14	0.00	0.96	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
15	0.00	0.91	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9
16	0.40	0.47	0.13								15
17	0.54	0.31	0.15								13
18	0.00	0.49	0.49	0.02	0.00	0.00	0.00	0.00	0.00	0.00	6
19			1.00								12
20			1.00								10
21	0.00	0.04	0.79	0.16	0.00	0.00	0.00	0.00	0.00	0.00	9
22			0.85	0.15							13
23			0.79	0.16	0.05						19
24			0.50	0.50							10
25			0.12	0.88							17
26			0.18	0.65	0.18						17
27			0.08	0.77	0.15						13
28			0.36	0.36	0.27						11
29	0.00	0.00	0.03	0.35	0.47	0.15	0.01	0.00	0.00	0.00	4
30	0.00	0.00	0.01	0.23	0.46	0.26	0.03	0.01	0.00	0.01	5
31	0.00	0.00	0.00	0.12	0.36	0.34	0.08	0.02	0.01	0.07	1
32	0.00	0.00	0.00	0.05	0.20	0.30	0.15	0.05	0.02	0.23	2
33	0.00	0.00	0.00	0.01	0.08	0.17	0.15	0.07	0.04	0.48	1
34	0.00	0.00	0.00	0.00	0.03	0.07	0.10	0.07	0.05	0.69	2
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.82	1
36	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.90	
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.94	2
38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	2
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98	
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	2
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

2004 (season 2)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.91	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.72	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.34	0.65	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
14	0.08	0.90	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
15		0.81	0.19								16
16		0.89	0.11								37
17		0.98	0.02								51
18		0.98	0.02								48
19		0.83	0.17								35
20		0.71	0.24	0.05							21
21		0.24	0.65	0.06	0.06						17
22		0.13	0.73	0.13							15
23		0.09	0.55	0.36							11
24			0.56	0.31	0.13						16
25			0.50	0.50							16
26			0.38	0.50	0.13						16
27			0.18	0.65	0.18						17
28	0.00	0.00	0.17	0.52	0.29	0.01	0.00	0.00	0.00	0.00	9
29	0.00	0.00	0.10	0.45	0.39	0.05	0.00	0.00	0.00	0.00	8
30	0.00	0.00	0.05	0.34	0.45	0.14	0.02	0.00	0.00	0.01	5
31	0.00	0.00	0.02	0.21	0.39	0.24	0.05	0.02	0.01	0.06	6
32	0.00	0.00	0.01	0.09	0.25	0.27	0.10	0.04	0.02	0.22	
33	0.00	0.00	0.00	0.03	0.11	0.18	0.12	0.06	0.03	0.46	3
34	0.00	0.00	0.00	0.01	0.04	0.09	0.09	0.06	0.04	0.68	
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.81	2
36	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.03	0.03	0.89	
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.93	4
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.96	1
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.97	2
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	1
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	1
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	2
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

TABLE 12. (continued)

2004 (season 3)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.92	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
14	0.82	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
15	0.62	0.37	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
16	0.45	0.55									22
17	0.21	0.79									28
18	0.03	0.95	0.03								38
19		1.00									37
20		0.91	0.06		0.03						34
21		0.95	0.05								39
22		0.79	0.21								34
23		0.76	0.24								17
24		0.22	0.61	0.17							18
25		0.11	0.56	0.33							18
26			0.55	0.30	0.15						20
27		0.06	0.61	0.28	0.06						18
28	0.00	0.01	0.33	0.50	0.16	0.00	0.00	0.00	0.00	0.00	7
29	0.00	0.00	0.21	0.50	0.27	0.01	0.00	0.00	0.00	0.00	2
30	0.00	0.00	0.12	0.42	0.38	0.05	0.01	0.00	0.00	0.01	1
31	0.00	0.00	0.06	0.29	0.40	0.14	0.03	0.01	0.01	0.06	3
32	0.00	0.00	0.02	0.15	0.29	0.21	0.07	0.03	0.02	0.22	3
33	0.00	0.00	0.01	0.05	0.14	0.18	0.09	0.05	0.03	0.45	
34	0.00	0.00	0.00	0.02	0.05	0.10	0.08	0.05	0.04	0.66	
35	0.00	0.00	0.00	0.00	0.02	0.05	0.05	0.04	0.04	0.80	3
36	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.03	0.88	1
37	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.03	0.92	
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.95	
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98	1
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

2005 (season 1)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.15	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.01	0.98	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
14	0.00	0.96	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
15	0.00	0.91	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5
16		1.00									23
17		0.95	0.05								20
18		0.64	0.36								14
19	0.00	0.27	0.68	0.05	0.00	0.00	0.00	0.00	0.00	0.00	6
20		0.04	0.92	0.04							24
21			0.91	0.09							23
22			1.00								29
23			0.90	0.10							21
24			0.71	0.29							14
25		0.07	0.40	0.53							15
26			0.36	0.36	0.18	0.09					11
27			0.08	0.46	0.38	0.08					13
28	0.00	0.00	0.06	0.46	0.41	0.06	0.00	0.00	0.00	0.00	8
29	0.00	0.00	0.03	0.35	0.47	0.15	0.01	0.00	0.00	0.00	7
30	0.00	0.00	0.01	0.23	0.46	0.26	0.03	0.01	0.00	0.01	2
31	0.00	0.00	0.00	0.12	0.36	0.34	0.08	0.02	0.01	0.07	2
32	0.00	0.00	0.00	0.05	0.20	0.30	0.15	0.05	0.02	0.23	1
33	0.00	0.00	0.00	0.01	0.08	0.17	0.15	0.07	0.04	0.48	2
34	0.00	0.00	0.00	0.00	0.03	0.07	0.10	0.07	0.05	0.69	1
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.82	1
36	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.90	
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.94	
38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	3
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98	
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

TABLE 12. (continued)

2005 (season 2)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.91	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.72	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
13	0.34	0.65	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
14	0.08	0.90	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
15	0.01	0.95	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
16		1.00									14
17	0.03	0.94		0.03							32
18	0.13	0.84	0.03								31
19		0.88	0.13								40
20		0.85	0.15								20
21		0.60	0.40								20
22		0.11	0.89								18
23			0.84	0.16							19
24		0.10	0.85	0.05							20
25			0.59	0.36	0.05						22
26			0.43	0.43	0.07	0.07					14
27			0.13	0.69	0.13	0.06					16
28			0.11	0.74	0.11	0.05					19
29	0.00	0.00	0.10	0.45	0.39	0.05	0.00	0.00	0.00	0.00	9
30			0.15	0.38	0.08	0.31	0.08				13
31	0.00	0.00	0.02	0.21	0.39	0.24	0.05	0.02	0.01	0.06	2
32	0.00	0.00	0.01	0.09	0.25	0.27	0.10	0.04	0.02	0.22	5
33	0.00	0.00	0.00	0.03	0.11	0.18	0.12	0.06	0.03	0.46	
34	0.00	0.00	0.00	0.01	0.04	0.09	0.09	0.06	0.04	0.68	4
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.81	
36	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.03	0.03	0.89	1
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.93	2
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.96	1
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.97	1
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

2005 (season 3)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.92	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
14	0.82	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
15	0.62	0.37	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5
16	1.00										17
17	0.80	0.10	0.10								10
18	0.04	0.89	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8
19	0.43	0.57									14
20	0.14	0.77	0.09								22
21	0.06	0.88		0.06							17
22		0.82	0.18								33
23		0.59	0.41								27
24	0.06	0.59	0.35								17
25		0.41	0.55	0.05							22
26		0.23	0.77								13
27		0.10	0.60	0.30							10
28	0.00	0.01	0.33	0.50	0.16	0.00	0.00	0.00	0.00	0.00	4
29	0.00	0.00	0.21	0.50	0.27	0.01	0.00	0.00	0.00	0.00	2
30	0.00	0.00	0.12	0.42	0.38	0.05	0.01	0.00	0.00	0.01	
31	0.00	0.00	0.06	0.29	0.40	0.14	0.03	0.01	0.01	0.06	2
32	0.00	0.00	0.02	0.15	0.29	0.21	0.07	0.03	0.02	0.22	1
33	0.00	0.00	0.01	0.05	0.14	0.18	0.09	0.05	0.03	0.45	
34	0.00	0.00	0.00	0.02	0.05	0.10	0.08	0.05	0.04	0.66	3
35	0.00	0.00	0.00	0.00	0.02	0.05	0.05	0.04	0.04	0.80	1
36	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.03	0.88	2
37	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.03	0.92	1
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.95	1
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	1
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98	3
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

TABLE 12. (continued)

2006 (season 1)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.15	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.01	0.98	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
14	0.00	0.96	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
15	0.00	0.91	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7
16		1.00									38
17		1.00									41
18		1.00									22
19		1.00									12
20		0.58	0.42								12
21	0.00	0.04	0.79	0.16	0.00	0.00	0.00	0.00	0.00	0.00	2
22	0.00	0.01	0.73	0.25	0.01	0.00	0.00	0.00	0.00	0.00	5
23	0.00	0.00	0.62	0.35	0.03	0.00	0.00	0.00	0.00	0.00	8
24			0.82	0.18							11
25			0.58	0.42							19
26			0.38	0.46	0.15						13
27			0.21	0.71			0.07				14
28			0.18	0.73	0.09						11
29	0.00	0.00	0.03	0.35	0.47	0.15	0.01	0.00	0.00	0.00	6
30	0.00	0.00	0.01	0.23	0.46	0.26	0.03	0.01	0.00	0.01	6
31	0.00	0.00	0.00	0.12	0.36	0.34	0.08	0.02	0.01	0.07	2
32	0.00	0.00	0.00	0.05	0.20	0.30	0.15	0.05	0.02	0.23	2
33	0.00	0.00	0.00	0.01	0.08	0.17	0.15	0.07	0.04	0.48	1
34	0.00	0.00	0.00	0.00	0.03	0.07	0.10	0.07	0.05	0.69	1
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.82	
36	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.90	1
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.94	1
38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98	1
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	1
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

2006 (season 2)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.91	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.72	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.34	0.65	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
14	0.08	0.90	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
15	0.01	0.95	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
16	0.00	0.94	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6
17		1.00									25
18	0.03	0.95	0.03								37
19		1.00									48
20		1.00									39
21		1.00									28
22		0.90	0.10								20
23		0.83	0.17								12
24		0.22	0.72	0.06							18
25		0.04	0.96								24
26			0.95	0.05							20
27			0.40	0.60							15
28			0.60	0.30		0.10					10
29	0.00	0.00	0.10	0.45	0.39	0.05	0.00	0.00	0.00	0.00	6
30	0.00	0.00	0.05	0.34	0.45	0.14	0.02	0.00	0.00	0.01	8
31	0.00	0.00	0.02	0.21	0.39	0.24	0.05	0.02	0.01	0.06	3
32	0.00	0.00	0.01	0.09	0.25	0.27	0.10	0.04	0.02	0.22	1
33	0.00	0.00	0.00	0.03	0.11	0.18	0.12	0.06	0.03	0.46	1
34	0.00	0.00	0.00	0.01	0.04	0.09	0.09	0.06	0.04	0.68	
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.81	
36	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.03	0.03	0.89	1
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.93	1
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.96	
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.97	1
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	1
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	1
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

TABLE 12. (continued)

2006 (season 3)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.92	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
14	0.82	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
15	0.90		0.10								10
16	1.00										17
17	0.93	0.07									14
18	0.33	0.67									15
19	0.08	0.92									24
20		0.98		0.02							48
21		0.96	0.04								53
22		0.94	0.06								49
23		0.88	0.09	0.03							33
24		0.75	0.25								24
25		0.38	0.46	0.15							26
26		0.21	0.63	0.16							19
27			0.72	0.28							18
28			0.80	0.20							20
29		0.09	0.55	0.27	0.09						11
30	0.00	0.00	0.12	0.42	0.38	0.05	0.01	0.00	0.00	0.01	6
31	0.00	0.00	0.06	0.29	0.40	0.14	0.03	0.01	0.01	0.06	1
32	0.00	0.00	0.02	0.15	0.29	0.21	0.07	0.03	0.02	0.22	2
33	0.00	0.00	0.01	0.05	0.14	0.18	0.09	0.05	0.03	0.45	1
34	0.00	0.00	0.00	0.02	0.05	0.10	0.08	0.05	0.04	0.66	
35	0.00	0.00	0.00	0.00	0.02	0.05	0.05	0.04	0.04	0.80	
36	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.03	0.88	1
37	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.03	0.92	3
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.95	
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	2
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98	1
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	1
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

2007 (season 1)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.15	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.01	0.98	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
14	0.00	0.96	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
15	0.00	0.91	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7
16		1.00									24
17		0.95	0.05								19
18		0.64	0.36								11
19	0.00	0.27	0.68	0.05	0.00	0.00	0.00	0.00	0.00	0.00	7
20		0.08	0.92								13
21	0.00	0.04	0.79	0.16	0.00	0.00	0.00	0.00	0.00	0.00	6
22			1.00								19
23			0.88	0.12							26
24			1.00								15
25			0.71	0.24	0.06						17
26			0.58	0.42							12
27	0.00	0.00	0.12	0.55	0.31	0.02	0.00	0.00	0.00	0.00	9
28			0.21	0.57	0.21						14
29				0.50	0.30	0.10				0.10	10
30	0.00	0.00	0.01	0.23	0.46	0.26	0.03	0.01	0.00	0.01	5
31	0.00	0.00	0.00	0.12	0.36	0.34	0.08	0.02	0.01	0.07	1
32	0.00	0.00	0.00	0.05	0.20	0.30	0.15	0.05	0.02	0.23	2
33	0.00	0.00	0.00	0.01	0.08	0.17	0.15	0.07	0.04	0.48	3
34	0.00	0.00	0.00	0.00	0.03	0.07	0.10	0.07	0.05	0.69	
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.82	1
36	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.90	1
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.94	
38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	3
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98	
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

TABLE 12. (continued)

2008 (season 1)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.15	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
11	0.01	0.98	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
14	0.00	0.96	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
15		1.00									20
16		1.00									35
17		0.88	0.13								32
18		0.38	0.63								16
19		0.05	0.95								22
20		0.02	0.98								42
21			1.00								35
22			0.95	0.05							40
23			0.94	0.06							36
24			0.82	0.18							33
25			0.38	0.63							16
26	0.00	0.00	0.21	0.58	0.21	0.01	0.00	0.00	0.00	0.00	9
27			0.08	0.85					0.08		13
28				0.83	0.17						12
29				0.85	0.15						13
30	0.00	0.00	0.01	0.23	0.46	0.26	0.03	0.01	0.00	0.01	6
31	0.00	0.00	0.00	0.12	0.36	0.34	0.08	0.02	0.01	0.07	3
32	0.00	0.00	0.00	0.05	0.20	0.30	0.15	0.05	0.02	0.23	2
33	0.00	0.00	0.00	0.01	0.08	0.17	0.15	0.07	0.04	0.48	2
34	0.00	0.00	0.00	0.00	0.03	0.07	0.10	0.07	0.05	0.69	1
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.82	1
36	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.90	1
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.94	1
38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	1
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98	3
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	1
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

2008 (season 2)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.91	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.72	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.34	0.65	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
14	0.08	0.90	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5
15		0.94	0.06								18
16		0.96	0.04								71
17		0.87	0.13								55
18		0.81	0.19								37
19	0.03	0.62	0.35								34
20		0.26	0.74								39
21		0.03	0.93	0.03							29
22		0.07	0.91	0.02							46
23		0.11	0.86	0.03							37
24			0.89	0.11							27
25		0.04	0.78	0.13	0.04						23
26		0.05	0.43	0.52							21
27			0.13	0.80	0.07						15
28			0.30	0.60	0.10						10
29			0.20	0.67	0.13						15
30	0.00	0.00	0.05	0.34	0.45	0.14	0.02	0.00	0.00	0.01	7
31	0.00	0.00	0.02	0.21	0.39	0.24	0.05	0.02	0.01	0.06	7
32	0.00	0.00	0.01	0.09	0.25	0.27	0.10	0.04	0.02	0.22	1
33	0.00	0.00	0.00	0.03	0.11	0.18	0.12	0.06	0.03	0.46	2
34	0.00	0.00	0.00	0.01	0.04	0.09	0.09	0.06	0.04	0.68	2
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.81	3
36	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.03	0.03	0.89	3
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.93	2
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.96	2
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.97	2
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	1
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	2
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

TABLE 12. (continued)

2007 (season 2)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.91	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.72	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
13	0.34	0.65	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
14	0.08	0.90	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
15	0.01	0.95	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5
16		0.95	0.05								39
17		0.98	0.02								48
18		0.97	0.03								30
19		1.00									23
20		0.81	0.16	0.03							31
21		0.67	0.33								15
22	0.00	0.19	0.69	0.12	0.00	0.00	0.00	0.00	0.00	0.00	9
23		0.13	0.75	0.06	0.06						16
24		0.13	0.87								15
25			0.95	0.05							19
26			0.78	0.22							23
27		0.05	0.38	0.52	0.05						21
28			0.30	0.70							10
29			0.23	0.54	0.15		0.08				13
30	0.00	0.00	0.05	0.34	0.45	0.14	0.02	0.00	0.00	0.01	9
31	0.00	0.00	0.02	0.21	0.39	0.24	0.05	0.02	0.01	0.06	6
32	0.00	0.00	0.01	0.09	0.25	0.27	0.10	0.04	0.02	0.22	5
33	0.00	0.00	0.00	0.03	0.11	0.18	0.12	0.06	0.03	0.46	1
34	0.00	0.00	0.00	0.01	0.04	0.09	0.09	0.06	0.04	0.68	3
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.81	6
36	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.03	0.03	0.89	2
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.93	6
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.96	5
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.97	
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	1
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

2007 (season 3)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
12	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
13	0.92	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
14	0.82	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
15	0.80	0.10	0.10								10
16	0.41	0.59									22
17	0.07	0.93									30
18	0.06	0.90	0.04								50
19		0.98	0.02								48
20	0.02	0.96	0.02								48
21		0.98	0.02								43
22		0.78	0.22								37
23		0.65	0.35								23
24		0.33	0.67								18
25		0.13	0.83	0.04							23
26			0.95	0.05							21
27		0.08	0.79	0.08	0.04						24
28			0.86	0.14							14
29		0.09	0.45	0.27	0.18						11
30	0.00	0.00	0.12	0.42	0.38	0.05	0.01	0.00	0.00	0.01	2
31	0.00	0.00	0.06	0.29	0.40	0.14	0.03	0.01	0.01	0.06	4
32	0.00	0.00	0.02	0.15	0.29	0.21	0.07	0.03	0.02	0.22	3
33	0.00	0.00	0.01	0.05	0.14	0.18	0.09	0.05	0.03	0.45	2
34	0.00	0.00	0.00	0.02	0.05	0.10	0.08	0.05	0.04	0.66	4
35	0.00	0.00	0.00	0.00	0.02	0.05	0.05	0.04	0.04	0.80	4
36	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.03	0.88	4
37	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.03	0.92	5
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.95	4
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	6
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98	2
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	3
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	5
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

TABLE 12. (continued)

2008 (season 3)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.92	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
14	0.82	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
15	0.62	0.37	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9
16	0.59	0.38			0.03						29
17	0.19	0.78	0.03								36
18	0.05	0.86	0.08								37
19		0.86	0.14								44
20		0.81	0.19								48
21		0.88	0.12								41
22		0.66	0.34								35
23		0.32	0.66	0.03							38
24		0.15	0.82	0.03							33
25		0.03	0.97								32
26		0.04	0.93	0.04							28
27		0.08	0.67	0.25							12
28	0.00	0.01	0.33	0.50	0.16	0.00	0.00	0.00	0.00	0.00	6
29	0.00	0.00	0.21	0.50	0.27	0.01	0.00	0.00	0.00	0.00	4
30	0.00	0.00	0.12	0.42	0.38	0.05	0.01	0.00	0.00	0.01	4
31	0.00	0.00	0.06	0.29	0.40	0.14	0.03	0.01	0.01	0.06	3
32	0.00	0.00	0.02	0.15	0.29	0.21	0.07	0.03	0.02	0.22	
33	0.00	0.00	0.01	0.05	0.14	0.18	0.09	0.05	0.03	0.45	2
34	0.00	0.00	0.00	0.02	0.05	0.10	0.08	0.05	0.04	0.66	2
35	0.00	0.00	0.00	0.00	0.02	0.05	0.05	0.04	0.04	0.80	1
36	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.03	0.88	2
37	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.03	0.92	
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.95	1
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	2
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98	
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

2009 (season 1)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.15	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.01	0.98	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
14	0.00	0.96	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
15		0.92	0.04	0.04							26
16		0.98	0.02								54
17		0.84	0.16								32
18		0.53	0.40	0.07							15
19		0.09	0.91								22
20		0.06	0.87	0.06							31
21			0.89	0.11							35
22			0.84	0.16							37
23			0.74	0.26							39
24			0.48	0.48	0.04						25
25			0.06	0.94							16
26			0.05	0.82	0.14						22
27			0.13	0.75	0.13						16
28				0.55	0.45						11
29	0.00	0.00	0.03	0.35	0.47	0.15	0.01	0.00	0.00	0.00	5
30	0.00	0.00	0.01	0.23	0.46	0.26	0.03	0.01	0.00	0.01	9
31	0.00	0.00	0.00	0.12	0.36	0.34	0.08	0.02	0.01	0.07	1
32	0.00	0.00	0.00	0.05	0.20	0.30	0.15	0.05	0.02	0.23	2
33	0.00	0.00	0.00	0.01	0.08	0.17	0.15	0.07	0.04	0.48	
34	0.00	0.00	0.00	0.00	0.03	0.07	0.10	0.07	0.05	0.69	
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.82	3
36	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.90	1
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.94	1
38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	1
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98	1
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	2
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	1
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	2
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

TABLE 12. (continued)

2009 (season 2)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.91	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.72	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.34	0.65	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
14	0.08	0.90	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
15		1.00									17
16		1.00									61
17		1.00									52
18		0.86	0.14								59
19		0.75	0.25								28
20		0.39	0.56	0.06							36
21		0.25	0.73	0.02							44
22		0.17	0.69	0.14							29
23		0.08	0.86	0.06							36
24		0.06	0.47	0.47							36
25			0.37	0.63							38
26			0.36	0.61	0.03						33
27			0.19	0.69	0.12						26
28			0.18	0.76	0.06						17
29			0.08	0.54	0.38						13
30	0.00	0.00	0.05	0.34	0.45	0.14	0.02	0.00	0.00	0.01	6
31	0.00	0.00	0.02	0.21	0.39	0.24	0.05	0.02	0.01	0.06	1
32	0.00	0.00	0.01	0.09	0.25	0.27	0.10	0.04	0.02	0.22	
33	0.00	0.00	0.00	0.03	0.11	0.18	0.12	0.06	0.03	0.46	1
34	0.00	0.00	0.00	0.01	0.04	0.09	0.09	0.06	0.04	0.68	
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.81	
36	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.03	0.03	0.89	1
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.93	
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.96	1
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.97	1
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	1
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

2009 (season 3)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.92	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
14	0.82	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
15	0.62	0.37	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9
16	0.73	0.27									15
17	0.27	0.73									26
18	0.04	0.96									27
19	0.04	0.88	0.08								24
20		0.74	0.26								46
21		0.65	0.33	0.02							49
22		0.46	0.44	0.10							50
23		0.37	0.50	0.13							30
24		0.08	0.75	0.17							24
25		0.05	0.68	0.26							19
26			0.55	0.45							29
27			0.40	0.60							15
28	0.00	0.01	0.33	0.50	0.16	0.00	0.00	0.00	0.00	0.00	9
29	0.00	0.00	0.21	0.50	0.27	0.01	0.00	0.00	0.00	0.00	8
30	0.00	0.00	0.12	0.42	0.38	0.05	0.01	0.00	0.00	0.01	1
31	0.00	0.00	0.06	0.29	0.40	0.14	0.03	0.01	0.01	0.06	1
32	0.00	0.00	0.02	0.15	0.29	0.21	0.07	0.03	0.02	0.22	4
33	0.00	0.00	0.01	0.05	0.14	0.18	0.09	0.05	0.03	0.45	
34	0.00	0.00	0.00	0.02	0.05	0.10	0.08	0.05	0.04	0.66	
35	0.00	0.00	0.00	0.00	0.02	0.05	0.05	0.04	0.04	0.80	
36	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.03	0.88	3
37	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.03	0.92	3
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.95	2
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	3
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98	3
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	5
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

TABLE 12. (continued)

2010 (season 1)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.15	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.01	0.98	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
14	0.00	0.96	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
15	0.00	0.91	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9
16		0.79	0.21								24
17		0.55	0.45								20
18		0.31	0.69								16
19		0.05	0.85	0.10							20
20		0.04	0.88	0.04	0.04						25
21		0.03	0.72	0.22	0.03						32
22			0.82	0.18							28
23			0.90	0.10							21
24			0.39	0.55	0.06						31
25			0.20	0.73	0.07						30
26			0.32	0.42	0.26						19
27	0.00	0.00	0.12	0.55	0.31	0.02	0.00	0.00	0.00	0.00	8
28			0.10	0.30	0.60						10
29	0.00	0.00	0.03	0.35	0.47	0.15	0.01	0.00	0.00	0.00	6
30	0.00	0.00	0.01	0.23	0.46	0.26	0.03	0.01	0.00	0.01	2
31	0.00	0.00	0.00	0.12	0.36	0.34	0.08	0.02	0.01	0.07	2
32	0.00	0.00	0.00	0.05	0.20	0.30	0.15	0.05	0.02	0.23	1
33	0.00	0.00	0.00	0.01	0.08	0.17	0.15	0.07	0.04	0.48	2
34	0.00	0.00	0.00	0.00	0.03	0.07	0.10	0.07	0.05	0.69	1
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.82	2
36	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.90	1
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.94	2
38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	1
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98	
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	2
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	1
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

2010 (season 2)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.91	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.72	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.34	0.65	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
14	0.08	0.90	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
15		1.00									13
16		1.00									41
17		0.98	0.02								41
18		0.95	0.05								40
19		0.93	0.07								27
20		0.43	0.57								14
21		0.21	0.68	0.11							19
22			0.83	0.17							12
23		0.12	0.82	0.06							17
24			0.80	0.13	0.07						15
25			0.83	0.17							12
26			0.69	0.23	0.08						13
27			0.36	0.45	0.18						11
28	0.00	0.00	0.17	0.52	0.29	0.01	0.00	0.00	0.00	0.00	7
29	0.00	0.00	0.10	0.45	0.39	0.05	0.00	0.00	0.00	0.00	8
30	0.00	0.00	0.05	0.34	0.45	0.14	0.02	0.00	0.00	0.01	1
31	0.00	0.00	0.02	0.21	0.39	0.24	0.05	0.02	0.01	0.06	3
32	0.00	0.00	0.01	0.09	0.25	0.27	0.10	0.04	0.02	0.22	
33	0.00	0.00	0.00	0.03	0.11	0.18	0.12	0.06	0.03	0.46	
34	0.00	0.00	0.00	0.01	0.04	0.09	0.09	0.06	0.04	0.68	1
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.81	
36	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.03	0.03	0.89	
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.93	1
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.96	
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.97	
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

TABLE 12. (continued)

2010 (season 3)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.92	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
14	0.82	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
15	0.62	0.37	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6
16	0.10	0.90									21
17	0.04	0.96									48
18	0.02	0.98									48
19		0.98	0.02								43
20		0.96	0.04								51
21		0.87	0.13								38
22		0.69	0.28	0.03							32
23		0.48	0.48	0.04							23
24		0.18	0.82								11
25		0.07	0.73	0.20							15
26			0.82	0.09	0.09						11
27	0.00	0.02	0.45	0.45	0.08	0.00	0.00	0.00	0.00	0.00	9
28	0.00	0.01	0.33	0.50	0.16	0.00	0.00	0.00	0.00	0.00	8
29	0.00	0.00	0.21	0.50	0.27	0.01	0.00	0.00	0.00	0.00	6
30	0.00	0.00	0.12	0.42	0.38	0.05	0.01	0.00	0.00	0.01	1
31	0.00	0.00	0.06	0.29	0.40	0.14	0.03	0.01	0.01	0.06	
32	0.00	0.00	0.02	0.15	0.29	0.21	0.07	0.03	0.02	0.22	1
33	0.00	0.00	0.01	0.05	0.14	0.18	0.09	0.05	0.03	0.45	
34	0.00	0.00	0.00	0.02	0.05	0.10	0.08	0.05	0.04	0.66	
35	0.00	0.00	0.00	0.00	0.02	0.05	0.05	0.04	0.04	0.80	
36	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.03	0.88	
37	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.03	0.92	
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.95	1
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	1
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98	
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	1
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

2011 (season 1)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.01	0.98	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.00	0.96	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
14	0.00	0.91	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
15		0.82	0.18								17
16		0.46	0.54								28
17		0.30	0.70								10
18			1.00								23
19			1.00								13
20			1.00								22
21			0.94	0.06							17
22			1.00								23
23			0.54	0.46							13
24	0.00	0.00	0.33	0.55	0.12	0.00	0.00	0.00	0.00	0.00	6
25			0.62	0.38							13
26	0.00	0.00	0.12	0.55	0.31	0.02	0.00	0.00	0.00	0.00	8
27	0.00	0.00	0.06	0.46	0.41	0.06	0.00	0.00	0.00	0.00	8
28	0.00	0.00	0.03	0.35	0.47	0.15	0.01	0.00	0.00	0.00	8
29	0.00	0.00	0.01	0.23	0.46	0.26	0.03	0.01	0.00	0.01	7
30	0.00	0.00	0.00	0.12	0.36	0.34	0.08	0.02	0.01	0.07	2
31	0.00	0.00	0.00	0.05	0.20	0.30	0.15	0.05	0.02	0.23	2
32	0.00	0.00	0.00	0.01	0.08	0.17	0.15	0.07	0.04	0.48	
33	0.00	0.00	0.00	0.00	0.03	0.07	0.10	0.07	0.05	0.69	
34	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.82	1
35	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.90	
36	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.94	3
37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	
38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98	2
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

TABLE 12. (continued)

2011 (season 2)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.91	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.72	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.34	0.65	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
14	0.08	0.90	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
15	0.01	0.95	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8
16		0.96	0.02	0.02							51
17		0.95	0.05								65
18		0.92	0.08								59
19		0.85	0.15								41
20		0.76	0.24								25
21		0.35	0.65								26
22		0.16	0.84								38
23			1.00								40
24			0.79	0.21							29
25			0.92	0.08							26
26		0.05	0.55	0.40							20
27		0.06	0.56	0.38							16
28			0.33	0.42	0.17	0.04				0.04	24
29			0.05	0.67	0.24	0.05					21
30				0.58	0.42						12
31	0.00	0.00	0.02	0.21	0.39	0.24	0.05	0.02	0.01	0.06	6
32	0.00	0.00	0.01	0.09	0.25	0.27	0.10	0.04	0.02	0.22	2
33	0.00	0.00	0.00	0.03	0.11	0.18	0.12	0.06	0.03	0.46	1
34	0.00	0.00	0.00	0.01	0.04	0.09	0.09	0.06	0.04	0.68	3
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.81	2
36	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.03	0.03	0.89	2
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.93	4
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.96	3
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.97	1
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	1
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

2011 (season 3)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
12	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
13	0.92	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
14	0.82	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
15	0.62	0.37	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5
16	0.35	0.62	0.04								26
17	0.03	0.97									63
18		1.00									85
19		0.97	0.03								69
20		0.91	0.09								85
21		0.82	0.18								77
22		0.61	0.39								57
23		0.37	0.61	0.02							51
24		0.02	0.91	0.07							57
25		0.04	0.91	0.04							47
26		0.02	0.85	0.11	0.02						47
27			0.67	0.30	0.04						27
28			0.53	0.29	0.18						17
29			0.55	0.27	0.18						11
30			0.29	0.64	0.07						14
31	0.00	0.00	0.06	0.29	0.40	0.14	0.03	0.01	0.01	0.06	3
32	0.00	0.00	0.02	0.15	0.29	0.21	0.07	0.03	0.02	0.22	1
33	0.00	0.00	0.01	0.05	0.14	0.18	0.09	0.05	0.03	0.45	
34	0.00	0.00	0.00	0.02	0.05	0.10	0.08	0.05	0.04	0.66	4
35	0.00	0.00	0.00	0.00	0.02	0.05	0.05	0.04	0.04	0.80	1
36	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.03	0.88	2
37	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.03	0.92	
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.95	
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	1
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98	
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	1
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

TABLE 12. (continued)

2012 (season 1)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.15	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
11	0.01	0.98	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
13	0.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
14	0.00	0.96	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
15		1.00									14
16		0.98	0.02								44
17		0.80	0.20								25
18		0.38	0.63								16
19			1.00								27
20			1.00								51
21		0.02	0.98								64
22			0.94	0.06							49
23			0.81	0.19							27
24			0.29	0.71							21
25			0.30	0.65	0.04						23
26			0.05	0.89		0.05					19
27			0.07	0.93							29
28			0.06	0.83	0.11						18
29				0.76	0.24						17
30				0.70	0.30						10
31	0.00	0.00	0.00	0.12	0.36	0.34	0.08	0.02	0.01	0.07	5
32	0.00	0.00	0.00	0.05	0.20	0.30	0.15	0.05	0.02	0.23	
33	0.00	0.00	0.00	0.01	0.08	0.17	0.15	0.07	0.04	0.48	1
34	0.00	0.00	0.00	0.00	0.03	0.07	0.10	0.07	0.05	0.69	
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.82	
36	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.90	
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.94	
38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	2
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98	
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	1
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

2012 (season 2)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.91	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.72	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
13	0.34	0.65	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
14	0.08	0.90	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
15		1.00									14
16		0.99	0.01								81
17		0.98	0.02								95
18		0.93	0.07								57
19		0.42	0.52	0.06							33
20		0.39	0.61								56
21		0.10	0.90								50
22		0.10	0.86	0.03							59
23		0.04	0.89	0.07							27
24			0.79	0.17	0.03						29
25			0.76	0.24							21
26			0.68	0.32							31
27			0.44	0.56							18
28			0.22	0.72	0.06						18
29		0.09	0.18	0.73							11
30	0.00	0.00	0.05	0.34	0.45	0.14	0.02	0.00	0.00	0.01	5
31	0.00	0.00	0.02	0.21	0.39	0.24	0.05	0.02	0.01	0.06	2
32	0.00	0.00	0.01	0.09	0.25	0.27	0.10	0.04	0.02	0.22	5
33	0.00	0.00	0.00	0.03	0.11	0.18	0.12	0.06	0.03	0.46	2
34	0.00	0.00	0.00	0.01	0.04	0.09	0.09	0.06	0.04	0.68	4
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.81	
36	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.03	0.03	0.89	2
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.93	3
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.96	3
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.97	2
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	3
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	2
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

TABLE 12. (continued)

2012 (season 3)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.92	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
14	0.82	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
15	0.62	0.37	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
16	0.34	0.64	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9
17	0.13	0.83	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7
18	0.04	0.89	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9
19	0.01	0.86	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9
20		1.00									11
21		0.83	0.17								24
22		0.67	0.33								15
23		0.38	0.62								13
24	0.00	0.22	0.63	0.15	0.00	0.00	0.00	0.00	0.00	0.00	9
25	0.00	0.12	0.63	0.25	0.01	0.00	0.00	0.00	0.00	0.00	6
26		0.08	0.75	0.17							12
27	0.00	0.02	0.45	0.45	0.08	0.00	0.00	0.00	0.00	0.00	5
28	0.00	0.01	0.33	0.50	0.16	0.00	0.00	0.00	0.00	0.00	3
29	0.00	0.00	0.21	0.50	0.27	0.01	0.00	0.00	0.00	0.00	
30	0.00	0.00	0.12	0.42	0.38	0.05	0.01	0.00	0.00	0.01	1
31	0.00	0.00	0.06	0.29	0.40	0.14	0.03	0.01	0.01	0.06	1
32	0.00	0.00	0.02	0.15	0.29	0.21	0.07	0.03	0.02	0.22	
33	0.00	0.00	0.01	0.05	0.14	0.18	0.09	0.05	0.03	0.45	1
34	0.00	0.00	0.00	0.02	0.05	0.10	0.08	0.05	0.04	0.66	
35	0.00	0.00	0.00	0.00	0.02	0.05	0.05	0.04	0.04	0.80	
36	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.03	0.88	
37	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.03	0.92	
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.95	
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98	1
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

2013 (season 1)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.15	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.01	0.98	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
14	0.00	0.96	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
15		0.80		0.10	0.10						10
16		0.85	0.15								13
17	0.00	0.69	0.30	0.01	0.00	0.00	0.00	0.00	0.00	0.00	7
18	0.00	0.49	0.49	0.02	0.00	0.00	0.00	0.00	0.00	0.00	8
19		0.27	0.73								11
20			0.90	0.10							21
21			0.92	0.08							25
22		0.09	0.65	0.26							23
23		0.03	0.63	0.28	0.06						32
24			0.68	0.26	0.05						19
25			0.73	0.27							11
26			0.30	0.60	0.10						10
27	0.00	0.00	0.12	0.55	0.31	0.02	0.00	0.00	0.00	0.00	8
28				0.27	0.67	0.07					15
29		0.10	0.10	0.40	0.40						10
30	0.00	0.00	0.01	0.23	0.46	0.26	0.03	0.01	0.00	0.01	6
31	0.00	0.00	0.00	0.12	0.36	0.34	0.08	0.02	0.01	0.07	6
32	0.00	0.00	0.00	0.05	0.20	0.30	0.15	0.05	0.02	0.23	5
33	0.00	0.00	0.00	0.01	0.08	0.17	0.15	0.07	0.04	0.48	5
34	0.00	0.00	0.00	0.00	0.03	0.07	0.10	0.07	0.05	0.69	7
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.82	6
36	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.90	3
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.94	7
38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	9
39				0.10						0.90	10
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	9
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	4
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

TABLE 12. (continued)

2013 (season 2)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.91	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.72	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.34	0.65	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
14	0.08	0.90	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
15		1.00									26
16		1.00									75
17		0.97	0.03								72
18		0.93	0.04	0.02							46
19		0.77	0.23								35
20		0.50	0.50								16
21		0.33	0.67								15
22		0.07	0.79	0.14							14
23			0.60	0.40							10
24			0.63	0.37							19
25			0.56	0.36	0.08						25
26			0.65	0.29	0.06						17
27			0.38	0.62							13
28	0.00	0.00	0.17	0.52	0.29	0.01	0.00	0.00	0.00	0.00	8
29	0.00	0.00	0.10	0.45	0.39	0.05	0.00	0.00	0.00	0.00	6
30	0.00	0.00	0.05	0.34	0.45	0.14	0.02	0.00	0.00	0.01	7
31	0.00	0.00	0.02	0.21	0.39	0.24	0.05	0.02	0.01	0.06	2
32	0.00	0.00	0.01	0.09	0.25	0.27	0.10	0.04	0.02	0.22	
33	0.00	0.00	0.00	0.03	0.11	0.18	0.12	0.06	0.03	0.46	
34	0.00	0.00	0.00	0.01	0.04	0.09	0.09	0.06	0.04	0.68	1
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.81	
36	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.03	0.03	0.89	2
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.93	1
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.96	2
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.97	4
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	1
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	1
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

2013 (season 3)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.92	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
14	0.82	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4
15	0.17	0.83									24
16	0.24	0.76									63
17	0.09	0.91									67
18	0.01	0.99									82
19		0.96	0.04								52
20	0.01	0.93	0.06								71
21		0.88	0.13								56
22		0.73	0.28								40
23		0.33	0.63	0.04							24
24		0.10	0.76	0.14							21
25		0.04	0.52	0.43							23
26			0.74	0.26							23
27			0.57	0.43							23
28			0.63	0.32	0.05						19
29			0.50	0.40	0.10						10
30	0.00	0.00	0.12	0.42	0.38	0.05	0.01	0.00	0.00	0.01	8
31	0.00	0.00	0.06	0.29	0.40	0.14	0.03	0.01	0.01	0.06	
32	0.00	0.00	0.02	0.15	0.29	0.21	0.07	0.03	0.02	0.22	1
33	0.00	0.00	0.01	0.05	0.14	0.18	0.09	0.05	0.03	0.45	1
34	0.00	0.00	0.00	0.02	0.05	0.10	0.08	0.05	0.04	0.66	4
35	0.00	0.00	0.00	0.00	0.02	0.05	0.05	0.04	0.04	0.80	4
36	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.03	0.88	1
37	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.03	0.92	5
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.95	1
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	4
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98	3
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

TABLE 12. (continued)

2014 (season 1)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.15	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.01	0.98	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
14	0.00	0.96	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
15		0.86	0.14								10
16		0.73	0.27								24
17		0.23	0.77								35
18			1.00								43
19		0.02	0.96							0.02	49
20			1.00								65
21		0.01	0.92	0.08							71
22			0.89	0.05	0.07						34
23			0.76	0.19	0.05						32
24			0.58	0.31	0.11						24
25		0.06	0.35	0.47	0.12						26
26			0.17	0.60	0.24						20
27			0.07	0.69	0.24						26
28			0.03	0.72	0.24						17
29				0.50	0.50						12
30	0.00	0.00	0.01	0.23	0.46	0.26	0.03	0.01	0.00	0.01	8
31	0.00	0.00	0.00	0.12	0.36	0.34	0.08	0.02	0.01	0.07	9
32	0.00	0.00	0.00	0.05	0.20	0.30	0.15	0.05	0.02	0.23	4
33	0.00	0.00	0.00	0.01	0.08	0.17	0.15	0.07	0.04	0.48	3
34	0.00	0.00	0.00	0.00	0.03	0.07	0.10	0.07	0.05	0.69	1
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.82	1
36	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.90	3
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.94	2
38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	6
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98	6
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	5
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	1
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1

2014 (season 2)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.91	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.72	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.34	0.65	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
14	0.08	0.90	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
15		0.91	0.09								11
16		0.97	0.03								101
17		0.92	0.08								138
18		0.89	0.11								93
19		0.56	0.42	0.01							71
20		0.27	0.73								67
21		0.09	0.91								79
22		0.08	0.87	0.05							45
23			0.96	0.04							37
24			0.85	0.15							35
25			0.61	0.38	0.01						28
26			0.52	0.44	0.04						25
27			0.24	0.65	0.12						26
28			0.11	0.85	0.01	0.03					15
29			0.16	0.63	0.21						16
30				0.49	0.51						14
31				0.33	0.24	0.21	0.21				10
32				0.38	0.41	0.09		0.12			11
33	0.00	0.00	0.00	0.03	0.11	0.18	0.12	0.06	0.03	0.46	6
34	0.00	0.00	0.00	0.01	0.04	0.09	0.09	0.06	0.04	0.68	2
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.81	5
36	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.03	0.03	0.89	3
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.93	4
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.96	8
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.97	2
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	3
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	3
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

TABLE 12. (continued)

2014 (season 3)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.92	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
14	0.82	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
15	0.62	0.37	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
16	0.41	0.49		0.10							17
17	0.08	0.79	0.05	0.03						0.05	39
18	0.06	0.85	0.03	0.03	0.03						62
19	0.05	0.80	0.07	0.08							42
20		0.84	0.16								40
21		0.77	0.23	0.01							44
22		0.56	0.35	0.09					0.00		41
23		0.24	0.76								28
24		0.28	0.60	0.12							39
25		0.02	0.82	0.04	0.12						22
26		0.11	0.67	0.13	0.06	0.03				0.00	32
27		0.00	0.79	0.21							21
28			0.50	0.49						0.00	19
29		0.01	0.42	0.56						0.01	11
30		0.41	0.01	0.51	0.06	0.00					14
31	0.00	0.00	0.06	0.29	0.40	0.14	0.03	0.01	0.01	0.06	7
32	0.00	0.00	0.02	0.15	0.29	0.21	0.07	0.03	0.02	0.22	8
33	0.00	0.00	0.01	0.05	0.14	0.18	0.09	0.05	0.03	0.45	1
34	0.00	0.00	0.00	0.02	0.05	0.10	0.08	0.05	0.04	0.66	2
35	0.00	0.00	0.00	0.00	0.02	0.05	0.05	0.04	0.04	0.80	2
36	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.03	0.88	5
37	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.03	0.92	7
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.95	6
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	7
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98	5
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	2
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	1
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

2015 (season 1)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.15	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.01	0.98	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
14	0.00	0.96	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
15		1.00									18
16		1.00									37
17		0.84	0.16		0.00						29
18		0.46	0.54								16
19		0.01	0.97	0.01			0.01				25
20			0.98	0.02							43
21			0.97	0.03							43
22			0.83	0.17							27
23			0.55	0.45							30
24		0.01	0.09	0.88	0.03						20
25			0.27	0.71	0.02						31
26			0.02	0.84	0.14						17
27			0.01	0.93	0.06						21
28			0.14	0.63	0.20	0.03					17
29				0.43	0.56	0.01					15
30	0.00	0.00	0.01	0.23	0.46	0.26	0.03	0.01	0.00	0.01	9
31	0.00	0.00	0.00	0.12	0.36	0.34	0.08	0.02	0.01	0.07	6
32	0.00	0.00	0.00	0.05	0.20	0.30	0.15	0.05	0.02	0.23	2
33	0.00	0.00	0.00	0.01	0.08	0.17	0.15	0.07	0.04	0.48	3
34	0.00	0.00	0.00	0.00	0.03	0.07	0.10	0.07	0.05	0.69	1
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.82	2
36	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.90	3
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.94	1
38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	2
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98	7
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	2
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	1
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	2
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

TABLE 12. (continued)

2015 (season 2)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.91	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.72	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.34	0.65	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
14	0.08	0.90	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
15		1.00									36
16		1.00	0.00								120
17		1.00	0.00								112
18		0.85	0.15	0.01							75
19		0.78	0.17	0.04							41
20		0.33	0.62	0.05							37
21		0.09	0.87	0.04							45
22		0.02	0.75	0.22	0.01						47
23		0.01	0.63	0.36	0.01						41
24			0.49	0.51							34
25			0.40	0.55	0.05						26
26			0.26	0.58	0.11	0.05					22
27			0.16	0.73	0.11	0.01					26
28			0.11	0.67	0.22						25
29				0.62	0.24	0.05	0.09				16
30	0.00	0.00	0.05	0.34	0.45	0.14	0.02	0.00	0.00	0.01	4
31	0.00	0.00	0.02	0.21	0.39	0.24	0.05	0.02	0.01	0.06	9
32	0.00	0.00	0.01	0.09	0.25	0.27	0.10	0.04	0.02	0.22	3
33	0.00	0.00	0.00	0.03	0.11	0.18	0.12	0.06	0.03	0.46	1
34	0.00	0.00	0.00	0.01	0.04	0.09	0.09	0.06	0.04	0.68	2
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.81	
36	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.03	0.03	0.89	1
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.93	4
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.96	
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.97	1
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	1
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

2015 (season 3)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.92	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
14	0.82	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
15	0.62	0.37	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9
16	0.12	0.88									46
17	0.05	0.91	0.02	0.02							76
18		0.97	0.03	0.01							78
19		0.96	0.04	0.00							80
20	0.02	0.77	0.16	0.05							80
21		0.65	0.30	0.04	0.01						52
22		0.44	0.45	0.10							46
23		0.09	0.66	0.24							56
24		0.15	0.68	0.16	0.01		0.00				40
25		0.03	0.51	0.42	0.03	0.01					41
26		0.08	0.46	0.46	0.00		0.00				49
27		0.07	0.25	0.63	0.02	0.02					27
28			0.24	0.66	0.08	0.03					16
29		0.11	0.15	0.48	0.26						12
30			0.17	0.51	0.20	0.12					15
31	0.00	0.00	0.06	0.29	0.40	0.14	0.03	0.01	0.01	0.06	9
32	0.00	0.00	0.02	0.15	0.29	0.21	0.07	0.03	0.02	0.22	9
33	0.00	0.00	0.01	0.05	0.14	0.18	0.09	0.05	0.03	0.45	
34	0.00	0.00	0.00	0.02	0.05	0.10	0.08	0.05	0.04	0.66	5
35	0.00	0.00	0.00	0.00	0.02	0.05	0.05	0.04	0.04	0.80	2
36	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.03	0.88	3
37	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.03	0.92	2
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.95	3
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	2
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98	2
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

TABLE 12. (continued)

2016 (season 1)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.15	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.01	0.98	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
14	0.00	0.96	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
15		1.00									25
16		0.96	0.04								39
17		0.80	0.20								32
18		0.41	0.59								24
19		0.12	0.81	0.07							27
20		0.03	0.94	0.03							33
21			0.91	0.07	0.01						31
22			0.98	0.02							17
23		0.02	0.75	0.23							18
24			0.68	0.28	0.04						17
25		0.12	0.14	0.68	0.06						17
26			0.15	0.57	0.23	0.03		0.03			17
27				0.28	0.72						10
28			0.01	0.61	0.38						13
29				0.41	0.59	0.00					15
30	0.00	0.00	0.01	0.23	0.46	0.26	0.03	0.01	0.00	0.01	7
31	0.00	0.00	0.00	0.12	0.36	0.34	0.08	0.02	0.01	0.07	1
32	0.00	0.00	0.00	0.05	0.20	0.30	0.15	0.05	0.02	0.23	1
33	0.00	0.00	0.00	0.01	0.08	0.17	0.15	0.07	0.04	0.48	4
34	0.00	0.00	0.00	0.00	0.03	0.07	0.10	0.07	0.05	0.69	
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.82	1
36	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.90	5
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.94	1
38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	3
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98	
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

2016 (season 2)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.91	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.72	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.34	0.65	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
14	0.08	0.90	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
15	0.06	0.80	0.15								26
16		0.95	0.03		0.02						110
17		0.92	0.06	0.01	0.02						97
18		0.86	0.09	0.02	0.03						69
19		0.66	0.32	0.01							40
20		0.46	0.54								72
21		0.39	0.55	0.07							39
22		0.23	0.77								35
23		0.08	0.81	0.03	0.07						40
24			0.71	0.17	0.10			0.03			33
25			0.80	0.18	0.02						29
26			0.38	0.43	0.19						26
27			0.30	0.59	0.11						19
28			0.17	0.47	0.31	0.05					19
29				0.25	0.75						16
30		0.21	0.06	0.08	0.65						14
31	0.00	0.00	0.02	0.21	0.39	0.24	0.05	0.02	0.01	0.06	1
32	0.00	0.00	0.01	0.09	0.25	0.27	0.10	0.04	0.02	0.22	6
33	0.00	0.00	0.00	0.03	0.11	0.18	0.12	0.06	0.03	0.46	3
34	0.00	0.00	0.00	0.01	0.04	0.09	0.09	0.06	0.04	0.68	3
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.81	2
36	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.03	0.03	0.89	3
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.93	2
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.96	2
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.97	2
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

TABLE 12. (continued)

2016 (season 3)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
12	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.92	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
14	0.82	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4
15	0.51	0.49									16
16	0.48	0.52									45
17	0.22	0.75	0.04								48
18	0.04	0.86	0.07	0.02							63
19	0.02	0.92	0.06								61
20	0.01	0.90	0.08	0.01							67
21	0.00	0.72	0.26	0.02							60
22	0.02	0.70	0.25	0.03							44
23		0.44	0.52		0.04						49
24		0.43	0.43	0.14							52
25		0.25	0.63	0.09	0.03						41
26		0.09	0.83	0.08							27
27		0.03	0.70	0.28							31
28			0.33	0.31	0.25	0.11					20
29			0.22	0.36	0.42						13
30	0.00	0.00	0.12	0.42	0.38	0.05	0.01	0.00	0.00	0.01	9
31	0.00	0.00	0.06	0.29	0.40	0.14	0.03	0.01	0.01	0.06	5
32	0.00	0.00	0.02	0.15	0.29	0.21	0.07	0.03	0.02	0.22	8
33	0.00	0.00	0.01	0.05	0.14	0.18	0.09	0.05	0.03	0.45	4
34	0.00	0.00	0.00	0.02	0.05	0.10	0.08	0.05	0.04	0.66	2
35	0.00	0.00	0.00	0.00	0.02	0.05	0.05	0.04	0.04	0.80	1
36	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.03	0.88	4
37	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.03	0.92	
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.95	1
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98	
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	1
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	1
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	1
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

2017 (season 1)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.15	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.01	0.98	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
14	0.00	0.96	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
15		1.00									43
16		0.97	0.02	0.01							122
17		0.92	0.06		0.02						96
18		0.83	0.12	0.04							54
19		0.58	0.35	0.07							20
20		0.11	0.81	0.08							19
21		0.05	0.83	0.07	0.04						35
22			0.91	0.09							27
23		0.06	0.81	0.11	0.01						46
24		0.01	0.73	0.23	0.03						39
25			0.88	0.12							31
26			0.48	0.47	0.05						16
27			0.22	0.74	0.01	0.03					17
28		0.11	0.28	0.46	0.14						12
29				0.65	0.09	0.27					13
30	0.00	0.00	0.01	0.23	0.46	0.26	0.03	0.01	0.00	0.01	6
31	0.00	0.00	0.00	0.12	0.36	0.34	0.08	0.02	0.01	0.07	7
32	0.00	0.00	0.00	0.05	0.20	0.30	0.15	0.05	0.02	0.23	4
33	0.00	0.00	0.00	0.01	0.08	0.17	0.15	0.07	0.04	0.48	
34	0.00	0.00	0.00	0.00	0.03	0.07	0.10	0.07	0.05	0.69	
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.82	1
36	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.90	1
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.94	
38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	2
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98	2
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	1
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	2
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

TABLE 12. (continued)

2017 (season 2)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.91	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.72	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
13	0.34	0.65	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
14	0.08	0.90	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
15		1.00									32
16		0.99	0.01								110
17	0.00	0.98	0.02								123
18	0.00	0.98	0.02								111
19	0.02	0.95	0.03								86
20		0.96	0.04								66
21	0.07	0.68	0.23	0.00	0.02						35
22		0.39	0.57	0.01	0.03						23
23		0.23	0.77								15
24		0.17	0.83								16
25		0.05	0.86	0.04	0.04						21
26		0.04	0.91	0.04							24
27		0.05	0.72	0.24							17
28	0.00	0.00	0.17	0.52	0.29	0.01	0.00	0.00	0.00	0.00	9
29			0.26	0.56	0.18						11
30	0.00	0.00	0.05	0.34	0.45	0.14	0.02	0.00	0.00	0.01	5
31	0.00	0.00	0.02	0.21	0.39	0.24	0.05	0.02	0.01	0.06	5
32	0.00	0.00	0.01	0.09	0.25	0.27	0.10	0.04	0.02	0.22	2
33	0.00	0.00	0.00	0.03	0.11	0.18	0.12	0.06	0.03	0.46	2
34	0.00	0.00	0.00	0.01	0.04	0.09	0.09	0.06	0.04	0.68	1
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.81	2
36	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.03	0.03	0.89	1
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.93	1
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.96	1
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.97	1
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	2
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	1
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

2017 (season 3)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
13	0.92	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
14	0.82	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
15	0.39	0.61									10
16	0.12	0.88									38
17		0.97	0.03								71
18		0.95	0.05								84
19	0.02	0.98	0.00								83
20		0.96	0.04								84
21	0.01	0.93	0.06								85
22		0.89	0.10	0.02							58
23		0.78	0.22	0.01							60
24		0.44	0.44	0.05	0.07						37
25		0.23	0.73	0.04							33
26		0.13	0.76	0.08	0.03						28
27			0.83	0.11			0.06				14
28		0.05	0.48	0.47							19
29			0.53	0.41		0.07					15
30	0.00	0.00	0.12	0.42	0.38	0.05	0.01	0.00	0.00	0.01	6
31	0.00	0.00	0.06	0.29	0.40	0.14	0.03	0.01	0.01	0.06	2
32	0.00	0.00	0.02	0.15	0.29	0.21	0.07	0.03	0.02	0.22	2
33	0.00	0.00	0.01	0.05	0.14	0.18	0.09	0.05	0.03	0.45	1
34	0.00	0.00	0.00	0.02	0.05	0.10	0.08	0.05	0.04	0.66	1
35	0.00	0.00	0.00	0.00	0.02	0.05	0.05	0.04	0.04	0.80	1
36	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.03	0.88	
37	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.03	0.92	2
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.95	1
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98	2
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	1
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

TABLE 12. (continued)

2018 (season 1)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.15	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.01	0.98	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
14	0.00	0.96	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
15		0.92	0.08								33
16		0.90	0.10								67
17		0.86	0.14								50
18		0.33	0.67								38
19		0.11	0.89				0.00				35
20		0.03	0.95	0.02							60
21		0.05	0.89	0.06							59
22		0.02	0.98								58
23			0.98	0.02							55
24		0.02	0.81	0.17							45
25			0.60	0.34	0.06		0.00				45
26			0.41	0.55	0.04						27
27			0.17	0.58	0.25						15
28			0.13	0.71	0.09		0.08				21
29			0.03	0.49	0.30	0.15	0.03				25
30	0.00	0.00	0.01	0.23	0.46	0.26	0.03	0.01	0.00	0.01	4
31				0.29	0.71						11
32	0.00	0.00	0.00	0.05	0.20	0.30	0.15	0.05	0.02	0.23	2
33	0.00	0.00	0.00	0.01	0.08	0.17	0.15	0.07	0.04	0.48	3
34	0.00	0.00	0.00	0.00	0.03	0.07	0.10	0.07	0.05	0.69	1
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.82	1
36	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.90	1
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.94	
38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	1
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98	
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	1
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	1
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

2018 (season 2)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.91	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
12	0.72	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.34	0.65	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
14	0.08	0.90	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4
15		0.99	0.01								54
16		0.97	0.03								256
17	0.00	0.96	0.03								237
18		0.90	0.10								167
19		0.69	0.31								120
20		0.44	0.54	0.02							73
21		0.21	0.78	0.01							44
22		0.15	0.79	0.06	0.00						53
23		0.06	0.91	0.03							56
24		0.00	0.94	0.06							60
25			0.89	0.11							61
26			0.76	0.23	0.00						45
27			0.69	0.23	0.08						29
28			0.66	0.13	0.11	0.10					19
29			0.06	0.69	0.19	0.06					10
30				0.59	0.41						12
31	0.00	0.00	0.02	0.21	0.39	0.24	0.05	0.02	0.01	0.06	5
32	0.00	0.00	0.01	0.09	0.25	0.27	0.10	0.04	0.02	0.22	2
33	0.00	0.00	0.00	0.03	0.11	0.18	0.12	0.06	0.03	0.46	2
34	0.00	0.00	0.00	0.01	0.04	0.09	0.09	0.06	0.04	0.68	2
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.81	2
36	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.03	0.03	0.89	2
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.93	6
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.96	8
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.97	8
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	4
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	2
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

TABLE 12. (continued)

2018 (season 3)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
13	0.92	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
14	0.82	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
15	0.45	0.55									12
16	0.24	0.74	0.02								45
17	0.07	0.93	0.00								103
18	0.00	0.95	0.05								97
19	0.01	0.94	0.05								109
20		0.96	0.04								101
21	0.00	0.74	0.26								81
22		0.60	0.40								56
23	0.00	0.22	0.77	0.01							50
24		0.10	0.84	0.06							50
25		0.06	0.94	0.00	0.00						42
26			0.92	0.08							33
27			0.80	0.20							26
28			0.99	0.01							10
29	0.00	0.00	0.21	0.50	0.27	0.01	0.00	0.00	0.00	0.00	6
30	0.00	0.00	0.12	0.42	0.38	0.05	0.01	0.00	0.00	0.01	3
31	0.00	0.00	0.06	0.29	0.40	0.14	0.03	0.01	0.01	0.06	2
32	0.00	0.00	0.02	0.15	0.29	0.21	0.07	0.03	0.02	0.22	1
33	0.00	0.00	0.01	0.05	0.14	0.18	0.09	0.05	0.03	0.45	1
34	0.00	0.00	0.00	0.02	0.05	0.10	0.08	0.05	0.04	0.66	
35	0.00	0.00	0.00	0.00	0.02	0.05	0.05	0.04	0.04	0.80	1
36	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.03	0.88	4
37	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.03	0.92	2
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.95	1
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	3
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98	3
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	1
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

2019 (season 1)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.15	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.01	0.98	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
12	0.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
14	0.00	0.96	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
15		0.81	0.19								22
16		0.69	0.31								50
17		0.36	0.64								54
18		0.08	0.92								44
19		0.00	0.99	0.01							46
20			1.00	0.00							52
21			0.81	0.16	0.04						47
22			0.88	0.12							51
23			0.72	0.28							37
24			0.51	0.49							22
25			0.38	0.62							17
26			0.27	0.59	0.14						13
27	0.00	0.00	0.12	0.55	0.31	0.02	0.00	0.00	0.00	0.00	9
28	0.00	0.00	0.06	0.46	0.41	0.06	0.00	0.00	0.00	0.00	8
29	0.00	0.00	0.03	0.35	0.47	0.15	0.01	0.00	0.00	0.00	9
30	0.00	0.00	0.01	0.23	0.46	0.26	0.03	0.01	0.00	0.01	3
31	0.00	0.00	0.00	0.12	0.36	0.34	0.08	0.02	0.01	0.07	4
32	0.00	0.00	0.00	0.05	0.20	0.30	0.15	0.05	0.02	0.23	3
33	0.00	0.00	0.00	0.01	0.08	0.17	0.15	0.07	0.04	0.48	2
34	0.00	0.00	0.00	0.00	0.03	0.07	0.10	0.07	0.05	0.69	1
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.82	1
36	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.90	3
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.94	2
38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	6
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98	2
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	5
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	1
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1

TABLE 12. (continued)

2019 (season 2)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.91	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.72	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
13	0.34	0.65	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
14	0.08	0.90	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4
15		1.00									48
16		0.97	0.03								119
17		0.94	0.06								129
18		0.74	0.24	0.02							81
19		0.55	0.45								54
20		0.18	0.79	0.03							48
21		0.10	0.89	0.01							62
22		0.03	0.94	0.03							59
23		0.06	0.86	0.08							61
24			0.89	0.11							42
25			0.74	0.26							41
26			0.56	0.44							22
27			0.19	0.78					0.03		12
28			0.19	0.51	0.31						15
29			0.19	0.79		0.02					10
30	0.00	0.00	0.05	0.34	0.45	0.14	0.02	0.00	0.00	0.01	3
31	0.00	0.00	0.02	0.21	0.39	0.24	0.05	0.02	0.01	0.06	6
32	0.00	0.00	0.01	0.09	0.25	0.27	0.10	0.04	0.02	0.22	3
33	0.00	0.00	0.00	0.03	0.11	0.18	0.12	0.06	0.03	0.46	5
34	0.00	0.00	0.00	0.01	0.04	0.09	0.09	0.06	0.04	0.68	
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.81	4
36	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.03	0.03	0.89	5
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.93	2
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.96	
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.97	1
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

2019 (season 3)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
13	0.92	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
14	0.82	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
15	0.22	0.78									21
16	0.28	0.68	0.03								69
17	0.08	0.92	0.00								80
18	0.03	0.89	0.06	0.01							100
19		0.85	0.15	0.00							102
20		0.68	0.29	0.02							86
21		0.39	0.61								61
22		0.36	0.62	0.02							70
23		0.18	0.77	0.03		0.01					71
24		0.05	0.85	0.10							84
25		0.03	0.86	0.11							68
26			0.81	0.19							40
27		0.03	0.54	0.42	0.01						56
28			0.54	0.39	0.07						28
29			0.46	0.54							14
30	0.00	0.00	0.12	0.42	0.38	0.05	0.01	0.00	0.00	0.01	7
31	0.00	0.00	0.06	0.29	0.40	0.14	0.03	0.01	0.01	0.06	5
32	0.00	0.00	0.02	0.15	0.29	0.21	0.07	0.03	0.02	0.22	3
33	0.00	0.00	0.01	0.05	0.14	0.18	0.09	0.05	0.03	0.45	2
34	0.00	0.00	0.00	0.02	0.05	0.10	0.08	0.05	0.04	0.66	4
35	0.00	0.00	0.00	0.00	0.02	0.05	0.05	0.04	0.04	0.80	2
36	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.03	0.88	
37	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.03	0.92	
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.95	1
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98	
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	1
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

TABLE 12. (continued)

2020 (season 1)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.15	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.01	0.98	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
14	0.00	0.96	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
15		0.76	0.24								14
16		1.00									37
17		0.66	0.25	0.09							31
18		0.48	0.52								17
19		0.08	0.92								11
20		0.05	0.86	0.09							27
21			0.86	0.14							19
22			0.80	0.20							20
23			0.30	0.70							13
24			0.54	0.46							23
25			0.35	0.48	0.17						14
26			0.18	0.77	0.05						24
27			0.08	0.82	0.10						16
28	0.00	0.00	0.06	0.46	0.41	0.06	0.00	0.00	0.00	0.00	9
29	0.00	0.00	0.03	0.35	0.47	0.15	0.01	0.00	0.00	0.00	8
30	0.00	0.00	0.01	0.23	0.46	0.26	0.03	0.01	0.00	0.01	5
31	0.00	0.00	0.00	0.12	0.36	0.34	0.08	0.02	0.01	0.07	6
32	0.00	0.00	0.00	0.05	0.20	0.30	0.15	0.05	0.02	0.23	2
33	0.00	0.00	0.00	0.01	0.08	0.17	0.15	0.07	0.04	0.48	2
34	0.00	0.00	0.00	0.00	0.03	0.07	0.10	0.07	0.05	0.69	
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.82	
36	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.90	
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.94	
38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98	2
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

2020 (season 2)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.91	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.72	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.34	0.65	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
14	0.08	0.90	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
15		0.91	0.09								28
16		0.86	0.14								91
17		0.89	0.10	0.01							122
18		0.81	0.19								93
19		0.75	0.25								63
20		0.33	0.63	0.05							50
21		0.35	0.55	0.09							42
22		0.13	0.82	0.05							27
23		0.07	0.82	0.10	0.01						24
24		0.01	0.78	0.21							24
25			0.73	0.27							23
26			0.25	0.67	0.08						15
27			0.27	0.38	0.34	0.02					17
28			0.30	0.36	0.34						13
29	0.00	0.00	0.10	0.45	0.39	0.05	0.00	0.00	0.00	0.00	8
30	0.00	0.00	0.05	0.34	0.45	0.14	0.02	0.00	0.00	0.01	4
31	0.00	0.00	0.02	0.21	0.39	0.24	0.05	0.02	0.01	0.06	6
32	0.00	0.00	0.01	0.09	0.25	0.27	0.10	0.04	0.02	0.22	2
33	0.00	0.00	0.00	0.03	0.11	0.18	0.12	0.06	0.03	0.46	2
34	0.00	0.00	0.00	0.01	0.04	0.09	0.09	0.06	0.04	0.68	
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.81	1
36	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.03	0.03	0.89	1
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.93	3
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.96	1
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.97	4
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	5
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	1
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	1
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

TABLE 12. (continued)

2020 (season 3)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.92	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
14	0.82	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
15	0.84		0.16								11
16	0.48	0.27	0.25								42
17	0.53	0.33	0.14								25
18	0.08	0.77	0.15								31
19	0.01	0.95	0.04								42
20	0.03	0.91	0.06								31
21		0.94	0.06								35
22	0.05	0.54	0.35	0.05							39
23		0.79	0.21								32
24		0.26	0.68	0.07							46
25		0.27	0.59	0.14							30
26		0.11	0.71	0.18							32
27		0.09	0.66	0.25							21
28		0.03	0.31	0.66							22
29			0.64	0.22	0.14						12
30	0.00	0.00	0.12	0.42	0.38	0.05	0.01	0.00	0.00	0.01	7
31	0.00	0.00	0.06	0.29	0.40	0.14	0.03	0.01	0.01	0.06	6
32	0.00	0.00	0.02	0.15	0.29	0.21	0.07	0.03	0.02	0.22	4
33	0.00	0.00	0.01	0.05	0.14	0.18	0.09	0.05	0.03	0.45	3
34	0.00	0.00	0.00	0.02	0.05	0.10	0.08	0.05	0.04	0.66	3
35	0.00	0.00	0.00	0.00	0.02	0.05	0.05	0.04	0.04	0.80	5
36	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.03	0.88	6
37						0.10				0.90	10
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.95	4
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	3
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98	2
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	1
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

2021 (season 1)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.15	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.01	0.98	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
14	0.00	0.96	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
15		1.00									36
16		0.93	0.06		0.01						78
17		0.96	0.04								69
18		0.82	0.14	0.04							38
19		0.53	0.47								32
20		0.20	0.80								30
21		0.06	0.90	0.04							34
22			0.98		0.02						35
23		0.01	0.85	0.12	0.02						40
24		0.01	0.71	0.13	0.16						31
25			0.31	0.46	0.14	0.10					27
26			0.35	0.49	0.16						14
27			0.19	0.69	0.07	0.05					25
28			0.18	0.30	0.45	0.07					19
29		0.04	0.04	0.31	0.60						13
30	0.00	0.00	0.01	0.23	0.46	0.26	0.03	0.01	0.00	0.01	9
31	0.00	0.00	0.00	0.12	0.36	0.34	0.08	0.02	0.01	0.07	6
32	0.00	0.00	0.00	0.05	0.20	0.30	0.15	0.05	0.02	0.23	5
33	0.00	0.00	0.00	0.01	0.08	0.17	0.15	0.07	0.04	0.48	
34	0.00	0.00	0.00	0.00	0.03	0.07	0.10	0.07	0.05	0.69	1
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.82	2
36	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.90	1
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.94	3
38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	1
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98	6
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	2
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	1
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

TABLE 12. (continued)

2021 (season 2)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.91	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.72	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.34	0.65	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
14	0.08	0.90	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
15		1.00									17
16	0.01	0.99									80
17		0.99	0.01								125
18		1.00	0.00								140
19		0.97	0.02	0.02							110
20		0.93	0.07	0.00							81
21		0.74	0.18	0.09							60
22		0.57	0.36	0.06							48
23		0.22	0.67	0.11							39
24		0.01	0.91	0.09							37
25			0.82	0.13	0.05						23
26		0.09	0.54	0.34	0.03						34
27			0.44	0.45	0.05	0.06					30
28			0.48	0.46	0.06						15
29		0.05	0.28	0.53	0.08	0.06					14
30			0.01	0.67	0.29		0.02				12
31	0.00	0.00	0.02	0.21	0.39	0.24	0.05	0.02	0.01	0.06	8
32	0.00	0.00	0.01	0.09	0.25	0.27	0.10	0.04	0.02	0.22	7
33	0.00	0.00	0.00	0.03	0.11	0.18	0.12	0.06	0.03	0.46	4
34	0.00	0.00	0.00	0.01	0.04	0.09	0.09	0.06	0.04	0.68	1
35	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.05	0.04	0.81	4
36	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.03	0.03	0.89	1
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.93	
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.96	1
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.97	2
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	1
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	1
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	2
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

2021 (season 3)

TL_IN	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	total
10	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
13	0.92	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
14	0.82	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
15	0.93				0.07						15
16	0.89	0.07	0.03								42
17	0.68	0.29		0.04							42
18	0.23	0.68	0.09								33
19	0.05	0.82	0.13								33
20	0.02	0.94		0.04							44
21		0.93	0.04	0.03							54
22	0.03	0.81	0.16								43
23	0.02	0.75	0.19	0.03							58
24		0.52	0.39	0.09							38
25		0.40	0.56	0.04							40
26		0.35	0.44	0.21							39
27		0.28	0.43	0.29	0.00						39
28		0.22	0.32	0.46							25
29		0.08	0.51	0.37	0.05						20
30		0.25	0.22	0.37	0.17						14
31			0.13	0.20	0.60	0.07					16
32	0.00	0.00	0.02	0.15	0.29	0.21	0.07	0.03	0.02	0.22	7
33	0.00	0.00	0.01	0.05	0.14	0.18	0.09	0.05	0.03	0.45	4
34	0.00	0.00	0.00	0.02	0.05	0.10	0.08	0.05	0.04	0.66	5
35	0.00	0.00	0.00	0.00	0.02	0.05	0.05	0.04	0.04	0.80	2
36	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.03	0.88	4
37	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.03	0.92	2
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.95	3
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97	2
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98	
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.98	1
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	1
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99	
44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

TABLE 13. Annual recreational Red Drum catch-at-age (harvest + dead discards) as numbers of fish and yield in pounds used as inputs of the ASAP base model.

	Recreational										
Year	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	Yield (lbs)
1982	490,379	406,163	238,310	80,678	13,789	512	65	24	12	124	2,351,778
1983	982,417	640,810	77,836	22,487	10,754	2,352	524	182	88	950	2,335,466
1984	475,519	486,993	97,647	22,579	2,599	523	193	94	71	2,882	1,783,195
1985	341,920	398,575	131,424	34,451	10,803	1,749	419	266	218	6,530	1,817,233
1986	476,084	315,141	84,439	20,388	4,931	803	213	88	51	1,441	1,378,567
1987	484,539	441,583	87,559	19,782	4,453	1,014	526	377	322	12,367	1,846,816
1988	73,363	309,148	87,263	13,857	1,355	150	39	24	29	3,211	1,114,779
1989	70,397	440,666	223,926	61,535	13,602	2,620	914	542	421	11,786	2,786,333
1990	50,195	263,892	184,041	58,122	8,051	1,298	411	321	358	18,138	2,213,214
1991	169,767	344,297	174,211	75,934	19,711	1,993	398	190	137	3,792	2,458,057
1992	111,243	723,480	227,139	50,912	14,464	1,981	354	212	194	8,332	3,003,262
1993	112,314	553,476	333,790	95,834	17,470	3,512	938	507	388	15,029	3,724,493
1994	64,383	431,764	367,753	128,442	23,464	2,128	635	370	296	12,381	3,746,849
1995	91,857	879,308	465,222	161,253	36,783	4,977	1,288	667	511	17,609	5,749,211
1996	59,061	539,358	548,144	205,996	47,091	6,952	1,475	786	617	25,587	5,660,025
1997	92,150	509,772	404,372	195,047	52,725	8,820	2,147	1,208	1,033	46,857	5,913,754
1998	102,367	646,762	316,794	117,521	30,346	5,050	1,724	1,102	937	36,290	4,569,354
1999	112,701	728,752	480,604	163,821	43,587	8,081	2,189	1,120	828	27,660	5,709,160
2000	106,754	804,657	560,350	237,174	67,020	11,499	2,566	1,186	809	32,196	7,199,702
2001	79,193	859,290	631,104	220,521	55,918	10,799	2,381	1,263	969	33,278	7,107,845
2002	176,011	624,979	421,575	168,899	34,532	11,405	2,569	1,505	1,314	61,345	6,263,101
2003	137,110	541,505	368,652	183,085	43,527	12,062	3,111	1,544	1,153	41,953	5,728,435
2004	85,928	562,996	268,031	124,622	35,287	4,758	2,099	1,756	1,773	75,120	5,262,071
2005	133,705	451,010	232,369	95,725	29,942	10,892	2,165	1,108	969	39,564	4,299,753
2006	107,676	654,274	179,265	70,311	15,985	5,805	2,010	1,232	1,151	46,010	4,715,369
2007	87,905	710,794	431,827	86,973	29,268	9,037	3,796	1,392	994	27,818	5,502,870
2008	98,430	662,295	622,068	115,554	20,346	4,458	1,685	952	1,403	22,837	5,698,988
2009	138,168	705,788	512,695	265,557	41,230	7,531	2,480	1,249	863	21,995	6,540,034
2010	85,870	1,087,728	654,421	202,708	72,235	8,244	2,206	1,393	1,158	34,919	7,723,879
2011	69,423	910,686	813,571	145,694	31,495	8,329	2,988	1,482	928	21,137	7,618,956
2012	86,739	714,744	515,575	152,796	23,529	4,898	1,482	888	766	30,107	5,870,340
2013	104,725	1,100,334	475,188	191,932	59,418	14,692	4,571	2,551	1,865	50,279	7,500,684
2014	87,931	543,062	531,992	140,748	37,471	8,800	3,869	1,727	1,216	42,902	5,802,226
2015	75,969	618,561	328,569	237,402	41,053	12,929	4,758	1,833	1,299	35,880	5,459,462
2016	93,690	525,955	328,712	86,991	60,024	7,863	2,236	2,032	871	22,266	4,344,263
2017	82,037	1,202,342	342,406	76,621	25,658	10,318	3,116	1,275	871	22,582	5,902,240
2018	95,092	1,170,988	675,524	96,261	28,936	7,630	3,175	1,115	968	34,506	7,175,799
2019	58,711	507,748	586,005	110,370	19,842	7,826	2,492	1,223	1,083	15,692	4,598,094
2020	76,361	518,590	343,176	131,829	29,689	8,451	2,113	911	572	14,888	4,099,834
2021	58,517	421,405	171,283	69,618	24,370	8,209	2,001	970	657	16,532	3,234,525

TABLE 14. Annual inshore and offshore commercial Red Drum catch-at-age compositions (proportion at age) and yield in pounds used as inputs of the ASAP base model.

Commercial Inshore											
Year	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	Yield (lbs)
1982	0.000	0.171	0.549	0.222	0.050	0.004	0.000	0.000	0.000	0.003	1,278,130
1983	0.000	0.171	0.549	0.222	0.050	0.004	0.000	0.000	0.000	0.003	1,761,350
1984	0.000	0.171	0.549	0.222	0.050	0.004	0.000	0.000	0.000	0.003	2,247,680
1985	0.000	0.171	0.549	0.222	0.050	0.004	0.000	0.000	0.000	0.003	2,229,310
1986	0.000	0.171	0.549	0.222	0.050	0.004	0.000	0.000	0.000	0.003	4,465,900
1987	0.000	0.171	0.549	0.222	0.050	0.004	0.000	0.000	0.000	0.003	4,528,900
1988	0.000	0.171	0.549	0.222	0.050	0.004	0.000	0.000	0.000	0.003	243,590
1989	0.000	0.171	0.549	0.222	0.050	0.004	0.000	0.000	0.000	0.003	24,810
1990	0.000	0.171	0.549	0.222	0.050	0.004	0.000	0.000	0.000	0.003	2,410
1991	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
1992	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
1993	0.000	0.171	0.549	0.222	0.050	0.004	0.000	0.000	0.000	0.003	1,880
1994	0.000	0.171	0.549	0.222	0.050	0.004	0.000	0.000	0.000	0.003	2,960
1995	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
1996	0.000	0.171	0.549	0.222	0.050	0.004	0.000	0.000	0.000	0.003	1,930
1997	0.000	0.171	0.549	0.222	0.050	0.004	0.000	0.000	0.000	0.003	2,200
1998	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
1999	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2000	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2001	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2002	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2003	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2004	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2005	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2006	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2007	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2008	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2009	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2010	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2011	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2012	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2013	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2014	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2015	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2016	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2017	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2018	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2019	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2020	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2021	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0

Commercial Offshore											
Year	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+	Yield (lbs)
1982	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	492,110
1983	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	728,450
1984	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1,347,900
1985	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	3,777,810
1986	0.000	0.012	0.049	0.058	0.039	0.048	0.055	0.051	0.027	0.662	9,259,810
1987	0.000	0.010	0.038	0.041	0.053	0.045	0.033	0.049	0.057	0.674	134,530
1988	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	5,440
1989	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
1990	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
1991	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
1992	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
1993	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
1994	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
1995	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
1996	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
1997	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
1998	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
1999	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2000	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2001	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2002	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2003	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2004	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2005	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2006	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2007	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2008	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2009	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2010	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2011	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2012	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2013	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2014	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2015	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2016	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2017	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2018	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2019	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2020	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
2021	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0

TABLE 15. Annual mean weights-at-age in pounds of recreational and commercial inshore and commercial offshore Red Drum landings used as inputs in the ASAP base model.

Recreational

Year	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+
1982	0.59	1.74	3.54	5.18	6.32	8.67	11.51	11.75	11.84	11.92
1983	0.85	1.47	3.25	7.23	9.38	10.58	10.90	10.93	10.95	11.18
1984	0.91	1.55	3.81	5.77	7.64	11.31	12.56	14.39	17.12	21.80
1985	0.80	1.68	3.22	6.16	8.02	10.13	13.15	15.11	16.49	18.62
1986	0.75	1.67	3.42	6.01	7.95	10.83	11.92	12.49	13.87	22.05
1987	0.92	1.54	3.20	5.29	7.61	12.34	14.60	15.71	17.36	21.63
1988	0.97	1.85	3.47	5.26	7.94	10.82	12.41	16.60	21.23	26.15
1989	0.99	2.40	3.97	6.19	8.43	11.26	13.28	15.02	16.29	18.53
1990	1.20	2.29	4.06	5.54	7.46	11.02	13.64	17.28	19.28	21.30
1991	1.02	2.23	4.42	6.48	7.98	10.07	11.99	13.81	15.67	18.46
1992	0.91	2.09	3.37	5.96	7.86	9.69	12.55	15.64	17.98	21.47
1993	0.86	2.24	3.94	5.50	7.93	10.65	12.83	14.63	16.48	23.10
1994	0.87	2.31	3.98	5.64	7.45	10.61	12.99	14.81	16.91	23.13
1995	1.07	2.33	4.07	6.00	7.78	10.46	12.53	14.59	16.54	20.83
1996	0.93	2.36	3.92	5.61	7.52	9.99	12.72	14.68	17.00	22.13
1997	0.83	2.28	4.46	6.31	8.07	10.48	12.71	15.20	17.73	22.55
1998	0.92	2.11	3.98	6.13	7.95	10.95	13.48	15.49	17.23	21.33
1999	0.94	2.26	3.92	6.04	8.39	10.77	12.47	14.14	16.01	20.79
2000	0.95	2.34	4.11	6.12	8.03	10.34	12.23	13.54	15.58	23.22
2001	0.90	2.29	3.92	5.76	8.20	10.32	12.53	14.57	16.44	20.91
2002	1.32	2.42	4.01	5.98	8.24	10.16	12.96	15.29	17.74	21.77
2003	1.32	2.45	4.27	6.23	8.84	10.74	12.38	14.26	16.54	21.69
2004	1.17	2.28	4.27	6.14	7.63	11.42	14.32	16.79	18.30	20.70
2005	1.44	2.44	4.72	6.91	8.41	9.41	12.52	15.50	17.68	21.05
2006	1.12	2.83	5.72	6.84	9.37	10.59	12.93	16.44	18.35	20.83
2007	0.99	2.32	4.98	7.31	9.31	11.17	11.54	14.20	15.84	19.16
2008	1.00	2.26	4.15	6.97	8.32	11.37	13.01	14.82	12.02	19.45
2009	1.05	2.26	4.30	6.32	8.96	11.38	12.59	13.89	15.29	18.32
2010	0.72	2.14	4.18	6.09	7.70	10.45	13.32	15.47	16.81	18.74
2011	0.83	2.27	4.54	6.72	8.72	11.18	12.92	13.52	14.37	17.94
2012	0.91	2.31	4.14	6.95	9.13	10.77	12.94	15.36	17.49	20.98
2013	0.93	2.08	4.51	6.39	8.65	10.90	13.03	14.50	15.75	18.70
2014	0.99	2.41	4.02	6.77	8.03	10.96	12.40	14.50	15.96	19.27
2015	0.84	2.02	4.16	6.26	8.79	10.63	11.57	14.26	15.66	19.36
2016	1.04	2.38	4.18	6.60	7.98	10.63	13.01	10.76	15.47	18.90
2017	0.88	2.29	5.02	7.17	8.14	10.66	11.69	13.97	15.35	18.68
2018	0.85	2.04	4.33	7.03	9.10	10.12	11.15	15.81	17.39	20.14
2019	0.86	1.95	3.89	6.27	9.05	10.88	12.69	13.63	12.49	16.70
2020	1.14	2.25	3.97	6.09	8.71	10.66	12.11	13.28	14.83	19.10
2021	1.40	2.70	5.06	7.02	8.89	10.28	12.67	13.93	15.13	18.65

Commercial Inshore

Year	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+
1982	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86
1983	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86
1984	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86
1985	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86
1986	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86
1987	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86
1988	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86
1989	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86
1990	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86
1991	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86
1992	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86
1993	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86
1994	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86
1995	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86
1996	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86
1997	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86
1998	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86
1999	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86
2000	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86
2001	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86
2002	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86
2003	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86
2004	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86
2005	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86
2006	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86
2007	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86
2008	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86
2009	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86
2010	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86
2011	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86
2012	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86
2013	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86
2014	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86
2015	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86
2016	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86
2017	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86
2018	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86
2019	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86
2020	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86
2021	0.49	2.15	3.38	5.12	6.69	8.36	11.10	15.67	17.69	18.86

TABLE 15. (continued)

	Commercial Offshore									
Year	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+
1982	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76
1983	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76
1984	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76
1985	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76
1986	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76
1987	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76
1988	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76
1989	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76
1990	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76
1991	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76
1992	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76
1993	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76
1994	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76
1995	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76
1996	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76
1997	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76
1998	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76
1999	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76
2000	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76
2001	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76
2002	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76
2003	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76
2004	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76
2005	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76
2006	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76
2007	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76
2008	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76
2009	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76
2010	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76
2011	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76
2012	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76
2013	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76
2014	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76
2015	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76
2016	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76
2017	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76
2018	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76
2019	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76
2020	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76
2021	3.86	4.30	9.16	11.30	12.53	13.93	15.37	16.46	17.25	18.76

TABLE 16. Annual Red Drum catch-at-size in total length inch bins from the LDWF fishery-independent marine trammel net survey.

Year	n	<10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40+
1985	21	0			14	1	1	2	1								1		1													0
1986	140	0		4	10	20	40	21	15	5	3	1	2	1	1	1	3	5	4	4												0
1987	208	1		12	48	47	46	32	12	2				2	4	1	1						1									0
1988	347	1	1	14	47	63	58	35	19	10	4	7	10	6	26	22	13	2	3	1	1	2										1
1989	318	0		11	21	27	18	23	5	5	13	24	36	31	37	28	20	8	2	6	1				1							0
1990	66	0				2	8	12	13	8	7	2		2	4	2	2	2	1			1										0
1991	578	1	3	84	172	155	87	37	13	7	1		1		2		3	4	3	2	2									1		1
1992	815	1	5	91	219	144	53	24	16	21	36	48	43	59	31	11	5	4	1	1	1											1
1993	840	0	1	47	157	147	84	41	15	20	41	49	45	31	27	42	44	16	16	8	6											3
1994	1605	0	34	380	481	337	112	12	4	9	30	38	24	34	29	27	15	12	13	3	3	3	5									0
1995	1551	2	3	68	171	233	146	64	58	95	119	113	92	51	40	51	68	66	18	32	14	23	12	5	4	1	1					0
1996	613	0	1	33	70	90	59	26	9	32	24	45	36	31	36	31	17	23	18	12	10	3	1	2	1	1	1			1		0
1997	541	4	2	35	103	104	56	24	3	10	13	9	22	14	23	18	23	18	18	15	12	7	4			2	1			1	1	1
1998	484	0		19	62	86	86	45	16	6	11	12	12	18	16	13	12	10	14	11	3	8	6	1		3	2		4	1	1	4
1999	710	0	1	30	93	107	126	72	51	18	12	10	21	21	25	32	17	9	8	16	12	11	7	4			2	1	1		1	0
2000	770	2	2	21	80	97	79	59	19	22	28	62	61	48	33	28	23	22	18	14	13	5	11	2	2	3	4	3	1		1	6
2001	525	0	2	36	68	70	25	9	9	16	28	42	40	29	35	21	13	25	15	13	6	5	2	4	1	4		5		1	1	0
2002	719	1	1	27	123	148	94	29	20	13	28	22	19	24	18	13	14	21	27	16	17	10	7	4	4	4	3	5	1	1	2	4
2003	839	1	10	154	191	83	26	4	1	17	30	28	20	28	21	22	26	21	27	35	21	10	15	9	11	6	5	3	4	4	5	3
2004	554	0		2	26	48	58	27	22	8	16	25	32	37	40	32	25	19	24	13	14	12	10	19	7	7	6	5	7	6	1	6
2005	537	0		13	58	81	65	32	21	10	13	17	26	18	14	24	14	20	10	14	14	13	7	11	5	9	6	5	3	2	4	6
2006	444	1	2	27	69	79	51	16	14	6	5	10	8	10	13	9	16	8	13	9	6	7	5	3	11	12	7	7	7	5	5	3
2007	456	5	7	30	65	57	17	28	10	9	11	15	22	17	15	8	5	9	3	9	10	10	6	12	11	10	15	13	10	8	1	8
2008	522	0	6	31	45	52	37	9	19	25	19	19	16	16	10	8	8	6	6	7	5	5	2	5	12	24	38	26	35	8	8	15
2009	976	0	15	132	159	151	26	27	12	4	16	32	26	16	34	43	39	24	30	40	24	26	18	8	7	11	8	8	10	7	12	10
2010	1485	5	9	97	125	119	64	32	35	35	26	63	58	81	49	37	35	36	59	53	48	34	25	21	18	23	39	65	76	66	26	24
2011	986	1	4	37	65	80	51	27	17	15	20	36	26	20	23	28	20	27	22	32	18	17	10	8	16	41	46	68	58	58	45	51
2012	1107	1	9	101	177	93	32	10	6	9	7	10	16	8	8	14	17	14	12	15	23	24	29	25	41	53	67	57	77	48	42	61
2013	757	2	5	54	67	53	24	13	25	26	54	45	38	34	27	26	40	20	26	21	21	26	11	7	7	12	10	8	21	11	8	16
2014	527	0	1	32	48	22	13	7	6	10	13	11	8	12	6	14	21	29	21	13	16	14	8	12	23	23	31	20	29	14	23	25
2015	422	0		4	21	24	3	6	3	1	4	2	2	2	4	3	3	10	12	13	26	13	14	16	15	22	23	43	42	27	28	36
2016	523	1	1	16	84	60	27	16	7	4	4	7	5	5	11	12	12	19	24	13	19	17	16	15	19	11	17	21	19	15	9	17
2017	962	1	7	128	221	116	80	24	24	18	20	29	15	15	16	8	19	14	19	8	7	11	8	10	25	10	21	29	18	15	11	15
2018	436	14	6	11	18	10	12	9	12	13	11	8	10	11	4	13	12	27	31	39	17	12	6	9	10	12	15	25	29	12	6	12
2019	387	0		8	22	20	15	21	12	13	11	9	7	8	5	7	8	18	16	12	13	14	13	21	6	18	27	20	15	11	7	10
2020	344	0		2	7	11	12	6	3	1		2	6	13	6	8	4	11	7	6	9	12	8	9	22	23	33	34	31	19	20	22
2021	254	0		1	3	1	2	2	2			3	5	2	2	4	2	2	4	7	18	26	19	16	24	18	13	22	14	13	12	17

TABLE 17. Annual Red Drum catch-at-size as total length in inches from the LDWF component of the SEAMAP nearshore bottom long line survey.

Year	n	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
2015	145					1	6	3	16	18	28	16	28	15	8	5			1						
2016	116				2			3	1	9	14	17	19	21	23	5	2								
2017	223			1		3	7	7	12	28	37	56	37	22	8	4					1				
2018	152						2	8	5	12	26	30	35	17	9	7	1								
2019	262		1	1		2	2	7	19	25	37	56	39	43	24	5			1						
2020	28			1		4		1		5	5	8	1	2	1										
2021	56								1	10	9	15	9	10	2										

TABLE 18. Probabilities of age given length used for age assignments of Red Drum catches from the LDWF fishery-independent marine trammel net survey.

TL_in	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+
8	0.18	0.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.00	0.96	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.00	0.92	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.83	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.67	0.32	0.01	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.43	0.55	0.02	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.21	0.75	0.05	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.08	0.84	0.09	0.00	0.00	0.00	0.00	0.00	0.00
20	0.00	0.02	0.83	0.15	0.00	0.00	0.00	0.00	0.00	0.00
21	0.00	0.01	0.76	0.23	0.01	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	0.64	0.33	0.02	0.00	0.00	0.00	0.00	0.00
23	0.00	0.00	0.50	0.45	0.05	0.00	0.00	0.00	0.00	0.00
24	0.00	0.00	0.35	0.55	0.10	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.22	0.60	0.18	0.00	0.00	0.00	0.00	0.00
26	0.00	0.00	0.12	0.59	0.28	0.02	0.00	0.00	0.00	0.00
27	0.00	0.00	0.06	0.51	0.38	0.04	0.00	0.00	0.00	0.00
28	0.00	0.00	0.03	0.40	0.46	0.11	0.00	0.00	0.00	0.00
29	0.00	0.00	0.01	0.28	0.49	0.21	0.01	0.00	0.00	0.00
30	0.00	0.00	0.00	0.17	0.45	0.32	0.04	0.01	0.00	0.01
31	0.00	0.00	0.00	0.09	0.33	0.37	0.11	0.03	0.01	0.07
32	0.00	0.00	0.00	0.03	0.18	0.30	0.17	0.06	0.03	0.23
33	0.00	0.00	0.00	0.01	0.07	0.15	0.16	0.08	0.04	0.48
34	0.00	0.00	0.00	0.00	0.02	0.06	0.10	0.07	0.05	0.69
35	0.00	0.00	0.00	0.00	0.01	0.02	0.05	0.05	0.04	0.83
36	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.90
37	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.95
38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.97
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.98
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99
41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.99
42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00

TABLE 19. Annual Red Drum survey age composition and sample sizes from the LDWF fishery-independent marine trammel net survey.

Year	n	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+
1985	21	0.000	0.809	0.107	0.055	0.027	0.002	0.000	0.000	0.000	0.000
1986	140	0.000	0.621	0.252	0.082	0.040	0.005	0.000	0.000	0.000	0.000
1987	208	0.000	0.801	0.171	0.021	0.004	0.002	0.001	0.000	0.000	0.000
1988	347	0.003	0.578	0.262	0.123	0.027	0.003	0.000	0.000	0.000	0.003
1989	318	0.000	0.288	0.416	0.240	0.048	0.004	0.001	0.000	0.000	0.002
1990	66	0.000	0.369	0.466	0.125	0.033	0.006	0.001	0.000	0.000	0.000
1991	578	0.000	0.861	0.109	0.016	0.008	0.001	0.000	0.000	0.000	0.003
1992	815	0.000	0.630	0.275	0.083	0.009	0.001	0.000	0.000	0.000	0.001
1993	840	0.000	0.531	0.284	0.140	0.037	0.004	0.000	0.000	0.000	0.004
1994	1605	0.000	0.802	0.131	0.050	0.014	0.003	0.000	0.000	0.000	0.000
1995	1551	0.000	0.434	0.343	0.147	0.053	0.014	0.003	0.001	0.000	0.004
1996	613	0.000	0.432	0.324	0.169	0.056	0.011	0.002	0.001	0.000	0.006
1997	541	0.000	0.557	0.201	0.144	0.068	0.017	0.002	0.001	0.000	0.010
1998	484	0.000	0.556	0.228	0.113	0.052	0.016	0.003	0.001	0.001	0.029
1999	710	0.000	0.562	0.248	0.111	0.049	0.017	0.003	0.001	0.001	0.009
2000	770	0.003	0.404	0.334	0.158	0.055	0.016	0.004	0.002	0.001	0.024
2001	525	0.000	0.390	0.328	0.179	0.062	0.015	0.004	0.002	0.001	0.021
2002	719	0.000	0.549	0.215	0.116	0.063	0.021	0.005	0.002	0.001	0.029
2003	839	0.000	0.541	0.174	0.129	0.075	0.028	0.008	0.003	0.002	0.042
2004	554	0.000	0.272	0.296	0.204	0.091	0.038	0.013	0.006	0.004	0.076
2005	537	0.000	0.431	0.239	0.140	0.073	0.031	0.010	0.005	0.003	0.067
2006	444	0.000	0.517	0.170	0.106	0.057	0.024	0.011	0.007	0.005	0.104
2007	456	0.007	0.425	0.206	0.099	0.055	0.033	0.016	0.009	0.006	0.144
2008	522	0.000	0.344	0.210	0.079	0.035	0.020	0.016	0.013	0.011	0.273
2009	976	0.000	0.496	0.165	0.143	0.083	0.031	0.008	0.004	0.003	0.068
2010	1485	0.001	0.295	0.208	0.144	0.084	0.034	0.012	0.008	0.007	0.207
2011	986	0.001	0.254	0.160	0.110	0.063	0.027	0.015	0.012	0.011	0.348
2012	1107	0.000	0.364	0.074	0.059	0.055	0.041	0.023	0.016	0.012	0.355
2013	757	0.000	0.294	0.289	0.170	0.085	0.033	0.009	0.005	0.004	0.111
2014	526	0.000	0.230	0.137	0.141	0.093	0.044	0.023	0.015	0.011	0.307
2015	422	0.000	0.129	0.051	0.085	0.100	0.062	0.029	0.019	0.016	0.508
2016	523	0.000	0.366	0.110	0.120	0.097	0.051	0.021	0.012	0.008	0.216
2017	962	0.000	0.573	0.153	0.069	0.037	0.019	0.010	0.007	0.005	0.128
2018	436	0.014	0.175	0.158	0.185	0.137	0.048	0.017	0.011	0.009	0.247
2019	387	0.000	0.214	0.169	0.130	0.105	0.060	0.027	0.016	0.011	0.267
2020	344	0.000	0.100	0.089	0.099	0.077	0.052	0.033	0.023	0.019	0.508
2021	254	0.000	0.034	0.054	0.098	0.149	0.119	0.051	0.027	0.019	0.449

TABLE 20. Annual Red Drum survey age composition and sample sizes from the LDWF component of the SEAMAP nearshore bottom long-line survey.

Year	n	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+
2015	145	0.000	0.000	0.000	0.007	0.022	0.034	0.032	0.028	0.026	0.851
2016	116	0.000	0.000	0.001	0.007	0.013	0.013	0.015	0.018	0.020	0.913
2017	223	0.000	0.000	0.001	0.010	0.023	0.030	0.028	0.027	0.026	0.855
2018	167	0.000	0.000	0.000	0.000	0.000	0.007	0.013	0.007	0.007	0.967
2019	293	0.000	0.000	0.000	0.008	0.011	0.000	0.011	0.015	0.004	0.951
2020	32	0.000	0.000	0.033	0.067	0.000	0.100	0.033	0.033	0.000	0.733
2021	60	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000

TABLE 21. Annual Red Drum age composition and sample sizes of the MARFIN dataset used to represent the NMFS mark-recapture estimates.

Year	n	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10+
1987	562	0.000	0.000	0.043	0.036	0.055	0.053	0.032	0.041	0.064	0.676
1997	556	0.000	0.002	0.004	0.043	0.070	0.113	0.160	0.018	0.020	0.570

TABLE 22. Summary of objective function components and likelihood values of the ASAP base model.

Objective function =12515.0			
Component	Lambda	ESS	Obj_fun
Catch_Fleet_Total	4		332.86
Index_Fit_Total	3		-22.76
Catch_Age_Comps		6450	8409.93
Index_Age_Comps		2859	3666.57
Sel_Params_Total	14		12.36
Index_Sel_Params_Total	8		5.36
q_dev (IOA NMFS)	1		-9.21
N_year1_dev	1		135.49
Recruit_devs	1		-15.61

TABLE 23. Annual Red Drum 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	Age_7	Age_8	Age_9	Age_10+	Totals
1982	3,532,120	1,802,770	1,164,770	753,774	296,153	162,926	175,665	189,543	197,425	5,496,760	13,771,906
1983	3,759,580	1,932,190	956,761	617,822	512,868	239,506	140,848	155,268	168,726	5,099,880	13,583,449
1984	4,225,460	2,093,510	1,040,530	479,257	404,826	409,515	206,165	124,158	137,868	4,706,790	13,828,079
1985	4,086,860	2,532,130	1,237,790	500,493	302,284	318,879	350,383	180,731	109,593	4,300,810	13,919,953
1986	3,754,080	2,466,420	1,517,550	605,490	311,810	233,216	266,417	299,698	155,624	3,819,190	13,429,495
1987	3,603,440	2,339,060	1,418,060	443,688	264,428	206,972	179,995	213,733	242,712	3,238,720	12,150,808
1988	2,867,880	2,115,040	1,248,580	442,888	220,200	194,716	175,870	158,865	190,481	3,122,370	10,736,890
1989	1,656,690	1,999,830	1,513,310	913,497	355,738	187,576	170,539	156,124	141,834	2,976,430	10,071,568
1990	3,231,080	1,143,890	1,297,670	1,046,430	714,587	297,888	162,641	150,616	139,050	2,800,490	10,984,342
1991	6,926,780	2,235,640	759,270	918,744	828,944	601,952	259,020	143,846	134,248	2,640,860	15,449,304
1992	5,830,070	4,793,560	1,486,580	538,454	728,372	698,525	523,473	229,090	128,209	2,492,950	17,449,283
1993	6,048,970	4,043,300	3,260,820	1,076,650	431,643	617,206	609,168	463,669	204,357	2,355,570	19,111,353
1994	7,621,000	4,202,010	2,798,600	2,399,580	870,133	367,209	539,243	540,015	413,746	2,300,290	22,051,826
1995	5,622,630	5,302,660	2,958,850	2,092,240	1,955,060	743,156	321,417	478,427	482,040	2,438,290	22,394,770
1996	4,347,420	3,895,550	3,569,340	2,122,460	1,669,520	1,653,300	647,594	284,656	426,841	2,624,390	21,241,071
1997	5,601,000	3,011,210	2,614,520	2,553,480	1,691,430	1,411,010	1,440,390	573,501	253,972	2,742,500	21,893,013
1998	5,945,670	3,871,520	1,977,520	1,833,310	2,013,850	1,422,200	1,226,220	1,274,020	511,368	2,693,240	22,768,918
1999	5,328,200	4,121,920	2,623,140	1,427,220	1,467,900	1,706,110	1,240,590	1,086,670	1,137,160	2,880,850	23,019,760
2000	4,903,250	3,680,700	2,689,480	1,828,430	1,122,130	1,232,360	1,481,570	1,096,900	968,762	3,608,750	22,612,332
2001	4,318,560	3,366,630	2,252,320	1,767,130	1,394,580	928,235	1,062,680	1,305,730	976,493	4,111,300	21,483,658
2002	3,970,100	2,955,370	1,989,240	1,432,950	1,325,690	1,144,340	797,380	934,919	1,161,510	4,569,430	20,280,929
2003	3,634,800	2,721,440	1,777,300	1,286,270	1,083,930	1,092,180	984,863	702,095	831,930	5,146,860	19,261,668
2004	3,247,770	2,493,320	1,648,640	1,157,020	976,440	894,598	940,810	867,574	624,913	5,371,400	18,222,485
2005	5,195,980	2,225,530	1,494,020	1,062,510	873,784	803,851	769,685	828,307	772,010	5,387,680	19,413,357
2006	5,809,700	3,579,590	1,410,890	1,014,220	824,339	728,960	696,086	679,771	738,203	5,536,570	21,018,329
2007	4,399,330	4,015,020	2,346,150	987,620	799,415	693,047	633,572	615,836	606,304	5,641,040	20,737,334
2008	4,483,190	3,035,210	2,585,030	1,615,520	771,834	669,272	601,128	559,972	549,010	5,615,950	20,486,116
2009	5,221,960	3,086,620	1,911,640	1,744,280	1,249,420	642,888	579,091	530,690	498,947	5,541,520	21,007,056
2010	4,049,680	3,575,640	1,834,800	1,222,970	1,312,310	1,026,680	552,636	509,635	472,148	5,427,670	19,984,169
2011	3,624,130	2,748,330	1,934,410	1,076,230	879,753	1,054,910	873,270	483,917	452,348	5,298,510	18,425,808
2012	4,474,040	2,458,180	1,478,220	1,128,510	771,828	706,025	896,425	764,216	429,330	5,163,060	18,269,834
2013	2,583,240	3,050,170	1,395,380	906,323	830,497	627,360	603,698	786,870	679,041	5,023,210	16,485,789
2014	2,657,420	1,738,240	1,507,950	753,234	624,445	653,543	528,117	525,966	696,672	5,116,160	14,801,747
2015	2,698,430	1,795,100	895,285	845,326	529,229	496,155	552,737	461,160	466,190	5,217,030	13,956,642
2016	4,295,580	1,809,560	856,053	467,483	572,433	412,919	415,923	480,575	407,871	5,098,300	14,816,697
2017	3,735,150	2,905,790	946,069	486,523	330,747	456,340	349,754	363,417	426,043	4,942,480	14,942,313
2018	1,990,060	2,511,970	1,428,270	507,959	334,247	259,894	383,859	304,592	321,676	4,817,030	12,859,557
2019	1,446,350	1,319,560	1,063,300	668,170	324,919	253,568	214,918	331,547	268,525	4,606,100	10,496,957
2020	1,394,100	966,122	603,718	534,378	443,547	251,026	211,541	186,415	292,881	4,371,810	9,255,538
2021	1,693,560	923,801	406,188	280,667	340,697	335,934	207,415	182,636	164,304	4,180,800	8,716,002

TABLE 24. Annual age-specific, apical, and average (N-weighted) Red Drum fishing mortality rates along with the escapement rates (E) of juvenile fish and F rates of adults (%) estimated from the ASAP base model.

Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Apical F	Avg. F	Escape	F adults
1982	0.254	0.428	0.477	0.251	0.090	0.031	0.013	0.008	0.007	0.006	0.646	0.180	22.8%	8.4%
1983	0.236	0.413	0.534	0.289	0.103	0.035	0.016	0.011	0.009	0.009	0.693	0.183	21.2%	10.0%
1984	0.163	0.320	0.575	0.327	0.117	0.041	0.022	0.017	0.015	0.015	0.691	0.163	23.0%	13.0%
1985	0.156	0.306	0.558	0.339	0.137	0.065	0.046	0.042	0.040	0.040	0.689	0.182	23.2%	23.4%
1986	0.124	0.347	1.073	0.694	0.288	0.144	0.110	0.103	0.101	0.101	1.228	0.295	8.6%	46.8%
1987	0.184	0.422	1.007	0.567	0.184	0.048	0.015	0.007	0.005	0.005	1.129	0.280	9.9%	11.8%
1988	0.012	0.129	0.155	0.085	0.038	0.018	0.009	0.005	0.004	0.003	0.167	0.052	66.4%	4.7%
1989	0.021	0.226	0.212	0.112	0.055	0.028	0.014	0.008	0.005	0.003	0.231	0.094	54.2%	6.9%
1990	0.019	0.204	0.188	0.099	0.050	0.025	0.013	0.007	0.004	0.003	0.206	0.064	57.8%	6.2%
1991	0.019	0.202	0.187	0.098	0.049	0.025	0.013	0.007	0.004	0.003	0.204	0.057	58.1%	6.2%
1992	0.017	0.179	0.166	0.087	0.044	0.022	0.011	0.006	0.004	0.003	0.181	0.075	61.8%	5.5%
1993	0.015	0.162	0.150	0.079	0.040	0.020	0.010	0.006	0.004	0.003	0.164	0.071	64.7%	5.1%
1994	0.014	0.145	0.134	0.071	0.036	0.018	0.010	0.006	0.004	0.003	0.147	0.059	67.7%	4.8%
1995	0.018	0.190	0.175	0.092	0.046	0.023	0.011	0.006	0.004	0.002	0.191	0.087	60.1%	5.6%
1996	0.018	0.193	0.178	0.093	0.046	0.023	0.012	0.006	0.003	0.002	0.194	0.084	59.7%	5.6%
1997	0.020	0.214	0.198	0.103	0.051	0.025	0.013	0.007	0.004	0.002	0.216	0.077	56.3%	6.2%
1998	0.017	0.183	0.169	0.088	0.044	0.022	0.011	0.006	0.003	0.002	0.184	0.064	61.2%	5.3%
1999	0.021	0.221	0.204	0.107	0.053	0.026	0.013	0.007	0.004	0.002	0.222	0.081	55.3%	6.4%
2000	0.027	0.285	0.263	0.137	0.068	0.033	0.016	0.008	0.004	0.003	0.286	0.102	46.6%	7.8%
2001	0.030	0.320	0.295	0.153	0.076	0.037	0.018	0.009	0.005	0.003	0.321	0.109	42.5%	8.6%
2002	0.029	0.303	0.279	0.145	0.072	0.035	0.017	0.009	0.005	0.003	0.303	0.096	44.5%	8.3%
2003	0.028	0.295	0.272	0.142	0.070	0.034	0.017	0.008	0.004	0.003	0.296	0.089	45.4%	8.1%
2004	0.029	0.306	0.282	0.147	0.072	0.035	0.017	0.009	0.005	0.003	0.307	0.090	44.1%	8.3%
2005	0.024	0.250	0.230	0.120	0.059	0.029	0.014	0.007	0.004	0.002	0.251	0.065	51.3%	6.9%
2006	0.020	0.216	0.200	0.104	0.051	0.025	0.012	0.006	0.003	0.002	0.217	0.065	56.0%	6.1%
2007	0.022	0.234	0.216	0.113	0.056	0.027	0.013	0.007	0.004	0.002	0.235	0.084	53.4%	6.5%
2008	0.024	0.256	0.236	0.123	0.061	0.030	0.015	0.007	0.004	0.002	0.257	0.087	50.4%	7.1%
2009	0.030	0.314	0.290	0.151	0.074	0.036	0.018	0.009	0.005	0.003	0.315	0.099	43.2%	8.5%
2010	0.039	0.408	0.376	0.195	0.096	0.047	0.023	0.011	0.006	0.003	0.409	0.138	33.6%	10.8%
2011	0.039	0.414	0.382	0.198	0.098	0.048	0.023	0.012	0.006	0.003	0.415	0.131	33.0%	11.0%
2012	0.034	0.360	0.332	0.173	0.085	0.042	0.020	0.010	0.005	0.003	0.361	0.102	38.2%	9.7%
2013	0.047	0.498	0.460	0.239	0.118	0.057	0.028	0.014	0.007	0.004	0.499	0.163	26.4%	13.0%
2014	0.043	0.457	0.422	0.219	0.108	0.053	0.026	0.013	0.006	0.004	0.458	0.125	29.4%	12.0%
2015	0.051	0.534	0.493	0.256	0.126	0.061	0.030	0.015	0.008	0.004	0.536	0.136	24.0%	13.9%
2016	0.042	0.443	0.408	0.212	0.105	0.051	0.025	0.012	0.006	0.004	0.444	0.104	30.6%	11.7%
2017	0.048	0.504	0.465	0.241	0.119	0.058	0.028	0.014	0.007	0.004	0.505	0.154	26.0%	13.2%
2018	0.062	0.654	0.603	0.313	0.154	0.075	0.037	0.018	0.009	0.005	0.655	0.226	17.4%	16.7%
2019	0.055	0.576	0.531	0.276	0.136	0.066	0.032	0.016	0.008	0.005	0.577	0.160	21.5%	14.9%
2020	0.063	0.660	0.609	0.316	0.156	0.076	0.037	0.018	0.009	0.005	0.662	0.150	17.1%	16.8%
2021	0.053	0.562	0.519	0.270	0.133	0.065	0.032	0.016	0.008	0.005	0.564	0.114	22.2%	14.7%

TABLE 25. Limit reference point estimates for the Louisiana Red Drum stock. Spawning stock fecundity units are trillions of eggs. Fishing mortality and escapement rate (E) units are per year.

Management Benchmarks		
Parameters	Derivation	Value
SPR_{limit}	GMFMC Amendment 2	20.0%
SSB_{limit}	Equation [24] and SPR_{limit}	26.8
F_{limit}	Equation [24] and SPR_{limit}	0.212
E_{limit}	GMFMC Amendment 2 and ACT 889 of the 1988 Regular Legislative Session	30.0%

TABLE 26. Sensitivity analysis table of proposed limit reference points. Current estimates are taken as the geometric mean of the 2019-2021 estimates. Yield units are millions of pounds, spawning stock fecundity units are trillions of eggs (with the exception of Model 10 where SSB units are millions of pounds), and fishing mortality and escapement rate units are per year.

Model run	negLL	SPR_{limit}	$Yield_{limit}$	F_{limit}	E_{limit}	SSB_{limit}	$SPR_{current}$	$SSB_{current}$	$F_{current}$	$E_{current}$	$F_{current}/F_{limit}$	$1/(E_{current}/E_{limit})$	$SSB_{current}/SSB_{limit}$
Base Model (h=1)	12515.0	20.0%	6.11	0.212	30.0%	26.8	40.1%	53.7	0.140	20.1%	0.661	1.49	2.00
Model 1 (h=0.9)	12515.5	20.0%	5.62	0.212	30.0%	24.6	39.9%	53.1	0.141	19.9%	0.668	1.51	2.16
Model 2 (h=0.8)	12516.1	20.0%	4.91	0.211	30.0%	21.5	40.0%	52.6	0.142	19.7%	0.674	1.52	2.45
Model 3 (h=0.7)	12517.0	20.0%	3.76	0.211	30.0%	16.4	40.1%	51.9	0.144	19.3%	0.684	1.55	3.16
Model 4 (Yield lambdas*10)	13283.8	20.0%	4.10	0.203	30.0%	17.3	24.7%	21.4	0.289	7.79%	1.42	3.85	1.24
Model 5 (IOA lambdas*10)	12262.0	20.0%	6.83	0.217	30.0%	30.5	51.3%	78.1	0.0861	37.6%	0.397	0.799	2.56
Model 6 (Input ESS/2)	6305.3	20.0%	5.97	0.209	30.0%	25.9	37.7%	48.8	0.137	24.1%	0.655	1.24	1.88
Model 7 (Discard M=0.08)	12577.2	20.0%	6.23	0.216	30.0%	28.0	43.0%	60.2	0.134	20.6%	0.620	1.46	2.15
Model 8 (Rec. Growth ALK only)	8415.2	20.0%	6.43	0.212	30.0%	29.9	51.5%	76.9	0.103	24.4%	0.485	1.23	2.57
Model 9 (LA comm. offshore yield only)	12449.9	20.0%	6.09	0.212	30.0%	26.6	39.9%	53.1	0.141	20.0%	0.666	1.50	1.99
Model 10 (SSB)	12515.0	20.0%	6.14	0.217	30.0%	26.9	36.3%	48.9	0.140	20.1%	0.645	1.49	1.82
Model 11 (Without NOAA N estimates)	11959.6	20.0%	4.87	0.183	30.0%	18.9	13.9%	13.1	0.312	9.05%	1.70	3.32	0.695
Model 12 (Without 1997 NOAA N estimate)	12198.3	20.0%	6.17	0.212	30.0%	27.1	41.4%	56.0	0.135	21.0%	0.636	1.43	2.07
Model 13 (Base M up 20%)	12551.4	20.0%	6.35	0.219	30.0%	20.8	41.0%	42.7	0.155	20.6%	0.707	1.46	2.05
Model 14 (Base M down 20%)	12476.1	20.0%	5.91	0.198	30.0%	36.3	38.3%	69.5	0.121	20.0%	0.614	1.50	1.92

TABLE 27. Sensitivity analysis table of MSY related reference points. Current estimates are taken as the geometric mean of 2019-2021 estimates. Yield units are millions of pounds, spawning stock fecundity units are trillions of eggs, and fishing mortality and escapement rate units are per year.

Model run	negLL	SPR_{MSY}	MSY	F_{MSY}	E_{MSY}	SSB_{MSY}	$SPR_{current}$	$SSB_{current}$	$F_{current}$	$E_{current}$	$F_{current}/F_{MSY}$	$1/(E_{current}/E_{MSY})$	$SSB_{current}/SSB_{MSY}$
Base Model (h=1)	12515.0	--	--	--	--	--	40.1%	53.7	0.140	20.1%	--	--	--
Model 1 (h=0.9)	12515.5	20.5%	5.62	0.208	24.0%	25.3	39.9%	53.1	0.141	19.9%	0.680	1.20	2.10
Model 2 (h=0.8)	12516.1	28.1%	5.16	0.156	31.9%	34.1	40.0%	52.6	0.142	19.7%	0.912	1.62	1.55
Model 3 (h=0.7)	12517.0	35.2%	4.83	0.122	39.1%	43.3	40.1%	51.9	0.144	19.3%	1.19	2.02	1.20

10. FIGURES

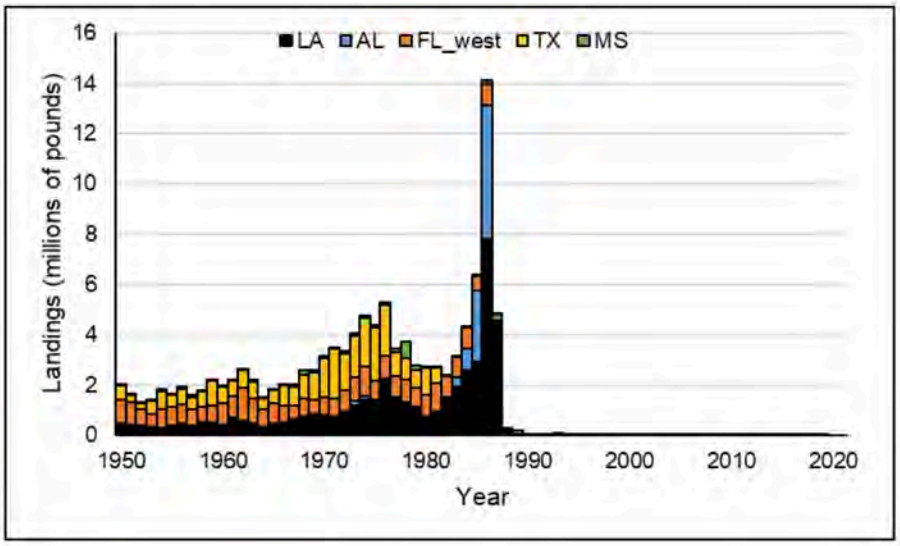


FIGURE 1. Commercial landings of Red Drum in the Gulf of Mexico by state, 1950-2021.

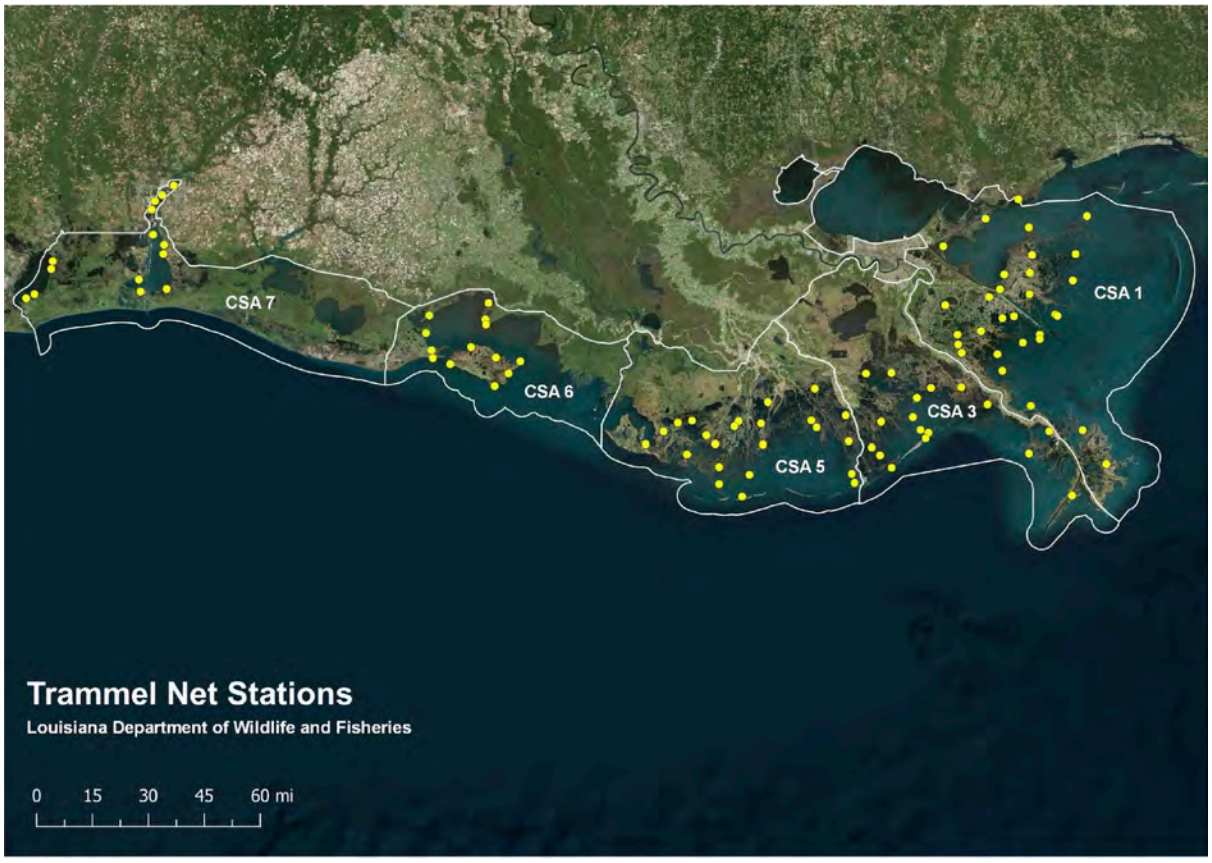


FIGURE 2. Station locations of the LDWF trammel net survey. Yellow lines delineate LDWF Coastal Study Areas and state/federal waters.

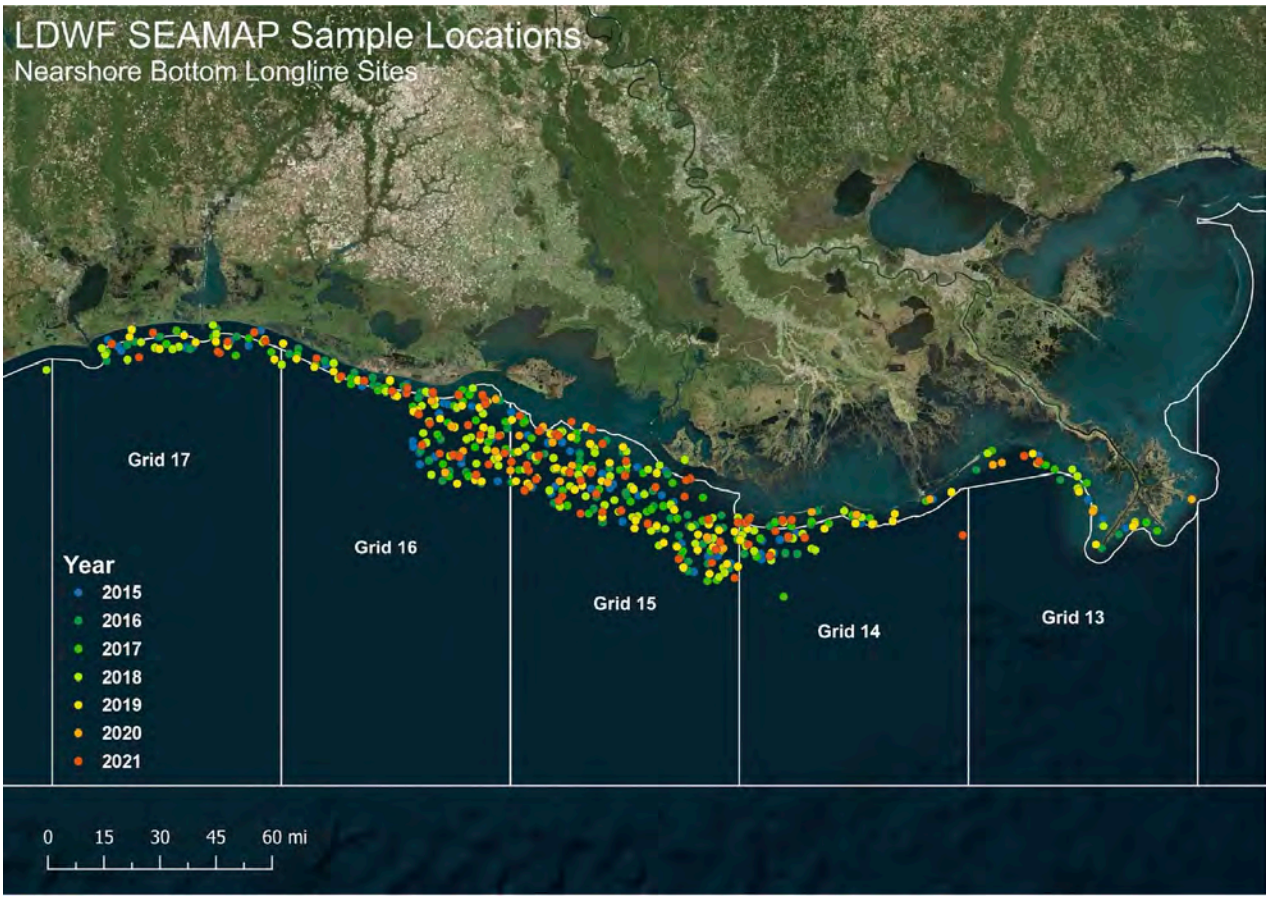


FIGURE 3. Sample locations of the LDWF SEAMAP bottom long line survey. White lines delineate state/federal waters and the NOAA Fisheries statistical grids.

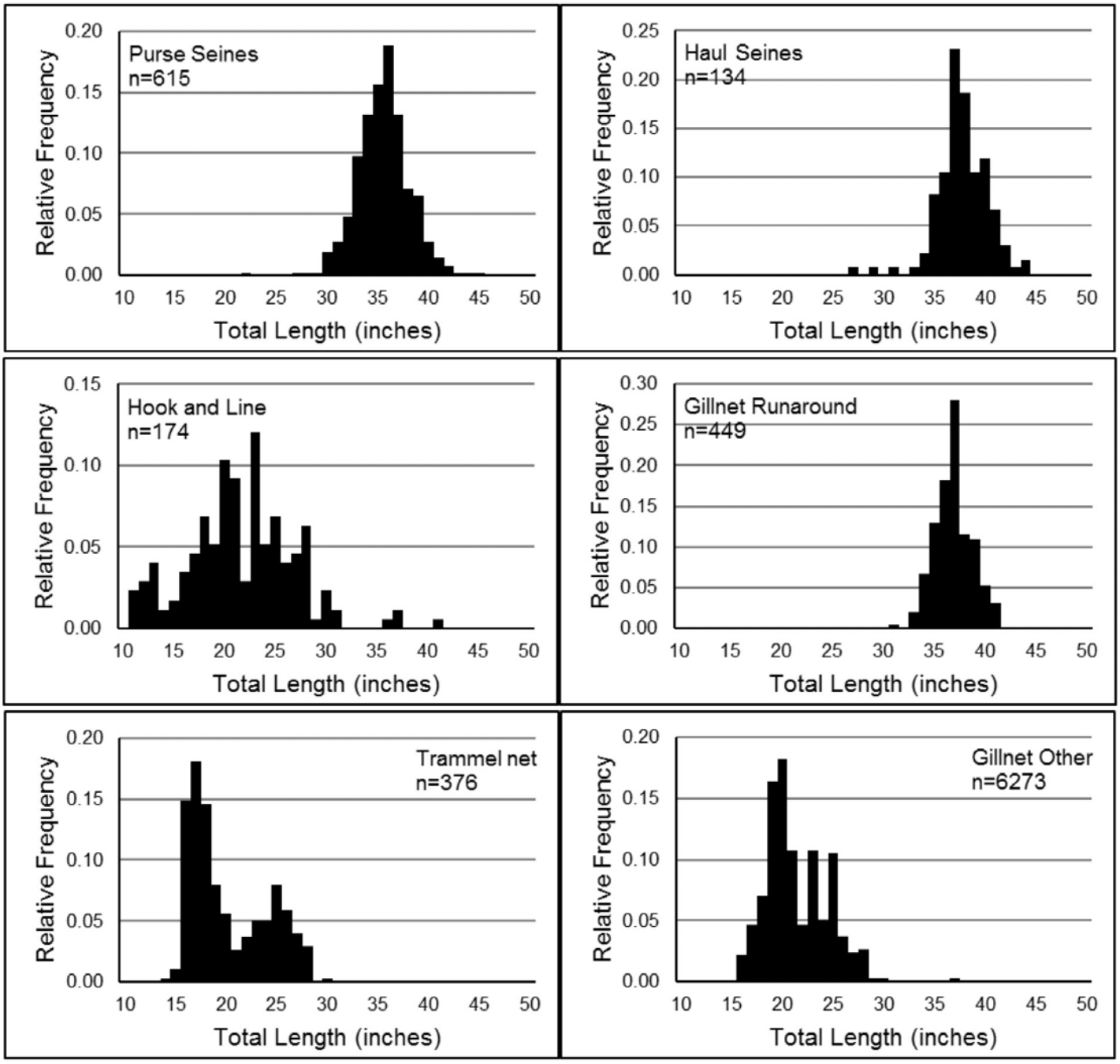


FIGURE 4. Length frequencies of Louisiana commercial Red Drum landings (1985-1987).

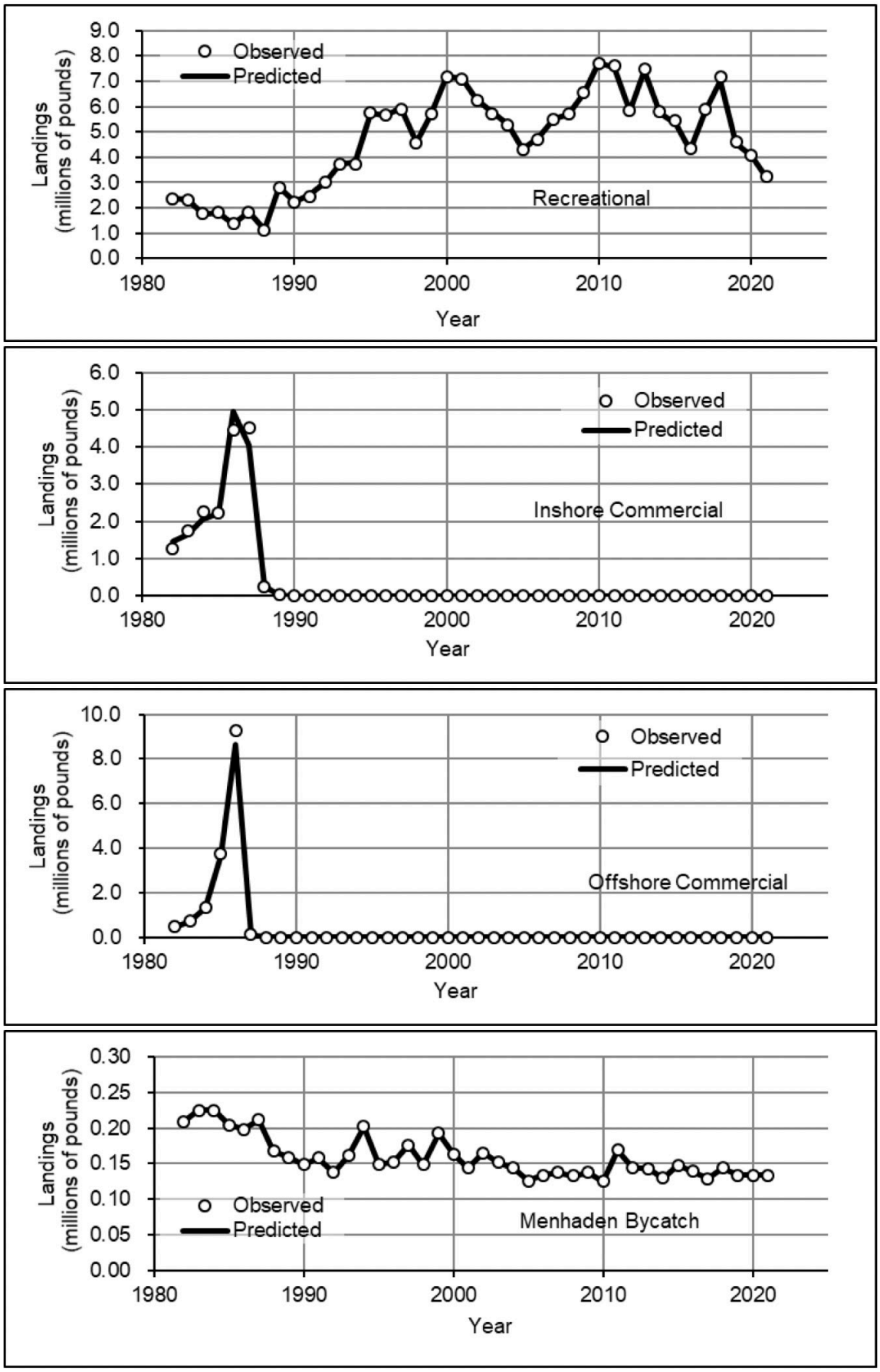
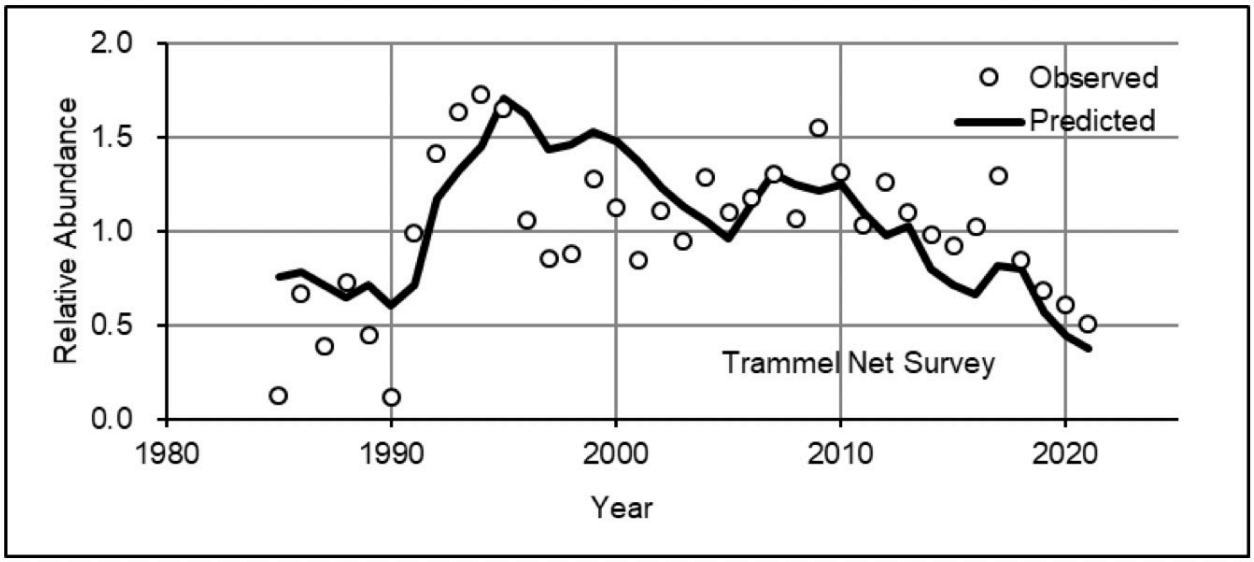
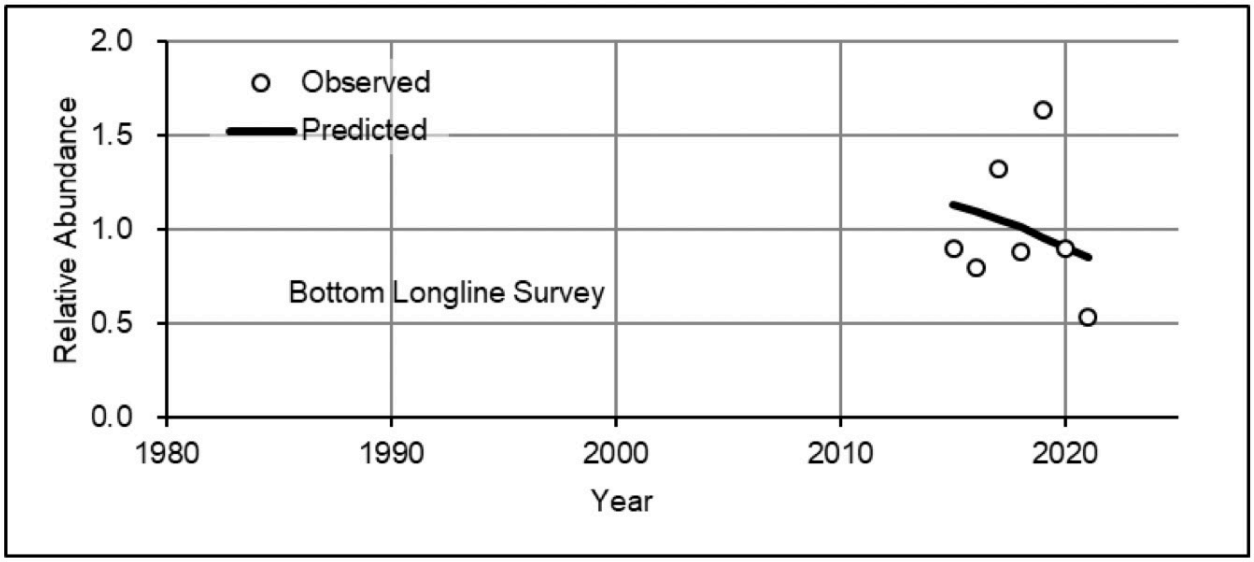


FIGURE 5. Observed and ASAP base model estimated Red Drum yield (top to bottom: recreational, inshore commercial, offshore commercial, menhaden reduction fishery dead bycatch).





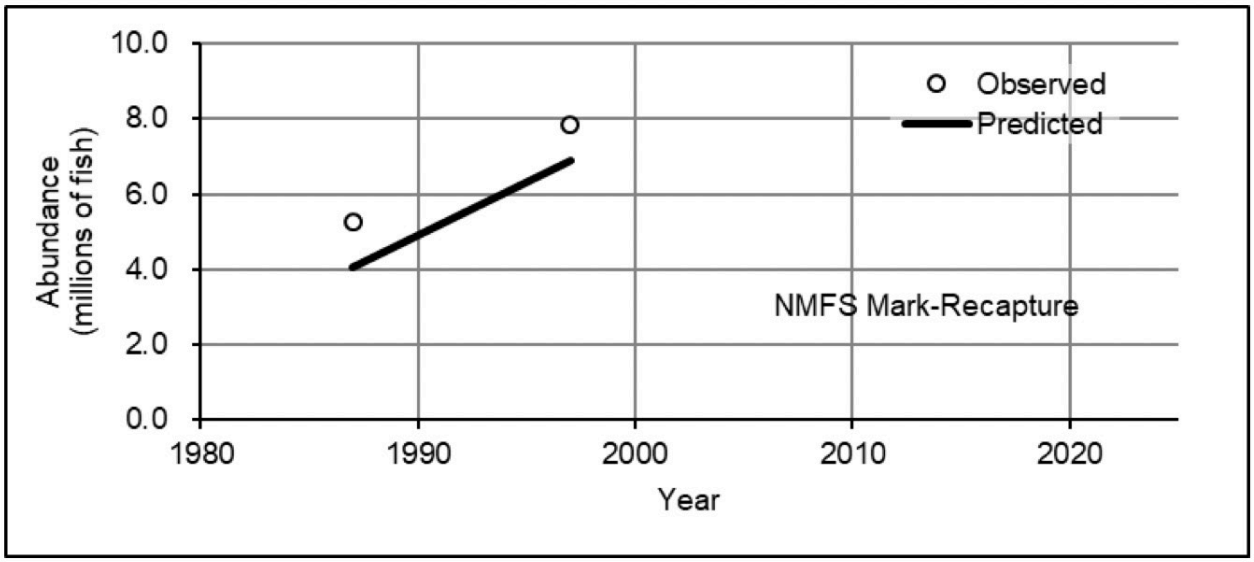


FIGURE 6. Observed and ASAP base model estimated abundance estimates (top to bottom: LDWF trammel net survey, SEAMAP nearshore bottom long-line survey, and NOAA Fisheries mark-recapture estimates).

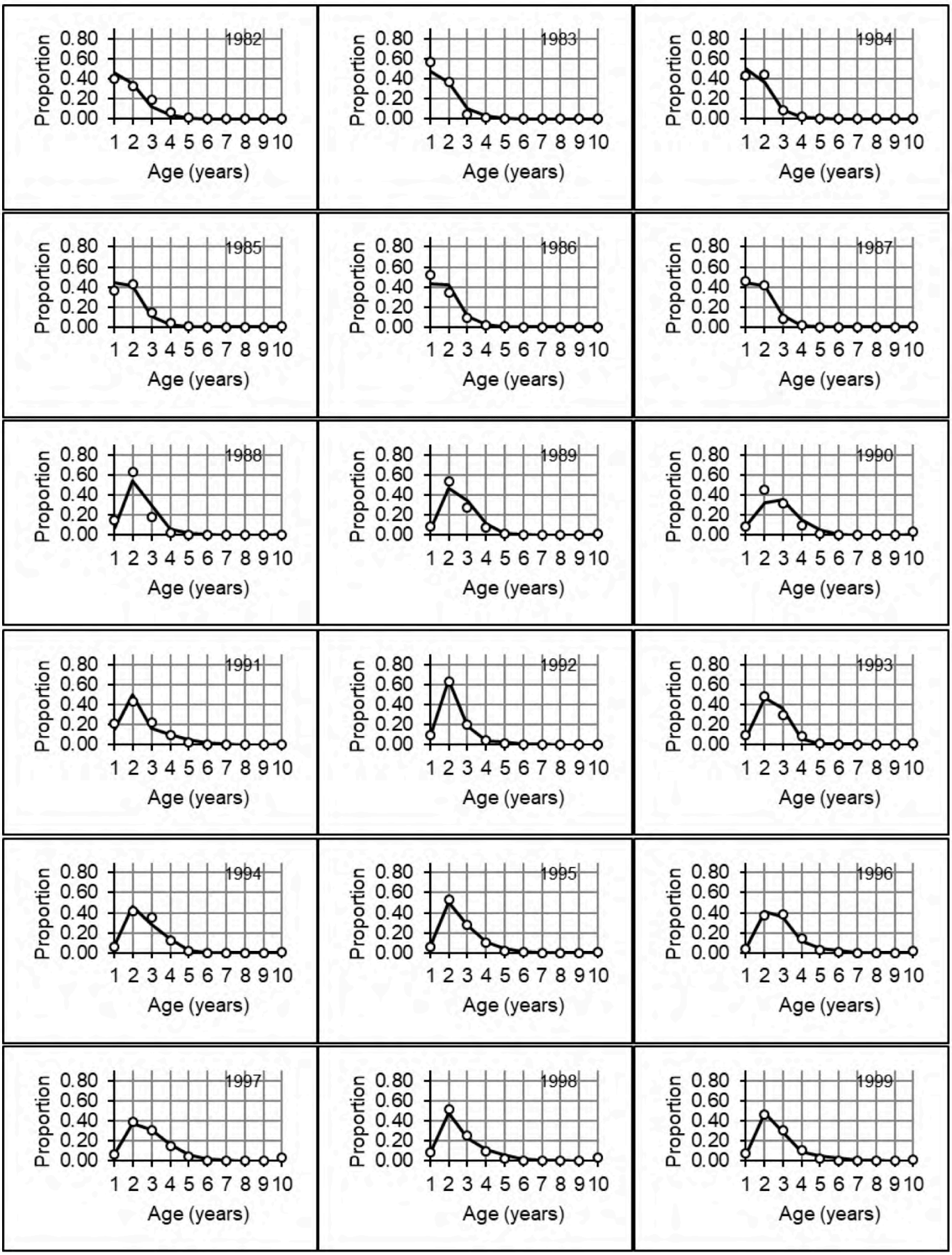


FIGURE 7. Annual input (open circles) and ASAP estimated (bold lines) recreational Red Drum landings age compositions.

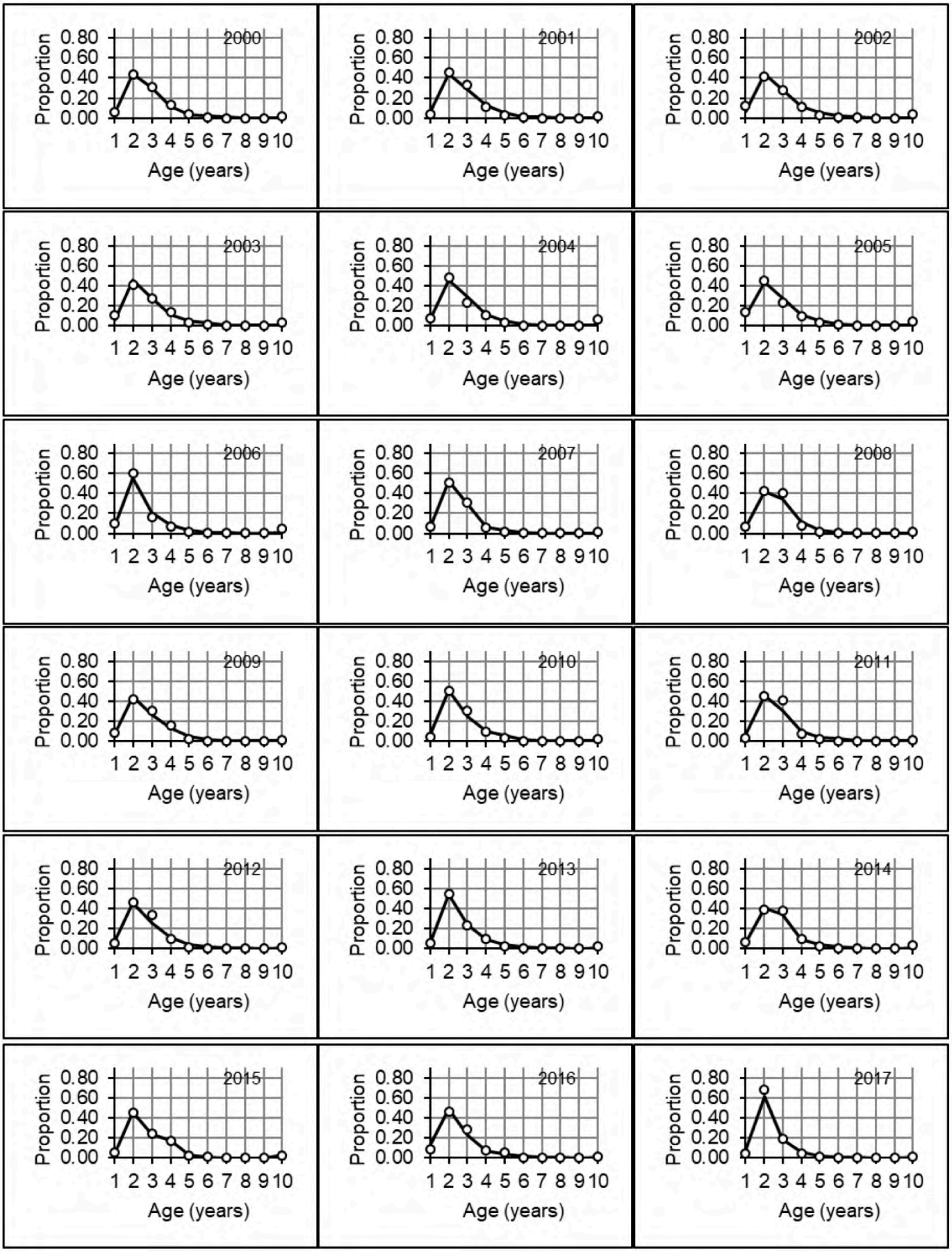


FIGURE 7. (continued)

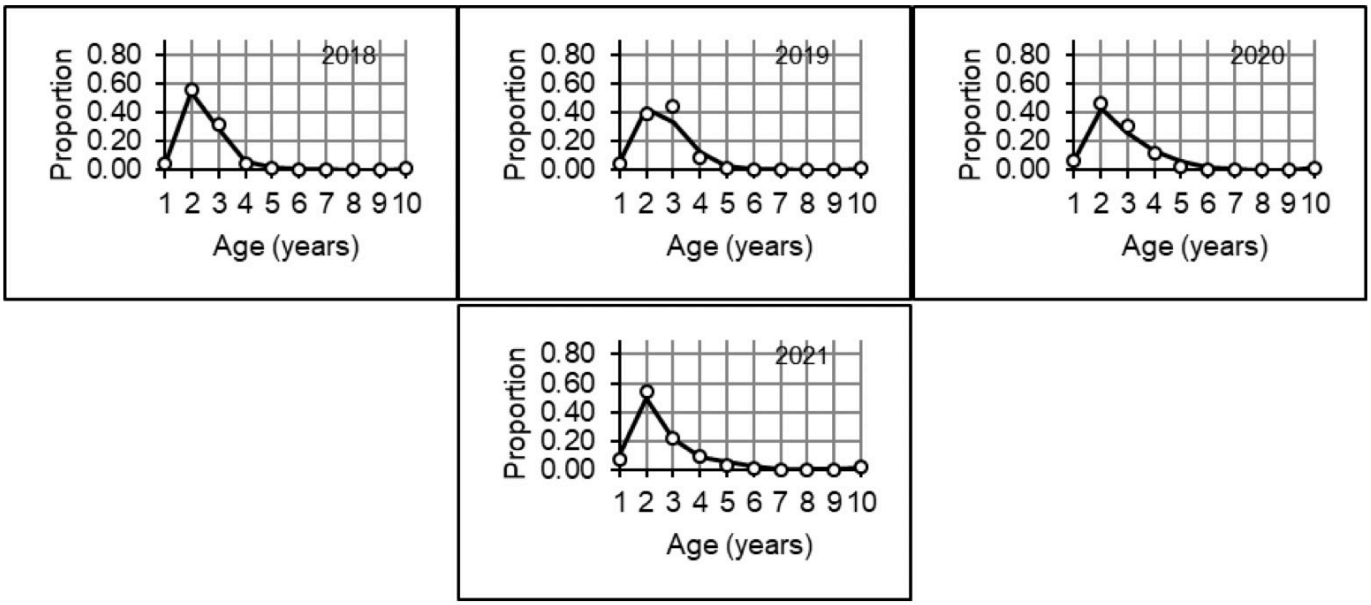


FIGURE 7. (continued)

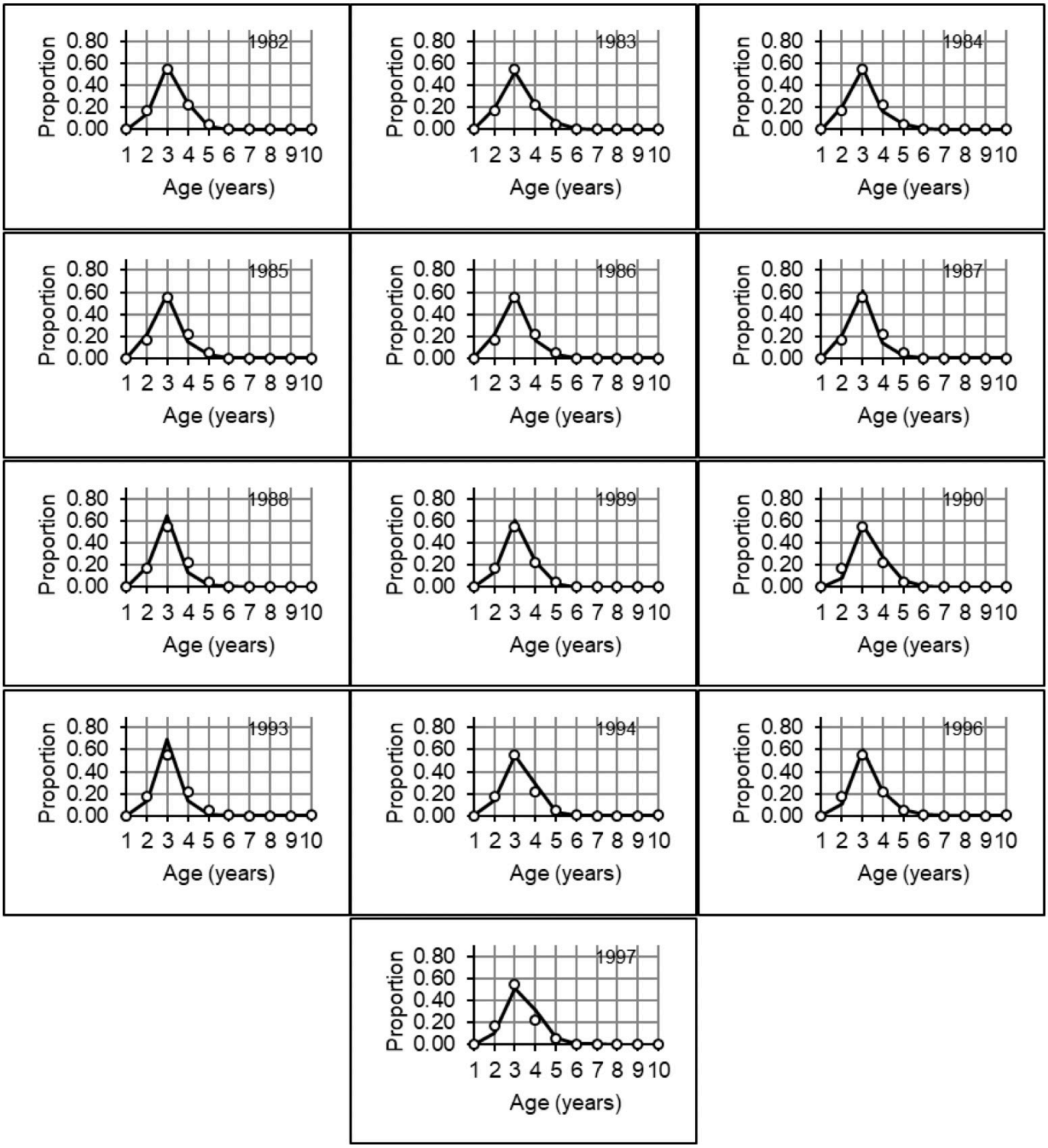


FIGURE 8. Annual input (open circles) and ASAP estimated (bold lines) inshore commercial Red Drum landings age compositions.

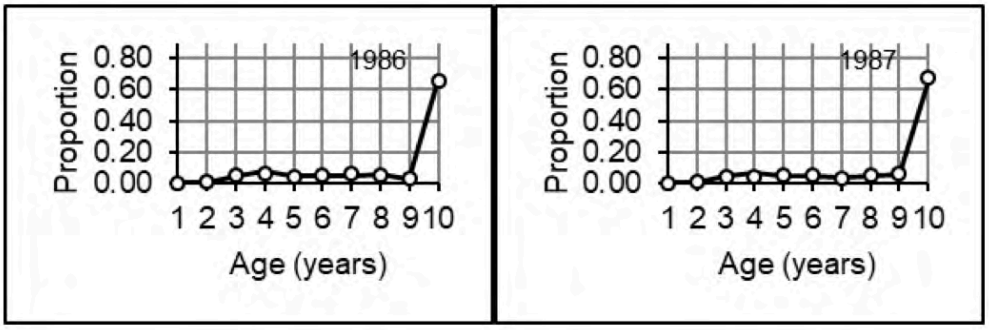


FIGURE 9. Annual input (open circles) and ASAP estimated (bold lines) offshore commercial Red Drum landings age compositions.

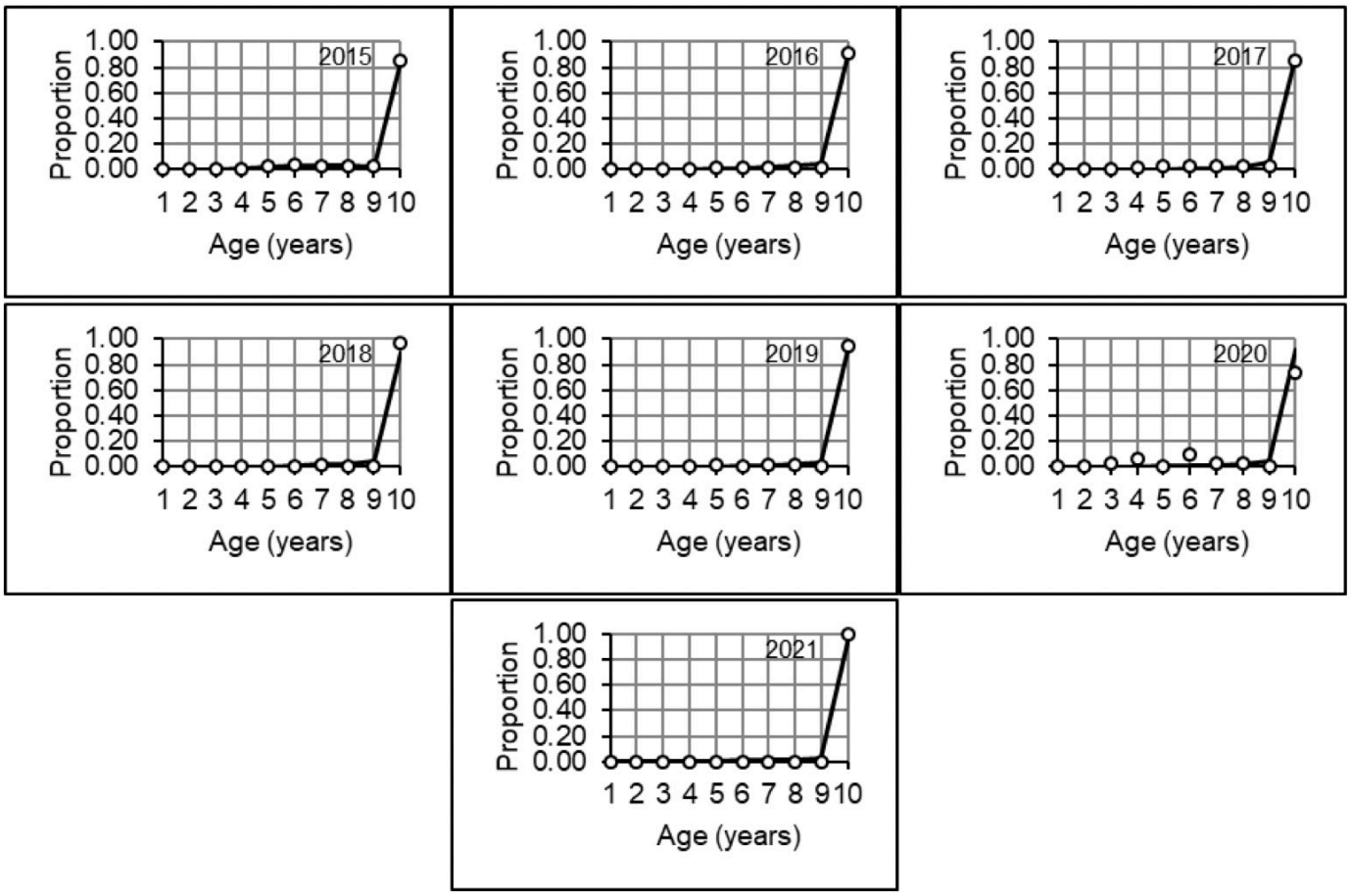


FIGURE 10. Annual input (open circles) and ASAP estimated (bold lines) age compositions of Red Drum catches of the LDWF component of the SEAMAP nearshore bottom long line survey.

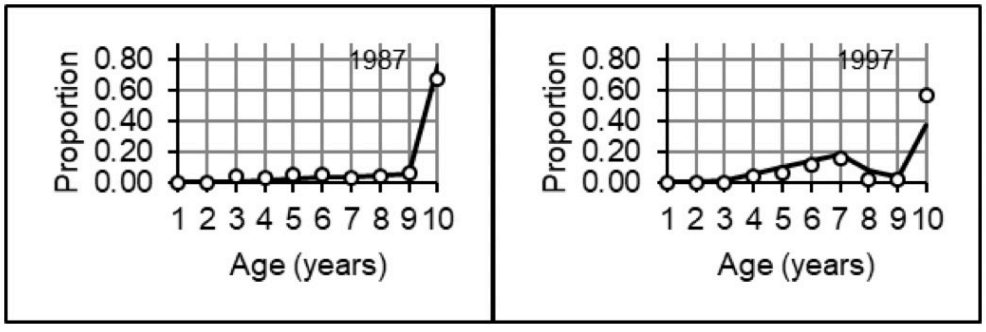


FIGURE 11. Annual input (open circles) and ASAP estimated (bold lines) age compositions of Red Drum catches from the MARFIN dataset used to represent the age composition of the NOAA Fisheries mark-recapture estimates.

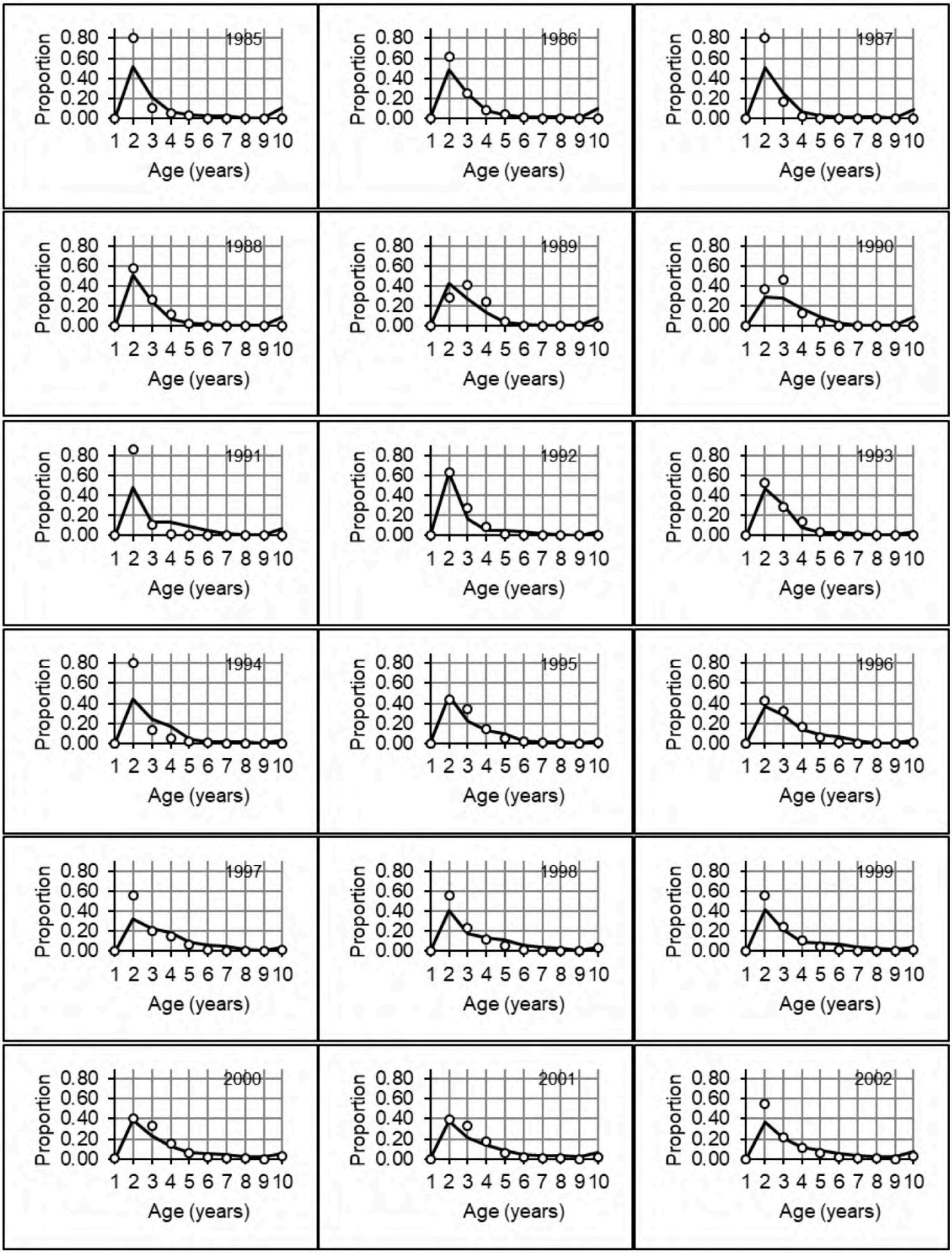


FIGURE 12. Annual input (open circles) and ASAP estimated (bold lines) age compositions of Red Drum catches from the LDWF marine FI trammel net survey.

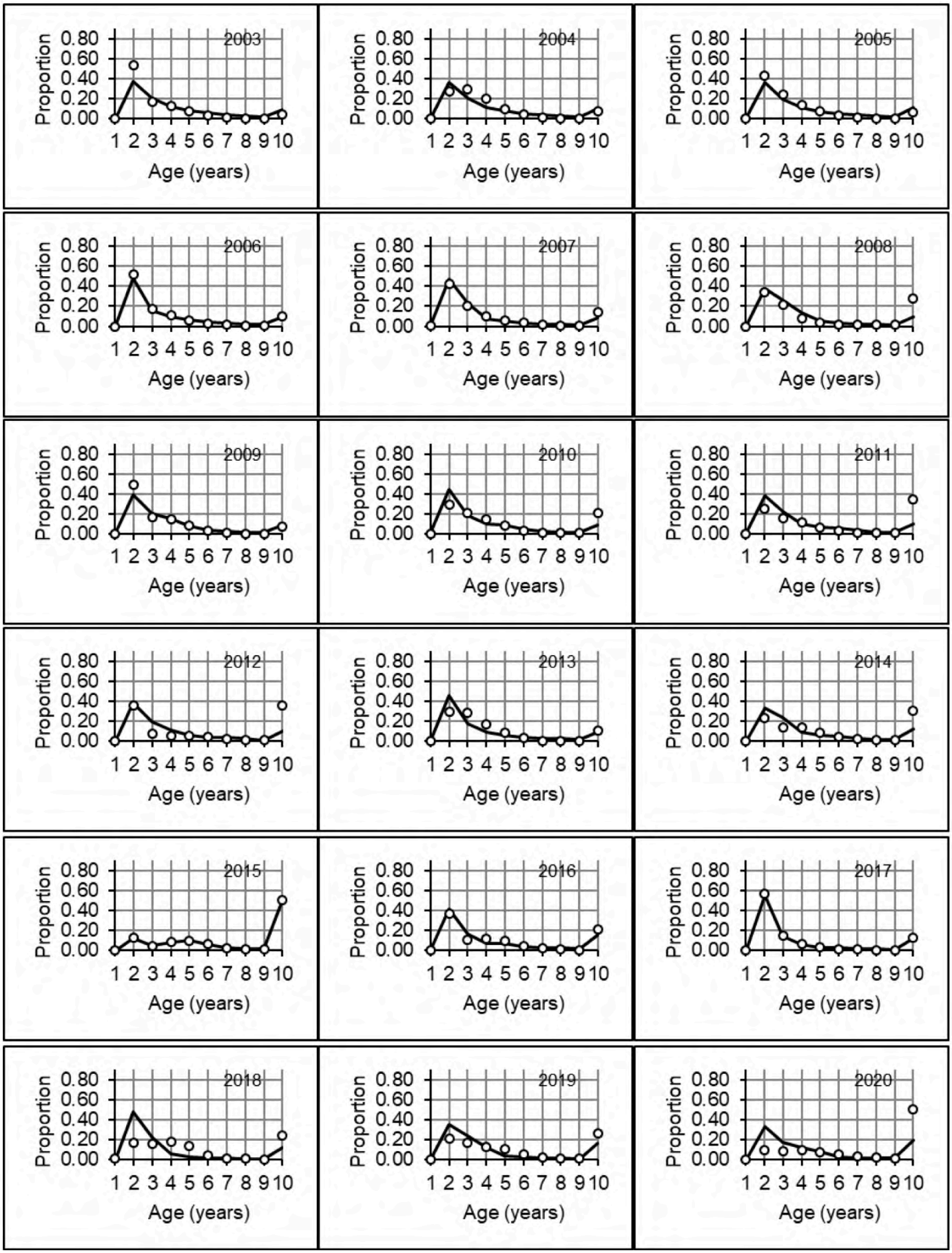


FIGURE 12. (continued)

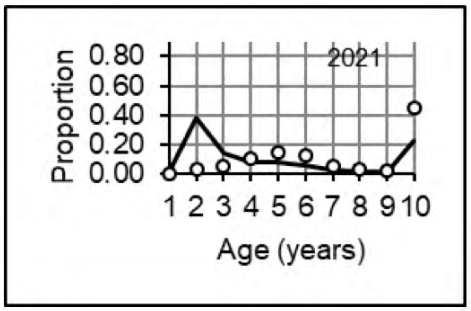


FIGURE 12. (continued)

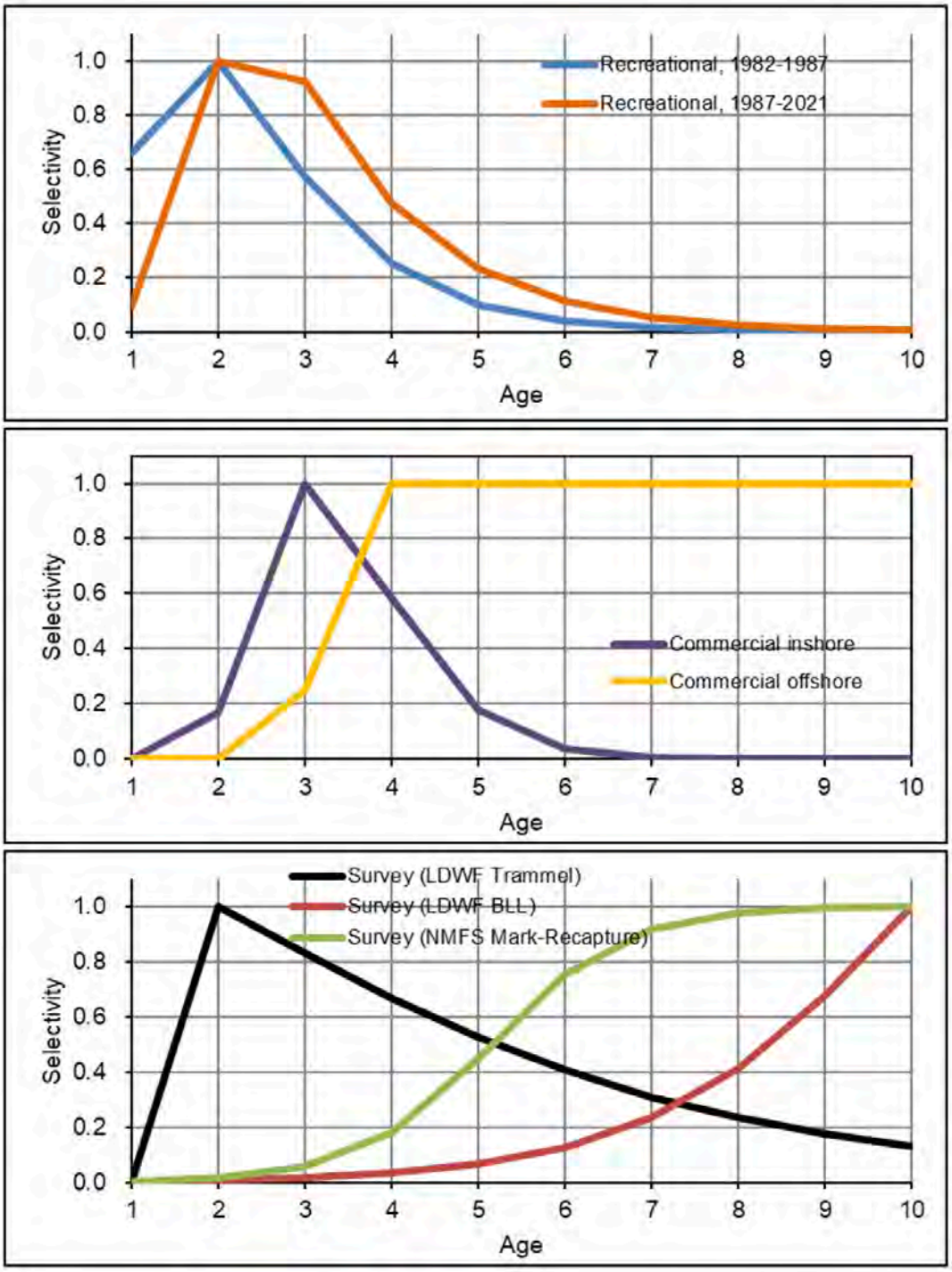


FIGURE 13. ASAP base model estimated recreational (top), commercial (middle), and survey (bottom) selectivities.

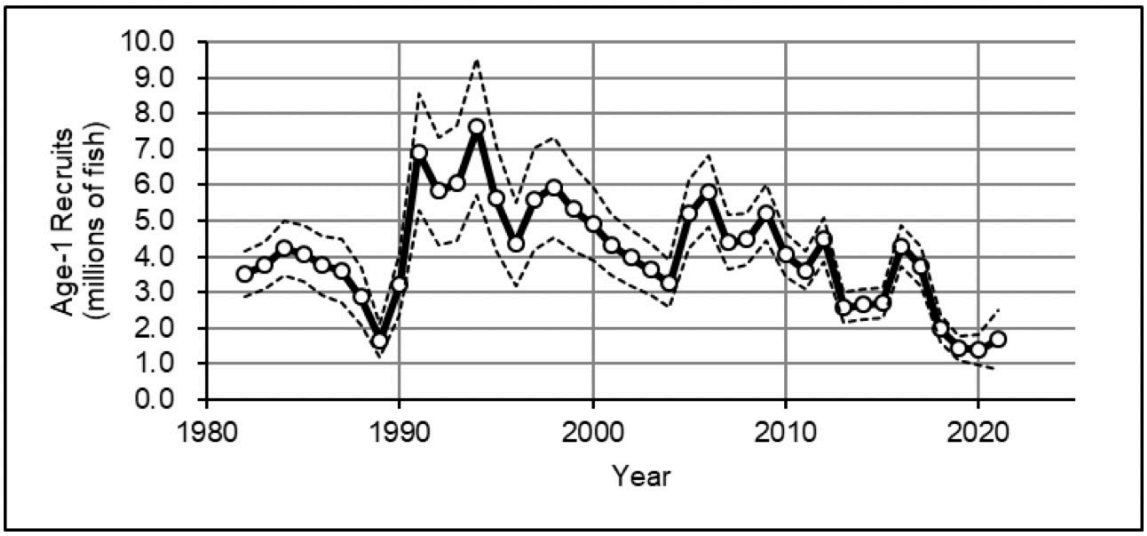


FIGURE 14. ASAP base model age-1 recruitment estimates. Dashed lines represent ±2 asymptotic standard errors.

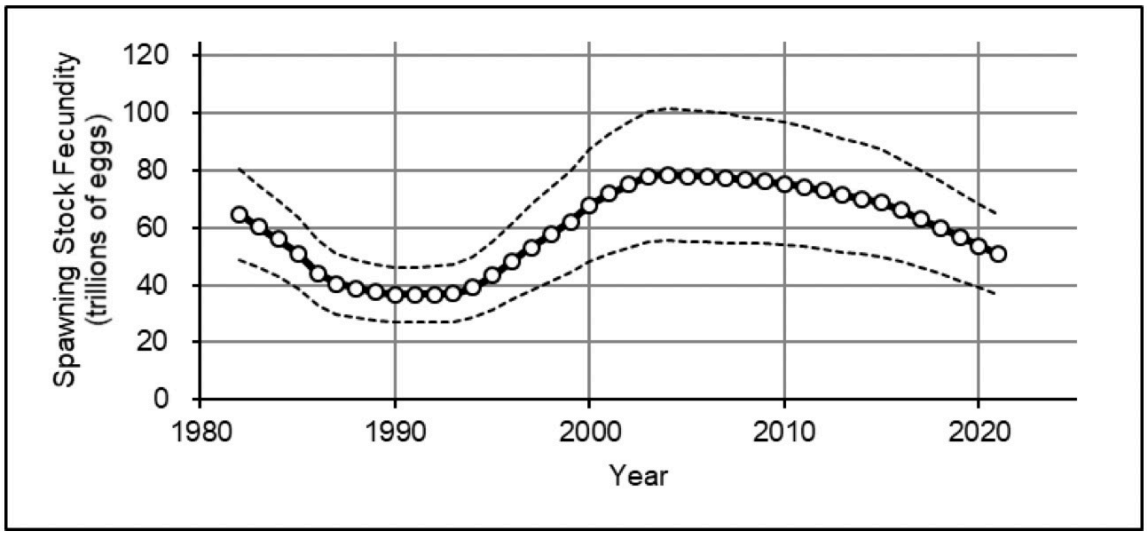


FIGURE 15. ASAP base model estimated spawning stock fecundity estimates. Dashed lines represent ±2 asymptotic standard errors.

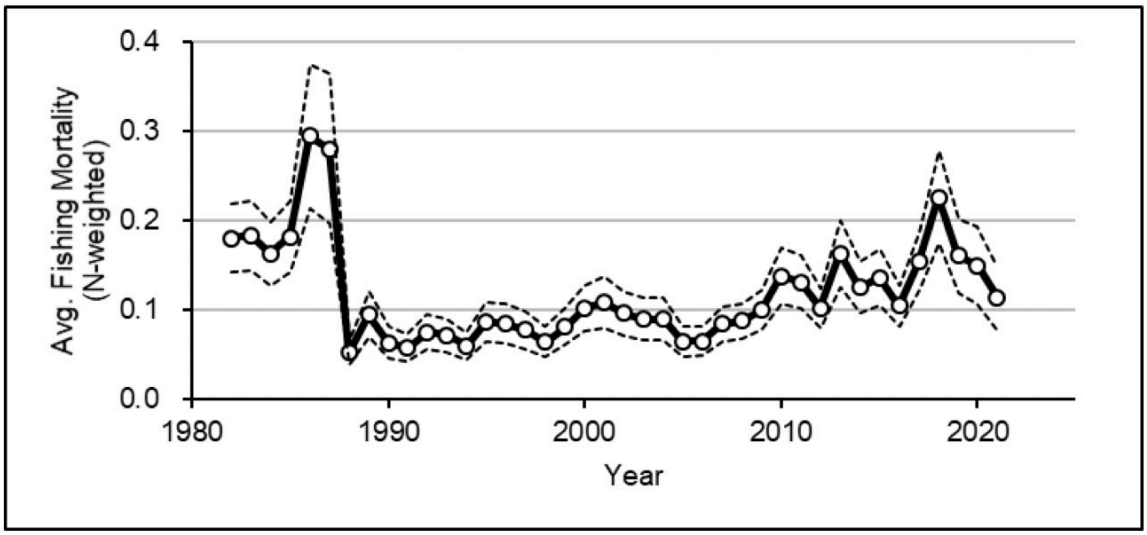


FIGURE 16. ASAP base model estimated average fishing mortality rates (N-weighted). Dashed lines represent ±2 asymptotic standard errors.

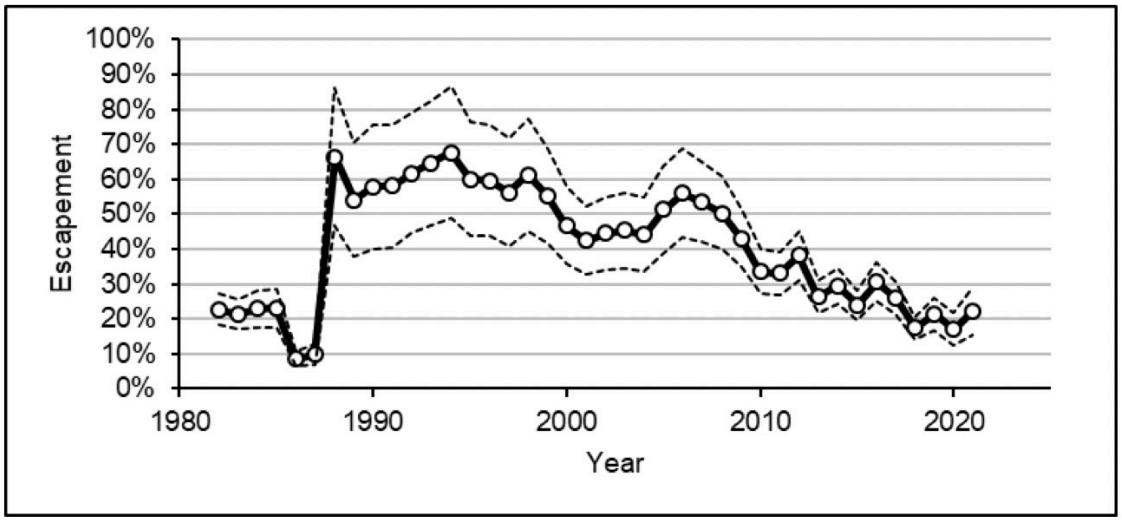


FIGURE 17. ASAP base model estimated escapement rates. Dashed lines represent ±2 asymptotic standard errors.

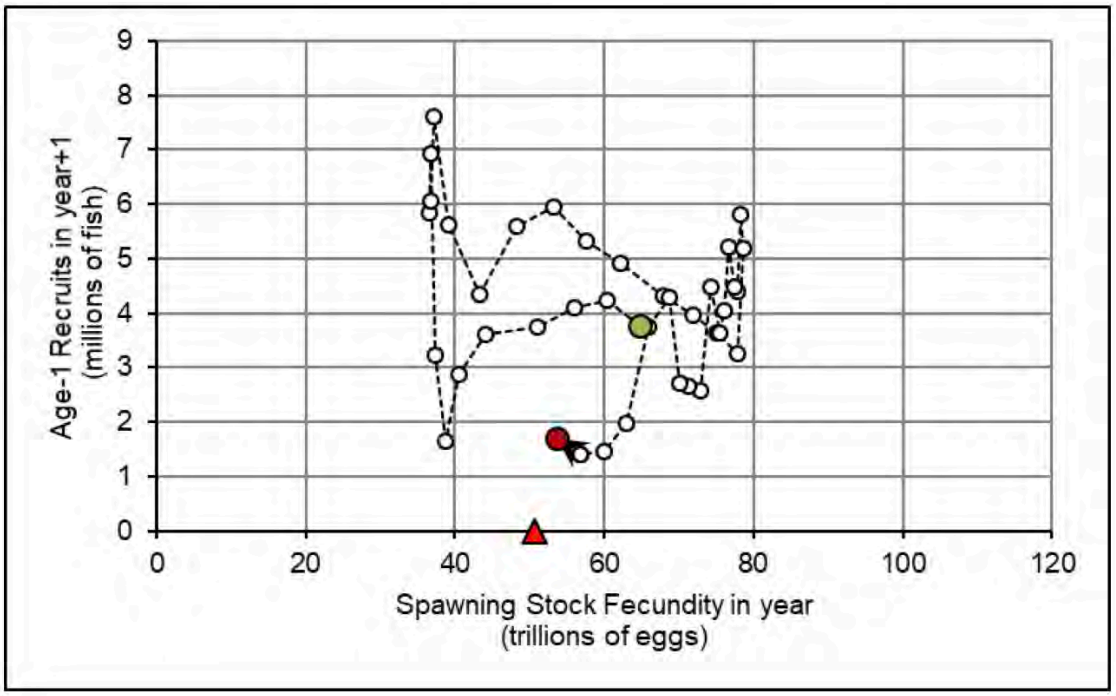


FIGURE 18. ASAP base model estimated age-1 recruits and female spawning stock fecundity. Arrow represents direction of the time-series. The red circle represents the most current data pair (2021 age-1 recruits / 2020 SSF) and the red triangle represents the 2021 SSF estimate. The green circle represents the first data pair (1983 age-1 recruits / 1982 female SSF).

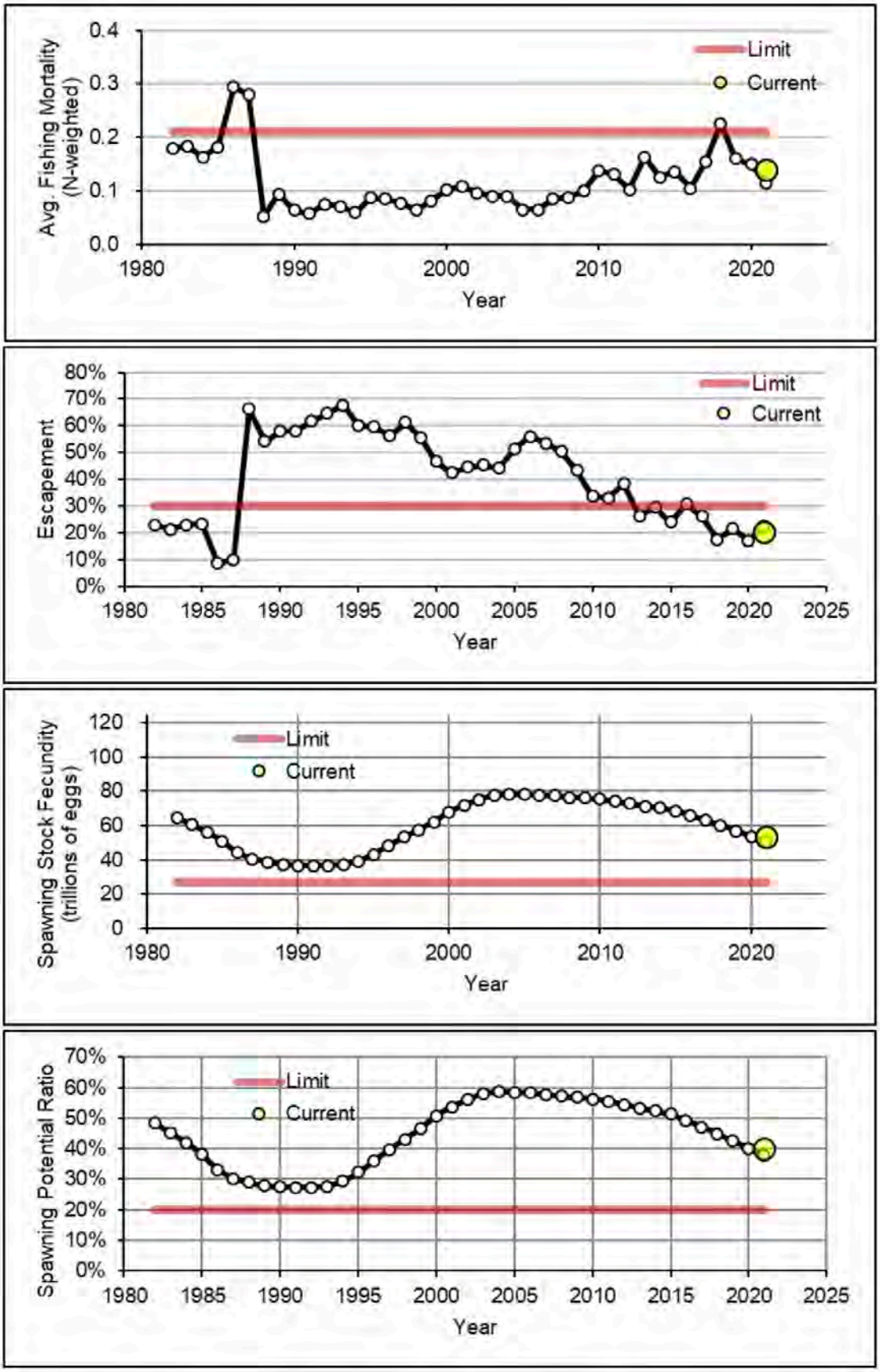


FIGURE 19. Time-series of ASAP base model estimated average fishing mortality rates (N-weighted), escapement rates, spawning stock fecundity, and spawning potential ratio relative to established limit reference points. Current values represent the geometric mean of the 2019-2021 estimates.

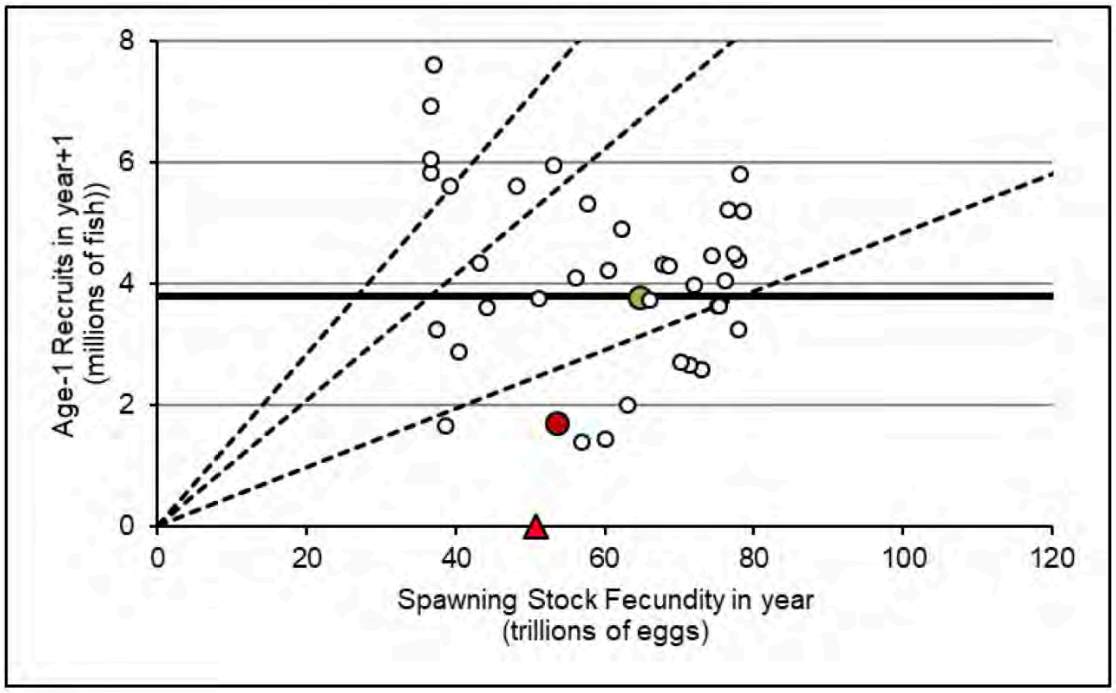


FIGURE 20. ASAP base model estimated age-1 recruits and spawning stock fecundity (open circles). Equilibrium recruitment is represented by the bold horizontal. The red circle represents the most current data pair (2021 age-1 recruits / 2020 SSF) and the red triangle represents the 2021 SSF estimate. The green circle represents the first data pair (1983 age-1 recruits / 1982 female SSF). Equilibrium recruitment per spawning stock biomass corresponding with the limit spawning stock fecundity reference point estimate and the minimum and maximum spawning stock fecundity estimates are represented by the slopes of the dashed diagonals (SSB_{limit}=20% SPR; min. SSB=27.4% SPR; max. SSB=58.7% SPR).

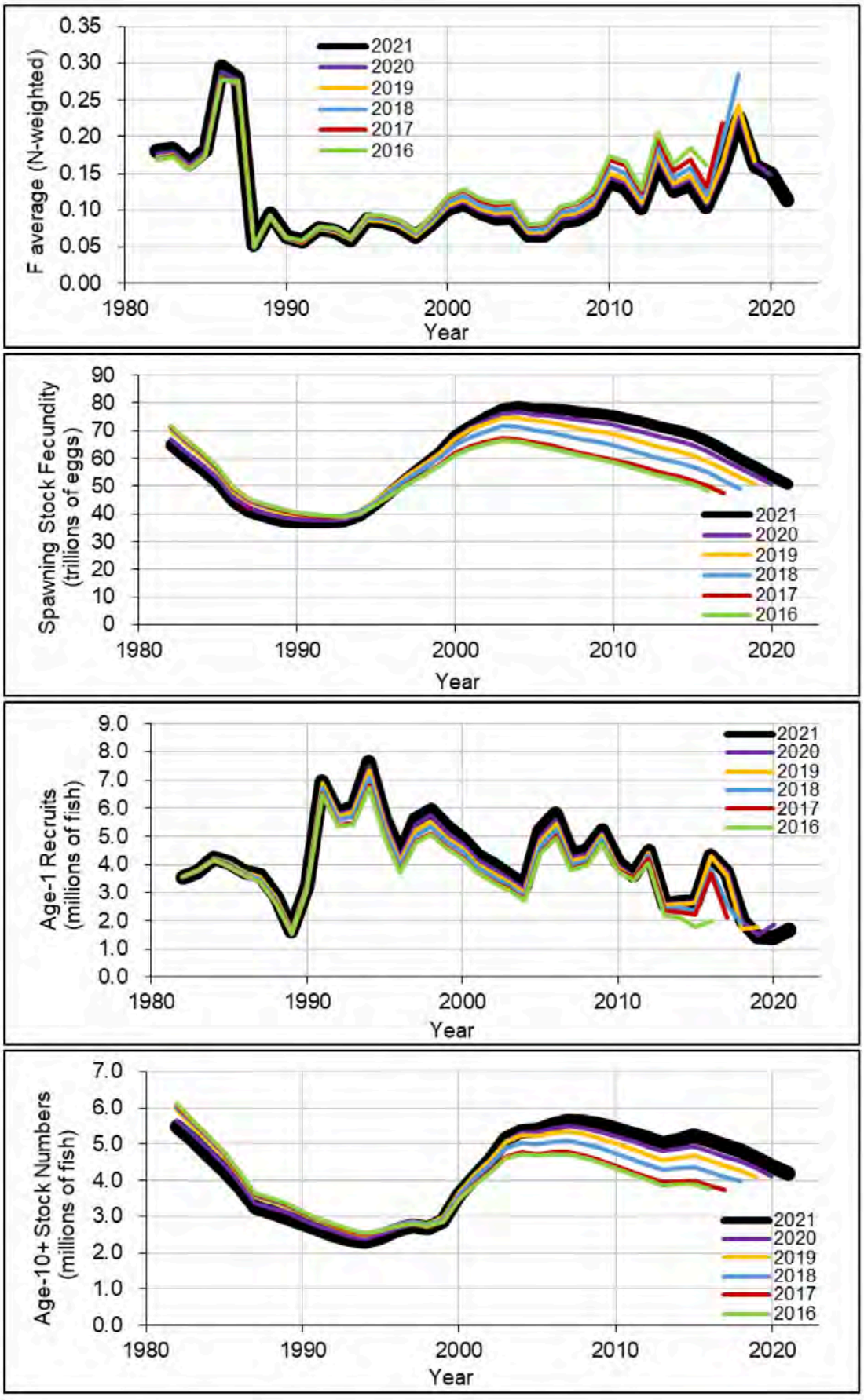


FIGURE 21. Retrospective analysis of ASAP base model estimates (top to bottom: average fishing mortality, spawning stock fecundity, age-1 recruits, and age 10+ stock numbers).

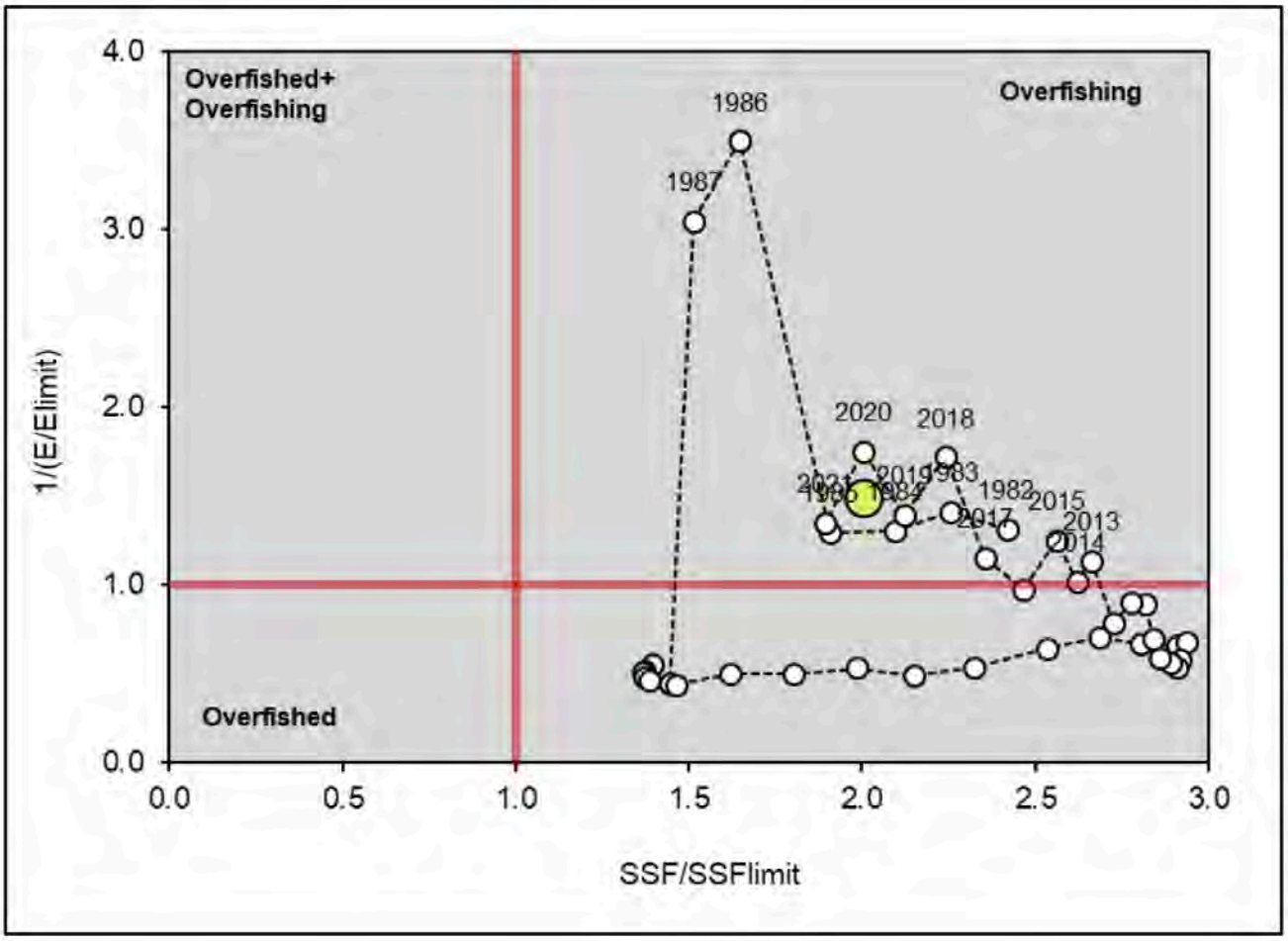


FIGURE 22. ASAP base model estimated ratios of annual escapement rates and spawning stock fecundity to limit reference points (Elimit and SSFlimit). The first and last year of the time-series are identified along with the other years overfishing occurred. The yellow circle represents current status (geometric mean 2019-2021).

Appendix 1:

LA Creel/MRIP Calibration Procedure

Joe West and Xinan Zhang
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 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.

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

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:

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

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	$\underline{E}_{LAcreel}$	$\underline{E}_{MRIP}$	$\hat{R}_E$
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:

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

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:

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

where

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

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:

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

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:

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

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

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

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

	Black Drum				Red Drum				Sheepshead				Southern Flounder				Spotted Seatrout			
	MRIP		LA Creel		MRIP		LA Creel		MRIP		LA Creel		MRIP		LA Creel		MRIP		LA Creel	
Year	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	17.9	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	29.4	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	16.9
1993	246,588	17.6	89,348	23.4	2,581,130	9.9	868,002	16.6	885,380	26.7	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

	Black Drum				Red Drum				Sheepshead				Southern Flounder				Spotted Seatrout			
	MRIP		LA Creel		MRIP		LA Creel		MRIP		LA Creel		MRIP		LA Creel		MRIP		LA Creel	
Year	Harvest	PSE	Harvest	PSE	Harvest	PSE	Harvest	PSE	Harvest	PSE	Harvest	PSE	Harvest	PSE	Harvest	PSE	Harvest	PSE	Harvest	PSE
			105,13																	
1982	880,444	22.8	1	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	24,551	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	13,588	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:

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

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:

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

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

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

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:

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

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

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

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

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

where

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

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.

FM = Private

	Black Drum				Red Drum				Sheepshead				Southern Flounder				Spotted Seatrout			
	MRIP		LA Creel		MRIP		LA Creel		MRIP		LA Creel		MRIP		LA Creel		MRIP		LA Creel	
Year	Discards	PSE	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	1,083,66							
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	8	45.5	421,148	51.2	1,654,868	35.7	594,062	39.0
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	145,644	54.4	50,016	55.2	2,092,864	42.4	785,069	46.9
1985	291,106	38.5	96,316	41.4	243,413	40.1	94,362	47.4	317,951	28.8	111,945	33.6	65,411	64.9	20,866	65.9	197,040	21.8	65,344	29.3
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	61,785	68.0	21,053	66.7	1,709,137	23.1	602,297	28.0
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	367,830	40.1	163,383	47.5	4,745,760	10.2	1,657,453	17.8
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	10,809	42.4	4,030	45.8	6,980,249	12.7	2,392,248	20.4
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	375,399	58.9	118,042	59.6	5,610,284	10.4	2,046,380	17.6
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	260,401	93.8	81,599	91.0	5,656,036	14.2	1,867,058	19.1
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	334,821	40.3	110,310	41.6	4,750,794	18.0	1,592,531	22.9
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	114,636	37.5	33,497	32.0	12,341,402	9.3	4,362,600	16.5
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	42,988	21.4	14,639	24.4	8,795,484	8.4	2,990,434	15.1
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	45,686	33.2	16,433	36.2	6,905,906	11.3	2,273,152	17.2
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	34,050	29.6	11,784	31.8	7,780,829	9.7	2,535,516	16.2
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	59,357	34.4	21,519	34.0	7,603,172	11.0	2,500,637	19.7
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	80,897	23.0	27,331	27.1	8,055,743	10.2	2,831,212	16.9
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	98,494	29.1	34,023	32.0	10,917,063	19.7	3,786,705	24.2
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	99,007	29.1	32,671	32.2	9,977,400	9.3	3,575,231	16.7
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	84,447	20.8	28,690	25.4	11,688,515	8.8	3,908,262	15.9
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	121,790	28.3	35,906	27.9	11,091,619	7.9	3,712,515	15.0
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	88,936	21.8	33,982	27.9	7,365,829	11.2	2,409,330	16.7
2003	1,172,837	17.8	404,338	21.7	5,286,909	10.2	1,718,114	18.6	930,576	20.8	289,313	26.9	90,982	26.1	33,016	29.7	6,778,238	11.5	2,352,328	17.5
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	172,327	23.4	66,101	29.7	10,682,302	9.5	3,736,073	17.8
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	149,844	27.6	52,254	29.8	9,847,326	11.5	3,369,107	17.0
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	87,557	25.3	30,737	27.2	10,903,988	9.7	3,744,965	16.4
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	41,784	27.7	13,966	30.2	11,930,250	9.1	4,301,096	16.2
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	78,231	25.8	27,959	31.2	9,924,934	8.4	3,372,169	15.8
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	50,063	26.0	17,563	28.6	13,158,192	9.4	4,636,757	16.2
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	89,961	28.4	31,515	31.9	13,919,234	10.0	4,676,052	16.5
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	111,912	23.5	40,390	25.4	9,190,616	12.6	3,268,802	20.1
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	85,027	24.1	31,292	27.7	10,091,732	9.5	3,470,918	16.1
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	152,363	24.3	53,816	27.4	13,175,745	8.7	4,589,246	17.3
2014			330,955	24.0			1,609,006	11.8			148,454	38.3	197,844	21.3	73,027	25.1	13,404,945	10.3	4,614,319	17.0
2015			295,893	21.4			1,486,227	10.3			98,800	30.3			44,345	56.6			2,316,191	11.3
2016			161,733	21.0			1,096,370	6.4			47,135	25.6			30,296	41.4			3,440,509	12.3
															29,612	24.3			3,643,636	8.6

FM = Shore

	Black Drum				Red Drum				Sheepshead				Southern Flounder				Spotted Seatrout			
	MRIP		LA Creel		MRIP		LA Creel		MRIP		LA Creel		MRIP		LA Creel		MRIP		LA Creel	
Year	Discards	PSE	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					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	3,384	99.3	290	100.4	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	12,292	79.8	830	80.6	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	11,853	75.8	921	77.8	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	117,501	46.9	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	189,917	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	6,737	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	2,252,160	31.5	175,034	33.5
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	1,035,758	30.9	89,243	35.9
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	1,546,106	34.1	113,669	37.9
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	1,547,223	44.2	171,926	58.2
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	895,780	34.2	84,088	37.7
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	939,354	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			51,901	55.7			9,346	53.3			594,294	15.1
2015			76,780	21.4			378,245	11.5			23,835	34.1			9,300	45.9			727,719	12.3
2016			50,106	21.9			275,986	8.7			24,951	66.9			9,495	37.5			892,875	11.4

FM = Charter

	Black Drum				Red Drum				Sheepshead				Southern Flounder				Spotted Seatrout			
	MRIP		LA Creel		MRIP		LA Creel		MRIP		LA Creel		MRIP		LA Creel		MRIP		LA Creel	
Year	Discards	PSE	Discards	PSE	Discards	PSE	Discards	PSE	Discards	PSE	Discards	PSE	Discards	PSE	Discards	PSE	Discards	PSE	Discards	PSE
1982																	7,252	32.4		
1983													352	57.8			121,816	54.1		
1984	182	112.8							1,166	78.8							116	101.5		
1985									587	107.7							42,739	26.9		
1986					25	55.4			266	97.1							16,514	42.5		
1987	2,752	45.9			2,597	42.5			2,484	64.6							64,522	30.1		
1988	5	106.1			1,561	59.4											59,254	37.7		
1989	298	63.1			26,854	45.6			1,199	62.5			1,401	106.9			190,285	38.2		
1990	6,449	56.2			30,305	40.5			16,177	94.7			445	57.1			39,578	32.1		
1991	3,258	52.2			46,366	44.7			1,641	52.5			280	82.8			144,689	30.9		
1992	7,421	46.7			63,966	35.7			3,664	55.2			225	61.5			91,373	31.5		
1993	410	71.7			58,230	19.2											155,919	30.0		
1994	329	100.1			70,705	32.6			1,123	61.4							243,186	36.3		
1995	2,606	72.8			198,687	34.0			1,654	110.7							300,673	31.6		
1996	4,776	74.9			113,101	28.6			406	56.1			843	103.1			223,999	36.0		
1997	20,581	37.1			157,816	23.0			19,422	46.2			490	68.4			260,983	23.5		
1998	18,161	43.4			138,650	25.5			8,030	44.8			647	48.0			199,955	31.8		
1999	12,980	33.2			105,462	22.3			5,944	40.9			520	57.8			277,771	21.3		
2000	10,335	28.4			108,340	13.2			1,739	48.3			259	59.4			175,694	15.8		
2001	13,566	28.8			203,577	19.3			12,615	31.6			1,224	72.4			211,516	15.0		
2002	9,657	30.9			138,601	17.2			4,954	29.6			1,248	50.0			104,977	25.3		
2003	25,831	34.0			129,125	18.5			16,306	53.2			982	53.9			170,658	26.6		
2004	13,050	32.7			105,936	14.2			10,370	38.8			503	55.6			221,275	16.5		
2005	5,692	45.0			53,333	25.0			3,190	61.4							263,044	26.2		
2006	30,916	38.8			144,300	48.0			10,206	71.3							464,015	26.8		
2007	13,350	37.3			178,892	21.5			23,101	34.4			486	60.6			238,335	19.0		
2008	31,830	33.1			198,411	16.5			30,031	55.1			1,197	59.3			323,315	17.3		
2009	62,094	27.2			332,961	19.7			16,588	52.9			98	71.3			356,216	17.4		
2010	38,261	33.5			151,250	23.0			10,938	36.4			69	107.9			167,473	21.6		
2011	29,517	38.0			203,917	17.0			5,021	34.4			640	62.2			149,933	27.4		
2012	21,344	30.0			153,584	17.6			5,844	46.6			2,353	48.7			205,441	22.7		
2013	83,501	7.5			281,131	7.2			48,342	11.3			12,017	15.1			222,879	7.6		
2014			14,093	31.5			353,243	19.2			2,706	40.6			442	53.7			316,892	29.4
2015			14,464	32.7			403,525	14.1			16,575	50.0			553	46.7			413,119	18.4
2016			16,975	33.3			338,910	7.4			10,778	23.1			497	31.4			439,247	9.6

Appendix 2:

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^2=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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TABLE 1. Spotted seatrout released and retained catches, number of sets observed, and the mean, minimum, and maximum catches per set across studies.

			released catch			retained catch		
Study	Year	Species	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			**0.11**			**0.000**
		Mean			**0.14**			**0.006**
		Max			**0.16**			**0.014**

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

			released catch			retained catch		
Study	Year	Species	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			**0.12**			**0.00**
		Mean			**0.80**			**0.04**
		Max			**1.65**			**0.14**

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.

	RD Bycatch		
Year	max	mean	min
1982	35,684	16,597	2,291
1983	38,355	17,839	2,462
1984	38,393	17,857	2,464
1985	34,884	16,225	2,239
1986	33,823	15,731	2,171
1987	36,139	16,808	2,320
1988	28,555	13,281	1,833
1989	27,056	12,584	1,737
1990	25,371	11,800	1,629
1991	26,910	12,516	1,727
1992	23,484	10,923	1,507
1993	27,659	12,865	1,775
1994	34,513	16,052	2,215
1995	25,548	11,883	1,640
1996	25,926	12,059	1,664
1997	30,089	13,995	1,931
1998	25,347	11,789	1,627
1999	32,941	15,321	2,114
2000	27,962	13,005	1,795
2001	24,607	11,445	1,580
2002	28,211	13,121	1,811
2003	26,049	12,116	1,672
2004	24,653	11,466	1,582
2005	21,497	9,998	1,380
2006	22,862	10,633	1,468
2007	23,526	10,942	1,510
2008	22,781	10,595	1,462
2009	23,463	10,913	1,506
2010	21,356	9,933	1,371
2011	28,811	13,400	1,849
2012	24,533	11,410	1,575
2013	24,485	11,388	1,572
2014	22,118	10,287	1,420
2015	25,219	11,730	1,619
2016	23,843	11,089	1,530
2017	22,047	10,254	1,415
2018	24,604	11,444	1,579
2019	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.

	SST Landings		SST Bycatch			RD Landings		RD Bycatch		
Year	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

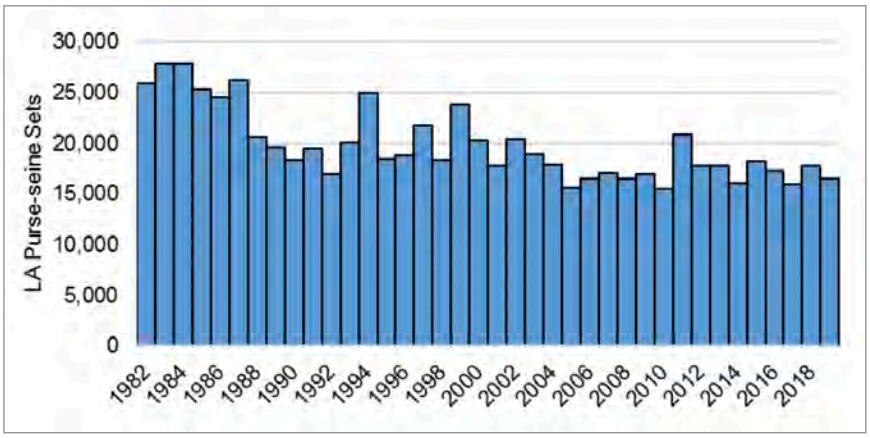

FIGURE 1. Time-series of estimated LA menhaden fishery effort (number of purse-seine sets per year).

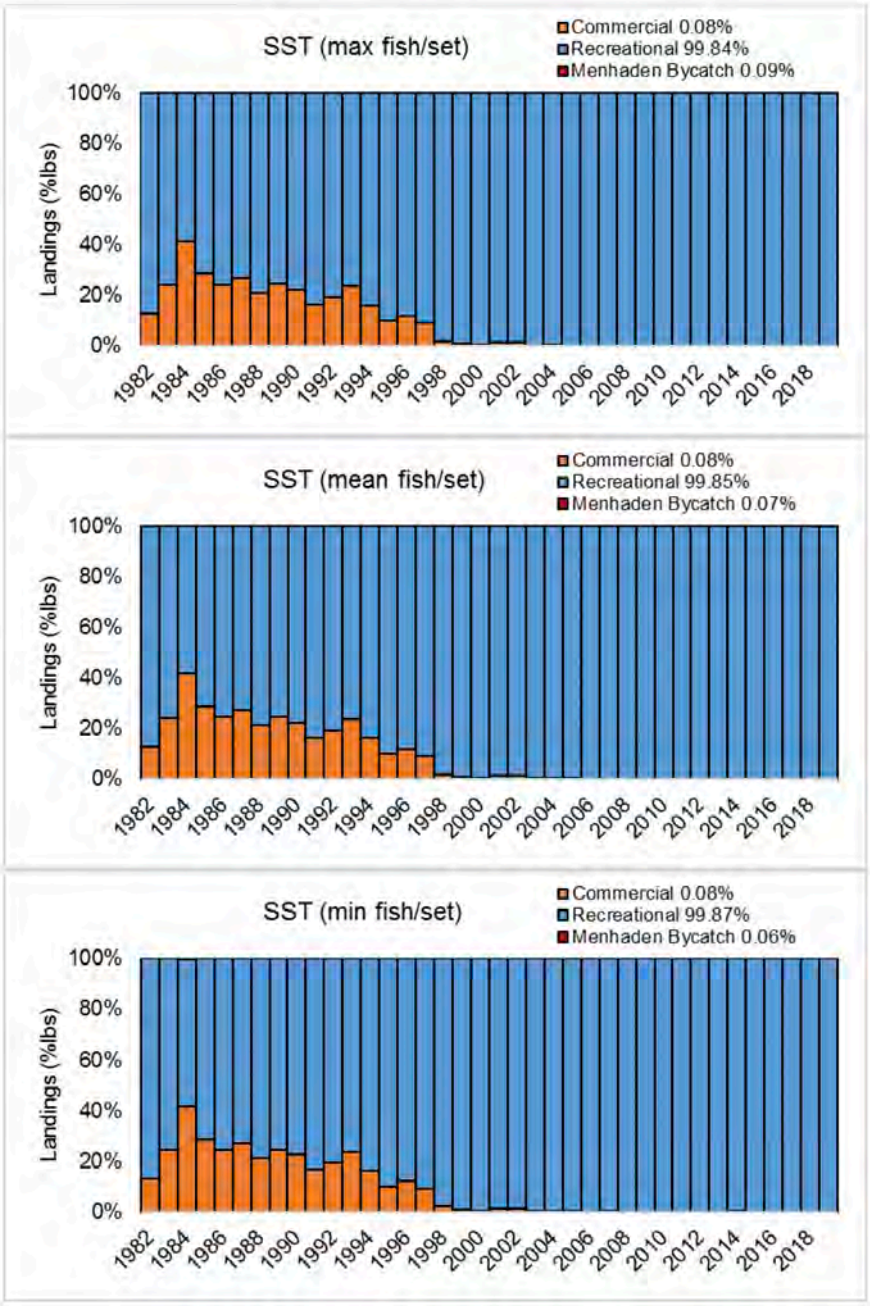

FIGURE 2. Comparison of LA spotted seatrout commercial and recreational landings, and LA menhaden bycatch estimates for the maximum (top), mean (center), and minimum (bottom) catch per set observations. Values in legends represent the mean landings percentages from 2010-2019.

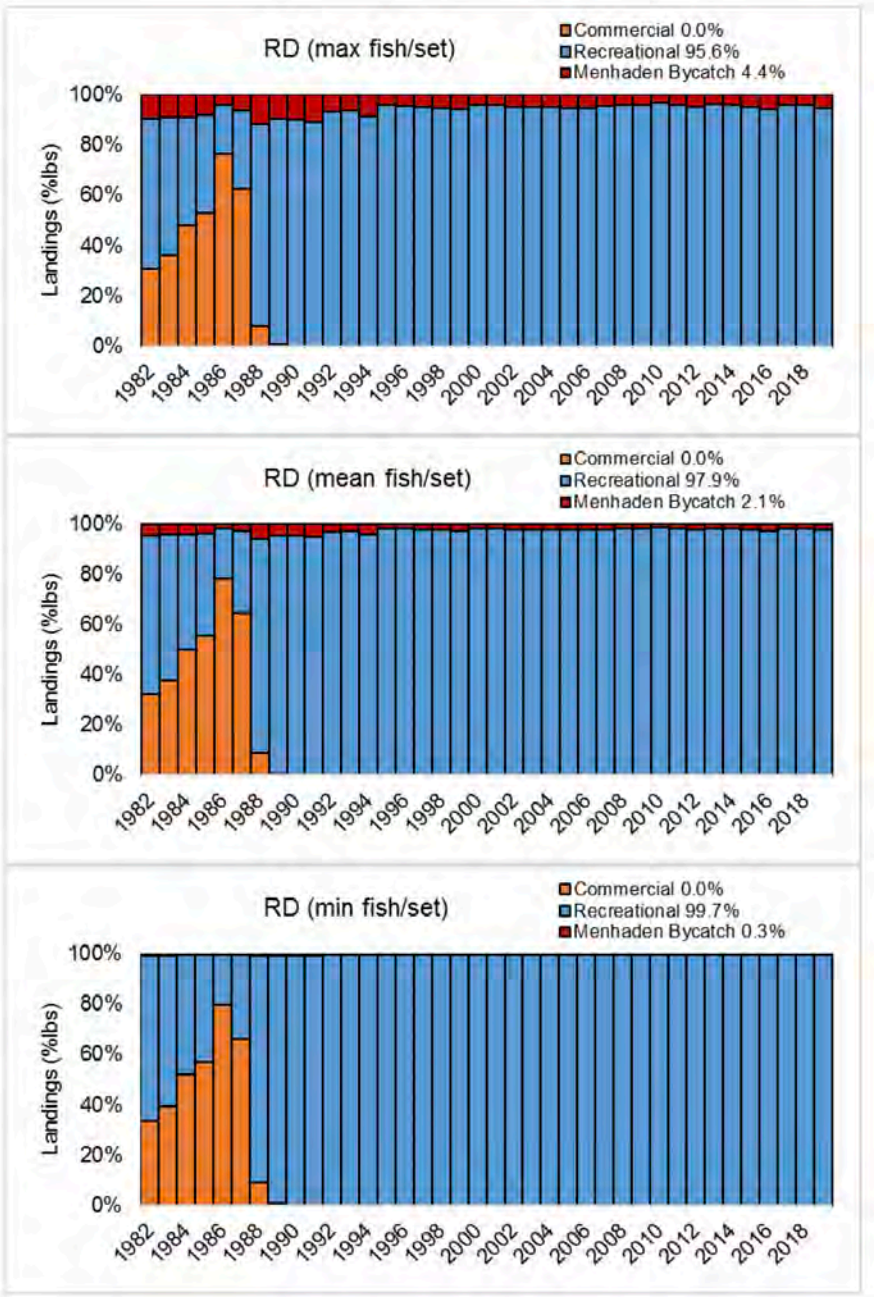

FIGURE 3. Comparison of LA Red Drum commercial and recreational landings, and LA menhaden bycatch estimates for the maximum (top), mean (center), and minimum (bottom) catch per set observations. Values in legends represent the mean landings percentages from 2010-2019.

Appendix 3:

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-2000s 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 though 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 12 participating vessels, nine fished with skimmer nets, two with otter trawls, and one 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 composi-

tions 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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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

	Fishery trips		Observed trips	
Gear	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%

	Fishery trips		Observed trips	
CSA	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%

	Fishery trips		Observed trips	
Season	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%

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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 POMPANO	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

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
THINSTRIPE 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)		
Bin	Frequency	Percent
0.0	163	50.309
1.0	55	16.975
2.0	39	12.037
3.0	18	5.556
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

Ratio (bycatch/shrimp)	
Mean	1.013
L95%CI	0.882
U95%CI	1.163
CV	1.986
Tows	324

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	

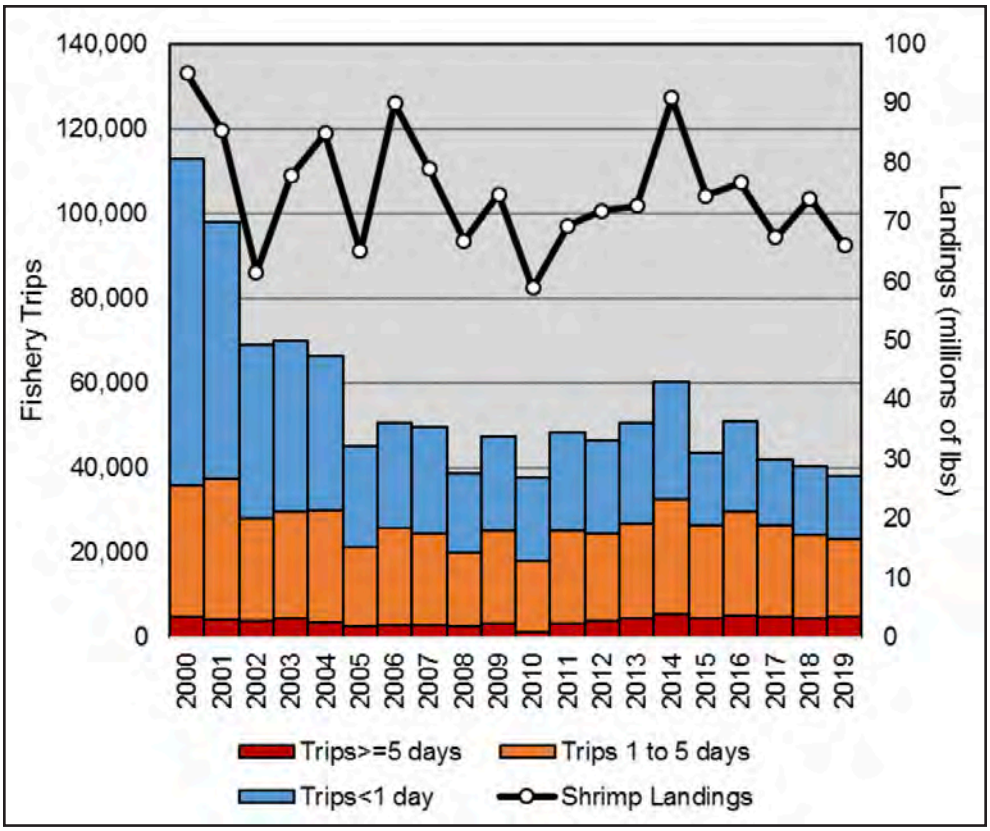
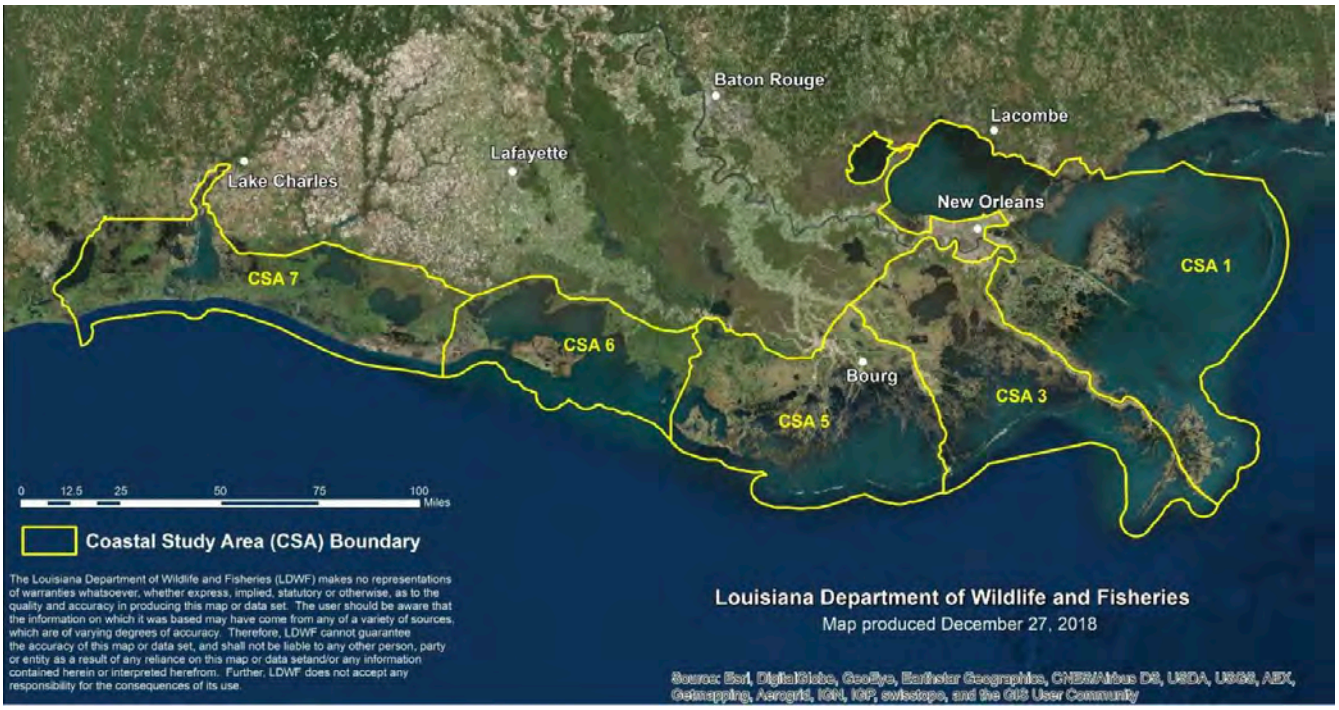


FIGURE 1. Shrimp fishery trips in LA waters by number of days at sea and corresponding total penaeid shrimp landings taken from the LDWF Trip Ticket program, 2000-2019. Note: Landings and fishery trips do not include records from out of state or federal waters.



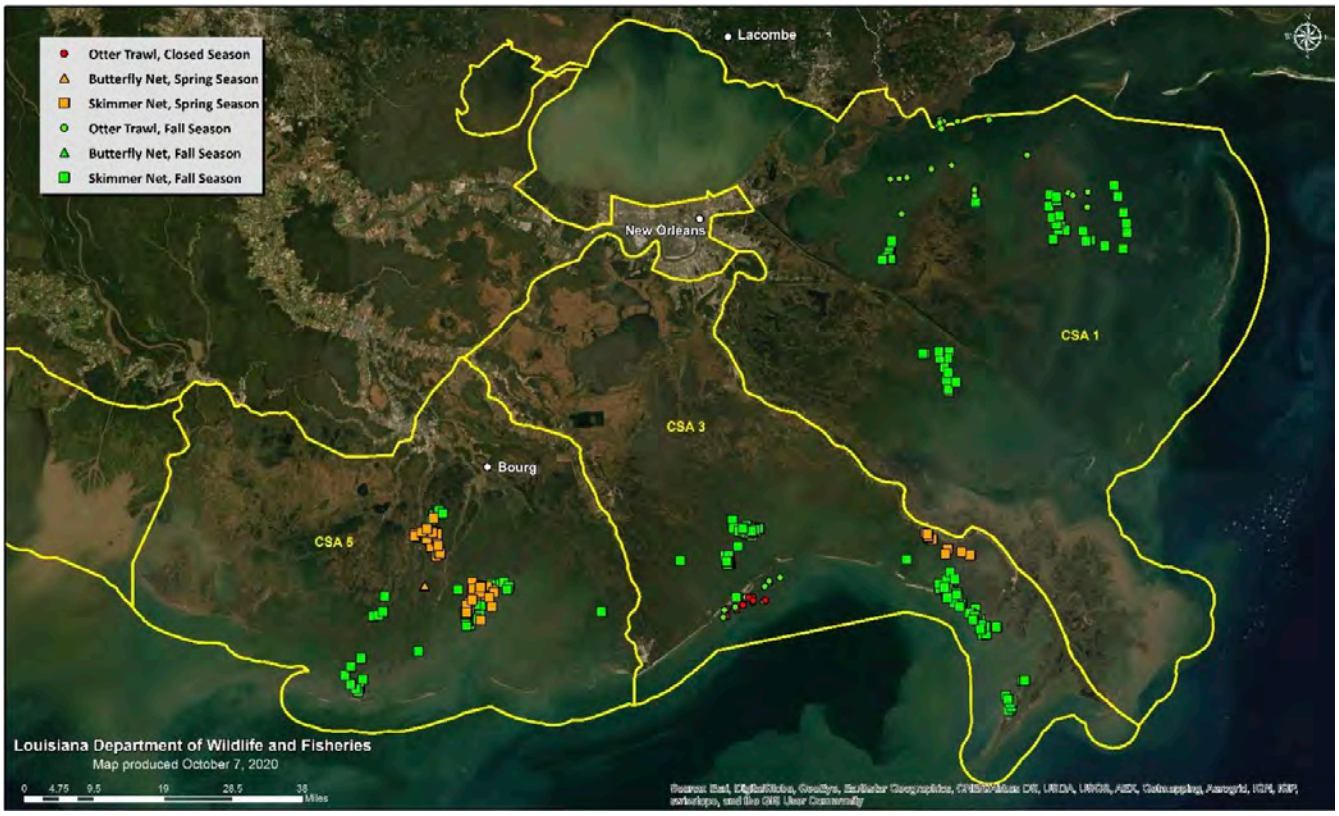


FIGURE 2. Louisiana state waters and LDWF Coastal Study Areas delineated by the yellow lines (top graphic) and locations of observed fishery tows (bottom graphic) by gear fished (otter trawl, skimmer net, butterfly net) and fishing season (spring, fall, inshore closed).

Appendix 4:

Louisiana Red Drum (*Sciaenops ocellatus*) Life History

Erik Lang and Joe West
Office of Fisheries
Louisiana Department of Wildlife and Fisheries

OVERVIEW

Red drum (*Sciaenops ocellatus*) growth and weight-length models are developed from Louisiana Department of Wildlife and Fisheries (LDWF) datasets for use in stock assessment.

METHODS

Growth

The von Bertalanffy growth model is the most common function used to model length-at-age and is configured as:

$$L_t = L_\infty\left(1 - e^{-k(t-t_0)}\right) \quad [1]$$

where L_t is mean length at age in years (t), L_∞ is the asymptotic average maximum size, k is the rate at which length approaches L_∞, and t_0 is the theoretical age when length = 0.

The von Bertalanffy growth model has been proven inadequate for fitting some sciaenid species length-at-age data, including Red Drum (Beckman et al. 1988). Because of the very rapid growth exhibited in juveniles and the relatively slow growth of adult Red Drum (RD), predicted lengths-at-age of younger fish tend to be overestimated and predicted lengths-at-age of older fish underestimated with the standard von Bertalanffy model.

A different growth model has been developed that accounts for growth rates changing continuously with age (damped growth; Porch et al. 2002), rather than the constant growth rate (k) across ages inherent to the von Bertalanffy model. The damped growth model allows a continuous change in growth rates across ages rather than a single discontinuous change at a particular age such as the "double" von Bertalanffy generalization. Length-at-age is calculated with the damped model as:

$$L_t = L_\infty(1 - e^{\beta - k_0(t-t_0)}) \quad [2]$$

$$\beta = \frac{k_1}{\lambda}(e^{-\lambda t} - e^{-\lambda t_0})$$

where $k = k_0 + k_1 e^{-\lambda t} \geq 0$ (i.e., assuming fish will not shrink with age). The λ parameter is the damping coefficient allowing growth rates to change with age.

Both growth models above were fit to a LDWF RD dataset with the SAS nonlinear regression fitting procedure (PROC NLIN; SAS 2008). To determine the most suitable model for stock assessment purposes, residual plots of each model were examined for normality and each model was ranked using Akaike's (1973) information criterion (AIC).

Due to the minimum size limit in the RD fishery, only LDWF FI information was used for model fitting. The FI length-at-age dataset (n = 1,333) consists of age samples from RD catches (2019-2021) collected from the LDWF estuarine trammel net and bag seine survey (LDWF 2018), and the LDWF component of the SEAMAP nearshore bottom longline survey (SEAMAP 2013). Biological ages are assigned with an assumed birthdate of Oct. 1.

The young-of-the-year fish (yoy) included from the marine bag seine survey are not directly aged, but are assigned ages using the assumed Oct. 1 birthdate and the sample collection date, and assuming only fish less than 8 inches total length are yoy fish after removing fish clearly not yoy. To not overfit the yoy data, a random draw of 100 yoy fish were selected from the available length-at-age samples from the seine survey and included in the modeled dataset.

Weight-Length

The relationship between fish length and weight is modeled with a power function configured as:

$$W = aL^b \quad [3]$$

where W is weight, L is length, a is the weight-length constant and b is the allometric exponent.

The power function above is fit to a LDWF RD weight-length dataset (n = 17,780) from fish samples collected from LDWF recreational sportfish sampling (2002-2021) and the LDWF marine trammel net survey (2019-2021) with the SAS nonlinear regression fitting procedure (PROC NLIN; SAS 2008). Outliers were identified with studentized residuals over an absolute value of 3 and removed from the dataset, and the model refit.

RESULTS

Growth

The damped growth model was chosen over the traditional von Bertalanffy model due to a lower AIC value (von Bertalanffy = 2196; damped = 2167) after examination of each models residual plot (*Figure 1*).

The damped growth model parameter estimates, standard errors, and confidence limits are presented in *Table 1*. The damped growth curve and length at age observations are also presented in *Figure 2*.

Examination of age-specific coefficient of variations (CV) from the damped growth model (*Figure 3*) shows a declining pattern through age-5 until becoming relatively uniform for fish age-6 and greater.

Weight-Length

Parameter estimates, standard errors, and confidence limits of the weight-length regression are presented in *Table 2*. Expected values and weight-length observations are also presented in *Figure 4*.

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TABLE 1. Damped growth model parameters with standard errors and 95% confidence limits for Louisiana Red Drum (*Sciaenops ocellatus*).Units are total length in inches and age in years.

Parameters	Estimate	SE	U95%CL	L95%CL
L_∞	37.9864	0.1161	38.2141	37.7586
k_0	0.4596	0.0911	0.6382	0.2810
t_0	-0.3206	0.0800	-0.1636	-0.4775
k_1	-0.1957	0.0742	-0.0501	-0.3412
$\lfloor$	0.2981	0.2640	0.8159	-0.2197

TABLE 2. Weight-length regression parameter estimates with standard errors and 95% confidence limits for Louisiana Red Drum (*Sciaenops ocellatus*). Units are total length in inches and whole weight in pounds.

Parameters	Estimate	SE	U95%CL	L95%CL
a	0.000248	0.0000034	0.000255	0.000242
b	3.1003	0.00399	3.1081	3.0925

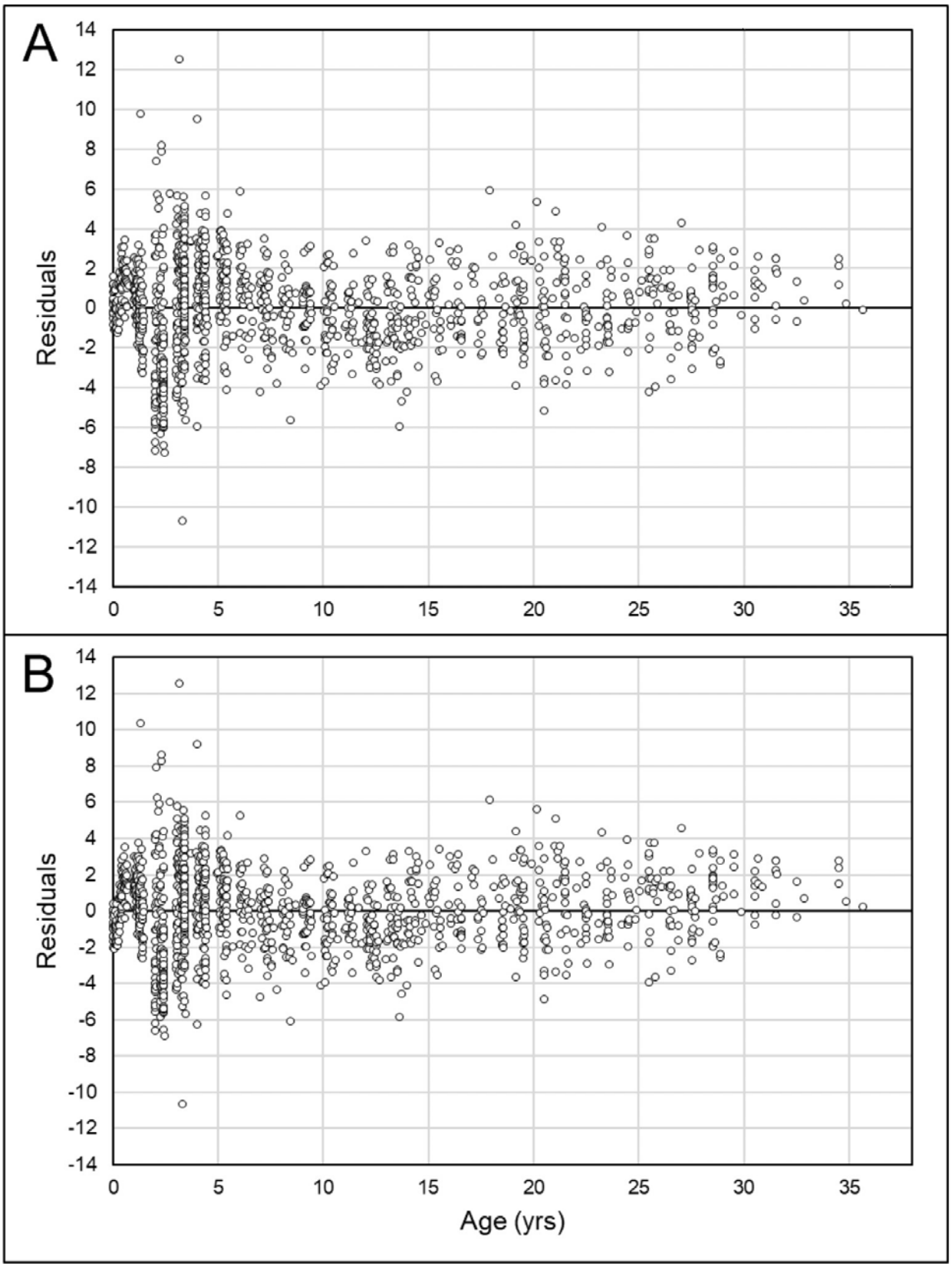


FIGURE 1. Residual plots for fits to the Louisiana Red Drum (*Sciaenops ocellatus*) age and length data of the traditional 3-parameter Von Bertalanffy growth model (A) and the 5-parameter damped Von Bertalanffy growth model (B).

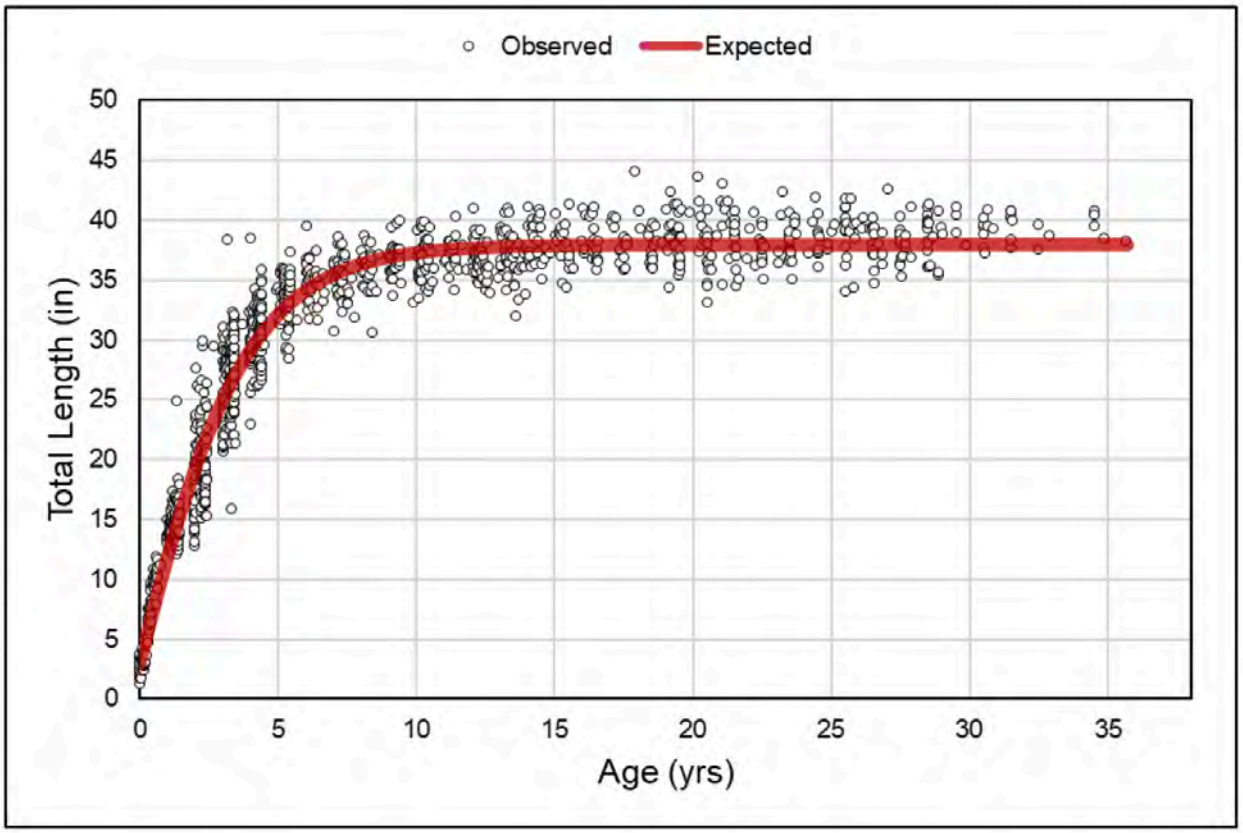


FIGURE 2. Louisiana Red Drum (*Sciaenops ocellatus*) total length-at-age observations and predicted total length-at-age from the damped growth model. Units are total length in inches and age in years.

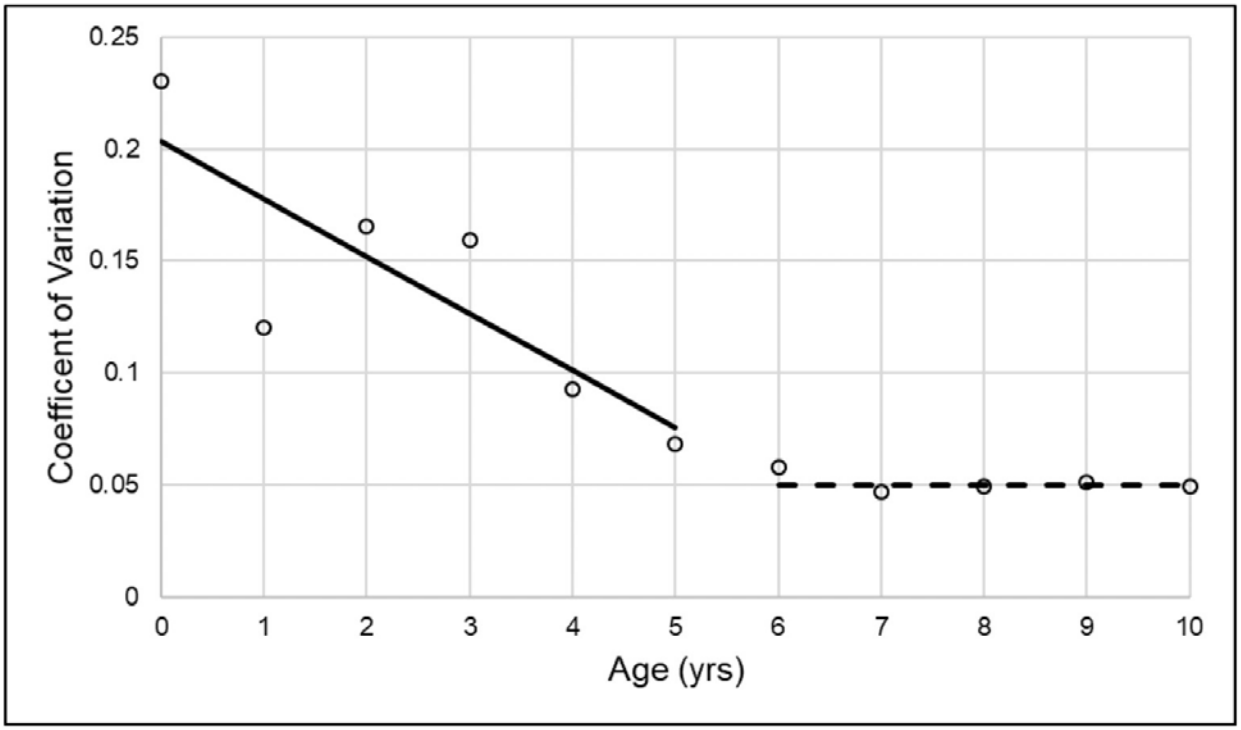


FIGURE 3. Age-specific (0-10+) coefficient of variations (CV) for Louisiana Red Drum (*Sciaenops ocellatus*) from the damped growth model with a linear regression fit from the age-0 to the age-5 CV represented by the solid diagonal and a uniform CV of the age-6 plus group represented by the dashed horizontal.

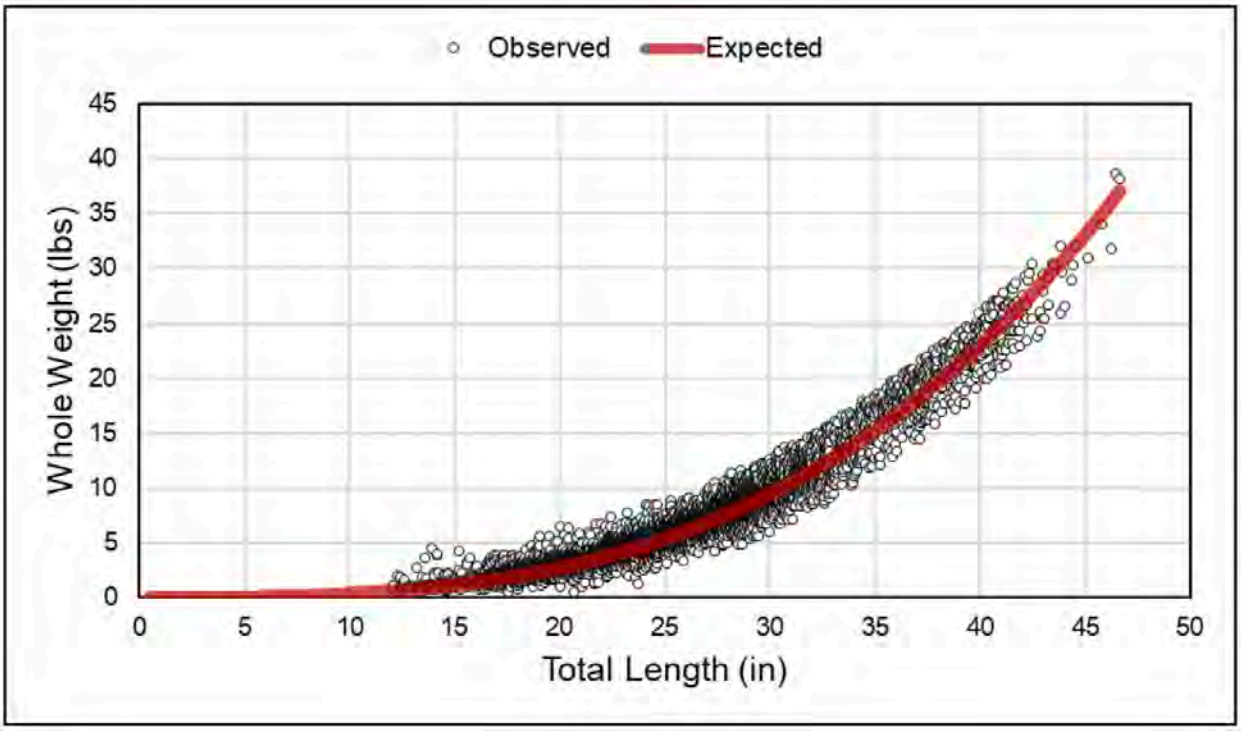


FIGURE 4. Louisiana Red Drum (*Sciaenops ocellatus*) whole weight/total length observations and predicted values from the power model. Units are total length in inches and whole weight in pounds

APPENDIX II. LA R.S. 56:638.1-5. Fish Conservation, Management, and Sustainability: Legislative Intent, Findings, Purposes, Policy, and Fishery Standards

The legislative intent, findings, purposes, policy and standards for the conservation and management of all species of fish in Louisiana are defined in LA R.S. 56:638.1-5, which functions similarly to those found in the federal MSA.

LA R.S. 56:638.1. Fish Conservation, Management, and Sustainability; Legislative Intent

Recognizing that there are ever-increasing numbers of both sport and commercial fishermen utilizing the waters of the state for recreational and commercial pursuits resulting in conflicts over limited space and competition for the same fish, and acknowledging that both the sport and commercial fishing industries are vital to the economy of the coastal region and the entire state, the fishery standards for conservation, management, and sustainability of all species of fish are hereby declared to be fair and in the best interest of the state.

LA R.S. 56:638.2. Findings

The state of Louisiana recognizes that:

(1) Its fish resources are of great value and are renewable. These fish resources make many contributions to the state, including but not limited to the food supply, economy, and health of the state and recreational opportunities. With proper regulations of the harvest by fishermen, coupled with protection and enhancement of their freshwater, saltwater, and estuarine habitat, Louisiana's fish resources should be available to provide these benefits to the state indefinitely.

(2) As a consequence of increased fishing pressure or other factors and because of the limitations of fish conservation, management, and sustainability practices, certain stocks of fish may have been or will become overfished.

(3) The future productivity of renewable fish resources and their supporting habitats may be seriously jeopardized as a consequence of the continued loss of Louisiana coastal wetlands, or because of human actions affecting the functionality and value of the state's renewable fish resources and their supporting habitats.

(4) Both commercial and recreational fishing constitute a major source of employment and contribute significantly to the economy of the state. Many coastal areas are dependent upon such fishing and related activities and their economies have been damaged by pollution, habitat degradation, or overfishing.

(5) Fish resources are finite but renewable. If timely placed under sound management, the fisheries can be conserved and maintained so as to provide optimum and sustainable yields on a continuing basis.

(6) A strong state program for the wise conservation, management, and sustainability of the fish resources of Louisiana is necessary to maintain plentiful fish populations, to prevent overfishing, to rebuild reduced stocks, to ensure conservation, and to realize their full potential.

(7) The safe development or improvement of fisheries that are not fully or properly utilized by the Louisiana commercial and recreational fishermen and fishing industries should help to ensure that Louisiana benefits from the employment, food supply, recreation, and social and economic benefit that could be maintained or generated thereby, if pursued in such a fashion that is socially, scientifically, economically, anthropologically, and biologically sound for the state, the species, any related species, and their supporting habitats.

(8) A strong state program is necessary to advocate the importance of the functionality and value of Louisiana's waters and coastal wetlands as estuary and habitat for fish resources, the social and economic value of these resources to the state and the nation, and the need to actively seek to avoid any net loss of this functionality and value.

LA R.S. 56:638.3. Purposes

A. In order to implement the objectives and purposes of this Subpart, the commission shall:

(1) Take timely action to conserve, manage, protect, and sustain fish species.

(2) Promote the use of sound conservation, management, and sustainability principles in the regulation of commercial and recreational fishing.

(3) Actively advocate, on behalf of the fish constituency, improvement of or no net loss of the functionality and value of the fisheries' habitat and estuary.

(4) Provide for the preparation and implementation of fish management plans, including plans for habitats, estuaries, and their supporting ecosystems, in accordance with this policy that will prevent overfishing and will achieve and maintain plentiful fish populations to ensure, on a continuing basis, the optimum yield from each fishery while ensuring its sustainability.

(5) Recognize that fish populations are subject to both natural and man-induced increases and decreases, and that changes in harvest levels may need to be recommended. If changes are required, these increases and decreases should be distributed among all fishermen in a fair and equitable manner that considers among other factors historical usage, ensuring that no historical user groups will be arbitrarily excluded.

B. A sustainable fishery is one that is scientifically monitored and actively managed to be viable today and in the future, conserving fish and their environment and supporting the communities and economies that depend upon these resources.

LA R.S. 56:638.4. Policy

The policy of the state of Louisiana is hereby declared to be the following:

Stewardship of the state's renewable fish resources shall have as its utmost concern the continued health and abundance of the resource and its habitat, shall provide for optimum sustained benefits to the state, shall be responsive to the needs of interested and affected citizens, shall ensure the proper and fair utilization of these resources for the citizens of the state in present and future generations, shall preserve the state's exclusive right to manage the fisheries within or beyond its jurisdiction, shall be based on the best scientific and technical information available. In addition, such stewardship of the state's fish resources shall draw upon federal, state, and academic capabilities and promote efficiency in carrying out research, administration, management, and enforcement.

LA R.S. 56:638.5. Fishery Standards

The commission shall adopt such rules and regulations consistent with the authority granted by this Chapter and in accordance with the Administrative Procedure Act, for the harvesting, conservation, management, and sustainability of all species of fish, in accordance with the following standards:

(1) Conservation, management, and sustainability measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield while maintaining healthy, plentiful stocks. In fact, every effort will be made at all times to prevent a harvest from exceeding the safe upper limit of harvests which can be taken consistently year after year without diminishing the stocks so that the stock is truly inexhaustible and perpetually renewable.

(2) Conservation, management, and sustainability measures shall be based upon the best scientific, economic, biological, anthropological, and sociological information available.

(3) To the extent practicable, an individual stock or unit of fish shall be managed as a unit throughout its range within the state's jurisdictional authority and interrelated stocks of fish and other renewable fish resources shall be managed in close coordination while considering their supporting habitats.

(4) If it becomes necessary to allocate or assign fishing privileges among various fishermen, such allocations to the extent practicable shall be:
(a) Fair and equitable to all such fishermen.
(b) Reasonably calculated to promote conservation.
(c) Carried out in such a manner that no particular individual, corporation, or other legal entity acquires an excessive share of such privileges.
(d) In the best interest of the citizens of Louisiana.

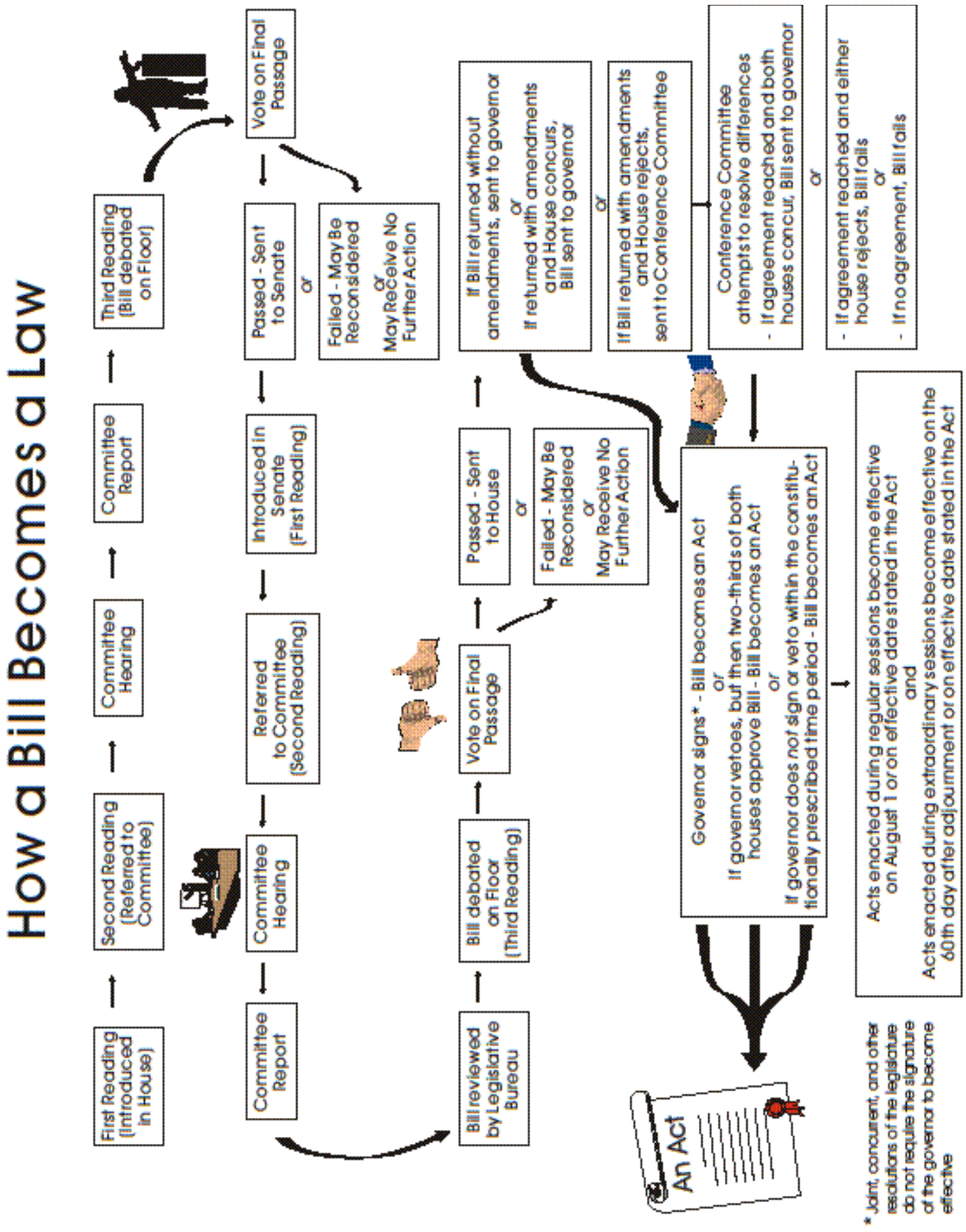
(5) Conservation, management, and sustainability measures shall, where practicable, promote efficiency in the conservation, management, and sustainability of fish resources; except that no such measure shall have economic allocation as its sole purpose.

(6) Conservation, management, and sustainability measures shall, where practicable, minimize costs and avoid unnecessary duplication.

(7) Conservation, management, and sustainability measures may take into account and allow for variations among, and contingencies in, fisheries, resources, and catches.

Acts 1991, No. 708, §1; Acts 2014, No. 553, §1.

APPENDIX III. Louisiana Legislative Process



APPENDIX IV. Authorities and Duties of the Louisiana Wildlife and Fisheries Commission

According to LA R.S. 56, the Commission's authorities and duties related to Red Drum include:

LA R.S. 56:2 Supervision and Direction of the Commission

The Commission has general control, management, supervision, and direction of itself. The Commission is a policy-making and budgetary-control board, with no administrative functions. The Commission has sole authority to establish definite management programs and policies, approve and accept all contracts at its discretion, make studies and investigations as it thinks necessary, formulate policies, and determine the wisdom and efficacy of its policies, plans, rules, regulations and proceedings.

LA R.S. 56:3 Ownership of Fish

The ownership and title to all wild birds, and wild quadrupeds, fish, other aquatic life, the beds and bottoms of rivers, streams, bayous, lagoons, lakes, bays, sounds, and inlets bordering on or connecting with the Gulf of Mexico within the territory or jurisdiction of the state, including all oysters and other shellfish and parts thereof grown thereon, either naturally or cultivated, and all oysters in the shells after they are caught or taken therefrom, are and remain the property of the state, and shall be under the exclusive control of the Wildlife and Fisheries Commission except as provided in R.S. 56:4 (Authority of Department of Natural Resources over navigable water bottoms).

LA R.S. 56:6 Special Powers and Duties

The Commission, through its secretary, shall:

- Adopt rules and regulations for the comprehensive control of finfish
- Improve, enlarge, and protect the natural oyster reefs of the state
- Enforce all law relative to the protection, propagation, and sale of all species of fish in the state
- Have full power and control over all fish within the state's waters
- Assist in protecting all leases of private oyster bedding grounds in the enjoyment of their rights
- Promulgate rules and regulations to set seasons, times, places, size limits, quotas, daily take, and possession limits based upon biological and technical data for all fish
- Impose a fee for nonresident recreational fishing licenses
- Provide for a program of dissemination of fisheries information and education in Louisiana.

LA R.S. 56:22 Rules and Regulations

The Commission may entirely prohibit the taking of any species of fish in any part of the state for not more than a three-year period.

LA R.S. 56:25 Fish and Wildlife Restoration and Management Projects

The Commission is authorized, empowered, and directed to perform acts as may be necessary to conduct and establish cooperative fish restoration projects as defined in the Dingell-Johnson Sport Fish Restoration Act, in compliance with said act and rules and regulations promulgated by the Secretary of Interior thereunder.

LA R.S. 56:40.2

The Commission shall adopt rules to establish guidelines for determining the value of injured or destroyed fish based upon recommendations of department staff and other relevant factors.

LA R.S. 56:301.5 Commission Rules and Regulations

The Commission may promulgate rules and regulations concerning any aspect of licensing not specifically provided for.

LA R.S. 56:313 Control of Fisheries

The Commission has exclusive control of fish having a game or commercial value in the state.

LA R.S. 56:315 Sanctuaries and Propagating Places

The Commission may operate and maintain hatcheries, sanctuaries and propagating places for the protection and propagation of fish and may restrict fishing in any manner it deems advisable.

LA R.S. 56:325.1 Size and Possession Limits for Recreational Saltwater Finfish

The Commission may set by rule daily take, possession, and size limits for saltwater finfish caught recreationally in Louisiana territorial waters, based on biological and technical data.

LA R.S. 56:325.3. Spotted Sea Trout Commercial Taking; Annual Quota; Red Drum Commercial Taking, Possession, or Landing Prohibited

A. (1) The commission shall establish a maximum annual quota for the commercial harvest of spotted sea trout taken within Louisiana waters or landed in Louisiana which shall not exceed one million pounds nor shall it be less than five hundred thousand pounds. The commercial taking or harvesting of spotted sea trout shall be prohibited within Louisiana waters west of Mermentau River. The Louisiana Wildlife and Fisheries Commission shall establish an open season for the commercial harvest of spotted sea trout which shall run from the second day of January each year until the maximum annual quota is reached. The commercial harvest or taking of spotted sea trout is prohibited during the period from sunset on Friday through sunrise on Monday, and there shall be no possession of spotted sea trout in excess of the recreational limit during the period between 10:00 p.m. and 5:00 a.m. However, when not on a commercial fishing trip, a person holding a permit for the commercial taking or possessing of spotted sea trout may take or possess an amount not to exceed the legal recreational limit of spotted sea trout between the hours of 10:00 p.m. and 5:00 a.m. during the open season and at any time during the closed season if that person also possesses a basic recreational fishing license and a saltwater fishing license. Only a rod and reel shall be used for the commercial harvest of spotted sea trout. The provisions of this Section are subject to quotas and size limits as established by law and rules and regulations of the commission. Fish taken under recreational licenses shall not be sold, bartered, traded, or exchanged.

(3) Nothing in this Section shall be deemed to prohibit the possession of fish legally taken prior to the closure order.
B. The commercial taking or landing of Red Drum in Louisiana is prohibited. No vessel possessing or fishing any seine net, gill net, trammel net, or hoop net shall have a Red Drum aboard the vessel, whether caught within or without the waters of the state. Violation of the provisions of this Subsection constitutes a class 5-B violation. Aquaculturally raised fish, as defined by LA R.S. 56:356, shall be exempt from the provisions of this Section.

C. The commercial taking or sale by a commercial fisherman of spotted sea trout is prohibited except by special permit issued by the Department of Wildlife and Fisheries at a cost of one hundred dollars for residents of this state and four hundred dollars for those who are nonresidents. No person shall purchase spotted sea trout from any commercial fisherman who does not possess a spotted sea trout permit. No person shall qualify for a charter boat fishing guide license and a spotted sea trout permit during the same licensure period.

D. (1) No person shall be issued a license or permit for the commercial taking of spotted sea trout unless that person meets all of the following requirements:
(a) The person shall provide proof that he purchased a valid Louisiana commercial saltwater gill net license in any two of the years 1995, 1994, and 1993.
(b) The person shall provide copies of unamended, original income tax returns, including Schedule C from the federal form 1040, which show that the person derived more than fifty percent of his earned income from the capture and sale of seafood species in any two of the years 1995, 1994, and 1993.
(c) The applicant shall not have been convicted of any fishery-related violations that constitute a class three or greater violation.

(2) The commission shall adopt rules and regulations for the entry of commercial fishermen into the commercial spotted sea trout fishery. Such rules shall include the provisions of Paragraph (1) of this Subsection as minimum requirements.

E. The department shall not issue nor shall any person receive more than one permit or license to commercially take spotted sea trout.

F. (1) Violation of any provision of this Section, except Subsection B, or of any Wildlife and Fisheries Commission regulation pertaining to spotted sea trout fishery, shall constitute a Class 6 violation. The offender shall also be penalized as follows:
(a) For a first offense, the offender shall forfeit any spotted sea trout permit or commercial fisherman's license issued to him and shall be barred from obtaining a spotted sea trout permit or a commercial fisherman's license for the remainder of the period for which it was issued plus one year, during which the offender shall be barred from participating in any spotted sea trout fishery.
(b) For a second offense, the offender shall forfeit any spotted sea trout permit or commercial fisherman's license issued to him and shall be barred from obtaining a spotted sea trout permit or a commercial fisherman's license for the remainder of the period for which it was issued plus two years, during which the offender shall be barred from participating in any spotted sea trout fishery.
(c) For a third offense, the offender shall forfeit any spotted sea trout permit or commercial fisherman's license issued to him and shall be forever barred from obtaining a spotted sea trout permit or a commercial fisherman's license and from participating in the spotted sea trout fishery.

(2) Any person who participates in the spotted sea trout fishery while barred shall be penalized under the provisions of a Class 7-B violation.

LA R.S. 56:326 Size and Possession Limits; Commercial Fish

The Commission shall have the authority to set seasons, regulate the type of gear used, and set possession limits for Spotted Seatrout and other estuarine fish in Calcasieu Lake, located in Calcasieu and Cameron Parishes, where it is clearly demonstrated that intense fishing competition exists, or if pollution levels exceed accepted standards, or if biological studies indicate the need.

LA R.S. 56:326.1 Size Limits

The Commission shall have the authority to set size limits for all saltwater fish for which no limits have been set by law.

LA R.S. 56:326.3 Possession Limits; Size Limits, Seasons, Quotas, Times, and Daily Take Limits

The Commission may set possession limits, quotas, places, seasons, times, size limits, and daily take limits based upon biological and technical data, for all saltwater finfish taken or possessed in Louisiana waters.

LA R.S. 56:326.4 Staggered and Split Seasons

The Commission may split, stagger or otherwise arrange seasons and quotas for fishing in such a manner as to maximize the availability of popular fish for serving in Louisiana restaurants throughout the year.

LA R.S. 56:327 Sale or Purchase of Freshwater or Saltwater Game Fish Prohibited; Commercial Sales and Purchases, Commercial License Required; Commercial Fingerlings and Certified Mariculture and Aquaculture Fish Excepted; Penalties

The Commission shall hold public hearings to determine areas in which the saltwater fish resources of the state must be allocated between the competing sport and commercial interests and shall promulgate rules and regulations defining such areas and the manner in which the saltwater fish resources shall be allocated.

APPENDIX V. Authorities and Duties of the Secretary and the Louisiana Department of Wildlife and Fisheries

According to LA R.S. 56 and LAC 76, the Secretary and LDWF's authority and duties related to Red Drum include:

LA R.S. 56:6.1 Emergency closures

The Secretary, in an emergency, may declare a closed season on any or all species of fish found or existing in the waters of the state or may restrict fishing in the closed season in any manner deemed advisable.

LA R.S. 56:17 Permits

The director may take fish of any kind in any manner or place for the purpose of science and cultivation and distribution and may grant permits to other persons for the same purpose.

LA R.S.56:301.4 Records; confidentiality

The Department shall draft regulations, prescribing procedures to preserve the confidentiality of all fisheries dependent data, information, or statistics submitted or collected pursuant to the provisions of this Section (licensing), for approval by the Wildlife and Fisheries Commission and promulgation in accordance with the Administrative Procedure Act. These regulations shall provide for compliance with all procedures set forth by the United States Department of Commerce, or any of its agencies or instrumentalities, for the confidentiality of fishing statistics collected from individuals or firms by that department, its agencies, or instrumentalities.

LA R.S.56:313 Control of fisheries; duty of the department

The Department shall enforce the provisions of the law regulating fish having game or commercial value in the state. The Department through its authorized agents shall confiscate all fish taken, possessed, or transported, contrary to the provisions of LA R.S. 56:313

LA R.S. 56:318 Permits

The Department may take fish of any kind when, where, and in such manner as may be deemed necessary for scientific or educational purposes and for propagation and distribution.

The Secretary may issue permits to any persons to take fish for scientific or educational purposes or for propagation or distribution.

LA R.S. 56:327 Sale or purchase of freshwater or saltwater game fish prohibited; commercial sales and purchases, commercial license required; commercial fingerlings and certified mariculture and aquaculture fish excepted; penalties

The Secretary shall have authority to set seasons, regulate type of gear used, and set possession limits for estuarine fish where it is clearly demonstrated that intense fishing competition exists or if pollution levels exceed adopted standards or if biological studies indicate the need.

LA R.S. 56:579.1(B) Mariculture permits

The Secretary may issue permits for mariculture projects within the coastal zone and exempt permittees from statutory limitations including the kind, number, size of harvested fish, the method of harvesting or taking, seasons, or other limitations.

LA R.S. 56:638.1-638.5 Fish Conservation, Management and Sustainability

Defines the legislative intent of this sub-part, findings that describe the need for fish conservation standards; the purposes of the standards; state policy for stewardship; and standards for Commission rules and regulations regarding harvesting, conservation, management, and sustainability of all species of fish (See *Appendix II* for details).

LA R.S. 56:640.3 Right to fish

The Department shall recommend the elimination or restriction of any fishing gear currently in use or which may be used in recreational or commercial fisheries in implementing its management responsibilities or in response to any emergency situation. While elimination or restriction may have uneven impacts on different groups of fishermen, the proposed measures should be applicable to all people of the state. In addition to acquiring the best available biological data, the Department shall use all practicable means to collect all relevant social and economic data in support of such allocation decision making efforts.

APPENDIX VI. Other States' Commercial Red Drum Fishing Regulations

State	Season	Commercial Fishing	
		Minimum Length (Inches)	Bag / Possession
Texas	None	Harvest Prohibited	
Mississippi	Open year round in state waters	18-30" Total Length	State Quota (60,000 lbs)
Alabama	None	Harvest Prohibited	
Florida (Gulf side)	None	Harvest Prohibited	
Florida (Atlantic side)	None	Harvest Prohibited	
Georgia	None	Harvest Prohibited	
South Carolina	None	Harvest Prohibited	
North Carolina	None	Harvest Prohibited	
Virginia	None	Harvest Prohibited	
Maryland	None	Harvest Prohibited	
Delaware	None	Harvest Prohibited	
New Jersey	None	Harvest Prohibited	
Connecticut	None	Harvest Prohibited	
Rhode Island	No season or regulations		
Massachusetts	None	Harvest Prohibited	

APPENDIX VII. Other States' Recreational Red Drum Fishing Regulations

State	Season	Commercial Fishing	
		Minimum Length (Inches)	Bag / Possession
Texas	Open year-round in state waters	20-28" Total Length	3/person/day. 2 over 28" per year with special tags
Mississippi	Open year-round in state waters	18-30" Total Length	3/person/day. Including 1 over 30" per day
Alabama	Open year-round in state waters	16-26" Total Length	3/person/day. Including 1 over 26" per day
Florida (Gulf side)	Open year-round in state waters	18-27" Total Length	Pan-handle and Big Bend Regions: 1/person/day; 4 fish per vessel
			Tampa Bay, Charlotte Bay, Sarasota Bay, and Southwest Regions: 1/person/per day; 2 fish per vessel
Florida (Atlantic side)	Open year-round in state waters	18-27" Total Length	Tampa Bay, Charlotte Bay, Sarasota Bay, and Southwest Regions: 1/person/per day; 2 fish per vessel
			Northeast Region: 1/person/day; 4 per vessel
			Indian River Lagoon Region: Catch-and-Release Only
Georgia	Open year-round in state waters	14-23" Total Length	5/person/day
South Carolina	Open year-round in state waters; closed to gig 12/1 - 2/28	15-23" Total Length	2/person/day; 6 per vessel
North Carolina	Open year-round in state waters	18-27" Total Length	1/person/day
Virginia	Open year-round in state waters	18-27" Total Length	1/person/day
Maryland	Open year-round in state waters	18-27" Total Length	1/person/day
Delaware	Open year-round in state waters	20-27" Total Length	5/person/day
New Jersey	Open year-round in state waters	18-27" Total Length	1/person/day
Connecticut	Open year-round in state waters	18-27" Total Length	1/person/day
Rhode Island	No season or regulations		
Massachusetts	Open year-round in state waters	18-27" Total Length	1/person/day

APPENDIX VIII. Federal Management Institutions

The following list of federal management institutions was adapted from a similar list in GSMFC 2023.

The Red Drum fishery operates almost exclusively in state waters; federal waters are closed to Red Drum harvest. Federal agencies do not directly manage Red Drum, but the Gulf States Marine Fisheries Commission has developed a fishery management plan in early 2023. Through their administration of laws, regulations, and policies, certain federal agencies may influence the Red Drum resources, fishery, and management practices.

Regional Fishery Management Councils

Under the MSA, federal authorities are responsible for monitoring and managing fisheries resources in federal waters (from the seaward boundary of state waters to 200 nautical miles offshore). Federal management is based on fishery management plans developed by regional fishery management councils, including the Gulf Council. Each council prepares plans for each fishery requiring management within its geographical area of authority and amends such plans as necessary. Plans are implemented as federal regulation through the U.S. Department of Commerce. There is no Red Drum fishery in federal waters of the Gulf, the Gulf Council has only set the criteria for the maximum sustainable yield for each inshore fishery.

U.S. Department of Commerce

The Secretary of U.S. Department of Commerce (Secretary of Commerce), acting through National Marine Fisheries Service, has the ultimate authority to approve or disapprove all fishery management plans prepared by regional fishery management councils. Where a council fails to develop a plan, or to correct an unacceptable plan, the Secretary of Commerce may do so.

National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS)

The National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS) collects data and statistics on fisheries and fishermen. It performs research and conducts management authorized by international treaties. NMFS has the authority to enforce the MSA and the Lacey Act and is the federal trustee for living and nonliving natural resources in coastal and marine areas under U.S. jurisdiction. NMFS exercises no management jurisdiction with respect to Red Drum in the Gulf. It conducts some research and data collection programs and comments on all projects that affect marine fishery habitat.

National Oceanic and Atmospheric Administration's Office of Ocean and Coastal Resource Management

The National Oceanic and Atmospheric Administration's Office of Ocean and Coastal Resource Management (OCRM), in conjunction with coastal states, administers the National Estuarine Research Reserve and National Marine Sanctuaries Programs as authorized under Section 315 of the Coastal Management Act of 1972. Under these programs, OCRM establishes protected areas which serve to provide suitable habitat for estuarine and marine species and serve as sites for research and education activities related to coastal management issues. These areas are managed under specific management plans that may include restrictions on harvest and use of marine and estuarine species. Such plans could directly affect the harvest of Red Drum.

OCRM may also influence fishery management for Red Drum indirectly through administering the Coastal Zone Management Program and by setting standards and approving funding for state coastal zone management programs. These programs often affect estuarine habitat on which many fisheries depend.

Department of the Interior's National Park Service

Under the Department of the Interior, the National Park Service may regulate fishing activities within park boundaries. Such regulations could affect Red Drum harvest if implemented within a given park area. For example, the National Park Service requires commercial fishermen to have a permit to fish commercially in Jean Lafitte National Historical Park and Preserve. However, there is no commercial Red Drum harvest at this time.

Department of the Interior's U.S. Fish and Wildlife Service

The Department of the Interior's U.S. Fish and Wildlife Service (USFWS) has little direct management authority over Red Drum. However, commercial fishing is prohibited in USFWS's coastal National Wildlife Refuges. USFWS may also affect the management of Red Drum through the Fish and Wildlife Coordination Act, under which USFWS and NMFS review and comment on proposals for projects such as dredging, filling, and marine construction that could affect Red Drum and their habitat.

U.S. Environmental Protection Agency

Through its administration of the Clean Water Act (CWA) and the National Pollutant Discharge Elimination System (NPDES), the U.S. Environmental Protection Agency (EPA) provides protection for Spotted Seatrout and their habitat. The EPA may disapprove or add conditions to applications for permits to discharge pollutants into estuarine waters to protect these marine resources.

Under Section 312 of the CWA, the EPA regulates the equipment that treats or holds sewage (marine sanitation devices) and establishes areas in which the discharge of sewage from vessels is not allowed (No Discharge Zones, or NDZs) to help protect human health and the aquatic environment from disease-causing microorganisms that may be present in sewage from vessels and boats. An individual state can petition the EPA to officially designate an NDZ to: (1) to protect aquatic habitats where pump-out facilities are available, (2) to protect special habitats or species, and/or (3) to protect human drinking water intake zones. Once a designation is official, the state and the U.S. Coast Guard, if applicable, enforce the limits of the NDZ. This means that the discharge of untreated and treated sewage is strictly forbidden and subject to fine if violated. Also, the U.S. Coast Guard can board vessels in an NDZ to verify that they have adequate facilities. Currently, the EPA can only designate areas associated with oyster harvesting as NDZs when there are sufficient pump-out facilities in the area to service vessel traffic.

The EPA and a local sponsor jointly administer the National Estuary Program. This program evaluates estuarine resources, local protection, and development of policies, and seeks to develop future management plans. Numerous user groups including industry, environmentalists, recreational and commercial interests, and policymakers provide input on these plans. The Barataria-Terrebonne estuarine complex in Louisiana became a National Estuary in 1990.

U.S. Army Corps of Engineers

Red Drum populations may be influenced by the U.S. Army Corps of Engineers' (Corps) responsibilities pursuant to the CWA and Section 10 of the Rivers and Harbors Act. Under these laws, the Corps issues or denies permits to individuals and other organizations for proposals to dredge, fill, and construct in wetland areas and navigable waters. The Corps is also responsible for planning, construction, and maintenance of navigation channels and other projects in aquatic areas; these projects could affect Red Drum and their habitat.

U.S. Coast Guard

The U.S. Coast Guard is responsible for enforcing fishery management regulations adopted by the DOC pursuant to management plans developed by the Gulf Council. The U.S. Coast Guard also enforces laws regarding marine pollution and marine safety, and they assist commercial and recreational fishing vessels in times of need. Although no regulations have been promulgated for Red Drum in the EEZ, enforcement of laws affecting marine pollution and fishing vessels could influence Red Drum populations.

U.S. Food and Drug Administration

The U.S. Food and Drug Administration (FDA) directly regulates the harvest and processing of seafood through its administration of the Food, Drug, and Cosmetic Act and other regulations that prohibit the sale and transfer of contaminated, putrid, or otherwise potentially dangerous foods. The FDA reserves the right and authority to enforce the Food, Drug, and Cosmetic Act and other regulations if the states fail to do so.

APPENDIX IX. Federal Laws, Regulations and Policies

The following federal laws, regulations, and policies may directly and/or indirectly influence the quality, abundance, and ultimately the management of Red Drum. This list was adapted from a similar list in GSMFC 1993.

Fishery Conservation and Management Act of 1976 (later renamed the Magnuson Fishery Conservation and Management Act and then the Magnuson-Stevens Fishery Conservation Act), and subsequent reauthorizations

The Magnuson-Stevens Fishery Conservation Act (MSA) extended U.S. jurisdiction from 12 nautical miles offshore to 200 nautical miles and established regional fishery management councils. The MSA mandates the councils to prepare fishery management plans for important fisheries resources within federal waters. These plans must comply with certain conservation and management requirements laid out in the MSA, including national standards for sustainable fisheries management. Congress has reauthorized the MSA twice, once in 1996 and again in 2007. The 1996 reauthorization strengthened requirements to prevent overfishing and rebuild overfished fisheries; added definitions for overfishing, overfished, and fishing communities; added three new national standards to address fishing vessel safety, fishing communities, and bycatch and also revised several existing standards; and addressed needs for improved fishery monitoring, enhanced research, greater consideration of fishing communities, identification of essential fish habitat, formation of constituent advisory panels, and analysis of fishing capacity, among other activities. The 2006 reauthorization featured a number of new requirements to prevent overfishing by establishing annual catch limits and accountability measures; promote market-based management strategies, including limited access privilege programs, such as catch shares; strengthen the role of science through peer review, the councils' Scientific and Statistical Committees, and the Marine Recreational Information Program; and enhance international fisheries sustainability by addressing illegal, unregulated, and unreported fishing and bycatch.

Interjurisdictional Fisheries Act of 1986

The Interjurisdictional Fisheries Act established a program to promote and encourage state activities in support of management plans, to promote and encourage management of interjurisdictional fisheries resources throughout their range, and to promote and encourage research in preparation for the implementation of the use of ecosystems and interspecies approaches to the conservation and management of interjurisdictional fisheries resources throughout their range. The enactment of this legislation repealed the Commercial Fisheries Research and Development Act.

Federal Aid in Sport Fish Restoration Act, commonly called the Dingell-Johnson Act or the Wallop-Breaux Act

The Federal Aid in Sport Fish Restoration Act provides funds to states, the U.S. Fish and Wildlife Service (USFWS), and the Gulf States Marine Fisheries Commission (GSMFC) to conduct research, planning, and other programs for enhancing and restoring marine sportfish populations.

Marine Protection, Research, and Sanctuaries Act of 1972 (Titles I and III) and the Shore Protection Act of 1988

The Marine Protection, Research, and Sanctuaries Act provides protection of fish habitat through establishing and maintaining marine sanctuaries. This act and the Shore Protection Act regulate ocean transportation and dumping of dredged materials, sewage sludge, and other materials. Criteria for issuing permits for such activities include considering effects of dumping on the marine environment, ecological systems, and fisheries resources.

Federal Food, Drug, and Cosmetic Act of 1938

The Federal Food, Drug, and Cosmetic Act prohibits the sale, transfer, or importation of "adulterated" or "misbranded" products. Adulterated products may be defective, unsafe, filthy, or produced under unsanitary conditions. Misbranded products may have false, misleading, or inadequate information on their labels. In many instances, this act also requires U.S. Food and Drug Administration (FDA)-approval for distribution of certain products.

Federal Water Pollution Control Act of 1948, the Clean Water Act of 1972, and amendments

The Federal Water Pollution Control Act was the first major U.S. law to address water pollution. It was significantly amended in 1972 and became commonly known as the Clean Water Act (CWA). The CWA's National Pollutant Discharge Elimination System (NPDES) program regulates point sources that discharge pollutants into waters of the United States. Any facility that discharges directly into U.S. waters must have an NPDES permit issued by the U.S. Environmental Protection Agency (EPA). Discharges of pollutants into rivers and estuaries that empty into the Gulf can harm or kill marine fisheries resources and alter habitats. The EPA has authorized the State of Louisiana to implement its own NPDES program to monitor program compliance and control water pollution.

Section 404 of the CWA regulates the placement of dredged or fill material into wetlands, lakes, streams, rivers, estuaries and certain other types of waters to avoid and minimize losses to wetlands and other waters and to compensate for unavoidable loss through mitigation and restoration. The EPA and the U.S. Army Corps of Engineers (Corps) jointly administer Section 404. The Corps issues Section 404 permits and monitors compliance with the issued permits. Both the Corps and EPA are responsible for on-site investigations and enforcement of unpermitted discharges under Section 404. USFWS and NMFS evaluate impacts of federally permitted projects on fish and wildlife.

The CWA prohibits discharge of oil or hazardous substances to U.S. waters or their adjoining shorelines in quantities that may be harmful to the public health or welfare or the environment. Owners and operators of non-transportation-related oil facilities must make and implement plans to prevent oil discharges. Some oil storage facilities and vessels must also prepare and submit plans for responding to discharges of oil and hazardous substances. If a facility or vessel discharges oil to navigable

waters or adjoining shorelines, the owner/operator is required to follow certain federal reporting requirements. National and area response plans must also be developed. EPA regional personnel periodically conduct inspections to ensure compliance with these regulations.

International Convention for the Prevention of Pollution from Ships

The International Convention for the Prevention of Pollution from Ships (MARPOL) is the main international convention that covers prevention of pollution of the marine environment by ships from operational or accidental causes. MARPOL is divided into annexes, each of which regulates a particular group of ship emissions including oil and oily water, bulk noxious liquid substances, harmful substances carried by sea in packaged form, sewage, garbage, and air pollution. As a signatory to MARPOL, the United States implemented the Act to Prevent Pollution from Ships to comply with the provisions of this convention. The Marine Plastic Pollution Research and Control Act later amended the Act to Prevent Pollution from Ships.

Clean Vessel Act of 1992, as amended

Congress passed the Clean Vessel Act (CVA) to help reduce pollution from vessel sewage discharges. The CVA was created to provide a viable alternative to the overboard disposal of recreational boater sewage. All recreational vessels must have access to pump-outs funded under the CVA. The CVA made grants available to the states on a competitive basis for the construction and/or renovation, operation and maintenance of pump-out and portable toilet dump stations. States may sub-grant to public and private marinas to install pump-outs. The USFWS administers this grant program. The CVA also provides a portion of its total funding for educational outreach regarding the effects of boater sewage and how boaters can avoid improper sewage disposal.

Coastal Zone Management Act of 1972, as amended

Under the Coastal Zone Management Act (CZMA), states receive federal assistance grants to maintain federally-approved planning programs for enhancing, protecting, and using coastal resources. These are state programs, but the CZMA requires that federal activities must be consistent with the respective states' coastal zone management programs. Depending upon the individual state's program, the CZMA provides the opportunity for considerable protection and enhancement of fisheries resources by regulation of activities and by planning for future development in the least environmentally damaging manner.

Endangered Species Act of 1973, as amended

The Endangered Species Act (ESA) provides for the listing of plant and animal species that are threatened or endangered. Once listed as threatened or endangered, a species may not be taken, possessed, harassed, or otherwise molested. It also provides for a review process to ensure that projects authorized, funded or carried out by federal agencies do not jeopardize the existence of these species or result in destruction or modification of habitats that are determined by the Secretary of the U.S. Department of the Interior to be critical.

National Environmental Policy Act of 1970

The National Environmental Policy Act (NEPA) requires that all federal agencies recognize and give appropriate consideration to environmental amenities and values in the course of their decision-making. To create and maintain conditions under which man and nature can exist in productive harmony, NEPA requires that federal agencies prepare an environmental impact statement (EIS) prior to undertaking major federal actions that significantly affect the quality of the human environment. Within these statements, federal agencies must carefully assess alternatives to the proposed action that may better safeguard environmental values.

Fish and Wildlife Coordination Act of 1958

Under the Fish and Wildlife Coordination Act, USFWS and NMFS review and comment on fish and wildlife aspects of proposals for work and activities sanctioned, permitted, assisted, or conducted by federal agencies that take place in or affect navigable waters, wetlands, or other critical fish and wildlife habitat. The review focuses on potential damage to fish, wildlife, and their habitat; therefore, it serves to provide some protection to fisheries resources from activities that may alter critical habitat in nearshore waters. This Act is important because federal agencies must give due consideration to the recommendations of USFWS and NMFS.

Fish Restoration and Management Projects Act of 1950

Under this act, DOI is authorized to provide funds to state fish and game agencies for fish restoration and management projects. Funds for protection of threatened fish communities that are located within state waters could be made available under this Act.

Lacey Act of 1981, as amended

The Lacey Act prohibits import, export, and interstate transport of illegally taken fish and wildlife. As such, the Act provides for federal prosecution for violations of state fish and wildlife laws. The potential for federal convictions under this Act has probably reduced interstate transport of illegally possessed fish and fish products.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, commonly called Superfund

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) names NMFS as the federal trustee for living and nonliving natural resources in coastal and marine areas under U.S. jurisdiction. It could provide funds for cleanup of fishery habitat in the event of an oil spill or other polluting event.

Fish and Wildlife Act of 1956

This Act provides assistance to states in the form of law enforcement training and cooperative law enforcement agreements. It also allows for disposal of abandoned or forfeited property with some equipment being returned to states. The Act prohibits airborne hunting and fishing activities.

APPENDIX X. Commercial and Recreational Red Drum Fishery Regulations—Detailed Text

In general, Red Drum management and conservation is covered in state law through LA R.S. Title 56 and rules promulgated by Commission within LAC Title 76. These regulations are listed below.

COMMERCIAL FINFISH REGULATIONS (COMMERCIAL RED DRUM HARVEST PROHIBITED)

LICENSING

Commercial Fisherman's License

- A commercial fisherman taking fish, including bait species, from state waters or possessing fish in the state must purchase a commercial fisherman's license. LA R.S. 56:303(A)(1)
- The cost of the commercial fisherman's license is $75.50 for residents and $540 for nonresidents. LA R.S. 56:303(B)
- A commercial fisherman's license is valid for one year, beginning on January 1 of each calendar year and expiring on December 31 of the same calendar year. LA R.S. 56:303.1(A)
- A commercial fisherman's license may be purchased at any time of the year for the current license year and from November 15 for the immediately following license year. LA R.S. 56:303.1(B)
- The person in charge of the operation of each vessel engaged in commercial fishing must have, in his possession and in his name, a valid, original commercial fisherman's license. This person must also have in his possession a gear license indicating that the applicable gear fee has been paid and, if applicable, a vessel license. LA R.S. 56:303.2(A)
- A resident of this state who is seventy years of age or older may obtain a senior commercial fishing license for an annual fee of $35. The senior commercial fishing license shall be valid from January 1 of each calendar year until December 31 of the same calendar year. The license may be purchased at any time for the current license year and may be purchased after November 15 for the following license year. The license shall be in lieu of a commercial fisherman's license required by this Section. LA R.S. 56:303(F)
- The holder of a commercial fisherman's license may transport and sell his own catch to any licensed Louisiana wholesale/retail seafood dealer located within the state of Louisiana. The holder of a commercial fisherman's license may transport and sell his own catch to a consumer only within the state and only when in possession of a fresh products license as provided in LA R.S. 56:303.1.1. However, if he purchases fish for resale or transports his catch out of the state of Louisiana, or if he sells fish to a retail seafood dealer, restaurant, or retail grocer, he becomes a wholesale/retail seafood dealer and must obtain a wholesale/retail seafood dealer's license and is governed by the laws, rules, and regulations concerning wholesale/retail seafood dealers. LA R.S. 56:303.7(A)
- Whenever the holder of a commercial fisherman's license sells or transfers possession of his own catch to a wholesale/retail seafood dealer, he shall present the license to the dealer for license verification. The commercial fisherman shall provide the wholesale/retail seafood dealer with all information, as determined by the commission to be necessary to properly manage the fishery resources of the state, that is required to complete the commercial receipt form, which shall include but not be limited to the fisherman's first and last name, license number, signature, gear used, vessel used, primary location of where fish were caught, duration of trip, and permit numbers for species requiring a permit to harvest. The commercial fisherman shall sign each commercial receipt form attesting that the information provided therein is correct. LA R.S. 56:303.7(B)
- A commercial fisherman selling fish under the authority of a fresh product license specified in LA R.S. 56:303.1.1 shall record all information required on the commercial receipt forms, except that the fresh product license number shall be recorded in place of the wholesaler/retailer seafood dealer's license number. The fresh product licensee shall complete monthly returns to the department as specified in LA R.S. 56:306.6 for wholesale/retail seafood dealers. The commercial fisherman shall sign each commercial receipt form attesting that the information provided therein is correct. LA R.S. 56:303.7(C)

Fresh Products License

- A commercial fisherman selling his catch directly to a consumer shall possess a fresh products license. LA R.S. 56:303(A)(2) and LA R.S. 56:303.1.1(A)
- The cost of a fresh products license shall be $61 for residents and $300 for nonresidents. The fresh products license shall be valid for one year, beginning on January 1 of each calendar year and expiring on December 31 of the same calendar year. LA R.S. 56:303.1.1(B)
- Anyone holding a fresh products license shall, on or before the 10th day of each month, submit to the department, on forms provided or approved by the department for that purpose, information required by the department as provided in LA R.S. 56:303.7. LA R.S. 56:303.1.1(D)
- A commercial fisherman may purchase a secondary fresh products license for any designated individual if he provides the individual's name and social security number to the department. This secondary license will allow the commercial fisherman to continue to fish while the designated individual sells the catch. The secretary of the Department of Wildlife and Fisheries shall promulgate

rules and regulations implementing the provisions of this Subsection. The department is authorized to collect a fee for issuance of the license not to exceed $5 which, after compliance with Article VII, Section 9(B) of the Constitution of Louisiana relative to the Bond Security and Redemption Fund, shall be credited to the Conservation Fund.

- A commercial fisherman selling fish under the authority of a fresh product license specified in LA R.S. 56:303.1.1 shall record all information required on the commercial receipt forms, except that the fresh product license number shall be recorded in place of the wholesaler/retailer seafood dealer's license number. The fresh product licensee shall complete monthly returns to the department as specified in LA R.S. 56:306.6 for wholesale/retail seafood dealers. The commercial fisherman shall sign each commercial receipt form attesting that the information provided therein is correct. LA R.S. 56:303.7(C)

Vessel License

- A vessel shall be licensed whenever engaged in commercial fishing in or whenever possessing fish for sale in the saltwater areas of the state defined in LA R.S. 56:322. A vessel may be licensed whenever engaged in commercial fishing in or whenever possessing fish for sale in the freshwater areas of the state defined in LA R.S. 56:322. LA R.S. 56:304(A)
- The cost of the vessel license for a resident is $32.50 for the first vessel, $25 for the second vessel, and $17.50 for the third and any subsequent vessel. The cost of the vessel license for a nonresident is $230. LA R.S. 56:304(B)
- Vessel licenses are issued in the name of the owner of the vessel and shall list the owner's name and address, the vessel name and registration or documentation number, and any other information required by the department. LA R.S. 56:304(D)
- A vessel license is valid for one year, beginning on January 1 of each calendar year and expiring on December 31 of the same calendar year. LA R.S. 56:304.1(A)
- A vessel license may be purchased at any time of the year for the current license year and from November 15 for the immediately following license year. LA R.S. 56:304.1(B)
- It is unlawful for the owner of a commercial fishing vessel licensed under this Subpart to permit any person not holding a valid, original commercial fisherman's license to operate such licensed vessel while the vessel is engaged in commercial fishing or while the vessel is possessing fish for sale in the waters of the state. LA R.S. 56:304.2(A)
- A vessel engaged in commercial fishing and operated by a person not possessing a valid, original commercial fisherman's license subjects the vessel owner to revocation of the vessel license and seizure of the vessel and all fish and equipment thereon. LA R.S. 56:304.2(B)
- Vessel licenses are not transferable except as provided by rule or regulation of the department. LA R.S. 56:304.5(A)
- The name of a vessel for which a vessel license has been issued cannot be changed without prior notification to the department. LA R.S. 56:304.5(B)
- The person in charge of the operation of each vessel engaged in commercial fishing must have, in his possession and in his name, a valid, original commercial fisherman's license. This person must also have in his possession a gear license indicating that the applicable gear fee has been paid and, if applicable, a vessel license. LA R.S. 56:303.2(A)

Commercial Gear Licenses

- A commercial fisherman must possess a commercial gear license indicating that the applicable gear fee has been paid whenever using or possessing on the fishing grounds any gear listed in Subsection B. LA R.S. 56:305(A)
- Resident commercial gear fees are listed in LA R.S. 56:305(B)
- The commercial gear fee for nonresidents is four times the gear fee for residents. LA R.S. 56:305(C)(1)
- No commercial gear license allowing the use of specific fishing gear shall be issued to any nonresident whose domiciliary state prohibits the use of similar commercial fishing gear. LA R.S. 56:305(C)(2)
- In the event more than one gear type is in possession on the fishing grounds the gear fee for each type of gear must be paid and so indicated on the gear license. LA R.S. 56:305(D)
- A gear fee must be paid for each piece of gear or each type of gear, whichever is applicable, being used to take fish or, if the gear is not in use but is in possession on the fishing grounds, the gear fee must be paid for each piece of gear or type of gear, whichever is applicable, intended for use or which was used to take fish. LA R.S. 56:305(E)
- Any commercial fisherman who purchases a trawl, skimmer, or butterfly gear license must also pay an annual fee of $10 (residents) or $40 (nonresidents) for deposit into the Shrimp Marketing and Promotion Account as provided for in LA R.S. 56:10(B)(1)(b)(i). LA R.S. 56:305(G)
- A commercial gear license is valid for one year, beginning on January 1 of each calendar year and expiring on December 31 of the same calendar year. LA R.S. 56:305.1(A)
- A commercial gear license may be purchased at any time of the year for the current license year and from November 15 for the immediately following license year. LA R.S. 56:305.1(B)
- A commercial gear license can only be purchased by a person possessing a valid commercial fisherman's license. LA R.S. 56:305.2(A)
- A valid commercial gear license may be transferred for temporary use only to a person holding a valid commercial fisherman's license and having the same residency status as indicated on the license being transferred. Gear licenses that require qualification shall not be transferred and may only be used by the person to whom it was issued. LA R.S. 56:305.3(A)
- A commercial gear license used by a person not holding a valid, original commercial fisherman's license and using gear under privilege of the commercial fisherman's license is subject to revocation. LA R.S. 56:305.3(B)
- The person in charge of the operation of each vessel engaged in commercial fishing must have, in his possession and in his name,

a valid, original commercial fisherman's license. This person must also have in his possession a gear license indicating that the applicable gear fee has been paid and, if applicable, a vessel license. LA R.S. 56:303.2(A)

Wholesale/Retail Seafood Dealer's License

- A commercial fisherman selling his catch to anyone other than a consumer or a licensed Louisiana wholesale/retail seafood dealer must possess a wholesale/retail seafood dealer's license as provided in R.S. 56:306 et seq. LA R.S. 56:303(A)2
- Any person buying, acquiring, or handling, from any person, by any means whatsoever, any species of fish, whether fresh, frozen, processed, or unprocessed, in Louisiana from within or outside the state, for sale or resale, including bait species, whether on a commission basis or otherwise, is a wholesale/retail seafood dealer and must purchase a wholesale/retail seafood dealer's license
- The license shall be in the name of the licensee and shall list the legal mailing address and the physical location of the place of business, and any other information required by the department. If the place of business is a vehicle, then the license shall state "vehicle" and shall list the legal mailing address and physical location of the licensee. LA R.S. 56:306(B)(1)
- If the licensee owns or operates more than one place of business, then an additional wholesale/retail seafood dealer's license must be purchased for each additional place of business or vehicle. The additional licenses shall be in the same name of the operator, list a different license number than the original license, list the legal mailing address and the location of the place of business, and any other information required by the department. LA R.S. 56:306(B)(3)
- The cost of the wholesale/retail seafood dealer's license is $550.00 for residents and $2,200.00 for nonresidents. LA R.S. 56:306.2(A)(1)
- A wholesale/retail seafood dealer's license is valid for one year, beginning on January 1 of each calendar year and expiring on December 31 of the same calendar year. LA R.S. 56:306.3(A)
- A wholesale/retail seafood dealer's license may be purchased at any time of the year for the current license year and from November 15 for the immediately following license year. LA R.S. 56:306.3(B)
- The department may also authorize the purchase of a wholesale/retail seafood dealer's license for a four-year period at four times the cost of the annual license fee. LA R.S. 56:306.3(C)
- Wholesale/retail seafood dealers shall buy directly from commercial harvesters validly licensed in Louisiana, and when purchasing fish for which a permit is required of the commercial harvesters, such dealers shall purchase only from those commercial harvesters possessing a valid permit. Wholesale/retail seafood dealers validly licensed in Louisiana, and in the case of wholesale/retail seafood dealers purchasing fish from out-of-state sellers and bringing the fish into Louisiana, shall purchase only from those persons from whom a wholesale/retail seafood dealer can legally purchase fish in the state of purchase, and from no one else. LA R.S. 56:306.4(A)(1)
- Each wholesale/retail seafood dealer who purchases fish from a licensed commercial fisherman shall record the sale on the three-part receipt form provided for in LA R.S. 56:303.7. The dealer shall copy the name and license number on the receipt form. The dealer, at the time of the sale, shall provide the commercial fisherman with a sales receipt which shall be one part of the three-part receipt form. All wholesale/retail seafood dealers shall comply with the records requirements contained in LA R.S. 56:306.5. LA R.S. 56:306.4(A)(2)
- Wholesale/retail seafood dealers can sell to anyone within or without the state. LA R.S. 56:306.4(B)

Retail Seafood Dealer License

- A wholesale/retail seafood dealer's license is valid for one year, beginning on January first of each calendar year and expiring on December thirty-first of the same calendar year. LA R.S. 56:306.3(A)
- A retail seafood dealer's license may be purchased at any time of the year for the current license year and from November 15 for the immediately following license year. LA R.S. 56:306.3(B)
- The department may also authorize the purchase of a retail seafood dealer's license for a four-year period at four times the cost of the annual license fee. LA R.S. 56:306.3(C)
- Restaurants and retail grocers shall buy directly only from wholesale/retail seafood dealers licensed in Louisiana. When a restaurant or retail grocer purchases fish from an out-of-state seller and brings the fish into the state, he shall buy directly from those persons from whom he can legally purchase fish in the state of purchase. When a restaurant or retail grocer buys fish from an out-of-state seller and brings the fish into the state, the restaurant or retail grocer shall be licensed in accordance with the provisions of R.S. 56:306 and shall possess a valid transport license when bringing such fish into the state.LA R.S. 56:306.4(C)(1)
- Restaurants and retail grocers who only purchase fish, whether fresh, frozen, processed, or unprocessed, from a licensed wholesale/retail seafood dealer and only sell such fish fully prepared by cooking for immediate consumption by the consumer, need not be licensed in compliance with the provisions of this Subpart. LA R.S. 56:306.4(C)(2)

Transport License

- Operators and drivers of any form of commercial transport, except common carriers, who are in the act of loading, unloading, or transporting fish shall have in their possession at least one of the following licenses:
  1. A commercial fisherman's license.
  2. A wholesale/retail dealer's license.
  3. A transport license. LA R.S. 56:307(A)
- Transport license requirements shall not apply to fish or fish products which are the result of processing as defined in LA R.S. 56:8. LA R.S. 56:307(C)
- The cost of a transport license is eighty-three per vehicle and can only be purchased by a person holding a valid Louisiana commercial fisherman's license or valid Louisiana wholesale/retail dealer's license. LA R.S. 56:307.1(A)
- The transport license shall be in the name of and bear the license number of the purchaser and shall state "transport license". LA R.S. 56:307.1(B)
- The transport license may be applied for in the same manner and is valid for the same one-year period as that of the purchaser's license. LA R.S. 56:307.1(C)
- The department may also authorize the purchase of a four-year transport license at four times the cost of the annual license fee. LA R.S. 56:307.1(D)
- A person transporting fish under privilege of a transport license is prohibited from buying or selling, by any means whatsoever, any species of fish. The provisions of this Section shall not apply to a person transporting fish under the privilege of a Louisiana transport license purchased in connection with a Louisiana wholesale/retail dealer's license when that person buys fish for or on behalf of the wholesale/retail dealer to whom such transport license was issued and only transports such fish to that wholesale/retail dealer. LA R.S. 56:307.2(A) and (B)
- A validly licensed commercial fisherman or wholesale/retail dealer may purchase any number of transport licenses. LA R.S. 56:307.3
- Transport licenses are freely transferable between vehicles, but the licensee remains responsible for all activities taking place under authority of that license. LA R.S. 56:307.5

LEGAL GEAR AND GEAR REQUIREMENTS

- "Trotline" means a line which is four hundred forty yards or less to which hoop drops are tied at various intervals or gangions and hooks are attached and which may be retrieved manually or by electric or hydraulic haulers. LA R.S. 56:8(140)
- Commercial finfish may be taken with pole, line, the device known as a yo-yo, the device known as a trigger device, handline, with any trotline wherein hooks are not less than 24 inches apart, approved slat traps, cans and minnow traps, with legal seines and nets, with bows and arrows, or by any skin diver in saltwater or freshwater, when submerged in water and using standard spearing equipment, and by no other means except as provided in Subsection C of this Section. In the saltwater areas of the state as defined in R.S. 56:322(A) and (B), commercial finfish may be taken by means of rod and reel. Violation of this Paragraph constitutes a class three violation. LA R.S. 56:320(B)(1)
- No person shall take or possess fish taken by means of spears, poisons, stupefying substances or devices, explosives, guns, tree-topping devices, lead nets, except as provided in R.S. 56:329(B), electricity, or any instrument or device capable of producing an electric current used in shocking said fish; except a barbless spear or a multi-pronged barbed gig that may be used in salt water for taking flounder. No person shall take or possess game fish taken by means of snagging devices, not including bow and arrow. It shall be unlawful to possess any of the prohibited instruments, weapons, substances, or devices set out hereinabove with the intent to take fish in violation of the provisions of this Section. LA R.S. 56:320(C)(1)
- No person shall use or deploy within the state territorial waters bandit gear or longline gear. A person may possess bandit gear or longline gear aboard a vessel within state territorial waters so long as such gear is not in use or deployed to take fish. No person shall possess fish taken within the state territorial waters using bandit gear or longline gear. LA R.S. 56:320(C)(2)
- It shall be unlawful for any person to use or employ any aircraft including fixed wing aircraft, dirigibles, balloons, helicopters, or any other form of aerial surveillance in the airspace of this state to assist in the taking of finfish except in the fisheries of menhaden and herring-like fish as defined in Title 76, Section 311 of the Louisiana Administrative Code. Any aircraft, boat, or vessel and equipment utilized in the taking of finfish and any fish taken or possessed, except in the fisheries of menhaden and other herring-like fish, contrary to the provisions of this Subsection shall be subject to confiscation. Violation of this Subsection constitutes a class 5-A violation. LA R.S. 56:320(G)
- No person shall use, possess, or have in his possession, or have aboard any vessel, a gill net, trammel net, strike net, or seine in the saltwater areas of the state as defined in LA R.S. 56:322(A) and (B), except as provided in LA R.S. 56:318 and 320.2. A violation of the provisions of this Section shall constitute a class six violation. LA R.S. 56:320.1(A) and (B)
- No person shall set, maintain, take, or attempt to take fish from any trotline of which any segment of the staging line measures in excess of four feet where any portion of any hook extends above the surface of the waters of any of the bodies of waters within the state of Louisiana. However, this Section shall not apply to White Lake in Vermilion Parish and Grand Lake and Lake Misere in Cameron Parish. Any violation of the provisions of this Section shall constitute a class two violation, LA R.S. 56:32. LA R.S. 56:321(A)

- No trawling shall be permitted in inside waters during the closed season. No vessel may pull more than the following trawl rigging in inside waters:
  a. One trawl which shall not exceed fifty feet in length along the cork-line and sixty-six feet along the lead line and in addition, one test trawl.
  b. Two trawls which shall not exceed twenty-five feet along the cork-line, thirty-three feet along the lead line, and have trawl doors no larger than eight feet in length and forty-three inches in height and, in addition, one test trawl.
  c. Two trawls which shall not exceed twenty-five feet along the cork-line, thirty-three feet along the lead line, and have no more than two outer trawl doors no larger than eight feet in length and forty-three inches in height and no more than two inner sled doors, and in addition, one test trawl. LA R.S. 56:495.1(A)(1)
- It shall be legal for a vessel in Breton and Chandeleur Sounds to pull no more than one or two trawls, either or both of which cannot exceed sixty-five feet along the cork-line and eighty-two feet along the lead line in length, plus one test trawl. LA R.S. 56:495.1(A)(2)
- Fishing with a butterfly net or skimmer net shall be prohibited in inside waters during the closed season. LA R.S. 56:495.1(B)
- In outside waters, no vessel shall pull more than four trawls and one test trawl. LA R.S. 56:495.1(C)
- The commercial taking of Black Drum, Sheepshead, Southern Flounder and other saltwater finfish species (other than Red Drum, spotted seatrout and mullet which may not be taken with this gear, and other than pompano taken under R.S. 56:406 and LAC 76:VII.703 regulations) with a pompano strike net is prohibited except by special permit issued by the Department of Wildlife and Fisheries, hereby designated as a restricted species strike net permit. This permit is required in addition to the pompano strike net license required by law. LAC 76:349 (A)

SEASONS

- The commission shall establish a maximum annual quota for the commercial harvest of finfish taken within Louisiana waters or landed in Louisiana.
- The commercial taking or harvesting of Red Drum is prohibited within Louisiana waters at this time. The Louisiana Wildlife and Fisheries Commission can establish seasons if finfish stocks are deemed harvestable. LA R.S. 56:325.3(A)(1)

SIZE & POSSESSION LIMITS

- The following are the legal size limits on commercial fish. No person shall take or possess these fish under or over the prescribed sizes for commercial purposes. Fish of the prescribed legal size may be taken, had in possession, or sold in unlimited quantities, provided there is compliance with all other requirements of the law. Any commercial fish under the minimum prescribed size or over the maximum prescribed size shall be returned immediately to the waters from which taken without avoidable injury. No person shall sell, purchase, barter, trade, or exchange, or attempt to sell, purchase, barter, trade, or exchange, any commercial species under the minimum prescribed size or over a maximum prescribed size or creel limit. Any commercial species upon which there is no specific size limit may be taken in any size or quantity. Notwithstanding any other provisions stated above, commercial fish under the legal size may be taken from privately owned ponds, impoundments, or waters by the owner thereof or his authorized representative and may be sold to other persons for purposes of stocking private waters, ponds, or impoundments. LA R.S. 56:326(A)
- All saltwater finfish except tuna, swordfish, and sharks possessed by a commercial fisherman shall have the head and caudal fin intact until set or put on shore or when sold. All saltwater finfish shall be measured in accordance with applicable law. LA R.S. 56:326(E)(1)(a)
- The commercial taking or landing of Red Drum in Louisiana is prohibited. LA R.S. 56:325.3(B)

BYCATCH

- No person shall waste any fish of this state. As used in this Section, "waste" means the harvesting of any fish for commercial purposes which results in the excessive killing of such fish. LA R.S. 56:409.1(A)
- Excessive killing shall be defined as "the killing resulting from taking or attempting to take any fish in excess of what the possessor thereof can process, utilize, or transport from the fishing grounds. Shrimp and shrimping operations are excluded." LAC 76:VII.313.B
- No person shall purchase, sell, exchange, or offer for sale or exchange, or possess or import with intent to sell or exchange any game fish as defined in R.S. 56:8. LA R.S. 56:327(A)(1)
- The commercial taking or landing of Red Drum in Louisiana is prohibited. LA R.S. 56:325.3(B)

AREA RESTRICTIONS

- Except as provided in Paragraph (2) of this Subsection, no obstructions including trawls, skimmer nets, butterfly nets, fyke nets, wings or leads, seines, gill nets, or trammel nets which interfere with the free passageway for fish as defined herein shall be set within five hundred feet of the mouth of any inlet or pass, or within five hundred feet of any water control structures, dams, or weirs. LA R.S. 56:329(B)(1)

- Trawling, skimming, or butterflying on White Lake in Cameron and Vermilion parishes and Grand Lake in Cameron Parish from official sunset to official sunrise is hereby prohibited. LA R.S. 56:410
- No person shall set or use any trammel net, gill net, or strike net for the taking of fish in that portion of Calcasieu Lake located in Cameron Parish including that portion of the Calcasieu Ship Channel which actually adjoins Calcasieu Lake, West and East Pass of Calcasieu River, and Turner's Bay during the hours after the official sunset on Friday and before the official sunset on Sunday of each week during the period from May first through September thirtieth of each year. LA R.S. 56:410.2 (A)
- The taking of fish, shrimp, and other seafood from the waters of the Lake Catherine and Lake Pontchartrain Sanctuary by use of trawls, skimmer nets, butterfly nets, seines, or traps or other netting, with the exception of cast nets, drop nets, or scoop nets, is hereby prohibited. LA R.S. 56:804(B)
- The areas within a 1/4-mile radius on the lake side only of the Lambert, Grand Bayou, Mangrove, and Peconi water control structures (otherwise identified as Structures No. 5, 1, 8 and 4 respectively), and the area within a 1/8-mile radius on the lake side only of the water control structure on No Name Bayou, all within the Calcasieu Lake system; the area within a 1/4-mile radius on the lake side only of the mouths of West Cove Bayou, West Cove Canal and the Sabine Refuge Headquarters Canal where they empty into Calcasieu Lake; and the area within a 1/4-mile radius on the lake side only of the mouths of Three Bayous and Willow Bayou where they empty into Sabine Lake, are fish sanctuaries and closed zones, and that all netting of fish by any means or method, including but not limited to trawls, butterfly nets, gill nets, seines, or trammel nets, is hereby prohibited, with the exception of hand cast nets, crab traps and crab drop nets. LAC 76:VII.333
- Commercial fishing is prohibited in the following areas:
  - Elmer's Island Wildlife Refuge LAC 76:III.337
  - Salvador/Timken Wildlife Management Area LAC 76:XIX.111.A
  - Pointe aux Chenes Wildlife Management Area except in Cut Off Canal and Wonder Lake LAC 76:XIX.111.A
  - Marsh Island Wildlife Refuge LAC 76:III.310.4
  - State Wildlife and Paul J. Rainey Refuges LAC 76:III.323.A.4
  - White Lake Wetlands Conservation Area LAC 76:III.335
  - Rockefeller Wildlife Refuge LAC 76:III.309.5
  - Isle Dernieres Barrier Island Refuge LAC 76:III.331

FEDERAL AREA RESTRICTIONS

- Commercial fishing is prohibited in the following coastal National Wildlife Refuges:
  - Big Branch Marsh National Wildlife Refuge
  - Bayou Sauvage National Wildlife Refuge
  - Breton National Wildlife Refuge
  - Delta National Wildlife Refuge
  - Mandalay National Wildlife Refuge
  - Shell Keys National Wildlife Refuge
  - Lacassine National Wildlife Refuge
  - Cameron Prairie National Wildlife Refuge
  - Sabine National Wildlife Refuge
- Jean Lafitte National Historical Park and Preserve
  - Commercial fishing allowed by permit only.

OPERATIONAL RESTRICTIONS

All saltwater finfish except tuna, swordfish, and sharks possessed by a commercial harvester shall have the head and caudal fin intact until set or put on shore or when sold. All saltwater finfish shall be measured in accordance with applicable law. LA R.S. 56:326(E)(1)(a)

FISHING GEAR INTERACTIONS

- It shall be unlawful for any person to knowingly and intentionally use or employ any net to encircle a vessel or to otherwise knowingly and intentionally use or employ any vessel or fishing gear to interfere with the lawful fishing of another. LA R.S. 56:320(I)(1)
- It shall be unlawful for any person to knowingly and intentionally use or employ any vessel or recreational gear to interfere with the lawful commercial fishing of another. LA R.S. 56:320(I)(2)

PACKAGING

- The secretary of the Department of Wildlife and Fisheries is authorized to adopt rules and regulations in accordance with the Administrative Procedure Act establishing standards for the packaging of seafood in Louisiana for wholesale or retail sale. Those standards may govern the quality, contents, and weight of all seafood packaged in this state. The Louisiana Seafood Promotion and Marketing Board may make recommendations to the secretary for standards for the packaging of seafood. For purposes of this Section, retail sale shall not include food service establishments which only serve food prepared for on premises or off premises consumption as defined by LA R.S. 40:5.5(E). LA R.S. 56:578.10

- Shipments containing fish shall be plainly marked, the tags or certificates to show the date and names of the consignor and the consignee, with an itemized statement of the number of pounds of fish and the names of each kind contained therein. Bills of lading issued by a common carrier for such shipments shall state the number of packages which contain fish, and the date and names of the consignor and consignee, with an itemized statement of the number of pounds of fish and the names of each kind contained therein. Shipments of fish of any species and fish products shall be subject to inspection by enforcement agents of the department while in transit and upon leaving the state. LA R.S. 56:307.7(A)

RECORDKEEPING AND REPORTING REQUIREMENTS

- Wholesale/retail seafood dealers, restaurants, and retail grocers shall keep, in the English language the following (LA R.S. 56:306.5(A)):
  - Records of the quantity and species of fish acquired, the date the fish was acquired, and the name and license number of the wholesale/retail seafood dealer or the out-of-state seller from whom the fish was acquired. When creel limits apply to commercial species, records shall also indicate the number by head count of such species of fish. LA R.S. 56:306.5(A)(1)
  - Records of the quantity and species of fish sold, the date the fish was sold, and the name and license number of the person to whom the fish was sold. When sold to the consumer, the records shall indicate the quantity, species, and date and shall state that the fish was sold to the consumer. LA R.S. 56:306.5(A)(2)
- Wholesale/retail seafood dealers purchasing or acquiring fish from commercial fisherman shall complete a commercial receipt form. The commercial receipt form shall be a three-part form signed by both the commercial fisherman and the wholesale/retail seafood dealer or his designee, attesting to that the information required to be provided by each is correct. One part of the receipt form shall be retained by the wholesale/retail seafood dealer, one part shall be given to the commercial fisherman at the time of the transaction, and one part shall be transmitted to LDWF as provided for in R.S. 56:306.6. LA R.S. 56:306.5 (B)(1)
- Required records must be maintained for three years and shall be open to inspection by LDWF. LA R.S. 56:306.5(C)
- Each wholesale/retail seafood dealer shall, on or before the 10th of each month, make a return to the department of all commercial receipt forms representing actual transactions from every commercial fisherman during the preceding month. All commercial receipt forms submitted by a dealer shall be accompanied by a monthly submission sheet signed by the wholesale/retail seafood dealer certifying that the transactions submitted represent all of the transactions by that dealer from commercial harvesters for that particular month. LA R.S. 56:306.6(A)
- A commercial fisherman selling fish under a fresh products license shall record all information required on trip tickets, except that the fresh products license number shall be recorded in place of the wholesaler/retailer seafood dealer's license number. The fresh products licensee shall complete monthly returns to LDWF as specified for wholesale/retail seafood dealers. The commercial fisherman shall sign each commercial receipt form attesting that the information provided therein is correct. LA R.S. 56:303.7(C)
- Each restricted species strike net permit holder shall on or before the tenth of each month file a return to the department on forms provided or approved for the purpose, the pounds of Black Drum from 16 to 27 inches, the number of Black Drum over 27 inches, the pounds of Sheepshead and the pounds of flounder taken commercially during the preceding month, the gears used for harvest, and the commercial dealers to whom these were sold. Monthly reports shall be filed, even if catch or effort is zero. LAC 76:349 (B)

LOUISIANA FINFISH TASK FORCE

- There is hereby established the Louisiana Finfish Task Force to study and monitor the finfish industry and to make recommendations to the Wildlife and Fisheries Commission, the Department of Wildlife and Fisheries, and other state agencies for the maximization of benefit from that industry for the state of Louisiana and its citizens. LA R.S. 56:301.10(A)
- The task force shall be composed as follows:
  - The governor or his designee.
  - Three members appointed by the secretary of the Department of Wildlife and Fisheries as follows:
    - One member who is a fisheries biologist.
    - One member who is an enforcement agent.
    - One member who is an economist.
  - The commissioner of the Department of Agriculture and Forestry or his designee.
  - The secretary of the Louisiana Department of Health or his designee.
  - Three members and three alternate members appointed by the governor each of whom shall possess a commercial fisherman's license with a "certified" endorsement pursuant to LA R.S. 56:303(E), with three to be selected from a list of six nominees submitted by the Louisiana Shrimp Association and three to be selected from a list of six nominees submitted by the Delta Commercial Fisheries Association.
  - One member appointed by the governor who is an active Louisiana dock buyer of finfish.
  - Three members and three alternate members appointed by the governor each of whom shall possess recreational freshwater and saltwater fishing licenses, with four to be selected from a list of eight nominees submitted by the Coastal Conservation Association Louisiana and two to be selected from a list of four nominees submitted by the Louisiana Chapter of the Bass Anglers Sportsman Society (B.A.S.S.).
  - One member of the Senate appointed by the president of the Senate.
  - One member of the House of Representatives appointed by the speaker of the House of Representatives. LA R.S. 56:301.10(B)

- The members appointed pursuant to the provisions of Paragraphs (B)(l) through (4) of this Section shall be nonvoting members. In addition, they shall not be considered members of the task force for determination of the number of members necessary for a quorum and for establishing the presence of a quorum. LA R.S. 56:301.10(C)
- The task force shall adopt bylaws under which it shall operate, and five voting members of the task force shall constitute a quorum sufficient to conduct meetings and business of the task force. The governor shall appoint the chairman of the task force for a period of one year, and thereafter the task force shall elect a chairman from its membership and may seek and receive assistance from universities within the state in the development of methods to increase production and marketability of finfish. The members of the task force shall serve without compensation; however, the task force may receive the same reimbursement of travel expenses for attending the meetings as is allowed for other state employees' travel, except all legislative members of the commission shall receive the same per diem and travel allowance for attending meetings of the task force or any meeting thereof as is normally provided for members of the legislature. LA R.S. 56:301.10(D)
- The task force is hereby charged with responsibility to do the following:
  - Coordinate efforts to increase finfish production and marketability.
  - Provide for the study of the decline in finfish marketability and market price, provide for the study of the impacts of imported finfish on the domestic market, assist in the development of a state finfish inspection program, assist in the development of a Louisiana finfish certification and branding program, and make recommendations to the Wildlife and Fisheries Commission, the Department of Wildlife and Fisheries, the Department of Natural Resources, the Department of Agriculture and Forestry, and the Louisiana Department of Health for implementation of policies to help enhance the domestic finfish industry.
  - Make recommendations with respect to issues pertaining to the finfish industry and finfish production to the various state agencies charged with responsibility for differing elements of the finfish industry in this state, including the Department of Wildlife and Fisheries, the Department of Natural Resources, the Coastal Protection and Restoration Authority, the Louisiana Department of Health, the Department of Agriculture and Forestry, and the legislature.
  - Develop markets and marketing strategies for the development and expansion of markets for finfish harvested from Louisiana waters.
  - Represent the interests of the Louisiana finfish industry before federal and state administrative and legislative bodies on issues of importance to the Louisiana finfish industry.
  - Contract for legal services to represent the interests of the Louisiana finfish industry in judicial, administrative, and legislative proceedings.
  - Perform any acts deemed necessary and proper to carry out its duties and responsibilities. LA R.S. 56:301.10(E)

LOUISIANA SEAFOOD PROMOTION AND MARKETING BOARD

- Recognizing that the commercial fishing industry in Louisiana has reached an ebb economically, creating an environment which has or could place, not only commercial harvesters, but also wholesale and retail dealers in dire economic straits, which situation could have an extreme economic impact on the state economy as a whole if nothing is done to alleviate the situation, and recognizing that there exist barriers and impediments to the economic well-being of the commercial fishery industry in Louisiana and recognizing that among these barriers and impediments, the virtual void in this state of any cohesive, coordinated and comprehensive seafood promotion and marketing effort and stratagem has a significant negative impact on the seafood industry, the Legislature of Louisiana does hereby establish the Louisiana Seafood Promotion and Marketing Board in an effort to aid the industry in two vital aspects--product promotion and marketing development. LA R.S. 56:578.1(A)
- The purpose of this Subpart, then, is to enhance the public image of commercial fishery products, thereby promoting the consumption of these products and, further, to assist the seafood industry, including commercial harvesters and wholesale and retail dealers, in market development so as to better utilize existing markets and to aid in the establishment of new marketing channels. Attention to the promotion and marketing of non-traditional and underutilized species of seafood would be inherent in the purpose of the council established herein. LA R.S. 56:578.1(B)

LOUISIANA WILD SEAFOOD CERTIFICATION PROGRAM

- A certification program for Louisiana wild fish, as defined in LA R.S. 56:8, and for Louisiana wild seafood products which are taken, harvested, or landed in Louisiana. LAC 76:I.701
- Must possess one of the following resident or nonresident Louisiana licenses: commercial fisherman's license; senior commercial fisherman's license; fresh products dealer license; seafood wholesale/retail dealer; or seafood retail dealer. LAC 76:I.701.C.1.a
- Wholesale/retail dealers must have their facility located within Louisiana. Retailers are not required to have their facility located within Louisiana. LAC 76:I.701.C.1.b
- Eligible participants not requiring an LDWF license include in-state restaurants or grocers who only sell seafood that is fully prepared by cooking for immediate consumption by the consumer, and all out-of state retailers. LAC 76:I.701.C.1.c
- Must possess and be in compliance with all other state and federal permits, licenses, and laws regarding the buying, acquiring, or handling, from any person, by any means whatsoever, any species of fish or seafood products, whether fresh, frozen, processed, or unprocessed, for sale or resale, whether on a commission basis or otherwise. LAC 76:I.701.C.1.d

- Product considered eligible to possess the LWSCP logo must meet the following criteria:
  - Eligible wild seafood includes crab, oysters, freshwater finfish, saltwater finfish, crawfish, and shrimp. Seafood must be wild-caught, taken from Louisiana waters or from the U.S. Gulf of Mexico (Gulf) and any other adjacent state waters, and landed in Louisiana. Farmed and/or aquaculture products are excluded from program participation. LAC 76:I.701.C.2.a
  - Seafood must be taken by a Louisiana licensed commercial fisherman. Seafood must be landed in Louisiana and either be sold under an LWSCP-participating fish products dealer license, or be purchased and/or physically acquired by a wholesale/retail seafood dealer participating in the LWSCP. Transfer of product throughout the supply chain must be between LWSCP participants until the product has been placed in sealed and LWSCP-labeled retail packaging. LAC 76:I.701.C.2.b
  - Seafood commingled with any other seafood that does not meet the above requirements, domestic or foreign, shall be prohibited from possessing the LWSCP label. LAC 76:I.701.C.2.c

RECREATIONAL RED DRUM REGULATIONS

LICENSING

Recreational License Requirements; Definitions

A. (1) Any person eighteen years of age or older engaged in an activity that involves hunting, fishing, or accessing property owned by the department for which a license is required shall have in their immediate possession a valid, original license, or an effective license number, together with a form of personal identification, and shall show such license and identification upon request to a duly authorized agent of the department. R.S. 56:3000(A)

Recreational Fishing Licenses; Fees

Fishing Licenses:

(1) Resident licenses including bona-fide residents, active and native-born retired members of the United States Armed Forces, including the Louisiana Army National Guard or the Louisiana Air National Guard, and nonresident students:

- Hook and line license - $5.00/year (allows using a pole, hook and line, without a reel and without using artificial bait, dip nets, landing nets, minnow traps, crab nets, or crab lines)
- Basic fishing license - $17.00/year (includes all legal recreational freshwater gear)
- Saltwater fishing license - $15.00/year (includes all legal recreational saltwater gear)
- Charter three-day saltwater fishing license - $20.00
- Charter three-day freshwater fishing license - $10.00

(2) Nonresident licenses:

- Basic fishing license - $68.00/year (includes all legal recreational freshwater gear)
- Saltwater fishing license - $60.00/year (includes all legal recreational saltwater gear)
- Five-day basic fishing - $30.00(includes all legal freshwater recreational gear)
- Five-day saltwater fishing - $30.00 (includes all legal saltwater recreational gear)
- Charter boat three-day saltwater fishing license - $20.00
- (Charter boat three-day freshwater fishing license - $10.00

LEGAL GEAR AND GEAR REQUIREMENTS

- Freshwater and saltwater recreational fish may be taken by means of rod, fishing pole, hook and line, trolling line, handline, bait casting, fly casting apparatus, crawfish nets, by use of devices known as yo-yos or trigger devices, bow and arrow, recreational hoop nets, recreational wire nets, recreational slat traps, standard spearing equipment used by a skin diver sport fishing in saltwater or freshwater when submerged in the water, recreational pipes, recreational buckets, recreational drums, recreational tires, and recreational cans, and by no other means except a barbless spear or a multi-pronged barbed gig that may be used in saltwater for taking flounder. Recreational wire nets and recreational hoop nets authorized for use under the provisions of this Section shall be used only in the geographical areas of the state designated as freshwater under the provisions of LA R.S. 56:322. LA R.S. 56:320(A)(1)
- No person shall take or possess fish taken by means of spears, poisons, stupefying substances or devices, explosives, guns, tree-topping devices, lead nets, except as provided in LA R.S. 56:329(B), electricity, or any instrument or device capable of producing an electric current used in shocking said fish; except a barbless spear or a multi-pronged barbed gig that may be used in salt water for taking Southern Flounder. LA R.S. 56:320(C)(1)
- No person shall use or deploy within the state territorial waters bandit gear or longline gear. A person may possess bandit gear or longline gear aboard a vessel within state territorial waters so long as such gear is not in use or deployed to take fish. No person shall possess fish taken within the state territorial waters using bandit gear or longline gear. LA R.S. 56:320(C)(2)

SEASONS

Recreational harvest of Red Drum is permitted year round. LAC 76:VII.3.363.A

SIZE AND POSSESSION LIMITS

- The daily take and possession limit for Red Drum (*Sciaenops ocellatus*) caught recreationally within or without Louisiana waters shall be 4 fish per day. LAC 76:VII.3.363.A(1)
- The minimum legal size for the recreational taking of Red Drum shall be 18 inches total length with the mouth closed. The maximum legal size for the taking of Red Drum shall be 27 inches total length when measured with the mouth closed. Possession of Red Drum over the prescribed maximum size of 27 inches total length with the mouth closed, is prohibited. LAC 76:VII.3.363.A(2)
- Captain and crew members shall not retain a bag limit of Red Drum while operating or representing themselves as a charter vessel or headboat. Captain and crew may engage in fishing activity to assist passengers to catch, retrieve, or land Red Drum, or to demonstrate to passengers how to catch Red Drum. LAC 76:VII.3.363.A(3)
- A recreational saltwater fisherman in possession of a valid basic and saltwater license or an equivalent license that grants both basic fishing and saltwater fishing privileges may possess twice the daily bag limit of Red Drum; however, no person shall be in possession of over the daily bag limit while fishing or while on the water, unless such recreational saltwater fisherman is aboard a trawler engaged in commercial fishing for a consecutive period of longer than twenty-five hours. 56:325.1(A)(3a)
- A fisherman who holds and is in possession of a valid recreational fishing license and can demonstrate to the department's satisfaction use of a boat launch located south of U.S. Highway 90 and that the fisherman has been actively on the water or at a remote camp that can be accessed only by water for two days or more may possess up to the possession limit of filleted Red Drum. The filleted fish shall have sufficient skin remaining on the fillet to allow for identification of the species and shall be segregated by species into plastic bags or plastic containers that are marked by species to allow easy identification, the date caught, and the name and license number of the person who took the fish. R.S. 56:325.1(A)(3b)
- The possession limit for Red Drum taken south of U.S. Highway 90 shall be three times the daily take limit when the fisherman holds and is in possession of a valid recreational fishing license and can show a landing receipt from a public boat launch located south of U.S. Highway 90 that demonstrates to the satisfaction of the department that the fisherman has been actively on the water or at a remote camp that can be accessed only by water for two days or more. The fish shall be kept whole or whole gutted in separate bags for each species of fish. The bags shall be marked with the date the fish were taken, the species, the number of fish contained in the bag, and the name and license number of the person taking the fish. The fish shall only be in the possession of the person who took the fish. However, no fisherman shall be actively fishing or engaged in fishing while in possession of more than the daily take limit. R.S. 56:325.1(A)(4)
- No saltwater sport fisherman shall take or possess at any one time in the Louisiana territorial waters extending to the outermost boundary limit of the Federal Exclusive Economic Zone any Red Drum under the prescribed minimum size nor over the maximum prescribed size and daily bag limit. Any Red Drum under the minimum prescribed size or over the maximum prescribed size and daily bag limit shall be returned immediately to the waters from which taken without avoidable injury. R.S. 56:325.1(A)(4b)

OPERATIONAL RESTRICTIONS

- No person shall sell or barter any fish that has been taken recreationally or under the authority of any type of recreational fishing license or with any recreational gear. LA R.S. 56:302.10(A)
- All saltwater recreational finfish shall have the head and caudal fin intact until set or put on shore. All saltwater recreational finfish shall be measured in accordance with applicable law. LA R.S. 56:325.2(A)
- No person shall possess any finfish parts, such as filleted fish, while aboard a vessel on the water. For the purpose of consumption at sea aboard the harvesting vessel, a person shall have no more than two pounds of finfish parts per person on board the vessel, provided that the vessel is equipped to cook such finfish and such finfish does not exceed applicable bag limits. LA R.S. 56:325.2(B)

FISHING GEAR INTERACTIONS

It shall be unlawful for any person to knowingly and intentionally use or employ any vessel or recreational gear to interfere with the lawful commercial fishing of another. LA R.S. 56:320(I)(2)

APPENDIX XI. Chronology of Major Changes to Louisiana's Red Drum Fisheries Regulations

PRIOR TO 1977

The commercial Red Drum fishery was underutilized and there were some gear regulations in place. Minimum bar mesh regulations of 1.5 inches for saltwater gillnets, 1 inch for the inside wall of saltwater trammel nets, and 0.875 inches for saltwater fish seines were in place. All nets used in the fishery were restricted to maximum lengths of 2,000 feet. Recreational fisherman were required to possess a basic fishing license to harvest Red Drum. Changes in gear, size, daily, and possession limits, and licensing requirements following 1976 are listed chronologically below. Prior to 1976 the fishery was virtually unregulated.

1977

Monofilament webbing banned in all saltwater nets except on board properly permitted vessels while engaged in the Pompano and Black Drum underutilized species program. Maximum net lengths of 1,200 feet established. Established a minimum mesh size of 2 inches bar for saltwater gillnets, and minimum bar meshes of 1 inch for the inside wall of saltwater trammel nets and 1 inch for saltwater fish seines.

1980

Established a minimum mesh size of 3 inches bar on the outer layer of saltwater trammel nets.

1983

All saltwater trammel nets to consist of three layers. Implemented a minimum mesh size of 1-inch bar for saltwater fish seines.

1984

- Recreational creel limit of 50 fish (combined Red Drum and Spotted Seatrout) established. One-day limit in possession. No minimum size limit but a maximum of two fish over 36 inches total length established.
- Possession of a saltwater fishing license required for all anglers fishing south of the officially established "saltwater line" for saltwater species.
- Commercial slot limit with a minimum of 16 inches total length and a maximum of 36 inches total length established.
- Required minimum bar mesh sizes of 1 ¾ inches for saltwater gillnets and 15/8 inches for the inside wall of saltwater trammel nets and a maximum mesh size of 12 inches bar for the outside wall of trammel nets. Mandated a mesh size of 1-inch bar for fish seines.

1986

- Recreational size limit adjusted to no more than two fish over 30 inches total length allowed, still no minimum size limit. Creel remains unchanged.
- Commercial 30-inch total length maximum size limit established. Ban on vessels carrying purse seines to possess Red Drum established.

1987

- Recreational slot limit established with a minimum size limit of 14 inches total length and no more than two fish over 30 inches maximum total length allowed. Creel remains unchanged.
- Commercial slot limit changed to 18-inch total length minimum size and 30-inch total length maximum size. Quota of 1.8 million pounds established.
- Established a minimum bar mesh size of 1¾ inches for the inside wall of saltwater trammel nets and 1 ¾ inches for saltwater fish seines.

1988

- January - Recreational minimum size limit changed to 15 inches total length. Creel and maximum size and over maximum size allotment remain unchanged.
- February - Commercial harvest quota reached and commercial harvest closed. Recreational harvest closed as well, over concerns of overfishing.
- July - Recreational creel limit changed to five fish per person, recreational harvest re-opened July 21. Recreational slot limit changed to a 16 inches total length minimum size and a 27 inches total length maximum size with one fish over 27 inches allowed within the creel limit. Commercial harvest moratorium established for three years.
- Gamefish status granted to Red Drum.

1991

Per R.S. 56:325.3(B), Commercial harvest moratorium extended indefinitely. Gamefish status granted to Red Drum permanently.

1995

- Entanglement nets banned in saltwater areas of the state, with some limited exceptions, most of which expired in 1998. Required possession of a Marine Resources Conservation Stamp by all saltwater anglers (three-year period with automatic expiration in 1998).

1997

Per R.S. 56:325.1(B)(2): Recreational saltwater fishermen in possession of a valid basic and saltwater license, may possess twice the daily bag limit of Red Drum and Spotted Seatrout. However, no person shall be in possession of over the daily bag limit while fishing or while on the water, unless such recreational saltwater angler is aboard a trawler engaged in commercial fishing for a consecutive period of longer than 25 hours.

2018

Per R.S. 56:325.1(A)(4): The possession limit for Red Drum and Spotted Seatrout taken south of U.S. Highway 90 shall be three times the daily take limit when the fisherman holds and is in possession of a valid recreational fishing license and can show a landing receipt from a public boat launch located south of U.S.

Highway 90 that demonstrates to the satisfaction of the department that the fisherman has been actively on the water or at a remote camp that can be accessed only by water for two days or more. The fish shall be kept whole or whole gutted in separate bags for each species of fish. The bags shall be marked with the date the fish were taken, the species, the number of fish contained in the bag, and the name and license number of the person taking the fish. The fish shall only be in the possession of the person who took the fish. However, no fisherman shall be actively fishing or engaged in fishing while in possession of more than the daily take limit.

2018

Per R.S. 56:325.1(A)(3)(b): Notwithstanding the provisions of Subparagraph (a) of this Paragraph and R.S. 56:325.2(A) and (B), a fisherman who holds and is in possession of a valid recreational fishing license and can demonstrate to the department's satisfaction 5-27 use of a boat launch located south of U.S. Highway 90 and that the fisherman has been actively on the water or at a remote camp that can be accessed only by water for two days or more may possess up to the possession limit of filleted Red Drum, Spotted Seatrout, and Southern flounder. The filleted fish shall have sufficient skin remaining on the fillet to allow for identification of the species and shall be segregated by species into plastic bags or plastic containers that are marked by species to allow easy identification, the date caught, and the name and license number of the person who took the fish. The Spotted Seatrout fillets shall be no less than 10 inches in length and the Red Drum shall be no less than 14 inches in length. The fish shall be in the possession only of the person who took the fish. However, no fisherman shall be actively fishing or engaged in fishing while in possession of more than the daily take limit.

2024

Recreational minimum size limit changed to 18 inches total length. Retention of Red Drum over 27 inches total length prohibited. Daily bag and possession limit changed to 4 fish per angler. Captain and crew members prohibited from retaining a bag limit of Red Drum while operating or representing themselves as a charter vessel or headboat. Captain and crew may engage in fishing activity to assist passengers to catch, retrieve, or land Red Drum, or to demonstrate to passengers how to catch Red Drum

APPENDIX XII. Penalties for Regulatory Violations

Classes of violations vary by legislative statute or Commission rule. Penalties for each class of violation are below (LA R.S. 56:31-37.1):

Class One: First offense - fine of $50, imprisonment for no more than 15 days, or both; second offense - fine of $75-250, imprisonment of 30-60 days, or both; third and subsequent offenses - fine of $250-550 and imprisonment of 30-90 days

Class Two: First offense - fine of $100-350, imprisonment of no more than 60 days, or both; second offense - fine of $300-550 and imprisonment of 30-60 days; third and subsequent offenses - fine of $500-750, imprisonment of 60-90 days, and forfeiture of anything seized in connection with the violation

Class Three: First offense - fine of $250-500, imprisonment of no more than 90 days, or both; second offense - fine of $500-800, imprisonment of 60-90 days, and forfeiture of anything seized in connection with the violation; third and subsequent offense - fine of $750-1,000, imprisonment of 90-120 days, and forfeiture of anything seized in connection with the violation. In addition to any other penalty, for a second or subsequent violation of the same provision of law the penalty imposed may include revocation of the permit or license under which the violation occurred for the period for which it was issued and bar the issuance of another permit or license for that same period.

Class Four: First offense - fine of $400-950, imprisonment of no more than 120 days, or both; second offense - fine of $750-999 and imprisonment of 90-180 days; third and subsequent offenses - fine of $1,000-5,000 and imprisonment of 180 days to two years. All Class Four penalties include forfeiture of anything seized in connection with the violation.

Class Five-A: First offense - fine of $500-750 and imprisonment of 15-30 days; second offense - fine of $750-1,000 and imprisonment of 60-90 days; third and subsequent offenses - fine of $750-1,000 and imprisonment of 90-120 days. All Class Five penalties include forfeiture of anything seized in connection with the violation. In addition, the license under which the violation occurred shall be revoked and not reinstated at any time during the period for which it was issued and for one year thereafter.

Class Five-B: First offense - fine of $350-500 and imprisonment of 30 days; second offense - fine of $500-1,000 and imprisonment of 60 days; third and subsequent offenses - fine of $1,000-2,000 and imprisonment of 90 days. All Class Five penalties include forfeiture of anything seized in connection with the violation. In addition, the license under which the violation occurred shall be revoked and not reinstated at any time during the period for which it was issued and for one year thereafter.

Class Six: For each offense, a fine of $900-950, imprisonment of no more than 120 days, or both, as well as forfeiture of anything seized in connection with the violation.

Class Seven-A: For each offense, a fine of $5,000-7,500, imprisonment for one year, or both, as well as forfeiture of anything seized in connection with the violation.

Class Seven-B: For each offense, a fine of $5,000-7,500 and imprisonment for one year, as well as forfeiture of anything seized in connection with the violation.

Class Eight: For each offense, a fine of $5,000-7,000 and imprisonment for 60 days to six months.

In addition to all other penalties, anyone convicted of Class 1-4, 6, and 7 violations may have their license under which the violation occurred revoked for the period for which it was issued. LA R.S. 56:38(A)

In addition to all other penalties, violators shall forfeit any Spotted Seatrout seized in connection with their violation upon conviction. LA R.S. 56:39

Anyone who kills, catches, takes, possesses, or injures any wildlife or aquatic life in violation of Title 56, regulations adopted pursuant to Title 56, or a federal statute or regulation governing fish and wildlife, or, through the violation of any other state or federal law or regulation, kills or injures any wildlife and aquatic life, is liable to the state for the value of each wildlife and aquatic life, unlawfully killed, caught, taken, possessed, or injured. LA R.S. 56:40.1